SOCIOECONOMIC STRAIN, CRIME AND ECONOMIC GROWTH: EVIDENCE FROM NIGERIA

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SOCIOECONOMIC STRAIN, CRIME AND ECONOMIC GROWTH: EVIDENCE FROM NIGERIA

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ABSTRACT

Owing to the challenges posed by crime in Nigeria on citizenry and government financial plans and the implementation, this study explores criminal activities with the aim of seeing how the crime rate can be minimised in the country. Previous studies on crime in Nigeria have made a tremendous contribution to the crime literature, but they have not examined the association between socioeconomic strain and crime and the effect of crime on economic growth statistically. Thus, this study examines how socioeconomic strain factors contribute to the development of crime, and how crimes affect economic growth in Nigeria. Based on previous research, the link between socioeconomic strain, crime, and economic growth was explained via strain theory and rational choice theory. In testing the proposition of the theory, data from 1970 to 2013 were analysed with an autoregressive distributed lag (ARDL) model to examine the relationship while the modified Wald test approach to Granger causality was used to provide the causality direction. The results showed that socioeconomic strain affects crime positively, and crime affects economic growth negatively. Besides, the causality ran from socioeconomic strain to crime and from economic growth to crime against person. Based on the results, this study suggests that socioeconomic strain should be monitored and controlled, deterrence institutions should be strengthened, and vigorous policies for various investments should be well planned and implemented to reduce crime in Nigeria. This study believes that the policy that would check and reduce crime would improve economic growth.

Keywords: Socioeconomic strain, crime, economic growth, autoregressive distributed lag model

ABSTRAK

Ekoran daripada cabaran-cabaran yang diakibatkan oleh jenayah terhadap penduduk dan pelan kewangan serta pelaksanaannya di Nigeria, kajian ini meneliti aktiviti jenayah dengan tujuan untuk melihat bagaimana kadar jenayah di negara ini dapat diminimumkan. Kajian terdahulu tentang jenayah di Nigeria telah memberi sumbangan yang besar terhadap literatur jenayah, namun begitu ia tidak meneliti hubungan statistik antara ketegangan sosioekonomi dengan jenayah dan kesannya terhadap pertumbuhan ekonomi. Oleh itu, kajian ini meneliti bagaimana faktor ketegangan sosioekonomi menyumbang kepada perkembangan jenayah, dan bagaimana jenayah mempengaruhi pertumbuhan ekonomi di Nigeria. Berdasarkan kajian lalu, hubungan antara ketegangan sosioekonomi, jenayah, dan pertumbuhan ekonomi dijelaskan melalui teori ketegangan dan teori pilihan rasional. Dalam menguji cadangan teori berkenaan, data dari tahun 1970 hingga 2013 dianalisis dengan menggunakan model autoregresi lat tertabur (ARDL) untuk memeriksa hubungan tersebut manakala pendekatan ujian Wald yang diubahsuai untuk kausaliti Granger telah digunakan untuk memberikan arah sebab-akibat. Keputusan kajian menunjukkan bahawa ketegangan sosioekonomi mempengaruhi jenayah secara positif dan jenayah mempengaruhi pertumbuhan ekonomi secara negatif. Selain itu, kaitan sebab-akibat berlaku daripada ketegangan sosioekonomi kepada jenayah dan daripada pertumbuhan ekonomi kepada jenayah terhadap individu. Berdasarkan dapatan tersebut, kajian ini mencadangkan agar ketegangan sosioekonomi hendaklah dipantau dan dikawal, institusi pencegahan harus diperkuatkan, dan dasar yang kukuh untuk pelbagai pelaburan perlu dirancang dan dilaksanakan dengan baik bagi mengurangkan jenayah di Nigeria. Kajian ini percaya bahawa dasar yang boleh mengawal dan mengurangkan jenayah akan meningkatkan pertumbuhan ekonomi.

Kata kunci: Ketegangan sosioekonomi, jenayah, pertumbuhan ekonomi, model autoregresi lat tertabur.

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LIST OF ABBREVIATIONS

ADF	Augmented Dickey-Fuller Unit Root Test
ARDL	Autoregressive Distributive Lag Model
ARDL OLS	Autoregressive Distributive Lag Model Ordinary Least Squares
ARDL IV	Autoregressive Distributive Lag Model Instrumental Variables
CBN	Central Bank of Nigeria
ECM	Error Correction Model
EFCC	Economic and Financial Crimes Commission
GMM	Generalised Method Moment
GDP	Gross Domestic Product
IV	Instrumental Variable
JICA	Japan International Cooperation Agency
MDG	Millennium Development Goals
MLPA	Money Laundering Prohibition Act
MWALD	Modified Wald Test
NBS	Nigeria Bureau of Statistics
NOPRIN	Network on Police Reform in Nigeria
OECD	Organisation for Economic Co-operation and Development
OLS	Ordinary Least Squares
PP	Philip-Perron Unit Root Test
UNDP	United Nation Development Programme
UNODC	United Nations Office on Drugs and Crime
VAR	Vector Autoregressive Model
VECM	Vector Error Correction Model

CHAPTER ONE

INTRODUCTION

1.1 Background

Crime-related issues have been identified as a threat to budget actualisation by the Nigeria Government (Federal Ministry of Finance of Nigeria, 2014). This threat of crime is manifested in the form of violence, arson, false pretence/cheating, unlawful possession, robbery, assault, murder, theft, destruction, fraud and corruption in the country. In the 2014 budget presentation, fraud in pension administration, corruption, destruction of property and theft were seen as the reasons for the increased costs of governance over time (Federal Ministry of Finance of Nigeria, 2014). In addition to the direct costs of these various crimes, the government also bore the social costs of crime including arrests, prosecution and fixing of properties. In turn, increased costs of governance may jeopardise development objectives like the drive for economic growth, improving income inequality and alleviating poverty. That is because the business and economic outlook in a crime-prone environment may not promote economic development due to the emigration of investors (National Planning Commission, 2010).

The United Nations Office on Drug and Crime (UNODC) (2005) asserted that crime is threatening the economic performance of African countries. This is because various crimes are pervasive across the continent including homicide, harassment and assault, bribery and corruption, and other crimes like armed robbery, fraud and money laundering. Even the rates of suicide are high in Africa. Indeed, the suicide rate in low and medium-income countries in the African region increased by 38% (% change in suicide rate per 100,000 population) from 2000 to 2012 (World Health Organization, 2014).

Suicide is especially problematic in Nigeria. During the same period from 2000 to 2012, suicide increased in Nigeria by 2% when other countries in the region witnessed a reduction in their suicide rate. The Republic of Benin and Sierra Leone had a reduction in the suicide rate of 5.5% and 20.1%, respectively; and Zambia and South Africa had a drop of 35.4% and 8.8%, respectively (World Health Organization, 2014).

Nigeria also has high rates of criminal activities including homicide and fraud, Nigeria was ranked the fifth among African countries and the first among West African nations in terms of homicide in 2012 (UNODC, 2013). Also, the International Crime Victim Survey of 2006 reported that Nigeria had 44.9% of consumer fraud incidences among the sampled countries in Africa (Naudé, Prinsloo, & Ladikos, 2006). Other sampled countries include Botswana (67.1%), South Africa (57.5%), Mozambique (38.3%), and Zambia (50.4%). Thus, overall crime and specific crime are measured as the number crime incidences per 100,000 population.

Table 1.1 presents an index of public violence from 2006 to 2013 in selected African countries due to unrest/breach of peace and violence. Of the 11 countries studied, the crime of public violence was more frequent in Nigeria than in other African countries like Sudan, Congo Democratic Republic, Algeria and Kenya. The average crime of public violence was the least in Senegal with an index of 3.56 and the highest in Nigeria with an index of 21.86 between 2006 and 2013.

Table 1.1

Crime of public violence index in African countries

Country	2006	2007	2008	2009	2010	2011	2012	2013	Average index
Nigeria	16.4	22.5	12.9	13.8	12.5	31.5	34.8	30.5	21.86
Egypt	3.5	2.0	4.3	4.1	1.3	12.3	16.8	29.0	9.16
Sudan	8.8	9.5	9.5	24.0	18.3	17.5	15.0	18.5	15.13
Central African Rep	6.0	2.8	2.8	7.3	9.0	4.5	8.3	18.5	7.40
Congo Dem Rep	12.0	17.3	10.3	18.8	11.5	4.8	12.0	13.8	12.56
Kenya	8.3	6.3	8.3	4.8	0.8	3.3	17.8	13.5	7.88
Mali	1.0	2.3	4.2	2.6	1.0	4.0	12.3	12.5	4.98
South Africa	0.5	0.0	4.3	4.3	0.5	4.3	8.3	8.3	3.81
Algeria	12.8	14.8	10.8	11	5.8	15.3	6.3	6.3	10.38
Cote d'Ivoire	7.0	1.3	1.0	1.0	2.5	10.8	7.3	2.8	4.21
Senegal	1.9	1.9	0.3	4.1	4.8	7.5	6.0	2.0	3.56

Source: African Economic Outlook, 2014

In comparing the crime rate in Ghana and South Africa with Nigeria from 2005 to 2010 as shown in Table 1.2, the crime rates were higher in Ghana and South Africa than in Nigeria. But, between 2009 and 2010, the crime rates per 100,000 population reduced in Ghana by 54.06 and likewise in South Africa by 12.98 and in contrast, the crime rate increased by 3.01 in Nigeria. In this period, the average crime rate per population for Ghana, South Africa and Nigeria stood at 914.56, 4,616.97 and 84.19, respectively. Similarly, in Table 1.3, the crime of assault in Burundi, Rwanda and Nigeria from 2008 to 2012 showed that the average assault rate per 100,000 population stood at 4.63, 23.12 and 9.90, respectively. This data does not necessarily mean that crime is low in Nigeria but it further affirmed that crime rates are not duly reported in most African nations which include Nigeria (UNODC, 2005).

Table 1.2

Crime Rates in Some Selected African Nations

Year	Ghana			South Africa			Nigeria		
	Crimes	Population	*Crime Rate per 100,000 population	Crimes	Population	*Crime Rate per 100,000 population	Crime	Populations	*Crime Rate per 100,000 population
2005	176,589	21,389,514	825.58	2,492,783	47,270,062	5,273.49	180,295	139,611,303	129.14
2006	204,952	21,951,891	933.64	2,265,598	47,921,682	4,727.70	172,326	14,3318,011	120.24
2007	222,641	22,528,041	988.28	2,219,604	48,596,781	4,567.38	93,817	147,152,502	63.75
2008	218,644	23,115,919	945.85	2,150,347	49,296,222	4,362.09	90,370	151,115,683	59.80
2009	219,123	23,713,164	924.05	2,196,948	50.020,917	4,392.05	100,303	155,207,145	64.62
2010	211,564	24,317,734	869.99	2,223,375	50,771,825	4,379.15	107,820	159,424,742	67.63
Average	208,918.8	22,836,044	914.56	2,258,109	48,979,582	4,616.97	124,155.2	149,304,897	84.19

Sources: www.data.gov.gh/agency-publications/datasets-agency/Ghana/police; www.crimestatssa.com/national.php; World Bank (2016) for population figures and NBS of various publications; and *author's calculation.

Table 1.3

Assault Rates in Selected African Nations

Year	Burundi			Rwanda			Nigeria		
	Assault	**Population**	***Assault Rate per 100,000 population**	**Assault**	**Population**	***Assault Rate per 100,000 population**	**Assault**	**Population**	***Assault Rate per 100,000 population**
2008	437	8,821,795	4.95	2,249	9,750,314	23.06	14,692	151,115,683	9.728
2009	496	9,137,786	5.428	1,985	10,024,594	19.80	14,075	155,207,145	9.06
2010	304	9,461,117	3.21	2,004	10,293,669	19.46	18,093	159,424,742	11.34
2011	499	9,790,151	5.09	2,526	10,556,429	23.92	16,740	163,770,669	10.22
2012	455	10,124,572	4.49	3,177	10,817,350	29.36	15,388	168,240,403	9.14
Average	438.2	9,467,084	4.63	2388.2	10,288,471	23.12	15797.7	159,551,728.4	9.90

Sources: www.knoema.com/atlas/topics/Crime-Statistics/Assaults-Kidnapping-Robbery-Sexual-Rape/Assault-count; World Bank (2016) for population figures and NBS of various publications; and *author's calculation.

The crime rates in Nigeria and other African countries seem to confirm the UNODC (2005) view on the reporting of crimes in African countries, which is crime victims are often reluctant to report crime. For instance, a survey carried out on the national level in Nigeria by the National Bureau of Statistics (NBS) in 2007 showed that the majority of crime victims believed that it was not worth reporting crime to the police. Furthermore, crimes are underreported because crime cases are not handled properly by the police in Nigeria (Okenyodo, 2013 and Ayodele, 2015) and of fear of retaliation by the offenders on the victims (Ayodele, 2015).

Nonetheless, the fact that crime is underreported in Nigeria does not prevent this study from examining crime based on the available data. There are four reasons: firstly, crime contributes to a high number of death rate in the country (Nigeria Watch, 2011; Ojedokun, 2014 and Nwankwo & James, 2016) and this culminates to wastage of resources and human potentials. For instance, the number of killings due to armed robbery activities contributed 50% of 8,516 deaths in 3,840 lethal incidents from 2006 to 2015 in Nigeria (Nwankwo & James, 2016). Likewise, Nigeria Watch (2011) affirmed that crime and conflict cause an average death per person of 1,655 between 2006 and 2011. In addition, several number of policemen were murdered by militants and armed bandits (Ojedokun, 2014).

Secondly, the shocks caused by criminal activities spate up insecurity and threats to citizens and properties in the country (Ebohon, 2012; Dike, 2014 and Ayodele, 2015). As the oil exploration investment in the Niger Delta is affected by the threat of extortions, killings, raping and abduction of foreign and local people with payment of ransom (Ebohon, 2012). To add, the criminality in unrest and insecurity pervaded the north-eastern part of the country caused destruction of infrastructures and by extension of anxiety to the whole country (Dike, 2014). Local businesswomen suffered a high level of crime victimisation which involve rape and theft of money, food items and moveable economic items (Ayodele, 2015).

Thirdly, crime stigmatises the nation internationally which portray the country as unsafe for investors (Maitanmi, Ogunlere, Ayinde & Adekunle, 2013). Since theft, cyber-crime, advance fee fraud and false pretence/cheating create loss of confidence. False pretence/cheating constitutes 49.57% of cases convicted by the Economic and Financial Crimes Commission (EFCC) in 2013 (EFCC, 2013).

Lastly, crime increases the cost of governance in the country (FMFN, 2014). This is because needed resources that should have been invested to boost output, health, agriculture and other welfare programmes are diverted to crime control and prevention (Adebayo, 2013). For example, from 2010 to 2013, the government expenditure on internal security was 7.43% while that of education and health stood at 7.96% and 4.72%, agriculture was 2.21% as road and construction remained at 5.70% (CBN Annual Report, 2014). Expenditure on internal security in this period was almost equal to education, but outweighed agriculture and health if put together, and also more than road and construction. The diversion of fund from health, agriculture and other crucial area in the country is disadvantageous to national development (Adebayo, 2013).

Thus, the means to increase the peace and welfare of citizens required an examination of the root causes of that crime so that it might be reduced. The crime ascribed to the above mentioned reasons are overall crime, person's crime (murder, felonious wounding and other crime against persons which include rape, kidnapping and others) and property crime (armed robbery which include robbery and extortion, burglary which include house/store breaking, and false pretence/cheating).

In Nigeria, crimes are classified into crimes against persons, crimes against property, crimes against lawful authority and crimes against local acts. Crime against local acts is not included here due to the limited number of years available, but it is included in the overall crime. Crime against persons includes murder, manslaughter, felonious wounding assault and other crime against persons. Crime against property includes armed robbery and extortion, burglary, cheating, unlawful possession of goods, arson and other crime against property. Crime against lawful authority includes forgery of currency, gambling, breach of peace, perjury, bribery and corruption, escape from custody and other minor crimes (The Nigeria Police, 2013).

Nigerian crime statistics from 1970 to 2013 are shown in Table 1.4, which is divided into four main columns. Column one shows crime types, while columns two, three and four focus on the average number of crime types to overall crime, the average share of crime types to overall crime in percentage, and the average growth of crime types in percentage respectively. In column two, the crime of assault dominated crime against persons with the highest average in each of the 11 years, while larceny and breach of peace dominated crime against property and crime against lawful authority respectively. Also, column three shows that average percentage of assault was the highest among crime against persons with 24.94 in 1970-1981, 16.81 in 1981-1991, and 18.92 and 16.82 in 1992-2002 and 2003-2013 respectively. Also, in the same period, larceny had the highest among crime against property with 33.06, 25.35, and 20.10 and 15.03 respectively, and in the crime against lawful authority, breach of the peace had the highest number of percentage with 4.33, 3.20, 3.37 and 4.65 respectively. Meanwhile, in the fourth column, the crime of murder and manslaughter increased with 53.42% and 333.33% respectively in the period of 2003-2013, while other crime types in this category were reduced. Likewise, in crime against property, arson increased with 11.07% while other crime types reduced. Also, forgery of currency, and bribery and corruption increased by 797.30% and 511.11 % respectively during the period.

Table 1.4
Crime types and crime in Nigeria

Crime types		Average number of crime types to overall crime				Average share of crime types to overall crime in percentage				Average growth of crime types in percentage			
		1970-1981	1981-1991	1992-2002	2003-2013	1970-1981	1981-1991	1992-2002	2003-2013	1970-1981	1981-1991	1992-2002	2003-2013
Murder	A	1,324	1,729	1,721	5,608	0.68	0.56	0.76	4.44	81.06	-11.85	31.59	53.42
Manslaughter	A	197	96	24	21	0.10	0.03	0.01	0.02	-47.33	15.22	-72.92	333.33
Felonious Wounding	A	7,044	14,504	15,995	12,824	3.60	4.66	7.04	10.15	244.11	27.82	1.62	-43.59
Assault	A	48,859	52,350	42,958	21,260	24.94	16.81	18.92	16.82	26.36	22.65	-45.75	-32.16
Other Crimes against Persons	A	3,727	19,101	19,641	10,237	1.90	6.13	8.65	8.10	-32.10	191.04	-24.05	-46.49
Armed Robbery, robbery and extortion	B	1,742	1,367	2,269	2,771	0.89	0.44	1.00	2.19	19.41	-35.24	72.90	-16.59
Larceny	B	64,768	78,925	45,647	18,992	33.06	25.35	20.10	15.03	19.04	47.80	-62.82	-25.67
Burglary, House and Store Breaking	B	15,935	28,604	16,762	9,088	8.13	9.19	7.38	7.19	16.28	44.46	-63.22	-8.37
False Pretence/Cheating	B	5,107	10,319	11,879	7,470	2.61	3.31	5.23	5.91	139.97	226.21	-43.07	-3.10
Unlawful Possession/receiving stolen property	B	8,698	11,804	11,600	5,407	4.44	3.79	5.11	4.28	-4.87	32.97	-49.43	-42.85
Arson	B	967	2,642	1,365	1,012	0.49	0.85	0.60	0.80	295.58	-15.20	31.99	11.07
Other Crimes against Property	B	10,191	101,096	32,983	24,076	5.20	32.47	14.53	19.05	116.18	330.36	309.41	-54.49
Forgery of Currency	C	1,434	1,526	640	156	0.73	0.49	0.28	0.12	142.92	-13.37	-95.45	797.30
Gambling	C	1,012	775	344	241	0.52	0.25	0.15	0.19	69.67	-62.82	-28.67	116.89
Breach of Peace	C	8,491	9,962	7,645	5,875	4.33	3.20	3.37	4.65	97.80	4.90	-23.80	9.17
Perjury	C	71	218	79	16	0.04	0.07	0.03	0.01	542.31	-98.00	54.55	-36.00
Bribery and Corruption	C	787	504	180	52	0.40	0.16	0.08	0.04	69.95	-27.15	-71.53	511.11

Table 1.4 (continued)

Crime types		**Average number of crime types to overall crime**				**Average share of crime types to overall crime in percentage**				**Average growth of crime types in percentage**			
		1970-1981	1981-1991	1992-2002	2003-2013	1970-1981	1981-1991	1992-2002	2003-2013	1970-1981	1981-1991	1992-2002	2003-2013
Escape from Custody	C	1,824	1,328	557	111	0.93	0.43	0.25	0.09	-64.31	-33.17	-73.90	-48.53
Other Minor offences/crimes	C	10,389	47,709	6,728	1,062	5.30	15.32	2.96	0.84	375.69	-30.42	-85.12	-66.38
Overall crime		195,890	311,349	227,071	126,385	100.00	100.00	100.00	100.00	56.20	19.16	-46.57	-26.69

Note: Author's calculation based on NBS and the Nigeria Police crime statistics

A, B and C shows the classification of various types of crime into crime against person (A), crime against property (B), crime against lawful authority (C) by the Police

In view of the high crime rates in Nigeria, the government established several agencies and commissions and increased its expenditures on crime prevention. The government created the Nigeria Police, the Economic and Financial Crime Commission, the Independent Corrupt Practices and Other Related Offences Commission, the National Security and Defence Corps, the National Drug Law and Enforcement Agencies and many more to prevent crime in Nigeria. Also, the Federal Government increased annual expenditures on internal security as a percentage of total government expenditures from 5.47% in 2005 to 6.96% and 9.13% in 2008 and 2012 respectively (Central Bank of Nigeria, 2012). Likewise, the annual expenditures on the total states' judiciary as a percentage of total expenditures moved up from 1.44% in 2005 to 2.03% in 2008 and reduce by 0.90% in 2012 (Central Bank of Nigeria, 2006 & 2012). The annual expenditures on internal security and annual expenditures on the total states' judiciary are shown in Figure 1.1. Also, the fund allocated to the Economic and Financial Corruption Commission was ₦13.8 billion Naira in 2011 and reduced by 23% in 2012, while the Independent Corrupt Practices and Other Related Offences Commission was financed with ₦3.6 billion Naira in 2011 and increased by 11.11% in 2012 (Omoniyi, 2014). Meanwhile, the personnel of the Nigeria Police Force increased by 19.03% and 16.32% from 2003 to 2007 and from 2007 to 2010 respectively (See Figure 1.2) (Network on Police Reform in Nigeria, 2010 and NBS, 2012). In addition, the allocated fund to the Nigeria Police Force increased by 3.6% from 2004 and further increased by 7.7% in 2007 (Network on Police Reform in Nigeria (NOPRIN), 2010).

The Central Bank of Nigeria has shown a continuing effort to fight money laundering and terrorism financing by establishing a unit to monitor compliance by banks (CBN

Annual Report, 2011). The battle against money laundering was made possible with the Money Laundering Prohibition Act (MLPA) by the Federal Government in 2004 and participation in the Intergovernmental Action Group against Money Laundering in West Africa (CBN Annual Report, 2011).

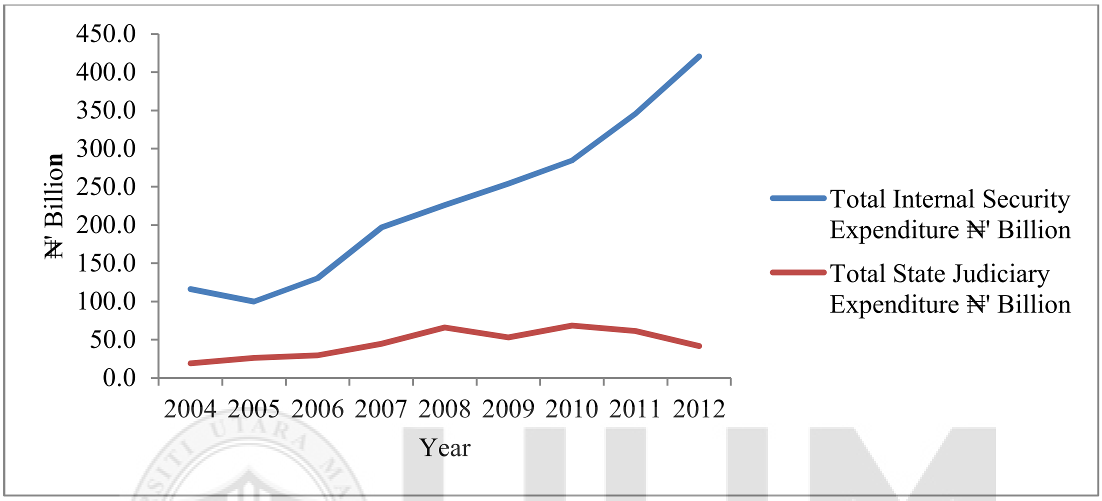


Figure 1.1.
Expenditures on Internal Security and State Judiciary
Sources: CBN Statistical Bulletin and Annual Reports of various years.

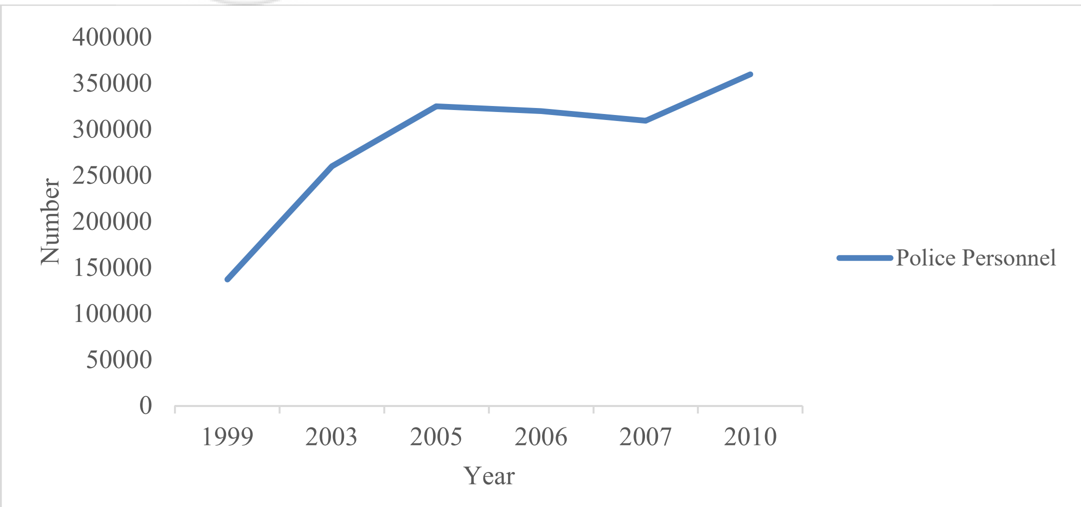


Figure 1.2
Police Personnel in Nigeria
Sources: NBS and NOPRIN (2010)

As do other governments, the Nigerian government provides the means of punishment to criminals when convicted including fines and imprisonment. Once incarcerated, convicted criminals require the expenditure of government funds. Prison and imprisonment in the country cost 0.97% and 1.20% of total government expenditures in 2011 and 2012 based on the 2012 Prison Services report in Nigeria (Adekoya & Abdul Razak, 2016). The increase in fund was due to the growth rate of prison admission, which increased from 4.79% in 2011 to 15.27% in 2012. In the wake of the democratisation in Nigeria in 1999, prison admission stood at 912.42% in 2000, but it reduced to 0.95% and 12.03% in 2001 and 2002 respectively. The worse period of prison admissions was aligned with the increase in crime rates from 64.62% in 2009 to 66.09% in 2011 and later to 66.51% in 2012 (Adekoya & Abdul Razak, 2016).

Although the efforts to fight crime through the establishment of crime agencies by using public resources for arrest, conviction and punishment are worthwhile, these efforts are confronted with challenges that weaken the crime agencies. This is because corruption has been identified as a main crucial factor subverting the administration of criminal justice in Nigeria (Ameh, 2013). The acceptance of bribes by the judiciary and security officers can turn a case in favour of the offender and raise doubts about the capability of the judiciary in the minds of the public (Ribadu, 2004 and Olesin, 2014).

Besides issues related to bribery, the Nigerian Police are also afflicted with other problems that affect their efficiency. This includes a low fact-gathering capability, pitiful working environments (Ojedokun, 2014) and a lack of modern equipment and accountability (Otu, 2012).

Due to these challenges, this current study believes that fighting crime should rather be initiated at the root level. This approach argues that strain factors contributing to the occurrence of crime in the country must be identified and treated before prosecution and punishment can be applied. Hence, this work examines socioeconomic strain factors that are believed to motivate criminal activities in the country.

1.2 Socioeconomic Strain and Crime

The socioeconomic strain was conceptualised as a structural framework to examine how the strain of living in a community can adversely affect their overall quality of life, work and living conditions (Mata & Bollman, 2007). A lack of jobs, poor earnings and limited opportunities accompanied by a high level of poverty are considered symptoms of socioeconomic strain. Thus, symptoms of socioeconomic strain manifest themselves more in less advantaged groups of people. This is because less advantaged group of people have low physical, emotional and behavioural health due to more stress and fatigue when compared with their counterparts that are more advantageous in status wise (Van Gundy *et al.*, 2015).

This study considers socioeconomic strain as the existence of factors that encourage envy, stress, fatigue and low morale in the economy. Among these factors are the interrelated factors of unemployment, income disadvantage and poverty (Mata & Bollman, 2007). Persistent unemployment leads to a whole cascade of negative consequences. One of these is that persistent unemployment is related to an ultimate reduction in skills and knowledge (Edmark, 2005), and low education is linked to continued poverty (Engle & Black, 2008). Also, it increased financial adversity and in turn, made family to experience instability (Broman, Hamilton & Hoffman, 1996). The family instability manifested in the form of separation and divorce which further led to poor parenting (Fomby & Cherlin, 2007).

This disadvantage begins early in life, income disadvantage families have lowered probabilities of good educational opportunities for their children (Ferguson, Bovaird, & Mueller, 2007). Thus, children from poor households are educationally disadvantaged compared to those from wealthier households (Timæus, Simelane, & Letsoalo, 2013). Children from income disadvantage families start school late, which reduces their ultimate educational outcomes (Ferguson, Bovaird, & Mueller, 2007).

Poverty of resources and consumption opportunities force poor households to engage in the low-level employment in order to meet their daily needs (Farias & Farias, 2010). This is because consumption is used to measure the material well-being in developing countries (Meyer & Sullian, 2003). Most people from income disadvantage families have access only to lower quality health care, which, in turn, results in higher mortality (Chen, Martin, & Matthews, 2006). Thus, income disadvantage is taken as an inverse of the logarithm average income per population (Mata & Bollman, 2007).

The prevalence of socioeconomic strain of stress, fatigue and pressure that citizens face as challenged in their daily lives is pronounced in Nigeria. For instance, Ibikunle, Umeadi, and Ummunah (2012) said that a low level of satisfaction existed among workers due to poor salaries, which made workers emotionally exhausted. Ebbe (1989) said that decreasing economic opportunities and the build-up of heterogeneity of the high- and medium-rent areas led some migrants in Lagos to commit crime. Ebbe noted that migrants facing economic deprivation resided mostly in income disadvantage residences, and they found more incentives to commit crime in the residential areas of medium- and high-income residents. Omotor (2009) concluded that unemployment causes criminal behaviour. Also, Badiora, Okunola, and Ojewale (2014) established that the involvement of young adults in criminal undertakings is encouraged by their high level of poverty, poor employment opportunities and income, and low family values. Besides, Torruam and Abur (2014) argued that unemployment lowers people's morale in the economy structure, and the low morale induces them to source for alternative means of income legally or illegally. Thus, the evidence of teenagers and young adults committing crime due to socioeconomic issues in Nigeria has been challenging (Okei-Odumakin, 2011).

To address those challenges of socioeconomic strain, research is required. This study examines unemployment, income disadvantage and poverty as socioeconomic strain factors in relationship to criminal activities in Nigeria. The investigation of these factors is based on four principal reasons. First, a growing population in Nigeria is facing economic hardship and deprivation due to poor employment income. Second, a vast number of the working age population that are either unemployed or underemployed may have their children denied good access to education. Third, denying children access to education ensures the continuation of poverty in the country, and last, the consequences of socioeconomic strain must be avoided if possible or at least minimised for sustainable security, peace and welfare of the Nigeria citizens.

1.2.1 Unemployment and Crime

The misery of economic deprivation exists in all parts of the world, but its level is surprisingly high in Nigeria. Nigeria has vast natural resources and an economy that is ranked the first in purchasing power parity in Africa and twenty-first in the word (World Bank, 2016; CIA Factbook, 2017). Unfortunately, the huge wealth has resulted in the creation of few jobs and has not alleviated economic deprivation (World Bank, 2013). Indeed, Nigeria has been described as a rich country, with poor people (BBC News, 2012).

One reason is the maldistribution of income in the country. For example, the Gini coefficient, an indicator of income inequality, rose from a score of 39 in 2004 to almost 49 in 2013 (UNDP, 2016). What this means is that the rich have gotten richer over time and the poor have become poorer. Indeed, a 2010 survey by Nigeria's National Bureau of Statistics found that 60.9% of the people were living in absolute poverty, a figure that had risen from 54.7% in 2004. In 2012, about 100 million of Nigeria's total population of 168 million were living on less than 1 US dollar a day.

Among the causes related to the spread of poverty is high unemployment (Aiyedogbon & Ohwofasa, 2012). The unemployment rate decreased from 12.29% in 2006 to 6.09% in 2011 and later increased to 10.4% in 2015. In same period, the active working population with no employment stood at 36.15% in 2006, increased to

44.59% in 2011 and later decreased to 34.37% in 2015. The working age population was 53.55% in 2006, decreased to 53.24% in 2011 and increased to 53.27% in 2015. (See Figure 1.3).

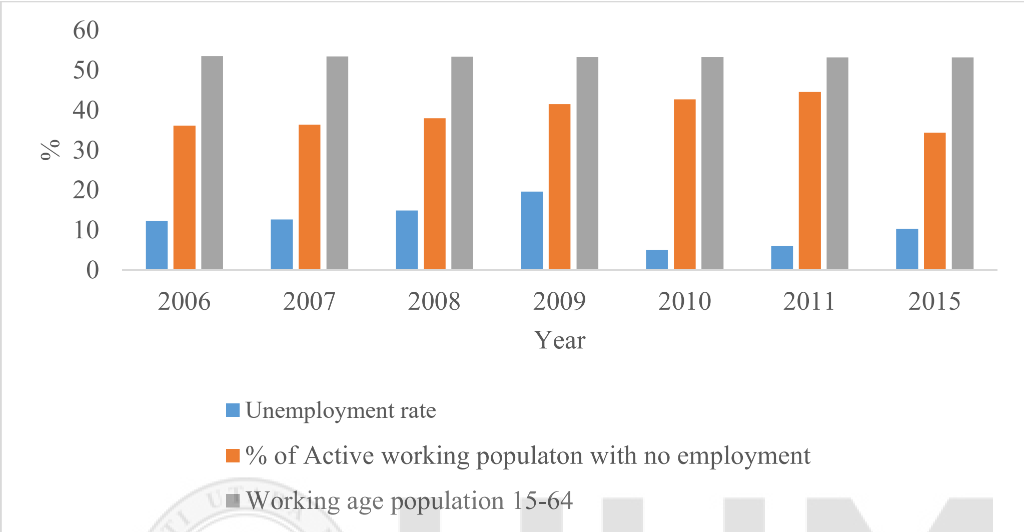


Figure 1.3
Unemployment in Nigeria: 2006-2015
Sources: NBS (2011) and WDI (2016).

The high unemployment rate may be attributed to several factors, including a low job creation, family size, education, the structure of the economy, corruption, and violence. A low job creation is a serious issue in the country (World Bank, 2013). In Nigeria, the unemployment rate rose by 1.1% a year between 2000 and 2010. This was caused by a 2.5% annual increase in the number of new entrants into the labour market and inability to create a sufficient number of jobs. Job creation increased only by 1.4% a year, but the country needs to grow by double digits to create 1.8 million jobs annually, which is equivalent to those who newly enter the labour force yearly. Unfortunately, the economy only creates about 1.1 million jobs annually (Alemu, 2015).

Even though the country has developed, it has undergone little demographic transition, birth rates per 1,000 population have fallen, but not significantly so from 46 in 1990 to 39.9 in 2012 (Trading Economics, 2014). In 2014, the live birth per women in Nigeria stood at 5.65 (World Bank, 2015). This rate is about three times that of developed countries such as the United States and the United Kingdom (CIA Factbook, 2017). This rate had a ripple effect on the economy for as with most other African countries, the larger the family the smaller is its income (BBC News, 2012).

Limited access to schools and advanced education has also been a problem (Poverties.org, 2012). Nigeria desperately needs more investment in education to help spur the development of entrepreneurs. In Nigeria, the distribution of education has suffered because it has been neglected so long due to the inadequate attention given to policy frameworks (African Economic Outlook, 2006). The national literacy rate is currently about 59.6%. Some 49% of the teaching force is unqualified. The lack of facilities and acutely inadequate resources exist at all levels. Wide disparities persist in educational standards and learning achievements (Amzat, 2010 and CIA Factbook, 2017).

Furthermore, the structure of the economy, which is typical of an underdeveloped country, has had an impact on employment as well. By occupation, the labor force of the economy was 70% in agriculture, 10% in industry, and 20% in services (CIA Factbook, 2017). More than half of the gross domestic product (GDP) is accounted for by the primary sector comprising agriculture and mining and quarrying (including crude oil and gas) with agriculture continuing to play a key role. The oil and gas sector, in particular, continues to be a major driver of the economy, accounting for more than 95% of export earnings and about 85% of government revenue between 2011 and 2012 (Chete, Adeoti, Adeyinka, & Ogundele, 2016).

Violence in all its forms has also adversely impacted the development of the Nigerian economy (Arowesegbe, 2009). One is violence connected with the violent behavior of disenfranchised youth who feel left behind. Another is the injustice practices existing against ethnic minorities. A third one is the activities of militants (Arowesegbe, 2009; Ejumudo, 2014). Among the root causes are high unemployment, the infrastructure deficit, and a feeling of inequality and injustice (Ubhenin & Enabunene, 2011; Ejumudo, 2014). Young people comprise 60% of the country's population, and most them are unemployed and underemployed. Because they are idle and frustrated, they become susceptible to violence (Arowesegbe, 2009).

Lastly, the preference of the younger generation for white collar jobs with reduced interest in jobs that is labour-intensive like agriculture has created issues (NBS, 2011). This segment of the working population remains vastly underemployed. By some estimates, about 47% of the country's 500,000 yearly university graduates remain unemployed in Africa's largest economy (Kazeem, 2016).

Apart from unemployment per se, most people who are fully employed are underpaid (NBS, 2011). The country is vast in natural resources and oil wealth, which is controlled by the political class. While a lawmaker earns large salaries and allowances, a classroom teacher is paid a meagre amount. Civil servants earn far lower salaries, and the salaries are often delayed (Obasa, 2015).

Underemployment is also an issue. The Nigerian National Bureau of Statistics reported an overall unemployment rate of about 29% and an overall underemployment rate of about 18.7% in 2015. With respect to groups, underemployment was more of a rural phenomenon at 22.6% rural underemployment compared to 9.7% for urban underemployment. The underemployment rate for those within the ages 15-24 was 34.5% and underemployment was 19.9%. for ages 25-34 (NBS, 2016). Also, about 18.5% of those with a post-secondary education were underemployed. (Underemployment is defined as working at least 20 hours but less than 40 hours on average in a week).

Prolonged unemployment or underemployment affords people with less ability to adequately provide for their families; the result, of which, may be low satisfaction, and this is dangerous to the country (Odumosu, 1999). Odumosu (1999) asserted that unemployed people are tempted to become more involved in criminal activities in the quest to satisfy their needs. The reason is that unemployed youths are responsible for the abduction taking place in the country because kidnapping for ransom is seen as a beneficial business (Onah & Okwuosa, 2016). Likewise, Omotor (2009) concluded that unemployment causes crime in the country. Many graduates are searching for jobs and finding it difficult to do so. Because they are unemployed and having the need to get higher income, they may resort o crime (Torruam & Abur, 2014).

1.2.2 Income Disadvantage and Crime

Income distribution in Nigeria as measured by the Gini coefficient showed that income is highly unequal (NBS, 2011). In Table 1.5, income inequality increased from 41% in 1992 to 44.7% in 2010. The aggregate income inequality of 48.8% in

2004 reflected high and varied inequality which exist among the six geopolitical zones in the country. A wide level of income inequality between the rich and poor ranged from 37.1% in Northwest to 50.7% in South South in 2004. Thus, the high income inequality in Nigeria suggested the need for more job opportunity and income-earning economic activities, and a more biased tax policy for income reallocation (MDG Report, 2013). This is especially true for the fast increasing labour force in the country (Anyanwu, 2013) since income and wealth contribute to the welfare of individuals and families in a country (United Nations, 2013).

Table 1.5
Inequality trend in Nigeria

	1985	**1992**	**1996**	**2004**	**2010**
National	0.43	0.41	0.49	0.488	0.447
Sector					
Urban	0.49	0.38	0.52	0.544	0.433
Rural	0.36	0.42	0.47	0.519	n/a
Geo-political zone					
South South	0.48	0.39	0.46	0.507	0.434
South East	0.44	0.40	0.39	0.449	0.444
South West	0.43	0.40	0.47	0.554	0.409
North Central	0.41	0.39	0.50	0.393	0.422
North East	0.39	0.40	0.49	0.469	0.446
North West	0.41	0.43	0.47	0.371	0.405

Sources: NBS 2011

Evidently and owing to nature of income inequality, there is a huge income gap between the income of the rich and the poor in Nigeria (See Table 1.6). This shows that the pattern of income gap permits the national income to be concentrated in the hands of the few (Bakare, 2012) since employment chances are not really available in the country (World Bank, 2013). Other contributory factors include low capital investment in rural area and market forces. Market forces pronounced through the variance between the small and slow-rising numbers of large local companies and multinationals that pay descent wages and the huge and fast-rising size of the labourforce (The Economist, 2014). Also, inequality in regional endowment of natural resources exacerbated income gap in Nigeria (Raheem, Oyeleye, Adeniji & Aladekoyi, 2014). This makes some regions to be more economically viable than the other, endowed region has higher per capita income, while poor endowed region has low per capita income (UNDP Nigeria, 2009 and Raheem *et al*. 2014). Moreover, high income inequality implied that the income share held by lowest 20% (Poor) in Table 1.6 may be referred to as income disadvantage. Income disadvantage earners have less resources to participate in economic activities than high earners (Murphy, Zhang, & Dionne, 2012) since income reveals financial capability of individual access to socioeconomic advantages or disadvantages (Pink, 2013). Similar to Mata and Bollman (2007), income disadvantage is measured by inverse of logarithm of per capita income due to non-availability of annual data on income share held by lowest 20%.

Table 1.6
Income share in Nigeria

	1985	**1992**	**1996**	**2004***	**2010***
Income share held by highest 20% **(High)**	45.01	49.32	56.52	46.04	48.99
Income share held by fourth 20% **(Middle)**	23.04	23.41	19.79	22.53	21.58
Income share held by third 20% **(1st Low)**	15.52	14.36	12.3	15.4	14.36
Income share held by second 20% **(2nd Low)**	10.41	8.93	7.72	10.37	9.71
Income share held by lowest 20% **(Poor)**	6.02	3.98	3.66	5.67	5.37

Note: 2004* and 2010* in NBS (2011) is documented as 2003 and 2009 in World Bank (2016).
Source: World Bank 2016

Among the households' income group, poor earnings increased the incidence of poverty among salary earners in Nigeria (Akerele *et al.*, 2012). This is because income disadvantage is inadequate to satisfy basic needs ranging from housing, food and clothing (Atseye, Takon, & Ogar, 2014). In turn, this low remuneration can cause conflicts and provides little motivation for workers afflicted by poor income in Nigeria (Obasa, 2015). Such workers retain their jobs, but they engage themselves in other activities to create additional income (Obasa, 2015).

Many attempts have been made to examine the consequences of income disadvantage in the country. For example, the UNODC (2005) identified low household income as one reason for social malaise exhibited in many African nations, a region often characterized by income disadvantage, high population and poverty. Badiora *et al.* (2014) observed that a high number of crimes were recorded in Ile-Ife, Nigeria, which has income disadvantage and poor environment quality. Consequently, Badiora *et al.* (2014) noted income as a factor that encouraged young adults to commit crime in the area. Obasa (2015) reported that poor income among workers encouraged them to collect bribes and steal materials from the work place (Obasa, 2015). In contrast, Omotor (2009) reported that income is not significant to crime in Nigeria. But existing inequality of opportunity in the country expose an individual's susceptibility to being organised by criminal gangs (The Economist, 2014). This is because dissatisfied people eager to enhance their material conditions through ransom and gains from looting (The Economist, 2014).

1.2.3 Poverty and Crime

As shown above in the previous two sub-sections, the link between unemployment and crime, income disadvantage and crime cannot be deemphasised. The unemployed are poor due to no access to employment-income, and the underemployed ones with income disadvantage may also find it challenging to fulfil their daily needs. The existence of a large number of those with poor income creates income inequality, and income inequality is a fair measurement of poverty in Nigeria (Holmes *et al.*, 2012).

The income distribution shows the consumption expenditures of the population in the country. Table 1.7 indicates the per capita expenditure of various income groups in Nigeria. The disparity of income between the quintile groups of 5 (richest) and 1 (poorest) per capita expenditure increased from 41.2% in 2003-2004 to 44.6% in 2009-2010. This is similar to the increase in the incidence of poverty from 54.4% in 2004 to 69.0% in 2010 as shown in Table 1.8. The population in high poverty level moved up from 68.7 million in 2004 to 112.47 million in 2010 (NBS, 2012).

Table 1.7.
Distribution of population by share of total national consumption expenditure

	2003–2004		**2009–2010**	
Quintile groups	**Per capita expenditure**	**Share of total**	**Per capita expenditure**	**Share of total**
	₦	%	₦	%
1 (poorest)	743.8	5.9	1,488.70	5.5
2	1,313.80	10.4	2,610.00	9.7
3	1,893.00	14.9	3,734.60	13.9
4	2,739.00	21.6	5,491.60	20.4
5 (richest)	5,974.00	47.2	13,540.80	50.4

Source: MGDs Report in Nigeria, 2013.

Table 1.8
Spread and Trend in Poverty Levels (%) in Nigeria

Year	**1980**	**1985**	**1992**	**1996**	**2004**	**2010**
Level						
NATIONAL	27.2	46.3	42.7	65.6	54.4	69.00
Urban	17.2	37.8	37.5	58.2	43.2	61.8

Rural	28.3	51.4	46	69.3	63.3	73.2
ZONE						
South South	13.2	45.7	40.8	58.2	35.1	63.8
South East	12.9	30.4	41	53.5	26.7	67
South West	13.4	38.6	43.1	60.9	43	49.8
North Central	32.2	50.8	46	64.7	67	67.5
North East	35.6	54.9	54	70.1	72.2	76.3
North West	37.7	52.1	36.5	77.2	71.2	77.7

Source: National Bureau of Statistics, 2010.

The maldistribution of income has encouraged the speedy development of poverty in Nigeria (Aigbokhan, 2008), and daily income per US dollar varies among the states in Nigeria (NBS, 2012). However, many states had an increase in poverty levels between 2004 and 2010 (NBS, 2012). Such states included Imo in South East (from 26.46% to 50.7%), Bornu in North East (from 48.65% to 55.1%), Oyo in South West (from 19.28% to 51.8%), Benue in North Central (from 42.84% to 67.2%), Sokoto in North West (from 70.54% to 81.9%) and Bayelsa in South South (from 26.29% to 47.0%).

The rising severity of poverty in Nigeria was witnessed not only in rural but also in urban areas (Anyanwu, 2012). Thus, both rural and urban sector experienced vast growth in poverty between 1980 and 2010 as revealed in Table 1.8. Moreover, the incidence and severity of poverty has become higher among households in Nigeria (Akerele *et al.*, 2012), and a greater percentage of the Nigerian population now lives in poverty, despite the huge wealth in the country (Holmes *et al.*, 2012).

The unemployment and underemployment of income disadvantage coupled with low-education are the main causes of poverty (Badiora *et al.*, 2014). Anyanwu (2014) noted that a vicious cycle of poverty existed among households with female heads and in those households with a large number of children, and in rural locations. An increase in the size of a household often leads to lower saving rates, escalates child rearing costs, and reduces the attendance of the school-aged children. Households in rural areas are relatively poor due to a poor farming investment system and formal job (Anyanwu, 2014). Consequently, in Nigeria, poverty encourages poor households to involve their children in child labour (Kazeem, 2012). Evidence abounds that children from families in the poorest wealth index quintiles had a primary education completion rate of only 58% in 2012 (NBS, 2012). Additionally, poor resources prevent access to habitable housing and good health care — a situation that causes a loss of work and food insecurity in a poor household (Yusuf *et al.*, 2010). This situation is compounded as poverty affects the health practice in the country because health practitioners operate in a poor resource-environment with shortage of funds for health research (Ahmed, 2007). Poverty has widened the gap between rural and urban welfare and it is a serious impediment to sustainable development (Federal Government of Nigeria, 2012).

Crime and violence are connected to long-term sociocultural conditions that bring forth opportunities and incentives for antisocial behaviour of crime and violence (UN-Habitat, 2007). That is, sociocultural conditions of low family values and poverty motivate individuals in a community to commit crime (Badiora *et al.*, 2014). Due to the limited opportunities for the poor to escape the cycle of poverty in Nigeria, many poor people resort to criminal acts to support themselves and their families (Marenin & Reisig, 1995). These acts include robbery, burglary and black market operations. Furthermore, poverty produces anti-social behaviour which has negative implication on the society (Odumosu, 1999). These includes trafficking, prostitution and abuse of children, a situation that worsens child protection in the country (Holmes *et al.*, 2012).

1.3 Crime and Economic Growth

Economic growth has been traditionally conceptualised as an increase in per capita income, but the means to achieve economic growth has remained the subject of contentious debate in the literature. The contention has been centered on the sufficiency of investment to drive growth rate. Harrod (1939) and Domar (1946) gave priorities to capital accumulation as a major drive of a nation's economic growth due to its dualistic role in the economy. That is, capital accumulation is used to generate income and increase productive capacity in the economy. While income generated creates more demand in the short run, the productive capacity expands the supply in the long run. A necessary condition required for economic growth is that income generated through spending should adequately clear the generated output through an increase in capital stocks to avoid idle production capacity. Fulfilling this necessary condition would guarantee full employment, and consequently, steady growth would be achieved in the long run (Dwivedi, 2010).

Moreover, Solow (1956) showed that a steady-state growth is possible when constant growth in per capita capital stock and savings from the increase in income is constant (equal). However, an increase in population per capita would lead to a decrease in capital, a condition that moves a nation's economy away from equilibrium (steady-state). Through technological progress, labour efficiency would be realised for per capita capital stock to increase, thereby moving the economy to a steady-state (Hagemann, 2009 & Dwivedi, 2010).

Romer (1990) augmented the Solow growth idea by emphasising the knowledge component in capital stock, which is transferred from certain firms to other firms across the economy. This investment in knowledge component in capital stock and infrastructure is possible through a free international market. Thereby, Romer postulated that an economy with a larger total stock of human capital will experience faster growth. Also, that a low level of human capital may help explain why growth is not observed in underdeveloped economies that are closed and why a less developed economy with a very large population can still benefit from economic integration with the rest of the world (Romer, 1990).

Notwithstanding, the common goal in this contention is to have a better way of achieving growth of the economy through investment, labour and research and development. Thus, achieving a desirous growth is a worrisome issue in Nigeria and other Sub-Sahara African countries. This is because low GDP per capita growth exists in Nigeria and Sub-Sahara African countries as presented in Table 1.9.

Table 1.9
GDP per capita growth (%)

Country/Region	2000	2003	2006	2009	2012	2015
Central Europe and the Baltics	4.60	4.75	6.82	-3.57	0.77	3.58
East Asia & Pacific	3.66	3.53	4.95	0.65	4.03	3.20
Europe & Central Asia	4.19	1.59	3.63	-4.90	-0.12	1.04
Middle East & North Africa	3.60	2.69	4.61	-0.58	2.17	1.05
Latin America & Caribbean	2.23	0.24	3.99	-2.91	1.66	-1.73
World	2.96	1.61	3.10	-2.91	1.27	1.27
Sub-Saharan Africa	0.88	2.14	4.21	0.07	0.85	0.24
Nigeria	2.70	7.58	5.41	4.11	1.50	-0.01

Source: World Bank Indicator (2016).

The slow pace of economic growth in Nigeria and other Sub-Sahara African countries has received a much-concerted effort from international communities (United Nations, 2001). These concerted efforts are in terms of policies like a structural adjustment programme and financial and other resources support from the World Bank, the United Nations and other international donors. For instance, the net official development assistance received by Sub-Sahara African nations and Nigeria increased from US$17.78 billion and US$0.255 in 1990 billion to US$46.25 billion and US$1.915 in 2012 (World Bank Indicators, 2014). Figure 1.4 shows the trends of the net official development assistance received by Sub-Sahara African nations and Nigeria. Despite these concerted efforts, Nigeria and other Sub-Sahara African countries are still facing many development difficulties such as poverty, inequality and low economic transformation (United Nations, 2014). That is, growth in Nigeria and other Sub-Sahara African countries has been unable to reduce income inequality and poverty substantially (The Nigerian Institute of Social and Economic Research, 2013; Anyanwu, 2013; The World Bank, 2014). Thus, Nigeria and other Sub-Sahara African countries have a low level of human development (United Nations Development Programme (UNDP), 2014) as reflected in Table 1.10.

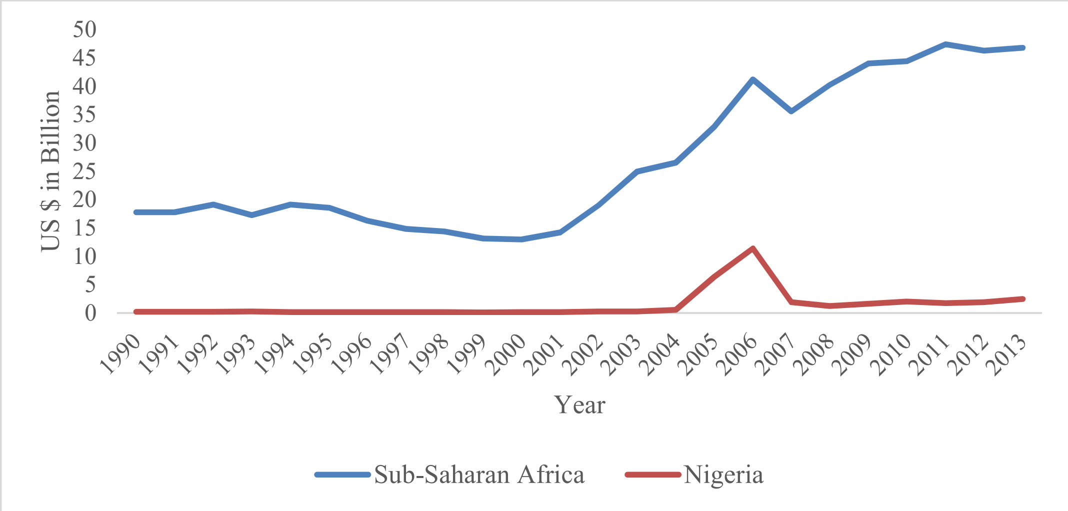


Figure 1.4
Net official development assistance in US$ in billion by Nigeria and Sub-Sahara Africa (Developing)
Source: World Bank Indicators, 2014

Table 1.10
Human Development Index

Region/World	**2005**	**2008**	**2010**	**2011**	**2012**	**2013**
World	0.667	0.685	0.693	0.698	0.700	0.702
Arab States	0.644	0.664	0.675	0.678	0.681	0.682
East Asia and the Pacific	0.641	0.671	0.688	0.695	0.699	0.703
Europe and Central Asia	0.700	0.716	0.726	0.733	0.735	0.738
Latin America and the Caribbean	0.705	0.726	0.734	0.737	0.739	0.740
South Asia	0.533	0.560	0.573	0.582	0.586	0.588
Sub-Saharan Africa	0.452	0.477	0.488	0.495	0.499	0.502
Nigeria	0.466	0.483	0.492	0.496	0.500	0.504

Source: Human Development Report, UNDP 2014.

The low level of economic development in terms of poor growth in Nigeria and other Sub-Sahara African countries has been a matter of much discourse, and several reasons have been advanced for this problem. For example, the United Nations (2001) attributed the low level of development to insufficient savings and low investment, and Gyimah-Brempong (2010) suggested that the low level of education has impeded development, and believed that there has been a loss of human capital with higher education through emigration (Gyimah-Brempong, Paddison, & Mitiku, 2006). Other scholars like Amin (1972) and Ebohon (2012) advanced colonialism, foreign dominance and structural distortion as the causes of the poor state of development in Sub-Sahara African nations, and weak institutions have impeded the development of African economies (Fosu, 2013). Meanwhile, Wong (2012) noted that the post-colonial period of most African nations featured civil war, ethnic conflict, violence and pervasive corruption. Stewart (1993) showed that the consequences of war and conflict-related issues in Sub-Sahara African countries were related to developmental costs in terms of social disintegration, migration and destruction of physical and social infrastructures. That is, violence and conflict scattered people and detached them from their jobs and assets that weakened their ability to cope with hardship (UNDP, 2014). Other notable scholars like Becker (1968) and Bourguignon (1999) pointed to crime as the cause of low development. That is, they believed that crime diverts resources from social infrastructure that may aid growth.

Nigeria is confronted with a high level of insecurity, political violence, corruption and crime (Omotoso, 2013). According to Agbiboa (2012), bribery and corruption have been institutionalised in Nigeria. Likewise, Marenin and Reisig (1995) and Ojedokun (2014) have emphasised that crime is increasing on the daily and yearly basis as reports have also indicated that crime of various forms was committed in the country (Nigeria Bureau of Statistics, 2012). Marenin and Reisig (1995) asserted that the occurrence of armed robbery is frequent and that, despite the provision of security apparatus at homes, people's properties are being carted away and resold into the black market. In addition, elites were involved in an organised crime like drugs, smuggling and theft rings and importation of prohibited goods into the country. Ojedokun (2014) noted that homicide occurred in Nigeria because of armed robbery attacks and violence of the militants. Similarly, various institutions that are meant to curb crime have been contributing to a crime occurrence (Ameh, 2013; Katsouris & Sayne, 2013). For example, on assaults and murder, extrajudicial killings are still perpetrated by security officials with impunity (NOPRIN, 2010). Moreover, harassment, extortion and killing of commercial motorcycle operators over their refusal to offer bribes to security agents have increased (NOPRIN, 2010).

Several attempts over the years have been made to address how economic growth can be improved in Nigeria. These measures have included entrepreneurship development schemes and subsidy reinvestment programmes for graduate internship schemes, national poverty eradication programmes and conditional cash transfer programmes (African Economic Outlook, 2012; Umukoro, 2013; MDG Report, 2013). For example, attempts to boost economic growth in Nigeria through Entrepreneurship Development Centres by the Central Bank of Nigeria were initiated in 2008, and these centres were responsible for the creation of 13,124 jobs from 2008 to 2013 (CBN, 2013). In 2013, the Micro, Small and Medium Enterprises Development Fund was launched to assist graduates from the Entrepreneurship Development Centres in 2013.

Thus the Micro, Small and Medium Enterprises Development Fund made efforts to provide capital assistance to entrepreneurs in Nigeria (Ojo, 2009).

Despite waves of government efforts to spur economic growth in Nigeria, achieving the expected average growth rate of 13.8% and income per capita of US$4,000 articulated in Vision 20: 2020 remained elusive. Similarly, the Millennium Development Goals target of reducing income inequality by 2015 by halving the number of people subsisting on US$1 and to reduce poverty to 21.40% remains unfulfilled (African Economic Outlook, 2012). This is because corruption has grossly made social protection on development inadequate in Nigeria (Umukoro, 2013). For example, 83 micro financial institutions were listed for bankruptcy due to fraudulent practices (Aborisade, 2014). Thus, the high rate of insider abuse and fraud were found to mitigate against the activities of micro financial institutions in Nigeria (Moghalu, 2010).

The high level of crime in Nigeria has been related to the decline in growth by the African Economic Outlook (2014). For example, per capita income growth in Nigeria remained stagnant between 2007 and 2010 at 4.04%, 3.48%, 4.11% and 4.98% respectively, but declined to 2.10% and 1.50% in 2011 and 2012 respectively. This is a source of concern (World Bank, 2016).

One large issue is that economic transactions in Nigeria are often burdened by fraud and forgery through theft, illegal funds transfer and fraudulent withdrawals (CBN Annual Report, 2012). The number of fraud and forgery cases increased from 2,557 in 2011 to 4,527 in 2012 with a loss of ₦29.5 billion in 2011 and ₦14.8 billion in 2012 (see Table 1.11). Also, through illegal bunkering, sabotage and theft, the Government lost ₦1.737 trillion from 2009 to 2011 (Ahmed, 2013). However, little attention has been given to studying how crime has affected economic growth in Nigeria. Therefore, a need exists empirically to demonstrate if and how crime has affected the standard of living and welfare of the citizenry through diminished economic growth in Nigeria. A graph comparing crime rates with economic growth shows the problem. For example, the crime rate was 66.09% in 2011 and 66.51% in 2012, and economic growth was 2.10% in 2011 and 1.50% in 2012 as illustrated in Figure 1.5. Crime other than financial including murder, felonious wounding, other crime against persons, armed robbery, burglary and false pretence/cheating among others probably have impeded the country’s economic performance as indicated in Figure 1.6.

