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Inflation, Deterrence and Crime: Evidence from Nigeria using Bounds Test Approach

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Abstract
This study examines the link between inflation and crime with an alternative way of reducing crime in Nigeria. The alternative to crime decrease tool apart from traditional deterrence measures is domestic investment. Besides, explanation on how inflation has affected crime in Nigeria rest on the strain and rational choice theory. Also, data set from 1970 to 2013 estimated by using the autoregressive distributed lag model. The results showed that inflation affects crime and other property crimes of armed robbery, false pretence/ cheating and arson at the 5% level of significance. In addition, domestic investment reduces crime statistically at 1% when compared with the prosecution that weakly reduces crime significantly at 10%. Punishment found weak to reduce crime in the long-run significantly. Based, on the results, this study suggests that inflation should be check and controlled, the crime deterrence institutions should be strengthen and domestic investment improved on to reduce crime in Nigeria.
Keywords: Inflation, crime, strain, deterrence, autoregressive distributed model.

1.0 Introduction

There exist good literature which have considered the link between inflation and crime. Most of those previous studies have affirmed a significant connection between inflation and crime positively (Seals & Nunley, 2007; Tang, 2009 & 2011; Torruam & Abur 2014; Sidebottom, Ashby & Johnson, 2014). Also, other previous works have found no statistical relation between inflation and crime (Omotor, 2009; Baharom, Habibullah & Noor, 2013; Aminu, Manu, El-Maude & Kabiru, 2013). Besides, previous works lingered more on this link without considering deterrence measures and emphasis on domestic investment to curb crime in the prevalence of inflation in a society in which this study differs. Also, the mixed findings and absence of deterrence measures in the previous studies between inflation and crime encouraged the need for this study.

In Nigeria, inflation is a yardstick to assess the capacity of a government in achieving economic development (Akinbobola, 2012). This assessment of the economy shall focus on the difference and distortion in the economy cause by inflation as a tool of monetary policy. In addition, the distortion created by inflation have reduced the growth of the economy (Bawa and Abdullahi, 2012). Also, the result of inflation has been a source of socioeconomic and political tension and unrest especially in developing economies (Akinbobola, 2012). That is, poor performance of the economy and socioeconomic tension occurred in the economy because inflation increases money supply due to more money chasing fewer goods. The effect of this is that inflation reduces the purchasing power and increases the cost of living. Besides, the low purchasing power and the high cost of living would mount pressure on individuals to seek for more alternative means of meeting their needs. Also, in trying to meet their needs, they faced stress and became emotionally unbalanced, creating the anomie in the country. The anomie created in the country by inflation has enjoyed fewer studies' in the crime studied in Nigeria based on the literature available.

However, this study improves on those previous studies that have examined inflation and crime. This is because this study considers prosecution, punishment and domestic investment which have not been verify in the crime model studying inflation. Therefore, apart from the need to find out how inflation affects crime in Nigeria, this work pays attention to the contributions of prosecution, punishment and domestic investment in crime decrease in the country. Thus, the following questions needed to examine the link between inflation and crime in Nigeria:

(i) What is the extent inflation has affected crime in Nigeria?
(ii) In what direction would deterrence measures and domestic investment affects crime in Nigeria?

Thus, this study consists of five sections, the first section is the introduction. Section two considered literature review and section three discussed the methodological part. Also, results of the estimation appeared in section four while the section five considered conclusion.

2.0 Literature Review

Theoretically, Merton (1938) emphasised that deviants in a society would display criminal behaviours because of their inability to achieve their expected goals as defined by the society. This is because society sets cultural values with low consideration for the gap that exist between the rich and poor. Besides, existing gap between rich and poor would create fewer opportunities for the poor and thus, achievement of their goals in confines of the societal values became difficult. Owing to this difficulty, individual would face the strains of frustration,

anger and sadness. The strains faced by the poor would make them seek other ways of achieving their goals which would cause a circumstance of anomie in the society. Based on explanation of Merton (1938), this study considers the relation between inflation and crime in Nigeria. In addition, the relation followed a simple channel through which inflation strain caused crime in Baharom, Habibullah, and Noor (2013). That is, in any inflationary period, the purchasing power becomes rather low, especially for the lower and fixed income earners. This implies the cost of living would high and economic life would become more difficult for the people. The difficulty that comes with the high cost of living would impose a strain of frustration on the people. Based on the strain, members of the society would commit a crime. Thus, the inflation instance in a society would lead to increase in crime happening.