Table 1.11
Crime of fraud /forgery in Nigeria

Year	Cases of fraud /forgery	Rate of fraud/forgery*	Amount loss in ₦'billion
2000	723	0.59	2.185
2001	908	0.72	2.530
2002	981	0.76	5.000
2003	1036	0.78	3.600
2004	1175	0.86	9.600
2005	1229	0.88	1.500
2006	1193	0.83	4.600
2007	1553	1.06	10.000
2008	1974	1.31	24.490
2009	3852	2.48	33.300
2010	5960	3.73	19.700

2011	2527	1.54	29.500
2012	4527	2.68	14.800

Sources: CBN Annual Reports and author's compilation*.

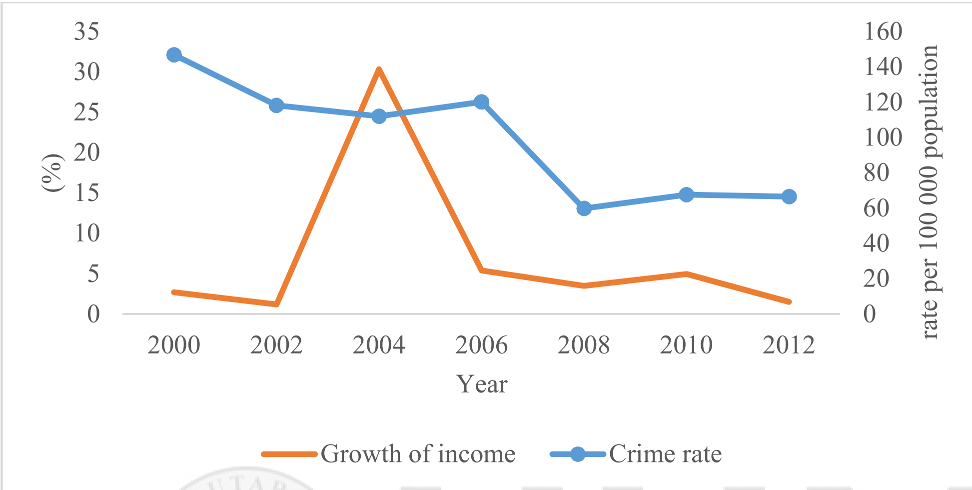


Figure 1.5
Crime rate and growth of income in Nigeria
Sources: NBS and the World Bank, 2016.

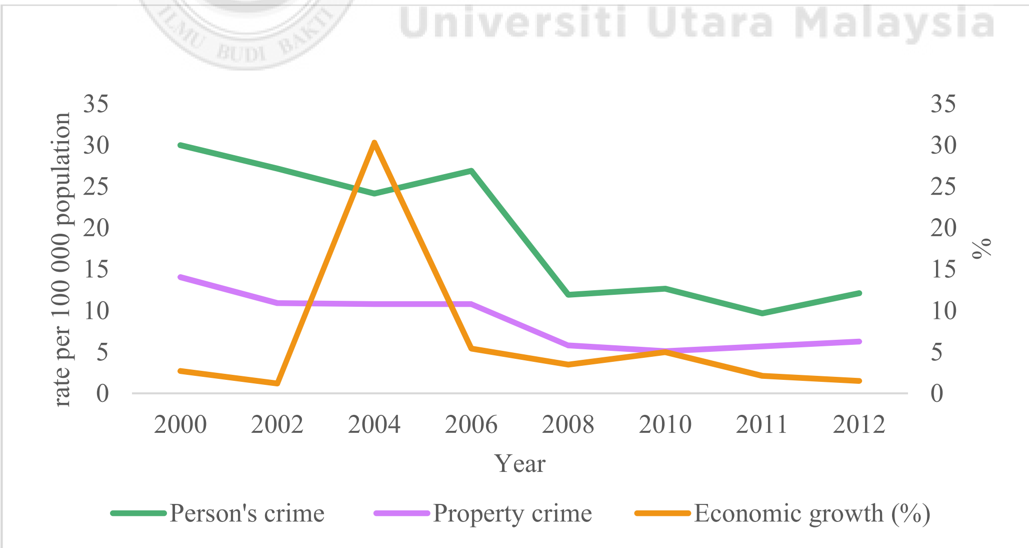


Figure 1.6
Types of crime and growth income in Nigeria
Sources: NBS and the World Bank, 2016

1.4 Problem Statement

Economic growth in Nigeria has been subject to periods of stagnation and even decline. This has occurred despite a wealth of natural resources and various means and measures that have been adopted to boost economic growth. Several reasons exist for this issue, but crime-related matters are a principal one. Over time, crime has become more pervasive in Nigeria despite several attempts and tactics used to reduce it. Unfortunately, the extent that crime poses much danger to the economy and the country's citizens is distressing. Inherent dangers include the loss of lives and properties and financial loss, and a poor image among investors that has led, in turn, to a reduction of investment in the country.

However, attempts to combat crime-related matters without identifying and address the root issues related to crime itself may result in a waste of resources. The high level of socioeconomic strain factors in the country that encourage poor satisfaction may be crucial issues related to the causes of crime in Nigeria. This is because the burden of socioeconomic strain causes stress, frustration and anger among the people and consequently, influencing them to commit crimes. Among these socioeconomic strain factors are unemployment, income disadvantage and poverty. To help solve this issue, this study seeks the means to address socioeconomic strain, which, in turn, may help minimise crime. The minimisation of crime may improve economic growth so as to promote and achieve a better standard of living in the country.

High unemployment and underemployment signifies economic strain and the distress of poverty-income in Nigeria. Unemployment idles potential in skilled persons and lowers productivity. It creates discomfort and a state of unhappiness in the affected people involved. Also, high unemployment increases the number of those subsisting under the poverty line in the country and leads to a vicious cycle of poverty. The challenge of poor income people may increase as they struggle to provide for their children's education. Also, merely meeting their daily needs may be stressful due to economic deprivation. The stress of being disadvantaged without any support from society caused more harm. This is because the stress due to economic deprivation could disadvantage citizens to think of meeting their daily needs unconventionally. Such unconventional means include engaging in illegal activities to earn enough income to survive. In spite of the problems of unemployment, available previous studies documented lesser years on unemployment and crime in Nigeria in which this study differs (Omotor 2009; Torruam and Abur, 2014).

The income of many workers remains low in Nigeria, and a poor income may not serve as a better means for income disadvantage workers to move out of poverty. Several reasons exist for this. One is that poor income would not motivate workers to perform better on their jobs, and poor motivation encourages income disadvantage workers to engage in industrial conflicts to demand better wages. Some income disadvantage worker may engage in legal work to satisfy their needs. Others, may resort to ritual killing, theft or bribery to earn extra income. However, despite the malaise that income disadvantage creates in Nigeria, few studies exist in this area, and among these studies their findings are mixed, which means that further evidence is required (Omotor 2009, Badiora *et al.*, 2014 and Obasa, 2015). Moreover, the relationship between income disadvantage and crime should be documented.

A large number of the population lives below the poverty line in Nigeria, which is amazing in a country like Nigeria that has abundant natural resources. Unfortunately, poverty breeds a vicious cycle. Poverty limits educational opportunities among the poor because it is directly related to child labour activities and a low educational completion rate. Among the other maladies related to poverty are poor housing and access to good health. With poor living conditions, most of the poor are emotionally exhausted and become involved in anti-social activities to fulfil their daily needs. Such anti-social activities include prostitution, trafficking and child abuse. Other crimes include violence, rape, burglary and robbery. Consequently, poverty is not only a threat to individual welfare but also to peace and security in the country due to the linkage with criminal activities (Odumosu, 1999 and Badiora *et al.*, 2014). Thus, the links between poverty and crime in Nigeria deserved to be studied.

Moreover, the economic performance of Nigeria has become stagnated. That is, the inadequacy of economic performance is reflected in the poor standards of living in the country. Furthermore, the economy faces a growing number of crime challenges in terms of armed robbery and burglary, fraud and corruption, and forgery. The Central Bank of Nigeria noted the frequent occurrence of these crimes in 2012 and that the economic performance of Nigeria featured the loss of huge sums through transactions involving criminal activities. Some available previous studies have empirically shown that corruption adversely affects economic growth in Nigeria (Aliyu & Elijah, 2008; Odubunmi & Agbelade, 2014). Although the presence of crime is unfavourable to economic growth, this has not been well documented in the case of Nigeria. Thus, this current study believes that an investigation on how crime has affected economic growth in Nigeria may assist in improving growth in the country through its findings and resultant recommendations.

1.5 Research Questions

This study addressed the following questions about the relationship of socioeconomic strain and crime occurrence in Nigeria with respect to the probability that it might affect economic growth. Primary questions include: would socioeconomic strain factors account for crime occurrence, and what is the effect of crime on economic growth in Nigeria? In addition to these broad questions, this study seeks the answers to the following specific research questions:

1. To what extent do socioeconomic strain factors affect crime in Nigeria?
2. To what extent does crime affect economic growth in Nigeria?
3. What is the nature of causality between socioeconomic strains, crime and economic growth in Nigeria?

1.6 Research Objectives

Following the questions raised in Section 1.5, the main objective of this study is to examine the effects of socioeconomic strain on crime in Nigeria and to investigate the effects of crime on economic growth. In achieving this broad objective, the study has the following specific objectives. They are:

1. To determine the extent to which socioeconomic strain has affected crime in Nigeria;
2. To determine the extent to which crime has affected economic growth in Nigeria; and

3. To determine the nature of causality between socioeconomic strain, crime and economic growth in Nigeria

1.7 Scope of the Study

This study is confined to Nigeria, a country within the Sub-Sahara Africa. The study examines socioeconomic strain factors (unemployment, income disadvantage and poverty) and crime in Nigeria. Also, the study seeks to investigate empirically how the strain present in these socioeconomic variables serve as incentives to commit crime in the country. The study examines the impact of crime activities on economic growth in Nigeria by using data from 1970 to 2013. The directionality that exists among the variables under investigation should be a matter of concern for policy suggestions.

Moreover, the study assesses the implications of deterrence as a means of curbing crime. Likewise, the study considers the justification for prosecution, conviction and punishment through the impact of internal security expenditure on crime. Also, the period of analysis is restricted to 44 years from 1970 to 2013 due to the availability of time series data. The study is limited to the exposition of socioeconomic strain variables that pertain to economic growth in Nigeria.

1.8 Significance of the Study

Despite the enormous problems that socioeconomic strain could cause, especially about how it contributes to criminal activities in Nigeria, it has not been given the much-deserved attention in the literature. A few studies exist in this area but the context of their discussion differs from the context of this study. This study considers the socioeconomic strain variables that serve as strains and incentives to crime. Thus, this study, with its distinct nature, is necessary for understanding why crime remains high despite the various attempts the government has made to reduce it.

The relevance of this study is related to the developmental issues in Nigeria and the concern of international communities and policy makers. Crime is a problem confronting developmental issues in Nigeria, including the safety of human beings and the people's welfare. Reduction in crime is required for the economy to have a positive impact on the people. However, controlling crime can be achieved not only through crime deterrence but by tackling socioeconomic strain to encourage the development of good atmosphere. Possibly, a better security situation would develop better income levels in the country. Hence, this study is more relevant based on the alternative means of preventing crime by means of adjusting the macro imbalances that exist in Nigeria.

Moreover, the drive to expose socioeconomic strain will help to ascertain the extent to which criminal activities have inhibited economic growth and adversely affect the welfare of citizens. This is because crime has been identified as a key challenge of developmental objectives in Nigeria, especially the developmental objectives of Vision 20: 2020 (Federal Ministry of Finance in Nigeria, 2014; Bertelsmann Stiftung's Transformation Index, 2014).

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This section discusses issues on theory relating to the relationship between socioeconomic strain and crime with attention given to the social disorganisation theory of Shaw and McKay, the strain theory of Merton and rational choice theory of Becker. Also, the theoretical review highlights the likely socioeconomic strain that may be derived from socioeconomic variables, which further serve as incentives for criminal activities. Moreover, focus is given to the empirical evidence on the relationship between crime and economic growth. This includes empirical evidence on the relationship between socioeconomic strain and crime in terms of unemployment and crime, income disadvantage and crime; and poverty and crime.

2.2 Reviews of Theories

2.2.1 Social Disorganisation Theory

The social disorganisation theory of Shaw and McKay (1942) concentrated on the explanation of crime and delinquency based on the community spatial distribution in their work titled *Juvenile Delinquency and Urban Areas*. This work focused on the inability of a set of communities to achieve a generalised value for their inhabitants or provide a solution to generalised problems. Stable communities have agreed upon norms and values within which inhabitants tend to operate and live happily. The state of inhabitants harmony rests on the social bonds and relationships that cordially exist among them in ensuring to achieve the common set of goals. But then what accounted for disorganisation? They argued that disorganisation results in the breakdown or weakening of social control of various institutions that are responsible for providing good networking for the smooth operation in the community. These social institutions are community peer group, family, educational and religious settings. Change of development in the social system due to poor control may lead to conflict because individuals would behave in a deviant manner through crime and delinquency.

Shaw and McKay provided three main factors that can lead to the breakdown or weakening of social control of various institutions in a set of communities. These factors are: 1) instability and mobility of inhabitants, 2) ethnic and racial heterogeneity, and 3) low economic status.

First, the instability and mobility of inhabitants occurs when an inhabitant has reasons to change locations due to better job security or for educational purpose. Also, when inhabitants frequently leave a community, this discourages the full participation of other inhabitants in the community.

Second, the restrictions that inhabitants impose in terms of racial or cultural barriers alienates some sets of people who do not belong to that same class. Then, during alienation. affected individuals may experience strain in terms of frustration and oppose the rules or values set in the community.

Third, poor economic status that exists among some members of the community would cause division of the community into higher and lower economic classes. The division would further draw the lower class away from the community set of values because of their economic incapacitation. That is, when the individuals in this community find that the values are difficult to achieve, frustration may set in and make them work against the standard regulation.

The relevance of the theory of social disorganisation of Shaw and MacKay to criminology is that it portrays the generation of crime and delinquency in a modern society. This generation of crime is through the disruptions taking place in the community, which puts inhabitants into incarceration. When a high incarceration rate occurs, the social vices in the community would, in turn, increase. Thus, the consequence of disorganisation in the community is increased crime and delinquency.

The social disorganisation theory of Shaw and McKay (1942) is applicable to the crime environment in Nigeria. The increased occurrence of crime has increased the level of insecurity and created fear among the citizens. This is due to the loss and destruction of property and lives and violations of rules. The unconducive atmosphere has increased crime, and the desire to have a better income and education has encouraged the movement of people especially from rural to urban areas. The effect is that social institutions have become weaken in their roles. Also, comfort indexes as measures of welfare socioeconomic environment become lower. These measurements include unemployment and income inequality, which Shaw and McKay described as indicators of low economic status. Thus, this current research considers unemployment due to the availability of data, and income disadvantage and poverty are studied instead of income inequality. Also, family instability as it relates to crime is also considered because the aimed to change location due to better income and education often led to instability.

2.2.2 Strain Theory

Merton (1938) developed the strain anomie theory in his work titled *Social Structure and Anomie*. The theory focused more on deviance than on criminal acts, and his work strongly helps to comprehend how deviant acts may lead to criminal behaviour. That is, a deviant may behave differently from the recognised societal structure or norms when frustrated due to the inability to achieve the recognised values set or operate successfully in society. This is because society places an emphasis on how values could be achieved in a legal manner through learning and hard work.

However, in every society some individuals may not have equal access to the means of achieving values that society requires. That is, the defects in setting the cultural values in a society occur because they do not consider the gap that exists among the groups or between the rich and the poor. The net result is that disadvantaged groups fail to achieve the set goals of success. Thus, the difficulty in attaining the set goals with limited means leads the disadvantaged group of people to become strained and frustrated. In turn, the strain of frustration and anger may make them deviate from acceptable cultural ways of behaving especially when the relative success in their surroundings is considered. In this instance, a situation that Merton described as anomie would occur.

Merton identified five roles in adapting to the strain caused by the limited chances to achieve the approved social values or goals. These are: 1) conformists, 2) innovators, 3) ritualists, 4) retreatists and 5) rebels. He contended that conformists would operate within the societal values and use the legal means to achieve the goals required by the society. However, the other modes showed that disadvantaged people become deviants. That is, innovators would uphold the set goals in the society by attaining them through illegal ways or other means not set by the society. Also, ritualists ensure that the values of society values are operationalized by keeping to the means in a secure manner, which now serves as their goals. This makes them resolve not to be unnecessarily strain towards achieving the original goals. In addition, the retreatists jettison the means and goals of a society. That is, they engage themselves in unproductive issues and lifestyles including that of alcoholism. Lastly, the rebels are people who would out rightly reject the values and means in the society. They rather prefer to restructure society by fashioning new means and goals instead of the existing ones.

Hence, the strain anomie theory of Merton's contribution to the field of criminologist demonstrated how the macro social structure may succeed in making deviants emerge at various levels in the society. That is, the creation of unequal class through value setting and less access to the means of achieving them by the lower class. The unequal access and the consequences of the inability to achieve the expected values may impose a strain on them. In turn, the strain imposed on them would cause frustration, which would make them behave criminally. Thus, the criminal behaviour displayed by the deviants is due to a disjoint between set goals and the means to attain those goals.

The psychological conditions, the means to achieve the value and the value itself present in the strain theory of Merton (1938) help explain the socioeconomic factors in Nigeria. First, value is likened to the standard of living measured by income and wealth. Wealth and income categorize the class of a worker or family as being either rich or poor, and a high number of Nigerians are considered poor based on the poverty index. Education has been described as a means in the theory to achieve the value (wealth), and many Nigerians have strived to move out of poor through education. In Nigeria, the rich are able to send their children to school while children in poor families engage in child labour to help pay the fees. Also, the rich have access to credit facilities but the poor do not. Therefore, the poor can only afford only an inferior quality education and have low or no employment or income disadvantage as a result. As a result, the psychological conditions of stress, anger and frustration are most visibly present among the poor, due to the inability to access credit facilities or gain the higher education necessary to achieve a better income. Merton posited that the options left for the poor were to either violate or not violate the societal rules while seeking other means to achieve the desired income. Thus, Merton's theory is linked with the following strain factors in Nigeria; these are unemployment, income disadvantage and poverty.

2.2.3 Rational Choice Theory

Rational Choice Theory became more prominent, especially in the studies of criminology during the 1970s and 1980s (Albertson & Fox, 2012). The theory became more popularised in Becker's (1968) article titled "Crime and Punishment: An Economic Approach", which was followed by Ehlirch (1973) in his work "Participation of Illegitimate Activities" and then Sjoquist (1973) "Property Crime and Economic Behavior: Some Empirical Results", and Block and Heineke (1975) "A Labor Theoretic Analysis of the Criminal Choice."

Subsequently, Rational Choice Theory has been extended to include the concept of time in terms of risk (Sjoquist, 1973), rational enforcement (Stigler, 1974) and multi-attribute problems of decisions under certainty and uncertainty (Block & Heineke, 1975). Thereafter, further empirical work considered the Rational Choice Theory in various forms to provide measures to reduce crime in society so that socio-economic lives can be enhanced (Bourguignon, 1999; Mauro & Carmeci, 2007).

The economic approach to crime assumes that an individual behaves in a rational manner by considering the potential gains and losses in legal and illegal activities, and then decides upon which one to engage. Becker (1968) identified two possible sets of activity in an economy, which give satisfaction to the participants in each set of these activities. These activities include legal and illegal activities. Furthermore, Stigler (1974) said that illegal activity includes the consumption of crime and the production of crime. While the consumption of crime is not economic in nature like assault and over speeding on the highway, the production of crime is more of economic in nature like smuggling and violating economic rules. Nevertheless, the economic approach viewed illegal activity as a rational behaviour based on the response to incentives that serve as a motivational drive (Ehrlich, 1973). These incentives factors are monetary components in the form of legal and illegal income, unemployment and prosecution. While legal income and prosecution increases the opportunity costs of crime, illegal income and unemployment decreases the opportunity costs of crime.

Based on the response to incentives, a criminal participating in an illegal activity is expected to consider if the gains of involving in an illegal activity are more than the gains in legal activity and vice versa (Becker, 1968). Thus, a criminal acts like a professional who pursues income in the realm of rules according to his choice of criminal occupation because he believes that such criminal activity is not different from legal work (Stigler, 1974). Moreover, both illegal and legal activities involve the ability to take risk (Ehrlich, 1973). Besides risk, a criminal would want to consider the time and resources he would use in carrying out the illegal act and ensure that the gains in committing crime are more than the costs of committing the crime, that is, the punishment he would receive if caught. This is why Sjoquist (1973) emphasised that an offender would allocate time to both legal and illegal activities, the amount of which depends on the costs and gains in these two activities. In addition, engaging in either of the two activities may result in financial and psychic gains and costs. That is, the offender sees that the gain from illegal means is commensurate to the time, financial (tools, expenditures) and psychic costs (arrest, conviction and punishment) from the illegal activity.

The consideration of a criminal to engage in an illegal activity is also based on the knowledge of the environment; for example, if there is more or less protection because societal members may be harmed (Becker, 1968). In order for the criminal to reduce the risks associated with committing a crime, the criminal gathers information on the likely outcomes of a particular chosen alternative about probable affairs in the future. For instance, Ehrlich (1973) argued that a criminal would violate laws if he knows that his wealth or psychic would increase and outweigh the penalties set by the society for offenders. Moreover, the criminal may decide to venture into crime if the time length of serving a punishment would justify the gain that he would obtain from committing a crime (Sjoquist 1973). The theory also emphasised that crime is reduced in a society when an improvement in the likelihood of criminal arrest and conviction is made and on the costs of crime (punishment) (Becker, 1968; Ehrlich, 1973; Sjoquist, 1973). That is, prevention and enforcement expenditures would encourage offence reductions, and the reduction in offences would serve as the returns from the expenditures (Stigler, 1974).

However, Becker (1968) concluded that illegal activity is one that dislocates economies and leads to diseconomies of scale in a society based on the number of offences. Offences increase when the criminal derives more social value from the gains from of illegal deals. In effect, a loss of earning, lives, forced redistribution of wealth and other public dissatisfaction occurs. However, public dissatisfaction towards crime would make society spend more on crime control inputs like policemen and machines thereby increasing the social costs of crime to the society.

Therefore, social loss in the rational choice theory is the social cost of damages, apprehension and convictions due to crime supply. This is because the supply of crimes determines the social costs based on the changes in punishments (Becker, 1968). Punishment through imprisonment would result in a net social loss because no payment is made to the society but rather public resources are consumed. Besides, social loss was explicitly tied to the poor social welfare caused by criminal activities. However, Becker noted that, to increase social welfare in a society, offenders must be discouraged through the expectation of conviction and punishment to reduce losses from crime. This is because more arrests, convictions and punishments may assist in reducing offences in society. Thus, the theory of rational choice affirms that a rise in the number of crime committed would probably increase the social loss of wealth (Becker, 1968; Ehrlich, 1973).

Crime occurs in Nigeria because of a violation of the rules. The rational choice theory posits the role of social institutions in deterring crime. This is done through the police, law courts and the prisons services. The arrest of criminals by the police, conviction by the law courts and incarceration by the prisons ensures that a criminal serves his punishment as recommended by the law court. These social institutions require funds to deter crime, and public internal security expenditures in the financial budget capture funds provided to deterrence institutions by the government. Expenditure on security and other resources used to deter crime are regarded as social costs. Loss of wealth is used in the theory to explain the effects of crime on society. Also, Nigeria has experienced poor growth in her economy that may be liken to the loss of wealth.

Therefore, this explains the need to include public expenditures on security, and economic growth in the current study. However, this theory provides the basis of explaining the incentives of reducing unemployment, income disadvantage and poverty as a means of decreasing opportunity costs of crime in Nigeria.

2.3 Empirical Evidence

2.3.1 Socioeconomic Strain and Crime

In establishing the link between socioeconomic strain and crime, some economic variables can be adequately measured directly while others would have to be considered more indirectly. In this study, socioeconomic variables are considered in terms of their influence in causing various types of crime. The idea of strains is that an economic variable may exert pressure on individuals to commit a crime, and, at the same time, an economic variable may serve as a motivational incentive to commit a crime. This is in relationship to that fact that the cultural values in Merton strain theory are economically driven based on the American Dream. Thus, a high probability that socioeconomic variables induces crime is based on the available literature discussed below.

2.3.1.1 Unemployment and Crime

Researchers have examined various means to increase the opportunity costs of crime. One of the identified means of increasing the opportunity costs of crime is labour market income (Oshen, 2010: Patalinghug. 2011). The argument is that a higher probability of better income in the market would prevent people from committing crime. Also, other works have devoted their time to exploring economic factors that reduce the opportunity costs of crime, especially the time spent not engaging in any meaningful work. They identified reducing unemployment as a means of reducing the opportunity costs of crime (Edmark, 2005; Altinga, 2012). The latter approach was adopted in this section and sections 2.3.1.2 and 2.3.1.3 due to data available.

Previous studies that have explored unemployment and the relationship with crime have had mixed results. While some researchers obtained a positive relationship between unemployment and crime (Speziale, 2014), others have produced negative (Wu & Wu, 2012) or no results (Pyle & Deadman, 1994). For example, Speziale (2014) examined the relationship between unemployment and crime in Italian provinces. The study used a panel data from 2000 to 2005, the panel data estimated with the Generalised Methods of Moment (GMM). Speziale established a positive link between unemployment and total crime with respect to theft, fraud and robbery. The study outcomes showed that juvenile unemployment was positively and significantly related with theft, fraud and robbery. The results, according to Speziale, revealed two things. One, previous experience in criminal activity influenced the decisions to become involve in crime; and two, a low efficiency of the legal system encouraged the increase in criminal activities.

Thus, Speziale's study provided support for the rational choice theory in two areas. First, efficient deterrence to crime is required increase the opportunity costs of crime. Second, unemployment served as motivational factor for crime.

Other researchers have also examined the relationship between crime and unemployment, but the results have been mixed. Wu and Wu (2012) found a negative significance between some types of crime and unemployment. Pyle and Deadman (1994) could not find a link between unemployment and crime in Scotland.

The reciprocal relationship between unemployment and crime has received the attention of the researchers (Raphael & Winter-Ebmer, 2001; Edmark, 2005; Lin, 2008). The nature of the argument is that unemployment might increase crime and that the effects of crime might likewise increase unemployment. Thus, criminal activities might increase unemployment in the market when offenders find it difficult to find a job or employment after being discharged from the prison. For example, Raphael and Winter-Ebmer (2001) argued that unemployment may be increased if convicts find no reason to engage in legal work. Also, crime may discourage the development of new firms, thus limiting the growth of employment in a crime-ridden area. Similarly, firms in crime areas pays high wages to sustain their workers as compensation (Gould, 2002).

Raphael and Winter-Ebmer (2001) and Gould (2002) believed that endogeneity issues must be resolved to make estimates valid. Although a positive link between unemployment and crime is possible by controlling for endogeneity, this depends on the choice of control variables included in the model (Lin, 2008).

Raphael and Winter-Ebmer (2001) and Lin (2008) examined the relationship between unemployment and crime in the United States. Raphael and Winter-Ebmer (2001) looked at unemployment and seven felony offenses in the United States with panel data from 1971 to 1997. They found significant positive effects of unemployment on property crime rates and that a substantial part of the decline in property crime rates was due to the decline of the unemployment rate. Rape was weakly related to the employment prospects of males. Similarly, studying unemployment and crime in the United State with panel data from 1974 to 2000, Lin (2008) found a positive and significant relationship between unemployment and property crime, and other of property crime including burglary and larceny. But, Lin result's on rape differed from that of Raphael and Winter-Ebmer because Lin found that unemployment reduced rape.

Studies have examined the relationship of unemployment and crime in other countries as well. Edmark (2005) used panel data from 1988 to 1999 to study unemployment and crime in Sweden. The results were like those of Lin with respect to in many respects. Edmark found a positive and significant link between unemployment and the property crimes of burglary, car theft and bike theft. Halicioglu, Andres, and Yamamura (2012) modelled crime in Japan with time series data from 1964 to 2009. They found obtained a positive and significant relationship between unemployment and aggregated crime, robbery, violent crime, and fraud.

Various approaches and types of datasets have been used to examine the link between unemployment and crime, and the approach is determined by intentions of the research, the nature of data employed and availability of data. Pyle and Deadman (1994) argued that evidence from regional data were best if crime and unemployment data capture the regional influence of deprivation. While this view is sound logical and reasonable, previous work using regional data are often confronted with a length of time problem (Wu & Wu, 2012). Wu and Wu's (2012) results were mixed based on the panel data from 2002 to 2007 in United Kingdom regions. The results of robbery, drug and other crime with unemployment were positive and significant. But the relationship of violent crimes, crimes of a sexual nature, damage and fraud with unemployment were negative and significant. Altinga (2012) examined the linkage of unemployment and crime using data from 33 European countries; the results showed a positive and significant relationship with aggregated property crime, burglary, and motor vehicle theft. However, the sample size was shorten due to missing data for some years and countries. Thus, this study could not use panel data due to the data available in the country. Consequently, a time series approach is explored by this study.

The time series approach in crime studies has allowed a single spatial unit investigation; overcoming the spatial dependence problem between cities or states (Dos Santos & Kassouf, 2013). Lee and Holoviak (2006) examined the link between unemployment and crime using annual data from 1972 to 2001 in Korea, Australia and Japan. The study found a joint movement of unemployment and crime using Johansen's maximum likelihood cointegration tests. Saridakis's (2011) extensive study supported the results of Johansen's cointegration approach. Saridakis considered violent crime and unemployment with annual time series from 1960 to 2000 in England and Wales. The study established a positive and significant estimates showing that an increase in crime was due to increase in unemployment.

Hence, this study notes the valuable work done by previous researchers in trying to establish a link between unemployment and crime. The mixed outcomes of their works showed that more study is required to validate the hypothesis of the opportunity costs of crime. The common proposition is that unemployment serves as an economic incentive to commit crimes. A similar analysis is required to examine and document the link between unemployment and crime in Nigeria, and previous studies have not emphasized the strain effect as a sign of distress in unemployment. Both necessitate a study in the context of Nigeria.

2.3.1.2 Income Disadvantage and Crime

The labour market provides an opportunity to receive an income for individuals who engage in legal work. This income could serve as an incentive to discourage people from committing crimes or, at least, to increase the opportunity costs of crime in society (Ochsen, 2010; Patalinhug, 2011). However, labour market income could be either high or low. High incomes create less of a problem with respect to crime for society when compared to income disadvantages. Ehrlich (1973) developed a market model of crime in relationship with income inequality in which a labour market with high inequality ends up creating incentives for a income disadvantage worker to engage in illegal activities. Thereafter, researchers began to focus on the relationship between income distribution and crime (Chiu & Madden, 1998; Fajnzylber, Lederman & Lloayza, 2002; Scorzafave & Soares, 2009; Hauner *et al.*, 2012).

However, rather than focusing on the income gap per se, this study focused on income disadvantage for four main reasons. First, income disadvantage workers have little saving as backup to cope with economic fluctuations. Second, income disadvantage among workers reduces the opportunity costs of crime. Third, few studies have paid attention to income disadvantage and crime (Fajnzylber *et al*., 2002; Bourguignon *et al.*, 2003; Machin & Meghir, 2004; Yildiz, Ocal, & Yildirim, 2013), and, lastly, limited data on income inequality is available in the country.

The discourse on income disadvantage and crime considers a threshold or benchmark for categorizing income as low. The threshold is then examined with those below it to draw conclusions. Such conclusions have not been definitive due to the divergent results across various studies, and income is sometimes not standalone. Suitable and effective public security are required to complement income policy in the labour market (Bourguignon, Nuñez, & Sanchez, 2003; Machin & Meghir, 2004; Yildiz, Ocal & Yildirim, 2013).

For instance, Bourguignon, Nuñez, and Sanchez (2003) specified a structural crime model with consideration given to inequality in Colombia. The study demonstrated how crime was proportionate to the number of various income ranges in the income distribution. The model described the part of the income distribution, which provided more explanation on the disparity of crime occurrence with OLS estimation. However, Bourguignon, Nuñez, and Sanchez (2003) concluded that people with an income below the threshold of 80% of population mean in the seven main cities of Colombia were mostly involved in crime. The translation of this is that a high probability exists for households with a income disadvantage-capita to commit a crime. Similarly, Fajnzylber *et al.* (2002) examined the strength of an alternative measure with respect to income inequality. That measure was the ratio of income of the rich-to-poor population. The benefit of this measure is that it captures the lowest income in the quintile and not the gap. A panel data is estimated with GMM using non-overlapping averages of 5-year for 39 nations through 1965–95 for homicide and 37 nations through 1970–94 for robberies. The results showed that countries with higher inequality suffer from more violent crime, which leads to the conclusion that reducing the income ratio would cause a reduction in those crimes. Thus, the means of analysis in Fajnzylber *et al.* (2002) made it is possible to evaluate a reduction effect of crime when income inequality is reduced and proffers appropriate measures on how to reduce crime in the most countries. This is because a poor income ratio increases homicide and robbery in both the short and long run.

The work of Machin and Meghir (2004) examined the low-wage rate of workers and property crime in a police force environment in England and Wales with panel data from 1975 to 1996. The low-wage rate was disaggregated into two: the 25th percentile wage and the 10th percentile wage. The 10th percentile wage was explained as comprising people who are working but have low-skills, and the 25th percentile was explained as comprising those who not really attached to the labour market (retail traders). The results of the OLS and 2SLS revealed a negative and significant relationship between low-wage rate at the 10th and 25th percentiles with all property crimes and the total property crime. Also, the marginal effect of wages was negative and significant, and this confirms that an attempt to reduce income at the lower bound of the income distribution demands caution in terms of adjustment. That is, reducing the low-wage rate in the labour market would cause more property crime in the society. The study used the conviction rate but controlled for endogeneity, the result showed that a higher conviction rate lowers crime rate. It is suggested that productivity and wages of individuals would increase with a better system of education, a guarantee of enhancing human capital. Thus, a combination of increasing in human capital and appropriate deterrence measures would reduce crime in society. Moreover, Yildiz, Ocal and Yildrim (2013) provided a missing link between Bourguignon, Nuñez, and Sanchez (2003) and Machin and Meghir (2004) while examining socioeconomic factors and crime in Turkey. Yildiz, Ocal, and Yildrim (2013) found that income disadvantage was positively and significantly associated with the crime rate that supports Bourguignon, Nuñez, and Sanchez (2003) but agreed with the marginal effect of income on crime as discussed in Machin and Meghir (2004).

Yildiz, Ocal, and Yildrim (2013) studied three levels of income , which were the lowest income (proxied as minimum wages), middle income and high income. Panel data from 2002 to 2009 was used. and panel GMM system estimation was utilized. The results indicated that all the three levels of income were positive and significantly related with crime. The marginal effect suggested that increasing income would reduce crime rate. Thus, the marginal effect suggested that income disadvantage workers engage in more crime compared with workers with high incomes. By implication, then, income disadvantage serves as an incentive to increase crime. Also, the clearance rate was an efficient tool because it was negative and significant with the crime rate. However, the clearance rate is of small value because the study affirmed that this was due to the non-disclosure of crime statistics to the public. Nonetheless, examining the association of various income levels with crime is a remarkable step, providing a clearer understanding of the link between income and crime but poverty was not examined in the model. However, due to unavailability of data in Nigeria, this current study is confined to the relationship between income disadvantage and crime.

Unfortunately, studying income disadvantage by previous research without paying attention to the strain cause by income disadvantage to workers misses a key a point in the analysis. Although the economic approach to crime affirmed that income reduces crime, further classifications of income into low and high groups have shown that income disadvantage does serve as incentive to commit crime (Fajnzylber *et al.*, 2002; Bourguignon, Nuñez, & Sanchez, 2003; Machin & Meghir, 2004; Yildiz *et al.* 2013). Also, the indefinite findings in Bourguignon *et al.* (2003), Machin and Meghir (2004) and Yildiz *et al.*, (2013) demonstrate that more studies are required to clarify the divergent results. However, previous studies have provided justification for crime deterrence as a support to labour market policy for crime reduction in society.

However, the available data on income disadvantage would prevent this study from considering the marginal approach. In this study, income disadvantage data is accessed with the inverse of the logarithm of average income per population, and this makes this current work different from the earlier ones. Thus, the data employed can provide reliable estimates for policy making to boost income and minimise crime.

2.3.1.3 Poverty and Crime

The assertion that poverty is positively related to criminal activities has been established by the criminologists (McKeown, 1948). Poverty limits the opportunities for an individual to achieve basic needs and goals. As poverty becomes more pronounced, it weakens social institutions, which, in turn, attracts people to crime and creates further disruptions in society (Shaw & McKay, 1942). The Becker-Ehrlich economic approach to crime rationalizes this positive relationship as poverty encourages people with poor income to commit crimes (Ehrlich, 1973). Subsequently, Berk, Lenihan and Rossi (1980) noted that the crime rate is higher among the poor due to a high number of arrest among the poor, which is especially true in instances in which where the poor have few or no safety nets (Meloni, 2014). Thus, resource deprivation resulting to poverty encourages the poor to engage in crime if no social protection is provided (Rogers & Pridemore, 2013). Nonetheless, further studies are required to create better strategies for crime-reduction poverty programmes (Fajnzylber et al., 2002). Strategic crime-reduction poverty programme should be sustainable and move beyond mere strategy (Berk, Lenihan, & Rossi, 1980; Meloni, 2014, Rogers & Pridemore, 2013). Therefore, a study on poverty and crime in Nigeria is a necessity to fill the gaps in the literature.

Berk, Lenihan, and Rossi (1980) discussed the results of The Transitional Aid Research Project (TRAP), which was designed to create better prospects for ex-prisoners and to reduce economic hardships prisoners usually faced after they were released from prison. The Transitional Aid Research Project (TARP), begun in January 1976, in which approximately 4,000 ex-felons (2,000 each in Texas and Georgia) were made eligible for short-term unemployment benefits to ascertain if limited financial aid would affect recidivism. A structural equation system of 3SLS was used to analyse the data because 3SLS is known to have less specification errors. However, TARP payments, as administered in Georgia and Texas, did not fulfil expectations that they would lower recidivism, but they had a strong negative impact on work-incentive. However, he results also suggest that the payments did work to some degree as intended by subsidizing a more effective job search. Berk, Lenihan, and Rossi (1980) contended that the TARP experiment policy implications lend considerable support to an income-maintenance strategy to reduce arrest recidivism among released prisoners.

Rauma and Berk (1987) studied the long-term impact of unemployment compensation on ex-offenders in California, and evidence suggested that recidivism among ex-offenders could be reduced by providing unemployment compensation available immediately after their release from prison. Using a 5-year follow-up and a failure-time model of a program in California conducted during the 1970s and 1980s, they showed how recidivism among those receiving aid was consistently lower over those 5 years than for those not receiving aid. The results in Rauma and Berk (1987) showed that a fairly small unemployment compensation does not increase crime among released prisoners.

The implications of Berk, Lenihan, and Rossi (1980) and Rauma and Berk (1987) is that prolonged unemployment generates a high level of poverty, thereby, causing poverty to increase crime. Moreover, Poveda (2012) tested employment, basic needs of salary with poverty on crime and the results provided support to Rauma and Berk

(1987). That is, reducing income or in cases in which employment is not sustained would increase further deprivation of poverty.

Following the harmful effect of 1998-2002 depression in Argentina, Meloni (2014) tested the efficacy of government means of reducing poverty. The alleviation was done through the unemployed heads of household programme, which involve cash transfers. A panel data set of 23 district in Argentina from 2002 to 2005 was utilized using the Generalised Method Moments (GMM) to provide the statistical relationships. The GMM tool revealed that poverty relief measured reduces total crime, total property crime, robbery, larceny and aggravated assault but was not significant with respect to murder. Thus, poverty (household below the poverty line) increased total crime, robbery while it not significant with respect to property crime, larceny and aggravated assault.

Welfare spending has two major roles in Argentina as observed in Meloni (2014). First, it helps in reducing poverty among the household facing economic deprivation thereby increasing the opportunity cost of crime. Second, strain is reduced due to improvement in household welfare, and, once strain is reduced, crime is lowered. However, the measure of deterrence (real public expenditures per capita) in the study was not significant with any of the crime variables. Consequently, the study suggested that further studies should investigate a better investment option between poverty relief and spending on police to reduce crime.

Similar results are found in Rogers and Pridemore (2013). Rogers and Pridemore (2013) examined the interaction effect of social protection with poverty on crime in a cross-sectional study of 30 countries. The data were estimated with weighted least square method. In terms of analysis, while Rogers and Pridemore (2013) provided an adverse effect moderating test of social protect with poverty on homicides. Although a robust result was demonstrated, the population size used in the study was relative small and the poverty proxy by infant mortality serves as limitations to the study. The study called for more research work to use more accurate measures and more advanced methods in proving the theoretical link between poverty and crime.

Moreover, results similar to Rogers and Pridemore (2013) was found in Ouimet (2012) who used excess infant mortality to measure poverty on homicides in 165 countries in 2010. While both studies were cross-sectional, Ouimet did not account for any crime-reduction poverty strategy unlike Rogers and Pridemore. Ouimet classified countries into high, medium and low on the human development index (HDI). The results showed that poverty causes the crime of homicides in countries with a high HDI. Also, inequality, autocratic regimes and ethnic heterogeneity along with poverty had positive effects in determining homicides in a cross-section of 165 countries. Homicide was higher in high HDI nations in which democracy was practiced but low in medium- and low-HDI nations in which the regime was autocratic. But violence was lowered in high HDI nations due to police and judicial institutions effectiveness. This shows the role of deterrence in society as Becker (1968) suggested. The fact that the proxy used by Ouimet for poverty did not show a significant result in medium- and low-HDI nations of which Nigeria is among requires more studies of this nature. Even Ouimet affirmed that the role of excess infant mortality as measure of poverty in developing countries needs further clarification.

Hence, the role of poverty in society in creating adverse effects on people's well-being, people means that those who lack basic needs or are poverty challenged are unhappier and emotional exhausted. Such a set of people, according to Shaw and McKay (1942), are likely to engage in criminal activities. Thus, engagement in crime is because of stress and frustration, and consequently, they are inured to be involved in illegal activities (Merton, 1938). The findings in Rauma and Berk (1987), Poveda (2012), Ouimet (2012) and Rogers and Pridemore (2013) that poverty induce people to commit crime support Shaw and McKay (1942), Merton (1938) and the Berker-Ehrlich model.

However, the issues in the literature concerning poverty and crime needs further research for two reasons. First, the findings in Berk *et al.* (1980) is not supported by Rauma and Berk (1987), and Ouimet (2012) has conflicted results between high HDI and medium- and low-HDI. Thus, a data set from Nigeria is required to clarify the mixed findings. Second, despite a positive link between poverty and crime, studies are deficient in demonstrating a crime-reduction poverty strategy over the long time term. The social relief in Meloni (2014) is believed to be a short-term measure when one considers the high number of people facing economic deprivation in Nigeria, and Rogers and Pridemore (2013) are not definite with respect to this kind of social protection. Therefore, a study of this nature is required to provide a long-term crime-reduction strategy as offered by Fajnzylber *et al.* (2002). Also, this current study differs from earlier studies mentioned here in terms of time series and method of analysis.

2.3.2 Crime and Economic Growth

Mauro and Carmeci (2007) demonstrated a link between crime and economic growth based on Becker's 1968) theory of rational choice . Prior to Mauro and Carmeci (2007), Bourguignon (1999) has theoretically linked crime rate with social loss per capita as an improvement on Becker. Other empirical studies like the World Bank (2006) and Dijk (2007) have also lent their support to this assertion. However, this current study differs from Mauro and Carmeci (2007), the World Bank (2006) and Dijk (2007) on crime and economic growth in terms of time series data employed, and the addition of policy variables that may promote to deterrence to crime. Mauro and Carmeci (2007) had considered growth in their work, but their results between crime and economic growth were mixed. Thus, this current study would further provide empirical evidence about the relationship between crime and economic growth. That is, the relationship between crime and economic growth follows Mauro and Carmeci (2007).

The roles of crime have been well emphasised in the literature, especially on how it acts as a stoppage on the progress of the economy in terms of growth (Mauro, 1995; Detotto & Ontranto, 2010). A crime committed in the economy incurs more expenditure and causes the mobility of highly skilled labour which is worse than the formal labour market (Mauro & Carmeci, 2007). This is because engagement in criminal activities would make the income gains of high human capital workers to be stolen and create fear in them. This fear would not prevent them from participating in the labour market and, by doing so, the anticipated yield to formal employment would be reduced (Huang, Laing, & Wang, 2004).

Besides, the literature has affirmed that a link between crime and economic growth, but the investigation needs more clarification as Burnham, Feinberg, and Husted suggested (2004). Also, the mixed findings in the link between crime and growth make the inference inconclusive. That is, while some available findings have proffered a robust relationship between crime and growth (Mo, 2001; Detotto & Ontranto, 2010; Goulas & Zervoyianni, 2013; Enamorado, López-Calva & Rodríguez-Castelán, 2014), Mauro and Carmeci (2007) found mixed results using two different growth measurements (Mauro & Carmeci, 2007) and Paul (20100 found a contrary result. Thus, this current study presents empirical evidence on the relationship between crime and economic growth.

Burnham *et al.* (2004) noted the high crime rates in the inner city and the trend of workers moving away from the inner city to suburban areas in the southern states of the United States. Moreover, they observed that the suburbs were becoming better places in which to live as personal safety became a source of concern in the inner city, a situation they claim may worsen the growth of income in all the urban regions. This development spurred them to investigate inner-city crime patterns using offence per capita and suburban income growth in the southern states of the United States from 1982 to 1997. The study used both cross-sectional and time series data with 2SLS to resolve the issue of simultaneity. They found that central city violent crime rates and real personal income growth at the county level were inversely correlated (–0.084). Likewise, central city property crime rates and real per capita county income growth rates were inversely correlated (–0.168). Moreover, the robust 2SLS estimation indicated that violent crime in the inner city had a negative effect on nearby suburbs, and the negative effects on suburbs were reduced the further they were from the metropolitan city. In contrast, property crime failed to show the same significant trend as violent crime. Thus, the study provided a weak result, which was not robust significantly, consequently suggested that more studies were required to clearly provide more understanding of how crime impacts growth.

Moreover, Enamorado *et al.* (2014) examined the convergence of growth due to the criminal activities of illegal drug dealers, which has led to increased homicide rates and economic loss of US$12.9 billion in Mexico between 2007 and 2011. To carry out this investigation, they used a cross-section and time series data from 2005 to 2010 with OLS estimation and 2SLS in proving a robust standard for the study. To study the effects of crime on growth, crime was looked at in terms of drug and non-drug related crimes. The study affirmed that the homicide rate increased from 9.3% in 2007 to 20% in 2011 and observed that, when drug-related homicides increased by a unit standard deviation, income growth was reduced by 0.20%. In segregating Mexico into semi-urban and urban municipals, they detected that the semi-urban income growth decreased more than the urban municipal income growth (0.19% versus 0.13%). Furthermore, the results of the study show that the homicide rate was insignificant and inversely related to the growth rate of per capita income at 0.02%. Moreover, the drug-related crimes of homicide were significantly related with the growth rate of per capita income with a coefficient of -0.011%, but non-drug-related crimes of homicide were not significantly related with a coefficient of 0.016. Noting the convergence of crime in municipals, the drug-related crimes of homicide significantly reduced the growth rate of per capita income by 0.008% in the semi-urban centres but was insignificant in urban centres though inversely related. Meanwhile, non-drug-related crimes of homicide were not significant with growth in the urban and semi-urban centres. In all, they concluded that drug-related crime of homicide has negatively impacted the income growth of Mexico cities.

Thus, the approach of Enamorado *et al.* (2014) to observe the effects of crime at various municipals in Mexico pinpoints a direction in which the government can channel public expenditure to control crime. Also, showing the homicide caused by the drug dealers' activities proves that the activities of the drug dealers must be curtailed if Mexico is to improve economically. But, the year sample size from 2005 to 2010 used by the study is rather short to provide a detailed conclusion to be drawn on. This limited year sample size was also noted by the study.

Similarly, Detotto and Ontranto (2010) studied the effects of crime on the economic performance of regions in Italy. This was done by using a state space model to evaluate the impact of crime on the Italian economy using a monthly data from January 1979 to September 2002, which was analysed by the OLS estimator. This allowed crime to be specifically examined across time over the various regions in Italy. They found that the effect of crime was greater when a slowdown in economic growth was present because of the need to divert resources required for repositioning the economy so as to control crime. For instance, the study showed that crime reduced economic growth monthly by 0.00041% in the recession period and by 0.00039% in the expansion time. In addition, the long-run exogenous variable of homicide rate reduced the GDP growth as well. This is because in the recession period when crime increased by 1%, the average change in annual GDP growth was -0.00022%. Also, there is a wider distortion of the economy during the recession period than the expansion time at the 5% level of significance, which was due to the high costs of the legal activities imposed by crime.

Thus, Detotto and Ontranto's (2010) study provided more insight on the effects of crime on growth by separating the sample into two different periods of the business cycle. Thus, the performance of the economy, especially in recessionary times, indicates that the economy would need more crime control measures to reduce crime. Nevertheless, the study did not control for other costs of crime like deterrence measures to actually see if the impact would be more. That is, the efforts of public on crime control were not considered in this study to see how they impacted growth along with crime itself. The result in fluctuation in the economy considered with crime in Detotto and Ontranto is supported in a similar study related of economic fluctuations by Goulas and Zervoyianni (2013).

Goulas and Zervoyianni (2013) likewise examined the effect that changes in crime have growth due to influences in the magnitude of macroeconomic uncertainty. Their contention is that the extent to which crime affects growth in various economic climates should form the basis of economic policy. This is because information about growth and crime differs in bad and good economic climates. That is, uncertainty will affect investments more during the bad period than during the good period. Noting this, they divided the uncertainty period into three categories: high uncertainty, low uncertainty and uncertainty interactions.

To embark on the study, Goulas and Zervoyianni (2013) conducted a cross-country study of 25 countries from 1991 to 2007. They analysed their data with a Pooled-

Panel GARCH model and applied the estimation technique system of GMM. They found that higher crime had a negative and significant effect on growth uncertainty interaction. Under high uncertainty crime was significant with growth, but it was not significant with growth in the low uncertainty period. Thus, the results indicated that crime impacted growth by -0.016 in the uncertainty interaction period. In high uncertain macroeconomic situations, an increase of 10% in crime would reduce GDP growth between 0.49% and 0.62%. Hence, they affirmed that investment earnings during bad economic climate were less safe because, during this time, crime occurrence is more harmful to growth. Also, the response of growth and its achievement on the rise of crime would depend on the degree of uncertainty in the economy.

In the situation of violence and crime, Pan *et al.* (2012) analysed the spatial effects of crime on growth in contiguous states of Mexico. The study observed that homicides due to rampant killings by the drug dealers in Mexico were high. The study asserted that crime succeeded in closing many businesses and increased security expenditures in Mexico. To analyse the criminal effects of drug dealers in Mexico, the study used panel data from 2005 to 2009 in all 31 states and the Federal District of Mexico. The analysis was done by using the spatially autoregressive model and the likelihood ratio test. They detected that, when crime increased by 10 per 100,000 inhabitants in the previous year within the state, that state's economic growth rate increased in the following year by 0.1% to 0.26%. This result, according to Pan *et al.* (2012), was due to government efforts in fighting crime and replacing lost properties in the following year that follow the crime occurrence. In addition, the spatially weighted crime of the neighbouring states negatively affected the whole region in terms of state GDP per capita growth by 0.024%. As the Government efforts to replace lost property and crime control reduced or stopped due to the more occurrence of crime in the surrounding states. In this manner, the growth of a state in the following year would be reduced. However, the study claimed the relevance of deterrence measures as viable in controlling crime in Mexico, but how viable these were was not demonstrated statistically. Nevertheless, demonstrating how crime in the surrounding states of a state in a country has affected another state is worth knowing. The finding in Pan *et al.* followed the trend in Detotto and Ontranto (2010), Goulas and Zervoyianni (2013).

In a discourse on corruption and economic growth, Mauro (1995) observed that corruption in a cross-study of 68 countries played a role in reducing private investment due to the difficulties in bureaucracy. That is, investors were denied licences to embark on their business because they refused to offer bribes to the public officials. The study made use of published indices by Business International, which comprised 56 country risk factors for 68 nations from 1980 to 1983 and that 30 nation risk factors for 57 countries from 1971 to 1979. These indices included corruption, terrorism, legal system and judiciary with others like bureaucracy and red tape. Using correlation, the OLS technique and 2SLS estimates, the study found that corruption reduced economic growth especially at the steady-state income level when corruption led to the misallocation of resources in the productive sectors. That is, bureaucratic inefficiency reduces economic growth indirectly when investment rates are reduced.

Mo (2001) found a similar result in his study. That is, Mo (2001) viewed that corruption in any society favoured some set of people over others, which further led to inequality of opportunities. He said that this situation could disrupt the transmission of investments in the economy. Having noticed this, Mo (2001) examined the effect of corruption on economic growth using a cross-sectional study of 46 countries. The study made use of the corruption perception index of the Transparency International from 1980 to 1985 and the OLS method was used. Mo (2001) found an inverse association of political instability and the growth rate of real GDP that was significant in a cross-study of 46 countries using OLS estimation for data set from 1970 to 1985. He found that when the corruption level increased by 1% the growth rate was reduced by 0.72%.

Similarly, Paul (2010) noticed the retardation effect of corruption on economic growth, which derailed the prospect of development among the developing countries. He observed that a high level of corruption in Bangladesh. He then studied the interaction that existed between corruption and economic growth using a data set from 1973 to 2009 and estimated by OLS. In contrast to Mauro (1995) and Mo (2001), Paul (2010) found a positive and significant relationship between corruption and growth in Bangladesh. The difference in the results may be due to the fact that, while Mauro (1995) and Mo (2001) were cross-country studies, Paul (2010) was a country-based study.

However, although the study of Paul (2010) affirmed that the results should be dealt with caution as corruption was not significant between 1973 and 1977, it was positive and significant in the period of economic reform from 1977. He noted that economic reform was implemented without bureaucracy reform in Bangladesh. As a result, private investors were encouraged to offer bribes to public officials who also saw bribery as a boost to their income. Thus, the interaction between regulators and investors has encouraged the high level of corruption in Bangladesh. In this manner, the study asserted that corruption has helped to contribute to the growth of the country economically.

In a related result to Paul (2010), Mauro and Carmeci (2007) examined the endogenous growth model of output per capita growth and crime rates in Italy from 1963 to 1995. The study found a non-significant result between crime and output per capita growth in a long-run estimation. This was found in spite of using ARDL structure to adjust the common time effects in the data. But, the study did establish a negative and significant relationship between the exogenous growth model and crime. Hence, the work affirmed that, due to the existence of crime, difficulties arose for regions in Italy to come out from the chain of poor economic growth. In no small measure that was revenue meant for economic expansion may not be forthcoming as crime acted functionally as a tax on firms profitability and thereby adversely affected the economy.

From the results of the above research, this current study noted that unavailability of data caused weak results in Enamoradoa *et al.* (2014). Also, the link between crime and economic growth has been analysed mostly with panel data method, but less with time series data. Owing to these reasons, this current study provides a missing link to time series data and its analysis in examining the link between crime and economic growth. Perhaps, this may provide a better clarification for the mixed findings, especially in the country-based studies. That is, the studies of Detotto and Ontranto (2010), Pan *et al.* (2012), Kumar (2013) and Enamoradoa *et al.* (2014) found a significant result, but the studies of Mauro and Carmeci (2007) found no significant result between output growth and crime, but did find a significant result between output and crime. Also, Paul (2010) demonstrated a positive relationship between corruption and growth as Burnham *et al.* (2004) found mixed results. Thus, the inconclusiveness in the study of how crime affects economic growth, especially among country-based studies, provides an avenue for this current study to examine and document the relationship between crime and growth in Nigeria.

2.4 Causality Evidence Socioeconomic Strain, Crime and Economic Growth

Many studies have examined individual social factors with respect to crime and economic growth while testing for Granger causality. Among them, Masih and Masih (1996), Halicioglu (2012), Hamzam and Lau (2013) are related to the socioeconomic strain discussed in this study. Their studies serve as a basis to show that crime study needs to move beyond causation of crime as endogeneity may exist between variables under investigation. The causality studies considered in this study are presented below.

The Granger causality is used to examine the socioeconomic determinants of crime by Masih and Masih (1996) in Australia, which was based on time series data from 1963 to 1990. The socioeconomic factors included urbanisation, divorce, police strength, youth male unemployment and dwelling commencements (as a proxy for wealth). Consequently, the Johansen-Juselius cointegration test was used to determine the joint movement of these variables before applying VECM to test for Granger causality. The result showed that the crime of homicide is jointly determined by socioeconomic factors in long-run temporal causality. Besides, the short-run Granger causality showed unidirectional causality from the crime of homicide, robbery, serious assault to youth male unemployment. Also, a unidirectional Granger causality ran from divorce to the crimes of serious assault and fraud and from the crimes of homicide and motor vehicle theft to divorce. While a unidirectional causality ran from dwelling commencements to the crime of fraud and ran from homicide and motor vehicle theft to dwelling commencements. Further, a unidirectional causal relation existed which ran from urbanisation to crime of burglary, and, similarly, from the crime of homicide to police strength. The result shows those types of crime that require concern of the government; for instance, the cause of homicide must be determined to reduce the cost of policing because homicide investigations require more police attention.

In examining the temporal causality in the context of crime dynamism in Turkey, Halicioglu (2012) considered socioeconomic factors and crime. The socioeconomic factors were per capita income, unemployment, divorce, urbanisation and public security expenditure. The causality test made use of time series data from 1965 to 2009. The data were subjected to cointegration test in the ARDL model, and consequently the Granger causality was analysed with the VECM. The results showed that socioeconomic factors jointly determined overall crime, non-violent and violent crime in a Granger long run temporal causality. In the short-run, a bidirectional causality existed between per capita income and overall crime, and unidirectional causality existed from per capita income to urbanisation. The causality ran from unemployment to non-violent and per capita income; from per capita income to unemployment, urbanisation and divorce, and from non-violent crime to unemployment and divorce when non-violent crime is considered. That is, a bidirectional causality existed between unemployment and non-violent crimes, and unemployment and per capita income. In violent crime, a short run causality ran from violent crime and per capita income to urbanisation, and from unemployment to per capita income. While the result of the Granger causality showed a unidirectional causality from violent crime to urbanisation in the short run, it runs from urbanisation to public security expenditure.

The recommendations of the study were that to reduce crime in Turkey, public cooperation would help make police expenditures more effective is crime reduction. This is based on the community's awareness and their participation in providing useful information to the police while on patrol. This assertion justifies the causality result with respect to urbanisation and public security expenditure. The result on violent crimes in Halicioglu (2012) has no links with types of violent crimes in Masih and Masih (1996).

Similarly, Hamzam and Lau (2013) considered the Granger causality among social factors and crime in Malaysia. The social factors were fertility rate, GDP growth rate, unemployment and population size, and crime included total crime, property crime and violent crime. Hamzam and Lau used the VECM approach to establish Granger causality based on annual data from 1973 to 2008. In the VECM, the results indicated the existence of long-run temporal causality (Engle & Granger, 1987). The results showed a unidirectional long-run temporal causality from total crime, property crime and other social factors to population. In the short-run Granger causality on total crime, causality existed from the fertility rate to GDP and total crime; from population to fertility, GDP, unemployment and total crime. Also, in property crime, the causality ran from population to GDP, unemployment and property crime. But in violent crime, causality ran from fertility to population and violent crime; unemployment to GDP, and violent crime to GDP.

The study drew the attention of the government for the need to adjust the growth of the economy positively and to reduce fertility because of their impacts on crime. This may be done by lowering expenditures on law and enforcement because it had a short-term insignificant effect because it diverted government attention away from the people's needs. Thus, the government should focus on social factors that concern the people. However, the study's opinion with respect to expenditures on law and enforcement was weakened because the results did not include expenditure on law and enforcement as found in Masih and Masih (1996) and Halicioglu (2012).

Granger causality among socioeconomic variables, crime and economic growth has been discussed in Masih and Masih (1996), Halicioglu (2012), Hamzam and Lau (2013). In this discussion, income disadvantage and poverty was not studied in their works, and this creates avenue to improve upon their studies. Although Halicioglu (2012) considered per capita income, the per capita income is above the income disadvantage measure employed in this study. If taken as income, the results showed that income could cause crime. Furthermore, their studies contain mixed results. For instance, in the short-run Granger causality, Halicioglu (2012) affirmed that a unidirectional causality existed from urbanisation to security expenditure, Masih and Masih (1996) showed that causality was from homicide to police strength and Hamzam and Lau (2013) did not study security expenditure. Besides, the short-run Granger causality between unemployment and crime is not definite. That is, while Masih and Masih (1996) found a unidirectional causality from the crime of homicide, robbery, serious assault to youth male unemployment; a bidirectional causality exist between unemployment and non-violent. (Halicioglu, 2012), Hamzam and Lau (2013) found a unidirectional causality from unemployment to property crime. Thus, the mixed findings in these previous studies among socioeconomic variables, crime and economic growth while testing the presence of Granger no-causality have shown that conclusion has yet to be reached.

2.5 Overview of the Chapter

In this chapter, this study reviewed the theoretical and empirical literature related to socioeconomic strain, crime and economic growth. The empirical literature is summarized in Table 2.1. To validate the position of the theory studied, the literature that has provided empirical evidence was appraised. The empirical literature appraisal showed that the occurrence of crime in a society is based on a causal event. For instance, Edmark (2005) said that unemployment affects crime, Bourguignon *et al.* (2003) said that income disadvantage affects criminal activities, and Meloni (2014) noted that poverty induced to people to commit crime. In addition, empirical evidence indicated that a consequence of crime in a society is poor economic growth (Detotto & Ontranto, 2010).

Table 2.1
Summary of the evidence of socioeconomic strain, crime and economic growth

s/n	Authors(s) & year	Unit/dimension	Dependent variable(s)	Independent variable(s)	Findings
1.	Speziale (2014)	Italian regions, panel data from 2000-2005	1. Total crime 2. Theft 3. Fraud 4. Robbery	Unemployment	1. Positive significant 2. Positive significant 3. Positive significant 4. Positive significant
			1. Total crime 2. Theft 3. Fraud 4. Robbery	Juvenile unemployment	1. Positive significant 2. Positive significant 3. Positive significant 4. Positive significant
2.	Pyle and Deadman (1994)	Scotland, panel data of six regions from 1974 to 1988.	1. Crime	Unemployment	Not significant
3.	Edmark (2005)	Sweden, panel data of countries from 1988-1999.	1. Aggregate property crime 2. Burglary 3. Robbery 4. Aggregate violence crime 5. Murder & assault	Unemployment	1. Not significant 2. Positive significant 3. Not significant 4. Not significant 5. Not significant
4.	Raphael and Winter-Ebmer (2001)	The United States, panel data from 1971 to 1997	Rape	Unemployment	Unemployment increases the crime of rape significantly
5.	Lin (2008)	The United States, a panel of 49 states from 1974-2000.	1.Violent crime 2. Rape 3. Property crime	Unemployment	1. Negative significant for rape 2. No significant for violent crime. 3. Positive significant for property crime and burglary, larceny.
6.	Halicioglu *et al.*, 2012	Japan, time series data from 1964 to 2009.	1. Aggregate crime, robbery, violent, larceny and fraud, homicide and bodily-violent.	Unemployment rate	1. Positive significant is obtained in the case of Aggregate crime, robbery, violent, larceny and fraud. 2. Not significant is obtained in homicide and bodily-violent.

Table 2.1 (continued)

s/n	Authors(s) & year	Unit/dimension	Dependent variable(s)	Independent variable(s)	Findings
7.	Wu and Wu (2012).	UK regions, panel data from 2002 to 2007	1. Violence crime 2. Robbery 3. Burglary 4. Fraud 5. Drugs trafficking 6. Others	Unemployment	Positive significant for fraud, drug and other crimes.
8.	Altinga (2012)	33 European countries, panel data from 1995 to 2003.	1. Property crime 2. Burglary 3. Larceny 4. Vehicle theft.	Unemployment Rate	1. Positive significant 2. Positive significant 3. Positive significant 4. Positive significant
9.	Saridakis (2011)	England and Wales, time-series data from 1960–2000.	Violent crime per capita	Male unemployment rate	Positive significant
10.	Lee and Holoviak (2006)	Korea, Australia and Japan, time series data for individual country from 1972-2001. Korea	1.Total crime 2. Property crime 3.Violence crime 4. Forgery 5. Moral offences	1. Total unemployment 2. Male unemployment 3. Male (15-19) unemployment 4. Male (20-29) unemployment	1. Long-run significant for Total unemployment and total crime 2. Long-run significant for Total male unemployment and total crime 3. Long-run significant for male (15-19) unemployment and total crime 4. Long-run significant for male (20-29) unemployment and total crime 5. Long-run significant for male (20-29) unemployment and property crime

Table 2.1 (continued)

s/n	Authors(s) & year	Unit/dimension	Dependent variable(s)	Independent variable(s)	Findings
10.	Lee and Holoviak (2006)	Australia	1. Burglary 2. Motor vehicle theft 3. Larceny 4. Homicides 5. Robbery	1. Total unemployment 2. Male unemployment	1. Long-run significant for total unemployment and motor vehicle theft. 2. Long-run significant for total unemployment and robbery 3. Long-run significant for male unemployment and burglary. 4. Long-run significant for male unemployment and robbery.
		Japan	1. Murder 2. Robbery 3. Rape 4. Arson 5. White collar crime	1. Total unemployment 2. Male unemployment	1. Long-run significant for total unemployment and rape. 2. Long-run significant for male unemployment and rape.
11.	Bourguignon *et al.*, (2003)	Colombia, panel data from 1996 to 1998 in seven cities.	Property crime per 100,000 inhabitants	Income below 80% threshold (Inequality)	Positive significant

Table 2.1 (continued)

s/n	Authors(s) & year	Unit/dimension	Dependent variable(s)	Independent variable(s)	Findings
12.	Allen (1996)	United States, annual data from 1959 to 1992.	1. Robbery 2. Burglary 3. Vehicle theft	1. Inflation 2. Unemployment 3. Imprisonment	1. Positive significant for burglary. 2. Negative significant for vehicle theft, but not significant for burglary and vehicle 3. Negative significant for burglary and vehicle theft
13.	Machin and Meghir (2004)	England and Wales, panel data from 1975 to 1996.	Property crime - vehicle, theft and handling, burglary	Low-wage rate 1. 25th percentile real hourly wage, and 2. 10th percentile real hourly wage	1a.Negative significant for property crime 1b. Negative significant for vehicle, theft and handling, and burglary. 2. Negative significant
14.	Yildiz, Ocal, and Yildirim (2013)	Turkey, panel data form 2002 to 2009.	Crime rate	Income disadvantage (minimum wage and lowest income), middle income and high income.	Positive significant for all
15.	Fajnzylber, Lederman, and Lloayza, 2002	A cross-countries of study of 39 from 1965 to 1995 for homicide. But 37 countries from 1970-1994 for robbery.	Homicide rate and robbery rate	1. Inequality using the ratio of income of the rich-to poor-population. (Lowest Income) 2. Average income	1. Positive significant 2. Negative significant

Table 2.1 (continued)

s/n	Authors(s) & year	Unit/dimension	Dependent variable(s)	Independent variable(s)	Findings
16.	Berk, Lenihan and Rossi (1980)	USA, randomised experiment of 2000 convicts for a period of 6 months.	Arrest and conviction for crime among the ex-prisoners for property and non-property	Poverty proxy through 1.No unemployment benefit (experiment group) 2. Unemployment benefit (TRAP) for control group.	Poverty measures ran contrary as 1. Not significant but increase arrest 2. Unemployment benefit produce less arrest but it is not significant
17.	Rauma and Berk (1987)	USA, randomised experiment of 2000 convicts for a period of 5 years.	Arrest and conviction for crime among ex-prisoners	Poverty proxy through 1.No unemployment benefit (experiment group) 2. Unemployment benefit (TRAP) for control group	Poverty measures showed 1. Prolong unemployment is positive significant to arrest. 2. Unemployment benefit is negative significant to arrest.
18.	Poveda (2012)	Colombia, panel data from 1984 to 2006.	Homicide rate from Violence	1. Poverty 2. Unemployment 3. Prices 4. Employment and basic salary	1. Positive significant 2. Not significant but positive 3. Positive significant 4. Negative significant

Table 2.1 (continued)

s/n	Authors(s) & year	Unit/dimension	Dependent variable(s)	Independent variable(s)	Findings
19.	Meloni (2014)	Argentina, panel data set of 23 district from 2002 to 2005.	1. Total crime rate. 2. Total property crime rate 3. Robbery 4. Larceny 5. Murder 6. Aggravated assault	1. Poverty 2. Unemployment 3. Inequality 4. Transfers (Welfare spending)	1. Poverty is positive significant with crime 1, 3 and 5. 2. Unemployment is positive significant with property crime rate 3. Gini is positive significant with property crime 4. Transfer is negative significant with all crimes except murder
20.	Rogers and Pridemore (2013)	A cross-section study of 30 countries based on 2004.	Homicide rate	1. Poverty proxy with under-5 infant mortality 2. Inequality 3. Social protection	1. Positive significant 2. Positive significant 3. Negative significant
21.	Ouimet (2012)	A cross-countries study of 165 based on 2010.	Homicide rate	1. Poverty proxy with excess of under-5 infant mortality 2. Inequality 3. Heterogeneity 4. Income per capita 5. Splitting to Low, Medium and High 6. Low HDI	1. Positive significant 2. Positive significant 3. Positive significant 4. Negative significant 5. Poverty is not significant 6. Inequality and heterogeneity are not significant

Table 2.1 (continued)

s/n	Authors(s) & year	Unit/dimension	Dependent variable(s)	Independent variable(s)	Findings
22.	Burnham *et al.* (2004)	United States city and suburban/ cross-sectional and time series data from 1982 to 1997.	1. Real personal income growth in the county, and 2. Real per capita county income growth.	1. Violent crime rate within the central city (or central city cluster) per capita. 2. Property crime rate within the central city (or central city cluster) per capita	1. Weak negative significant 2. Not significant
23.	Detotto and Otranto (2010)	Italy, monthly panel data from 1979 to 2002.	Real GDP growth	A crime index of intentional homicides; robberies, drug offences, fraud and total crime	Negative significant
24.	Pan *et al.* (2012)	31 states and the Federal District states in Mexico/ over the years 2005 to 2009.	The annual real GDP per capita growth in a state of Mexico.	The homicide used as the total crime rate per 100,000 inhabitants	Negative significant

Table 2.1 (continued)

s/n	Authors(s) & year	Unit/dimension	Dependent variable(s)	Independent variable(s)	Findings
25.	Goulas and Zervoyianni, (2013)	Cross-country study of 25 countries from 1991 to 2007.	Real Output Growth	Total crime is computed as the sum of data on robberies, thefts, burglaries, rapes, assaults and completed intentional homicides, with the crime rate.	Weak negative significant in uncertainty interaction; not significant within low uncertainty
26.	Enamorado *et al.* (2014).	Municipality in Mexico from 2005 to 2010/ Cross section and time series data.	Real income growth	1.Total rate of homicides, 2. The drug-related rate of homicides, and 3. The non-drug-related rate of homicides.	1. Not significant 2. Negative significant 3. Not significant
27.	Mauro, 1995	Cross section of countries for the period 1980-1983.	Investment to GDP ratio.	Corruption (bureaucratic inefficiency)	Negative significant
28.	Mo, 2001.	Cross section of 46 countries for the period 1980-1985	Growth rate of real GDP	Corruption index. a measure of political instability	Negative significant
29.	Paul, 2010	Bangladesh/ time series data from 1973 to 2009	Growth	Corruption	Positive significant
30.	Mauro and Carmeci (2007)	19 Regions in Italy/ annual panel data from 1963 to 1995.	1.Output per capita growth, and 2.Output per capita growth	Crime rates (homicides rates);	1. Non-significant 2. Negative significant

Table 2.1 (continued)

s/n	Authors(s) & year	Unit/dimension	Dependent variable(s)	Independent variable(s)	Findings
31.	Masih and Masih (1996)	Australia, time series data from 1963 to 1990	Crime of burglary, fraud, motor vehicles theft, serious assault and robbery	Socioeconomic factors includes urbanisation, divorce, police strength, youth male unemployment and dwelling commencements (as a proxy for wealth).	1. Homicide, robbery, serious assault Granger causes youth male unemployment. 2. Divorce Granger causes serious assault and fraud. 3. Homicide and motor vehicle theft Granger causes divorce. 4. Dwelling Granger causes fraud; and homicide and motor vehicle theft Granger causes dwelling. 5. Homicide to police strength. Urbanisation Granger-causes only burglary

Table 2.1 (continued)

s/n	Authors(s) & year	Unit/dimension	Dependent variable(s)	Independent variable(s)	Findings
32.	Halicioglu (2012)	Turkey, time series data from 1965 to 2009.	1. Aggregate crime, 2. Property crime and 3. Violent crime	Per capita income, unemployment rate, divorce rate, urbanisation rate, and public security expenditure per capita.	1. Bidirectional causality between per capita income and overall crime; per capita income Granger causes urbanisation. 2. Bidirectional causality between unemployment and non-violent; and unemployment and per capita income; per capita income Granger causes urbanisation and divorce. 3. Violent crime Granger causes per capita income and urbanisation; unemployment Granger causes per capita income; violent crime Granger causes urbanisation; and urbanisation Granger causes public security expenditure.
33.	Hamzam and Lau (2013)	Malaysia, times series from 1973 to 2008.	1.Total crime, 2.Property crime and 3.Violent crime	Social factors- fertility rate, GDP growth rate, unemployment and population	1. Fertility Granger causes GDP and total crime; population Granger causes fertility, GDP, unemployment and total crime 2. Population Granger causes GDP, unemployment and property crime. 3. violent crime Granger causes GDP; unemployment Granger causes GDP

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This chapter considers how the relationship among the socioeconomic strain variables, crime and economic growth is hypothetically explained in line with the Merton's strain theory of 1938. In addition, it considers the development of hypotheses specified in relationship to the objectives in chapter one. These hypotheses are developed based on the dynamic theoretical framework that Mauro and Carmeci (2007) developed for the growth model while the crime model followed Baharom *et al.* (2013). Furthermore, models are specified, and methods of analysing the data are discussed with the sources of data for each variable used in the model disclosed.

3.2 Research Framework

The idea of incentives in Becker's economic approach to crime are compatible with the strains discussed in Merton's theory. This is because incentives and strains as noted in the field of criminology both point to what determines crime in a society. In a real sense, poor accessibility to means of achieving better welfare by an individual in a society might serve as an incentive to device illegal ways of achieving better welfare. At the same time, poor accessibility to means of achieving better welfare by an individual in a society might subject such a deprived individual to take quarrel with or envy his mates who have easy access to means to promote their own best welfare. In the course of envying his mates, he might become emotionally imbalanced and face undue stress, especially when he has no legal means to achieve such better welfare. Burdened with this undue frustration and annoyance, that individual may behave in an antisocial way by committing a crime to achieve better welfare for himself. Thus, this study seeks to explain the relationship between socioeconomic strain and crime in the Nigerian context by focusing on the Merton's strain theory.

Moreover, this study has chosen a simple channel through which to examine the socioeconomic strain that causes crime, which, in turn, would hamper economic growth. This simple channel is based on the relation framework in Baharom *et al.* (2013). Unemployment in any circumstance creates difficult conditions because it cause a loss of a source of income. Being unemployed, a person has the tendency to face strain conditions such as frustration and anger. In turn, the strain conditions might influence him to engage in criminal activities. Ultimately, then, high unemployment in a society would lead to an increase in occurrence of crime.

Similarly, income disadvantage may measure economic deprivation that limits the expected values of decency and desirable welfare in a country. In any society, people with poor income often do not have access to a good education due to family background, environmental degradation and poor access to credit facilities. This poor income condition imposes a strain on them, which, in turn, may bring about their involvement in crime. In this circumstance, income disadvantage would increase crime.

Likewise, poverty exposes deprived people to many challenges that make life unbearable for them. Such is seen in their inability to achieve desirable welfare for their children and themselves. The strain from these challenges stimulates them to envy people with higher status in their environments. This envy is often accompanied by frustration and anger, which leads them to seek illegal means to satisfy their needs. Therefore, the existence of a high number of people below the poverty line would increase crime.

Traditionally, crime at any level in the society may hinder economic output. Thus, a reduction in economic output may result in poor economic growth. Meanwhile, the existence of investment policies as a deterrence measure to either curb or reduce crime may also have meaningful impacts on improving economic growth. That is, the relationship between crimes and economic growth is expected to be inversely related (Mauro & Carmeci, 2007; Mauro, 1995). Moreover, society at large emphasises better welfare and a good standard of living. In achieving the common goal of better welfare and standard of living, society outlines the means to realise the goal. Part of the means includes budget planning and broad development targets. But, when crime is pervasive in the society, it may either increase the budgetary costs or elongate the time of achieving the development targets or both. Thus, in any of these circumstances, the cost of governance increases and the planned budget is distorted. Thus, the society may wish to reduce the illegal means (crime) through money meant to achieve developmental targets. This means crime would possibly overstretch the resources of society and create undue frustration in realising the planned budget and development targets. Thus, the occurrence of crime in a society would reduce the level of achievement for a good standard of living.

The theoretical explanation for socioeconomic strain, crime and economic growth is further illustrated in the research framework (Figure 3.1).

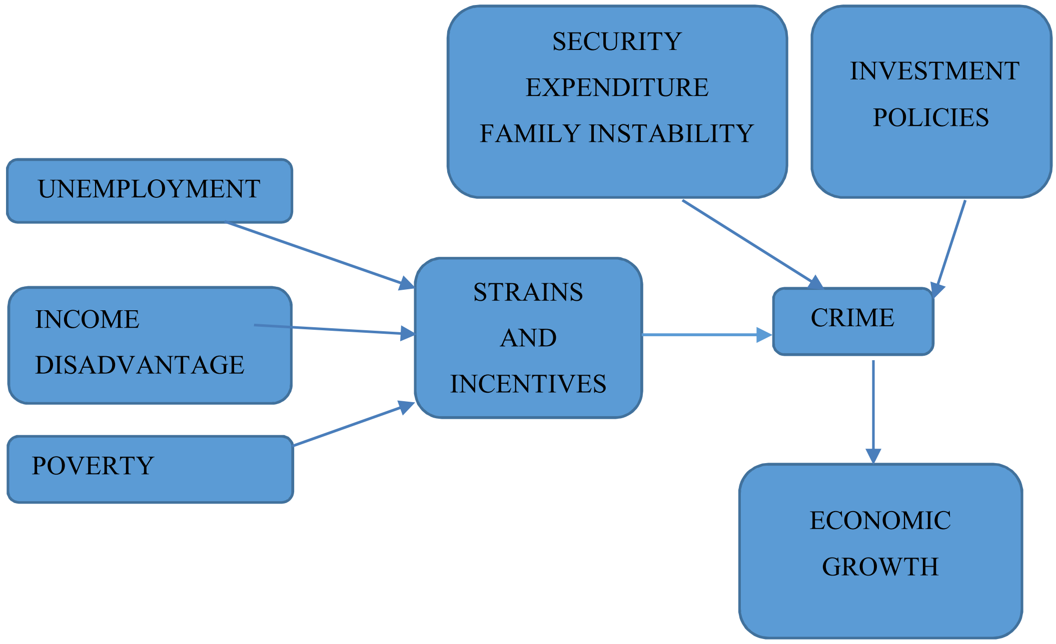


Figure 3.1. Theoretical *Relationship between Socioeconomic strain, Crime and Economic Growth.*

3.3 Theoretical Framework

The model in this work starts from the work of Becker (1968) on crime and punishment. In determining crime, Becker (1968) specified the supply of crime in society as follows in equation 3.1:

$$CR_t = f(PR_t, PA_t, U_t) \quad (3.1)$$

In equation 3.1, CR_t is the total number of offences which depends on PR_t, PA_t and U_t. The PR_t shows the probability of arrest and prosecution of criminal, while PA_t is the punishment for committing offense and U_t indicates other variables that influence the act of crime.

Moreover, Ehrlich (1973) extended the crime model to include income inequality and other variables in the model as presented in equation 3.2:

$$CR_t = f(PR_t, PA_t, Y_t, Yl_t, UNE_t, V_t, Z_t)$$
(3.2)

In equation 3.2, CR_t is crime rate per person in a country, PR_t is probability of prosecution rate, PA_t is penalty received on crime, Y_t is returns from illegal activity as incentive to commit crime, and Yl_t is the legal existing gap in income, UNE_t is probability of unemployment, V_t is the vector of environmental variables while Z_t capture the psychic effect and other unquantifiable variables on the rate of crime.

Virén (2001) added demographic variables (X_t) to the crime model of Becker-Ehrlich as presented in equation 3.3:

$$CR_t = f(PR_t, PA_t, E_t, Y_t, Yl_t, A_t, X_t) \quad (3.3)$$

In equation 3.3, PR_t, PA_t, Y_t, and Yl_t are as defined in equation 3.2 above, and E_t, A_t, and X_t are the working time, income transfers and the possible demographic variables, which include other accounted variables for crime respectively. Moreover, the socioeconomic variables in Virén (2001) include unemployment rate, population age 15-24 and urban population.

In examining how socio macroeconomic variables affect crime in Malaysia, Baharom *et al.* (2013) restructured the crime model based on Virén (2001). The restructuring of the crime model in equation 3.4 shows that both socio factors and macroeconomic factors were considered in their work. The model is specified as follows in equation 3.4:

$$CR_t = f(X_t, M_t, U_t)$$
(3.4)

In the crime model specified in Baharom *et al.* (2013), X_t are socioeconomic variables that cause strain in the economy, M_t are macroeconomic variables that exert undue strain on the people, while U_t are other variables in the model. This research work employs the crime model in 3.4 with inclusion of family instability and deterrence variable (security expenditure) which are not considered in Baharom *et al.* (2013).

Moreover, Becker (1968) theoretically examined the consequences of crime on society; the consequences were viewed as a cost of crime to society. That is, due to crime (CR) the society would bear more weights of damages from crime (D); more cost of arrest and conviction of offenders (PR); increase in social cost of punishment (PA); and the effect of this crime tax on the society would result in social loss of wealth (GR) in the society. Thus, Becker came up with the following model to examine the social loss of crime on the society:

$$GR_t = f(D_t, PR_t, PA_t, CR_t) \quad (3.5)$$

Moreover, this model of social loss function by Becker (1968) was modified by Bourguignon (1999) by dividing the social loss due to crime (CR) into three components. These components are: 1) the cost of pain that is associated with economic cost of crime as PN which is seen as the direct cost of crime in terms of physical and psychological pain borne by the victims; 2) the cost of preventing crime and the cost incurred on judicial system (PR); and 3) the implicit cost of sanctions (PA) to criminals who were convicted and this represents the forgone earnings due to imprisonment. Thus, Bourguignon (1999) concluded that the social loss per capita $(RGPC)$ was associated with the crime rate which can be expressed as follows:

$$GR_t = f(PN_t, PR_t, PA_t, CR_t) \quad (3.6)$$

The simple channel explained above was developed into a dynamic model by Mauro and Carmeci (2007) to study the relationship between the poverty trap of crime and unemployment. The model is dynamic because it considered the price of wage setting that was logged and differenced with respect to time which depend on technology. The consideration for technology made the study adopt the labour market imperfection assumption in the endogenous growth in Romer (1986) and the standard neoclassical exogenous growth in Solow (1956). The distinction in these models is that the endogenous growth considered the increasing return to scale in technology while the exogenous growth focuses on the constant return to scale in technology. By exogenous, the log of output per capita was used and determined outside the model while output per capita growth was determined within the model for the endogenous. The study had result in favouring the exogenous growth model.

In the two models, Mauro and Carmeci (2007) took into consideration the effect of poor income and income growth as a poverty trap in the society due to crime rates. This is because crime was proven to be detrimental to income due to the taxation that crime imposed on society. That is, an increase in crime return reduces permanently the rate of growth in the economy. The consequence of crime is poor growth which encourages a poverty trap in society, and this is represented in equation 3.7 as follows:

$$GR_t = f(AA_t, UNE_t, CR_t) \tag{3.7}$$

In equation 3.7, $RGPC_t$ is the growth of the economy; AA_t is the return on asset, and the returns are considered in terms of physical (TIV_t) and human resources (EIV_t); UNE_t is the rate of unemployment in the society, and CR_t is the crime rate.

Thus, this study differs from Mauro and Carmeci (2007) in view of policy considered their model. While labour policy through unemployment is observed on growth, this current study considers investment policies that could be used to promote growth. Mauro and Carmeci (2007) used panel data but this current study uses annual time series from Nigeria. Also, the demonstration of a causality relationship between crime and economic growth variable was not considered by their study. Besides, this study moves further to consider how crime is being determined using the supply function of crime as offered by Becker (1968) as it is subsequently amended.

3.4 Empirical Framework

3.4.1 Model Specifications

3.4.1.1 Crime Model

This section of the study presents the outline for the model specification on socioeconomic strain as a determinant of crime. These models follow the crime model in Baharom *et al.* (2013). The model was specified by Baharom *et al.* (2013) to test the effects of socioeconomic strains on crime. Moreover, in the model this study controls for family instability. In addition, the study included internal security expenditure as deterrence variable based on a rational choice theory. The model is adopted because it fits this current study when examining the effect of a socioeconomic strain of unemployment, income disadvantage and poverty on crime. This is in spite of the fact that the model was explored in a cross-section and time series of 21 countries while the model is used in a country-based study in this current study. The use of time series by this study is due to available data on the variables under investigation in Nigeria. Nevertheless, the time series data with the long span of forty-four years from 1970 to 2013 overcomes the problem of low data constraint normally faced in crime studies. Therefore, to analyse crime determinants through socioeconomic strain, the socioeconomic strain is proxied by unemployment, income disadvantage and poverty while family instability and security expenditure are control variables. Family instability is considered in the model with two reasons. One, its link with unemployment mention in paragraph in Section 1.2 and second, it is discussed in social disorganisation theory –Section 2.2.1. In the model, all crime variables and security expenditure are transformed into logarithms. Thus, the crime model tested is presented in equation 3.8 following equation 3.4.

$$lnCR_t = \gamma_0 + \gamma_1 UN_t + \gamma_2 YL_t + \gamma_3 POV_t + \gamma_4 lnFI_t + \gamma_5 lnPES_t + \varepsilon_t$$

(3.8)

In equation 3.8, CR_t is the annual crime activities in the country, UN_t is the annual unemployment rate, YL_t is the income disadvantage rate, POV_t is the poverty rate, FI_t is the family instability, PES_t is the annual security expenditure, ε_t is the white-noise term, and $\gamma_0, \gamma_1, \gamma_2, \gamma_3, \gamma_4$ and γ_5 are parameters.

3.4.1.2 Growth Model

This section presents the outline for the model specification on exogenous economic growth as specified in Mauro and Carmeci (2007). First, the crime-growth model follows Mauro and Carmeci (2007) as presented in 3.7. This model is specified to test the effects of crime on growth by taking account of how poverty existed in the economy. Also, the model is controlled by resources accumulations, which includes physical and human capital. The model is followed because it fits this study when examining the effect of crime on growth. However, a modification is made to the model in terms of using investment policies variables instead of labour policy (unemployment) in the model. Therefore, this study examines the relationship between crime and economic growth from the period from 1970 to 2013. This is done by using the exogenous growth model in equation 3.9 with the addition of agriculture, transportation and communication, and utilities as follows:

$$lnGR_t = \theta_0 + \theta_1 lnCR_t + \theta_2 TIV_t + \theta_3 EIV_t + \theta_4 lnAG_t + \theta_5 TRC_t + \theta_6 UT_t + \mu_t \quad (3.9)$$

In equation 3.9, GR_t is the growth of the economy, CR_t is the annual crime rate in the country, TIV_t is the total investment in the economy, EIV_t is the annual rate of education expenditure to GDP, AG_t is the annual value of agricultural export, TRC_t is the annual rate of transport and communication contributions to GDP, UT_t is the annual rate of contribution of utilities to GDP, μ_t is the white-noise term, and $\theta_0, \theta_1, \theta_2, \theta_3, \theta_4, \theta_5$ and θ_6 are parameters.

3.4.2 Granger Causality

The work of Granger (1969) brought light to the issue of causality and feedback mechanism of series by using a simple two-variable model. He argued that the extent of economic variables having causation would depend on the speed of information flows in an economy and also, the series sampling period. That is, the extent of causality of variable Y_t by variable X_t would depend on whether X_t has past information that could help predict and consequently help to improve Y_t. A simple causation model of two stationary time series with zero means is represented in equations 3.10 and 3.11 as follows:

$$X_t = \sum_{i=1}^{m} a_i X_{t-i} + \sum_{j=1}^{m} b_j Y_{t-j} + \varepsilon_t \dots \dots \dots (3.10)$$

$$Y_t = \sum_{i=1}^{m} c_i X_{t-i} + \sum_{j=1}^{m} d_j Y_{t-j} + \mu_t \dots \dots \dots \dots (3.11)$$

In these two equations, X_t would cause Y_t if $c_i \neq 0$ and likewise, Y_t would cause X_t if $b_j \neq 0$. Also, ε_t and μ_t are two uncorrelated white-noise series, that is, $E[\varepsilon_t \varepsilon_s] = 0$

= $E[\mu_t \mu_s]$, $s \neq t$, and $E[\varepsilon_t \varepsilon_s]$ = 0 all t, s. Then, m is the finite length of data available.

However, the above simple method of determining variable causation is noted with a shortcoming. For instance, the two-variable system may produce invalid results due to omitted variables that were not included in the model (Sims, 1980). Thus, Sims (1980) believed that to test causality of variables for instance, where Y_t causes X_t, he suggested the following equations that consider the inclusion of X_t as the leading values term in equation 3.12 which is then similar to Y_t in equation 3.13. Then, if Y_t causes X_t in equation 3.12, it presupposes that a relationship exist between Y_t and the leading values of X_t. Then, instead of testing for the lagged values of X_t the test would be on $\sum_{p=1}^{k} \varphi_p = 0$.

$$Y_t = a_1 + \sum_{i=1}^{m} \beta_i X_{t-i} + \sum_{j=1}^{m} \gamma_j Y_{t-j} + \sum_{p=1}^{k} \varphi_p X_{t+p} + e_{1t} \dots \dots \dots \dots (3.12)$$

$$X_t = a_2 + \sum_{i=1}^{m} \theta_i X_{t-i} + \sum_{j=1}^{m} \delta_j Y_{t-j} + \sum_{p=1}^{k} \omega_p Y_{t+p} + e_{2t} \dots \dots \dots . (3.13)$$

In addition, the above causality tests in Granger (1969) and Sims (1980) gave less room for the lag test, which did not help in ensuring asymptotic distribution in a model. That is, the Wald test in the above methods is used to determine the extent that parameters in a model are jointly zero and such method would not be valid when the series have been integrated or were cointegrated (Zapata & Rambaldi, 1997). However, to address this shortcoming in the above methods where variables are integrated or cointegrated, Engle and Granger (1987) suggested the inclusion of error correction term to the Vector Autoregressive (VAR) model. Thus, the addition of error correction term would show a temporal Granger causality in at least one direction when variables are cointegrated and consequently use it to determine Granger causality in both the long-run and short-run. Moreover, variables to be included in the model must be integrated at the order of one (Halicioglu, 2012). The method could allow for more than two variables as demonstrated in Halicioglu (2012) in equation 3.14.

$$(1-L)\begin{bmatrix} C_{tj} \\ Y_t \\ U_t \\ D_t \\ R_t \\ S_t \end{bmatrix} = \begin{bmatrix} \varphi_1 \\ \varphi_2 \\ \varphi_3 \\ \varphi_4 \\ \varphi_5 \\ \varphi_6 \end{bmatrix} + \sum_{i=1}^{p}(1-L) \begin{bmatrix} \theta_{11i}\ldots\ldots\theta_{16i} \\ \theta_{21i}\ldots\ldots\theta_{26i} \\ \theta_{31i}\ldots\ldots\theta_{36i} \\ \theta_{41i}\ldots\ldots\theta_{46i} \\ \theta_{51i}\ldots\ldots\theta_{56i} \\ \theta_{61i}\ldots\ldots\theta_{66i} \end{bmatrix} \begin{bmatrix} C_{tj-1} \\ Y_{t-1} \\ U_{t-1} \\ D_{t-1} \\ R_{t-1} \\ S_{t-1} \end{bmatrix} + \begin{bmatrix} \partial_1 \\ \partial_2 \\ \partial_3 \\ \partial_4 \\ \partial_5 \\ \partial_6 \end{bmatrix} [ECT_{t-1}] + \begin{bmatrix} \omega_{1t} \\ \omega_{2t} \\ \omega_{3t} \\ \omega_{4t} \\ \omega_{5t} \\ \omega_{6t} \end{bmatrix} \quad \ldots\ldots(3.14)$$

Nevertheless, the method of Granger causality with at least one temporal direction which exist in causation is not without shortcomings. This is because time series variables with integrated order other than one cannot be considered in the model. Also, the error correction term approach to Granger causality apart from Johansen and Juselius (1990) and Toda and Phillips (1993) tried to improve the power of Granger non-causality test by developing alternative procedures but these alternative procedures were not simple to carry out (Huang, 2007). In addition, the method only considered variables with integration order one and has poor performance on a small sample, and with these shortcomings, the error correction term procedures became less efficient (Zapata & Rambaldi, 1997). Therefore, to address the deficiencies in error correction term procedures and the earlier version methods in Granger (1969) and Sims (1980), Toda and Yamamoto (1995) came up with the modified Wald test to test the Granger non-causality. This procedure was simpler to approach causation among variables due to the consideration it gives for studying a small sample size. Also, variables need not be integrated or cointegrated before Granger causality is determined (Toda and Yamamoto, 1995 and Zapata & Rambaldi, 1997). Hence, in view of the greater advantages of modified Wald test by Toda and Yamamoto (1995) in testing the Granger non-causality over others, this study employed the augmented vector autoregressive procedures in examining the causality among socioeconomic strain, crime and economic growth in Nigeria.

Moreover, the vector autoregressive with the modified Wald test by Toda and Yamamoto (1995) was employed to examine the Granger non-causality among variables in this work. The modified Wald test is considered to be superior to the common Granger-causality test. This is because the modified Wald test can be performed whether the series were integrated or cointegrated of an arbitrary order and especially when the integration order is not more than the true lag length of the model. That is, the augmented VAR model of Toda and Yamamoto (1995) showed that the Wald test for restrictions on the parameters of a VAR (k) has an asymptotic χ^2 distribution when a VAR $(k + d_{max})$ is estimated where d_{max} is the optimal lag length in the model that is suspected to take place in the system (Zapata & Rambaldi, 1997).

Moreover, the process of carrying out the Granger non-causality test involves the determination of lag length k with the maximum order of integration d_{max}. Also, the determination the lag length k can be done using the Schwarz Bayesian criterion or Akaike Information criterion (Huang, 2007 and Shyh-Wei, 2009). Thus, the selection of VAR (k) with the integration d_{max} would show the over-fitted of the model due to the additional d_{max} lags. The d_{max} as an additional extra lag ensures that the test is done on a safer side even when there is no certainty that variables are I(1) or I(0) (Zapata & Rambaldi, 1997). Also, the estimated VAR order would be $p = k + d_{max}$ (Farhani, Shahbaz, Arouri & Teulon, 2014). The essence of $p = k + d_{max}$ provided the t-statistic in Granger causality to have the asymptotic χ^2 distribution through the process of the modified Wald test statistics for restrictions on the parameter of VAR. Thus, socioeconomic strain, crime and growth in this study were described by a VAR system in Farhani *et al.* (2014), and it is stated in equation 3.15.

$$\begin{bmatrix} \Delta y_t \\ \Delta g_t \\ \Delta k_t \\ \Delta tr_t \end{bmatrix} = \begin{bmatrix} \varphi_1 \\ \varphi_2 \\ \varphi_3 \\ \varphi_4 \end{bmatrix} + \sum_{i=1}^{d} \begin{bmatrix} \theta_{11i} & \theta_{12i} & \theta_{13i} & \theta_{14i} \\ \theta_{21i} & \theta_{22i} & \theta_{23i} & \theta_{24i} \\ \theta_{31i} & \theta_{32i} & \theta_{33i} & \theta_{34i} \\ \theta_{41i} & \theta_{42i} & \theta_{43i} & \theta_{44i} \end{bmatrix} \times \begin{bmatrix} \Delta y_{t-i} \\ \Delta g_{t-i} \\ \Delta k_{t-i} \\ \Delta tr_{t-i} \end{bmatrix} + \sum_{i=k+1}^{d_{max}} \begin{bmatrix} \theta_{11i} & \theta_{12i} & \theta_{13i} & \theta_{14i} \\ \theta_{21i} & \theta_{22i} & \theta_{23i} & \theta_{24i} \\ \theta_{31i} & \theta_{32i} & \theta_{33i} & \theta_{34i} \\ \theta_{41i} & \theta_{42i} & \theta_{43i} & \theta_{44i} \end{bmatrix} \times \begin{bmatrix} \Delta y_{t-i} \\ \Delta g_{t-i} \\ \Delta k_{t-i} \\ \Delta tr_{t-i} \end{bmatrix} + \begin{bmatrix} v_{1,t} \\ v_{2,t} \\ v_{3,t} \\ v_{4,t} \end{bmatrix} \quad ..(3.15)$$

From equation 3.15 and based on Rambaldi and Doran (1996) and Wolde-Rufael (2005), it follows that Granger causality is from g_t to y_t is $\theta_{12i} \neq 0 \forall_i$; likewise Granger causality is from y_t to g_t is $\theta_{22i} \neq 0 \forall_i$. Therefore, in line with Farhani *et al.* (2014), the modified Wald test model employed in this study is presented in equation 3.16.

$$\begin{bmatrix}\Delta lnGR_t\\ \Delta lnCR_t\\ \Delta UN_t\\ \Delta YL_t\\ \Delta POV_t\end{bmatrix} = \begin{bmatrix}\varphi_1\\ \varphi_2\\ \varphi_3\\ \varphi_4\\ \varphi_5\end{bmatrix} + \sum_{i=1}^{d} \begin{bmatrix}\beta_{11i}\,\beta_{12i}\,\beta_{13i}\,\beta_{14i}\,\beta_{15i}\,\beta_{16i}\\ \beta_{21i}\,\beta_{22i}\,\beta_{23i}\,\beta_{24i}\,\beta_{25i}\,\beta_{26i}\\ \beta_{31i}\,\beta_{32i}\,\beta_{33i}\,\beta_{34i}\,\beta_{35i}\,\beta_{36i}\\ \beta_{41i}\,\beta_{42i}\,\beta_{43i}\,\beta_{44i}\,\beta_{45i}\,\beta_{46i}\\ \beta_{51i}\,\beta_{52i}\,\beta_{53i}\,\beta_{54i}\,\beta_{55i}\,\beta_{56i}\end{bmatrix} \times \begin{bmatrix}\Delta lnGR_{t-i}\\ \Delta lnCR_{t-i}\\ \Delta UN_{t-i}\\ \Delta YL_{t-i}\\ \Delta POV_{t-i}\end{bmatrix}$$

$$+ \sum_{i=k+1}^{d_{max}} \begin{bmatrix}\beta_{11i}\,\beta_{12i}\,\beta_{13i}\,\beta_{14i}\,\beta_{15i}\,\beta_{16i}\\ \beta_{21i}\,\beta_{22i}\,\beta_{23i}\,\beta_{24i}\,\beta_{25i}\,\beta_{26i}\\ \beta_{31i}\,\beta_{32i}\,\beta_{33i}\,\beta_{34i}\,\beta_{35i}\,\beta_{36i}\\ \beta_{41i}\,\beta_{42i}\,\beta_{43i}\,\beta_{44i}\,\beta_{45i}\,\beta_{46i}\\ \beta_{51i}\,\beta_{52i}\,\beta_{53i}\,\beta_{54i}\,\beta_{55i}\,\beta_{56i}\end{bmatrix} \times \begin{bmatrix}\Delta lnGR_{t-i}\\ \Delta lnCR_{t-i}\\ \Delta UN_{t-i}\\ \Delta YL_{t-i}\\ \Delta POV_{t-i}\end{bmatrix}$$

$$+ \begin{bmatrix}v_{1,t}\\ v_{2,t}\\ v_{3,t}\\ v_{4,t}\\ v_{5,t}\end{bmatrix} \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots (3.16)$$

3.4.3 Variance Decomposition

The variance decomposition shows the distribution of the variance of the forecast error of variables. That is, it measures the contribution of each type of shock to the forecast error variance in a model. This is because it can provide indications of the relationship among the variables in a model. Also, an optimal forecasted variable based on its own lagged values will have its forecast error variance accounted for by its own disturbances. Moreover, the use of variance decomposition extends the usefulness of a VAR model in Granger causality due to the validation it provides for the findings in causal relations among variables.

3.4.4 Hypotheses

In most economics research work, hypotheses are formulated to test or verify whether one or more explanatory variables would affect the dependent variable in a regression model. That is, where the t-statistic calculated value > t-statistic critical value the null hypothesis would be rejected, and the alternative hypothesis would be accepted.

Therefore, in considering the problem statement in 1.2, the study developed hypotheses that are in line with the research question while relying on the theoretical propositions in 3.2. The hypotheses were as follows:

1. The null hypothesis states that socioeconomic strain would not affect crime in Nigeria in both the long-run and short-run. Nevertheless, the alternative hypothesis is non-zero either positive or negative, which is indicated symbolically as follows:

$$H_0: \gamma_1 = 0$$

$$H_1: \gamma_1 \neq 0$$

2. Also, the null hypothesis emphasised that crime would not contribute negatively both in the long-run and short-run to economic growth in Nigeria. However, the alternative hypothesis is non-zero either positive or negative. In a symbolic way, these hypotheses are as follows:

$$H_0: \theta_1 = 0$$

$$H_1: \theta_1 \neq 0$$

3. In addition, the null hypothesis states that socioeconomic strains, crime and economic growth do not Granger-causes each other in Nigeria. Moreover, the alternative hypothesis suggests that the Granger-causes are not indifferent from zero as symbolically expressed as follows:

$$H_0: \beta_{1i} = 0\forall_i$$

$$H_1: \beta_{1i} \neq 0\forall_i$$

3.5 Estimation Techniques

In estimating the relationship of socio macroeconomic variables, this study employs time-series data and the time-series estimation method. Most studies on crime effects have used cross-section and time series data. However, the few available studies that used time series data did not study effects of crime as noted in Corman and Mocan (2000); Habibullah and Baharom (2009); Saridakis (2011) and dos Santos and Kassouf (2013) but focus on crime determination.

3.5.1 Tests of Stationarity

It is observed in Granger and Newbold (1974) that spurious regression should be avoided because it makes estimated coefficients inefficient, forecasted values to be sub-optimal and tests of significance to be invalid. A spurious result may occur when there is low or high extreme value of the high coefficient of determination (R^2) and autocorrelation in a model. Moreover, serial correlation may occur when the error term is known to depend on previous year series (Hartmann *et al.*, 1980). To avoid spurious results that may emanate from the series when they are not stationary or not revolving around the constant variance mean, the series should be integrated; that is, the series should be made stationary before testing the relationships between them (Dickey & Fuller, 1979). Unit root tests may be carried out with many procedures including the Augmented Dickey-Fuller Test and the Phillip-Perron Test.

3.5.1.1 Augmented Dicker-Fuller (ADF) Test

In carrying out the stationarity test using ADF, the variable would be tested at a level in equation 3.17 (constant only) and 3.18 (constant and trend) and indifference forms in equation 3.19 (constant only) and 3.20 (constant and trend).

$$y_t = \mu + \tau y_{t-1} + \sum_{i-1}^{k-1} \delta_i \, y_{t-1} + \varepsilon_t \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots (3.17)$$

$$y_t = \mu + \rho t + \tau y_{t-1} + \sum_{i-1}^{k-1} \delta_i \, y_{t-1} + \varepsilon_t \quad \ldots\ldots\ldots\ldots (3.18)$$

$$\Delta y_t = \mu + \tau y_{t-1} + \sum_{i-1}^{k-1} \delta_i \, \Delta y_{t-1} + \varepsilon_t \quad \ldots\ldots\ldots\ldots\ldots . (3.19)$$

$$\Delta y_t = \mu + \rho t + \tau y_{t-1} + \sum_{i-1}^{k-1} \delta_i \, \Delta y_{t-1} + \varepsilon_t \quad \ldots\ldots\ldots (3.20)$$

where y_t is the series, μ is the constant, ρt is the trend, τ is the coefficient of the series y_{t-1}, Δy_t is the first difference of variable y and ε_t is the white noise. Besides, the null hypothesis is stated as $H_o\!: \tau = 1$ and the alternate hypothesis is stated as $H_A\!: \tau \neq 1 \; or \; \tau < 0$. That is, when test statistics are greater than critical value, $H_o\!: \tau = 1$ would be rejected. Based on the hypothesis, variables would first be tested at level I(0) and where the null hypothesis of non-stationarity ($H_o\!: \tau = 1$) fails to be rejected, then such a variable would then be transformed. The transformation of the variables into a differentiated form would also be put to test, that is, applying the same testing processes (Huang, 2007). However, when such a variable is tested in a difference form I(1) and the null hypothesis of non-stationarity ($H_o\!: \tau = 1$) is not failed to be rejected, then it means that such a variable has been integrated at I(1) and it would be considered in further estimation. If otherwise, such a variable is not fit to be considered in further estimation. Hence, the results of the unit root test would decide the choice of method estimation in terms of Vector Autoregressive tests; Johansen Cointegration tests and Autoregressive Distributive Lag Model Cointegration tests.

3.5.1.2 Philip-Perron (PP) Test

The Philip-Perron (PP) test considered the weakly dependent and heterogeneously distributed innovation in time series, which is not considered by the ADF. This is because errors of dependence and heteroscedasticity are usually found in time series data, which may make the regression spurious. Also, the occurrence of a break in a series can be accommodated by the PP test and is good for moderate-sized samples (Phillip & Perron, 1988). The test can be estimated with the following equations for a variable y_t.

$$\Delta y_t = \mu_1 + \alpha y_{t-1} + \varepsilon_{1t}$$

(3.21)

$$\Delta y_t = \mu_2 + \theta_t + \beta y_{t-1} + \varepsilon_{2t}$$

(3.22)

Where Δy_t is the first difference of variable y_t ; α, θ and β are parameters to be estimated; μ_1 and μ_2 are constants (drift terms); t is a deterministic time trend while the residuals are ε_{1t} and ε_{2t}. In both equations, the null hypothesis is tested against the alternate hypothesis. That is, in equation 3.21 $H_0: \alpha = 0$ and $\mu_1 = 0$; $H_1: \alpha \neq$

0 and $\mu_1 \neq 0$. Likewise, in 3.22 $H_0: \beta = 0,\ \theta = 0$ and $\mu_2 = 0$; $H_1: \beta \neq 0,\ \theta \neq 0$ and $\mu_2 \neq 0$.

3.5.2 Exogeneity Tests

In the crime literature, endogeneity problem is discovered among endogenous variables which made regression to be spurious. Because some independent endogenous variables in a model does correlate with the residual (Raphael & Winter-Ebmer, 2001). As the existence of residual correlation or measurement errors made OLS biased and inconsistent (Seddighi, 2012). Therefore, to have a valid estimates exogeneity test is done with the computation of Hausman statistics using OLS (Pesaran & Pesaran, 2009). In equation 3.23, to test whether $c_t\ (crime)\ and\ p_t\ (prosecution)$ would exogenously determine $g_t(growth)$; the processes are as follows:

$H_o: no\ measurement\ error\ or\ no\ simulateneity\ problem$

$H_1: measurement\ error\ or\ simulateneity\ problem\ exist$

$$g_t = \alpha_0 + \beta_1 c_t + \beta_2 p_t + \mu_t \qquad (3.23)$$

Obtaining the reduced form of $c_t\ and\ p_t$ as $\widehat{c_t}\ and\ \widehat{p_t}$ by regressing $c_t\ and\ p_t$ on lagged values in the model such as $c_{t-1}, c_{t-2}, p_{t-1}, p_{t-2}, g_{t-1}$ and g_{t-2} in equation 3.24 and 3.25 respectively. Then regress g_t on $c_t\ and\ p_t$ with the lagged variables and their residuals $\widehat{c_t}\ and\ \widehat{p_t}$ as indicated in equation 3.26. That is,

$$c_t = \alpha_0 + \beta_3 c_{t-1} + \beta_4 c_{t-2} + \beta_5 p_{t-1} + \beta_6 p_{t-2} + \beta_7 g_{t-1} + \beta_8 g_{t-2} + \mu_{1t} \qquad (3.24)$$

$$p_t = \alpha_0 + \beta_3 c_{t-1} + \beta_4 c_{t-2} + \beta_5 p_{t-1} + \beta_6 p_{t-2} + \beta_7 g_{t-1} + \beta_8 g_{t-2} + \mu_{2t} \quad (3.25)$$

$$g_t = \alpha_0 + \beta_1 c_t + \beta_2 p_t + \beta_3 c_{t-1} + \beta_4 c_{t-2} + \beta_5 p_{t-1} + \beta_6 p_{t-2} + \beta_7 g_{t-1} + \beta_8 g_{t-2} + \beta_9 \widehat{c_t} + \beta_{10} \widehat{p_t} + \mu_{3t} \quad (3.26)$$

The above null and alternate hypothesis to test $\widehat{c_t}\ and\ \widehat{p_t}$ becomes as follows:

$H_o: \beta_9 = \beta_{10} = 0$

$H_1: H_o\ is\ not\ true.$

By using the $F - test$ (since it involves more than one variable), the hypothesis of $\beta_9 = \beta_{10} = 0$ is tested. If the $F - test\ critical\ value$ is greater than $F - test\ calculated\ value$, then H_o is not rejected but if otherwise, it is rejected (Seddighi, 2012). The failure to reject the H_o showed that variables can be treated as exogenous (Pesaran & Pesaran, 2009 and Gujarati & Porter, 2009). Further, rejecting the H_o showed that OLS is not consistent and the estimation should be done using Instrumental Variables method (IV) (Seddighi, 2012).

3.5.3 Cointegration Test: The Autoregressive Distributed Lag Model (ARDL) Approach

The ARDL Model of Pesaran, Shin, and Smith (2001) classified series into I(0) and I(1) and makes used of their lag to determine the estimates of the series in a model. In addition, ARDL estimated an equation with the use of Ordinary Least Squares (OLS) technique. Thereafter, it employed the Wald test (F-statistic) to determine the movement of a series in a model. Moreover, restrictions were imposed on the Wald test conducted for the long-run estimations to be determined (Abdullah, Mustafa & Habibullah, 2009). This approach to cointegration by Pesaran *et al.* (2001) and further consideration of ARDL to accommodate small sample observation by Nayaran (2005) provided its superiority over another approach to cointegration. For instance, the cointegration approach by the Johansen-Juselius test and Engle-Granger test cannot be used to estimate series with a mixed order of integration such as I(0) and I(1). Moreover, the Johansen-Juselius test can be used for a large span of a series. In addition, the Engle-Granger test may be less efficient, which can cause contradictory results in cases in which there are more than two I(1). Therefore, the use of the Johansen-Juselius test and Engle-Granger test cannot accommodate those mentioned problems, and, consequently, these problems in the Johansen-Juselius test and Engle-Granger test would have impacts on the results. Also, Dogan (2015) provided the benefits of using ARDL as follows:

1. In light of a small sample size and the endogeneity of independent variables, the estimates provided by this approach are consistent and unbiased;
2. It ensures the possibilities of different appropriate lag lengths for each time-series;
3. The estimates for the long and short run can be simultaneously realised for the dependent and independent variables in a regression model;
4. It affords the use of mixed orders of integration of I(0) and I(1) even when they are mutually exclusive but does not consider variables with I(2).

In view of the advantages of the ARDL model over other cointegration methods, this study employed the ARDL model to analyse time series data on the socioeconomic strain, crime and economic growth in Nigeria. Following Nayaran (2005) and Abdullah *et al.* (2009), the ARDL model is described here with the equation specified in equation 3.23 (equation 3.23 is recalled from Section 3.5.2), which is transformed into an ARDL framework as presented in equation 3.27.

$$g_t = \alpha_0 + \beta_1 c_t + \beta_2 p_t + \mu_t \quad (3.23)$$

where g_t is the dependent variable, c_t and p_t are the regressors' vector, α_0 is the drift component, β_1 and β_2 are the parameters, μ_t is the white noise errors.

$$\Delta g_t = \alpha_0 + \beta_1 g_{t-1} + \beta_2 c_{t-1} + \beta_3 p_{t-1} + \sum_{i=1}^{p} \gamma_1 \Delta g_{t-i} + \sum_{i=0}^{p} \gamma_2 \Delta c_{t-i} + \sum_{i=0}^{p} \gamma_3 \Delta p_{t-i} + \mu_t \quad (3.27)$$

The ARDL framework specified in equation 3.27 has two parts. The first part without sigma signs indicated the long-run relationship, and the second part with sigma signs showed the error correction dynamics. That is, β_1, β_2 and β_3 are the estimates used to explain the long-run relationship while γ_1, γ_2 and γ_3 described the short-run dynamics in the model.

In equation 3.27, the long-run relationship is established with the following procedure. First, the long-run relationship is explained by the ARDL model hypothesis that is specified in both null and alternate forms, which are as follows:

$H_0: \beta_1, \beta_2 and\ \beta_3 = 0$ (mull hypothesis indicates no cointegration)

$H_A: at\ least\ one\ of\ \beta_1, \beta_2\ or\ \beta_3 \neq 0$ (Alternate hypothesis indicates that cointegration exists).

Moreover, in deciding the option between the null and alternate hypothesis as regards the results of the estimation, Pesaran *et al.* (2001) used the *F*-test and came up with two sets of critical values that cover the specifications of the deterministic terms. That is, they assumed that a forcing variable $\{x_{1t}\}$ is I(0) and another forcing variable $\{x_{2t}\}$ is I(1). These I(0) and I(1) serve as the lower and upper critical value bounds that enabled $\{x_t\}$ to be classified into I(0), I(1) and mutually cointegrated process. Thus, when the F-statistics fall below the lower level band, H_0 is failed to be rejected; but when the F-statistics is above the upper band, then the H_0 is rejected and where, the F-statistics lies between the lower and upper bound, the result is not conclusive. Then, to ascertain the series order of integration if they were at I(0) or I(1) for appropriate decision to be made whether to reject the null hypothesis of no cointegration, it is necessary to carry out a unit root test. Also, where all the series were I(0) the decision is made at I(0) bound but, where all the series were I(1) or at both I(0) and I(1) the decision is made at I(1).

Moreover, to estimate equation 3.27, Pesaran *et al.* (2001) indicated that appropriate optimal lag length structure must be determined. The optimal lag length structure is determined by estimating $(p+1)^k$ regression for each equation. That is, p is the maximum number of lags while k is the number of variables in the equation. Thus, to ascertain the optimal lag length structure for a model, the Akaike Information Criteria (AIC) and the Schwartz-Bayesian Criteria (SBC) can be used. While AIC select the maximum lag SBC select the smaller lag length, and with this smaller lag length SBC is referred to as parsimonious.

Furthermore, the long-run estimate is estimated through the ARDL selected model by any of the criterion. The existence of the long-run relationship among the variables indicates that there is an occurrence of error correction representation. In addition, the estimation of error correction model is done following the estimation of long-run relationship. The error correction model shows the speed of adjustment from the short-run path to the long-run equilibrium path after the shock in the short-run.

Thus, the error correction model within the ARDL framework can be specified as follows in equation 3.28 where γ_1, γ_2 *and* γ_3 denote the short-run dynamics coefficients and the speed of adjustment is denoted by ψ. Also, the error correction term (ecm_{t-i}) is defined as presented in equation 3.29 which is in line with Pesaran and Pesaran (2009).

$$\Delta g_t = \alpha_{0b} + \sum_{i=1}^{p} \gamma_1 \Delta g_{t-i} + \sum_{i=0}^{p} \gamma_2 \Delta c_{t-i} + \sum_{i=0}^{p} \gamma_3 \Delta p_{t-i} + \psi ect_{t-i} + \mu_t \quad (3.28)$$

$$ect_{t-i} = g_t - (\beta_2 c_t + \beta_3 p_t + \alpha_0) \quad (3.29)$$

In ensuring that the coefficient results of the long-run relationship by the ARDL model were robust and consequently, reliable for policy suggestion, the study conducted diagnostic tests of normality, functionality, serial correlation, heteroscedasticity and the structural stability test. The Jarque-Bera showed the normality test for the series normal distribution and Ramsey's RESET test indicated functional forms of the model specification. In addition, the LM test is the Breusch-Godfrey Serial Correlation test, which showed whether the models have a trace of autocorrelation. Also, Breusch-Pagan-Godfrey heteroskedasticity test indicated whether the disturbance has equal or constant variance. Hence, the structural stability test of the cumulative sum of recursive residuals (CUSUM) was applied to analyse the extent of stability in the models for the long-run relationship. The essence of employing stability test is to ensure that coefficients and variances of the disturbance terms do not change with time (Pesaran & Pesaran, 2009). Also, the structural stability tests are graphically illustrated with an upper bound and a lower bound, for which the CUSUM and CUSUMSQ must be in-between to pass the test at 5% level of significance.

3.5.4 ARDL Instrumental Variables Approach

Where variables are endogenous the ARDL OLS method may provide valid estimates. This is because ARDL OLS uses lagged of the dependent variable as regressors. But it estimates would only be valid provided that the residual is not serially correlated (Pesaran & Shin, 1997 and Giles, 2014). With absence of serial correlation in the residual of ARDL OLS, it can be taken or assumed that there is no endogeneity problem (Pesaran & Shin, 1997 and Giles, 2014). Besides, if endogeneity problem comes up after using ARDL OLS and the variables in the model are indeed endogenous, then the ARDL IV would be used to address this problem of simultaneity (Pesaran & Shin, 1997).

The ARDL IV combined the short-run and the long-run in the same model. When it is used to model variables, the problem of simultaneity bias is avoided, and a further test for exogeneity is not required (Stučka, 2004). That is, making relevant adjustment to ARDL orders, ARDL model is adequate to simultaneously correct for the serial correlation in the residual and further problems in endogenous regressors (Pesaran & Shin, 1997). This process allows endogenous variables to be estimated with ARDL IV. The ARDL OLS is transformed to Bewley's equation of 1979 and thus, estimated with Instrumental Variables method by using 2SLS (Pesaran & Shin, 1997).

To test for ARDL IV and following Pesaran and Shin (1997), equation 3.27 is reparametrized as equation 3.30 with instrument specified as

$$1, c_t, p_t, \Delta c_t, \Delta p_t, \Delta c_{t-1}, \dots, \Delta c_{t-m+1}, \Delta p_{t-1}, \dots, \Delta p_{t-m+1}, g_{t-1}, g_{t-1}, g_{t-p}.$$

$$\Delta g_t = \frac{a_0}{\emptyset(1)} + \beta_1 c_t + \beta_2 p_t + \frac{1}{\emptyset(1)} \sum_{i=0}^{m_1-1} \gamma_1 \Delta c_{t-i} + \frac{1}{\emptyset(1)} \sum_{i=0}^{m_2-1} \gamma_2 \Delta p_{t-i} - \frac{1}{\emptyset(1)} \sum_{i=0}^{p-1} \gamma_3 \Delta g_{t-i} + \frac{\eta_t}{\emptyset(1)} \quad (3.30)$$

Where the long-run is represented by β_1 and β_2 in equation 3.30 and the short-run is depicted with γ_1, γ_2 and γ_3. The Δg_{t-i} is the lagged change of dependent variable, Δc_{t-i} and Δp_{t-i} are lagged change of independent variables. $\frac{a_0}{\emptyset(1)}$ and $\frac{\eta_t}{\emptyset(1)}$ are constant and residual. The short-run is represented by equation 3.31.

$$\Delta g_t = \frac{a_0}{\emptyset(1)} + \frac{1}{\emptyset(1)} \sum_{i=0}^{m_1-1} \gamma_1 \Delta c_{t-i} + \frac{1}{\emptyset(1)} \sum_{i=0}^{m_2-1} \gamma_2 \Delta p_{t-i} - \frac{1}{\emptyset(1)} \sum_{i=0}^{p-1} \gamma_3 \Delta g_{t-i} + \frac{\eta_t}{\emptyset(1)} \quad (3.31)$$

Equation 3.27 is referred to as ARDL OLS while equation 3.30 is referred to as ARDL IV. To show that there is no further problem of endogeneity exists in endogenous regressors, Pesaran and Shin (1997) viewed that standard errors provided in equation 3.30 (ARDL IV) are numerically identical to standard errors in equation 3.27 (ARDL OLS). Similar to equation 3.28 and equation 3.31. This means that the standard errors provided in the ARDL OLS are subjected to test using the ARDL IV (2SLS). Similarly, Bardsen (1989) proved that standard errors in the delta-method (ARDL OLS) is numerically identical to the standard error in 2SLS. That is, by rewritten the conditional ECM equation 12 in his work with lagged of the variables as instrument in Bewley equation (1979), he found that the standard errors for each parameter in the OLS and 2SLS were numerically identical. Besides, when ECM (dynamic equation) is reparametrized in Bewley equation endogeneity bias problems are insignificant and reasonably inconsequential (Inder, 1993). Thus, the process in Pesaran and Shin (1997) and Bardsen (1989) is described by Bewley (1979) as "the pseudo-structural form of the general linear dynamic process' which directly made 2SLS to equivalent to OLS.

3.6 Data Description

3.6.1 Economic Growth

The role of economic growth as a measure of economic performance is worthwhile because it shows how the economy has been expanding. In view of this major role of economic growth, this current study measured economic growth via the gross domestic product. This is because the gross domestic output captures the output produced in an economy over a period of years and its increase improves the people's standard of living. Also, GDP growth measures the wealth of a country. Mauro and Carmeci (2007) and Dettoto and Ontranto (2010) used real GDP to measure economic growth; these studies showed that a link exists between crime and economic growth. While Mauro and Carmeci (2007) considered how crime reduced output through activities of organised crime, Dettoto and Ontranto (2010) observed that crime worsens businesses and the economy. Similarly, this study proxies economic growth by real GDP based on evidence in Mauro and Carmeci (2007) and Dettoto and Ontranto (2010). The real GDP from World Bank Indicator (2016) is relied on for the estimation.