Similarly, the rational choice theory stressed that agents weigh their likely returns to the cost of committing a crime. This is because an agent would engage in crime provided the likely returns outweigh the returned to legal means (Becker, 1968). Economic agents include both the criminal and other agents who react to incentives in a market. Teles (2004) provided a theoretical link between inflation and crime. Further, he argued that government controlled an economy through monetary policies which used to finance shortfall in an economy. Therefore, he based inflationary rate on monetary growth rate because monetary growth rate associates with the currency, and thus, he formed a link with currency and crime. Besides, more leisure time by an agent would make him opt for more money. Also, when a criminal jettison leisure time and spent the time for leisure for crime, he would have more income due to trade off. This is because transaction costs in monetary term tied to agents' consumption. Therefore, an increase in agents' consumption means more currency would demand in economy. The demand for more currency in economy exerted more pressure on economy in term of inflation. Later, an increase in currency demand serve as more incentive for agents to commit more crime.

However, Seals and Nunley (2007), Tang and Lean (2007), Tang (2009), Baharom, Habibullah and Noor (2013), and Sidebottom, Ashby and Johnson (2014) considered how inflation affects crime happening with a common conclusion that inflation affects crime positively. Also, while Tang and Lean (2007), Tang (2009) and Baharom, Habibullah and Noor (2013) based their study on total crime rate, Sidebottom, Ashby and Johnson (2014) considered crime of theft while Seals and Nunley (2007) paid attention to property crimes and not overall crime rate. Thus, this study differs from these studies in considering crime deterrence and domestic investment as an alternative means of reducing crime. The means of macroeconomic policy to reduce crime is in Baharom, Habibullah and Noor (2013), but the study provided no empirical evidence on domestic investment.

Also, in Nigeria Omotor (2009) examined the link between discomfort index and crime and affirmed that crime happening is not cause by inflation statistically. Similarly, Aminu, Manu, El-Maude and Kabiru (2013) found no statistical relation between inflation and crime. Yet, they asserted that crime happening has the tendency to be higher during inflationary times because of the high costs of living. Besides, Torruam & Abur (2014) considered the relation between inflation and crime. They found inflation to be a strong cause that affects crime level in Nigeria. Further, they asserted that negative side of inflation make the income of the citizens to reduce in purchasing power which thus, attracts citizens to commit a crime. Meanwhile, this study differs with Omotor (2009), Aminu, Manu, El-Maude and Kabiru (2013) and Torruam & Abur (2014) because this study presents the significance of inflation's effect on crime positively both in the long-run and short-run. Also, this study considers three property crimes as well as the overall crime.

2.1 Crime in Nigeria

In Table 1 below, this study provides statistics on overall crime and crime of property which includes armed robbery, false pretence /cheating and arsons in Nigeria from 1970 to 2013. The crime statistics considered the average number of cases and percentage share of property crimes studied to the total crime. Also, armed robbery classified as property crime because of how the crime classified by the Nigeria Police. Nevertheless, total crime includes other crimes not discussed in this study such as murder, burglary and so on. In Table 1 presented, the average percentage of false pretence/cheating have the largest share in each period considered. For instance, from 1970-74, 1990-95 and 2010-13 crime of false pretence/cheating stood at 2.15%, 4.79 and 6.83%, crime of armed robbery was 0.74%, 0.60% and 2.58%, and crime of arson remained 0.31%, 0.53 and 0.78. Still, in the same period, crime of armed robbery increased from 1,310 to 1,670 and 2,864 in an average number of cases.

Based on crime in Nigeria, the Government have made several efforts to reduce crime in the country. Parts of the efforts includes Police reform carried out in 2006 and legislative recognition given to the Nigeria Civil Services and Defense Corps in the early 2000s. The personnel of the Nigeria Police Force increased by 19.03% and 16.32% from 2003 to 2007 and from 2007 to 2010 respectively (Network on Police Reform in Nigeria, 2010 and Nigeria Bureau of Statistics, 2012). In addition, Government ensured that military equipped with modern gadgets and equipment to combat the insurgency of criminal behaviours. Also, the internal security expenses as percentage of total expenses increased from 5.47% in 2005 to 6.96% and 9.13% in 2008 and 2012 (Central Bank of Nigeria, 2012).