3.6.2 Crime

Crime data have been problematic in the area of record keeping as noted by the United Nations Office on Drug and Crime, especially in Africa (2005). The issues of crime data being problematic in developing countries are due to inadequate funding of the policing (Wu & Wu, 2012). Moreover, the recorded number of crime has served as a proxy for the return on crime due to the inability of quantifying the return on crime adequately by many studies like Enamorado *et al.* (2014), Detotto and Ontranto (2010), and Mauro and Carmeci (2007). Crime proxy may be deficient as used by many studies because it does not capture the various numbers of crimes committed. To overcome the deficiency in proxy for crime, this study measured crime by using overall crime rates in Nigeria as did Goulas and Zervoyianni (2013) in a cross-country based study. However, the crime rates in Goulas and Zervoyianni (2013) only cover robberies, thefts, burglaries, rapes, assaults and completed intentional homicides, and thus, are not exhaustive.

Thus, crime and crime rates in this current study cover both serious crimes and minor crimes. Serious crimes include murder, manslaughter, felonious wounding, assault, other crimes against persons, armed robbery, burglary, house and store breaking, larceny, currency forgery, other crimes against property, bribery and corruption. Minor crimes include false pretence/cheating, unlawful possession, receiving stolen property, arson, perjury, gambling, breach of peace, escape from custody, local acts and others. In addition to the overall crime, person's crime and property crime is considered base on the reasons provided in Section 1.1 (pp 6-8) to study crime in Nigeria. The person's crime are murder, felonious wounding and other crimes against persons. Property crime includes armed robbery which include robbery and extortion, burglary and false pretence/cheating crimes. Data were sourced from the National Bureau of Statistics and The Nigeria Police.

3.6.3 Unemployment

Miyoshi (2011) observed that was less possibility of committing a crime by an individual having a legal income. In Nigeria, unemployment stood at 24.7% in 2013 (NBS, 2015), which may serve as an incentive to commit a crime. Wu and Wu (2012) demonstrated that unemployment is associated with drug crime positively. Therefore, when unemployment is more rampant in a country, the tendency existed to negatively affect productivity as noted in NBS (2015). Owing to the impact of unemployment and its possibility of causing crime in Nigeria, the unemployment rate was examined in the crime model to assess the impact of the labour policy in Nigeria. Estimated data were sourced from the National Bureau of Statistics of various publications.

3.6.4 Income Disadvantage

Income disadvantage is measured by disparity in income, the lowest income at the lowest quintiles and the inverse of income. No matter how disparity is measured, it ascertains the disparity in wealth among nations and individuals in a country (Easterly, 2007). Poor income causes mobility, which leads to population gains or losses in both rural and urban areas (Mata & Bollman, 2007) because its extremes may induce hardships on people life and causes strain (Baharom *et al.*, 2013). In a cross country study, Fajnzylber *et al.* (2002) affirmed that a high disparity in income caused crime, including homicide and robbery. High income disparity increased from 0.389 in 2004 to 0.416 in 2010 survey of Nigeria (NBS, 2012). But due to non-available data on income inequality, this study chose to consider the income disadvantage as measured in Mata and Bollman (2007). Therefore, an inverse of the logarithm average income per population was used to proxy income disadvantage. Calculation is based on GDP per capita from World Bank Indicators (2016).

3.6.5 Poverty

Poverty in any economy shows the extent to which wealth through policies and programmes have changed the lives of the poor meaningfully, as it measures the depth and severity of poverty and the utilisation of resources in the lives of the citizens of a country. This is ascertained by the poverty gap or headcount of a country. Although the increased in poverty incidence in Nigeria has been addressed by various measures (Obadan, 2002) but these measures seem inadequate (Umukoro, 2013). This is because halving number of people living below US$ 1 a day and reduction of poverty to 21.40% has proven difficult (MDG Report, 2013). Indeed, an increased in poverty rate without adequate social protections to reduce it and its affection promotes crime (Rogers & Pridemore, 2013). This is supported by Meloni (2014) as his study measured poverty by means of the percentage of households below the poverty line. Mean police per capita expenditure at the lowest quintiles is examined with violent crime by Demombynes and Ozler (2005) and is significantly related to crime. Similar to Demombynes and Ozler (2005), poverty was thus measured in this current study with an inverse of logarithm of household per capita consumption. That was done because this metric captures the inability to achieve a minimal standard of living by the poor when considering basic consumption needs (World Bank, 1990: Sehrawat & Giri, 2016). The data estimated were sourced from Nigeria Data Portal.

3.6.6 Family Instability

According to Shaw and McKay (1942), society is disorganised when mobility takes place because such mobility weakens social control. Mobility is related to migration, which results in family instability and, thus, poverty could also be the cause of family instability (Wong, 2007). Separated families tend not to have contact with their children compared to married couples who have direct supervision over their children (Alwin, Converse, & Martin, 1985), as often seen when divorce and separation took place in family (Fomby & Cherlin, 2007). A female head of household often loses control of children, which, in turn, induces children from such homes to commit crimes (Kelly, 2000).

Following Kelly (2000), family instability is considered in this study. But due to unavailable data, a dummy variable of 1 and 0 was constructed (family instability = 1 and 0 = stable). For explanatory sake, the dummy is tailored towards the number of years (1970-78 & 1984-98) with had full military rule in the country. The choice of these years was because of family instability that is often related to military jobs. For instance, child maltreatment and abuse may be experienced by a child from civilian female spouse when the male is deployed to war or is redeployed (Creech, Hadley, & Borsari, 2014). Also, military families are often more separated and change locations frequently (Alfano, Lau, Balderas, Bunnell, & Beidel, 2016). However, the dummy is treated as a determinant variable in ARDL model since the critical value bounds for the long run are unaffected (Pesaran & Pesaran, 2009). Similar approach is found in Pahlavani, Wilson and Worthington (2005) where dummy variables are tested in the long-run and short-run ARDL model.

3.6.7 Public Expenditure on Internal Security

Deterrence variables in the study showed the role of the government in crime reduction via the provision of safety measures to the public. These efforts help to increase the opportunity cost of crime because presence of security discourages people from committing crime. Also, a deterrence variable may be used to reduce crime and improve growth due to its endogeneity. However, reducing crime and social loss caused by crime through police, court and prison requires the expenditure of public funds (Becker, 1968). Perhaps, the use of security funds is only effective in tackling crime when security measures receive public cooperation (Halicioglu *et al.*, 2012).

While considering the role of deterrence, Poveda (2012) suggested that the elements of government expenditure on security should be tested along with crime. Halicioglu *et al.* (2012) tested real police total expenditures and found that they reduced crime significantly. Therefore, public expenditure on internal security was tested in the crime model as a policy variable to control crime. Estimated data were obtained from the Central Bank of Nigeria based on various annual reports.

3.6.8 Total Investment

The significance of gross fixed capital formation as a form of physical investment is adjudged as a driver for growth in an economy. This is because output level is greatly determined by investment in physical capital in the long-run (Mauro & Carmeci, 2007). Moreover, the poor performance of institutional quality due to corruption would not promote investment because of its negative impacts on investment (Mauro, 1995). That is, the presence of corruption causes a less-than-optimal structure of government spending (Mauro, 1998). For example, the crime of destruction on physical investment in 2008 was valued at ₦14.594 billion Naira in Nigeria (National Bureau of Statistics, 2011). With these reasons and its consideration in the exogenous model in (Mauro & Carmeci, 2007), total investment was included in the growth model. This data was sourced from the Department of Economic and Social, Statistic Division-United Nations (2017).

3.6.9 Investment in Education

Following Mauro and Carmeci (2007), Goulas and Zervoyianni (2013), this study controls for policy on education to capture human capital accumulation. While Mauro and Carmeci (2007) measured the total enrolment rate in high school, Goulas and

Zervoyianni (2013) used the ratio of gross enrolment of tertiary education to population. Their studies found that education exerted a positive influence on economic growth. Due to the data available, this study used investment in total education as percentage to GDP to capture policy on human capital. The belief is that education is useful in promoting economic growth. Estimated data was sourced from the Central Bank of Nigeria based on various annual reports.

3.6.10 Agriculture

Agriculture is a dynamic leading sector as it primarily provides sufficient low-priced food and manpower required for the expansion of industrial economy (Todaro & Smith, 2011). Also, it employs a high number of people, contributes to GDP and generates foreign income (Oni, Nkonya, Pender, Philips, and Kato, 2009). However, agriculture has not been consistent in performing this role in Nigeria. For instance, its share of the GDP has declined yearly from 32.0% in 2006 to 23.89% in 2010, 22.05% in 2012 and 20.24% in 2014 (CBN Annual Reports, 2014). While employment in agriculture declined from 58.31% to 56.4% to 54.46% in 2005, 2007 and 2009 respectively (NBS, 2006 & 2012), its share of non-oil exports stood at 37.8% in 2006, 55.4% in 2010, 46.3% in 2012 and 38.7% in 2014 (CBN Annual reports, 2014). Probably, the inconsistency may be due to the percentage change in funds allocated to agriculture as it was reduced from 5.26% in 2006 to 2.53% in 2010, 2.09% in 2012 and then increase to 2.20% in 2014 (CBN Annual reports, 2014).

No doubt exists that agriculture does not play its primary role in Nigeria adequately. Since studies have shown that agriculture has positive linked with economic growth (Oyakhilomen & Zibah, 2014; Owolabi-Merus & Bello, 2015). Agriculture was documented as a policy instrument in previous studies on growth-crime models available to this study. Therefore, agriculture is included in the growth-crime model to determine its effectiveness using a Nigeria data set to see if it would be useful in controlling crime. Estimated data were obtained from the Central Bank of Nigeria based on various annual reports.

3.6.11 Transportation and Communication

Jointly, transportation and communication are key inputs into the production process as they improve productivity and facilitate the proximity and movement of production factors (Eruygur, Kaynak, & Mert, 2012). Adequate transportation and communication, lowers the cost of input factors, create employment, enrich education and health, and deepen trade and private investments (Deng, 2013).

Due to it relevancy, previous studies have found that transportation and communication jointly moved with economic growth (Eruygur, Kaynak, & Mert, 2012; Abu & Abdullahi, 2010). With the diverse role of transportation and communication, this study included it in the growth-crime model. While technology was found to promote economic growth by Goulas and Zervoyianni (2013), transportation and communication also deserves to be documented in the growth-crime literature. Annual data estimated were sourced from the Central Bank of Nigeria based on various annual reports.

3.6.12 Utilities

Utilities are valuable to human and economic development apart from the profit business makes from them (Sutton, 2007). Further, Sutton argued that inadequacies in utilities can cause poor health, low readiness for education and the strain of getting water from a long distance due to the poor viability of electricity. Their availability ensures direct cost savings because it lowers prices and affords the poor the opportunity to use their money for other valuable needs. Also, adequate supplies reduce illness and money spend on medical treatments, and, in turn, improved health and education enhances productivity as electricity permits the use of machinery instead of manual labour.

Nigeria has low electricity generation and poor distribution, which culminates in poor service delivery (Oseni, 2011). Oseni (2011) argued that government provision of electricity can expand employment, economic growth and reduce poverty. However, the impact of utilities was yet to be documented in any previous studies available to this study on growth-crime model. The positive trend of utilities with economic growth and development in Sutton (2007) and Oseni (2011) suggested that utilities should be included in the growth-crime model as it links to poverty reduction, which may be useful in controlling crime. Data estimated were obtained from the Central Bank of Nigeria of various annual reports.

3.7 Data and Sources of Data

Annual data from 1970 to 2013 were used to adequately capture all the variables in this study as presented in Table 3.1. These data were sourced from the World Bank Indicators (2016); Department of Economic and Social, United Nations; the Annual Report and Statement of Accounts of the Central Bank of Nigeria and Statistical Bulletin of the Central Bank of Nigeria; various publications of the National Bureau of Statistics and other relevant governmental offices in Nigeria.

Table 3.1
Variables and data sources for the socioeconomic strain, crime and economic growth

s/n	Variable	Measurement	Nature of the Data	Sources of Data
1.	Economic Growth	Real GDP	Time series data from 1970 to 2013	World Bank (2016)
2.	Crime	1. Crime rate per 100,000 population. 2. Person's crime rate per 100,000 population. (murder, felonious wounding and other crime against persons). 3. Property crime rate per 100,000 population (armed robbery, burglary and false pretence crimes)	Time series data from 1970 to 2013	National Bureau of Statistics and The Nigeria Police Force
3.	Unemployment	Annual unemployment rate	Time series data from 1970 to 2013	National Bureau of Statistics.
4.	Income disadvantage	Inverse of logarithm of the GDP per capita	Time series data from 1970 to 2013	World Bank Indicator (2016)
5.	Poverty	Inverse of logarithm of the Real Household Consumption Expenditure Per Capita	Time series data from 1970 to 2013	www. nigeria.opendata forafrica.org
6.	Family Instability	Dummy based on the period of full military regime in Nigeria	Time series data from 1970 to 2013	Author
7.	Security Expenditure	Annual Public Expenditure on Internal Security	Time series data from 1970 to 2013	Central Bank of Nigeria
8.	Total investment	Foreign direct investment, net inflows (BoP, current US$) plus Gross capital formation current in $ (Total as % of Gross Domestic Product (GDP) current in $).	Time series data from 1970 to 2013	United Nations, Department of Economic and Social
9.	Education	Total Education Expenditure (% to GDP)	Time series data from 1970 to 2013	Central Bank of Nigeria
10.	Agriculture	Annual value of agricultural exports in tonnes	Time series data from 1970 to 2013	Central Bank of Nigeria
11.	Transportation and communication	Transport and communication (% of GDP)	Time series data from 1970 to 2013	Central Bank of Nigeria
12.	Utilities	Electricity and Water Supply (% of GDP)	Time series data from 1970 to 2013	Central Bank of Nigeria

CHAPTER FOUR

RESULTS PRESENTATION AND ANALYSIS

4.1 Introduction

The previous chapter discussed the econometrics models employed in this study and highlighted the hypotheses for the study's objectives. Data were collected to test these hypotheses, and the results are presented in this chapter. Section 4.2 highlight the results of unit root tests conducted using the Augmented Dicker-Fuller Test and Philip-Perron Test. Also, based on the ARDL model approach, the cointegration test is discussed in Section 4.3. Sequel to the cointegration tests, Sections 4.4 and 4.5 focus on the long-run and short-run estimates. Section 4.6 show the result of the Granger causality while the last section highlighted the results of the variance decomposition.

4.2 Stationarity Tests

The variables model in this study are socioeconomic strain measured by unemployment rate (UN), income disadvantage rate (YL) and poverty rate (POV). Other are family instability (FI), public security expenditure (*ln*PES), economic growth (*ln*GR), total investment (TIV), education (EIV), agriculture (*ln*AG), transportation and communication (TRC), utilities (UT) and crime variables. These crime variables as discussed in Section 3.6.2 are represented by overall crime rate (*ln*CR), person's crime rate (*ln*CPS) and property crime rate (*ln*CPR). While *ln*CPS comprises murder, felonious wounding and other crimes against persons such as rape and kidnapping, *ln*CPR comprise armed robbery which include also robbery and extortion, burglary and false pretence/cheating crimes.

To avoid spurious regression and free the estimated results from any bias, this study conducted unit roots tests on the time series data employed. Thus, the following means of testing for the presence of unit root in the time series data are employed: the Augmented Dicker-Fuller test and the Phillip-Perron (PP) test; the results are presented in Tables 4.1 and 4.2. In using the ADF and PP unit root tests, all the variables are integrated at I(1) with exception of persons crime (LCPS). The persons crime (LCPS) is found at order I(0) in PP and I(1) in ADF.

Table 4.1
Augmented Dickey-Fuller (ADF) Unit Roots Test

Variables	Level		1ST Difference		Decisions
	Intercept	**Intercept & trend**	**Intercept**	**Intercept & trend**	
*ln*CR	0.236	-2.344	-6.738***	-7.013***	I(1)
*ln*CPS	-2.921	-2.901	-7.374***	-7.789***	1(1)
*ln*CPR	-1.662	-3.186	-8.801***	-.8.760***	I(1)
UN	-2.255	-2.905	-6.605***	-6.517***	I(1)
YL	-0.201	-2.933	-5.553***	-6.015***	I(1)
POV	-1.678	-2.477	-6.375***	-6.597***	I(1)
FI	-1.700	-2.169	-6.375***	-6.295***	I(1)
*ln*PES	0.178	-1.989	-6.904***	-6.909***	1(1)
*ln*GR	1.189	-0.258	-5.595***	-6.065***	I(1)
TIV	-2.040	-2.288	-5.819***	-5.912***	1(1)
EIV	1.005	-1.090	-6.298***	-5.231***	I(1)
*ln*AG	0.465	-2.578	-6.526***	-6.648***	I(1)
TRC	-0.750	1.059	-4.967***	-5.573***	I(1)
UT	-2.074	-1.901	-6.069***	-6.056***	I(1)

Notes: The figures reported are t-ratio of MacKinnon (1996) one-sided at various levels of significance. The asterisks (***) is at 1%; (**) is at 5% and (*) is at 10%.

Table 4.2
Phillip-Perron Unit Roots Test

Variables	Level		1ST Difference		Decisions
	Intercept	**Intercept & trend**	**Intercept**	**Intercept & trend**	
lnCR	0.286	-2.325	-6.754***	-7.442***	I(1)
lnCPS	-2.804*	-2.740	-10.917***	-13.967***	I(0)
lnCPR	-1.470	-3.114	-8.801***	-8.848***	I(1)
UN	-2.226	-2.814	-7.926***	-7.824***	I(1)
YL	-0.645	-0.493	-5.634***	-6.014***	I(1)
POV	-1.863	-2.559	-9.254***	-11.224***	I(1)
FI	-1.784	-2.308	-6.375***	-6.295***	I(1)
lnPES	0.461	-2.303	-6.995***	-7.037***	I(1)
lnGR	0.961	-0.458	-5.682***	-6.066***	I(1)
TIV	-2.020	-2.311	-6.958***	-7.971***	I(1)
EIV	2.584	0.170	-6.299***	-10.477	I(1)
lnAG	1.054	-2.546	-6.588***	-7.294***	I(1)
TRC	-0.769	-1.386	-6.705***	-7.303***	I(1)
UT	-2.176	-2.029	-6.069***	-6.067***	I(1)

Notes: The figures reported are t-ratio of MacKinnon (1996) one-sided at various levels of significance. The asterisks (***) is at 1%; (**) is at 5% and (*) is at 10%.

Owing to the consistency in the results of ADF and PP tests, one of the variable is mixed order of I(0) and I(1) while others variables are I(1). The cointegration technique (ARDL) proposed by Pesaran and Shin (1997), and Pesaran *et al.* (2001) was used to analyse all the models due to the following reasons. First, to find a joint movement of series and second, the OLS estimation was super-consistent due to one period lagged variables as the problem of endogeneity may not arise once errors are not serially correlated (Giles, 2014). Third, it has sufficient process to simultaneously correct for the residual serial correlation and the problem of endogenous regressors (Pesaran & Shin, 1997). Lastly, this study followed similar crime studies that have used ARDL for the estimation of a model with endogenous variables (Halicioglu, 2012; Halicioglu *et al.*, 2012). In addition, this study tested for endogeneity in the models as described in Pesaran and Pesaran (2009) and Seddighi (2012) with further application of ARDL IV in Pesaran and Shin (1997).

4.3 Exogeneity Tests (Results)

Section 3.5.3 pointed out that crime models and growth models in this study may consists of endogenous variables. To ascertain if variables modelled in this study have problem of simultaneity bias, exogeneity tests are conducted following Gujarati and Porter (2009), Pesaran and Pesaran (2009) and Seddighi (2012). To test for exogeneity, equation 4.1 is formulated which is line with equation 3.8 in Section 3.4.1.1. The simultaneity hypothesis is also stated below. Variables are as defined in Section 3.4.1.1 and Section 4.2.

$$lnCR_t = \gamma_0 + \gamma_1 UN_t + \gamma_2 YL_t + \gamma_3 POV_t + \gamma_4 FI_t + \gamma_5 lnPES_t + \varepsilon_t$$

(4.1)

$H_o: no\ simulateneity\ problem$

$H_1: simulateneity\ problem\ exist$

The residual of independent variables ($UN_t, YL_t, POV_t, FI_t\ and\ lnPES_t$) are obtained as reduced form by regressing each individual independent variable on lagged values and other lagged variables in the model. This is expressed in equation 4.2 to 4.6 as their reduced form indicated as $\widehat{UN}$, $\widehat{YL}$, $\widehat{POV}$, $\widehat{FI}\ and\ \widehat{lnPES}$ in equation 4.7. Besides, to avoid near singular matrix error which may make regressors to be perfectly collinear, lag two (2) of independent variables are not included in equation 4.7.

$$UN_t = \beta_{0A} + \beta_1 UN_{t-1} + \beta_2 UN_{t-2} + \beta_3 YL_{t-1} + \beta_4 YL_{t-2} + \beta_5 POV_{t-1} + \beta_6 POV_{t-2} + \beta_7 FI_{t-1} + \beta_8 FI_{t-2} + \beta_9 lnPES_{t-1} + \beta_{10} lnPES_{t-2} + \beta_{11} lnCR_{t-1} + \beta_{12} lnCR_{t-2} + \epsilon_{1t} \quad (4.2)$$

$$YL_t = \beta_{0B} + \beta_1 UN_{t-1} + \beta_2 UN_{t-2} + \beta_3 YL_{t-1} + \beta_4 YL_{t-2} + \beta_5 POV_{t-1} + \beta_6 POV_{t-2} + \beta_7 FI_{t-1} + \beta_8 FI_{t-2} + \beta_9 lnPES_{t-1} + \beta_{10} lnPES_{t-2} + \beta_{11} lnCR_{t-1} + \beta_{12} lnCR_{t-2} + \epsilon_{2t} \quad (4.3)$$

$$POV_t = \beta_{0C} + \beta_1 UN_{t-1} + \beta_2 UN_{t-2} + \beta_3 YL_{t-1} + \beta_4 YL_{t-2} + \beta_5 POV_{t-1} + \beta_6 POV_{t-2} + \beta_7 FI_{t-1} + \beta_8 FI_{t-2} + \beta_9 lnPES_{t-1} + \beta_{10} lnPES_{t-2} + \beta_{11} lnCR_{t-1} + \beta_{12} lnCR_{t-2} + \epsilon_{3t} \quad (4.4)$$

$$FI_t = \beta_{0D} + \beta_1 UN_{t-1} + \beta_2 UN_{t-2} + \beta_3 YL_{t-1} + \beta_4 YL_{t-2} + \beta_5 POV_{t-1} + \beta_6 POV_{t-2} + \beta_7 FI_{t-1} + \beta_8 FI_{t-2} + \beta_9 lnPES_{t-1} + \beta_{10} lnPES_{t-2} + \beta_{11} lnCR_{t-1} + \beta_{12} lnCR_{t-2} + \epsilon_{4t} \quad (4.5)$$

$$LPES_t = \beta_{0E} + \beta_1 UN_{t-1} + \beta_2 UN_{t-2} + \beta_3 YL_{t-1} + \beta_4 YL_{t-2} + \beta_5 POV_{t-1} + \beta_6 POV_{t-2} + \beta_7 FI_{t-1} + \beta_8 FI_{t-2} + \beta_9 lnPES_{t-1} + \beta_{10} lnPES_{t-2} + \beta_{11} lnCR_{t-1} + \beta_{12} lnCR_{t-2} + \epsilon_{5t} \quad (4.6)$$

$$lnCR_t = \beta_{0F} + \gamma_1 UN_t + \gamma_2 YL_t + \gamma_3 POV_t + \gamma_4 FI_t + \gamma_5 lnPES_t + \beta_1 UN_{t-1} + \beta_3 YL_{t-1} + \beta_5 POV_{t-1} + \beta_7 FI_{t-1} + \beta_9 lnPES_{t-1} + \beta_{11} lnCR_{t-1} + \beta_{12} lnCR_{t-2} + \beta_{13}\widehat{UN}_t + \beta_{14}\widehat{YL}_t + \beta_{15}\widehat{POV}_t + \beta_{16}\widehat{YL}_t + \beta_{17}\widehat{lnPES}_t + \epsilon_{6t} \quad (4.7)$$

The above hypothesis is denoted by

H_o: $\beta_{13} = \beta_{14} = \beta_{15} = \beta_{16} = \beta_{17} = 0$

$H_1: H_o$ *is not true*

Following the OLS estimation of equation 4.7, Hausman F-test ($\boldsymbol{HF_T}$) is carried out to test the hypothesis if $\beta_{13} = \beta_{14} = \beta_{15} = \beta_{16} = \beta_{17} = 0$ by using the Moore-Penrose generalised inverse of the Wald statistics (Green, 2012). The result of exogeneity tests for the overall crime, persons' crime and property crime are presented in Table 4.3 (see evidences attached in Appendix B to D). These exogeneity tests are based on based on lag two (2) specification for overall crime (Model 1A), persons' crime (Model 1B) and property crime (Model 1C). The results revealed that all the crime models pass the exogeneity test beyond 10% as they are not significant. This means that the null hypothesis failed to be rejected which show that all the variables are exogenous (see Gujarati & Porter, 2009; Green, 2012 and Seddighi, 2012).

Table 4.3
Results of Exogeneity Tests on crime models

Crime model 1A (Overall crime)			**Crime model 1B (Person's crime)**			**Crime model 1C (Property crime)**		
Variables	t-statistics	p-value	Variables	t-statistics	p-value	Variables	t-statistics	p-value
C	-1.346	0.190	C	-1.082	0.289	C	-0.206	0.838
LCR(-1)	1.376	0.181	LCPS(-1)	-0.276	0.784	LCPR(-1)	-0.155	0.878
LCR(-2)	-1.481	0.151	LCPS(-2)	-0.538	0.595	LCPR(-2)	0.290	0.773
UN	-1.300	0.205	UN	0.136	0.892	UN	1.354	0.188
UN(-1)	1.343	0.191	UN(-1)	0.573	0.571	UN(-1)	-0.340	0.736
YL	1.356	0.187	YL	0.153	0.879	YL	-0.693	0.494
YL(-1)	-1.353	0.188	YL(-1)	-0.133	0.895	YL(-1)	0.636	0.530
POV	1.353	0.188	POV	0.828	0.415	POV	0.534	0.597
POV(-1)	1.336	0.193	POV(-1)	-0.278	0.783	POV(-1)	-1.213	0.236
FI	-1.346	0.190	FI	0.521	0.606	FI	0.901	0.376
FI(-1)	1.351	0.189	FI(-1)	0.237	0.814	FI(-1)	-0.205	0.838
LPES	1.349	0.189	LPES	0.589	0.561	LPES	-0.490	0.628
LPES(-1)	-1.360	0.186	LPES(-1)	-0.587	0.562	LPES(-1)	0.385	0.703
RUN †	1.292	0.208	RUN4 †	0.388	0.701	RUN3†	-0.550	0.587
RYL †	-1.354	0.188	RYL4 †	0.109	0.913	RYL3†	0.880	0.387
RPOV†	-1.343	0.191	RPOV4 †	-0.744	0.463	RPOV3†	-0.490	0.628
RFI†	1.356	0.187	RFI4 †	-0.416	0.680	RFI3†	-0.376	0.710
RLPES†	-1.354	0.188	RLPES4 †	-0.575	0.570	RLPES3†	0.468	0.643

Diagnostic Tests

Test	Statistic	p-value	Decision	Statistic	p-value	Decision	Statistic	p-value	Decision
$\boldsymbol{HF_T}$	1.033	0.420	H_0 *not rejected*	0.322	0.894	H_0 *not rejected*	1.022	0.426	H_0 *not rejected*

Note: the asterisk (†) showed that residual variables considered in each of the crime model. H_o: $\beta_{13}RUN = \beta_{14}RYL = \beta_{15}RPOV = \beta_{16}RFI = \beta_{17}LPES = 0$ which means "no simultaneity". Jointly, F-test tests the Hausman Test of no simultaneity (see Seddighi, 2012) and results showed that all the variables are exogenous beyond 10%.

Moreover, similar processes are used for all the growth models with lagged two (2) specification. The equation specified for growth model 2A which represent Model 2B and Model 2C is presented below in 4.8 (equation 4.8 is in line with equation 3.9 in Section 3.4.1.2). Thus to test for the exogeneity, equation 4.9 to 4.14 are specified to regress $lnCR_t, TIV_t$, $EIV_t, lnAG_t, TRC_t and\ UT_t$ on their lagged values and other variables (lagged values) in the model to obtain their reduced form in terms of $\widehat{lnCR_t}$, $\widehat{TIV_t}$, $\widehat{EIV_t}$, $\widehat{lnAG_t}$, $\widehat{TRC_t}$ and $\widehat{TRC_t}$. These reduced forms are further tested in equation 4.15 if exogeneity does or does not exists in growth-overall crime model. The results for exogeneity tests based on the Hausman F-test ($\boldsymbol{HF_T}$) is diverged a bit from the one found in the crime models. This result is presented in Table 4.4 (see attached evidences in Appendix E to G). While growth-overall crime and growth-persons' crime models passed the exogeneity test at 5%, growth-property crime passed it at 1%. This means that simultaneity bias does not exist in growth-overall crime (Model 2A) and growth-persons' crime (Model 2B) but does exist in growth-property crime (Model 2C) at 5%. Similarly to equation 4.7, lag two (2) of independent variables are not included in equation 4.15 to avoid problem of perfect collinearity.

$$lnGR_t = \theta_0 + \theta_1 lnCR_t + \theta_2 TIV_t + \theta_3 EIV_t + \theta_4 lnAG_t + \theta_5 TRC_t + \theta_6 UT_t + \mu_t \quad (4.8)$$

$$lnCR_t = \omega_{0A} + \omega_1 lnCR_{t-1} + \omega_2 lnCR_{t-2} + \omega_3 TIV_{t-1} + \omega_4 TIV_{t-2} + \omega_5 EIV_{t-1} + \omega_6 EIV_{t-2} + \omega_7 lnAG_{t-1} + \omega_8 lnAG_{t-2} + \omega_9 TRC_{t-1} + \omega_{10} TRC_{t-2} + \omega_{11} UT_{t-1} + \omega_{12} UT_{t-2} + \omega_{13} lnGR_{t-1} + \omega_{14} lnGR_{t-2} + \epsilon_{1t} \quad (4.9)$$

$$TIV_t = \omega_{0A} + \omega_1 lnCR_{t-1} + \omega_2 lnCR_{t-2} + \omega_3 TIV_{t-1} + \omega_4 TIV_{t-2} + \omega_5 EIV_{t-1} + \omega_6 EIV_{t-2} + \omega_7 lnAG_{t-1} + \omega_8 lnAG_{t-2} + \omega_9 TRC_{t-1} + \omega_{10} TRC_{t-2} + \omega_{11} UT_{t-1} + \omega_{12} UT_{t-2} + \omega_{13} lnGR_{t-1} + \omega_{14} lnGR_{t-2} + \epsilon_{2t} \quad (4.10)$$

$$EIV_t = \omega_{0A} + \omega_1 lnCR_{t-1} + \omega_2 lnCR_{t-2} + \omega_3 TIV_{t-1} + \omega_4 TIV_{t-2} + \omega_5 EIV_{t-1} + \omega_6 EIV_{t-2} + \omega_7 lnAG_{t-1} + \omega_8 lnAG_{t-2} + \omega_9 TRC_{t-1} + \omega_{10} TRC_{t-2} + \omega_{11} UT_{t-1} + \omega_{12} UT_{t-2} + \omega_{13} lnGR_{t-1} + \omega_{14} lnGR_{t-2} + \epsilon_{3t} \quad (4.11)$$

$$lnAG_t = \omega_{0A} + \omega_1 lnCR_{t-1} + \omega_2 lnCR_{t-2} + \omega_3 TIV_{t-1} + \omega_4 TIV_{t-2} + \omega_5 EIV_{t-1} + \omega_6 EIV_{t-2} + \omega_7 lnAG_{t-1} + \omega_8 lnAG_{t-2} + \omega_9 TRC_{t-1} + \omega_{10} TRC_{t-2} + \omega_{11} UT_{t-1} + \omega_{12} UT_{t-2} + \omega_{13} lnGR_{t-1} + \omega_{14} lnGR_{t-2} + \epsilon_{4t} \quad (4.12)$$

$$TRC_t = \omega_{0A} + \omega_1 lnCR_{t-1} + \omega_2 lnCR_{t-2} + \omega_3 TIV_{t-1} + \omega_4 TIV_{t-2} + \omega_5 EIV_{t-1} + \omega_6 EIV_{t-2} + \omega_7 lnAG_{t-1} + \omega_8 lnAG_{t-2} + \omega_9 TRC_{t-1} + \omega_{10} TRC_{t-2} + \omega_{11} UT_{t-1} + \omega_{12} UT_{t-2} + \omega_{13} lnGR_{t-1} + \omega_{14} lnGR_{t-2} + \epsilon_{5t} \quad (4.13)$$

$$UT_t = \omega_{0A} + \omega_1 lnCR_{t-1} + \omega_2 lnCR_{t-2} + \omega_3 TIV_{t-1} + \omega_4 TIV_{t-2} + \omega_5 EIV_{t-1} + \omega_6 EIV_{t-2} + \omega_7 lnAG_{t-1} + \omega_8 lnAG_{t-2} + \omega_9 TRC_{t-1} + \omega_{10} TRC_{t-2} + \omega_{11} UT_{t-1} + \omega_{12} UT_{t-2} + \omega_{13} lnGR_{t-1} + \omega_{14} lnGR_{t-2} + \epsilon_{6t} \quad (4.14)$$

$$lnGR_t = \omega_{0A} + \theta_2 lnCR_t + \theta_3 TIV_t + \theta_4 EIV_t + \theta_5 lnAG_t + \theta_6 TRC_t + \theta_7 UT_t + \omega_1 lnCR_{t-1} + \omega_3 TIV_{t-1} + \omega_5 EIV_{t-1} + \omega_7 lnAG_{t-1} + \omega_9 TRC_{t-1} + \omega_{11} UT_{t-1} + \omega_{13} lnGR_{t-1} + \omega_{14} lnGR_{t-2} + \beta_{15} \widehat{lnCR_t} + \beta_{16} \widehat{TIV_t} + \beta_{17} \widehat{EIV_t} + \beta_{18} \widehat{lnAG_t} + \beta_{19} \widehat{TRC_t} + \beta_{20} \widehat{TRC_t} + \epsilon_{7t} \quad (4.15)$$

H_o: $\beta_{15} = \beta_{16} = \beta_{17} = \beta_{18} = \beta_{19} = \beta_{20} = 0$

H_1: H_o *is not true*

Based on the results of exogeneity tests, a dynamic model is required to carry out the estimation for policy suggestions. Especially that Model 2C has simultaneity problem which required IV. Therefore, this study employed ARDL OLS and ARDL IV to estimate crime models (Model 1A, 1B & 1C) and growth models (Model 2A, 2B & 2C). This is done in spite that none of the residual found to be serially correlated in any of the model when ARDL OLS is conducted. Thus, for simplicity, the ARDL OLS and ARDL IV for crime models and growth models are explained in Sections 4.4 and 4.5 respectively.

Table 4.4
Results of Exogeneity Tests on growth models

Growth Model 2A (Overall crime)			**Growth Model 2B (Person's crime)**			**Growth Model 2C (Property crime)**		
Variables	t-statistics	p-value	Variables	t-statistics	p-value	Variables	t-statistics	p-value
C	1.816	0.083	C	3.276	0.003	C	0.331	0.743
LGR(-1)	-0.397	0.694	LGR(-1)	1.213	0.238	LGR(-1)	0.176	0.861
LGR(-2)	0.575	0.571	LGR(-2)	-1.500	0.148	LGR(-2)	-0.548	0.588
LCR	-1.007	0.325	LCPS	-0.203	0.840	LCPR	0.074	0.941
LCR(-1)	1.293	0.210	LCPS(-1)	-0.203	0.840	LCPR(-1)	0.010	0.992
TIV	0.062	0.950	TIV	0.061	0.951	TIV	-0.128	0.899
TIV(-1)	-0.630	0.535	TIV(-1)	0.014	0.988	TIV(-1)	0.317	0.754
EIV	-0.877	0.390	EIV	1.005	0.326	EIV	0.177	0.861
EIV(-1)	-0.175	0.862	EIV(-1)	1.619	0.120	EIV(-1)	0.103	0.918
LAG	-0.630	0.535	LAG	-0.132	0.895	LAG	-0.065	0.948
LAG(-1)	0.367	0.716	LAG(-1)	0.438	0.665	LAG(-1)	0.071	0.944
TRC	0.855	0.401	TRC	0.805	0.429	TRC	0.067	0.947
TRC(-1)	1.070	0.296	TRC(-1)	-0.705	0.488	TRC(-1)	-0.090	0.928
UT	0.257	0.799	UT	-1.982	0.060	UT	-0.514	0.612
UT(-1)	1.162	0.258	UT(-1)	3.544	0.001	UT(-1)	0.329	0.745
RLCR †	0.970	0.342	RLCPS †	-0.162	0.872	RLCPR †	-0.087	0.931
RTIV †	0.003	0.996	RTIV2 †	0.137	0.892	RTIV3 †	0.183	0.856
REIV †	0.896	0.380	REIV2 †	-1.063	0.299	REIV3 †	-0.172	0.864
RLAG †	0.606	0.550	RLAG2 †	0.312	0.757	RLAG3 †	0.071	0.943
RTRC †	-0.861	0.398	RTRC2 †	-0.888	0.384	RTRC3 †	-0.077	0.938
RUT †	-0.002	0.997	RUT2 †	2.244	0.035	RUT3 †	0.648	0.523

Diagnostic Tests

Test	Statistic	p-value	Decision	Statistic	p-value	Decision	Statistic	p-value	Decision
$\boldsymbol{HF_T}$	1.993	0.112	H_0 *rejected*	2.266	0.076	H_0 *not rejected*	2.699	0.042	H_0 *not rejected at* 1%

Note: the asterisk (†) showed that residual variables considered in each of the crime model. H_o: $\beta_{13}RUN = \beta_{14}RYL = \beta_{15}RPOV = \beta_{16}RFI = \beta_{17}LPES = 0$ which means "no simultaneity". Jointly, F-test tests the Hausman Test of no simultaneity (see Seddighi, 2012) and results showed that all the variables are exogenous beyond 10% in Model 2A, 5% in Model 2B except model 2A, 5% in Model 2B except model 2C which is significant at 1%.

4.4 Empirical Results of Crime Models (Socioeconomic Strain and Crime)

This section answers research question one by one by testing hypotheses posited in chapter three. The socioeconomic strains of unemployment rate (UN), income disadvantage rate (YL) and poverty rate (POV) are tested on crime variables and appropriate evaluation is made at various levels of significance. The crime variables are represented by the overall crime rate (CR), persons crime (CPS) and property crime (CPR). The CPS comprises murder, felonious wounding and other crimes perpetuated on persons. CPR are armed robbery, burglary and false pretence crimes. In addition, family instability (FI) and public security expenditure (PES) are included in the crime models as control variables. The PES capture the deterrence variable as discussed in Becker (1968). Thus, to examine this link three equations on crime models are tested. CR, CPS and CPR serve in turn as dependent variable; each of the models is represented by means of the model presented in 4.1 (equation 4.1 is recalled from Section 4.3) as follows:

$$lnCR_t = \gamma_0 + \gamma_1 UN_t + \gamma_2 YL_t + \gamma_3 POV_t + \gamma_4 FI_t + \gamma_5 lnPES_t + \varepsilon_t \qquad (4.1)$$

4.4.1 Bounds Test

The crime model specified in 4.1 was transformed to the dynamic version using the ARDL model, which is thus, specified as indicated in equation 4.16.

$$\Delta lnCR_t = \gamma_0 + \gamma_1 lnCR_{t-1} + \gamma_2 UN_{t-1} + \gamma_3 YL_{t-1} + \gamma_4 POV_{t-1} + \gamma_5 FI_{t-1} + \gamma_6 lnPES_{t-1} + \sum_{i=1}^{p} \tau_1 \Delta \ln CR_{t-i} + \sum_{i=0}^{p} \tau_2 \Delta UN_{t-i} + \sum_{i=0}^{p} \tau_3 \Delta YL_{t-i} + \sum_{i=0}^{p} \tau_4 \Delta POV_{t-i} + \sum_{i=0}^{p} \tau_5 \Delta FI_{t-i} + \sum_{i=0}^{p} \tau_6 \Delta lnPES_{t-i} + \varepsilon_t \ldots\ldots \qquad (4.16)$$

With this ARDL model, the long-run, short-run and error correction term are obtained and represented by equation 4.17, 4.18 and 4.19 respectively.

$$lnCR_t = \gamma_1 lnCR_{t-1} + \gamma_2 UN_{t-1} + \gamma_3 YL_{t-1} + \gamma_4 POV_{t-1} + \gamma_5 FI_{t-1} + \gamma_6 lnPES_{t-1} + \gamma_{a0} + \varepsilon_t \quad (4.17)$$

$$\Delta lnCR_t = \gamma_{b0} + \sum_{i=1}^{p} \tau_1 \ \Delta \ln CR_{t-i} + \sum_{i=0}^{p} \tau_2 \Delta UN_{t-i} + \sum_{i=0}^{p} \tau_3 \Delta YL_{t-i} + \sum_{i=0}^{p} \tau_4 \Delta POV_{t-i} + \sum_{i=0}^{p} \tau_5 \Delta FI_{t-i} + \sum_{i=0}^{p} \tau_6 \Delta lnPES_{t-i} + \psi ect_{t-i} + \varepsilon_t \ldots\ldots \quad (4.18)$$

where ect_{t-i} is obtained from estimating the following model:

$$ect_{t-i} = lnCR_t - (\gamma_2 UN_t + \gamma_3 YL_t + \gamma_4 POV_t + \gamma_5 FI_t + \gamma_6 lnPES_t + \gamma_{a0}) \quad (4.19)$$

The estimates of long-run relationships are given as γ_1, γ_2, γ_3, γ_4, γ_5 and γ_6, and the coefficient of short-run dynamics are shown by τ_1, τ_2, τ_3, τ_4, τ_5 and τ_6, while the error correction term and residual are ψecm_{t-i} *and* ε_t respectively, and γ_0, γ_{a0} and γ_{b0} are constants. Also, to establish the cointegration, the joint significance of the coefficients is tested with F-statistic at one period of lag as shown in equation 4.16. That is, the F-statistic is computed for the long-run relationship through the null hypothesis of no cointegration between socioeconomic strain and crime variable models as follows:

$H_0 : \gamma_1\ to\ \gamma_6 = 0$ (no cointegration), and the alternate hypothesis is $H_1 :$ where at least one of the $\gamma_1\ \ to\ \gamma_6\ \neq 0$ (which implies cointegration).

Moreover, the bound test in the ARDL model has two sets of critical bounds for the order of integration, which are lower bound I(0) and upper bound I(1). The critical bound values are used to validate the result of the computed F-statistic to determine if it is valid for the rejection of the null hypothesis of no cointegration. That is, the F-statistics must be above the upper bound I(1) to show that at least one of the long-run coefficients is not zero.

In all of the crime models, the bound test results presented in Table 4.5 show that the F-statistics under model 1A (overall crime rate-$\boldsymbol{CR_t}$) is significant at 5% while under model 1B (person's crime rate-$\boldsymbol{CPS_t}$**)** and model 1C (property crime rate**-**$\boldsymbol{CPR_t}$**)** are significant at 1% respectively. Thus, the null hypothesis of no cointegration is rejected.

Table 4.5
Bounds test for crime models

Criterion	**Crime Models**					
	Model IA	**Model IB**			**Model IC**	
	$\boldsymbol{CR_t}$	$\boldsymbol{CPS_t}$			$\boldsymbol{CPR_t}$	
F-statistic	3.795**	7.104***			6.886***	
Level of Significance	10%		5%		1%	
Bounds	I(0)	I(1)	I(0)	I(1)	I(0)	I(1)
Critical Values	2.08	3.00	2.39	3.38	3.06	4.15
K					5	

Notes: F-statistics are significant at 1% (***); 5% (**) and 10% (*) appropriately. * indicates the bound at which each model is significant to show if there is cointegration between the dependent variable and the regressors. Overall crime rate is $\boldsymbol{CR_t}$, person's crime rate is $\boldsymbol{CPS_t}$ and property crime rate is $\boldsymbol{CPR_t}$.

The ARDL model redistributes the original lag-length specified as ARDL (d_1, d_2, d_3, d_4, d_5, d_6) models. This redistribution is done based on the criterion selected for the optimal lag length. The criteria for the optimal length is determined using AIC. Liew (2004) concluded that the AIC is appropriate to be considered when determining lag length selection for a small sample. In each of the three crime models, there are six variables, and each model is estimated with $(p+1)^k$ where p is the maximum lag to be employed and k is the number of variables in each crime equation. Meanwhile, the sum of regression estimates for each of the overall crime rate and property crime rate model is 468 as the sum for person's crime rate remain at 32. The number of evaluations each model is run is based on the maximum automatic lag selection of two (Pesaran & Shin, 1999) but one for person's crime. Thus, the optimal lag selected and distributed in each crime model and criterion selected are presented in Table 4.6.

Table 4.6
Summary of the selected lagged criteria (crime models)

Criterion	Crime Models		
	Model IA CR_t	Model IB CPS_t	Model IC CPR_t
LogL	37.003272	-3.379514	4.546386
AIC*	-1.190632	0.529280	0.354934
BIC	-0.694155	0.856945	0.851411
HQ	-1.008654	0.650112	0.536912
Adj. R^2	0.965364	0.643263	0.846521
No. of evaluations	468	32	486
Specification	ARDL(1, 0, 0, 2, 2, 1)	ARDL(1, 0, 0, 0, 1, 0)	ARDL(1, 0, 1, 2, 1, 1)

Note: Overall crime rate is CR_t, person's crime rate is CPS_t and property crime rate is CPR_t.

4.4.2 ARDL Instrumental Variables Results (Crime Models)

As pointed out earlier in Section 4.3 that crime models and growth models in this study consist of endogenous variables. Pesaran and Shin (1997) suggested that ARDL model has the process on how to detect for any presence of serial correlation in the residual, and endogeneity problem. That is, where a model is tested with ARDL OLS and there is no sign of serial correlation shown in the residuals, such model has no problem of endogeneity bias (Giles, 2014). Besides, the results of all crime models did not have serial correlation since the residuals are serially uncorrelated in model 1A, 1B and 1C. Therefore, there is no problem of endogeneity in all the models tested in this study. Proof of the results are contained in Table 4.7 to Table 4.9 and Appendix H to M. However, a further check of whether problem of endogeneity exists in any of the crime models is subjected to test using the process described in Pesaran and Shin (1997). For instance, to eliminate endogeneity problem if it even exists in the overall crime model, equation 4.16 as ARDL OLS is rewritten in the form of Bewley equation as Instrumental Variable using 2SLS in equation 4.20.

$$\Delta lnCR_t = \frac{\gamma_0}{\emptyset(1)} + \gamma_1 UN_t + \gamma_2 YL_t + \gamma_3 POV_t + \gamma_4 FI_t + \gamma_5 lnPES_t + \frac{1}{\emptyset(1)}\sum_{i=0}^{m_1-1}\gamma_1\,\Delta UN_{t-i} + \frac{1}{\emptyset(1)}\sum_{i=0}^{m_2-1}\gamma_2\,\Delta YL_{t-i} + \frac{1}{\emptyset(1)}\sum_{i=0}^{m_3-1}\gamma_3\,\Delta POV_{t-i} + \frac{1}{\emptyset(1)}\sum_{i=0}^{m_4-1}\gamma_4\,\Delta FI_{t-i} + \frac{1}{\emptyset(1)}\sum_{i=0}^{m_5-1}\gamma_5\,\Delta lnPES_{t-i} - \frac{1}{\emptyset(1)}\sum_{i=0}^{p-1}\gamma_6\,\Delta lnCR_{t-i} + \frac{\eta_t}{\emptyset(1)} \qquad (4.20)$$

For instance, the ARDL IV equation estimated for the overall crime (Model 1A) long run and short run are as stated in equation 4.21 and equation 4.22 using ARDL(1, 0, 0, 2, 2, 1).

$$lnCR_t = \frac{\gamma_{0LR}}{\emptyset(1)} + \gamma_1 UN_t \ + \gamma_2 YL_t + \gamma_3 POV_t \ + \gamma_4 FI_t + \ \gamma_5 lnPES_t \ + \frac{1}{\emptyset(1)}\gamma_6 \, \Delta PDOV_t$$

$$+ \frac{1}{\emptyset(1)}\gamma_7 \, \Delta PDOV_{t-1} + \frac{1}{\emptyset(1)}\gamma_8 \, \Delta FI_t + \frac{1}{\emptyset(1)}\gamma_9 \, \Delta FI_{t-1} \ + \frac{1}{\emptyset(1)}\gamma_9 \, \Delta lnPES_t$$

$$- \frac{1}{\emptyset(1)}\gamma_{11} \, \Delta lnCR_t \ + \frac{\eta_{tLR}}{\emptyset(1)} \quad (4.21)$$

$$\Delta lnCR_t = \frac{\gamma_{0SR}}{\emptyset(1)} + \tau_1 UN_t \ + \tau_2 YL_t + \tau_3 POV_{t-1} \ + \tau_4 FI_{t-1} + \ \tau_5 lnPES_{t-1}$$

$$+ \frac{1}{\emptyset(1)}\tau_1 \Delta PDOV_t + \frac{1}{\emptyset(1)}\tau_2 \Delta PDOV_{t-1} + \frac{1}{\emptyset(1)}\tau_3 \Delta FI_t + \frac{1}{\emptyset(1)}\tau_4 \, \Delta FI_{t-1}$$

$$+ \frac{1}{\emptyset(1)}\tau_5 \Delta lnPES_t - \frac{1}{\emptyset(1)}\tau_6 \Delta lnCR_t$$

$$+ \frac{\eta_{tSR}}{\emptyset(1)} \quad (4.22)$$

In the ARDL IV, the instrumental variables used while applying the 2SLS are

$1, UN_t, YL_t, POV_{t-1}, FI_{t-1}, lnPES_{t-1}, \Delta POV_t, \Delta POV_{t-1}, \Delta FI_t, \Delta FI_{t-1}, \Delta lnPES_t, lnCR_{t-1}$.

The results of the ARDL IV for the overall crime (Model 1A), persons' crime (Model 1B) and property crime (Model 1C) are presented in Table 4.7, 4.8 and 4.9 respectively. The ARDL IV results showed identical estimation with ARDL OLS numerically in terms of the coefficients and standard errors. Evidences are further attached in the Appendix H to M. Also, these results confirmed the proof in Bardsen (1989), Pesaran and Shin (1997) on numerical identical of standard errors in OLS and 2SLS. By estimating ARDL IV, endogeneity problem is eliminated even if it exists in any of the crime model. Further test on endogeneity is no longer required when ARDL IV is estimated (see Stučka, 2004 and Razmi

& Blecker, 2008). Therefore the ARDL OLS estimates are interpreted for policy suggestions since residuals are serially uncorrelated.

4.4.3 Long Run and Short Run Relationships (Crime Models)

Having found that all the crime models are cointegrated using the F-statistic in the bounds test, the long run and short run coefficients estimated are presented in Tables 4.7 to 4.9. The robust check for the long run estimates is highlighted in Tables 4.7 to 4.9 and Figures 4.1 to 4.3. Moreover, the results of the long run estimates on how the socioeconomic strain impacts crime variables at various levels of significance are outlined before the short-run estimates. This is in addition to person's and property crime models.

In the short run, the dynamic estimates are in line with the long-run for some variables while it differs for some variables as presented in Tables 4.7 to 4.9. Notwithstanding, the one-lag error correction terms (ECT_{t-1}) in model 1A, 1B and 1C reveal the expected negative sign at the 1% level of significance. This confirms the presence of feedback mechanism to restore any deviation in the crime models in the long run. In addition, it confirms the existence of the long run relationships in all the crime models.

Moreover, the results in the long-run relationship became robust and reliable for policy suggestions based on the confirmation by diagnostic tests as presented in Tables 4.7 to 4.9 and Figures 4.1 to 4.3 for all the crime models. The study conducted diagnostic tests of normality by Jarque-Bera; functionality of Ramsey RESET; serial correlation of Breusch-Godfrey; heteroscedasticity of Breusch-Pagan-Godfrey, and the structural stability test proposed by Brown, Durbin and Evans as noted in Pesaran and Pesaran (2009). The test of normality (χ^2_N) by Jarque-Bera indicated that errors were normally distributed. Also, the functional test of Ramsey RESET test (χ^2_{FF}) showed that important variables were not omitted. In addition, the LM test (χ^2_{SC}) of serial correlation by Breusch-Godfrey gave no evidence of autocorrelation in the disturbance error term. Again, Breusch-Pagan-Godfrey heteroskedasticity test (χ^2_{H}) affirmed that errors are homoscedastic. Further, the structural stability tests ensured that parameters are constant in each of the models as they move together.

Hence, to ascertain that the parameters in the study remained constant over time (Pesaran & Pesaran, 2009), the structural stability test of cumulative sum of recursive residuals (CUSUM) and cumulative sum of recursive residuals squares were applied. Thus, parameters were stable over time at the 5% level of significance based on the results of the CUSUM and CUSUMSQ tests as indicated in Figure 4.1-4.3.

4.4.3.1 Overall Crime and Socioeconomic Strain

In the long-run estimates of crime rate model (1A) presented in Table 4.7, income disadvantage shows a positive relationship with the crime rate at the 1% level of significance. The magnitude of the estimated coeffient suggests that an increase of 1% in income disadvantage increases the crime rate by 1.117%. The result demonstrated that the existence of poor income would encourage more crime in Nigeria which is in line with idea that poor income people find it difficult or stressful to meet up their daily needs. This evidence follows Yildiz *et al.* (2013), Bourguignon *et al.* (2003), and Fajnzylber *et al.* (2002).

Also, the deterrence variable is significant at the 1% level of significance in causing an adverse effect on crime. The magnitude of the estimated coeffient suggests that an increase of

1% in public security expenditure would reduce the occurrence of crime by 0.233%. This means that employing more police and patrolling using modern equipment would discourage criminal activities. This result is line with Berker (1968), Fajnzylber *et al.* (2002) and Halicioglu *et al.* (2012) . Unemployment, poverty and family instability are not significant.

Moreover, in the short run the income disadvantage measure shows a positive trend with the crime rate at the 1% level of significance. An increase of income disadvantage by 1% would increase the crime rate by 0.745%. This result is consistent with the long run estimates between income disadvantage and crime rate. Unemployment, poverty, family instability and security expenditure are not significant. The consistency of the result further rested on the error correction term (ECT_{t-1}) as the ECT_{t-1} was -0.702% and significant at the 1% level. This means that any distortion that may occur between the short run and the long run would restore the model back to equilibrium by 70.2% over the first year. But it would take short run deviations to be adjusted for in 1.7 years to attain the long run equilibrium relationship where the equilibrium is 100%. Furthermore, the diagnostic tests showed that the model passed all the tests at the 5% level of significance. These evidences are presented in Table 4.7 and Figure 4.1.

Table 4.7

Estimates of overall crime (model 1A)

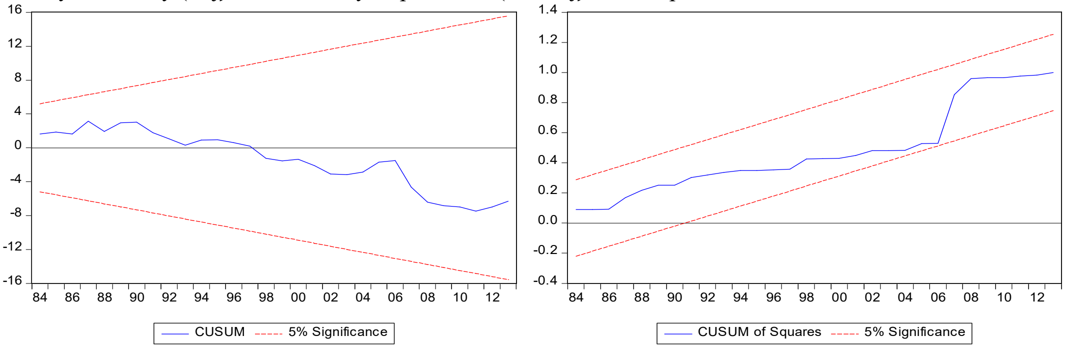
DV is overall crime rate; ARDL(1, 0, 0, 2, 2, 1)					
ARDL OLS	**Long-run Estimates**		**ARDL IV**	**Long-run Estimates**	
Variables	Coefficients	t-statistics	Variables	Coefficients	t-statistics
C	2.658	0.996	C	2.658	0.996
UN	-0.007	-0.610	UN	-0.007	-0.610
YL	1.117	3.295***	YL	1.117	3.295***
POV	-0.490	-1.109	POV	-0.490	-1.109
FI	0.107	1.107	FI	0.107	1.107
***ln*PES**	-0.233	-9.777***	***ln*PES**	-0.233	-9.777***
			ΔPOV	0.734	2.022*
			ΔPOV(-1)	0.578	1.923*
			ΔFI	0.228	1.777*
			ΔFI(-1)	0.163	1.447
			Δ*ln*PES	0.108	1.504
			Δ*ln*CR	-0.499	-1.515
	Short-run Estimates			**Short-run Estimates**	
C	1.773	1.034	C	1.773	1.034
*ln*CR(-1)	-0.666	-4.552***	*ln*CR(-1)	-0.666	-4.552***
UN	-0.005	-0.616	UN	-0.005	-0.616
YL	0.745	2.852***	YL	0.745	2.852***
POV(-1)	-0.327	-1.147	POV(-1)	-0.327	-1.147
FI(-1)	0.071	1.038	FI(-1)	0.071	1.038
*ln*PES(-1)	-0.155	-4.965***	*ln*PES(-1)	-0.155	-4.965***
ΔPOV	0.162	0.870	ΔPOV	0.162	0.870
ΔPOV(-1)	0.385	1.956*	ΔPOV(-1)	0.385	1.956*
ΔFI	0.223	2.710**	ΔFI	0.223	2.710**
ΔFI(-1)	0.109	1.435	ΔFI(-1)	0.109	1.435
Δ*ln*PES	-0.083	-1.757*	Δ*ln*PES	-0.083	-1.757*
ECT(-1)	-0.702	-5.539***			

Diagnostics Tests

		ARDL OLS	ARDL IV	
Test	H_0	Statistic	Statistic	Decision
χ^2_N	Normal distribution	$JB = 1.957\ (0.375)$	$JB = 1.957\ (0.375)$	H_0 *not rejected*
χ^2_{FF}	Absence of model misspecification	$t = 1.655\ (0.108)$	N/A	H_0 *rejected*
χ^2_{SC}	There is no serial correlation (1)	$\chi^2 = 0.080\ (0.776)$	$\chi^2 = (0.776)$	H_0 *not rejected*
χ^2_H	There is no autoregressive conditional heteroscedasticity	$\chi^2 = 12.749\ (0.310)$	$\chi^2 = 15.342\ (0.167)$	H_0 *not rejected*

$\boldsymbol{F_T}$	Wald Test (No Cointegration)	F_T =3.79	F_T = 95.255 (0.000)	H_0 *rejected*

Note: the asterisk (*) showed that the estimated coefficients are significant at 1% (***); 5% (**) and 10% (*). Also, χ^2_N , χ^2_{FF}, χ^2_{SC} and χ^2_H are significant at 5%. P-value for diagnostic tests are in parenthesis. Variables are defined as Overall crime rate is $lnCR_t$ as DV. Unemployment in % (UN_t) , Income disadvantage log-rate (YL_t) , Poverty log-rate (POV_t) , Family Instability (FI_t) , and Security Expenditure $(lnPES_t)$ are independent variables.



a. *b.*

Note: The straight lines represent critical bounds at the 5% significance level

Figure 4.1

Stability Test for Crime Model 1A.

4.4.3.2 Person's Crime and Socioeconomic Strain

The study examines the link between socioeconomic strain and person's crime rate which include murder, felonious wounding and other crime against persons. Table 4.8 showed the estimated results. It shows a positive link between unemployment and person's crime rate at the 5% level of significance. When there is a rise in unemployment by 1%, the occurrence of a person's crime rate is increased by 0.076%. This result provided support to Raphael and Winter-Ebmer (2001) on rape and Halicioglu *et al.* (2012) on violent crime.

While a person's crime may not be financially motivated as in the case of rape, the idleness produced by not having a job could motivate unemployed people to commit such a crime (Raphael & Winter-Ebmer, 2001). Merton (1938) argued that inability to have a better means of livelihood may impose the strain of anger, envy and frustration on the disadvantage people. This condition of strain would induce them to seek alternative means to satisfy their needs.

This result differs from unemployment when it is considered in overall crime rate as it was not significant. Also, income disadvantage exerts a positive influence on the occurrence of person's crime at the 1% level of significance. An increase in disadvantaged income by 1% would increase a person's crime by 1.939%. While this result supports the result between income disadvantage and overall crime rate, it further shows that poor income is a strong factor for a criminal to engage in crime. The strong factor of income show in the positive link between poverty and person's crime. Poverty increases a person's crime at the 10% level of significance. A rise in poverty would increase a person's crime by 0.972%. This result differs from overall crime rate as poverty is not significant possibly because crime is disaggregated. A similar result was found in Ouimet (2012), Rogers and Pridemore (2013) on homicide and Meloni (2014) with respect to aggravated assault.

The joint positive influence of unemployment, income disadvantage and poverty on a person's crime demonstrated three facts. First, it confirms that societies are disorganised due to poor economic factors (Shaw & McKay, 1942). Second, it confirms that disorganisation in the society is due to the condition of strain factors imposed on the disadvantaged people in society, a situation that makes them seek alternative means of achieving their needs (Merton, 1938). Third, there is no denial that poor economic factors as demonstrated here reduce the opportunity costs of crime in society (Berker, 1968). It would not be an overstatement to say that if each of these factors led an individual to engage in crime. Then, it becomes a fact that an individual experiencing a joint set of this factors would make a choice to engage in criminal activities. The remaining two variables, family instability and security expenditure, were not significant. While the result for family instability did not differ from the overall crime rate, the result on security expenditure differed.