3.0 Methodology

3.1 Data description and source

Data for overall crime, armed robbery, arsons, false pretence /cheating and prosecution of crime got from the Nigeria Police and Nigeria Bureau of Statistics (NBS). Also, domestic investment captured by gross fixed capital formation and gotten from the Central Bank of Nigeria (CBN). In addition, the prison admission of inmates obtained from the Nigeria Prison Service and NBS. Statistics on inflation and urban population retrieved from the World Bank Indicator (2016). All the time series data used in this study starts from 1970 to 2013. Also, crime per capita, prosecution per capita and prison per capita are employed in other similar studies (Witt & Witte, 2000; Halicioglu, 2012 and Detotto & Pulina, 2012) and that of inflation is in line with Baharom, Habibullah and Noor (2013). The urban population considered in Viren (2001), gross fixed capital formation employed in Farhani, Shahbaz, Arouri and Teulon (2014). Therefore, descriptive statistics and their definition of variables employed in this study presents in Table 2.

3.2 Model Specification

To examine how inflation affects crime in Nigeria, data collected analyse with the model specified in equation 1. The crime model in equation 1 followed Baharom, Habibullah and Noor (2013) but with addition of deterrence variables not considered in their work. Also, this study focus on socio-macroeconomic-inflation, domestic investment and urban population, with deterrence measures of arrest/prosecution (PR_t) and punishment (PA_t) as offered in the theory of rational choice by Becker (1968). Domestic investment measured by the expenditure on gross fixed capital formation (GFC_t) and considered as macroeconomic tool on the search for better approach to reduce crime (Baharom, Habibullah & Noor, 2013). Inflation (INF_t) affected the country with high increase in price of goods and services which shrink the purse of many Nigerians. Besides, this study considered overall crime rate (CR_t) and three other property crime of armed robbery (ARB_t), false pretence/cheating (FPR_t) and arson (ARS_t). Also, four crime models analysed, each served as dependent variables (that is, Model I is the overall crime rate, model II and III are crime of armed robbery rate and false pretence/cheating rate while, model IV is the crime of arsons rate). Thus, in the crime models, δ_0 is a constant parameter; γ_1 and γ_2 are the elasticity effects of inflation and urban population growth on crime variables and they are expected with positive signs. In addition, γ_3 ,γ_4 and γ_5 shows the negative effects of domestic investment, prosecution and punishment through prison on crime variables respectively. Hence, ε_t shows the residual in each of the crime models and ln is the log of variables.

$$lnCR_t = \delta_0 + \gamma_1 lnINF_t + \gamma_2 \ln UPGR_t + \gamma_3 \ln GFC_t + \gamma_4 \ln PR_t + \gamma_5 PA_t + \varepsilon_t \qquad (1)$$

3.3 Unit root tests

The work of Granger and Newbold (1974) emphasised that existence of autocorrelation in time series data could make the R^2 not reliable and lead to a spurious regression. To overcome this problem, time series were put to unit root tests as a precondition for joint movement of series in a model (Engle and Granger, 1987). Thus, this study conducts unit root tests on each variable with the aid of Augmented Dickey-Fuller (ADF) and Phillip and Perron.. Using these two tests, all the non-stationary variables were made stationary at I(0) and I(1). Moreover, these tests were conducted using automatic based on Schwartz Bayesian criterion with maximum lag9 for ADF; and Newey-West automatic using Bartlett kernel for PP. Thus, the null hypothesis is that the series has a unit root and the rejection of this null hypothesis is that series is not having a unit root, that is series is stationary based on the MacKinnon (1996) as specified in E-view 9.5. The results of the unit root tests are presented in Table 3.

3.4 Bounds Test Approach

Based on result of the unit root tests, series in this study found to be made stationary at I(0) and I(1). Due to the mixed series with I(0) and I(1) integration, this study employs autoregressive distributed lag model (ARDL). Pesaran, Smith and Shin (2001) proposed the auto-regressive distributed lag model (ARDL) as an appropriate estimation for mixed series. This is due to the fact that other cointegration methods focus only on series with I(1) and in addition, ARDL yield no negative influence while using small sample size (Narayan, 2005). Furthermore, the use of ARDL takes care of endogeneity problem that features in most economic variables, and endogeneity problem resolved through dynamics of the lagged transformation in the ARDL tool. Thus, this presumes that variables made use of dynamic lag; that is, equation 1 transformed to dynamic form as showed in equation 2. Meanwhile, to transformed equation 1 into dynamic form, this study uses Akaike Information Criterion (AIC). Liew (2004) concluded that AIC is appropriate to determine lag length selection for small sample size. Moreover, in order to minimise autocorrelation in residual, it is better to determine optimal lag length (Shyh-Wei, 2009). Thus, the lag selection specified are ARDL(2, 0, 1, 1, 2, 0), ARDL(1, 1, 0, 1, 0, 1), ARDL(1, 1, 2, 1, 2, 0) and ARDL(1, 1, 2, 2, 0, 0) for model I, II, III and IV based on AIC using automatic lag selection of 2 and 1

in E-views 9.5. Also, all the models were run by using the restricted intercept and no trend (Pesaran et al., 2001). However, this study uses F-test statistic in bounds test to determine cointegration in the long-run. That is, the joint significance of the coefficients tested with F-statistic at one period of lag as shown in equation 2. Moreover, the null hypothesis of no cointegration is that $H_0: \gamma_1 \; to \; \gamma_6 = 0$ and the alternate H_1 is where at least one of the $\gamma_1 \; to \; \gamma_6 \neq 0$ (implies cointegration).

Moreover, to establish a long-run relationship the criteria is that F-statistic test value should not below or be in between the I(0) and I(1) bounds but should be above I(1). In this study, the null hypothesis of no cointegration was not failed to be rejected at the appropriate level of significance. Thus, each crime model found cointegrated not beyond 10% as showed in in Table 4. Model I is the overall crime rate, model II and III are crime of armed robbery rate and false pretence/cheating rate while, model IV is the crime of arson rate.

$$\Delta lnCR_t = \delta_0 + \gamma_1 lnCR_{t-1} + \gamma_2 lnINF_{t-1} + \gamma_3 lnUPGR_{t-1} + \gamma_4 lnGFC_{t-1} + \gamma_5 lnPR_{t-1} + \gamma_6 lnPA_{t-1} + \sum_{i=1}^{p} \tau_1 \; \Delta \ln CR_{t-i} + \sum_{i=0}^{p} \tau_2 \Delta lnINF_{t-i} + \sum_{i=0}^{p} \tau_3 \Delta lnUPGR_{t-i} + \sum_{i=0}^{p} \tau_4 \Delta lnGFC_{t-i} + \sum_{i=0}^{p} \tau_5 \Delta lnPR_{t-i} + \sum_{i=0}^{p} \tau_6 \; \Delta lnPA_{t-i} + \varepsilon_t \qquad (2)$$

However, the error correction model within the ARDL framework is stated as it appears in equation 3 where $\tau_1, \tau_2, \tau_3, \tau_4, \tau_5, and \; \tau_6$ indicates short-run dynamics coefficients. Besides, the speed of adjustment is denoted by ψ and δ_0 is constant when it is not restricted but it is restricted in this study based on the short-run results in Table 6.

$$\Delta lnCR_t = \delta_0 + \sum_{i=1}^{p} \tau_1 \; \Delta \ln CR_{t-i} + \sum_{i=0}^{p} \tau_2 \Delta lnINF_{t-i} + \sum_{i=0}^{p} \tau_3 \Delta lnUPGR_{t-i} + \sum_{i=0}^{p} \tau_4 \Delta lnGFC_{t-i} + \sum_{i=0}^{p} \tau_5 \Delta lnPR_{t-i} + \sum_{i=0}^{p} \tau_6 \; \Delta lnPA_{t-i} + \psi ecm_{t-i} + \varepsilon_t \qquad (3)$$

4.0 Results and Discussion

Following the result of the unit root tests, this study employs the bounds test approach to find out the long-run relationship among the study's variables. The bound test approach shows a joint movement of these series in the long-run. The sequel, the long-run and short-run coefficients determined and the results presented in Table 5 and 6 respectively. In addition, the long-run coefficients confirmed with five diagnostics tests highlighted in Table 5 and Figure 1-4.