Similarly, in model 1B, the short run estimation revealed that unemployment, income disadvantage and poverty exerted a positive influence on a person's crime. Unemployment and income disadvantage are significant at the 1% level of significance, and poverty is significant at the 10% level of significance. This result supports the long-run results as family instability and security expenditure were not significant. Also, the error correction term (ECT_{t-1}) was -0.772% and significant at the 1% level of significance. That is, the model can adjust back to equilibrium over the following year by 77.2%. Also, deviations that may occur in the short run would take 1.7 years to be restored to ensure the long run equilibrium. Furthermore, the results of diagnostic tests presented in Table 4.8 and Figure 4.2 reveal that only the test of normal distribution failed. But, the model has an excess of kurtosis, which shows that the estimates are valid (Saridakis, 2011).

Table 4.8

Estimates of person's crime (model 1B)

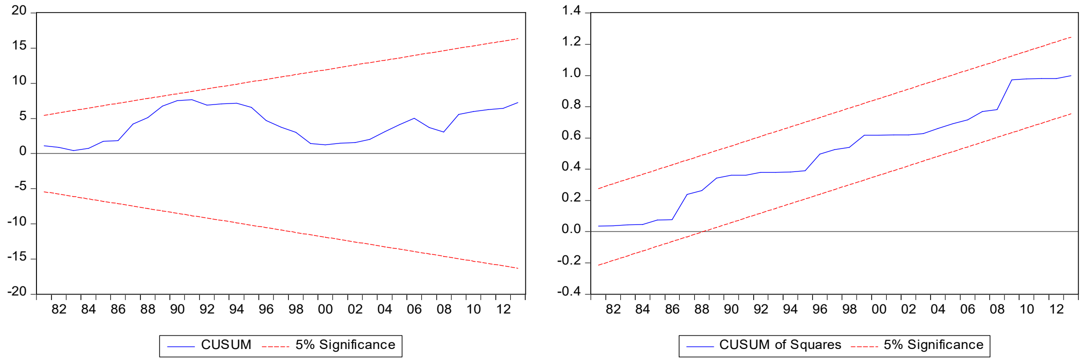
DV is persons crime rate; ARDL(1, 0, 0, 0, 1, 0)

ARDL OLS	**Long-run Estimates**		**ARDL IV**	**Long-run Estimates**	
Variables	Coefficients	t-statistics	Variables	Coefficients	t-statistics
C	-21.752	-4.871***	C	-21.752	-4.871***
UN	0.076	2.387**	UN	0.076	2.387**
YL	1.939	3.498***	YL	1.939	3.498***
POV	0.972	1.738*	POV	0.972	1.738*
FI	0.331	1.563	FI	0.331	1.563
***ln*PES**	-0.0007	-0.017	***ln*PES**	-0.0007	-0.017
			ΔFI	-0.371	-1.444
			Δ*ln*CPS	-0.346	-1.346
	Short-run Estimates			**Short-run Estimates**	
C	-16.152	-4.004	C	-16.152	-4.004
*ln*CPS(-1)	-0.742	-5.229***	*ln*CPS(-1)	-0.742	-5.229***
UN	0.056	3.048***	UN	0.056	3.048***
YL	1.440	2.842***	YL	1.440	2.842***
POV	0.722	1.765*	POV	0.722	1.765*
FI(-1)	0.246	1.704*	FI(-1)	0.246	1.704*
*ln*PES	-0.0005	-0.017	*ln*PES	-0.0005	-0.017
ΔFI	-0.029	-0.159	ΔFI	-0.029	-0.159
ECT(-1)	-0.772	-4.579***			

Diagnostics Tests

Test	H_0	ARDL OLS Statistic	ARDL IV Statistic	Decision
χ^2_N	Normal distribution	$JB = 8.230$ (0.016)	$JB = 8.230$ (0.016)	H_0 *rejected*
	Kurtosis	4.443>3.0	4.443>3.0	
χ^2_{FF}	Absence of model misspecification	$t = 0.477$ (0.635)	N/A	H_0 *rejected*
χ^2_{SC}	There is no serial correlation (1)	$\chi^2 = 0.146$ (0.701)	$\chi^2 = (0.701)$	H_0 *not rejected*
χ^2_H	There is no autoregressive conditional heteroscedasticity	$\chi^2 = 10.382$ (0.167)	$\chi^2 = (0.167)$	H_0 *not rejected*
F_T	Wald Test (No Cointegration)		$F_T = 8.917$ (0.000)	H_0 *rejected*

Note: the asterisk (*) showed that the estimated coefficients are significant at 1% (***); 5% (**) and 10% (*). Also χ^2_{FF}, χ^2_{SC} and χ^2_H are significant at 5% with exception of χ^2_N. P-value for diagnostic tests are in parenthesis. Variables are defined as Person's crime rate is $lnCPS_t$ as DV. Unemployment in % (UN_t), Income disadvantage log-rate (YL_t) , Poverty log-rate (POV_t) , Family Instability (FI_t) , and Security Expenditure ($lnPES_t$) are independent variables.



a. b.

Note: The straight lines represent critical bounds at the 5% significance level.

Figure 4.2

Stability Test for Crime Model 1B

4.4.3.3 Property Crime and Socioeconomic Strain

The result of model 1C is presented in Table 4.9, and it supports the overall crime and a person's crime models with a slight difference. The main difference is that family instability is significant in the property crime model. Property crime are armed robbery which include also robbery and extortion, burglary and false pretence/cheating crimes. Unemployment increases property crime at the 5% level of significance. Increasing unemployment by 1% would increase property crime by 0.05%. This means improving labour policy would cause a crime reduction in property crime. A similar result is presented in Speziale (2014), Altinga (2012), and Edmark (2005). Also, income disadvantage encourages the poor to engage in property crime at the 10% level of significance. An increase in income disadvantage by 1% would increase property crime by 1.066%. This means an increase in the number of people with disadvantaged incomes would cause crime to increase. Perhaps, increasing income disadvantage even further would intensify more strain on the income disadvantage earners and this would eventually lead them to engage in property crime (Machin & Meghir, 2004). To add, financial gain serve as incentive to the criminals to commit property theft as stolen property could be resold to the market for income gain (Sidebottom, Ashby & Johnson, 2014).

Poverty is not significant in this model. The deterrence variable showed an adverse effect on property crime at the 1% level of significance. With an increase in security expenditure by 1% property crime would be reduced by 0.209%. The result supported the overall crime rate but differed from the person's crime rate because it was not significant in the person's crime model. A similar result was found in Kelly (2000) as police expenditures have a stronger effect on property crime than on violent crime.

Family instability showed a positive relationship with property crime at the 1% level of significance. This means any increase in family instability results in a property crime increase. Thus, the failure to improve conditions that stimulate family instability would encourage children from families experiencing instability to engage in crime. These conditions includes emotional disturbance in children due to family structure, family break-up and the poverty rate (Fomby & Cherlin, 2007; Kelly, 2000). Results presented here support Kelly (2000) on property crime, but Kelly's work is more robust because family instability was found to be positively related with violent and property crime. With the measure of divorce rate for family instability, Halicioglu *et al.* (2012) found a positive relationship between family instability and property crime, including robbery and larceny.

The short run in model 1C indicated only unemployment was significant at the 5% level with property crime. This result supported the long-run result and further validated unemployment as an economic factor that lowers the opportunity cost of crime. This connotes that increasing the rate of unemployment by 1% property crime rate would increase criminal activities by 0.044%. Speziale (2014) affirmed that overall unemployment led to the increase in criminal activities in Italy especially on property crime.

Also, the result of the error correction model (ECT_{t-1}) is -0.805% at the 1% level of significance. This shows that distortions are quickly adjusted for within the model by 80.5% in the coming period. The distortions that occurred in the short run would restore in 1.8 years to adjust to the long-run equilibrium. The diagnostic tests for model 1C indicated in Table 4.9 and Figure 4.3 show that the model passed all tests except the normality test (χ_N^2). However, based on Saridakis (2011), the excess of kurtosis in this model shows that the result is still valid; the result of the kurtosis for model 1C was 5.606.

Table 4.9

Estimates of the property crime (model 1C)

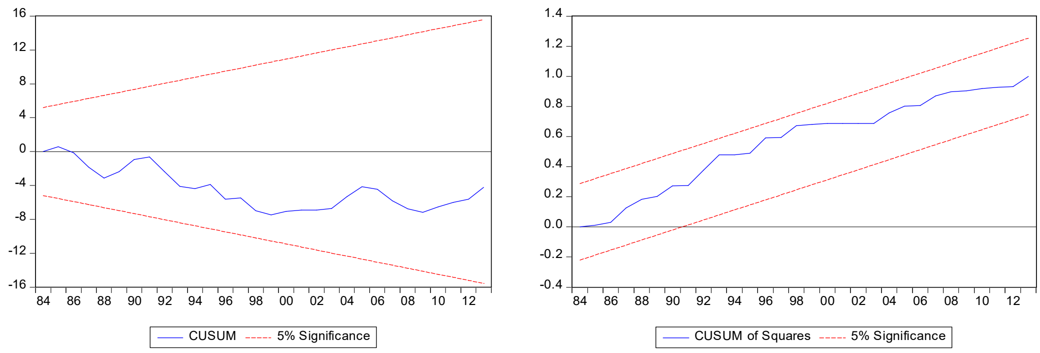
DV is property crime rate; ARDL(1, 0, 1, 2, 1, 1)					
ARDL OLS	Long-run Estimates		ARDL IV	Long-run Estimates	
Variables	Coefficients	t-statistics	Variables	Coefficients	t-statistics
C	3.442	0.718	C	3.442	0.718
UN	0.055	2.313**	UN	0.055	2.313**
YL	1.066	1.733*	YL	1.066	1.733*
POV	-0.920	-1.166	POV	-0.920	-1.166
FI	0.833	4.476***	FI	0.833	4.476***
$\boldsymbol{ln}$PES	-0.209	-5.109***	$\boldsymbol{ln}$PES	-0.209	-5.109***
			ΔYL	1.932	1.347
			ΔPOV	1.161	1.937*
			ΔPOV(-1)	1.166	2.166**
			ΔFI	-0.369	-1.763*
			ΔlnPES	0.169	1.313
			ΔlnCPR	-0.240	-1.122
	Short-run Estimates			Short-run Estimates	
C	2.773	0.738	C	2.773	0.738
lnCPR(-1)	-0.805	-5.782***	lnCPR(-1)	-0.805	-5.782***
UN	0.044	2.459**	UN	0.044	2.459**
YL(-1)	0.858	1.685	YL(-1)	0.858	1.685
POV(-1)	-0.741	-1.197	POV(-1)	-0.741	-1.197
FI(-1)	0.671	4.613***	FI(-1)	0.671	4.613***
lnPES(-1)	-0.168	-4.308***	lnPES(-1)	-0.168	-4.308***
ΔYL	2.416	2.303**	ΔYL	2.416	2.303**
ΔPOV	0.194	0.473	ΔPOV	0.194	0.473
ΔPOV(-1)	0.939	2.217**	ΔPOV(-1)	0.939	2.217**
ΔFI	0.373	2.183**	ΔFI	0.373	2.183**
ΔlnPES	-0.032	-0.320	ΔlnPES	-0.032	-0.320
ECT (-1)	-0.805	-7.605***			

Diagnostics Tests

Test	H_0	ARDL OLS Statistic	ARDL IV Statistic	Decision
χ^2_N	Normal distribution	$JB = 12.496$ (0.001)	$JB = 12.496$ (0.001)	H_0 *rejected*
	Kurtosis	5.606>3.0	5.606>3.0	
χ^2_{FF}	Absence of model misspecification	$t = 1.453$ (0.156)	N/A	H_0 *rejected*
χ^2_{SC}	There is no serial correlation (1)	$\chi^2 = 0.489$ (0.484)	$\chi^2 = (0.484)$	H_0 *not rejected*
χ^2_H	There is no autoregressive conditional heteroscedasticity	$\chi^2 = 10.731$ (0.466)	$\chi^2 = 10.731$ (0.466)	H_0 *not rejected*

$\boldsymbol{F_T}$	Wald Test (No Cointegration)	$F_T = 25.282$ (0.000)	H_0 *rejected*

Note: the asterisk (*) showed that the estimated coefficients are significant at 1% (***); 5% (**) and 10% (*). Also, the diagnostic tests χ^2_{SC} , χ^2_{FF} and χ^2_H are significant at 5% with exception of χ^2_N. P-value for diagnostic tests are in parenthesis. Variables are defined as Property crime rate is $lnCPR_t$ as DV. Unemployment in % (UN_t) , Income disadvantage log-rate (YL_t) , Poverty log-rate (POV_t), Family Instability (FI_t) , and Security Expenditure $(lnPES_t)$ are independent variables.



a. b.

Note: The straight lines represent critical bounds at the 5% significance level.

Figure 4.3

Stability Test for Crime Model 1C

Moreover, the summary on the estimates of crime models are presented in Table 4.10 to show the trends between socioeconomic strain and crime variables. The result showed that socioeconomic strain increased crime significantly. A combination of unemployment, income disadvantage and poverty would reduce the opportunity costs of crime, and, thus, would motivate people to commit crime. Besides, a pair combination of unemployment and income disadvantage exerted higher influence on occurrence of crime. But predominantly, income disadvantage affects crime as it cuts across all the three types of crime examined but poverty only affects person's crime. A similar trend among socioeconomic strain was shown in Mata and Bollman (2007). Mata and Bollman (2007) found that earning disadvantage is more reliable as a strain factor followed by unemployment and poverty in terms of how population gain/loss was affected in urban and rural area in Canada.

Table 4.10
Summary on the estimates of crime models

DV is Types of Crime						
	Long-run Estimates			**Short-run Estimates**		
	Model 1A	**Model 1B**	**Model 1C**	**Model 1A**	**Model 1B**	**Model 1C**
Variable	Overall Crime $lnCR_t$	Person's Crime $lnCPS_t$	Property Crime $lnCPR_t$	Overall Crime $lnCR_t$	Person's Crime$lnCPS_t$	Property Crime $lnCPR_t$
UN	Not Significant	Positive Significant	Positive Significant	Not Significant	Positive Significant	Positive Significant
YL	Positive Significant	Positive Significant	Positive Significant	Positive Significant	Positive Significant	N/A
POV	Not Significant	Positive Significant	Not Significant	N/A	Positive Significant	N/A
FI	Not Significant	Not Significant	Positive Significant	N/A	N/A	N/A
PES	Negative Significant	Not Significant	Negative Significant	N/A	Not Significant	N/A

Notes: The dependent variable are kinds of crimes as indicated above in each column. N/A signifies no results from the ARDL estimation. Variables are defined as Overall crime rate is $lnCR_t$, Person's crime rate is $lnCPS_t$ and Person's crime rate is $lnCPS_t$ as DV, Unemployment rate (UN_t), Income disadvantage rate (YL_t) , Poverty rate (POV_t), Family Instability (FI_t), and Security Expenditure ($lnPES_t$) are independent variables.

4.4.4 Discussion of the Crime Models

Socioeconomic strains have similar dimensions of impacts on crime variables regarding the positive relationship based on the above results. Deterrence variables performed as expected on other crime variables except on person's crime. Family instability showed a positive impact on property crime. The extent that socioeconomic strain affects crime variables has shown that the strain of frustration, anger and stress in people are exhibited in the social and economic factors that prevail in Nigeria. Individuals facing economic hardships brought by socioeconomic factors would innovate alternative means to survive. These alternatives are described as being illegal in Becker (1968) and Merton (1938). Other means are to engage in property crime and person's crime including assassination/murder, rape, kidnapping, felonious wounding, burglary, armed robbery and false pretence to complement their earnings.

The results showed that unemployment affects the person's crime rate and property crime rate positively at various significance levels both in the long run and the short run. This may be not a surprise because high unemployment exists in Nigeria (NBS 2016). The high unemployment rate includes graduates and non-graduates who are produced from educational institutions looking for jobs but are unable to find ones. Those who found jobs might not be fully engaged with the nature of the work that they are doing if those jobs do not take into consideration their qualifications. These young graduates and non-graduates should be able to contribute meaningfully to the country.

According to NBS (2016), the underemployment rate increased from 16.3% in 2010 to 16.8% and 18.7% in 2012 and 2015 respectively as the overall unemployment rate stood at 10.4%. This suggests two facts: one, reduced labour productivity from 12.45% in 2011 to 7.48% in 2014 (NBS, 2015) and two, the labour market policy in the country featured reducing opportunity costs of crime due to high strain conditions of emotional disturbance among the unemployed. The effect of the latter is that unemployed people are susceptible to any available anti-social behaviour as they are easily recruited by criminal groups (Nwankwo & James, 2016).

Similarly, the long run and short run effects of income disadvantage on crime reveals that income disadvantage is harmful. This is because income disadvantage measures of income disadvantage, lower bound income and high income inequality distribution provide opportunity for people to commit crimes (Yildiz *et al.*, 2013; Bourguignon *et al.*, 2003; Fajnzylber et al., 2002), noting the wideness of income inequality correlates with crime rate in Africa (UNODC, 2005). Also, income disadvantage is due to poor employment situation among the labour force in the country (Aiyedogbon & Ohwofasa, 2012) as output in Nigeria is driven by low-skilled employment and underemployment (NBS, 2015). People with income challenges find it difficult to pay their medical bills thereby increasing the rate of mortality (Umukoro, 2012).

Poverty has no clear cut division between unemployment and income disadvantage as they are intertwined. For instance, Rauma and Berk (1987) affirmed that unemployment generates poverty as much as poor income does (Ehrlich, 1973). Lowering income and poor employment encourages poverty (Poveda, 2012). Although poverty affected only person's crime in this study, other evidence in Meloni (2014) showed that poverty affects total crime and property crime. Odumosu (1999) observed that the existence of poverty when socioeconomic aspirations are high would provide room for criminal activities. These criminal activities include robbery and dealing in illicit goods and services. Robbery and illicit goods are higher among the disadvantaged people in the country due to high poverty and poor income (Oyeakale, 2012). Due to the impact of income, especially its bearing on determining criminal activities, financial incapacity among the poor requires crime-reduction measures (Fajnzylber et al., 2002) for at least two reasons, to reduce crime and poverty in society. Besides, Meloni (2014) noted that improving income through cash transfer among the unemployed could control the effect of poverty on crime. Evidence of improved income in reducing the proportion of poor living below the poor line is also found in Fanta and Upadhyay (2009).

In considering the poor economic status in the country as it affects property crime, the literature has linked poor economic status with family instability. Changes in family structure due to cohabitation, divorce and separation result in adverse effects on children (Fornby & Cherlin, 2007). Fornby and Cherlin (2007) found that children reared in single parent and multiple homes must adjust to lifestyle of the new family structure. The effect of this change in family structure is that it reduces social control, which in turn leads to more crime (Halicioglu *et al.* 2012). Such a case is noticed in Stansfield, Williams, and Parker, (2017) as they found that divorce causes homicide in transitional aged youth (13-17 and 18-24). Economic disadvantage experienced in the transition from youth to adult encouraged homicide as well (Stansfield, Williams & Parker 2017). This supports the findings in Kelly (2000) on violent crime and family instability. Crime is linked to families experiencing instability as they also experienced poverty especially in instances in which the family is headed by a female (Kelly, 2000).

Deterrence variable displayed the expected magnitude of relationship with the crime variables. The results revealed how best security expenditure can be used in curbing crime in the country, but they were significant with respect to person's crime. Notwithstanding this, security expenditure shows the safety offered by security agencies on the citizens. Security agencies include the police, the prison services and other crime agencies. Resources of security agencies above may not be enough to fight crime, and this could be reason why the person's crime is not significant. Because violent crimes are common in an environment populated by the poor (Badiora *et al.* 2014), even the distribution of police may be unequal because the rich area demand more security than the poor area (Fajnzylber *et al*., 2002). Perhaps, this informs as to why security expenditure is significant with property crime. Its significance on overall crime may suggest that the police role is still required in fighting crime in Nigeria as proposed by the rational choice theory.

4.5 Empirical Results of the Growth Models (Crime and Economic Growth)

The second objective of this study focuses on the long-run and short-run relationship between crime and economic growth. The growth model comprise three different growth models based on the overall crime rate, the person's crime rate and the property crime rate. Each of the growth models has seven variables: economic growth (GR), crime variables, total investment (TIV), education (EIV), agriculture (AG), transportation and communication (TRC) and utilities (UT). Here, the crime variables are represented by the overall crime rate (CR), the person's crime rate (CPS) and the property crime rate (CPR). Thus, the relationship between crime variables and economic growth is tested with equation 4.8 (equation 4.8 is recalled from Section 4.3).

$$lnGR_t = \theta_0 + \theta_1 lnCR_t + \theta_2 TIV_t + \theta_3 EIV_t + \theta_4 lnAG_t + \theta_5 TRC_t + \theta_6 UT_t + \mu_t \quad (4.8)$$

4.5.1 Bounds Test

Similar to the crime model discussed in the previous section, the growth model comprises a series of annual data with the mixed order of I(0) and I(1). The mixed order is found only in the growth model with person's crime but not with the overall crime rate and property crime. Notwithstanding, the ARDL model is applied because the model is capable of providing a valid result for a model with I(1) order of integration or where series are mutually exclusive (Pesaran et al, 2001). In addition, this study possesses a small sample size and the relationship between crime and economic growth might be endogenous. The growth model in equation 4.8 is transformed to ARDL framework as presented in equation 4.23. Also, the dynamic form of the growth model is represented in equation 4.23 with sigma notations.

$$\Delta lnGR_t = \theta_0 + \theta_1 lnGR_{t-1} + \theta_2 lnCR_{t-1} + \theta_3 TIV_{t-1} + \theta_4 EIV_{t-1} + \theta_5 lnAG_{t-1} + \theta_6 TRC_{t-1} + \theta_7 UT_{t-1} + \sum_{i=1}^{p} \varphi_1 \Delta lnGR_{t-i} + \sum_{i=0}^{p} \varphi_2 \Delta lnCR_{t-i} + \sum_{i=0}^{p} \varphi_3 \Delta TIV_{t-i} + \sum_{i-0}^{p} \varphi_4 \Delta EIV_{t-i} + \sum_{i=0}^{p} \varphi_5 \Delta lnAG_{t-i} + \sum_{i=0}^{p} \varphi_6 \Delta TRC_{t-i} + \sum_{i=0}^{p} \varphi_7 \Delta UT_{t-i} + \psi ect_{t-i} + \mu_t \quad \ldots\ldots \quad (4.23)$$

Similar to the ARDL crime model in 4.4.1, the long run is represented by equation 4.24, the short run is presented in equation 4.25, while the error correction term is shown in equation 4.26.

$$lnGR_t = \theta_1 lnGR_{t-1} + \theta_2 lnCR_{t-1} + \theta_3 TIV_{t-1} + \theta_4 EIV_{t-1} + \theta_5 lnAG_{t-1} + \theta_6 TRC_{t-1} + \theta_7 UT_{t-1} + \theta_{a0} + \mu_t \quad (4.24)$$

$$\Delta lnGR_t = \theta_{b0} + \sum_{i=0}^{p} \varphi_2 \, \Delta lnCR_{t-i} + \sum_{i=0}^{p} \varphi_3 \, \Delta TIV_{t-i} + \sum_{i-0}^{p} \varphi_4 \, \Delta EIV_{t-i}$$

$$+ \sum_{i=0}^{p} \varphi_5 \; \Delta lnAG_{t-i} + \sum_{i=0}^{p} \varphi_6 \, \Delta TRC_{t-i} + \sum_{i=0}^{p} \varphi_7 \, \Delta UT_{t-i} + \psi ect_{t-i}$$

$$+ \mu_t \; \ldots .. \qquad (4.25)$$

$$ect_{t-i} = lnGR_t - (\theta_2 lnCR_t + \theta_3 TIV_t + \theta_4 EIV_t + \theta_5 lnAG_t + \theta_6 TRC_t + \theta_7 UT_t$$

$$+ \theta_{a0}) \qquad (4.26)$$

The result of F-statistic in each of the growth models is validated to establish cointegration of series. That is, F-statistic is ensured to have greater values than critical values in the bounds test at the appropriate level of significance as presented in Table 4.11.

Moreover, the null hypothesis of no cointegration is tested against the alternative where at least one of the coefficients is not equal to zero. That is, the null hypothesis of no cointegration is stated as follows:

$H_0 : \theta_1 \; to \; \theta_7 = 0$, and the alternate is $H_1 :$ where at least one of the $\theta_1 \; to \; \theta_7 \neq 0$ (which implies cointegration).

In addition, the short-run dynamics are represented in the growth models by $\varphi_1, \varphi_2, \varphi_3, \varphi_4, \varphi_5, \varphi_6, and \; \varphi_7$. Also, ψect_{t-i}, μ_t, $\theta_{0,}$ θ_{a0} and θ_{b0} are error correction model, error term and constant accordingly.

Table 4.11
Bounds test for growth models

Criterion	Growth Models					
	Model 2A $GR - CR_t$		Model 2B $GR - CPS_t$		Model 2C $GR - CPR_t$	
F-statistic	6.549***		8.114***		6.658***	
Level of Significance	10%		5%		1%	
Bounds	I(0)	I(1)	I(0)	I(1)	I(0)	I(1)
Critical Values	1.99	2.94	2.27	3.28	2.88	3.99
K				6		

Notes: F-statistics are significant at 1% (***); 5% (**) and 10% (*) appropriately. * indicates the bound at which each model is significant to show if there is cointegration between the dependent variable and the regressors. $GR - CR_t$ means growth on overall crime model, $GR - CPS_t$ means growth on person's crime model and $GR - CPR_t$ means growth on property crime model.

Moreover, in deciding the optimal lag length for growth model, the AIC is selected for being parsimonious among the criteria especially for small sample size (Liew, 2004). The ARDL model thus redistributes the lag-length as ARDL (d_1, d_2, d_3, d_4, d_5, d_6, d_7) based on AIC. Besides, $(p+1)^k$ is used in estimating the growth model. The number of variables is indicated by k in each of the growth models, while p shows the maximum lag used for each of the variables. This study also uses maximum automatic lag selection of 2 (Pesaran & Shin, 1999), and each model is evaluated as indicated in Table 4.12.

Table 4.12
Summary of the selected lagged criteria (growth models)

Criterion	Growth Models		
	Model 2A $GR - CR_t$	Model 2B $GR - CPS_t$	Model 2C $GR - CPR_t$
LogL	71.904767	76.365847	74.353802
AIC*	-2.804989	-2.922183	-2.826372
BIC	-2.267139	-2.301587	-2.205775
HQ	-2.607846	-2.69471	-2.598898
Adj. R^2	0.984558	0.986588	0.985239

No. of evaluation	1458	1458	1458
Specification	ARDL(1, 0, 0, 2, 0, 1, 2)	ARDL(1, 0, 0, 2, 2, 1, 2)	ARDL(1, 2, 0, 2, 0, 1, 2)

Note: $GR - CR_t$ means growth on overall crime model, $GR - CPS_t$ means growth on person's crime model and $GR - CPR_t$ means growth on property crime model.

4.5.2 ARDL Instrumental Variables Results (Growth Models)

In all the growth models, residuals are found to be serial uncorrelated which portray that there are no problems of endogenous regressors in growth model 2A, 2B and 2C when ARDL OLS is conducted. The results on serial correlation are presented in Table 4.13 to Table 4.15. Even though there is presence of simultaneity in Model 2C as mentioned in Section 4.3. But similar to the discussion of endogeneity on crime models in Section 4.4.2, growth models are subjected to ARDL IV test as proposed by Pesaran and Shin (1997). To test for ARDL IV in growth model, the growth model on overall crime is demonstrated using equation 4.23 (ARDL OLS). The ARDL OLS in equation 4.23 is reparametrized as ARDL IV based on Bewley (1979) in equation 4.27.

$$\Delta lnGR_t = \frac{\theta_0}{\emptyset(1)} + \theta_1 lnCR_t + \theta_2 TIV_t + \theta_3 EIV_t + \theta_4 lnAG_t + \theta_5 TRC_t + \theta_6 UT_t$$

$$+ \frac{1}{\emptyset(1)} \sum_{i=0}^{m_1-1} \theta_1 \Delta lnCR_{t-i} + \frac{1}{\emptyset(1)} \sum_{i=0}^{m_2-1} \theta_2 \Delta TIV_{t-i} + \frac{1}{\emptyset(1)} \sum_{i=0}^{m_3-1} \theta_3 \Delta EIV_{t-i}$$

$$+ \frac{1}{\emptyset(1)} \sum_{i=0}^{m_4-1} \theta_4 \Delta lnAG_{t-i} + \frac{1}{\emptyset(1)} \sum_{i=0}^{m_5-1} \theta_5 \Delta TRC_{t-i} + \frac{1}{\emptyset(1)} \sum_{i=0}^{m_6-1} \theta_6 \Delta UT_{t-i}$$

$$- \frac{1}{\emptyset(1)} \sum_{i=0}^{p-1} \theta_7 \Delta lnGR_{t-i}$$

$$+ \frac{\eta_t}{\emptyset(1)} \qquad (4.27)$$

The ARDL IV estimated on growth model on overall crime (Model 2A) presented in equation

4.28 and 4.29 for long run and short run respectively. The long-run and short-run ARDL IV equations on growth-overall crime (Model 2A) are based on ARDL (1, 0, 0, 2, 0, 1, 2).

$$lnGR_t = \frac{\theta_{0LR}}{\emptyset(1)} + \theta_1 lnCR_t + \theta_2 TIV_t + \theta_3 EIV_t + \theta_4 lnAG_t + \theta_5 TRC_t + \theta_6 UT_t + \frac{1}{\emptyset(1)}\theta_7 \Delta EIV_t + \frac{1}{\emptyset(1)}\theta_8 \Delta EIV_{t-1} + \frac{1}{\emptyset(1)}\theta_9 \Delta TRC_t + \frac{1}{\emptyset(1)}\theta_{10} \Delta UT_t + \frac{1}{\emptyset(1)}\theta_{10} \Delta UT_{t-1} - \frac{1}{\emptyset(1)}\theta_7 \Delta lnGR_t + \frac{\eta_{tLR}}{\emptyset(1)} \quad (4.28)$$

$$\Delta lnGR_t = \frac{\theta_{0SR}}{\emptyset(1)} + \varphi_1 lnCR_t + \varphi_2 TIV_t + \varphi_3 EIV_{t-1} + \varphi_4 lnAG_t + \varphi_5 TRC_{t-1} + \varphi_6 UT_{t-1} + \frac{1}{\emptyset(1)}\varphi_7 \Delta EIV_t + \frac{1}{\emptyset(1)}\varphi_8 \Delta EIV_{t-1} + \frac{1}{\emptyset(1)}\varphi_9 \Delta TRC_t + \frac{1}{\emptyset(1)}\varphi_{10} \Delta UT_t + \frac{1}{\emptyset(1)}\varphi_{10} \Delta UT_{t-i} - \frac{1}{\emptyset(1)}\varphi_7 \Delta lnGR_t + \frac{\eta_{tSR}}{\emptyset(1)} \quad (4.29)$$

In the ARDL IV for equations 4.28 and 4.29, the instrumental variables used while applying the 2SLS are

$1, lnCR_t, TIV_t, lnAG_t, EIV_{t-1}, TRC_{t-1}, UT_{t-1}, \Delta EIV_t, \Delta EIV_{t-1}, \Delta TRC_t, \Delta UT_t, \Delta UT_{t-1},$ $\Delta lnGR_{t-1}$.

Estimates of ARDL IV on growth-overall crime model (Model 2A) is presented in Table 4. 11. The estimated ARDL IV results is numerically identical to ARDL OLS in Table 4.11, this shares the same pattern with results presented on all the crime model in Section 4.4.3 using ARDL IV. Likewise, the results obtained in growth-person's crime (Model 2B) and growth-property crime (Model 2C) are in line with growth-overall crime (Model 2A) as presented in Table 4.12 and 4.13. Further, results are attached in the Appendix N to S for evidences. Besides, the results justified the proof in Bardsen (1989), Pesaran and Shin (1997) as regard the numerical identical of standard errors in OLS and 2SLS. Apart from the numerical identical in standard errors in ARDL OLS and ARDL IV, problem of endogeneity is eliminated in all the growth models with ARDL IV estimation which does not require further endogeneity test (see Stučka, 2004 and Razmi & Blecker, 2008). Hence, ARDL OLS estimates in growth model are interpreted for policy suggestions since residuals are not serially correlated.

4.5.3 Long run and Short run Relationships (Growth Models)

Owing to the results of unit root tests, the bounds test approach as proposed by Pesaran *et al.* (2001), and re-echoed by Nayaran (2005) is used to establish the existence of cointegration in all of the growth models. Consequently, the long run and short run coefficients are estimated, and their estimates for the growth models are presented in Tables 4.13 to 4.15. In addition, the diagnostic tests that provide a robust check for the long-run results are showed in Tables 4.13 to 4.15 and Figures 4.4 to 4.6. These diagnostic tests are normality (χ^2_N), functionality (χ^2_{FF}), serial correlation (χ^2_{SC}), heteroscedasticity (χ^2_H) and stability. Further, the stability tests of cumulative sum of recursive residuals (CUSUM) and cumulative sum of recursive residuals squares are conducted. All the growth models passed the two tests at the 5% level of significance. The two tests ensured that the parameters are stable over a long period. These results are presented in Figures 4.4 to 4.6. Thus, the long run and short run models evaluate the impact of overall crime rate, person's crime rate and property crime rate on economic growth.

The results in Tables 4.13 to 4.15 showed the dynamic estimates of the long-run, the short-run and the error correction term. The error correction model in each of the growth model is negative at the 1% level of significance. Adequate restoration to the equilibrium is ensured for any deviations in the long run over the following year. This validates the results of the F-statistic test obtained in Table 4.11. The short-run estimates are further explained for each model in the subsequent paragraphs.

4.5.3.1 Economic Growth and Overall Crime

In model 2A, the long run results presented in Table 4.13 indicated that the crime rate exerts an adverse effect on economic growth at the 10% level of significance whereby an increase of 1% in the crime rate would decrease economic growth by 0.246%. This result is consistent with Mauro and Carmeci (2007) on exogenous growth and Pan *et al.* (2012) and Goulas and Zervoyannni (2013) who examined the overall crime rate on growth.

Implementation of economic growth policy is distorted by criminal activities in Nigeria, and this is reflected in the loss of income which affects the standard of living. The illegal tax imposed on business by criminal gangs would reduce business' income (Mauro & Carmeci, 2007).

Also, education indicates a positive relationship with economic growth at the 5% level of significance, such that when the rate of education increase by 1%, economic growth would increase by 0.942%. This result is consistent with Gouals and Zervoyyianni (2013 & 2015), and this means that economic growth can be enhanced by educational policy in Nigeria.

Transportation and communication (TRC) is found to be efficient in promoting economic growth as it is significant at the 5% level of significance. An increase of TRC by 1% would improve economic growth by 0.032%. A similar result is demonstrated by Abu and Abdullahi (2010), but their result is based on a one year lagged.

The result for utilities, which comprise electricity and water supply, supports the promotion of economic growth at the 1% level of significance. With utilities increasing by 1%, economic growth increases by 0.094%. An abundance of water resources facilitates socioeconomic development because of its inputs into industrial, agriculture and electricity production which in turn enhance economic growth (Cox, 1987). Also, Ouédraogo (2010) established that the relevance of electricity in the society would improve economic growth. However, investment and agriculture are not significant in this model.

In the short run, the result indicates an inverse relationship between crime rate and economic growth at the 10% level of significance. That is, a 1% rise in crime reduces economic growth by 0.143%. Also, investment and other variables are not significant. The error correction term (ECT_{t-1}) is -0.582 and significant at the 1% level This shows that adequate feedback mechanism exist that could restore the model back to equilibrium. For instance, the model would restore in a year by 58.2%. In addition, if the full adjustment is 100%, it would take 1.58 years to adjust any deviation in the short-run. That means, any disequilibrium in the model would take 1.58 years to move back to the long run equilibrium relationship. Diagnostic tests presented in Table 4.13 and Figure 4.4 show that model 2A pass all these tests at the 5% level of significance.

Table 4.13

Estimates of growth-overall crime (model 2A)

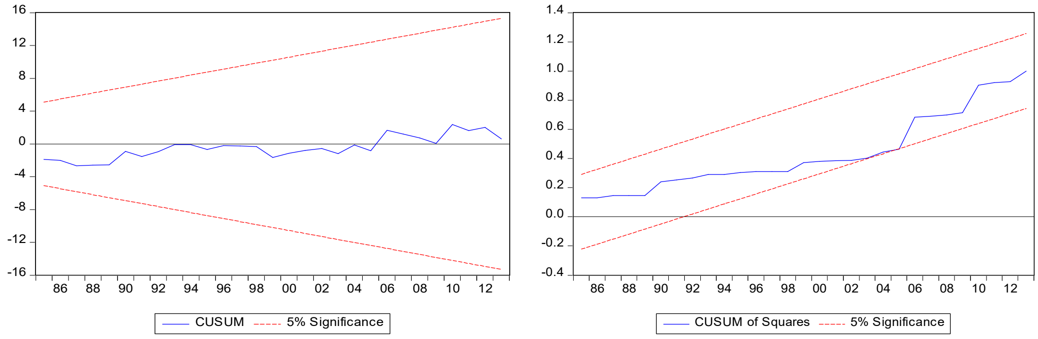
DV is Economic Growth; ARDL(1, 0, 0, 2, 0, 1, 2)

ARDL OLS	**Long-run Estimates**		**ARDL IV**	**Long-run Estimates**	
Variables	Coefficients	t-statistics	Variables	Coefficients	t-statistics
C	31.480	36.133	C	31.480	36.133
***ln*CR**	-0.246	-1.865*	LCR	-0.246	-1.865*
TIV	0.001	0.367	TIV	0.001	0.367
EIV	0.942	2.160**	EIV	0.942	2.160**
***ln*AG**	0.022	1.189	LAG	0.022	1.189
TRC	0.032	2.096**	TRC	0.032	2.096**
UT	0.094	4.324***	UT	0.094	4.324***
			ΔEIV	-1.022	-2.699**
			ΔEIV(-1)	-1.585	-3.000***
			ΔTRC	-0.036	-2.454**
			ΔUT	-0.055	-1.743*
			ΔUT(-1)	-0.077	-2.445**
			ΔLGR	-0.715	-1.939*
	Short-run Estimates			**Short-run Estimates**	
C	18.346	4.701	C	18.346	4.701
*ln*GR(-1)	-0.582	-4.648***	*ln*GR(-1)	-0.582	-4.648***
*ln*CR	-0.143	-1.829*	*ln*CR	-0.143	-1.829*
TIV	0.0007	0.365	TIV	0.0007	0.365
EIV(-1)	0.549	2.014*	EIV(-1)	0.549	2.014*
*ln*AG	0.013	1.151	*ln*AG	0.013	1.151
TRC(-1)	0.018	1.867*	TRC(-1)	0.018	1.867*
UT(-1)	0.054	3.001***	UT(-1)	0.054	3.001***
ΔEIV	-0.046	-0.192	ΔEIV	-0.046	-0.192
ΔEIV(-1)	-0.923	-3.225***	ΔEIV(-1)	-0.923	-3.225***
ΔTRC	-0.002	-0.245	ΔTRC	-0.002	-0.245
ΔUT	0.022	1.304	ΔUT	0.022	1.304
ΔUT(-1)	-0.045	-2.179**	ΔUT(-1)	-0.045	-2.179**
ECM(-1)	-0.582	-8.065***			

Diagnostics Tests

Test	H_0	ARDL OLS Statistic	ARDL IV Statistic	Decision
χ^2_N	Normal distribution	$JB = 0.326$ (0.849)	$JB = 0.326$ (0.849)	H_0 *not rejected*
χ^2_{FF}	Absence of model misspecification	$t = 0.907$ (0.371)	N/A	H_0 *rejected*
χ^2_{SC}	There is no serial correlation (1)	$\chi^2 = 2.466$ (0.116)	$\chi^2 =$(0.116)	H_0 *not rejected*
χ^2_H	There is no autoregressive conditional heteroscedasticity	$\chi^2 = 12.845$ (0.380)	$\chi^2 = 11.318$ (0.5010)	H_0 *not rejected*
F_T	Wald Test (No Cointegration)		$F_T = 72.301$ (0.000)	H_0 *rejected*

Note: the asterisk (*) showed that the estimated coefficients are significant at 1% (***); 5% (**) and 10% (*). Also, the diagnostic tests χ^2_N , χ^2_{FF}, χ^2_{SC} and χ^2_H are significant at 5%. P-value for diagnostic tests are in parenthesis. Variables are defined as Economic Growth is $lnGR_t$ as DV. Overall Crime rate ($lnCR_t$), Total Investment rate (TIV_t), Education in % (EIV_t) , Agriculture ($lnAG_t$) , Transportation and Communication in % (TRC_t) , and Utilities in % (UT_t) are independent variables.



a. b.

Note: The straight lines represent critical bounds at the 5% significance *level.*

Figure 4.4. Stability Test for Growth Model 2A.

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4.5.3.2 Economic Growth and Person's Crime

The long run result in model 2B (economic growth and person's crime) is presented in Table 4.14. It shows that person's crime has an inverse relationship with economic growth at the 5% level of significance. In the instance of a 1% increase in person's crime, economic growth would decrease by 0.091%. This result is consistent with Detotto and Ontranto (2010) and Mauro and Carmeci (2007) who examined the relationship between the crime of homicide and economic growth. This result supports evidence reported on the overall crime rate, but it has more of an impact on economic growth as a disaggregated crime. Education is positively related to economic growth at the 1% level of significance, the magnitude of the coefficient means a rise of 1% opportunity for education improves economic growth by 1.097%. The result support the one in the overall crime rate model. This result is consistent with that found in Enamorado *et al.* (2014), and Goulas and Zervoyianni (2013).

Apart from the fact that investment is not significant, other variables are significant. Agriculture stimulates economic growth at the 1% level of significance. This means that a rise in agriculture by 1% would improve economic growth in the country by 0.071%. This result for agriculture is in line with Oyakhilomen and Zibah (2014) but differ from the overall crime model. Similar to the overall crime result, transport and communication, and utilities were significant at the 10% level of significance. A 1% increase in transport and communication enhances economic growth by 0.017%, and utilities improves economic growth by 0.105%. The result on utilities supports Apergis and Payne (2011). As sufficient use of electricity would boost economic growth not only in high-income nations but also in low- and medium-income countries (Apergis & Payne, 2011).

Moreover, in model 2B, the short-run reveal that person's crime has an adverse effect on economic growth at the 5% level of significance. An increase in person's crime by 1% causes a 0.06% reduction in economic growth. This result is consistent with what is obtained in overall crime. Other variables are not significant, which is similar to the result in overall crime model. The error correction term (ECT_{t-1}) is -0.658% and significant at the 1% level. Disequilibrium in the model become stable by 65.8% in a year. This means that deviation in short run is corrected for in 1.65 years for the model to get back to equilibrium in which the full equilibrium is 100%. In addition, the results presented in Table 4.14 and Figure 4.5 indicate that model 2B pass all tests at the 5% level of significance.

Table 4.14
Estimates of growth-person's (model 2B)

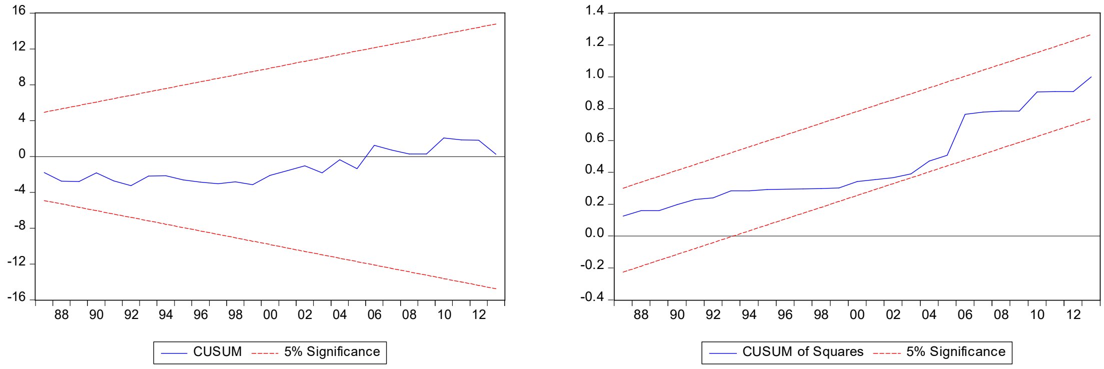
DV is Economic Growth; ARDL(1, 0, 0, 2, 2, 1, 2)

ARDL OLS	**Long-run Estimates**		**ARDL IV**	**Long-run Estimates**	
Variables	Coefficients	t-statistics	Variables	Coefficients	t-statistics
C	30.053	180.755	C	30.053	180.755
***ln*CPS**	-0.091	-2.297**	***ln*CPS**	-0.091	-2.297**
TIV	0.002	0.956	TIV	0.002	0.956
EIV	1.097	4.201***	EIV	1.097	4.201***
***ln*AG**	0.071	4.915***	***ln*AG**	0.071	4.915***
TRC	0.017	1.727*	TRC	0.017	1.727*
UT	0.105	5.278*	UT	0.105	5.278*
			ΔEIV	-1.099	-3.568***
			ΔEIV(-1)	-1.297	-2.781***
			Δ*ln*AG	-0.049	-1.617
			Δ*ln*AG(-1)	-0.046	-1.429
			ΔTRC	-0.019	-1.706*
			ΔUT	-0.062	-2.350**
			ΔUT(-1)	-0.069	-2.628**
			ΔD(LGR)	-0.519	-1.835*
	Short-run Estimates			**Short-run Estimates**	
C	19.778	5.396	C	19.778	5.396
*ln*GR(-1)	-0.658	-5.367***	*ln*GR(-1)	-0.658	-5.367***
*ln*CPS	-0.060	-2.351**	*ln*CPS	-0.060	-2.351**
TIV	0.001	0.939	TIV	0.001	0.939
EIV(-1)	0.722	3.569***	EIV(-1)	0.722	3.569***
*ln*AG(-1)	0.047	4.113***	*ln*AG(-1)	0.047	4.113***
TRC(-1)	0.011	1.542	TRC(-1)	0.011	1.542
UT(-1)	0.069	3.533***	UT(-1)	0.069	3.533***
ΔEIV	-0.001	-0.005	ΔEIV	-0.001	-0.005
ΔEIV(-1)	-0.853	-2.982***	ΔEIV(-1)	-0.853	-2.982***
Δ*ln*AG	0.014	0.673	Δ*ln*AG	0.014	0.673
Δ*ln*AG(-1)	-0.030	-1.365	Δ*ln*AG(-1)	-0.030	-1.365
ΔTRC	-0.001	-0.150	ΔTRC	-0.001	-0.150
ΔUT	0.028	1.657	ΔUT	0.028	1.657
ΔUT(-1)	-0.045	-2.342**	ΔUT(-1)	-0.045	-2.342**
ECT (-1)	-0.658	-9.041***			

Diagnostics Tests

Test	H_0	ARDL OLS Statistic	ARDL IV Statistic	Decision
χ^2_N	Normal distribution	$JB = 1.431$ (0.488)	$JB = 1.431$ (0.488)	H_0 *not rejected*
χ^2_{FF}	Absence of model misspecification	$t = 0.285$ (0.777)	N/A	H_0 *rejected*
χ^2_{SC}	There is no serial correlation (1)	$\chi^2 = 1.526$ (0.216)	χ^2 =(0.216)	H_0 *not rejected*
χ^2_H	There is no autoregressive conditional heteroscedasticity	$\chi^2 = 14.564$ (0.380)	$\chi^2 = 15.175$ (0.366)	H_0 *not rejected*
F_T	Wald Test (No Cointegration)		$F_T = 109.057$ (0.000)	H_0 *rejected*

Note: the asterisk (*) showed that the estimated coefficients are significant at 1% (***); 5% (**) and 10% (*). Also, the diagnostic tests χ^2_N, χ^2_{FF}, χ^2_{SC} and χ^2_H are significant at 5%. P-value for diagnostic tests are in parenthesis. Variables are defined as Economic Growth is $lnGR_t$ as DV. Person's Crime rate ($lnCPS_t$), Total Investment rate (TIV_t), Education in % (EIV_t), Agriculture ($lnAG_t$), Transportation and Communication in % (TRC_t), and Utilities in % (UT_t) are independent variables.



a. b.

Note: The straight lines represent critical bounds at the 5% significance level.

Figure 4.5

Stability Test for Growth Model 2B

4.5.3.3 Economic Growth and Property Crime

Model 2C focus on property crime and economic growth as presented in Table 4.15. The long run results differ from the overall crime and person's crime model as investment is significant, but transport and communication is not significant. Property crime show an adverse effect on economic growth at the 10% level of significance. An increase in property crime by 1% would reduce economic growth by 0.103%. The result support Goulas and Zervoyianni (2013) as the overall crime rate in their study included robbery, theft and burglary. Investment is significant with economic growth at the 5% level of significance. An increase of investment by 1% enhance economic growth by 0.006%. This is line with Goulas and Zervoyianni (2013). Education continue its positive trend on economic growth at the 1% level of significance. Here, education would improve economic growth by 1.289% when it increase by 1%. The more people who are educated and the high knowledge accumulation takes place in them, the more growth would occur in the economy (Adekoya & Abdul Razak, 2016). This result supports Pribac, Angelina, and Blaga (2016) and Dima (2014). Similar to person's crime model, agriculture and utilities are significant with economic growth at the 1% level of significance. A rise in agriculture by 1% would increase economic growth by

0.052%, and this evidence supports Owolabi-Merus and Bello (2015). With an improvement of 1% in utilities, economic growth would be enhanced by 0.094% because a relationship of joint movement exist between electricity and economic growth in Nigeria (Akinlo, 2009).

Similar to the result presented on investment in the long run in model 2C, the short run showed that an investment is significant at 10% level of significance. This means an that an increase of 1% in investment would increase economic growth by 0.003%. Also, agriculture is significant at the 10% level of significance. With an increase of 1% in agriculture, economic growth would improve by 0.029%. Education, transport and communication, utilities are not significant. Furthermore, the error correction model (ECT_{t-1}) is -0.566% at the 1% level of significance. The model would only restore 56.6% of distortion in a year, and it would take the distortions in short run 1.56 years to adjust to long run equilibrium relationship if the full equilibrium is 100%. Thus, the diagnostic test results are presented in Tables 4.15 and Figure 4.9, reveal that model 2C pass all tests at the 5% level of significance.

Table 4.15

Estimates of growth-property crime (model 2C)

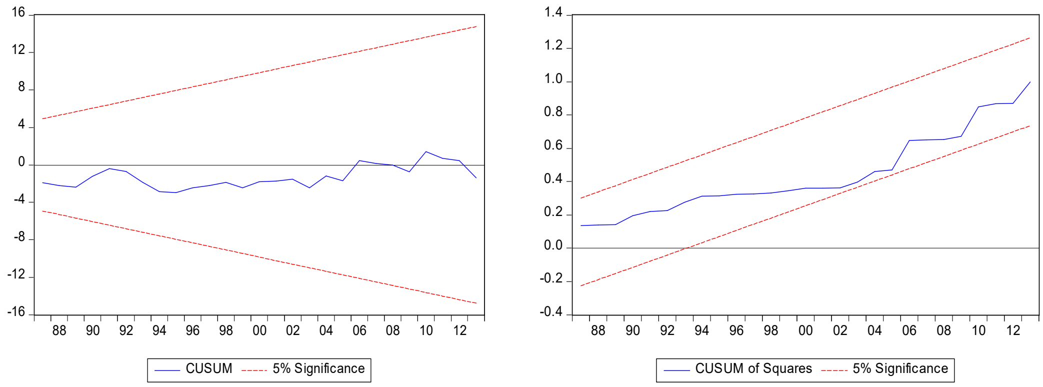
DV is Economic Growth; ARDL(1, 2, 0, 2, 0, 1, 2)

ARDL OLS	**Long-run Estimates**		**ARDL IV**	**Long-run Estimates**	
Variables	Coefficients	t-statistics	Variables	Coefficients	t-statistics
C	30.155	129.701	C	30.155	129.701
lnCPR	-0.103	-1.739*	lnCPR	-0.103	-1.739*
TIV	0.006	2.127**	TIV	0.006	2.127**
EIV	1.289	3.728***	EIV	1.289	3.728***
lnAG	0.052	3.469***	lnAG	0.052	3.469***
TRC	0.017	1.433	TRC	0.017	1.433
UT	0.094	4.206***	UT	0.094	4.206***
			ΔlnCPR	0.018	0.275
			ΔlnCPR(-1)	0.092	1.807*
			ΔEIV	-1.115	-2.576**
			ΔEIV(-1)	-1.740	-2.951***
			ΔTRC	-0.038	-2.528**
			ΔUT	-0.043	-1.317
			ΔUT(-1)	-0.082	-2.528**
			ΔlnGR	-0.764	-1.798*
	Short-run Estimates			**Short-run Estimates**	
C	17.093	4.160	C	17.093	4.160
lnGR(-1)	-0.566	-4.151***	lnGR(-1)	-0.566	-4.151***
lnCPR(-1)	-0.058	-1.623	lnCPR(-1)	-0.058	-1.623
TIV	0.003	1.939*	TIV	0.003	1.939*
EIV(-1)	0.730	3.423*	EIV(-1)	0.730	3.423*
lnAG	0.029	2.790*	lnAG	0.029	2.790*
TRC(-1)	0.009	1.271	TRC(-1)	0.009	1.271
UT(-1)	0.053	2.688**	UT(-1)	0.053	2.688**
ΔlnCPR	-0.048	-1.657	ΔlnCPR	-0.048	-1.657
ΔlnCPR(-1)	0.052	1.691	ΔlnCPR(-1)	0.052	1.691
ΔEIV	0.098	0.471	ΔEIV	0.098	0.471
ΔEIV(-1)	-0.986	-3.534***	ΔEIV(-1)	-0.986	-3.534***
ΔTRC	-0.012	-1.354	ΔTRC	-0.012	-1.354
ΔUT	0.028	1.662	ΔUT	0.028	1.662
ΔUT(-1)	-0.046	-2.243**	ΔUT(-1)	-0.046	-2.243**
ECT (-1)	-0.566	-8.189***			

Diagnostics Tests

Test	H_0	ARDL OLS Statistic	ARDL IV Statistic	Decision
χ^2_N	Normal distribution	$JB = 2.144\ (0.342)$	$JB = 2.144\ (0.342)$	H_0 *not rejected*
χ^2_{FF}	Absence of model misspecification	$t = 0.512\ (0.612)$	N/A	H_0 *rejected*
χ^2_{SC}	There is no serial correlation (1)	$\chi^2 = 10.136\ (0.711)$	$\chi^2 = (0.711)$	H_0 *not rejected*
χ^2_H	There is no autoregressive conditional heteroscedasticity	$\chi^2 = 17.018\ (0.255)$	$\chi^2 = 15.526\ (0.342)$	H_0 *not rejected*
F_T	Wald Test (No Cointegration)		$F_T = 61.983\ (0.000)$	H_0 *rejected*

Note: the asterisk (*) showed that the estimated coefficients are significant at 1% (***); 5% (**) and 10% (*). Also, the diagnostic tests χ^2_N , χ^2_{FF}, χ^2_{SC} and χ^2_H are significant at 5%. P-value for diagnostic tests are in parenthesis. Variables are defined as Economic Growth is $lnGR_t$ as DV. Property Crime rate ($lnCPR_t$), Total Investment in % (TIV_t), Education in % (EIV_t) , Agriculture ($lnAG_t$), Transportation and Communication in % (TRC_t), and Utilities in % (UT_t) are independent variables.



a. b.

Note: The straight lines represent critical bounds at the 5% significance level.

Figure 4.6

Stability Test for Growth Model 2C

The summary on the growth models presented in Table 4.16 indicate the trends between growth, crime variables and other variables considered. All the independent variables examined conformed to the expected sign for policy implications. The estimated results favour the long-run rather than the short-run, this suggests that the results are valid for policy inferences. Thus, evidences from the above estimation pointed that economic growth as a measure of the standard of living in Nigeria is hampered by the incidence of criminal activities. The criminal activities included the overall crime rate, person's crime rate and property crime rate. Policies put in place to reduce crime include various total investment and investment in education, agriculture, transport and communication, and utilities. In all the growth models, all these policies are significant in the long run in fighting crime, but few are effective in the short run. The implication is that preventing crime through any of these polices or joint use of these policies would aid economic growth. This connotes that economic loss as related to crime, as in Bourguignon (1999), would be reduced in the country.

Table 4.16
Summary on the estimate of growth models

DV is Economic Growth						
Variables	**Long-run Estimates**			**Short-run Estimates**		
	Model 2A $GR-CR_t$	**Model 2B** $GR-CPS_t$	**Model 2C** $GR-CPR_t$	**Model 2A** $GR-CR_t$	**Model 2B** $GR-CPS_t$	**Model 2C** $GR-CPR_t$
LCR	Negative Significant			Negative Significant		
LCPS		Negative Significant			Negative Significant	
LCPR			Negative Significant			N/A
TIV	Not Significant	Not Significant	Positive Significant	Not Significant	Not Significant	Positive Significant
EIV	Positive Significant	Positive Significant	Positive Significant	N/A	N/A	N/A
LAG	Not Significant	Positive Significant	Positive Significant	Not Significant	N/A	Positive Significant
TRC	Positive Significant	Positive Significant	Not Significant	N/A	N/A	N/A
UT	Positive Significant	Positive Significant	Positive Significant	N/A	N/A	N/A

Note: $GR-CR_t$ means growth on overall crime model, $GR-CPS_t$ means growth on person's crime model and $GR-CPR_t$ means growth on property crime model. Variables are defined as Economic Growth is $lnGR_t$ as DV. Overall Crime rate ($lnCR_t$), Person's Crime rate ($lnCPS_t$), Property Crime rate ($lnCPR_t$), Total Investment rate (TIV_t), Education in rate (EIV_t), Agriculture ($lnAG_t$) , Transportation and Communication rate (TRC_t), and Utilities rates (UT_t) are independent variables.

4.5.4 Discussion of the Growth Models

The result of growth models revealed that crime ensures the occurrence of social loss per capita in society as proposed in Becker (1968). That is due to the poor economic situation created by crime in society, some costs of crime would be imposed as a tax on individuals and society at large. Moreover, the social loss per capita implied that there would be poor economic growth in a society. The exogenous growth model in Mauro and Carmeci (2007) is tested and the above results are arrived at. From the result, it shows that crime exerts a negative effect on economic growth in Nigeria. The crime include the overall crime rate, person's crime rate and property crime rate. Therefore, the conclusion that poor economic growth in the country is partly due to crime-related activities as mentioned by the Federal

Government of Nigeria (2014) is justified. Government revenues are undermined through criminal practices of economic and political elites in Nigeria (Otusanya, 2012).

Numerous factors have been ascribed to cause poor economic growth in Nigeria and Sub-Saharan Africa. Some of these factors include a poor saving rate and low investment (United Nations, 2001), a low level of education (Gyimah-Brempong, 2010), emigration of human capital (Gyimah-Brempong, Paddison, & Mitiku, 2006) and institutional weakness (Fosu, 2010). While these factors cannot be totally disregarded, evidence in this study suggests that criminal activities cause poor growth in Nigeria. Pan *et al.* (2012) asserted that crime drives away skilled workers/labour and investment because skilled labour would prefer to work in a secure environment to enjoy their earnings. Furthermore, investors would prefer a secure place in which to invest their money to have good returns. Illegal activities and criminal groups impose illegal taxes on business profit, which consequently lower their capital returns (Mauro & Camerci, 2007). Drawing from Pan *et al.* (2012) and Mauro and Camerci (2007), the high criminal activities in the country may have led to the flight of human and physical capital from Nigeria. To add, crime institution is affected by activities of the gangsters (Ojedokun, 2014). Thus, there is probability a that crime may have increased factors mentioned in the United Nations (2001) report, Gyimah-Brempong, Paddison and Mitiku (2006) and Fosu (2010).

Moreover, this study reaffirmed the evidence suggested that illegal activities act as a brake on economic growth, which reduce the chances for economic expansion (Detotto & Pulina, 2012). Similarly, criminal activity affect the growth and public service provision, distorts the environment for engaging in business and functions as a tax on personal investments in Nigeria (Okonjo-Iweala & Osafo-Kwaako, 2007). The result of this is that the country has become one of the unfortunate nations in the world (Nigeria Human Right Commission, 2007). The multiplier influence has been the mass range of poverty and the avoidable situation on the list of poor and under-developed nations amidst vast rich natural wealth in Nigeria (Cleen, 2010). The trap of poor economic growth and high crime rate based on the results of this study has policy implications that are discussed in the next few paragraphs.

Investment in social and physical infrastructure has a long-term capacity to sustain economic growth, and this capacity is pro-poor as it helps the poor to gain from the growth process (Ogun, 2010; Jerome, 2011). Apart from low investment, infrastructure has suffered from poor maintenance in Africa, which has led to inefficient infrastructure services. As a matter of fact, millions in African nations lack functional amenities (Jerome, 2011). This is reflected in Nigeria as cities are littered with slums and ghettos and abysmal living conditions (Ogun, 2010). Alabi and Adams (2014) noted that the rich benefit more than the poor with regard to physical amenities in Nigeria. Therefore, the poor are subjected to live in poverty. This is further exacerbated as they are constrained with poor income and lack of job being the evidence of strain conditions in the country. Nevertheless, economic growth can reduce poverty and help to achieve other anticipated development outcomes in Africa (UN-Habitat, 2011).