In the long-run estimates, inflation positively affects all crime variables at 5% level of significance. The rate of inflation increased the crime and armed robbery rate by 0.4%, arson rate by 0.3% and false pretence/cheating by 0.2%. It is worth to note here that similar results found in Tang (2009), although Tang (2009) did not consider an individual crime. The strain inflicted by inflation on the citizens in the country serve as an incentive to commit crime and especially property crime as showed by all the three property crimes examined. That is, the high cost of living reduced purchasing power, individuals who could not bear the strain as an innovator would employ other illegal means of meeting their needs (Merton, 1938). One way for innovators to meet with their needs is to illegally corner items that worth resold into the market which may converted to cash. Based on the result in the short-run, inflation affects crime and armed robbery rates significantly at 5%. That is, in Nigeria the effects of inflation showed right from beginning of inflationary policies till longer period of time in the country.

Also, the domestic investment exerted the expected negative and significant influence on the crime variables both in the short and long-run except for of armed robbery rate. By domestic investment, the crime rate and false pretence/cheating reduced with 0.57% and 2.15% at 5% level of significance in the long-run. In the short-run, false pretence/cheating and arsons rate were negatively significant at 1%. This result shows that, effective use of domestic investment in the economy especially during the inflationary time is a tool that affords means of reducing crime occurrence in the country. This is the alternative macroeconomic means suggested by Baharom, Habibullah and Noor (2013) in reducing crime. Surprisingly, domestic investment increases with the crime of arson in the long-run which calls for more security measure of surveillance with the use of closed circuit television for proper checking in the country. This is because the traditional means of crime reduction through arrest and punishment acted contrary to their capacities in the period of inflation to reduce crime variables. Besides, the use of arrest and prosecution affect the overall crime rate adversely at 10% which is poor when one considers the impact of police per capita in reducing crime in Japan at 1% level of significance of (Miyoshi, 2011).

However, the rate of assets vandalisation in Nigeria both in the memorial and recent times could account for the positive sign between the crime of arson and domestic investments at 10% significance. In addition, the crisis in the oil-rich Niger Delta region in Nigeria that involves militants and self- determination groups found to have destroyed lives and properties. These militants and self- determination groups functioning under different names involved in violent attacks on oil installations and abductions in places like Port-Harcourt and Warri (Nigeria Human Right Commission, 2007). Also, the rate of arrest and prosecution was positively significant at 1% for this crime by domestic investment may contribute to the positive sign obtained between domestic investment and crime of arson. Further, the domestic investment is positive and significant at 1% with the crime of armed robbery in the short-run. Here, it means that valuable items become an incentive to deviant behaviour in the in the country especially at inflationary times leading to crime. This is because wealthy items would be a higher means of transferring assets in the country, and would be attractive for potentials criminals (Ehrlich, 1973 and Habibullah & Baharom, 2009).

Moreover, in Table 6, each model has lagged error correction model (ECT_{t-1}) which is negative and significant at 1%. That is, the ECT_{t-1} confirmed the long-run relationships in all the models due to existence of adequate feedback mechanism to adjust the crime models to equilibrium level. This is because a higher ECT_{t-1} in a model provides better evidence of an existence of stable long-run relationship (Bannerjee, Dolado & Mestre, 1998). Moreover, the ECT_{t-1} coefficients for model 1 is -0.243, -0.450 and -0.260 for model 2 and 3 respectively while model 4 is -1.011. The coefficients suggested deviations from long-run in each crime model and its correction. For instance, the deviation in overall crime model was corrected by 0.243% over the following year.

In this study, the long-run coefficients became robust for policy suggestions due to diagnostics tests carried out, the results of diagnostic tests presented in Table 5. That is, this study conducts diagnostic tests of normality; functionality; serial correlation; heteroscedasticity and structural stability test. The normality test (χ^2_N) of Jarque-Bera showed that model 1 and 3 passed at 5% while model 3 and 4 failed to pass the test. Also, the Kurtosis for model 3 and 4 are 5.589 and 5.712 respectively. The results of the Kurtosis were in excess which indicate that there is normal distribution following Saridakis (2011). Meanwhile, with the exception of model 4, all other models passed the functional forms test of Ramsey's RESET (χ^2_{FF}) showing that the models were well specified. In addition, this study found no traces of autocorrelation using the Chi-squared tool of Breusch-Godfrey (χ^2_{SC}) in lag 1 at 5% level of significance. Also, the Chi-squared tool of Breusch-Pagan-Godfrey heteroskedasticity test (χ^2_H) showed that all the models passed at 5% level of significance. However, to find out the parameters in this study remains constant over time (Pesaran & Pesaran, 2009), structural stability test is applied. The structural stability test includes cumulative sum of recursive residuals (CUSUM) and cumulative sum of recursive residuals squares. Thus, parameters ound stable over time at 5% level of significance based on the results of the CUSUM and CUSUMSQ tests as showed in Figure 1-4.

5.0 Conclusion

This study examines the link between inflation, deterrence and crime in Nigeria with use of bounds test approach. The results showed that inflation significantly increases crime and other types of the crime of armed robbery, false pretence/cheating and arsons positively in the long-run. But, this study identifies domestic investment as a better alternative means to have crime reduced in the country. Also, domestic investment needs to support the traditional means of crime reduction which are arrest and punishment. This work advances that poor performance of deterrence in the models reflected the weakness associated with deterrence institutions responsible to deliver satisfactory prosecution and punishment of crime in the country. However, it is relevant to ask here how possible could deterrence institutions perform poorly without reasons? Besides, Otu (2012) argued that in an attempt to combat crime and reinstate mood of security in Nigeria, deterrence institutions suffered from modern equipment and job accountability. In addition, the Nigeria Police characterised with low fact gathering capability, sabotages and pitiable working environments (Ojedokun, 2014). Akanbi (2012) found out governance is important to improve socioeconomic environment in the country for domestic investment to improve. Therefore, this study infers that reduction of crime occurrence in Nigeria is possible by embracing the following suggestions.

i. Domestic investment should target vulnerable people in the country for equipping them adequately equip with good means of livelihood. These good means of livelihood needs presence of social infrastructure across the country. The presence of social and sound infrastructure would promote income generation of vulnerable people and others.
ii. The citizens deserved better governance and better governance promotes institutional performance. Thus, deterrence institutions need more fund to have modern facilities to strengthen their performance. Also, better deterrence institution's performance demand good accountability from them for public to impose more of their trust on them. This is because people's trust would foster good relation between them and deterrence institutions for effective combating of crime.

iii. Inflation as a macroeconomic tool should be check and controlled. This could realise through increase in productivity and output with good use of domestic investment in the country.

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Table 1: Crime and some property crimes in Nigeria

Years	**Average number of cases**				**Average share of kinds of crime to overall crime (%)**			
	Overall Crime	Armed Robbery, robbery and extortion	False Pretence/ Cheating	Arson	Overall Crime	Armed Robbery, robbery and extortion	False Pretence/ Cheating	Arson
1970-1974	174,882	1,310	3,767	553	100	0.74	2.15	0.31
1975-1979	213,903	2,046	6,321	1,216	100	0.95	2.95	0.56
1980-1984	275,469	1,596	6,254	4,329	100	0.57	2.27	1.57
1985-1989	343,166	1,335	12,634	1,349	100	0.38	3.68	0.39
1990-1995	275,614	1,670	13,216	1,461	100	0.60	4.79	0.53
1996-1999	229,892	2,160	12,237	1,170	100	0.93	5.32	0.50
2000-2004	164,514	3,042	9,448	1,419	100	1.84	5.74	0.86
2005-2009	127,422	2,476	6,560	973	100	1.94	5.14	0.76
2010-2013	110,833	2,864	7,579	868	100	2.58	6.83	0.78

Note: Author compilation and must be cited when using these statistics for research purposes only.

Table 2: Descriptive statistics and definition of variables

Variables	**Obser vations**	**Mean**	**Std. Dev.**	**Minimum**	**Maximum**	**Definition**
CR	44	238.5275	116.5941	59.80187	474.3379	Crime recorded per 100,000 population
ARB	44	2.023563	0.637237	1.084769	3.992103	Armed robbery crime per 100,000 population
ARS	44	1.623519	2.724914	0.341854	18.90548	Arson crime per 100,000 population
FPR	44	0.877964	0.358217	0.334710	1.519429	False pretence and cheating crime per 100,000 population
INF	44	19.11300	16.45840	3.457650	72.83550	Annual growth rate of inflation
UPGR	44	4.807272	0.557552	3.693857	5.860042	Annual growth rate of urban population
GFC	44	941115.0	2181573.	1353.000	9363030.	Gross capital formation in millions Naira(₦)
PR	44	144.7402	87.27442	16.76648	324.8790	Prosecution of crime at 100,000 per population
PA	44	120.9533	55.51995	38.96894	263.9846	Prison admission per 100,000 population