Evidence provided in this study and previous work has shown that boosting social and physical amenities drives economic growth and reduces poverty (Mesagan & Dauda, 2016; Jerome, 2011; Ouédraogo, 2013). For instance, Mesagan and Dauda (2016) advanced that achieving inclusive economic growth is possible with enhanced investment and quality of the various levels of education. Skill acquisition to be included in the curriculum to make educated youth depend less on low-paying jobs because investment and high-quality education reduces unemployment (Mesagan & Dauda, 2016). Additionally, education is an aid to health as shown in Jamisona, Jamison, and Hanushek (2007). Their results demonstrated that education improves economic growth as education and economic growth in turn is found to reduce mortality. Also, educating various groups in Malaysia became visible initiatives for policy changes to reduce harm from the illicit drug (Narayanan, Vicknasingam, & Robson, 2011). Adams (2003) noted that education facilitates communication-based development, which is helpful to enhance economic growth. One way that communication boosts economic growth is its links with trade because efficient network and linkage encourage the flow of trading activities. Therefore, boosting trade through improved infrastructure on communication facilities research and development, further enhance socioeconomic development (Bankole, Osei-Bryson, & Brown, 2015).

Similarly, Jerome (2011) contended that financial allocation to transportation and other infrastructure must be increased to guarantee desirable welfare. His results demonstrated that access to electricity, water and sanitation is low in Sub-Saharan Africa when compared to other regions in the world. Bosede, Bamidele, and Afolabi (2013) found that boosting transportation improves economic growth and reduces traffic congestion and road accidents. Besides, construction of roads opens rural areas, enhances mobility and supports rural households engaging in agriculture. Thus, transportation becomes a measure to reduce poverty in rural areas as it sustains employment in agriculture among the farmers (Bryceson, Bradbury, & Bradbury, 2008).

Sustaining agriculture makes it a contributing factor, which help transfer resources to other sectors that are productive in an economy (Kao, 1965). Capital increases general development and labour stimulates the growth process. Growth is stimulated as investment in agriculture is used to enhance the movement of labour to non-agricultural industries. Its contribution to export earnings create markets, and this can be used to fund capital goods required to generate new products. The dynamic role of agriculture reduces poverty as shown in Minten and Barett (2007). Minten and Barett (2007) found that improving agricultural technology increases output, reduces food prices, boosts farmers income, and, thus, welfare is improved among the rural farmers. But, it is not in all instances that improved economic growth translates into poverty reduction despite the positive contribution of agriculture to economic growth in Nigeria (Oyakhilomen & Zibah, 2014). The impact of poverty as found by this study showed that poverty causes persons' crime. Thus, the country would require an investment in agricultural technology as argued by Minten and Barrett (2007) not only to boost economic growth but to reduce poverty and minimise the crime rate in Nigeria.

The vital role of utilities in the growth-crime model is beyond growth enhancement as utilities showed a crime reduction effect (Willis, Powe, & Garrod, 2005). That is the improvement in street lighting enhance safety perception because it minimise road accidents and crime (Willis, Powe, & Garrod, 2005). Also, the provision of pipe-borne water, electricity, education and health help (Oseni, 2011). But the provision of utilities alone is not sufficient to meet people's needs in Nigeria (Federal Government of Nigeria, 2012) as the poor have low marginal benefits of utilities compared to the rich because utilities expenditures are not pro-poor in the country (Alabi & Adams, 2014). Insufficient utilities such as water causes violence and crime as people struggle to get portable water, and environmental security is threatened as well (Brisman, McClanahan & South, 2016). Likewise, poor electricity serves as a major impediment to socioeconomic programmes in the West African region (Ouédraogo, 2013). Therefore, this study argued that insufficient utilities is enough to impose strain on the people. This strain becomes higher when coupled with high unemployment, income disadvantage and poverty in the country. Of course, crime is inevitable in this circumstance. Perhaps, this is why Oseni (2011) and Ouédraogo (2013) viewed that sufficient electricity used to enhance economic growth would reduce poverty.

4.6 Granger Causality

In Sections 4.4 and 4.5, this study established that a relationship between socioeconomic strain, crime and economic growth based on the bounds test approach. Notwithstanding, it is the interest of this study to confirm the direction of the relationship that exists between socioeconomic strain, crime and economic growth. Especially because an ongoing argument exists about the exact direction among these variables about which one causes the other. This is to add that economic variables are endogenous, and a need for more clarification existed based on the argument in Granger (1969), which is yet unresolved. Thus, the third objective is answered in this section to identify and establish the nature of causality that exists between socioeconomic strain, crime and economic growth.

In section 3.4.3, Toda and Yamamoto's approach to Granger causality is explained. The approach is known to fit for a small sample size, allow for mixed series of integration order to be examined, and variables need not be cointegrated before it can be applied. Likewise, the coefficients for the variables tested are more adequately validated through the modified Wald test. This simplicity of Toda and Yamamoto's approach to Granger causality demonstrated its superiority over the other approach to Granger causality as it resolves the simultaneity bias in an equation through seemingly unrelated regression (SUR) technique.

The process included knowing the integration order of variables through ADF and PP unit root tests, and the integration order is used as the order of d_{max} to over-fit the model. Then, the optimal lag of VAR (k) is selected through AIC because of the number of sampled size. Further, the VAR order that is estimated becomes of $p(k + d_{max})th$ where the coefficients for the last lagged d_{max} is ignore in VAR (Wolde-Rufael, 2005). Also, the appropriate lag length without serial correlation is selected, and, based on 44 observations, the VAR order (k) selected is 4 for in model 3A, 3B and 3C. The lag for d_{max} is 1, and the summary of tests conducted for selection of lag criteria are presented in Table 4.17. Thus, to estimate VAR $p(k + d_{max})th$ model, this study follows Farhani *et al.* (2014), and specified the model as indicated in equation 4.30 to determine the Granger causality between socioeconomic strain, crime and economic growth. The result of Granger causality is presented in Tables 4.18 to 4.20 based on the overall crime rate, person's crime rate and property crime rate.

Table 4.17
Selection of lag criteria for Granger causality Toda & Yamamoto test

	Model 3A		**Model 3B**		**Model 3C**	
Optimal lag length (VAR order) k+d_max	5		5		5	
Optimal lag *(k)*	4		4		4	
Values for AIC	-11.165*		-9.723*		-9.397*	
Values for SBC	-6.732		-5.289		-4.963	
Values for HQ	-9.562		-8.120		-7.794	
Serial Correlation (LM test) χ^2_{SC}	lag	1	lag	1	lag	1
	stat	25.841	stat	25.473	stat	50.082
	prob	0.416	prob	0.436	prob	0.059

Notes: The asterisk (*) showed the lag criterion selected, and p-values for $\chi^2_{SC}$are significant at 5% (**).

$$\begin{bmatrix}\Delta lnGR_t\\ \Delta lnCR_t\\ \Delta UN_t\\ \Delta YL_t\\ \Delta POV_t\end{bmatrix} = \begin{bmatrix}\varphi_1\\ \varphi_2\\ \varphi_3\\ \varphi_4\\ \varphi_5\end{bmatrix} + \sum_{i=1}^{d} \begin{bmatrix}\beta_{11i}\ \beta_{12i}\ \beta_{13i}\ \beta_{14i}\ \beta_{15i}\ \beta_{16i}\\ \beta_{21i}\ \beta_{22i}\ \beta_{23i}\ \beta_{24i}\ \beta_{25i}\ \beta_{26i}\\ \beta_{31i}\ \beta_{32i}\ \beta_{33i}\ \beta_{34i}\ \beta_{35i}\ \beta_{36i}\\ \beta_{41i}\ \beta_{42i}\ \beta_{43i}\ \beta_{44i}\ \beta_{45i}\ \beta_{46i}\\ \beta_{51i}\ \beta_{52i}\ \beta_{53i}\ \beta_{54i}\ \beta_{55i}\ \beta_{56i}\end{bmatrix} \times \begin{bmatrix}\Delta lnGR_{t-i}\\ \Delta lnCR_{t-i}\\ \Delta UN_{t-i}\\ \Delta YL_{t-i}\\ \Delta POV_{t-i}\end{bmatrix}$$

$$+ \sum_{i=k+1}^{d_{max}} \begin{bmatrix}\beta_{11i}\ \beta_{12i}\ \beta_{13i}\ \beta_{14i}\ \beta_{15i}\ \beta_{16i}\\ \beta_{21i}\ \beta_{22i}\ \beta_{23i}\ \beta_{24i}\ \beta_{25i}\ \beta_{26i}\\ \beta_{31i}\ \beta_{32i}\ \beta_{33i}\ \beta_{34i}\ \beta_{35i}\ \beta_{36i}\\ \beta_{41i}\ \beta_{42i}\ \beta_{43i}\ \beta_{44i}\ \beta_{45i}\ \beta_{46i}\\ \beta_{51i}\ \beta_{52i}\ \beta_{53i}\ \beta_{54i}\ \beta_{55i}\ \beta_{56i}\end{bmatrix} \times \begin{bmatrix}\Delta lnGR_{t-i}\\ \Delta lnCR_{t-i}\\ \Delta UN_{t-i}\\ \Delta YL_{t-i}\\ \Delta POV_{t-i}\end{bmatrix}$$

$$+ \begin{bmatrix}v_{1,t}\\ v_{2,t}\\ v_{3,t}\\ v_{4,t}\\ v_{5,t}\end{bmatrix} \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots (4.30)$$

From equation 4.30, it means that $lnCR_t$ does Granger-causes UN_t if $\beta_{12i} \neq 0\forall_i$, and UN_t does not Granger-causes $lnCR_t$ if $\beta_{22i} = 0\forall_i$ as it relates to the result model 3A in Table 4.18.

4.6.1 Results of Granger Causality (Overall Crime)

From Table 4.18, the results in model 3A show that a unidirectional causality exists between crime rate and unemployment. The causality ran from crime rate to unemployment at the 1% level of significance and not vice versa. Similar result is obtained by Masih and Masih (1996). This result suggests that unemployment and crime are endogenous as discussed in Section 2.3.1.1. That is, involving in criminal activities may reduce the employability of previous convicted offenders (Halicioglu *et al.*, 2012). Also, the causality between poverty and unemployment indicate a unidirectional one from poverty to unemployment at the 5% level of significance. It tends to imply that many poor household would take up low paid employment to meet up their daily needs (Farias & Farias, 2010). Other variables not included in the table show no directional. For instance, a neutral relationship exists between economic growth and crime, economic growth and unemployment. Similar result of neutral relationship is demonstrated in Chen (2009). The graphical illustration is presented in Figure 4.7.

Table 4.18
Result of Granger causality Toda & Yamamoto test (overall crime)

Model 3A: Socioeconomic strain, Overall Crime and Growth		
H_0	χ^2	**P-Value**
LCR → UN	24.938	0.000***
UN → LCR	2.429	0.657
POV → UN	23.900	0.000***
UN → POV	3.747	0.441

Notes: → indicates the direction of causality, ***, ** and * denote the significance level at 1%, 5% and 10% respectively.

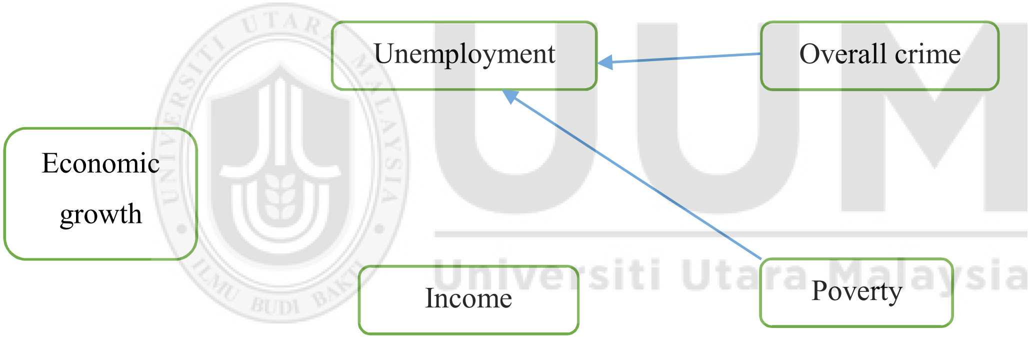


Figure 4.7
Direction of Granger causality (overall crime)

4.6.2 Results of Granger Causality (Person's Crime)

In model 3B, a unidirectional causality exists between person's crime and economic growth at the 10% level of significance presented in Table 4.19. The causality ran from economic growth to person's crime. The result differ from overall crime and economic growth in Section 4.6.1. Besides, this result is contrary to Detotto and Pulina (2010) as their result indicated a unidirectional from crime of homicides to economic growth. But it supports

Hamzam and Lau (2013) on violent crime to economic growth. This tends to confirm the endogenous nature of person's crime and economic growth. Crime is possible to disrupt economic growth and affect people's welfare. As it is also possible that good economy may attract more unemployed people in quest of searching job. Since economic growth Granger-causes unemployment at the 5% which indicate a unidirectional causality from economic growth to unemployment. Further, the aftermath of people searching for job if unable to get the job on time may result to crime. This is seen as unemployment Granger-causes person's crime at the 10% level of significance, it shows a unidirectional causality ran from unemployment to person's crime. Also, income disadvantage Granger-causes person's crime at the 5% level of significance. This shows a unidirectional causality from income disadvantage to person's crime. This result differs from the overall crime. But it confirms that a link exists between income and crime (Halicioglu (2012). Income disadvantage Granger-causes unemployment at 5% level of significance. This shows a unidirectional causality from income disadvantage to unemployment. Poverty Granger-causes unemployment at 1% level of significance and unemployment also Granger-causes poverty at 10% level of significance. This means a bidirectional causality exist between poverty and unemployment. Because unemployed people faces hardship of meeting their consumption needs, at the same time children from household with poverty has low educational attainment which may not provide them better income-employment (Ferguson, Bovaird, & Mueller, 2007 and Farias & Farias, 2010). The person's crime Granger-causes poverty at the 10% as the direction of causality from person's crime to poverty. Justino and Verwimp (2013) affirmed that the aftermath of violence-conflict that engulfed Rwanda in the mid-1990s made some provinces became poorer. As violence of adult death reduced the income per adult being a measure of poverty. Thus, the graphical illustration of causality is presented in Figure 4.8.

Table 4.19

Result of Granger causality Toda & Yamamoto test (person's crime)

Model 3B: Socioeconomic strain, Persons and Economic Growth		
H_0	χ^2	P-Value
$LGR \rightarrow LCPS$	9.179	0.056*
$LCPS \rightarrow LGR$	4.490	0.343
$YL \rightarrow LCPS$	9.673	0.046**
$LCPS \rightarrow YL$	4.681	0.382
$LGR \rightarrow UN$	10.914	0.027**
$UN \rightarrow LGR$	4.367	0.358
$LCPS \rightarrow UN$	2.982	0.567
$UN \rightarrow LCPS$	9.167	0.057*
$YL \rightarrow UN$	11.597	0.020**
$UN \rightarrow YL$	4.682	0.321
$POV \rightarrow UN$	20.895	0.000***
$UN \rightarrow POV$	9.240	0.055*
$LCPS \rightarrow POV$	8.794	0.066*
$POV \rightarrow LCPS$	6.187	0.185

Notes: → indicates the direction of causality, ***, ** and * denote the significance level at 1%, 5% and 10% respectively.

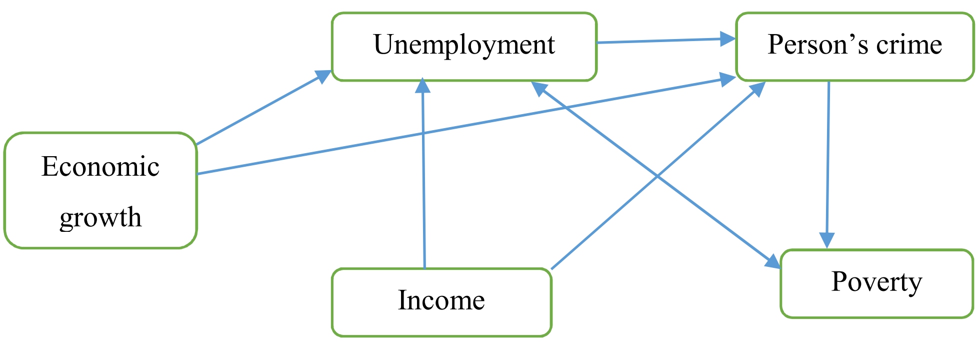


Figure 4.8
Direction of Granger causality (person's crime)

4.6.3 Results of Granger Causality (Property Crime)

Moreover, in Table 4.20, the results in model 3C reveal that economic growth Granger-causes property crime at the 5% level of significance, and the causality ran from economic growth to property crime. Similar result is obtained between person's crime and economic growth. Also, a unidirectional causality exists between income disadvantage and property crime at the 1% level of significance. The causality run from income disadvantage to property crime and it supports previous results in Section 4.6.2. Property crime Granger-causes poverty at the 10% level of significance as the direction run from property crime to poverty. This means destruction and theft of property could result to poverty as demonstrated in Justino and Verwimp (2013). In addition, a unidirection exists between unemployment and poverty at the 5% level of significance, and it runs from unemployment to poverty. Causality result between unemployment and poverty is line with person's crime except that a bidirectional causality obtained in person's crime. Graphical illustration for the causality direction is presented in Figure 4.9

Table 4.20
Result of Granger causality Toda & Yamamoto test (property crime)

Model 3C: Socioeconomic strain, Property and Economic Growth		
H_O	χ^2	P-Value
LGR → LCPR	13.203	0.010**
LCPR → LGR	6.116	0.190
YL → LCPR	13452	0.009***
LCPR → YL	6.174	0.186

LCPR → POV	8.980	0.061*
POV → LCPR	4.573	0.333
UN → POV	8.007	0.091*
POV → UN	6.064	0.194

Note: → indicates the direction of causality, ***, ** and * denote the significance level at 1%, 5% and 10% respectively.

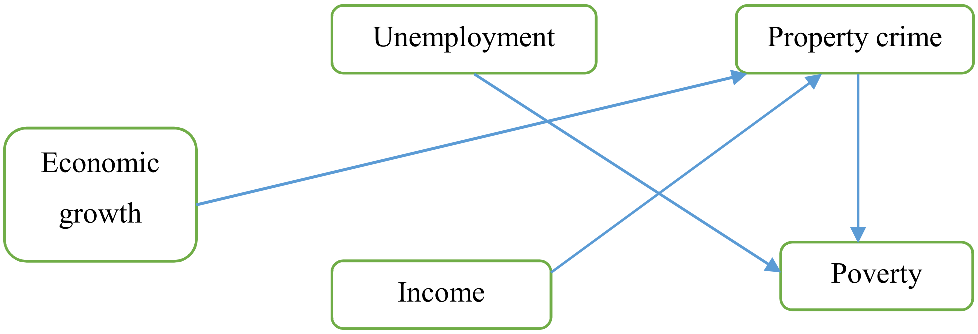


Figure 4.9
Direction of Granger causality (property crime)

Hence, this study showed that at least causality exist between socioeconomic strain, crime and economic growth. The causality between socioeconomic strain and economic growth is presented in Figure 4.8 as economic growth Granger causes unemployment. This connotes that socioeconomic strain affects the growth of the economy indirectly possibly through crime. As socioeconomic strain (unemployment and income disadvantage) Granger causes crime both in Figure 4.8 and 4.9. In a subtle way, poverty affects crime through unemployment (Figure 4.8), and this connotes that causality exist between socioeconomic strain and crime. The causality direction between economic growth and crime informs that a link exist between the two (Figure 4.8 and 4.9). This indicates that, when problem of poor economic growth is dealt with, it will have impact on criminal activities directly and indirectly. The indirect way comes through unemployment, which has links with poverty and income disadvantage. The link between crime and poverty in Figure 4.8 and 4.9 suggest that failure to combat crime due to its adverse affect on economic growth would always bring about poverty.

4.7 Variances Decomposition

The variance decomposition indicate the results of out-of-sample causality tests which cannot be provided within the sampled period offer by Granger causality. Granger causality provides no dynamic indicator and do not permit the known of the relative strength of the Granger-causal degree of causality among variables studied (Mashi & Masih, 1996). This shows variance decomposition provide justification for the result obtain in Granger causality by showing the percentage of the forecast error that is accountable to one variable based on other variables in the VAR model. Also, it explains the impact of a variable on another variable. Likewise, it tells how a variable of concern react to shocks or innovations of other variables which include its own. Thus, the understanding of these shocks based on one variable strength in impacting on another assisted in policy transmission machinery.

Moreover, the results of the variance decomposition in Table 4.21-4.23 indicate various shocks that cause changes in economic growth, crime rate, and socioeconomic strain. Thus, the results validated results in Granger causality in previous section 4.6. Also, Table 4.21-4.23 have three panels with each panel focusing on variance decomposition of economic growth, crime variables, unemployment, income disadvantage and poverty. Further, in Table 4.21-4.23 column one indicate the number of periods, column 2 indicate variables' forecasted error in different horizons' forecast. Also, the remaining columns show the proportion of variance based on specific shocks.

Table 4.21 show the shocks contributed to the distortion in economic growth by overall crime and socioeconomic. The trend of the shocks are similar in Table 4.22 for person's crime except in property crime that has more intensity on economic growth in Table 4.23. For instance, in Table 4.21, periods 2 and 3 show that that the distortion of 96.85% and 95.68% respectively in economic growth comes from economic growth itself. But this distortion reduces in the long run, which is period 10 to 25.31. In the long run, distortion contributed to economic growth increases from by socioeconomic strain and crime. For instance, unemployment contributes the highest distortion to economic growth in the period of 10 by 46.58%. Followed by income disadvantage with 17.52% and overall crime with 8.93% then poverty with 1.64%. At first, the shocks by unemployment and income disadvantage supports their positive effects on crime variables in Section 4.4.

Second, unemployment and income disadvantage shocks on economic growth signify that economic strain causes not only crime but indirectly affects economic growth. Although, crime's shocks in long run (period 10) also increases to 8.93% from 1.93% in period 3. This connotes that as unemployment and income disadvantage problems increase in the country, crime becomes pervasive and further has a negative effect on economic growth.

Third, unemployment and income disadvantage attracts more poverty as they jointly affect person's crime in Section 4.4. Their effect on poverty caused increase in shocks contribute by poverty to economic growth in Table 4.22. The distortion created by poverty increases from 1.61% and 1.171% in period 2 and 3 to 7.21% in period 10 in Table 4.22. More precisely, unemployment and income disadvantage serve as threats to the country in the long run as crime and poverty do. Besides, in Table 4.23 property crime distorts economic growth by

20.12%, which is more than the distortion created by person's crime to economic growth in Table 4.22. Thus, drawing from the shocks provided by socioeconomic strain and crime to economic growth, this suggests inform that, while crime cause economic growth directly, socioeconomic strain indirectly affect economic growth.

Table 4.21
Variance decomposition (Overall Crime)

Variance Decomposition of LGR: Overall Crime						
Period	S.E.	LGR	LCR	UN	YL	POV
1	0.067649	100.0000	0.000000	0.000000	0.000000	0.000000
2	0.099779	96.85906	0.110828	0.380984	1.738989	0.910137
3	0.121664	95.68051	1.939457	0.351099	1.416436	0.612496
4	0.140823	93.70468	3.034745	0.308925	2.171384	0.780267
5	0.158378	87.51309	5.633228	4.459569	1.773986	0.620126
10	0.377778	25.31544	8.934177	46.58003	17.52587	1.644482
Cholesky Ordering: LGR LCR UN YL POV						

Table 4.22
Variance decomposition (Person's Crime)

Variance Decomposition of LGR: Person's Crime						
Period	S.E.	LGR	LCPS	UN	YL	POV
1	0.066943	100.0000	0.000000	0.000000	0.000000	0.000000
2	0.097366	98.23136	0.055433	0.086904	0.008502	1.617803
3	0.119940	95.91179	0.121253	1.489290	0.764508	1.713163
4	0.138009	88.06104	2.351844	1.631647	4.108905	3.846565
5	0.147293	83.79423	2.098818	5.292129	4.064449	4.750376
10	0.417474	38.09229	7.489312	29.70755	17.49575	7.215106
Cholesky Ordering: LGR LCR UN YL POV						

Table 4.23
Variance decomposition (Property Crime)

Variance Decomposition of LGR: Property Crime

Period	S.E.	LGR	LCPR	UN	YL	POV
1	0.063083	100.0000	0.000000	0.000000	0.000000	0.000000
2	0.093091	91.15399	2.690515	1.651714	2.416428	2.087358
3	0.111847	88.02349	5.986964	1.147710	1.781634	3.060205
4	0.127813	87.33329	4.908659	0.999473	1.401823	5.356751
5	0.147275	78.90924	3.963402	9.647770	1.662026	5.817560
10	0.328569	29.27508	20.12230	36.78382	12.25949	1.559300
Cholesky Ordering: LGR LCR UN YL POV						

4.8 Overview of the Chapter

In this chapter, this study demonstrates that non-stationary variables are made stationary through the unit root tests of ADF and PP. Upon the results of the unit root tests, the ARDL cointegration technique was found suitable to examine and determine the joint movement of these variables investigated in this study. In addition to the cointegration test, the long-run estimates are established and became more robust with different diagnostic tests conducted. The diagnostic test further proved that long-run estimates were stable over time and thus, which is good for policy suggestions. Also, the dynamic version of the ARDL model was identified and demonstrated to indicate the short run estimates in the models. Moreover, the error correction coefficients shown were based on the ECM part of the ARDL models. The error correction models indicated the feedback mechanism, which restores the models back to equilibrium due to deviation in the models. Models are found to restore to equilibrium appropriate over the following year based on the negative coefficients of the ECM. However, to detect the causality direction between variables, the Toda-Yamamoto modified Wald test approach to Granger causality was used. In addition, to overcome the shortcomings in the causality tests, the variance decomposition tool was used to provide each variable's contribution while in determining others and itself.

CHAPTER FIVE

SUMMARY OF FINDINGS, POLICY IMPLICATIONS AND CONCLUSION

5.1 Introduction

This chapter presents a summary of the major findings in the study, conclusion and recommendations/policy implications. In addition, areas for further studies are suggested, and a discussion of the limitations to the study included. Three objectives were examined to determine the causation and causal direction between socioeconomic strain, crime and economic growth. These objectives were 1) to determine the effect of socioeconomic strain on crime, 2) to determine the effect of crime on economic growth, and 3) to ascertain the nature of causality between socioeconomic strain, crime and economic growth. Also, the direction of this study follows the research framework in Baharom *et al.* (2013).

5.2 Summary of Findings

In the first objective, this study found that socioeconomic strain relates to crime and its determination in Nigeria. That is, socioeconomic strain variables are positive and significant to crime in the long run. This is because 1) unemployment is positive and significant to crime through person's crime and property crime, 2) income disadvantage in the country is positive and significant to crime, and 3) poverty is positive and significant to crime through person's crime. Also, family instability is positive and significant to property crime in the long run. The deterrence variable, which is security expenditure, adversely affects crime in the long run.

Second, the consequences of criminal activities were examined on economic growth. In this part, the study found that crime is significant and adversely affects economic growth in the country. Investment, education, transport and communication, and utilities have positive and significant impacts on economic growth. While investment impacts on growth are noticed in growth-property crime model, education and utilities impact on growth in all growth models. Agriculture impacts on economic growth are observed in growth-crime disaggregated models. Transport and communication impacts are high on economic growth when overall crime is considered. Thus, various investments in education, agriculture, transport and communication, and utilities observed are positive and significant to economic growth.

The third objective was examined through Granger causality. Here, economic growth Granger-cause socioeconomic strain through unemployment, and economic growth Granger-causes crime through person's crime and property crime. Moreover, socioeconomic strain Granger-causes crime through unemployment and income disadvantage. A bidirectional causality exists between unemployment and poverty as income disadvantage Granger–causes unemployment. Besides, an indirect link exists from economic growth to poverty through crime.

The results in objective 1 to 3 above are validated with the shock of variability in the variance decomposition. Thus, unemployment, income disadvantage and poverty have high shock impacts on economic growth in the long term. Among these socioeconomic strains, unemployment has the largest shocks that cause distortion to economic growth. Also, shocks contributed to economic growth by crime is larger in the long run than in the short run as the shocks caused by economic growth within itself reduces in the long period.

5.3 Conclusion

The determinant-effect approach to crime in Nigeria from 1970 to 2013 supports the postulations of social disorganisation theory, strain theory and rational choice theory and other empirical evidences. That socioeconomic strain of frustration and stress inflicted on citizens encourage criminal activities. The socioeconomic strain manifested in the form of high unemployment, income disadvantage and poverty. Besides, criminal activities contributed to poor economic growth because crime reduces standards of living and diverts funds from developmental programs. As billions of Naira are stolen or consumed through crime, additional monies are needed to combat crime and remedy the resulting consequences. Also, it is thus observed that public security expenditure as a deterrence variable is effective in reducing crime in the country. But, security institutions suffer from lack of modern equipment, accountability, low fact gathering capability, sabotages and pitiable working environments (Otu, 2012 and Ojedokun, 2014). In respective of the problems confronting deterrence/security institutions, this study believes that investment in other sectors of the economy as identified in this study should be used to complement efforts of deterrence/security institutions to reduce crime. There are high possibilities that if the socioeconomic environment is improved through investment (on education, agriculture, transportation and communication and utilities), deterrence policy would work more effectively. Therefore, a policy that would improve economic growth would reduce crime in the country.

5.4 Policy Recommendations

This study establishes that unemployment, income disadvantage and poverty as socioeconomic strains having negative influences on the country. Due to the negative role played by socioeconomic strain variables, economic growth was adversely affected by crime occurrence. Thus, curbing crime with deterrence policies without addressing how to reduce the problem of unemployment, income disadvantage and poverty would be less effective and a waste of resources. These would amount to a waste of resources because criminal activities would continue to increase because of poor economic growth in the country. Moreover, it is most likely that effort to enhance economic growth through various investment policies if properly channelled, would address and resolve the problem of socioeconomic strain in the country. Thus, to promote the ultimate goals of welfare through economic growth in Nigeria, the following are recommended:

First, investment projects that could enhance knowledge and skill acquisition through education would not only reduce the number of illiterate, but prepare the future working population for better employment income. With the hope of better employment-income, the opportunity cost of crime would be increased. Fiscal policy in the annual budget should give more priority to education through investments for educational infrastructures and facilities. Boosting the level of education would ensure that opportunity costs of crime are increased in the country.

Second, complementing with education is a viable investment in agriculture. Knowledge and skill relating to agriculture should be emphasised. With agricultural education and investment in agriculture, large future population employment can be guarantee. This would not only guarantee jobs but also boost the income level both at individual and national level. Output in agriculture would be used in diversifying the economy. Inputs would aid the manufacturing sector and boost exports capacity to improve the economy reserve and foreign exchange. Also, the problem of food insecurity would be reduced as people would have cheaper access to daily food and nutrition. Thereby, poverty of hunger and malnutrition would be minimised – a situation that would reduce stress and increase the opportunity costs of crime.

Third, investment in viable transportation and communication is required to move the country from poor growth as transportation would ease the linkage of rural area to urban area. It would afford easy flow of agricultural output to urban for consumption and for export use. Once farm producers had better markets for their products, they would up farming production. And, rural-urban migration would be reduced because they have jobs to do in the rural area. On the side of communication, adequate information would be disseminated to farmers on modern farming techniques once they are equipped with the necessary skills and knowledge. Of course, employment-income can also be guaranteed through transportation and communication.

Fourth, sound investment in utilities that embraces the electricity and water supply would improve the life of the citizens and thereby enhance economic growth. Utilities would serve as input-boost capacity to manufacturing and keep the existing manufacturing company in production. With electricity, new manufacturing investors would come in to invest their capital in the country because the cost of production would be reduced. That means that employment-income would be guaranteed for the large population. Better existence of utilities would discourage rural-urban migration because utilities would assist them in their farming production via an improved rural life. Also, the establishment new industries could be encouraged in rural areas via a tax-holiday. This venture would boost employment-income in the rural area in addition to the farming job. Thus, the desire to engage in criminal activities would be reduced once this are achieved.

Fifth, this study recognises the role played by the government in using security expenditures through the police and other crime agencies to deter crime. Security expenditure has a long-term effect in reducing crime. But it would be more effective if it is complemented with investments in those aforementioned sectors because a sound transportation and communication system would help security officers fight crime. Investment made on modern equipment and facilities would put the police ahead of the criminals by making early detection of criminal activities. The employment-income provided through agriculture would create better emotional satisfaction for the people, thereby, exposing them to little or no strain conditions like frustration, stress and anger. A situation that would give lessen the job of the security officers as opportunity costs to crime would increase in society. Thus, crime cases would be prosecuted, and justice would be dispensed promptly without delay. This would help to decongest the system and consequently encourage cost-savings measures

5.5 Limitations of the Study

Crime records in Nigeria are deficient due to low reports on crime. Where crime are reported and documented, there is a low rate of accessibility to the crime statistics. These problems have constrained many previous studies on crime in Nigeria. The problem with respect crime data is not peculiar just to Nigeria but also in other countries as noted in Mauro and Carmeci (2007) and Wu and Wu (2012). However, this study overcame the problem by relying on data from the Nigeria Bureau of Statistics, and complement it with data sourced from The Nigeria Police. Given this, a crime against local acts could not be examined as others due to the number of year's available.

5.6 Suggestions for Further Research

This study considers the annual time series to examine socioeconomic strain, crime and economic growth based on available data. Future studies should examine these variables using national disaggregated data whenever such is available in the country. Such research work should concentrate on the approach used in Pan *et al.* (2012).

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APPENDIX

Appendix A Results of the Unit Roots

Null Hypothesis: LCR has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		0.236669	0.9719
Test critical values:	1% level	-3.592462	
	5% level	-2.931404	
	10% level	-2.603944	

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

Null Hypothesis: LCR has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.344902	0.4019
Test critical values:	1% level	-4.186481	
	5% level	-3.518090	
	10% level	-3.189732	

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

Null Hypothesis: D(LCR) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-6.738864	0.0000
Test critical values:	1% level	-3.596616	
	5% level	-2.933158	
	10% level	-2.604867	

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

Null Hypothesis: D(LCR) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-7.013627	0.0000
Test critical values:	1% level	-4.192337	
	5% level	-3.520787	
	10% level	-3.191277	

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

Null Hypothesis: LCR has a unit root
Exogenous: Constant
Bandwidth: 1 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		0.286473	0.9749
Test critical values:	1% level	-3.592462	
	5% level	-2.931404	
	10% level	-2.603944	

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

Null Hypothesis: LCR has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 2 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-2.325077	0.4120
Test critical values:	1% level	-4.186481	
	5% level	-3.518090	
	10% level	-3.189732	

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

Null Hypothesis: D(LCR) has a unit root
Exogenous: Constant
Bandwidth: 2 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-6.754091	0.0000
Test critical values:	1% level	-3.596616	
	5% level	-2.933158	
	10% level	-2.604867	

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

Null Hypothesis: D(LCR) has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 6 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-7.442077	0.0000
Test critical values:	1% level	-4.192337	
	5% level	-3.520787	
	10% level	-3.191277	

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

Null Hypothesis: LCPS has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.921721	0.0511
Test critical values:	1% level	-3.592462	
	5% level	-2.931404	
	10% level	-2.603944	

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

Null Hypothesis: LCPS has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.901281	0.1722
Test critical values:	1% level	-4.186481	
	5% level	-3.518090	
	10% level	-3.189732	

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

Null Hypothesis: D(LCPS) has a unit root
Exogenous: Constant
Lag Length: 1 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-7.374330	0.0000
Test critical values:	1% level	-3.600987	
	5% level	-2.935001	
	10% level	-2.605836	

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

Null Hypothesis: D(LCPS) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 1 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-7.789977	0.0000
Test critical values:	1% level	-4.198503	
	5% level	-3.523623	
	10% level	-3.192902	

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

Null Hypothesis: LCPS has a unit root
Exogenous: Constant
Bandwidth: 3 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-2.804626	0.0660
Test critical values:	1% level	-3.592462	
	5% level	-2.931404	
	10% level	-2.603944	

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

Null Hypothesis: LCPS has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 3 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-2.740203	0.2265
Test critical values:	1% level	-4.186481	
	5% level	-3.518090	
	10% level	-3.189732	

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

Null Hypothesis: D(LCPS) has a unit root
Exogenous: Constant
Bandwidth: 5 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-10.91754	0.0000
Test critical values:	1% level	-3.596616	
	5% level	-2.933158	
	10% level	-2.604867	

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

Null Hypothesis: D(LCPS) has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 9 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-13.96745	0.0000
Test critical values:	1% level	-4.192337	
	5% level	-3.520787	
	10% level	-3.191277	

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

Null Hypothesis: LCPR has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-1.662921	0.4425
Test critical values:	1% level	-3.592462	
	5% level	-2.931404	
	10% level	-2.603944	

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

Null Hypothesis: LCPR has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.186992	0.1005
Test critical values:	1% level	-4.186481	
	5% level	-3.518090	
	10% level	-3.189732	

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

Null Hypothesis: D(LCPR) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-8.801981	0.0000
Test critical values:	1% level	-3.596616	
	5% level	-2.933158	
	10% level	-2.604867	

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

Null Hypothesis: D(LCPR) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-8.760698	0.0000
Test critical values:	1% level	-4.192337	
	5% level	-3.520787	
	10% level	-3.191277	

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

Null Hypothesis: LCPR has a unit root
Exogenous: Constant
Bandwidth: 3 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-1.470707	0.5387
Test critical values:	1% level	-3.592462	
	5% level	-2.931404	
	10% level	-2.603944	

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

Null Hypothesis: LCPR has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 3 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-3.114690	0.1159
Test critical values:	1% level	-4.186481	
	5% level	-3.518090	
	10% level	-3.189732	

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

Null Hypothesis: D(LCPR) has a unit root
Exogenous: Constant
Bandwidth: 0 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-8.801981	0.0000
Test critical values:	1% level	-3.596616	
	5% level	-2.933158	
	10% level	-2.604867	

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

Null Hypothesis: D(LCPR) has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 1 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-8.848188	0.0000
Test critical values:	1% level	-4.192337	
	5% level	-3.520787	
	10% level	-3.191277	

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

Null Hypothesis: UN has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.255681	0.1906
Test critical values:	1% level	-3.592462	
	5% level	-2.931404	
	10% level	-2.603944	

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

Null Hypothesis: UN has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.905201	0.1710
Test critical values:	1% level	-4.186481	
	5% level	-3.518090	
	10% level	-3.189732	

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

Null Hypothesis: D(UN) has a unit root
Exogenous: Constant
Lag Length: 1 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-6.605361	0.0000
Test critical values:	1% level	-3.600987	
	5% level	-2.935001	
	10% level	-2.605836	

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

Null Hypothesis: D(UN) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 1 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-6.517855	0.0000
Test critical values:	1% level	-4.198503	
	5% level	-3.523623	
	10% level	-3.192902	

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

Null Hypothesis: UN has a unit root
Exogenous: Constant
Bandwidth: 1 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-2.226587	0.2002
Test critical values:	1% level	-3.592462	
	5% level	-2.931404	
	10% level	-2.603944	

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

Null Hypothesis: UN has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 2 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-2.814636	0.2001
Test critical values:	1% level	-4.186481	
	5% level	-3.518090	
	10% level	-3.189732	

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

Null Hypothesis: D(UN) has a unit root
Exogenous: Constant
Bandwidth: 6 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-7.926509	0.0000
Test critical values:	1% level	-3.596616	
	5% level	-2.933158	
	10% level	-2.604867	

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

Null Hypothesis: D(UN) has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 6 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-7.824359	0.0000
Test critical values:	1% level	-4.192337	
	5% level	-3.520787	
	10% level	-3.191277	

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

Null Hypothesis: YL has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-0.201213	0.9305
Test critical values:	1% level	-3.592462	
	5% level	-2.931404	
	10% level	-2.603944	

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

Null Hypothesis: YL has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-0.293056	0.9884
Test critical values:	1% level	-4.186481	
	5% level	-3.518090	
	10% level	-3.189732	

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

Null Hypothesis: D(YL) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.553926	0.0000
Test critical values:	1% level	-3.596616	
	5% level	-2.933158	
	10% level	-2.604867	

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

Null Hypothesis: D(YL) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-6.015278	0.0001
Test critical values:	1% level	-4.192337	
	5% level	-3.520787	
	10% level	-3.191277	

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

Null Hypothesis: YL has a unit root
Exogenous: Constant
Bandwidth: 4 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-0.645581	0.8494
Test critical values:	1% level	-3.592462	
	5% level	-2.931404	
	10% level	-2.603944	

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

Null Hypothesis: YL has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 3 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-0.493253	0.9801
Test critical values:	1% level	-4.186481	
	5% level	-3.518090	
	10% level	-3.189732	

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

Null Hypothesis: D(YL) has a unit root
Exogenous: Constant
Bandwidth: 4 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-5.634397	0.0000
Test critical values:	1% level	-3.596616	
	5% level	-2.933158	
	10% level	-2.604867	

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

Null Hypothesis: D(YL) has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 2 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-6.014658	0.0001
Test critical values:	1% level	-4.192337	
	5% level	-3.520787	
	10% level	-3.191277	

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

Null Hypothesis: POV has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-1.678378	0.4348
Test critical values:	1% level	-3.592462	
	5% level	-2.931404	
	10% level	-2.603944	

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

Null Hypothesis: POV has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.477514	0.3371
Test critical values:	1% level	-4.186481	
	5% level	-3.518090	
	10% level	-3.189732	

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

Null Hypothesis: D(POV) has a unit root
Exogenous: Constant
Lag Length: 2 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-6.375413	0.0000
Test critical values:	1% level	-3.605593	
	5% level	-2.936942	
	10% level	-2.606857	

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

Null Hypothesis: D(POV) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 2 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-6.597191	0.0000
Test critical values:	1% level	-4.205004	
	5% level	-3.526609	
	10% level	-3.194611	

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

Null Hypothesis: POV has a unit root
Exogenous: Constant
Bandwidth: 13 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-1.863534	0.3459
Test critical values:	1% level	-3.592462	
	5% level	-2.931404	
	10% level	-2.603944	

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

Null Hypothesis: POV has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 9 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-2.559173	0.3000
Test critical values:	1% level	-4.186481	
	5% level	-3.518090	
	10% level	-3.189732	

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

Null Hypothesis: D(POV) has a unit root
Exogenous: Constant
Bandwidth: 21 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-9.254966	0.0000
Test critical values:	1% level	-3.596616	
	5% level	-2.933158	
	10% level	-2.604867	

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

Null Hypothesis: D(POV) has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 18 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-11.22431	0.0000
Test critical values:	1% level	-4.192337	
	5% level	-3.520787	
	10% level	-3.191277	

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

Null Hypothesis: FI has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-1.700160	0.4240
Test critical values:	1% level	-3.592462	
	5% level	-2.931404	
	10% level	-2.603944	

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

Null Hypothesis: FI has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.169084	0.4940
Test critical values:	1% level	-4.186481	
	5% level	-3.518090	
	10% level	-3.189732	

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

Null Hypothesis: D(FI) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-6.375356	0.0000
Test critical values:	1% level	-3.596616	
	5% level	-2.933158	
	10% level	-2.604867	

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

Null Hypothesis: D(FI) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-6.295777	0.0000
Test critical values:	1% level	-4.192337	
	5% level	-3.520787	
	10% level	-3.191277	

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

Null Hypothesis: FI has a unit root
Exogenous: Constant
Bandwidth: 2 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-1.784594	0.3830
Test critical values:	1% level	-3.592462	
	5% level	-2.931404	
	10% level	-2.603944	

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

Null Hypothesis: FI has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 2 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-2.308711	0.4204
Test critical values:	1% level	-4.186481	
	5% level	-3.518090	
	10% level	-3.189732	

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

Null Hypothesis: D(FI) has a unit root
Exogenous: Constant
Bandwidth: 0 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-6.375356	0.0000
Test critical values:	1% level	-3.596616	
	5% level	-2.933158	
	10% level	-2.604867	

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

Null Hypothesis: D(FI) has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 0 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-6.295777	0.0000
Test critical values:	1% level	-4.192337	
	5% level	-3.520787	
	10% level	-3.191277	

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

Null Hypothesis: LPES has a unit root
Exogenous: Constant
Lag Length: 1 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		0.178468	0.9679
Test critical values:	1% level	-3.596616	
	5% level	-2.933158	
	10% level	-2.604867	

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

Null Hypothesis: LPES has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 1 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-1.989842	0.5898
Test critical values:	1% level	-4.192337	
	5% level	-3.520787	
	10% level	-3.191277	

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

Null Hypothesis: D(LPES) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-6.904557	0.0000
Test critical values:	1% level	-3.596616	
	5% level	-2.933158	
	10% level	-2.604867	

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

Null Hypothesis: D(LPES) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-6.909892	0.0000
Test critical values:	1% level	-4.192337	

	5% level	-3.520787	
	10% level	-3.191277	

*MacKinnon (1996) one-sided p-values.
Null Hypothesis: LPES has a unit root
Exogenous: Constant
Bandwidth: 5 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		0.461616	0.9833
Test critical values:	1% level	-3.592462	
	5% level	-2.931404	
	10% level	-2.603944	

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

Null Hypothesis: LPES has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 4 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-2.303607	0.4231
Test critical values:	1% level	-4.186481	
	5% level	-3.518090	
	10% level	-3.189732	

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

Null Hypothesis: D(LPES) has a unit root
Exogenous: Constant
Bandwidth: 4 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-6.995614	0.0000
Test critical values:	1% level	-3.596616	
	5% level	-2.933158	
	10% level	-2.604867	

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

Null Hypothesis: D(LPES) has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 7 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-7.037468	0.0000
Test critical values:	1% level	-4.192337	
	5% level	-3.520787	
	10% level	-3.191277	

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

Null Hypothesis: LGR has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		1.189025	0.9976
Test critical values:	1% level	-3.592462	
	5% level	-2.931404	
	10% level	-2.603944	

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

Null Hypothesis: LGR has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-0.258469	0.9894
Test critical values:	1% level	-4.186481	
	5% level	-3.518090	
	10% level	-3.189732	

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

Null Hypothesis: D(LGR) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.595435	0.0000
Test critical values:	1% level	-3.596616	
	5% level	-2.933158	
	10% level	-2.604867	

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

Null Hypothesis: D(LGR) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-6.065733	0.0000
Test critical values:	1% level	-4.192337	
	5% level	-3.520787	
	10% level	-3.191277	

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

Null Hypothesis: LGR has a unit root
Exogenous: Constant
Bandwidth: 3 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		0.961606	0.9954
Test critical values:	1% level	-3.592462	
	5% level	-2.931404	
	10% level	-2.603944	

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

Null Hypothesis: LGR has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 3 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-0.458782	0.9819
Test critical values:	1% level	-4.186481	
	5% level	-3.518090	
	10% level	-3.189732	

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

Null Hypothesis: D(LGR) has a unit root
Exogenous: Constant
Bandwidth: 4 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-5.682045	0.0000
Test critical values:	1% level	-3.596616	
	5% level	-2.933158	
	10% level	-2.604867	

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

Null Hypothesis: D(LGR) has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 2 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-6.066419	0.0000
Test critical values:	1% level	-4.192337	
	5% level	-3.520787	
	10% level	-3.191277	

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

Null Hypothesis: TIV has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.040122	0.2693
Test critical values:	1% level	-3.592462	
	5% level	-2.931404	
	10% level	-2.603944	

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

Null Hypothesis: TIV has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.288414	0.4310
Test critical values:	1% level	-4.186481	
	5% level	-3.518090	
	10% level	-3.189732	

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

Null Hypothesis: D(TIV) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.819041	0.0000
Test critical values:	1% level	-3.596616	
	5% level	-2.933158	
	10% level	-2.604867	

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

Null Hypothesis: D(TIV) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 1 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.912896	0.0001
Test critical values:	1% level	-4.198503	
	5% level	-3.523623	
	10% level	-3.192902	

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

Null Hypothesis: TIV has a unit root
Exogenous: Constant
Bandwidth: 5 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-2.020528	0.2773
Test critical values:	1% level	-3.592462	
	5% level	-2.931404	
	10% level	-2.603944	

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

Null Hypothesis: TIV has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 3 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-2.311921	0.4188
Test critical values:	1% level	-4.186481	
	5% level	-3.518090	
	10% level	-3.189732	

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

Null Hypothesis: D(TIV) has a unit root
Exogenous: Constant
Bandwidth: 15 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-6.958966	0.0000
Test critical values:	1% level	-3.596616	
	5% level	-2.933158	
	10% level	-2.604867	

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

Null Hypothesis: D(TIV) has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 16 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-7.971392	0.0000
Test critical values:	1% level	-4.192337	
	5% level	-3.520787	
	10% level	-3.191277	

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

Null Hypothesis: EIV has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		1.005262	0.9960
Test critical values:	1% level	-3.592462	
	5% level	-2.931404	
	10% level	-2.603944	

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

Null Hypothesis: EIV has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-1.090796	0.9189
Test critical values:	1% level	-4.186481	
	5% level	-3.518090	
	10% level	-3.189732	

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

Null Hypothesis: D(EIV) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-6.298967	0.0000
Test critical values:	1% level	-3.596616	
	5% level	-2.933158	
	10% level	-2.604867	

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

Null Hypothesis: D(EIV) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 3 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.231825	0.0007
Test critical values:	1% level	-4.211868	
	5% level	-3.529758	
	10% level	-3.196411	

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

Null Hypothesis: EIV has a unit root
Exogenous: Constant
Bandwidth: 28 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		2.584936	1.0000
Test critical values:	1% level	-3.592462	
	5% level	-2.931404	
	10% level	-2.603944	

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

Null Hypothesis: EIV has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 30 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		0.170264	0.9970
Test critical values:	1% level	-4.186481	
	5% level	-3.518090	
	10% level	-3.189732	

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

Null Hypothesis: D(EIV) has a unit root
Exogenous: Constant
Bandwidth: 11 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-6.299767	0.0000
Test critical values:	1% level	-3.596616	
	5% level	-2.933158	
	10% level	-2.604867	

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

Null Hypothesis: D(EIV) has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 18 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-10.47724	0.0000
Test critical values:	1% level	-4.192337	
	5% level	-3.520787	
	10% level	-3.191277	

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

Null Hypothesis: LAG has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		0.465572	0.9835
Test critical values:	1% level	-3.592462	
	5% level	-2.931404	
	10% level	-2.603944	

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

Null Hypothesis: LAG has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.578765	0.2914
Test critical values:	1% level	-4.186481	
	5% level	-3.518090	
	10% level	-3.189732	

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

Null Hypothesis: D(LAG) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-6.526260	0.0000
Test critical values:	1% level	-3.596616	
	5% level	-2.933158	
	10% level	-2.604867	

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

Null Hypothesis: D(LAG) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-6.648230	0.0000
Test critical values:	1% level	-4.192337	
	5% level	-3.520787	
	10% level	-3.191277	

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

Null Hypothesis: LAG has a unit root
Exogenous: Constant
Bandwidth: 8 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		1.054830	0.9965
Test critical values:	1% level	-3.592462	
	5% level	-2.931404	
	10% level	-2.603944	

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

Null Hypothesis: LAG has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 3 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-2.546574	0.3055
Test critical values:	1% level	-4.186481	
	5% level	-3.518090	
	10% level	-3.189732	

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

Null Hypothesis: D(LAG) has a unit root
Exogenous: Constant
Bandwidth: 5 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-6.588424	0.0000
Test critical values:	1% level	-3.596616	
	5% level	-2.933158	
	10% level	-2.604867	

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

Null Hypothesis: D(LAG) has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 9 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-7.294648	0.0000
Test critical values:	1% level	-4.192337	
	5% level	-3.520787	
	10% level	-3.191277	

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

Null Hypothesis: TRC has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-0.750290	0.8228
Test critical values:	1% level	-3.592462	
	5% level	-2.931404	
	10% level	-2.603944	

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

Null Hypothesis: TRC has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 4 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		1.059442	0.9999
Test critical values:	1% level	-4.211868	
	5% level	-3.529758	
	10% level	-3.196411	

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

Null Hypothesis: D(TRC) has a unit root
Exogenous: Constant
Lag Length: 3 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.967052	0.0002
Test critical values:	1% level	-3.610453	
	5% level	-2.938987	
	10% level	-2.607932	

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

Null Hypothesis: D(TRC) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 3 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.573788	0.0002
Test critical values:	1% level	-4.211868	
	5% level	-3.529758	
	10% level	-3.196411	

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

Null Hypothesis: TRC has a unit root
Exogenous: Constant
Bandwidth: 1 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-0.769171	0.8176
Test critical values:	1% level	-3.592462	
	5% level	-2.931404	
	10% level	-2.603944	

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

Null Hypothesis: TRC has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 1 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-1.386659	0.8509
Test critical values:	1% level	-4.186481	
	5% level	-3.518090	
	10% level	-3.189732	

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

Null Hypothesis: D(TRC) has a unit root
Exogenous: Constant
Bandwidth: 2 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-6.705334	0.0000
Test critical values:	1% level	-3.596616	
	5% level	-2.933158	
	10% level	-2.604867	

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

Null Hypothesis: D(TRC) has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 6 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-7.303136	0.0000
Test critical values:	1% level	-4.192337	
	5% level	-3.520787	
	10% level	-3.191277	

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

Null Hypothesis: UT has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.074129	0.2557
Test critical values:	1% level	-3.592462	
	5% level	-2.931404	
	10% level	-2.603944	

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

Null Hypothesis: UT has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-1.901960	0.6362
Test critical values:	1% level	-4.186481	
	5% level	-3.518090	
	10% level	-3.189732	

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

Null Hypothesis: D(UT) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-6.069346	0.0000
Test critical values:	1% level	-3.596616	
	5% level	-2.933158	
	10% level	-2.604867	

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

Null Hypothesis: D(UT) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-6.056631	0.0001
Test critical values:	1% level	-4.192337	
	5% level	-3.520787	
	10% level	-3.191277	

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

Null Hypothesis: UT has a unit root
Exogenous: Constant
Bandwidth: 1 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-2.176922	0.2173
Test critical values:	1% level	-3.592462	
	5% level	-2.931404	
	10% level	-2.603944	

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

Null Hypothesis: UT has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 1 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-2.029634	0.5690
Test critical values:	1% level	-4.186481	
	5% level	-3.518090	
	10% level	-3.189732	

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

Null Hypothesis: D(UT) has a unit root
Exogenous: Constant
Bandwidth: 1 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-6.069681	0.0000
Test critical values:	1% level	-3.596616	
	5% level	-2.933158	
	10% level	-2.604867	

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

Null Hypothesis: D(UT) has a unit root
Exogenous: Constant, Linear Trend
Bandwidth: 2 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-6.067096	0.0000
Test critical values:	1% level	-4.192337	
	5% level	-3.520787	
	10% level	-3.191277	

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

Appendix B Results on Exogeneity (Overall Crime Model 1A)

Dependent Variable: LCR
Method: Least Squares
Date: 06/14/17 Time: 13:07
Sample (adjusted): 1972 2013
Included observations: 42 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-189.2352	140.5806	-1.346097	0.1908
LCR(-1)	37.91783	27.54406	1.376625	0.1813
LCR(-2)	-3.715579	2.507938	-1.481527	0.1515
UN	-0.764473	0.587664	-1.300869	0.2057
UN(-1)	2.382447	1.773712	1.343198	0.1918
YL	317.4935	234.0454	1.356547	0.1875
YL(-1)	-364.8924	269.5043	-1.353939	0.1884
POV	23.97818	17.71258	1.353737	0.1884
POV(-1)	9.834905	7.356099	1.336973	0.1938
FI	-35.34591	26.24893	-1.346566	0.1907
FI(-1)	32.52594	24.06313	1.351692	0.1891
LPES	25.49598	18.89562	1.349306	0.1898
LPES(-1)	-15.91915	11.70182	-1.360399	0.1863
RUN	0.759659	0.587764	1.292456	0.2085
RYL	-316.9841	234.0461	-1.354366	0.1882
RPOV	-23.80491	17.71377	-1.343864	0.1916
RFI	35.61288	26.24911	1.356728	0.1875
RLPES	-25.59220	18.89570	-1.354393	0.1882

R-squared	0.976751	Mean dependent var	5.302644
Adjusted R-squared	0.960283	S.D. dependent var	0.637433
S.E. of regression	0.127035	Akaike info criterion	-0.991174
Sum squared resid	0.387312	Schwarz criterion	-0.246458
Log likelihood	38.81465	Hannan-Quinn criter.	-0.718206
F-statistic	59.31140	Durbin-Watson stat	2.042431
Prob(F-statistic)	0.000000		

Wald Test:
Equation: Untitled

Test Statistic	Value	df	Probability
F-statistic	1.033632	(5, 24)	0.4206
Chi-square	5.168159	5	0.3957

Null Hypothesis: C(14)= C(15)=C(16)=C(17)= C(18)=0
Null Hypothesis Summary:

Normalized Restriction (= 0)	Value	Std. Err.
C(14)	0.759659	0.587764
C(15)	-316.9841	234.0461
C(16)	-23.80491	17.71377
C(17)	35.61288	26.24911
C(18)	-25.59220	18.89570

Restrictions are linear in coefficients.

Appendix C Results on Exogeneity (Persons' Crime Model 1B)

Method: Least Squares
Date: 06/16/17 Time: 11:23
Sample (adjusted): 1972 2013
Included observations: 42 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-33.15578	30.62853	-1.082513	0.2898
LCPS(-1)	-0.254143	0.920494	-0.276094	0.7848
LCPS(-2)	-0.397347	0.738187	-0.538274	0.5953
UN	0.014961	0.109219	0.136983	0.8922
UN(-1)	0.105591	0.184037	0.573748	0.5715
YL	1.755458	11.43968	0.153453	0.8793
YL(-1)	-1.696455	12.74915	-0.133064	0.8953
POV	4.222935	5.099115	0.828170	0.4157
POV(-1)	-0.292445	1.051680	-0.278075	0.7833
FI	0.685102	1.312920	0.521815	0.6066
FI(-1)	0.209379	0.883155	0.237080	0.8146
LPES	2.098059	3.559520	0.589422	0.5611
LPES(-1)	-1.909500	3.249619	-0.587607	0.5623
RUN4	0.044203	0.113778	0.388498	0.7011
RYL4	1.260564	11.53213	0.109309	0.9139
RPOV4	-3.819672	5.130915	-0.744443	0.4638
RFI4	-0.558094	1.340528	-0.416324	0.6809
RLPES4	-2.050574	3.561932	-0.575692	0.5702

R-squared	0.737421	Mean dependent var	3.216745
Adjusted R-squared	0.551428	S.D. dependent var	0.489067
S.E. of regression	0.327555	Akaike info criterion	0.903207
Sum squared resid	2.575019	Schwarz criterion	1.647923
Log likelihood	-0.967350	Hannan-Quinn criter.	1.176175
F-statistic	3.964776	Durbin-Watson stat	1.921244
Prob(F-statistic)	0.001095		

Wald Test:
Equation: Untitled

Test Statistic	Value	df	Probability
F-statistic	0.322465	(5, 24)	0.8945
Chi-square	1.612326	5	0.8998

Null Hypothesis: C(14)=C(15)=C(16)=C(17)=C(18)=0
Null Hypothesis Summary:

Normalized Restriction (= 0)	Value	Std. Err.
C(14)	0.044203	0.113778
C(15)	1.260564	11.53213
C(16)	-3.819672	5.130915
C(17)	-0.558094	1.340528
C(18)	-2.050574	3.561932

Restrictions are linear in coefficients.

Appendix D Results on Exogeneity (Property Crime Model 1C)

Dependent Variable: LCPR
Method: Least Squares
Date: 06/14/17 Time: 13:17
Sample (adjusted): 1972 2013
Included observations: 42 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-3.752167	18.16512	-0.206559	0.8381
LCPR(-1)	-0.059225	0.381832	-0.155107	0.8780
LCPR(-2)	0.072090	0.248150	0.290508	0.7739
UN	0.076882	0.056745	1.354869	0.1881
UN(-1)	-0.042789	0.125844	-0.340012	0.7368
YL	-9.890412	14.25695	-0.693725	0.4945
YL(-1)	10.01215	15.72318	0.636776	0.5303
POV	1.890854	3.535059	0.534886	0.5976
POV(-1)	-1.110551	0.915111	-1.213570	0.2367
FI	0.848699	0.941033	0.901880	0.3761
FI(-1)	-0.285930	1.390489	-0.205633	0.8388
LPES	-0.663090	1.353047	-0.490072	0.6285
LPES(-1)	0.463506	1.203648	0.385084	0.7036
RUN3	-0.033463	0.060806	-0.550330	0.5872
RYL3	12.59274	14.30979	0.880009	0.3876
RPOV3	-1.749488	3.565500	-0.490671	0.6281
RFI3	-0.364063	0.967433	-0.376319	0.7100
RLPES3	0.636432	1.358035	0.468642	0.6436

R-squared	0.892546	Mean dependent var	2.903183
Adjusted R-squared	0.816433	S.D. dependent var	0.655830
S.E. of regression	0.280988	Akaike info criterion	0.596521
Sum squared resid	1.894908	Schwarz criterion	1.341236
Log likelihood	5.473066	Hannan-Quinn criter.	0.869488
F-statistic	11.72658	Durbin-Watson stat	1.806307
Prob(F-statistic)	0.000000		

Wald Test:
Equation: Untitled

Test Statistic	Value	df	Probability
F-statistic	1.022842	(5, 24)	0.4264
Chi-square	5.114210	5	0.4021

Null Hypothesis: C(14)= C(15)=C(16)=C(17)= C(18)=0
Null Hypothesis Summary:

Normalized Restriction (= 0)	Value	Std. Err.
C(14)	-0.033463	0.060806
C(15)	12.59274	14.30979
C(16)	-1.749488	3.565500
C(17)	-0.364063	0.967433
C(18)	0.636432	1.358035

Restrictions are linear in coefficients.