Table 3: Unit Roots Tests

	Augmented Dickey-Fuller (ADF)		Phillip-Perron (PP)		Decisions
Variables	Level	1ST Difference	Level	1ST Difference	
	Intercept and trend	Intercept and trend	Intercept and trend	Intercept and trend	
lnCR	-2.756	-8.522***	-2.730	-8.473***	I(1)
lnARB	-3.270*	-6.871***	-3.397*	-6.912***	I(0)
lnARS	-3.898**	-76412***	-3.825**	-14.518***	I(0)
lnFPR	-2.326	-5.172***	-2.381	-5.038***	I(1)
lnINF	-3.721**	-7.057***	-3.471*	-16.111***	I(0)
lnUPGR	-3.002	-6.993***	-3.051	-6.992***	I(1)
lnGFC	-1.728	-4.415***	-1.203	-4.275***	I(1)
lnPR	-2.946	-7.809***	-2.903	-7.809***	I(1)
lnPA	-2.649	-7.424***	-2.672	-7.460***	I(1)

NOTE: the figures reported are t-ratio and those figures in parenthesis show the p-values of MacKinnon (1996) one-sided at various level of significant. The asterisks (***) is at 1%; (**) is at 5% and (*) is at 10%.

Table 4: Bounds Test for crime models

	Model I ARDL(2, 0, 1, 1, 2, 0) (overall crime)		Model II ARDL(1, 1, 0, 1, 0, 1) (armed robbery)		Model III ARDL(1, 1, 2, 1, 2, 0) (false pretence/cheating)		Model 1V ARDL(1, 1, 2, 2, 0, 0) (arson)	
F-statistic	3.358*		3.710**		4.091**		5.291***	
Level of Significance	99%				95%		90%	
Bounds	I(0)	I(1)	I(0)	I(1)	I(0)	I(1)	I(0)	I(1)
Critical Values	3.06	4.15	2.39	3.38	2.08	3.00		
K	5							

Note: the F-statistics are significant at 1% (***); 5% (**) and 10% (*) appropriately. The model I is the overall crime rate, model II and III are a crime of armed robbery rate and false pretence/cheating rate while, model IV is the crime of arson rate.

Table 5: Estimates of the crime models in the long-run relationship using ARDL Model

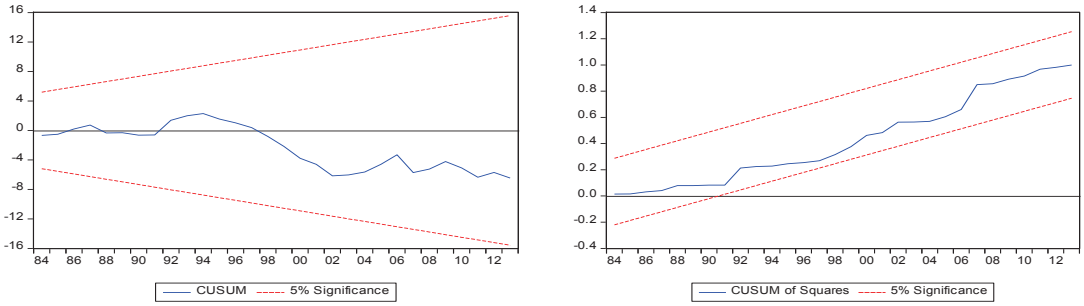
Variables	Model I		Model II		Model III		Model IV	
	ARDL(2, 0, 1, 1, 2, 0) (overall crime)		ARDL(1, 1, 0, 1, 0, 1) (armed robbery)		ARDL(1, 1, 2, 1, 2, 0) (false pretence/cheating)		ARDL(1, 1, 2, 2, 0, 0) (arson)	
LOG(INF)	0.406	2.677**	0.407	2.380**	0.336	2.056**	0.247	2.647**
LOG(UPGR)	1.551	1.692	-0.266	-0.405	0.385	0.395	0.699	1.293
LOG(GFC)	-0.575	-3.221***	0.065	0.783	-0.381	-2.156**	0.129	1.762*
LOG(PR)	-1.212	-1.965*	0.203	0.743	-0.966	-1.581	0.833	3.682***
LOG(PA)	0.280	1.335	0.550	2.574**	-0.129	-0.583	0.025	0.181
C	12.523	3.570***	-4.466	-1.796*	8.020	1.806*	-6.741	-3.123***
	Diagnostics tests							
	Value	Prob	Value	Prob	Value	Prob	Value	Prob
χ^2_N	0.416	0.812	0.994	0.608	18.035	0.000	27.060	0.000
χ^2_{FF}	0.889	0.380	1.043	0.304	0.950	0.350	2.667	0.012
χ^2_{SC}	2.448	0.117	0.149	0.699	0.194	0.659	0.775	0.378
χ^2_H	10.551	0.481	9.329	0.407	14.704	0.258	12.491	0.327
$Adj\ R^2$	0.975		0.531		0.891		0.701	