Appendix E Results on Exogeneity (Growth-Overall Crime Model 2A)

Dependent Variable: LGR
Method: Least Squares
Date: 06/14/17 Time: 12:47
Sample (adjusted): 1972 2013
Included observations: 42 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	34.37631	18.92343	1.816601	0.0836
LGR(-1)	-0.750406	1.887275	-0.397613	0.6949
LGR(-2)	0.925993	1.608531	0.575676	0.5710
LCR	-1.740422	1.727743	-1.007338	0.3252
LCR(-1)	0.269577	0.208452	1.293232	0.2100
TIV	0.000940	0.015043	0.062464	0.9508
TIV(-1)	-0.026716	0.042352	-0.630814	0.5350
EIV	-2.697860	3.073786	-0.877699	0.3900
EIV(-1)	-0.201071	1.143637	-0.175817	0.8621
LAG	-0.200377	0.317901	-0.630313	0.5353
LAG(-1)	0.062080	0.168902	0.367552	0.7169
TRC	0.119580	0.139715	0.855884	0.4017
TRC(-1)	0.047721	0.044590	1.070221	0.2967
UT	0.032416	0.125698	0.257887	0.7990
UT(-1)	0.067639	0.058187	1.162441	0.2581
RLCR	1.681526	1.731758	0.970993	0.3426
RTIV	5.98E-05	0.015376	0.003887	0.9969
REIV	2.769647	3.089481	0.896477	0.3802
RLAG	0.193584	0.318987	0.606872	0.5504
RTRC	-0.120726	0.140197	-0.861119	0.3989
RUT	-0.000341	0.127771	-0.002666	0.9979

R-squared	0.990704	Mean dependent var	30.83284
Adjusted R-squared	0.981851	S.D. dependent var	0.422970
S.E. of regression	0.056982	Akaike info criterion	-2.585305
Sum squared resid	0.068186	Schwarz criterion	-1.716470
Log likelihood	75.29140	Hannan-Quinn criter.	-2.266842
F-statistic	111.9025	Durbin-Watson stat	2.184338
Prob(F-statistic)	0.000000		

Wald Test:
Equation: Untitled

Test Statistic	Value	df	Probability
F-statistic	1.993260	(6, 21)	0.1123
Chi-square	11.95956	6	0.0629

Null Hypothesis: C(16)=C(17)= C(18)=C(19)=
C(20)=C(21)=0
Null Hypothesis Summary:

Normalized Restriction (= 0)	Value	Std. Err.
C(16)	1.681526	1.731758
C(17)	5.98E-05	0.015376
C(18)	2.769647	3.089481

C(19)	0.193584	0.318987
C(20)	-0.120726	0.140197
C(21)	-0.000341	0.127771

Restrictions are linear in coefficients.

Appendix F Results on Exogeneity (Growth-Persons' Crime Model 2B)

Dependent Variable: LGR
Method: Least Squares
Date: 06/14/17 Time: 12:53
Sample (adjusted): 1972 2013
Included observations: 42 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	26.42215	8.064395	3.276395	0.0036
LGR(-1)	0.526286	0.433840	1.213089	0.2386
LGR(-2)	-0.397642	0.265056	-1.500221	0.1484
LCPS	-0.037784	0.185289	-0.203920	0.8404
LCPS(-1)	-0.013923	0.068251	-0.203993	0.8403
TIV	0.000568	0.009238	0.061508	0.9515
TIV(-1)	0.000143	0.009622	0.014841	0.9883
EIV	0.547625	0.544814	1.005158	0.3263
EIV(-1)	0.655066	0.404478	1.619533	0.1203
LAG	-0.014372	0.108144	-0.132896	0.8955
LAG(-1)	0.042417	0.096699	0.438646	0.6654
TRC	0.024094	0.029920	0.805294	0.4297
TRC(-1)	-0.016365	0.023196	-0.705529	0.4882
UT	-0.088516	0.044656	-1.982166	0.0607
UT(-1)	0.150356	0.042425	3.544046	0.0019
RLCPS	-0.030575	0.188200	-0.162459	0.8725
RTIV2	0.001337	0.009734	0.137366	0.8920
REIV2	-0.650943	0.612281	-1.063144	0.2998
RLAG2	0.034879	0.111459	0.312934	0.7574
RTRC2	-0.028662	0.032247	-0.888808	0.3842
RUT2	0.112542	0.050147	2.244253	0.0357

R-squared	0.991704	Mean dependent var	30.83284
Adjusted R-squared	0.983803	S.D. dependent var	0.422970
S.E. of regression	0.053831	Akaike info criterion	-2.699088
Sum squared resid	0.060853	Schwarz criterion	-1.830253
Log likelihood	77.68084	Hannan-Quinn criter.	-2.380626
F-statistic	125.5143	Durbin-Watson stat	2.097924
Prob(F-statistic)	0.000000		

Wald Test:
Equation: Untitled

Test Statistic	Value	df	Probability
F-statistic	2.266309	(6, 21)	0.0764
Chi-square	13.59785	6	0.0345

Null Hypothesis: C(16)=C(17)= C(18)=C(19)=
C(20)=C(21)=0
Null Hypothesis Summary:

Normalized Restriction (= 0)	Value	Std. Err.
C(16)	-0.030575	0.188200
C(17)	0.001337	0.009734
C(18)	-0.650943	0.612281
C(19)	0.034879	0.111459
C(20)	-0.028662	0.032247
C(21)	0.112542	0.050147

Restrictions are linear in coefficients.

Appendix G Results on Exogeneity (Growth-Property Crime Model 2C)

Dependent Variable: LGR
Method: Least Squares
Date: 06/14/17 Time: 13:00
Sample (adjusted): 1972 2013
Included observations: 42 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	26.76180	80.83668	0.331060	0.7439
LGR(-1)	0.669509	3.800717	0.176153	0.8619
LGR(-2)	-0.570588	1.039562	-0.548873	0.5889
LCPR	0.134389	1.799269	0.074691	0.9412
LCPR(-1)	0.008115	0.808706	0.010034	0.9921
TIV	-0.006700	0.052131	-0.128519	0.8990
TIV(-1)	0.010266	0.032351	0.317346	0.7541
EIV	1.671096	9.433589	0.177143	0.8611
EIV(-1)	0.312383	3.010722	0.103757	0.9183
LAG	-0.123312	1.882026	-0.065521	0.9484
LAG(-1)	0.142335	2.003150	0.071055	0.9440
TRC	0.024246	0.361312	0.067105	0.9471
TRC(-1)	-0.038330	0.423120	-0.090589	0.9287
UT	-0.102470	0.199354	-0.514013	0.6126
UT(-1)	0.161962	0.491535	0.329501	0.7450
RLCPR	-0.157411	1.799693	-0.087465	0.9311
RTIV3	0.009587	0.052250	0.183478	0.8562
REIV3	-1.627330	9.437480	-0.172433	0.8647
RLAG3	0.134045	1.882208	0.071217	0.9439
RTRC3	-0.028086	0.361492	-0.077696	0.9388
RUT3	0.130091	0.200633	0.648403	0.5238

R-squared	0.991517	Mean dependent var	30.83284
Adjusted R-squared	0.983439	S.D. dependent var	0.422970
S.E. of regression	0.054432	Akaike info criterion	-2.676868
Sum squared resid	0.062220	Schwarz criterion	-1.808033
Log likelihood	77.21423	Hannan-Quinn criter.	-2.358406
F-statistic	122.7331	Durbin-Watson stat	2.090889
Prob(F-statistic)	0.000000		

Wald Test:
Equation: Untitled

Test Statistic	Value	df	Probability
F-statistic	2.699352	(6, 21)	0.0421
Chi-square	16.19611	6	0.0127

Null Hypothesis: C(16)=C(17)= C(18)=C(19)=
C(20)=C(21)=0
Null Hypothesis Summary:

Normalized Restriction (= 0)	Value	Std. Err.
C(16)	-0.157411	1.799693
C(17)	0.009587	0.052250
C(18)	-1.627330	9.437480
C(19)	0.134045	1.882208
C(20)	-0.028086	0.361492
C(21)	0.130091	0.200633

Restrictions are linear in coefficients.

Appendix H ARDL OLS Results for Overall Crime Model 1A

Dependent Variable: LCR
Method: ARDL
Date: 05/20/17   Time: 10:51
Sample (adjusted): 1972 2013
Included observations: 42 after adjustments
Maximum dependent lags: 2 (Automatic selection)
Model selection method: Akaike info criterion (AIC)
Dynamic regressors (2 lags, automatic): UN YL POV FI LPES
Fixed regressors: C
Number of models evalulated: 486
Selected Model: ARDL(1, 0, 0, 2, 2, 1)

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
LCR(-1)	0.333004	0.146525	2.272680	0.0304
UN	-0.005030	0.008162	-0.616298	0.5423
YL	0.745347	0.261269	2.852790	0.0078
POV	0.162900	0.187109	0.870617	0.3909
POV(-1)	-0.104063	0.182976	-0.568727	0.5738
POV(-2)	-0.385928	0.197305	-1.956002	0.0598
FI	0.223765	0.082555	2.710484	0.0110
FI(-1)	-0.042910	0.101915	-0.421038	0.6767
FI(-2)	-0.109334	0.076151	-1.435742	0.1614
LPES	-0.083407	0.047463	-1.757325	0.0891
LPES(-1)	-0.072121	0.050709	-1.422264	0.1653
C	1.773388	1.713521	1.034938	0.3090

R-squared	0.974656	Mean dependent var	5.302644
Adjusted R-squared	0.965364	S.D. dependent var	0.637433
S.E. of regression	0.118632	Akaike info criterion	-1.190632
Sum squared resid	0.422203	Schwarz criterion	-0.694155
Log likelihood	37.00327	Hannan-Quinn criter.	-1.008654
F-statistic	104.8846	Durbin-Watson stat	2.026042
Prob(F-statistic)	0.000000		

*Note: p-values and any subsequent tests do not account for model selection.

Model Selection Criteria Table
Dependent Variable: LCR
Date: 05/20/17   Time: 10:54
Sample: 1970 2013
Included observations: 42

Model	LogL	AIC*	BIC	HQ	Adj. R-sq	Specification
461	37.003272	-1.190632	-0.694155	-1.008654	0.965364	ARDL(1, 0, 0, 2, 2, 1)

ARDL Long Run Form and Bounds Test
Dependent Variable: D(LCR)
Selected Model: ARDL(1, 0, 0, 2, 2, 1)
Case 2: Restricted Constant and No Trend
Date: 05/20/17 Time: 10:54
Sample: 1970 2013
Included observations: 42

Conditional Error Correction Regression

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.773388	1.713521	1.034938	0.3090
LCR(-1)*	-0.666996	0.146525	-4.552104	0.0001
UN**	-0.005030	0.008162	-0.616298	0.5423
YL**	0.745347	0.261269	2.852790	0.0078
POV(-1)	-0.327091	0.285130	-1.147166	0.2604
FI(-1)	0.071522	0.068855	1.038729	0.3072
LPES(-1)	-0.155528	0.031322	-4.965387	0.0000
D(POV)	0.162900	0.187109	0.870617	0.3909
D(POV(-1))	0.385928	0.197305	1.956002	0.0598
D(FI)	0.223765	0.082555	2.710484	0.0110
D(FI(-1))	0.109334	0.076151	1.435742	0.1614
D(LPES)	-0.083407	0.047463	-1.757325	0.0891

* p-value incompatible with t-Bounds distribution.
** Variable interpreted as Z = Z(-1) + D(Z).

Levels Equation
Case 2: Restricted Constant and No Trend

Variable	Coefficient	Std. Error	t-Statistic	Prob.
UN	-0.007541	0.012356	-0.610357	0.5462
YL	1.117468	0.339084	3.295553	0.0025
POV	-0.490394	0.442145	-1.109126	0.2762
FI	0.107230	0.096859	1.107070	0.2771
LPES	-0.233177	0.023849	-9.777367	0.0000
C	2.658768	2.668641	0.996300	0.3271

EC = LCR - (-0.0075*UN + 1.1175*YL -0.4904*POV + 0.1072*FI -0.2332 *LPES + 2.6588)

ARDL Error Correction Regression
Dependent Variable: D(LCR)
Selected Model: ARDL(1, 0, 0, 2, 2, 1)
Case 2: Restricted Constant and No Trend
Date: 05/20/17 Time: 10:55
Sample: 1970 2013
Included observations: 42

ECM Regression
Case 2: Restricted Constant and No Trend

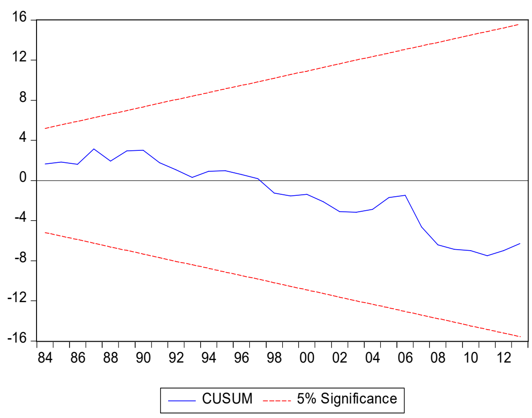
Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(POV)	0.162900	0.129835	1.254667	0.2193
D(POV(-1))	0.385928	0.133936	2.881428	0.0072
D(FI)	0.223765	0.065205	3.431717	0.0018
D(FI(-1))	0.109334	0.065974	1.657226	0.1079
D(LPES)	-0.083407	0.038565	-2.162738	0.0387
CointEq(-1)*	-0.666996	0.118124	-5.646592	0.0000

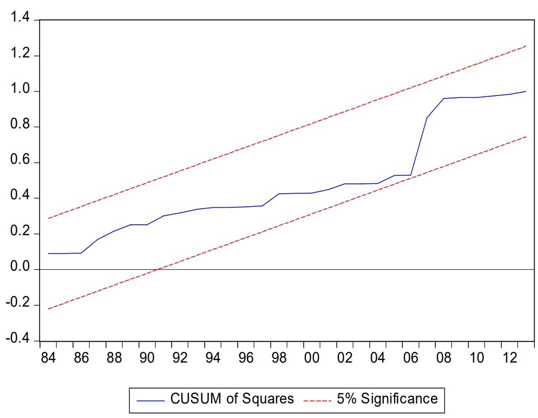
R-squared	0.537511	Mean dependent var	-0.034669
Adjusted R-squared	0.473277	S.D. dependent var	0.149217
S.E. of regression	0.108295	Akaike info criterion	-1.476346
Sum squared resid	0.422203	Schwarz criterion	-1.228108
Log likelihood	37.00327	Hannan-Quinn criter.	-1.385357
Durbin-Watson stat	2.026042		

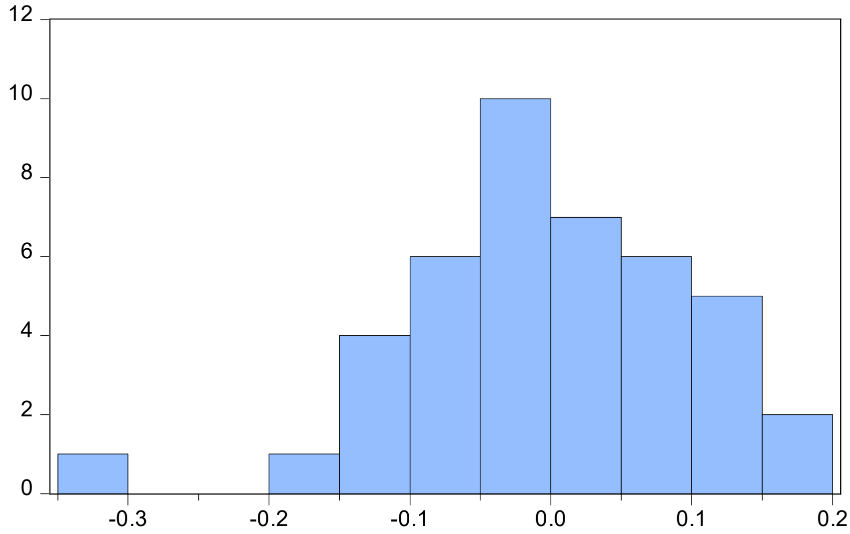
* p-value incompatible with t-Bounds distribution.

F-Bounds Test   Null Hypothesis: No levels relationship

Test Statistic	Value	Signif.	I(0)	I(1)
F-statistic	3.795714	10%	2.08	3
k	5	5%	2.39	3.38
		2.5%	2.7	3.73
		1%	3.06	4.15







Series: Residuals
Sample 1972 2013
Observations 42

Mean	-3.42e-16
Median	-0.005714
Maximum	0.195669
Minimum	-0.307123
Std. Dev.	0.101477
Skewness	-0.450793
Kurtosis	3.552834
Jarque-Bera	1.957346
Probability	0.375810

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	1.019769	Prob. F(2,28)	0.3737
Obs*R-squared	2.851594	Prob. Chi-Square(2)	0.2403

Heteroskedasticity Test: Breusch-Pagan-Godfrey

F-statistic	1.188743	Prob. F(11,30)	0.3357
Obs*R-squared	12.74949	Prob. Chi-Square(11)	0.3100
Scaled explained SS	8.302891	Prob. Chi-Square(11)	0.6859

Ramsey RESET Test
Equation: UNTITLED
Specification: LCR LCR(-1) UN YL POV POV(-1) POV(-2) FI FI(-1) FI(-2) LPES LPES(-1) C
Omitted Variables: Squares of fitted values

	Value	df	Probability
t-statistic	1.655205	29	0.1087
F-statistic	2.739705	(1, 29)	0.1087

F-test summary:

	Sum of Sq.	df	Mean Squares
Test SSR	0.036444	1	0.036444
Restricted SSR	0.422203	30	0.014073
Unrestricted SSR	0.385760	29	0.013302

Appendix I ARDL IV Results for Overall Crime Model 1A

Dependent Variable: LCR
Method: Two-Stage Least Squares
Date: 06/13/17 Time: 14:44
Sample (adjusted): 1972 2013
Included observations: 42 after adjustments
Instrument specification: 1 UN YL POV(-1) FI(-1) LPES(-1) D(POV) D(POV(-1)) D(FI) D(FI(-1)) D(LPES) LCR(-1)
Constant added to instrument list

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	2.658768	2.668641	0.996300	0.3271
UN	-0.007541	0.012356	-0.610357	0.5462
YL	1.117468	0.339084	3.295553	0.0025
POV	-0.490394	0.442145	-1.109126	0.2762
FI	0.107230	0.096859	1.107070	0.2771
LPES	-0.233177	0.023849	-9.777367	0.0000
D(POV)	0.734624	0.363190	2.022701	0.0521
D(POV(-1))	0.578606	0.300833	1.923347	0.0640
D(FI)	0.228253	0.128412	1.777508	0.0856
D(FI(-1))	0.163919	0.113219	1.447808	0.1580
D(LPES)	0.108129	0.071865	1.504603	0.1429
D(LCR)	-0.499259	0.329355	-1.515869	0.1400

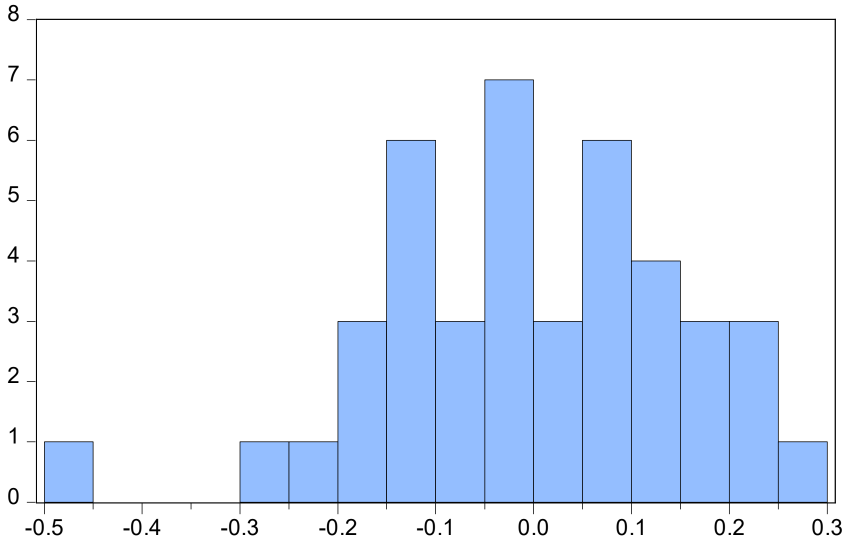
R-squared	0.943033	Mean dependent var	5.302644
Adjusted R-squared	0.922145	S.D. dependent var	0.637433
S.E. of regression	0.177859	Sum squared resid	0.949020
F-statistic	46.66144	Durbin-Watson stat	2.026042
Prob(F-statistic)	0.000000	Second-Stage SSR	0.422203
J-statistic	0.000000	Instrument rank	12

Breusch-Godfrey Serial Correlation LM Test:

Obs*R-squared	0.080429	Prob. Chi-Square(1)	0.7767

Heteroskedasticity Test: Breusch-Pagan-Godfrey

F-statistic	1.569579	Prob. F(11,30)	0.1590
Obs*R-squared	15.34200	Prob. Chi-Square(11)	0.1674
Scaled explained SS	9.991220	Prob. Chi-Square(11)	0.5312



Series: Residuals
Sample 1972 2013
Observations 42

Mean	-4.80e-15
Median	-0.008567
Maximum	0.293359
Minimum	-0.460457
Std. Dev.	0.152141
Skewness	-0.450793
Kurtosis	3.552834
Jarque-Bera	1.957346
Probability	0.375810

Wald Test:
Equation: Untitled

Test Statistic	Value	df	Probability
F-statistic	95.25563	(5, 30)	0.0000
Chi-square	476.2782	5	0.0000

Null Hypothesis: C(2)=C(3)=C(4)=C(5)=C(6)=0
Null Hypothesis Summary:

Normalized Restriction (= 0)	Value	Std. Err.
C(2)	-0.007541	0.012356
C(3)	1.117468	0.339084
C(4)	-0.490394	0.442145
C(5)	0.107230	0.096859
C(6)	-0.233177	0.023849

Restrictions are linear in coefficients.

Dependent Variable: D(LCR)
Method: Two-Stage Least Squares
Date: 06/13/17 Time: 14:50
Sample (adjusted): 1972 2013
Included observations: 42 after adjustments
Instrument specification: 1 UN YL POV(-1) FI(-1) LPES(-1) D(POV) D(POV(-1)) D(FI) D(FI(-1)) D(LPES) LCR(-1)
Constant added to instrument list

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.773388	1.713521	1.034938	0.3090
LCR(-1)	-0.666996	0.146525	-4.552104	0.0001
UN	-0.005030	0.008162	-0.616298	0.5423
YL	0.745347	0.261269	2.852790	0.0078
POV(-1)	-0.327091	0.285130	-1.147166	0.2604
FI(-1)	0.071522	0.068855	1.038729	0.3072
LPES(-1)	-0.155528	0.031322	-4.965387	0.0000
D(POV)	0.162900	0.187109	0.870617	0.3909
D(POV(-1))	0.385928	0.197305	1.956002	0.0598
D(FI)	0.223765	0.082555	2.710484	0.0110
D(FI(-1))	0.109334	0.076151	1.435742	0.1614
D(LPES)	-0.083407	0.047463	-1.757325	0.0891

R-squared	0.537511	Mean dependent var	-0.034669
Adjusted R-squared	0.367932	S.D. dependent var	0.149217
S.E. of regression	0.118632	Sum squared resid	0.422203
F-statistic	3.169675	Durbin-Watson stat	2.026042
Prob(F-statistic)	0.005909	Second-Stage SSR	0.422203
J-statistic	0.000000	Instrument rank	12

Appendix J ARDL OLS Results for Person's Crime Model 1B

Dependent Variable: LCPS
Method: ARDL
Date: 05/20/17 Time: 12:30
Sample (adjusted): 1971 2013
Included observations: 43 after adjustments
Maximum dependent lags: 1 (Automatic selection)
Model selection method: Akaike info criterion (AIC)
Dynamic regressors (1 lag, automatic): UN YL POV FI LPES
Fixed regressors: C
Number of models evalulated: 32
Selected Model: ARDL(1, 0, 0, 0, 1, 0)

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
LCPS(-1)	0.257406	0.142001	1.812702	0.0785
UN	0.056769	0.018624	3.048164	0.0044
YL	1.440067	0.506567	2.842794	0.0074
POV	0.722233	0.409086	1.765480	0.0862
FI	-0.029536	0.184878	-0.159758	0.8740
FI(-1)	0.275781	0.185331	1.488042	0.1457
LPES	-0.000554	0.030860	-0.017963	0.9858
C	-16.15294	4.034020	-4.004180	0.0003

R-squared	0.702719	Mean dependent var	3.209164
Adjusted R-squared	0.643263	S.D. dependent var	0.485760
S.E. of regression	0.290132	Akaike info criterion	0.529280
Sum squared resid	2.946181	Schwarz criterion	0.856945
Log likelihood	-3.379514	Hannan-Quinn criter.	0.650112
F-statistic	11.81912	Durbin-Watson stat	2.021943
Prob(F-statistic)	0.000000		

*Note: p-values and any subsequent tests do not account for model selection.

Model Selection Criteria Table
Dependent Variable: LCPS
Date: 05/20/17 Time: 12:30
Sample: 1970 2013
Included observations: 43

Model	LogL	AIC*	BIC	HQ	Adj. R-sq	Specification
30	-3.379514	0.529280	0.856945	0.650112	0.643263	ARDL(1, 0, 0, 0, 1, 0)

ARDL Long Run Form and Bounds Test
Dependent Variable: D(LCPS)
Selected Model: ARDL(1, 0, 0, 0, 1, 0)
Case 2: Restricted Constant and No Trend
Date: 05/20/17   Time: 12:30
Sample: 1970 2013
Included observations: 43

Conditional Error Correction Regression

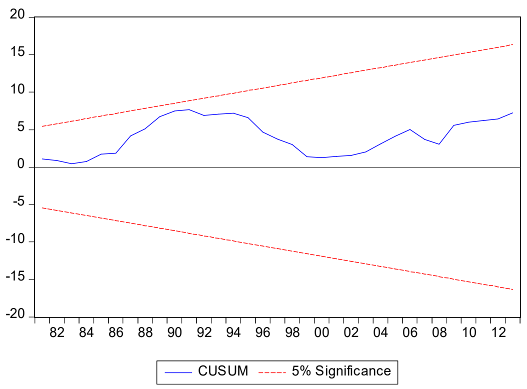
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-16.15294	4.034020	-4.004180	0.0003
LCPS(-1)*	-0.742594	0.142001	-5.229491	0.0000
UN**	0.056769	0.018624	3.048164	0.0044
YL**	1.440067	0.506567	2.842794	0.0074
POV**	0.722233	0.409086	1.765480	0.0862
FI(-1)	0.246245	0.144469	1.704480	0.0972
LPES**	-0.000554	0.030860	-0.017963	0.9858
D(FI)	-0.029536	0.184878	-0.159758	0.8740

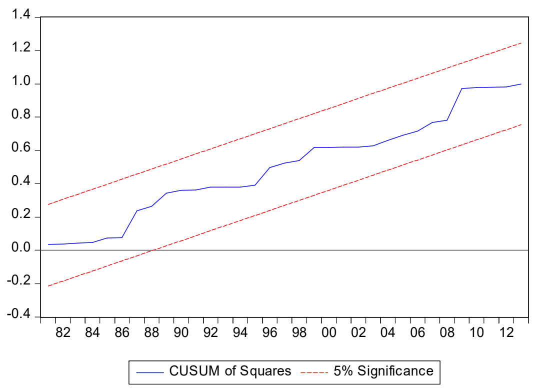
 * p-value incompatible with t-Bounds distribution.
** Variable interpreted as Z = Z(-1) + D(Z).

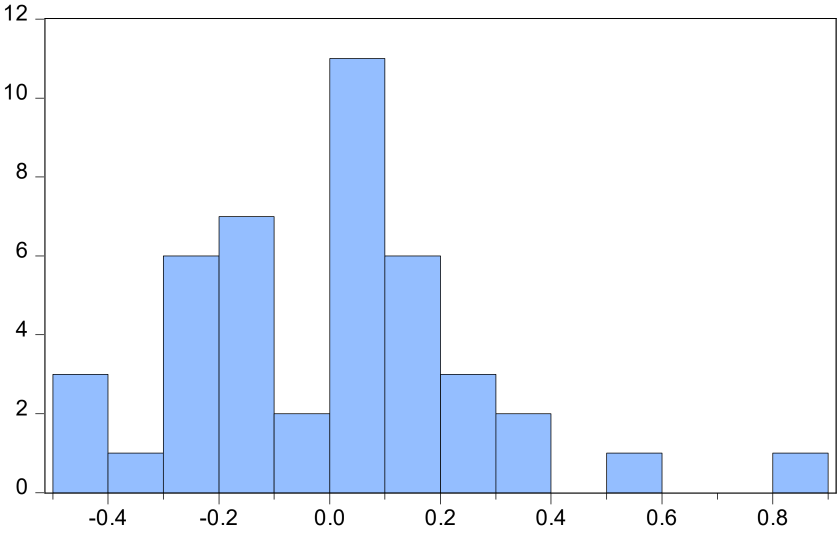
Levels Equation
Case 2: Restricted Constant and No Trend

Variable	Coefficient	Std. Error	t-Statistic	Prob.
UN	0.076447	0.032024	2.387197	0.0225
YL	1.939238	0.554236	3.498937	0.0013
POV	0.972581	0.559374	1.738696	0.0909
FI	0.331601	0.212023	1.563986	0.1268
LPES	-0.000747	0.041593	-0.017948	0.9858
C	-21.75205	4.464918	-4.871768	0.0000

EC = LCPS - (0.0764*UN + 1.9392*YL + 0.9726*POV + 0.3316*FI -0.0007
*LPES -21.7520)







Series: Residuals
Sample 1971 2013
Observations 43

Mean	4.30e-15
Median	0.015854
Maximum	0.867388
Minimum	-0.447050
Std. Dev.	0.264853
Skewness	0.796538
Kurtosis	4.433827
Jarque-Bera	8.230470
Probability	0.016322

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	0.116376	Prob. F(1,34)	0.7351
Obs*R-squared	0.146679	Prob. Chi-Square(1)	0.7017

Heteroskedasticity Test: Breusch-Pagan-Godfrey

F-statistic	1.591511	Prob. F(7,35)	0.1705
Obs*R-squared	10.38229	Prob. Chi-Square(7)	0.1679
Scaled explained SS	11.80975	Prob. Chi-Square(7)	0.1070

Ramsey RESET Test
Equation: UNTITLED
Specification: LCPS LCPS(-1) UN YL POV FI FI(-1) LPES C
Instrument specification: 1 LCR(-1) UN YL POV POV(-1) POV(-2) FI FI(-1) FI(-2) LPES LPES(-1)
Omitted Variables: Squares of fitted values

	Value	df	Probability
t-statistic	0.477814	34	0.6358
F-statistic	0.228307	(1, 34)	0.6358

F-test summary:

	Sum of Sq.	df	Mean Squares
Test SSR	0.019651	1	0.019651
Restricted SSR	2.946181	35	0.084177
Unrestricted SSR	2.926530	34	0.086074

Appendix K ARDL IV Results for Person's Crime Model 1B

Method: Two-Stage Least Squares
Date: 06/13/17 Time: 16:28
Sample (adjusted): 1971 2013
Included observations: 43 after adjustments
Instrument specification: 1 UN YL POV FI(-1) LPES D(FI) LCPS(-1)
Constant added to instrument list

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-21.75205	4.464918	-4.871768	0.0000
UN	0.076447	0.032024	2.387197	0.0225
YL	1.939238	0.554236	3.498937	0.0013
POV	0.972581	0.559374	1.738696	0.0909
FI	0.331601	0.212023	1.563986	0.1268
LPES	-0.000747	0.041593	-0.017948	0.9858
D(FI)	-0.371375	0.257021	-1.444922	0.1574
D(LCPS)	-0.346631	0.257507	-1.346102	0.1869

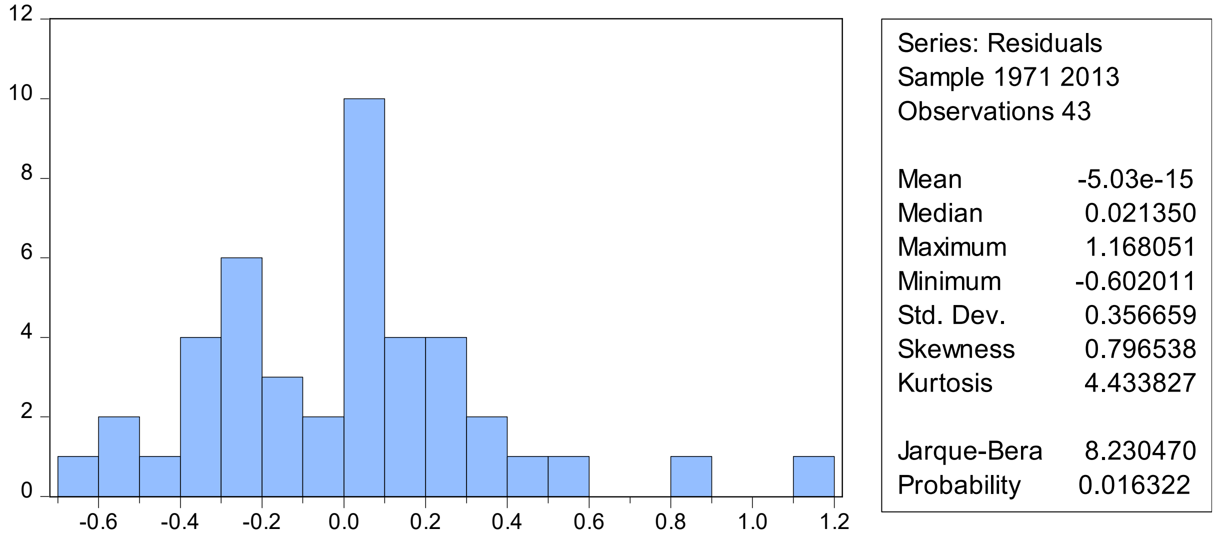
R-squared	0.460907	Mean dependent var	3.209164
Adjusted R-squared	0.353088	S.D. dependent var	0.485760
S.E. of regression	0.390701	Sum squared resid	5.342646
F-statistic	6.517605	Durbin-Watson stat	2.021943
Prob(F-statistic)	0.000059	Second-Stage SSR	2.946181
J-statistic	5.88E-35	Instrument rank	8

Breusch-Godfrey Serial Correlation LM Test:

Obs*R-squared	0.146679	Prob. Chi-Square(1)	0.7017

Heteroskedasticity Test: Breusch-Pagan-Godfrey

F-statistic	1.591511	Prob. F(7,35)	0.1705
Obs*R-squared	10.38229	Prob. Chi-Square(7)	0.1679
Scaled explained SS	11.80975	Prob. Chi-Square(7)	0.1070



Wald Test:
Equation: Untitled

Test Statistic	Value	df	Probability
F-statistic	8.917580	(5, 35)	0.0000
Chi-square	44.58790	5	0.0000

Null Hypothesis: C(2)=C(3)=C(4)=C(5)=C(6)=0
Null Hypothesis Summary:

Normalized Restriction (= 0)	Value	Std. Err.
C(2)	0.076447	0.032024
C(3)	1.939238	0.554236
C(4)	0.972581	0.559374
C(5)	0.331601	0.212023
C(6)	-0.000747	0.041593

Restrictions are linear in coefficients.

Dependent Variable: D(LCPS)
Method: Two-Stage Least Squares
Date: 06/13/17 Time: 16:34
Sample (adjusted): 1971 2013
Included observations: 43 after adjustments
Instrument specification: 1 UN YL POV FI(-1) LPES D(FI) LCPS(-1)
Constant added to instrument list

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-16.15294	4.034020	-4.004180	0.0003
LCPS(-1)	-0.742594	0.142001	-5.229491	0.0000
UN	0.056769	0.018624	3.048164	0.0044
YL	1.440067	0.506567	2.842794	0.0074
POV	0.722233	0.409086	1.765480	0.0862
FI(-1)	0.246245	0.144469	1.704480	0.0972
LPES	-0.000554	0.030860	-0.017963	0.9858
D(FI)	-0.029536	0.184878	-0.159758	0.8740

R-squared	0.586969	Mean dependent var	-0.005483
Adjusted R-squared	0.504363	S.D. dependent var	0.412110
S.E. of regression	0.290132	Sum squared resid	2.946181
F-statistic	7.105625	Durbin-Watson stat	2.021943
Prob(F-statistic)	0.000027	Second-Stage SSR	2.946181
J-statistic	1.75E-34	Instrument rank	8

Appendix L ARDL OLS Results for Property Crime Model 1C

Dependent Variable: LCPR
Method: ARDL
Date: 05/20/17 Time: 12:42
Sample (adjusted): 1972 2013
Included observations: 42 after adjustments
Maximum dependent lags: 2 (Automatic selection)
Model selection method: Akaike info criterion (AIC)
Dynamic regressors (2 lags, automatic): UN YL POV FI LPES
Fixed regressors: C
Number of models evalulated: 486
Selected Model: ARDL(1, 0, 1, 2, 1, 1)

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
LCPR(-1)	0.194195	0.139353	1.393550	0.1737
UN	0.044440	0.018067	2.459673	0.0199
YL	2.416396	1.048814	2.303932	0.0283
YL(-1)	-1.557408	1.053378	-1.478488	0.1497
POV	0.194049	0.409714	0.473620	0.6392
POV(-1)	0.004067	0.391627	0.010386	0.9918
POV(-2)	-0.939930	0.423880	-2.217442	0.0343
FI	0.373972	0.171299	2.183152	0.0370
FI(-1)	0.297442	0.175095	1.698741	0.0997
LPES	-0.032216	0.100392	-0.320904	0.7505
LPES(-1)	-0.136235	0.104108	-1.308602	0.2006
C	2.773859	3.755778	0.738558	0.4659

R-squared	0.887698	Mean dependent var	2.903183
Adjusted R-squared	0.846521	S.D. dependent var	0.655830
S.E. of regression	0.256930	Akaike info criterion	0.354934
Sum squared resid	1.980398	Schwarz criterion	0.851411
Log likelihood	4.546386	Hannan-Quinn criter.	0.536912
F-statistic	21.55797	Durbin-Watson stat	1.816569
Prob(F-statistic)	0.000000		

*Note: p-values and any subsequent tests do not account for model selection.

Model Selection Criteria Table
Dependent Variable: LCPR
Date: 05/20/17 Time: 12:42
Sample: 1970 2013
Included observations: 42

Model	LogL	AIC*	BIC	HQ	Adj. R-sq	Specification
437	4.546386	0.354934	0.851411	0.536912	0.846521	ARDL(1, 0, 1, 2, 1, 1)

ARDL Long Run Form and Bounds Test
Dependent Variable: D(LCPR)
Selected Model: ARDL(1, 0, 1, 2, 1, 1)
Case 2: Restricted Constant and No Trend
Date: 05/20/17 Time: 12:42
Sample: 1970 2013
Included observations: 42

Conditional Error Correction Regression

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	2.773859	3.755778	0.738558	0.4659
LCPR(-1)*	-0.805805	0.139353	-5.782482	0.0000
UN**	0.044440	0.018067	2.459673	0.0199
YL(-1)	0.858988	0.509713	1.685240	0.1023
POV(-1)	-0.741814	0.619411	-1.197611	0.2404
FI(-1)	0.671413	0.145518	4.613958	0.0001
LPES(-1)	-0.168451	0.039102	-4.308007	0.0002
D(YL)	2.416396	1.048814	2.303932	0.0283
D(POV)	0.194049	0.409714	0.473620	0.6392
D(POV(-1))	0.939930	0.423880	2.217442	0.0343
D(FI)	0.373972	0.171299	2.183152	0.0370
D(LPES)	-0.032216	0.100392	-0.320904	0.7505

* p-value incompatible with t-Bounds distribution.
** Variable interpreted as Z = Z(-1) + D(Z).

Levels Equation
Case 2: Restricted Constant and No Trend

Variable	Coefficient	Std. Error	t-Statistic	Prob.
UN	0.055149	0.023841	2.313224	0.0277
YL	1.066000	0.614796	1.733908	0.0932
POV	-0.920587	0.789481	-1.166067	0.2528
FI	0.833221	0.186129	4.476575	0.0001
LPES	-0.209047	0.040916	-5.109201	0.0000
C	3.442346	4.789481	0.718731	0.4779

EC = LCPR - (0.0551*UN + 1.0660*YL -0.9206*POV + 0.8332*FI -0.2090
*LPES + 3.4423)

ARDL Error Correction Regression
Dependent Variable: D(LCPR)
Selected Model: ARDL(1, 0, 1, 2, 1, 1)
Case 2: Restricted Constant and No Trend
Date: 05/20/17 Time: 12:43
Sample: 1970 2013
Included observations: 42

ECM Regression
Case 2: Restricted Constant and No Trend

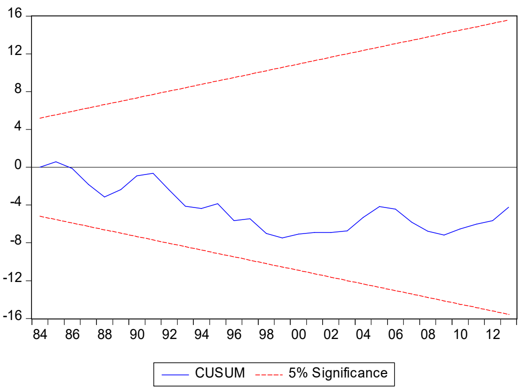
Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(YL)	2.416396	0.813740	2.969493	0.0058
D(POV)	0.194049	0.274244	0.707576	0.4847
D(POV(-1))	0.939930	0.286664	3.278852	0.0026
D(FI)	0.373972	0.141253	2.647539	0.0128
D(LPES)	-0.032216	0.081504	-0.395269	0.6954
CointEq(-1)*	-0.805805	0.105951	-7.605425	0.0000

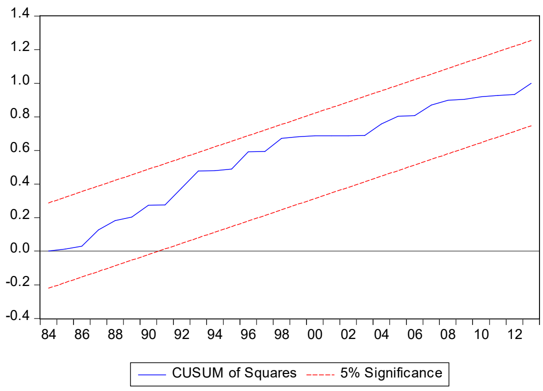
R-squared	0.651120	Mean dependent var	-0.028155
Adjusted R-squared	0.602665	S.D. dependent var	0.372089
S.E. of regression	0.234544	Akaike info criterion	0.069220
Sum squared resid	1.980398	Schwarz criterion	0.317458
Log likelihood	4.546386	Hannan-Quinn criter.	0.160209
Durbin-Watson stat	1.816569		

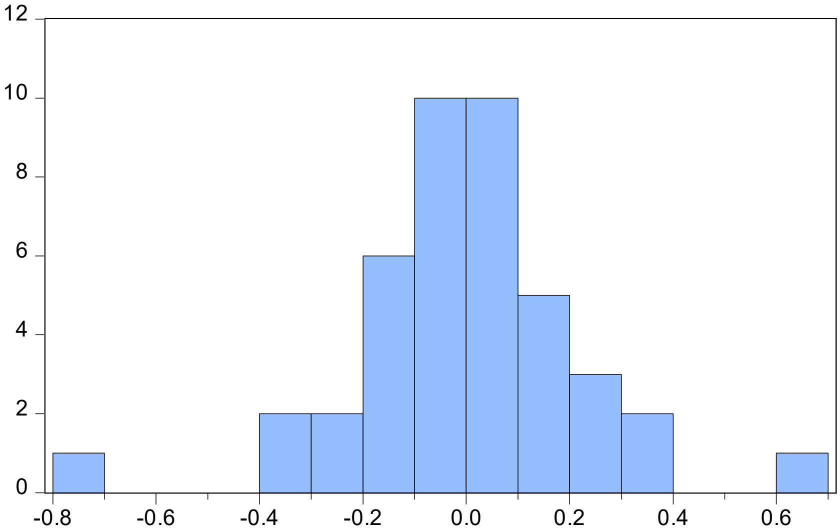
* p-value incompatible with t-Bounds distribution.

F-Bounds Test — Null Hypothesis: No levels relationship

Test Statistic	Value	Signif.	I(0)	I(1)
F-statistic	6.886011	10%	2.08	3
k	5	5%	2.39	3.38
		2.5%	2.7	3.73
		1%	3.06	4.15







Series: Residuals	
Sample 1972 2013	
Observations 42	
Mean	-3.31e-15
Median	0.008291
Maximum	0.641807
Minimum	-0.719147
Std. Dev.	0.219778
Skewness	-0.295201
Kurtosis	5.606183
Jarque-Bera	12.49634
Probability	0.001934

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	0.341663	Prob. F(1,29)	0.5634
Obs*R-squared	0.489060	Prob. Chi-Square(1)	0.4843

Heteroskedasticity Test: Breusch-Pagan-Godfrey

F-statistic	0.936013	Prob. F(11,30)	0.5210
Obs*R-squared	10.73150	Prob. Chi-Square(11)	0.4660
Scaled explained SS	12.61002	Prob. Chi-Square(11)	0.3196

Ramsey RESET Test
Equation: UNTITLED
Specification: LCPR LCPR(-1) UN YL YL(-1) POV POV(-1) POV(-2) FI FI(-1) LPES LPES(-1) C
Instrument specification: 1 LCR LCR(-1) UN YL POV POV(-1) POV(-2) FI FI(-1) FI(-2) LPES LPES(-1) C
Omitted Variables: Squares of fitted values

	Value	df	Probability
t-statistic	1.453568	29	0.1568
F-statistic	2.112860	(1, 29)	0.1568

F-test summary:

	Sum of Sq.	df	Mean Squares
Test SSR	0.134488	1	0.134488
Restricted SSR	1.980398	30	0.066013
Unrestricted SSR	1.845910	29	0.063652

Appendix M ARDL IV Results for Property Crime Model 1C

Dependent Variable: LCPR
Method: Two-Stage Least Squares
Date: 06/13/17 Time: 15:02
Sample (adjusted): 1972 2013
Included observations: 42 after adjustments
Instrument specification: 1 UN YL(-1) POV(-1) FI(-1) LPES(-1) D(YL) D(POV) D(POV(-1)) D(FI) D(LPES) LCPR(-1)
Constant added to instrument list

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	3.442346	4.789481	0.718731	0.4779
UN	0.055149	0.023841	2.313224	0.0277
YL	1.066000	0.614796	1.733908	0.0932
POV	-0.920587	0.789481	-1.166067	0.2528
FI	0.833221	0.186129	4.476575	0.0001
LPES	-0.209047	0.040916	-5.109201	0.0000
D(YL)	1.932735	1.434443	1.347377	0.1879
D(POV)	1.161401	0.599564	1.937075	0.0622
D(POV(-1))	1.166448	0.538328	2.166800	0.0383
D(FI)	-0.369124	0.209287	-1.763717	0.0880
D(LPES)	0.169067	0.128694	1.313719	0.1989
D(LCPR)	-0.240995	0.214613	-1.122930	0.2704

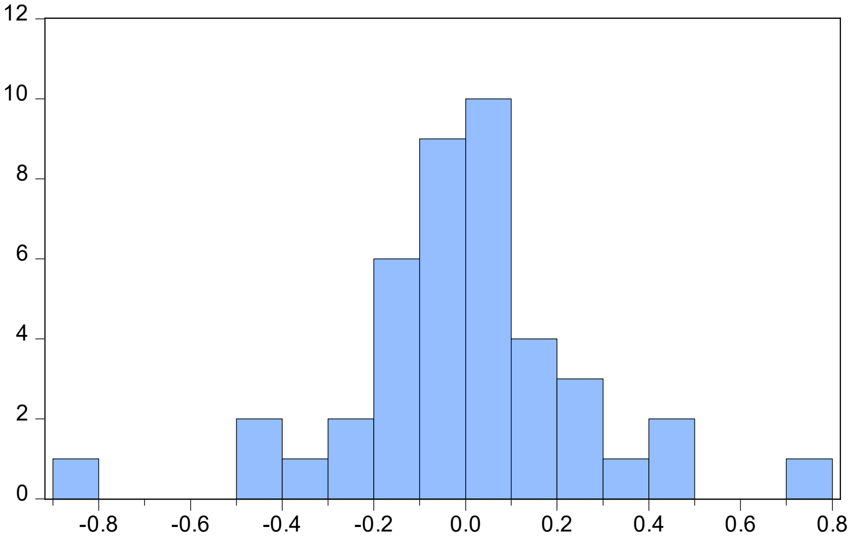
R-squared	0.827048	Mean dependent var	2.903183
Adjusted R-squared	0.763632	S.D. dependent var	0.655830
S.E. of regression	0.318850	Sum squared resid	3.049950
F-statistic	13.99805	Durbin-Watson stat	1.816569
Prob(F-statistic)	0.000000	Second-Stage SSR	1.980398
J-statistic	2.05E-35	Instrument rank	12

Breusch-Godfrey Serial Correlation LM Test:

Obs*R-squared	0.489060	Prob. Chi-Square(1)	0.4843

Heteroskedasticity Test: Breusch-Pagan-Godfrey

F-statistic	1.026287	Prob. F(11,30)	0.4487
Obs*R-squared	11.48351	Prob. Chi-Square(11)	0.4037
Scaled explained SS	13.49367	Prob. Chi-Square(11)	0.2623



Series: Residuals
Sample 1972 2013
Observations 42

Mean	6.11e-16
Median	0.010289
Maximum	0.796479
Minimum	-0.892458
Std. Dev.	0.272744
Skewness	-0.295201
Kurtosis	5.606183
Jarque-Bera	12.49634
Probability	0.001934

Wald Test:
Equation: Untitled

Test Statistic	Value	df	Probability
F-statistic	25.28228	(5, 30)	0.0000
Chi-square	126.4114	5	0.0000

Null Hypothesis: C(2)=C(3)=C(4)=C(5)=C(6)=0
Null Hypothesis Summary:

Normalized Restriction (= 0)	Value	Std. Err.
C(2)	0.055149	0.023841
C(3)	1.066000	0.614796
C(4)	-0.920587	0.789481
C(5)	0.833221	0.186129
C(6)	-0.209047	0.040916

Restrictions are linear in coefficients.

Dependent Variable: D(LCPR)
Method: Two-Stage Least Squares
Date: 06/13/17 Time: 16:22
Sample (adjusted): 1972 2013
Included observations: 42 after adjustments
Instrument specification: 1 UN YL(-1) POV(-1) FI(-1) LPES(-1) D(YL) D(POV) D(POV(-1)) D(FI) D(LPES) LCPR(-1)
Constant added to instrument list

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	2.773859	3.755778	0.738558	0.4659
LCPR(-1)	-0.805805	0.139353	-5.782482	0.0000
UN	0.044440	0.018067	2.459673	0.0199
YL(-1)	0.858988	0.509713	1.685240	0.1023
POV(-1)	-0.741814	0.619411	-1.197611	0.2404
FI(-1)	0.671413	0.145518	4.613958	0.0001
LPES(-1)	-0.168451	0.039102	-4.308007	0.0002
D(YL)	2.416396	1.048814	2.303932	0.0283
D(POV)	0.194049	0.409714	0.473620	0.6392
D(POV(-1))	0.939930	0.423880	2.217442	0.0343
D(FI)	0.373972	0.171299	2.183152	0.0370
D(LPES)	-0.032216	0.100392	-0.320904	0.7505

R-squared	0.651120	Mean dependent var	-0.028155
Adjusted R-squared	0.523198	S.D. dependent var	0.372089
S.E. of regression	0.256930	Sum squared resid	1.980398
F-statistic	5.089959	Durbin-Watson stat	1.816569
Prob(F-statistic)	0.000185	Second-Stage SSR	1.980398
J-statistic	0.000000	Instrument rank	12

Appendix N ARDL OLS Results for Growth Model 2A (Overall Crime)

Dependent Variable: LGR
Method: ARDL
Date: 05/04/17 Time: 12:55
Sample (adjusted): 1972 2013
Included observations: 42 after adjustments
Maximum dependent lags: 2 (Automatic selection)
Model selection method: Akaike info criterion (AIC)
Dynamic regressors (2 lags, automatic): LCR TIV EIV LAG TRC UT
Fixed regressors: C
Number of models evalulated: 1458
Selected Model: ARDL(1, 0, 0, 2, 0, 1, 2)

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
LGR(-1)	0.417201	0.125383	3.327417	0.0024
LCR	-0.143417	0.078389	-1.829551	0.0776
TIV	0.000768	0.002102	0.365377	0.7175
EIV	-0.046140	0.239705	-0.192485	0.8487
EIV(-1)	-0.328199	0.306531	-1.070689	0.2931
EIV(-2)	0.923867	0.286433	3.225428	0.0031
LAG	0.013390	0.011623	1.151983	0.2587
TRC	-0.002290	0.009334	-0.245390	0.8079
TRC(-1)	0.021081	0.009189	2.294225	0.0292
UT	0.022483	0.017232	1.304687	0.2023
UT(-1)	-0.012733	0.026006	-0.489609	0.6281
UT(-2)	0.045126	0.020703	2.179713	0.0375
C	18.34696	3.902111	4.701802	0.0001

R-squared	0.989077	Mean dependent var	30.83284
Adjusted R-squared	0.984558	S.D. dependent var	0.422970
S.E. of regression	0.052562	Akaike info criterion	-2.804989
Sum squared resid	0.080119	Schwarz criterion	-2.267139
Log likelihood	71.90477	Hannan-Quinn criter.	-2.607846
F-statistic	218.8344	Durbin-Watson stat	2.285041
Prob(F-statistic)	0.000000		

*Note: p-values and any subsequent tests do not account for model selection.

Model Selection Criteria Table
Dependent Variable: LGR
Date: 05/04/17 Time: 12:55
Sample: 1970 2013
Included observations: 42

Model	LogL	AIC*	BIC	HQ	Adj. R-sq	Specification
1399	71.904767	-2.804989	-2.267139	-2.607846	0.984558	ARDL(1, 0, 0, 2, 0, 1, 2)

ARDL Long Run Form and Bounds Test
Dependent Variable: D(LGR)
Selected Model: ARDL(1, 0, 0, 2, 0, 1, 2)
Case 2: Restricted Constant and No Trend
Date: 05/04/17 Time: 12:56
Sample: 1970 2013
Included observations: 42

Conditional Error Correction Regression

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	18.34696	3.902111	4.701802	0.0001
LGR(-1)*	-0.582799	0.125383	-4.648151	0.0001
LCR**	-0.143417	0.078389	-1.829551	0.0776
TIV**	0.000768	0.002102	0.365377	0.7175
EIV(-1)	0.549529	0.272724	2.014962	0.0533
LAG**	0.013390	0.011623	1.151983	0.2587
TRC(-1)	0.018790	0.010061	1.867580	0.0720
UT(-1)	0.054876	0.018283	3.001438	0.0055
D(EIV)	-0.046140	0.239705	-0.192485	0.8487
D(EIV(-1))	-0.923867	0.286433	-3.225428	0.0031
D(TRC)	-0.002290	0.009334	-0.245390	0.8079
D(UT)	0.022483	0.017232	1.304687	0.2023
D(UT(-1))	-0.045126	0.020703	-2.179713	0.0375

* p-value incompatible with t-Bounds distribution.
** Variable interpreted as Z = Z(-1) + D(Z).

Levels Equation
Case 2: Restricted Constant and No Trend

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LCR	-0.246083	0.131925	-1.865320	0.0723
TIV	0.001318	0.003583	0.367882	0.7156
EIV	0.942913	0.436534	2.160002	0.0392
LAG	0.022975	0.019307	1.189966	0.2437
TRC	0.032242	0.015376	2.096917	0.0448
UT	0.094159	0.021775	4.324197	0.0002
C	31.48077	0.871229	36.13377	0.0000

EC = LGR - (-0.2461*LCR + 0.0013*TIV + 0.9429*EIV + 0.0230*LAG + 0.0322 *TRC + 0.0942*UT + 31.4808)

ARDL Error Correction Regression
Dependent Variable: D(LGR)
Selected Model: ARDL(1, 0, 0, 2, 0, 1, 2)
Case 2: Restricted Constant and No Trend
Date: 05/04/17 Time: 12:55
Sample: 1970 2013
Included observations: 42

ECM Regression
Case 2: Restricted Constant and No Trend

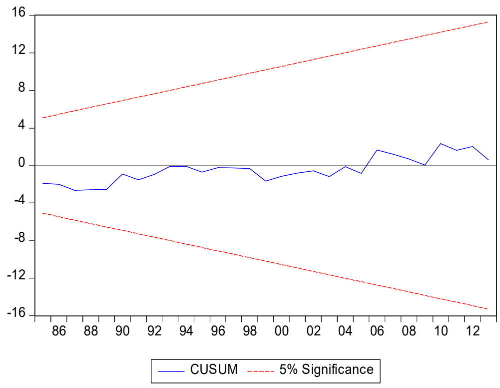
Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(EIV)	-0.046140	0.157392	-0.293152	0.7715
D(EIV(-1))	-0.923867	0.220826	-4.183694	0.0002
D(TRC)	-0.002290	0.006067	-0.377549	0.7085
D(UT)	0.022483	0.014279	1.574543	0.1262
D(UT(-1))	-0.045126	0.017558	-2.570068	0.0156
CointEq(-1)*	-0.582799	0.072262	-8.065047	0.0000

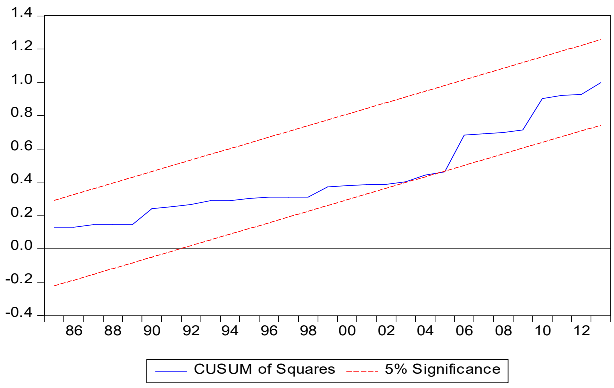
R-squared	0.603544	Mean dependent var	0.033689
Adjusted R-squared	0.548481	S.D. dependent var	0.070207
S.E. of regression	0.047175	Akaike info criterion	-3.138322
Sum squared resid	0.080119	Schwarz criterion	-2.890084
Log likelihood	71.90477	Hannan-Quinn criter.	-3.047333
Durbin-Watson stat	2.285041		

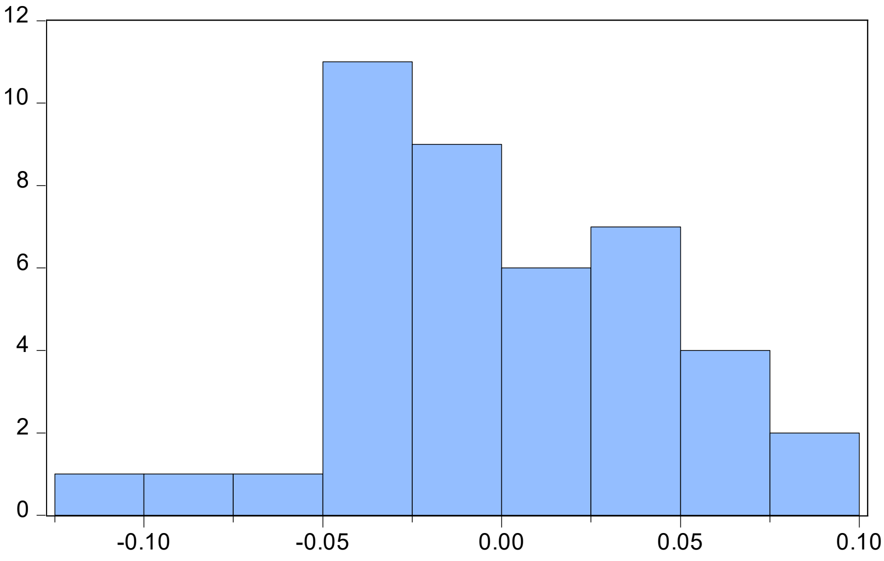
* p-value incompatible with t-Bounds distribution.

F-Bounds Test Null Hypothesis: No levels relationship

Test Statistic	Value	Signif.	I(0)	I(1)
F-statistic	6.549668	10%	1.99	2.94
k	6	5%	2.27	3.28
		2.5%	2.55	3.61
		1%	2.88	3.99







Series: Residuals
Sample 1972 2013
Observations 42

Mean	2.45e-15
Median	-0.005803
Maximum	0.096194
Minimum	-0.101572
Std. Dev.	0.044205
Skewness	0.164160
Kurtosis	2.719693
Jarque-Bera	0.326139
Probability	0.849532

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	1.746579	Prob. F(1,28)	0.1970
Obs*R-squared	2.466042	Prob. Chi-Square(1)	0.1163

Heteroskedasticity Test: Breusch-Pagan-Godfrey

F-statistic	1.064821	Prob. F(12,29)	0.4224
Obs*R-squared	12.84580	Prob. Chi-Square(12)	0.3803
Scaled explained SS	5.265985	Prob. Chi-Square(12)	0.9485

Ramsey RESET Test
Equation: UNTITLED
Specification: LGR LGR(-1) LCR TIV EIV EIV(-1) EIV(-2) LAG TRC TRC(-1) UT UT(-1) UT(-2) C
Omitted Variables: Squares of fitted values

	Value	df	Probability
t-statistic	0.907460	28	0.3719
F-statistic	0.823484	(1, 28)	0.3719

F-test summary:

	Sum of Sq.	df	Mean Squares
Test SSR	0.002289	1	0.002289
Restricted SSR	0.080119	29	0.002763
Unrestricted SSR	0.077830	28	0.002780

Appendix O ARDL IV Results for Growth Model 2A (Overall Crime)

Method: Two-Stage Least Squares
Date: 06/13/17 Time: 12:04
Sample (adjusted): 1972 2013
Included observations: 42 after adjustments
Instrument specification: 1 LCR TIV EIV(-1) LAG TRC(-1) UT(-1) D(EIV) D(EIV(-1)) D(TRC) D(UT) D(UT(-1)) LGR(-1)
Constant added to instrument list

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	31.48077	0.871229	36.13377	0.0000
LCR	-0.246083	0.131925	-1.865320	0.0723
TIV	0.001318	0.003583	0.367882	0.7156
EIV	0.942913	0.436534	2.160002	0.0392
LAG	0.022975	0.019307	1.189966	0.2437
TRC	0.032242	0.015376	2.096917	0.0448
UT	0.094159	0.021775	4.324197	0.0002
D(LGR)	-0.715858	0.369148	-1.939214	0.0623
D(EIV)	-1.022082	0.378666	-2.699164	0.0115
D(EIV(-1))	-1.585225	0.528345	-3.000363	0.0055
D(TRC)	-0.036172	0.014737	-2.454410	0.0204
D(UT)	-0.055582	0.031883	-1.743314	0.0919
D(UT(-1))	-0.077430	0.031667	-2.445112	0.0208

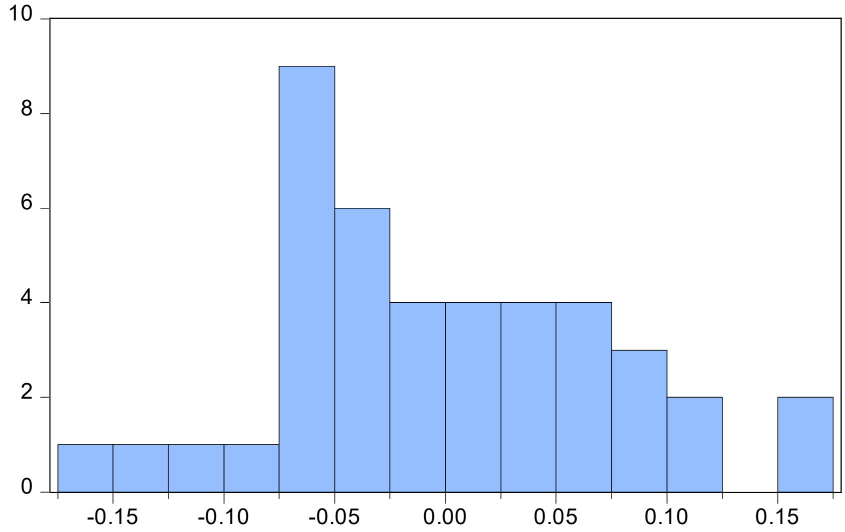
R-squared	0.967842	Mean dependent var	30.83284
Adjusted R-squared	0.954535	S.D. dependent var	0.422970
S.E. of regression	0.090188	Sum squared resid	0.235883
F-statistic	74.32808	Durbin-Watson stat	2.285041
Prob(F-statistic)	0.000000	Second-Stage SSR	0.080119
J-statistic	7.05E-34	Instrument rank	13

Breusch-Godfrey Serial Correlation LM Test:

Obs*R-squared	2.466042	Prob. Chi-Square(1)	0.1163

Heteroskedasticity Test: Breusch-Pagan-Godfrey

F-statistic	0.891481	Prob. F(12,29)	0.5652
Obs*R-squared	11.31818	Prob. Chi-Square(12)	0.5019
Scaled explained SS	4.639754	Prob. Chi-Square(12)	0.9689



Series: Residuals	
Sample 1972 2013	
Observations 42	
Mean	-5.95e-15
Median	-0.009957
Maximum	0.165056
Minimum	-0.174282
Std. Dev.	0.075850
Skewness	0.164160
Kurtosis	2.719693
Jarque-Bera	0.326139
Probability	0.849532

Wald Test:
Equation: Untitled

Test Statistic	Value	df	Probability
F-statistic	72.30189	(6, 29)	0.0000
Chi-square	433.8114	6	0.0000

Null Hypothesis: C(2)=C(3)=C(4)=C(5)=C(6)=C(7)=0
Null Hypothesis Summary:

Normalized Restriction (= 0)	Value	Std. Err.
C(2)	-0.246083	0.131925
C(3)	0.001318	0.003583
C(4)	0.942913	0.436534
C(5)	0.022975	0.019307
C(6)	0.032242	0.015376
C(7)	0.094159	0.021775

Restrictions are linear in coefficients.

Dependent Variable: D(LGR)
Method: Two-Stage Least Squares
Date: 06/13/17 Time: 12:14
Sample (adjusted): 1972 2013
Included observations: 42 after adjustments
Instrument specification: 1 LCR TIV EIV(-1) LAG TRC(-1) UT(-1) D(EIV) D(EIV(-1)) D(TRC) D(UT) D(UT(-1)) LGR(-1)
Constant added to instrument list

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	18.34696	3.902111	4.701802	0.0001
LGR(-1)	-0.582799	0.125383	-4.648151	0.0001
LCR	-0.143417	0.078389	-1.829551	0.0776
TIV	0.000768	0.002102	0.365377	0.7175
EIV(-1)	0.549529	0.272724	2.014962	0.0533
LAG	0.013390	0.011623	1.151983	0.2587
TRC(-1)	0.018790	0.010061	1.867580	0.0720
UT(-1)	0.054876	0.018283	3.001438	0.0055
D(EIV)	-0.046140	0.239705	-0.192485	0.8487
D(EIV(-1))	-0.923867	0.286433	-3.225428	0.0031
D(TRC)	-0.002290	0.009334	-0.245390	0.8079
D(UT)	0.022483	0.017232	1.304687	0.2023
D(UT(-1))	-0.045126	0.020703	-2.179713	0.0375

R-squared	0.603544	Mean dependent var	0.033689
Adjusted R-squared	0.439494	S.D. dependent var	0.070207
S.E. of regression	0.052562	Sum squared resid	0.080119
F-statistic	3.679014	Durbin-Watson stat	2.285041
Prob(F-statistic)	0.002009	Second-Stage SSR	0.080119
J-statistic	0.000000	Instrument rank	13

Appendix P ARDL OLS Results for Growth Model 2B (Person's Crime)

Dependent Variable: LGR
Method: ARDL
Date: 05/04/17 Time: 13:04
Sample (adjusted): 1972 2013
Included observations: 42 after adjustments
Maximum dependent lags: 2 (Automatic selection)
Model selection method: Akaike info criterion (AIC)
Dynamic regressors (2 lags, automatic): LCPS TIV EIV LAG TRC UT
Fixed regressors: C
Number of models evalulated: 1458
Selected Model: ARDL(1, 0, 0, 2, 2, 1, 2)

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
LGR(-1)	0.341895	0.122614	2.788385	0.0096
LCPS	-0.060112	0.025565	-2.351324	0.0263
TIV	0.001608	0.001711	0.939890	0.3556
EIV	-0.001171	0.221861	-0.005278	0.9958
EIV(-1)	-0.130431	0.320133	-0.407427	0.6869
EIV(-2)	0.853760	0.286240	2.982670	0.0060
LAG	0.014559	0.021617	0.673518	0.5063
LAG(-1)	0.001929	0.028230	0.068329	0.9460
LAG(-2)	0.030873	0.022602	1.365953	0.1832
TRC	-0.001368	0.009076	-0.150702	0.8813
TRC(-1)	0.013139	0.007977	1.647047	0.1111
UT	0.028356	0.017112	1.657121	0.1091
UT(-1)	-0.004673	0.024721	-0.189027	0.8515
UT(-2)	0.045624	0.019477	2.342477	0.0268
C	19.77815	3.665195	5.396207	0.0000

R-squared	0.991168	Mean dependent var	30.83284
Adjusted R-squared	0.986588	S.D. dependent var	0.422970
S.E. of regression	0.048984	Akaike info criterion	-2.922183
Sum squared resid	0.064785	Schwarz criterion	-2.301587
Log likelihood	76.36585	Hannan-Quinn criter.	-2.694710
F-statistic	216.4262	Durbin-Watson stat	2.202035
Prob(F-statistic)	0.000000		

*Note: p-values and any subsequent tests do not account for model selection.

Model Selection Criteria Table
Dependent Variable: LGR
Date: 05/04/17 Time: 13:04
Sample: 1970 2013
Included observations: 42

Model	LogL	AIC*	BIC	HQ	Adj. R-sq	Specification
1381	76.365847	-2.922183	-2.301587	-2.694710	0.986588	ARDL(1, 0, 0, 2, 2, 1, 2)

ARDL Long Run Form and Bounds Test
Dependent Variable: D(LGR)
Selected Model: ARDL(1, 0, 0, 2, 2, 1, 2)
Case 2: Restricted Constant and No Trend
Date: 05/04/17 Time: 13:04
Sample: 1970 2013
Included observations: 42

Conditional Error Correction Regression

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	19.77815	3.665195	5.396207	0.0000
LGR(-1)*	-0.658105	0.122614	-5.367289	0.0000
LCPS**	-0.060112	0.025565	-2.351324	0.0263
TIV**	0.001608	0.001711	0.939890	0.3556
EIV(-1)	0.722158	0.202323	3.569332	0.0014
LAG(-1)	0.047361	0.011513	4.113656	0.0003
TRC(-1)	0.011771	0.007630	1.542727	0.1345
UT(-1)	0.069307	0.019614	3.533621	0.0015
D(EIV)	-0.001171	0.221861	-0.005278	0.9958
D(EIV(-1))	-0.853760	0.286240	-2.982670	0.0060
D(LAG)	0.014559	0.021617	0.673518	0.5063
D(LAG(-1))	-0.030873	0.022602	-1.365953	0.1832
D(TRC)	-0.001368	0.009076	-0.150702	0.8813
D(UT)	0.028356	0.017112	1.657121	0.1091
D(UT(-1))	-0.045624	0.019477	-2.342477	0.0268

* p-value incompatible with t-Bounds distribution.
** Variable interpreted as Z = Z(-1) + D(Z).

Levels Equation
Case 2: Restricted Constant and No Trend

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LCPS	-0.091341	0.039751	-2.297791	0.0296
TIV	0.002444	0.002554	0.956638	0.3472
EIV	1.097330	0.261160	4.201757	0.0003
LAG	0.071966	0.014640	4.915526	0.0000
TRC	0.017886	0.010356	1.727178	0.0956
UT	0.105313	0.019951	5.278637	0.0000
C	30.05319	0.166265	180.7553	0.0000

EC = LGR - (-0.0913*LCPS + 0.0024*TIV + 1.0973*EIV + 0.0720*LAG + 0.0179
*TRC + 0.1053*UT + 30.0532)

ARDL Error Correction Regression
Dependent Variable: D(LGR)
Selected Model: ARDL(1, 0, 0, 2, 2, 1, 2)
Case 2: Restricted Constant and No Trend
Date: 05/04/17 Time: 13:05
Sample: 1970 2013
Included observations: 42

ECM Regression
Case 2: Restricted Constant and No Trend

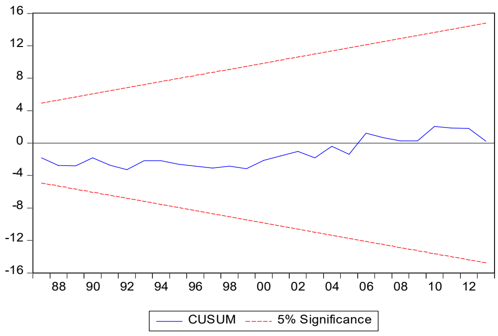
Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(EIV)	-0.001171	0.153801	-0.007614	0.9940
D(EIV(-1))	-0.853760	0.200451	-4.259196	0.0002
D(LAG)	0.014559	0.016228	0.897192	0.3775
D(LAG(-1))	-0.030873	0.016258	-1.898954	0.0683
D(TRC)	-0.001368	0.005893	-0.232103	0.8182
D(UT)	0.028356	0.013483	2.103042	0.0449
D(UT(-1))	-0.045624	0.016090	-2.835475	0.0086
CointEq(-1)*	-0.658105	0.072790	-9.041196	0.0000

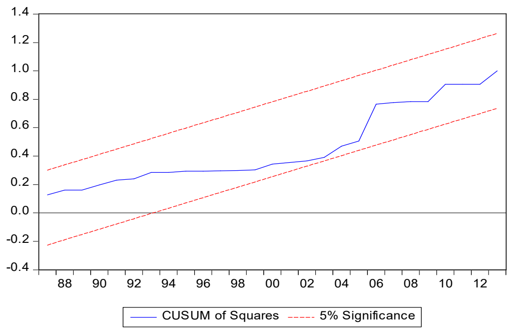
R-squared	0.679420	Mean dependent var	0.033689
Adjusted R-squared	0.613418	S.D. dependent var	0.070207
S.E. of regression	0.043651	Akaike info criterion	-3.255517
Sum squared resid	0.064785	Schwarz criterion	-2.924532
Log likelihood	76.36585	Hannan-Quinn criter.	-3.134198
Durbin-Watson stat	2.202035		

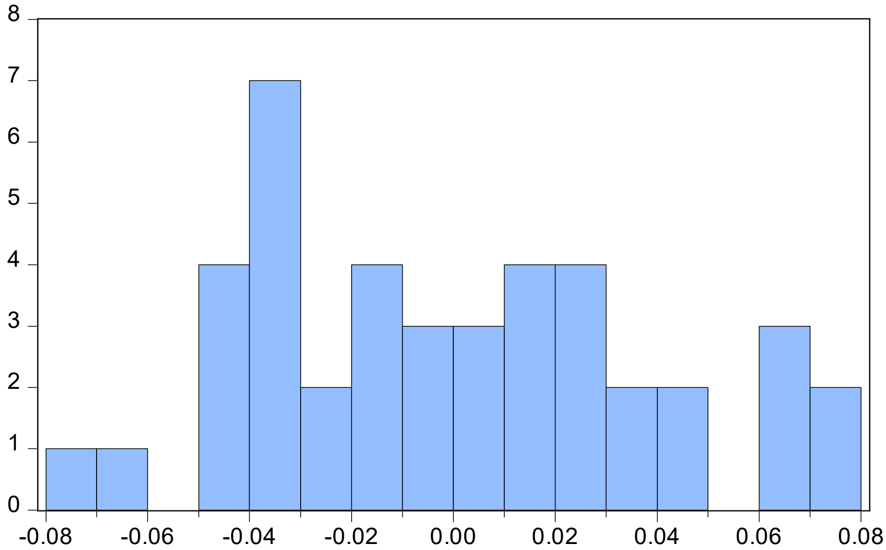
* p-value incompatible with t-Bounds distribution.

F-Bounds Test — Null Hypothesis: No levels relationship

Test Statistic	Value	Signif.	I(0)	I(1)
F-statistic	8.114217	10%	1.99	2.94
k	6	5%	2.27	3.28
		2.5%	2.55	3.61
		1%	2.88	3.99







Series: Residuals
Sample 1972 2013
Observations 42

Mean	4.65e-15
Median	-0.004129
Maximum	0.079711
Minimum	-0.073568
Std. Dev.	0.039751
Skewness	0.272449
Kurtosis	2.278014
Jarque-Bera	1.431811
Probability	0.488749

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	0.980805	Prob. F(1,26)	0.3311
Obs*R-squared	1.526783	Prob. Chi-Square(1)	0.2166

Heteroskedasticity Test: Breusch-Pagan-Godfrey

F-statistic	1.023784	Prob. F(14,27)	0.4604
Obs*R-squared	14.56428	Prob. Chi-Square(14)	0.4086
Scaled explained SS	3.846125	Prob. Chi-Square(14)	0.9963

Ramsey RESET Test
Equation: UNTITLED
Specification: LGR LGR(-1) LCPS TIV EIV EIV(-1) EIV(-2) LAG LAG(-1) LAG(-2) TRC TRC(-1) UT UT(-1) UT(-2) C
Omitted Variables: Squares of fitted values

	Value	df	Probability
t-statistic	0.285072	26	0.7778
F-statistic	0.081266	(1, 26)	0.7778

F-test summary:

	Sum of Sq.	df	Mean Squares
Test SSR	0.000202	1	0.000202
Restricted SSR	0.064785	27	0.002399
Unrestricted SSR	0.064583	26	0.002484

Appendix Q ARDL IV Results for Growth Model 2B (Person's Crime)

Dependent Variable: LGR
Method: Two-Stage Least Squares
Date: 06/13/17   Time: 12:47
Sample (adjusted): 1972 2013
Included observations: 42 after adjustments
Instrument specification: 1 LCPS TIV EIV(-1) LAG(-1) TRC(-1) UT(-1) D(EIV) D(EIV(-1)) D(LAG)D(LAG(-1)) D(TRC) D(UT) D(UT(-1)) LGR(-1)
Constant added to instrument list

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	30.05319	0.166265	180.7553	0.0000
LCPS	-0.091341	0.039751	-2.297791	0.0296
TIV	0.002444	0.002554	0.956638	0.3472
EIV	1.097330	0.261160	4.201757	0.0003
LAG	0.071966	0.014640	4.915526	0.0000
TRC	0.017886	0.010356	1.727178	0.0956
UT	0.105313	0.019951	5.278637	0.0000
D(EIV)	-1.099109	0.308038	-3.568099	0.0014
D(EIV(-1))	-1.297301	0.466447	-2.781242	0.0098
D(LAG)	-0.049842	0.030818	-1.617341	0.1174
D(LAG(-1))	-0.046911	0.032806	-1.429959	0.1642
D(TRC)	-0.019965	0.011698	-1.706685	0.0994
D(UT)	-0.062225	0.026470	-2.350812	0.0263
D(UT(-1))	-0.069326	0.026374	-2.628572	0.0140
D(LGR)	-0.519515	0.283107	-1.835050	0.0775

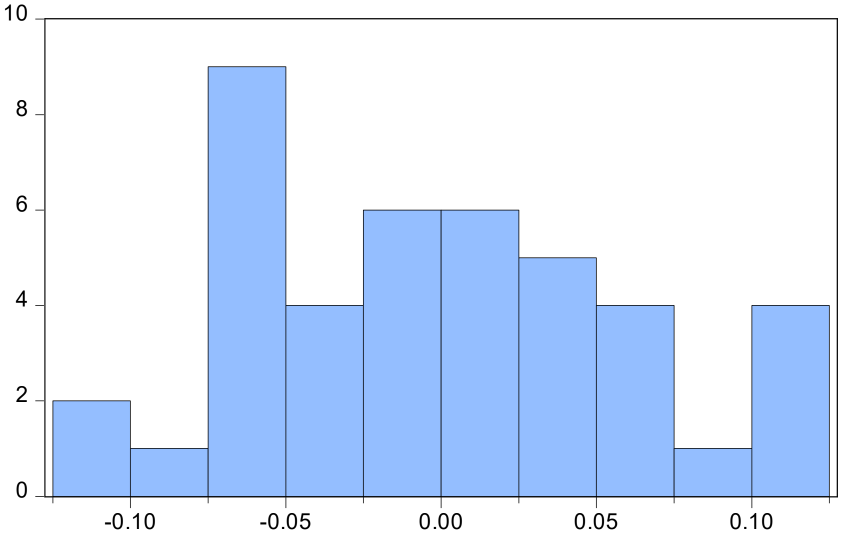
R-squared	0.979607	Mean dependent var	30.83284
Adjusted R-squared	0.969033	S.D. dependent var	0.422970
S.E. of regression	0.074432	Sum squared resid	0.149584
F-statistic	93.73463	Durbin-Watson stat	2.202035
Prob(F-statistic)	0.000000	Second-Stage SSR	0.064785
J-statistic	0.000000	Instrument rank	15

Breusch-Godfrey Serial Correlation LM Test:

Obs*R-squared	1.526783	Prob. Chi-Square(1)	0.2166

Heteroskedasticity Test: Breusch-Pagan-Godfrey

F-statistic	1.091059	Prob. F(14,27)	0.4070
Obs*R-squared	15.17552	Prob. Chi-Square(14)	0.3663
Scaled explained SS	4.007542	Prob. Chi-Square(14)	0.9954



Series: Residuals
Sample 1972 2013
Observations 42

Mean	-2.60e-15
Median	-0.006274
Maximum	0.121122
Minimum	-0.111788
Std. Dev.	0.060402
Skewness	0.272449
Kurtosis	2.278014
Jarque-Bera	1.431811
Probability	0.488749

Wald Test:
Equation: Untitled

Test Statistic	Value	df	Probability
F-statistic	109.0577	(6, 27)	0.0000
Chi-square	654.3462	6	0.0000

Null Hypothesis: C(2)=C(3)=C(4)=C(5)=C(6)=C(7)=0
Null Hypothesis Summary:

Normalized Restriction (= 0)	Value	Std. Err.
C(2)	-0.091341	0.039751
C(3)	0.002444	0.002554
C(4)	1.097330	0.261160
C(5)	0.071966	0.014640
C(6)	0.017886	0.010356
C(7)	0.105313	0.019951

Restrictions are linear in coefficients.

Dependent Variable: D(LGR)
Method: Two-Stage Least Squares
Date: 06/13/17 Time: 12:54
Sample (adjusted): 1972 2013
Included observations: 42 after adjustments
Instrument specification: 1 LCPS TIV EIV(-1) LAG(-1) TRC(-1) UT(-1) D(EIV) D(EIV(-1)) D(LAG) D(LAG(-1)) D(TRC) D(UT) D(UT(-1)) LGR(-1)
Constant added to instrument list

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	19.77815	3.665195	5.396207	0.0000
LGR(-1)	-0.658105	0.122614	-5.367289	0.0000
LCPS	-0.060112	0.025565	-2.351324	0.0263
TIV	0.001608	0.001711	0.939890	0.3556
EIV(-1)	0.722158	0.202323	3.569332	0.0014
LAG(-1)	0.047361	0.011513	4.113656	0.0003
TRC(-1)	0.011771	0.007630	1.542727	0.1345
UT(-1)	0.069307	0.019614	3.533621	0.0015
D(EIV)	-0.001171	0.221861	-0.005278	0.9958
D(EIV(-1))	-0.853760	0.286240	-2.982670	0.0060
D(LAG)	0.014559	0.021617	0.673518	0.5063
D(LAG(-1))	-0.030873	0.022602	-1.365953	0.1832
D(TRC)	-0.001368	0.009076	-0.150702	0.8813
D(UT)	0.028356	0.017112	1.657121	0.1091
D(UT(-1))	-0.045624	0.019477	-2.342477	0.0268

R-squared	0.679420	Mean dependent var	0.033689
Adjusted R-squared	0.513193	S.D. dependent var	0.070207
S.E. of regression	0.048984	Sum squared resid	0.064785
F-statistic	4.087312	Durbin-Watson stat	2.202035
Prob(F-statistic)	0.000840	Second-Stage SSR	0.064785
J-statistic	2.99E-30	Instrument rank	15

Appendix R ARDL OLS Results for Growth Model 2C (Property Crime)

Dependent Variable: LGR
Method: ARDL
Date: 05/05/17 Time: 11:31
Sample (adjusted): 1972 2013
Included observations: 42 after adjustments
Maximum dependent lags: 2 (Automatic selection)
Model selection method: Akaike info criterion (AIC)
Dynamic regressors (2 lags, automatic): LCPR TIV EIV LAG TRC UT
Fixed regressors: C
Number of models evalulated: 1458
Selected Model: ARDL(1, 2, 0, 2, 0, 1, 2)

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
LGR(-1)	0.433155	0.136529	3.172629	0.0037
LCPR	-0.048262	0.029112	-1.657776	0.1089
LCPR(-1)	0.042364	0.031052	1.364283	0.1837
LCPR(-2)	-0.052686	0.031153	-1.691194	0.1023
TIV	0.003620	0.001866	1.939384	0.0630
EIV	0.098813	0.209747	0.471106	0.6413
EIV(-1)	-0.354421	0.300946	-1.177690	0.2492
EIV(-2)	0.986541	0.279110	3.534591	0.0015
LAG	0.029807	0.010682	2.790317	0.0095
TRC	-0.012062	0.008907	-1.354210	0.1869
TRC(-1)	0.021733	0.008715	2.493819	0.0191
UT	0.028757	0.017303	1.662005	0.1081
UT(-1)	-0.021639	0.025405	-0.851792	0.4018
UT(-2)	0.046543	0.020742	2.243890	0.0332
C	17.09352	4.108794	4.160228	0.0003

R-squared	0.990280	Mean dependent var	30.83284
Adjusted R-squared	0.985239	S.D. dependent var	0.422970
S.E. of regression	0.051388	Akaike info criterion	-2.826372
Sum squared resid	0.071300	Schwarz criterion	-2.205775
Log likelihood	74.35380	Hannan-Quinn criter.	-2.598898
F-statistic	196.4762	Durbin-Watson stat	1.994824
Prob(F-statistic)	0.000000		

*Note: p-values and any subsequent tests do not account for model selection.

Model Selection Criteria Table
Dependent Variable: LGR
Date: 05/05/17 Time: 11:31
Sample: 1970 2013
Included observations: 42

Model	LogL	AIC*	BIC	HQ	Adj. R-sq	Specification
913	74.353802	-2.826372	-2.205775	-2.598898	0.985239	ARDL(1, 2, 0, 2, 0, 1, 2)

ARDL Long Run Form and Bounds Test
Dependent Variable: D(LGR)
Selected Model: ARDL(1, 2, 0, 2, 0, 1, 2)
Case 2: Restricted Constant and No Trend
Date: 05/05/17 Time: 11:31
Sample: 1970 2013
Included observations: 42

Conditional Error Correction Regression

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	17.09352	4.108794	4.160228	0.0003
LGR(-1)*	-0.566845	0.136529	-4.151829	0.0003
LCPR(-1)	-0.058583	0.036091	-1.623205	0.1162
TIV**	0.003620	0.001866	1.939384	0.0630
EIV(-1)	0.730934	0.213519	3.423267	0.0020
LAG**	0.029807	0.010682	2.790317	0.0095
TRC(-1)	0.009670	0.007608	1.271091	0.2145
UT(-1)	0.053661	0.019956	2.688997	0.0121
D(LCPR)	-0.048262	0.029112	-1.657776	0.1089
D(LCPR(-1))	0.052686	0.031153	1.691194	0.1023
D(EIV)	0.098813	0.209747	0.471106	0.6413
D(EIV(-1))	-0.986541	0.279110	-3.534591	0.0015
D(TRC)	-0.012062	0.008907	-1.354210	0.1869
D(UT)	0.028757	0.017303	1.662005	0.1081
D(UT(-1))	-0.046543	0.020742	-2.243890	0.0332

* p-value incompatible with t-Bounds distribution.
** Variable interpreted as Z = Z(-1) + D(Z).

Levels Equation
Case 2: Restricted Constant and No Trend

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LCPR	-0.103350	0.059412	-1.739536	0.0933
TIV	0.006386	0.003001	2.127891	0.0426
EIV	1.289479	0.345863	3.728291	0.0009
LAG	0.052585	0.015154	3.469947	0.0018
TRC	0.017060	0.011900	1.433605	0.1632
UT	0.094666	0.022507	4.206121	0.0003
C	30.15557	0.232500	129.7013	0.0000

EC = LGR - (-0.1034*LCPR + 0.0064*TIV + 1.2895*EIV + 0.0526*LAG + 0.0171 *TRC + 0.0947*UT + 30.1556)

ARDL Error Correction Regression
Dependent Variable: D(LGR)
Selected Model: ARDL(1, 2, 0, 2, 0, 1, 2)
Case 2: Restricted Constant and No Trend
Date: 05/05/17 Time: 11:32
Sample: 1970 2013
Included observations: 42

ECM Regression
Case 2: Restricted Constant and No Trend

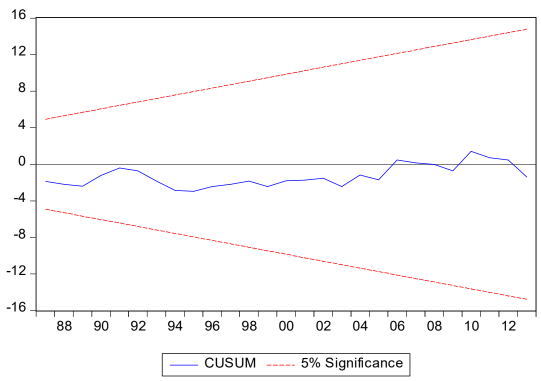
Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LCPR)	-0.048262	0.021552	-2.239352	0.0336
D(LCPR(-1))	0.052686	0.022161	2.377451	0.0248
D(EIV)	0.098813	0.154741	0.638570	0.5285
D(EIV(-1))	-0.986541	0.221828	-4.447335	0.0001
D(TRC)	-0.012062	0.006344	-1.901273	0.0680
D(UT)	0.028757	0.013967	2.058993	0.0493
D(UT(-1))	-0.046543	0.017102	-2.721574	0.0112
CointEq(-1)*	-0.566845	0.069212	-8.189918	0.0000

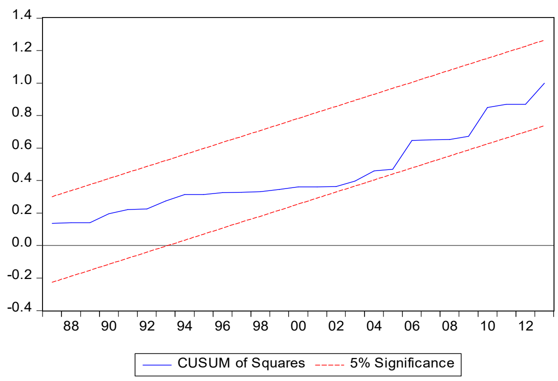
R-squared	0.647185	Mean dependent var	0.033689
Adjusted R-squared	0.574547	S.D. dependent var	0.070207
S.E. of regression	0.045794	Akaike info criterion	-3.159705
Sum squared resid	0.071300	Schwarz criterion	-2.828720
Log likelihood	74.35380	Hannan-Quinn criter.	-3.038386
Durbin-Watson stat	1.994824		

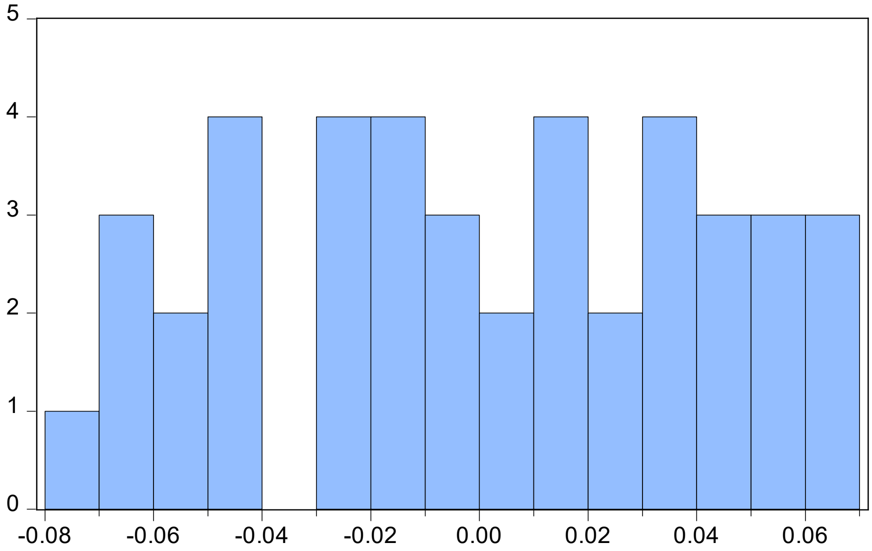
* p-value incompatible with t-Bounds distribution.

F-Bounds Test   Null Hypothesis: No levels relationship

Test Statistic	Value	Signif.	I(0)	I(1)
F-statistic	6.658155	10%	1.99	2.94
k	6	5%	2.27	3.28
		2.5%	2.55	3.61
		1%	2.88	3.99







Series: Residuals
Sample 1972 2013
Observations 42

Mean	-2.45e-15
Median	-0.000748
Maximum	0.068516
Minimum	-0.072410
Std. Dev.	0.041701
Skewness	-0.073683
Kurtosis	1.902811
Jarque-Bera	2.144695
Probability	0.342204

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	0.084990	Prob. F(1,26)	0.7730
Obs*R-squared	0.136845	Prob. Chi-Square(1)	0.7114

Heteroskedasticity Test: Breusch-Pagan-Godfrey

F-statistic	1.313819	Prob. F(14,27)	0.2625
Obs*R-squared	17.01843	Prob. Chi-Square(14)	0.2552
Scaled explained SS	3.174793	Prob. Chi-Square(14)	0.9987

Ramsey RESET Test
Equation: UNTITLED
Specification: LGR LGR(-1) LCPR LCPR(-1) LCPR(-2) TIV EIV EIV(-1) EIV(
-2) LAG TRC TRC(-1) UT UT(-1) UT(-2) C
Omitted Variables: Squares of fitted values

	Value	df	Probability
t-statistic	0.512363	26	0.6127
F-statistic	0.262516	(1, 26)	0.6127

F-test summary:

	Sum of Sq.	df	Mean Squares
Test SSR	0.000713	1	0.000713
Restricted SSR	0.071300	27	0.002641
Unrestricted SSR	0.070587	26	0.002715

Appendix S ARDL OLS Results for Growth Model 2C (Property Crime)

Dependent Variable: LGR
Method: Two-Stage Least Squares
Date: 06/13/17 Time: 14:06
Sample (adjusted): 1972 2013
Included observations: 42 after adjustments
Instrument specification: 1 LCPR(-1) TIV EIV(-1) LAG TRC(-1) UT(-1)
D(LCPR) D(LCPR(-1)) D(EIV) D(EIV(-1)) D(TRC) D(UT) D(UT(-1)) LGR(
-1)
Constant added to instrument list

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	30.15557	0.232500	129.7013	0.0000
LCPR	-0.103350	0.059412	-1.739536	0.0933
TIV	0.006386	0.003001	2.127891	0.0426
EIV	1.289479	0.345863	3.728291	0.0009
LAG	0.052585	0.015154	3.469947	0.0018
TRC	0.017060	0.011900	1.433605	0.1632
UT	0.094666	0.022507	4.206121	0.0003
D(LCPR)	0.018209	0.066048	0.275692	0.7849
D(LCPR(-1))	0.092946	0.051433	1.807112	0.0819
D(EIV)	-1.115157	0.432759	-2.576854	0.0158
D(EIV(-1))	-1.740409	0.589745	-2.951123	0.0065
D(TRC)	-0.038339	0.015162	-2.528652	0.0176
D(UT)	-0.043934	0.033336	-1.317913	0.1986
D(UT(-1))	-0.082109	0.032471	-2.528726	0.0176
D(LGR)	-0.764152	0.424910	-1.798387	0.0833

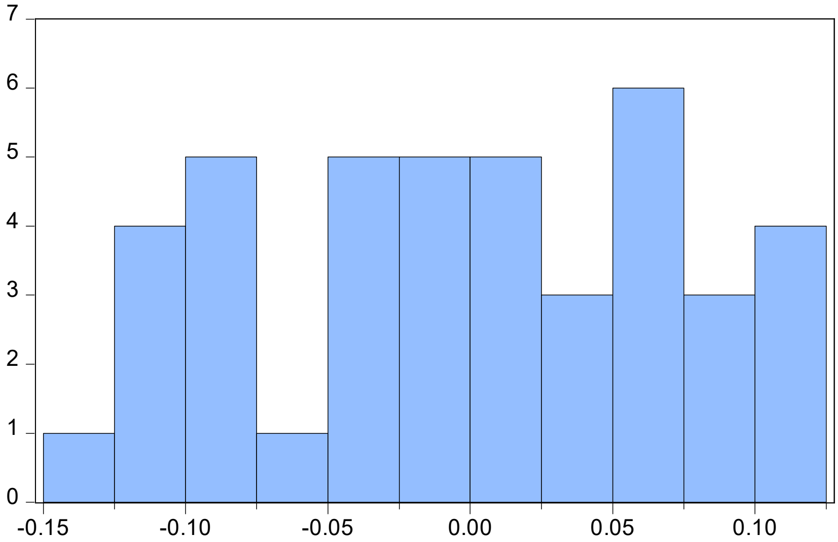
R-squared	0.969748	Mean dependent var	30.83284
Adjusted R-squared	0.954062	S.D. dependent var	0.422970
S.E. of regression	0.090656	Sum squared resid	0.221901
F-statistic	63.13031	Durbin-Watson stat	1.994824
Prob(F-statistic)	0.000000	Second-Stage SSR	0.071300
J-statistic	0.000000	Instrument rank	15

Breusch-Godfrey Serial Correlation LM Test:

Obs*R-squared	0.136845	Prob. Chi-Square(1)	0.7114

Heteroskedasticity Test: Breusch-Pagan-Godfrey

F-statistic	1.131043	Prob. F(14,27)	0.3774
Obs*R-squared	15.52607	Prob. Chi-Square(14)	0.3432
Scaled explained SS	2.896393	Prob. Chi-Square(14)	0.9992



Series: Residuals
Sample 1972 2013
Observations 42

Mean	-6.91e-16
Median	-0.001320
Maximum	0.120872
Minimum	-0.127742
Std. Dev.	0.073568
Skewness	-0.073683
Kurtosis	1.902811
Jarque-Bera	2.144695
Probability	0.342204

Wald Test:
Equation: Untitled

Test Statistic	Value	df	Probability
F-statistic	61.98353	(6, 27)	0.0000
Chi-square	371.9012	6	0.0000

Null Hypothesis: C(2)=C(3)=C(4)=C(5)=C(6)=C(7)=0
Null Hypothesis Summary:

Normalized Restriction (= 0)	Value	Std. Err.
C(2)	-0.103350	0.059412
C(3)	0.006386	0.003001
C(4)	1.289479	0.345863
C(5)	0.052585	0.015154
C(6)	0.017060	0.011900
C(7)	0.094666	0.022507

Restrictions are linear in coefficients.

Dependent Variable: D(LGR)
Method: Two-Stage Least Squares
Date: 06/13/17 Time: 14:12
Sample (adjusted): 1972 2013
Included observations: 42 after adjustments
Instrument specification: 1 LCPR(-1) TIV EIV(-1) LAG TRC(-1) UT(-1) D(LCPR) D(LCPR(-1)) D(EIV) D(EIV(-1)) D(TRC) D(UT) D(UT(-1)) LGR(-1)
Constant added to instrument list

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	17.09352	4.108794	4.160228	0.0003
LCPR(-1)	-0.058583	0.036091	-1.623205	0.1162
TIV	0.003620	0.001866	1.939384	0.0630
EIV(-1)	0.730934	0.213519	3.423267	0.0020
LAG	0.029807	0.010682	2.790317	0.0095
TRC(-1)	0.009670	0.007608	1.271091	0.2145
UT(-1)	0.053661	0.019956	2.688997	0.0121
D(LCPR)	-0.048262	0.029112	-1.657776	0.1089
D(LCPR(-1))	0.052686	0.031153	1.691194	0.1023
D(EIV)	0.098813	0.209747	0.471106	0.6413
D(EIV(-1))	-0.986541	0.279110	-3.534591	0.0015
D(TRC)	-0.012062	0.008907	-1.354210	0.1869
D(UT)	0.028757	0.017303	1.662005	0.1081
D(UT(-1))	-0.046543	0.020742	-2.243890	0.0332
LGR(-1)	-0.566845	0.136529	-4.151829	0.0003

R-squared	0.647185	Mean dependent var	0.033689
Adjusted R-squared	0.464244	S.D. dependent var	0.070207
S.E. of regression	0.051388	Sum squared resid	0.071300
F-statistic	3.537672	Durbin-Watson stat	1.994824
Prob(F-statistic)	0.002368	Second-Stage SSR	0.071300
J-statistic	1.79E-29	Instrument rank	15

Appendix T Results for Granger Causality (Overall Crime)

VAR Lag Order Selection Criteria
Endogenous variables: LGR LCR UN YL POV
Exogenous variables: C
Date: 05/05/17   Time: 21:12
Sample: 1970 2013
Included observations: 40

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-44.55532	NA	8.20e-06	2.477766	2.688876	2.554097
1	235.6734	476.3889	2.38e-11	-10.28367	-9.017012*	-9.825687*
2	254.2420	26.92438	3.49e-11	-9.962098	-7.639889	-9.122461
3	272.1324	21.46858	5.86e-11	-9.606622	-6.228863	-8.385331
4	328.3109	53.36950*	1.74e-11*	-11.16554*	-6.732235	-9.562599

* indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

VAR Residual Serial Correlation LM Tests
Null Hypothesis: no serial correlation at lag order h
Date: 05/05/17   Time: 21:14
Sample: 1970 2013
Included observations: 40

Lags	LM-Stat	Prob
1	25.84105	0.4161
2	8.991279	0.9986

Probs from chi-square with 25 df.

VAR Granger Causality/Block Exogeneity Wald Tests
Date: 05/05/17   Time: 21:15
Sample: 1970 2013
Included observations: 39

Dependent variable: LGR

Excluded	Chi-sq	df	Prob.
LCR	3.822024	4	0.4306
UN	4.645480	4	0.3256
YL	5.237002	4	0.2638
POV	2.231512	4	0.6933
All	15.68188	16	0.4754

Dependent variable: LCR

Excluded	Chi-sq	df	Prob.
LGR	6.819592	4	0.1457
UN	2.429980	4	0.6572
YL	6.869742	4	0.1429
POV	2.380662	4	0.6661
All	15.91755	16	0.4587

Dependent variable: UN

Excluded	Chi-sq	df	Prob.
LGR	4.827516	4	0.3055
LCR	24.93858	4	0.0001
YL	4.640094	4	0.3263
POV	23.90008	4	0.0001
All	58.41629	16	0.0000

Dependent variable: YL

Excluded	Chi-sq	df	Prob.
LGR	5.185245	4	0.2688
LCR	3.951218	4	0.4126
UN	4.663124	4	0.3236
POV	2.112329	4	0.7151
All	15.84874	16	0.4636

Dependent variable: POV

Excluded	Chi-sq	df	Prob.
LGR	0.639836	4	0.9585
LCR	4.156000	4	0.3853
UN	3.747257	4	0.4413
YL	0.575050	4	0.9658
All	16.49392	16	0.4191

Variance Decomposition of LGR:

Period	S.E.	LGR	LCR	UN	YL	POV
1	0.067649	100.0000	0.000000	0.000000	0.000000	0.000000
2	0.099779	96.85906	0.110828	0.380984	1.738989	0.910137
3	0.121664	95.68051	1.939457	0.351099	1.416436	0.612496
4	0.140823	93.70468	3.034745	0.308925	2.171384	0.780267
5	0.158378	87.51309	5.633228	4.459569	1.773986	0.620126
6	0.199527	62.64073	8.126934	22.61578	5.878126	0.738427
7	0.243937	42.77319	13.13231	33.31745	10.16752	0.609528
8	0.293550	30.05425	13.06766	41.65515	14.25850	0.964438

9	0.342825	25.19312	10.04167	46.86663	16.88242	1.016162
10	0.377778	25.31544	8.934177	46.58003	17.52587	1.644482
Variance Decomposition of LCR:						
Period	S.E.	LGR	LCR	UN	YL	POV
1	0.149197	8.194390	91.80561	0.000000	0.000000	0.000000
2	0.202813	11.94739	80.18595	2.519968	5.266221	0.080473
3	0.246078	8.235605	68.38942	1.978910	20.15095	1.245116
4	0.276199	9.809388	60.69749	2.297610	26.20306	0.992451
5	0.310741	9.459694	53.67483	6.546604	27.16503	3.153844
6	0.361871	9.702158	46.38085	9.562639	28.28759	6.066759
7	0.417754	10.42896	35.93667	14.94039	33.64785	5.046129
8	0.462935	9.740826	29.59706	20.22095	36.31005	4.131113
9	0.487160	9.188933	26.84544	23.07910	36.30912	4.577411
10	0.498913	9.540159	25.85779	24.38839	35.55898	4.654686
Variance Decomposition of UN:						
Period	S.E.	LGR	LCR	UN	YL	POV
1	1.772442	1.106750	0.107072	98.78618	0.000000	0.000000
2	2.135697	0.781042	15.15522	83.62100	0.436796	0.005941
3	2.870652	3.248660	21.80261	51.42091	0.385109	23.14270
4	3.161482	2.907870	22.18416	53.10097	0.700031	21.10697
5	3.409821	2.505161	25.94200	46.03962	0.991766	24.52145
6	3.605119	2.944158	23.25535	47.08904	1.014037	25.69741
7	3.881461	6.381326	20.26156	46.61659	2.238084	24.50243
8	4.339464	7.218036	16.83313	41.58036	14.16364	20.20484
9	4.559721	7.094672	15.48317	39.64258	18.24148	19.53810
10	4.650806	8.527884	15.20437	38.10615	17.54193	20.61967
Variance Decomposition of YL:						
Period	S.E.	LGR	LCR	UN	YL	POV
1	0.044049	99.90089	0.000466	0.010303	0.088337	0.000000
2	0.064941	96.52473	0.131602	0.234311	2.303778	0.805574
3	0.078856	95.32350	1.968639	0.215389	1.937973	0.554495
4	0.090639	93.57326	3.117824	0.187082	2.430349	0.691484
5	0.101873	86.80294	5.886908	4.760246	2.002272	0.547633
6	0.128969	61.39460	8.564605	23.35320	5.998067	0.689527
7	0.157907	41.79257	13.82882	33.78357	10.00425	0.590797
8	0.189388	29.54296	13.83391	41.84688	13.77195	1.004305
9	0.219587	24.98056	10.79158	46.94540	16.17611	1.106343
10	0.240450	25.13649	9.720560	46.60390	16.70237	1.836685
Variance Decomposition of POV:						
Period	S.E.	LGR	LCR	UN	YL	POV
1	0.115561	8.746689	8.732136	5.412141	0.333468	76.77557
2	0.149705	33.18768	12.54484	8.039343	0.274020	45.95412
3	0.160335	34.76309	14.30489	10.61284	0.247170	40.07201
4	0.166560	32.75177	15.27518	10.45167	2.930782	38.59059
5	0.174975	35.22927	14.63620	10.11434	2.658668	37.36152
6	0.188547	33.49995	14.35755	16.90126	3.007408	32.23384
7	0.205782	31.30519	17.58999	19.64920	3.035478	28.42014
8	0.219302	35.41824	17.94158	18.79741	2.818666	25.02410
9	0.240271	45.67215	15.24201	15.65952	2.569857	20.85647
10	0.268453	47.47362	13.03855	17.54466	5.106174	16.83699
Cholesky Ordering: LGR LCR UN YL POV						

Appendix U Results for Granger Causality (Person's Crime)

VAR Lag Order Selection Criteria
Endogenous variables: LGR LCPS UN YL POV
Exogenous variables: C
Date: 05/05/17   Time: 21:18
Sample: 1970 2013
Included observations: 40

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-72.61925	NA	3.34e-05	3.880962	4.092072	3.957293
1	215.9001	490.4830	6.39e-11*	-9.295007	-8.028348*	-8.837023*
2	231.6586	22.84974	1.08e-10	-8.832929	-6.510720	-7.993292
3	255.2117	28.26378	1.37e-10	-8.760586	-5.382828	-7.539295
4	299.4651	42.04075*	7.37e-11	-9.723257*	-5.289949	-8.120313

* indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

VAR Residual Serial Correlation LM Tests
Null Hypothesis: no serial correlation at lag order h
Date: 05/15/17   Time: 16:54
Sample: 1970 2013
Included observations: 40

Lags	LM-Stat	Prob
1	25.47389	0.4361
2	30.56811	0.2037

Probs from chi-square with 25 df.

VAR Granger Causality/Block Exogeneity Wald Tests
Date: 05/05/17   Time: 21:19
Sample: 1970 2013
Included observations: 39

Dependent variable: LGR

Excluded	Chi-sq	df	Prob.
LCPS	4.490072	4	0.3437
UN	4.596418	4	0.3313
YL	4.104810	4	0.3920
POV	3.813166	4	0.4319
All	18.62055	16	0.2888

Dependent variable: LCPS

Excluded	Chi-sq	df	Prob.
LGR	9.179754	4	0.0568
UN	2.982610	4	0.5607
YL	9.673613	4	0.0463
POV	6.187733	4	0.1856
All	34.55638	16	0.0046

Dependent variable: UN

Excluded	Chi-sq	df	Prob.
LGR	10.91485	4	0.0275
LCPS	29.17147	4	0.0000
YL	11.59711	4	0.0206
POV	20.89587	4	0.0003
All	94.19447	16	0.0000

Dependent variable: YL

Excluded	Chi-sq	df	Prob.
LGR	4.181237	4	0.3820
LCPS	4.681245	4	0.3216
UN	4.682641	4	0.3214
POV	3.793997	4	0.4346
All	19.37851	16	0.2495

Dependent variable: POV

Excluded	Chi-sq	df	Prob.
LGR	5.392775	4	0.2493
LCPS	8.794680	4	0.0664
UN	9.240694	4	0.0554
YL	5.316989	4	0.2563
All	27.86162	16	0.0328

Variance Decomposition of LGR:						
Period	S.E.	LGR	LCPS	UN	YL	POV
1	0.066943	100.0000	0.000000	0.000000	0.000000	0.000000
2	0.097366	98.23136	0.055433	0.086904	0.008502	1.617803
3	0.119940	95.91179	0.121253	1.489290	0.764508	1.713163
4	0.138009	88.06104	2.351844	1.631647	4.108905	3.846565
5	0.147293	83.79423	2.098818	5.292129	4.064449	4.750376
6	0.169844	64.31210	7.238818	20.44269	3.580709	4.425686
7	0.210505	43.55592	14.45017	32.60810	4.170919	5.214888
8	0.271012	35.82704	14.21151	35.33217	9.525658	5.103623
9	0.342729	36.01080	10.51114	33.34145	14.99153	5.145078
10	0.417474	38.09229	7.489312	29.70755	17.49575	7.215106
Variance Decomposition of LCPS:						

Period	S.E.	LGR	LCPS	UN	YL	POV
1	0.295456	19.21705	80.78295	0.000000	0.000000	0.000000
2	0.375067	27.27189	50.13353	1.037952	19.57166	1.984964
3	0.403381	26.74128	44.76809	4.157090	17.68303	6.650514
4	0.414176	28.06889	43.29798	4.249557	18.06451	6.319067
5	0.440010	30.33308	38.38456	3.804762	16.42496	11.05264
6	0.518660	22.44322	28.22512	24.39573	14.75139	10.18455
7	0.603866	19.03529	23.76454	36.59425	10.91105	9.694868
8	0.688479	21.82860	20.38275	34.38955	9.057124	14.34197
9	0.804534	23.86877	15.09444	31.86624	15.97574	13.19481
10	0.979625	28.15249	10.44667	31.93020	16.88424	12.58640
Variance Decomposition of UN:						
Period	S.E.	LGR	LCPS	UN	YL	POV
1	1.534903	1.475760	0.002464	98.52178	0.000000	0.000000
2	2.694400	2.840406	40.79577	47.45832	8.807142	0.098364
3	3.291326	4.884361	43.26387	33.61828	5.941223	12.29226
4	3.422762	5.020679	40.03714	32.40412	10.72384	11.81421
5	3.528686	4.894145	37.67079	32.01539	11.37530	14.04438
6	4.016564	11.37713	29.07530	25.98393	11.40794	22.15570
7	4.525107	14.44481	25.49866	20.53093	11.05599	28.46960
8	4.792407	17.03690	24.91455	19.96752	12.43857	25.64247
9	5.036702	15.77399	22.93092	18.47945	18.05126	24.76439
10	5.185741	14.88862	25.59784	18.20845	17.06433	24.24076
Variance Decomposition of YL:						
Period	S.E.	LGR	LCPS	UN	YL	POV
1	0.043454	99.89935	0.015439	0.006697	0.078518	0.000000
2	0.063207	98.17243	0.068963	0.033685	0.044382	1.680539
3	0.077619	95.71567	0.145923	1.732350	0.605876	1.800184
4	0.088874	87.68612	2.603215	1.964145	3.640647	4.105877
5	0.094758	82.88423	2.303649	6.050979	3.562396	5.198750
6	0.109904	62.50171	7.263947	22.00821	3.297987	4.928147
7	0.137700	42.07774	14.15413	33.93969	4.070872	5.757573
8	0.178608	35.55441	13.58306	35.82284	9.479255	5.560432
9	0.226750	36.56642	9.864747	33.18871	14.87919	5.500933
10	0.276748	39.05057	6.947638	29.23027	17.30012	7.471396
Variance Decomposition of POV:						
Period	S.E.	LGR	LCPS	UN	YL	POV
1	0.109600	0.429275	1.217502	2.388019	0.695798	95.26941
2	0.149450	25.82573	0.685720	5.680296	0.473003	67.33525
3	0.170923	25.98817	0.542310	14.82881	0.430537	58.21017
4	0.177683	25.78184	3.805342	14.32658	0.759473	55.32676
5	0.200025	28.44691	5.954922	13.39623	1.576785	50.62514
6	0.250786	29.30516	4.401818	25.26322	7.177374	33.85243
7	0.366315	39.05332	6.743144	28.27836	5.963806	19.96138
8	0.490222	48.72326	5.807513	23.90075	8.854697	12.71378
9	0.631883	57.70573	3.500302	17.73770	12.51107	8.545196
10	0.752169	62.04282	2.780749	13.54859	14.53724	7.090596
Cholesky Ordering: LGR LCPS UN YL POV						

Appendix V Results for Granger Causality (Property Crime)

VAR Lag Order Selection Criteria
Endogenous variables: LGR LCPR UN YL POV
Exogenous variables: C
Date: 05/05/17 Time: 21:20
Sample: 1970 2013
Included observations: 40

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-75.44786	NA	3.84e-05	4.022393	4.233503	4.098724
1	210.2074	485.6140	8.50e-11*	-9.010372	-7.743712*	-8.552388*
2	227.3274	24.82392	1.34e-10	-8.616369	-6.294160	-7.776732
3	249.3096	26.37871	1.84e-10	-8.465482	-5.087723	-7.244191
4	292.9425	41.45123*	1.02e-10	-9.397126*	-4.963817	-7.794182

* indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

VAR Residual Serial Correlation LM Tests
Null Hypothesis: no serial correlation at lag order h
Date: 05/15/17 Time: 16:54
Sample: 1970 2013
Included observations: 40

Lags	LM-Stat	Prob
1	26.96938	0.3574
2	32.25386	0.1508

Probs from chi-square with 25 df.

VAR Granger Causality/Block Exogeneity Wald Tests
Date: 05/05/17 Time: 21:21
Sample: 1970 2013
Included observations: 39

Dependent variable: LGR

Excluded	Chi-sq	df	Prob.
LCPR	6.116250	4	0.1906
UN	3.946200	4	0.4133
YL	6.509672	4	0.1642
POV	3.027977	4	0.5532
All	21.48798	16	0.1605

Dependent variable: LCPR

Excluded	Chi-sq	df	Prob.
LGR	13.20308	4	0.0103
UN	6.119166	4	0.1904
YL	13.45264	4	0.0093
POV	4.573613	4	0.3339
All	50.92098	16	0.0000

Dependent variable: UN

Excluded	Chi-sq	df	Prob.
LGR	1.428809	4	0.8392
LCPR	3.183470	4	0.5276
YL	1.420416	4	0.8406
POV	6.064901	4	0.1944
All	18.49132	16	0.2959

Dependent variable: YL

Excluded	Chi-sq	df	Prob.
LGR	6.710802	4	0.1520
LCPR	6.174389	4	0.1865
UN	4.093574	4	0.3935
POV	2.920693	4	0.5712
All	22.03431	16	0.1421

Dependent variable: POV

Excluded	Chi-sq	df	Prob.
LGR	2.561293	4	0.6337
LCPR	8.980766	4	0.0616
UN	8.007864	4	0.0913
YL	2.340198	4	0.6735
All	27.31358	16	0.0381

Variance Decomposition of LGR:						
Period	S.E.	LGR	LCPR	UN	YL	POV
1	0.063083	100.0000	0.000000	0.000000	0.000000	0.000000
2	0.093091	91.15399	2.690515	1.651714	2.416428	2.087358
3	0.111847	88.02349	5.986964	1.147710	1.781634	3.060205
4	0.127813	87.33329	4.908659	0.999473	1.401823	5.356751
5	0.147275	78.90924	3.963402	9.647770	1.662026	5.817560
6	0.184983	54.74224	2.715748	32.86243	5.843426	3.836152
7	0.215935	40.18469	5.366724	40.94714	10.14790	3.353550
8	0.253274	31.04008	12.10392	41.47451	12.77096	2.610524
9	0.294935	29.09127	15.44495	39.83816	13.69914	1.926490
10	0.328569	29.27508	20.12230	36.78382	12.25949	1.559300
Variance Decomposition of LCPR:						
Period	S.E.	LGR	LCPR	UN	YL	POV

1	0.239285	12.45727	87.54273	0.000000	0.000000	0.000000
2	0.287048	8.677244	76.49907	11.61296	2.227377	0.983347
3	0.353814	5.799084	53.01092	11.85755	26.76088	2.571569
4	0.399902	17.15664	41.54878	11.58183	27.43522	2.277523
5	0.477430	26.39443	31.10289	10.09956	26.40888	5.994232
6	0.657840	56.63380	16.47407	6.127479	16.83416	3.930493
7	0.854443	65.33409	10.19612	7.044187	12.55260	4.873010
8	1.076691	71.83194	7.317842	6.061782	9.671929	5.116507
9	1.233753	77.07943	5.654424	4.731402	7.570105	4.964638
10	1.378650	77.38208	4.534507	5.882953	6.064542	6.135917
Variance Decomposition of UN:						
Period	S.E.	LGR	LCPR	UN	YL	POV
1	2.603001	0.038341	23.25173	76.70993	0.000000	0.000000
2	3.265647	0.910441	17.05117	81.62479	0.408733	0.004872
3	3.569889	1.293852	19.32632	71.17786	1.416085	6.785884
4	3.645103	1.578112	18.99025	71.22964	1.654273	6.547720
5	3.672897	2.843090	18.70418	70.17855	1.629931	6.644248
6	4.244920	5.911489	19.64295	64.70452	2.419300	7.321745
7	4.371811	8.400928	19.77180	61.94992	2.331026	7.546325
8	4.514054	9.491657	20.82037	58.25102	4.278555	7.158398
9	4.646287	12.31701	19.75755	55.06045	5.848388	7.016598
10	4.687755	12.20955	19.48244	55.47563	5.938989	6.893392
Variance Decomposition of YL:						
Period	S.E.	LGR	LCPR	UN	YL	POV
1	0.041047	99.88940	0.044997	0.009077	0.056522	0.000000
2	0.060603	90.36709	3.139123	1.606677	2.873356	2.013753
3	0.072733	86.96634	6.843423	1.124168	2.131051	2.935015
4	0.082684	86.37322	5.752853	0.974362	1.694973	5.204590
5	0.095141	77.77774	4.662476	9.994376	1.876694	5.688714
6	0.119919	53.66275	3.172304	33.59982	5.841787	3.723341
7	0.140036	39.35559	5.965988	41.38980	9.991835	3.296787
8	0.163788	30.34861	12.98415	41.61301	12.45356	2.600673
9	0.189462	28.26142	16.51963	39.95038	13.31976	1.948814
10	0.209881	28.04907	21.46264	36.97586	11.90487	1.607550
Variance Decomposition of POV:						
Period	S.E.	LGR	LCPR	UN	YL	POV
1	0.106828	18.26028	15.16837	5.456482	1.315747	59.79912
2	0.156771	49.17725	11.78670	9.511209	0.979915	28.54493
3	0.168106	53.93616	11.29856	8.868627	0.881293	25.01536
4	0.181379	48.88416	11.04283	12.15913	6.281664	21.63222
5	0.185582	47.15555	10.73779	14.45424	6.011935	21.64049
6	0.207634	37.80026	8.601168	30.52021	4.814232	18.26413
7	0.234295	34.22056	9.837188	35.04744	4.334308	16.56050
8	0.254667	32.38563	19.04456	29.98648	4.407584	14.17574
9	0.264809	30.15463	24.06414	28.57921	4.085249	13.11678
10	0.280281	27.08408	24.42220	29.90226	6.583490	12.00798
Cholesky Ordering: LGR LCPR UN YL POV						