Note: the t-statistics are failed to be rejected at 1% (***); 5% (**) and 10% (*) appropriately. Also, χ^2_N, χ^2_{FF}, χ^2_{SC} and χ^2_H are significant at 5% except χ^2_{FF} in model III and χ^2_N in model III and IV.

Table 6: Estimates of the crime models in the short-run relationship using ARDL Model

Model 1 ARDL(2, 0, 1, 1, 2, 0) (overall crime)			**Model 2 ARDL(1, 1, 0, 1, 0, 1) (armed robbery)**		
Variables	Coefficients	t-statistics	Variables	Coefficients	t-statistics
DLOG(CR(-1))	-0.453	-3.288***	D(INF)	0.004	2.267**
D(INF)	0.004	3.229***	DLOG(UPGR)	0.148	0.331
DLOG(UPGR)	-0.078	-0.281	DLOG(GFC)	0.342	3.535***
DLOG(GFC)	0.047	0.871	DLOG(PR)	0.038	0.335
DLOG(PR)	0.231	3.220***	DLOG(PA)	0.118	1.420
DLOG(PR(-1))	0.236	2.684**	CointEq(-1)	-0.450	-5.581***
DLOG(PA)	0.117	2.386**			
CointEq(-1)	-0.243	-5.623***			
Model III: ARDL(1, 1, 2, 1, 2,0) (false pretence/cheating)			**Model 1V: ARDL(1, 1, 2, 2, 0, 0) (arson)**		
Variables	Coefficients	t-statistics	Variables	Coefficients	t-statistics
D(INF)	0.001	0.953	D(INF)	0.004	1.025
DLOG(UPGR)	-0.573	-1.543	DLOG(UPGR)	0.112	0.118
DLOG(UPGR(-1))	-0.828	-2.111**	DLOG(UPGR(-1))	-2.381	-2.471**
DLOG(GFC)	-0.263	-3.564***	DLOG(GFC)	-1.094	-4.377***
DLOG(PR)	0.109	1.241	DLOG(GFC(-1))	-0.497	-1.680
DLOG(PR(-1))	0.228	2.360**	DLOG(PR)	1.088	4.899***
DLOG(PA)	0.021	0.331	DLOG(PA)	0.176	0.973
CointEq(-1)	-0.260	-5.414***	CointEq(-1)	-1.011	-6.329***

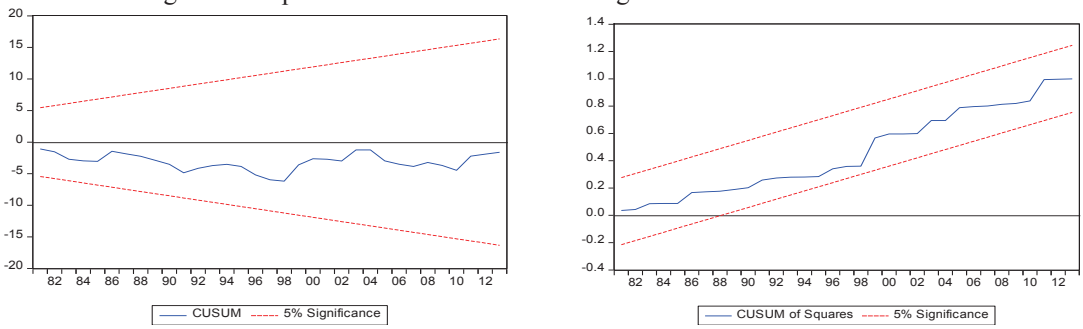
Note: the t-statistics in the study are failed to be rejected at 1% (***); 5% (**) and 10% (*).



a. b.

Figure 1: Stability Test for **Model I**

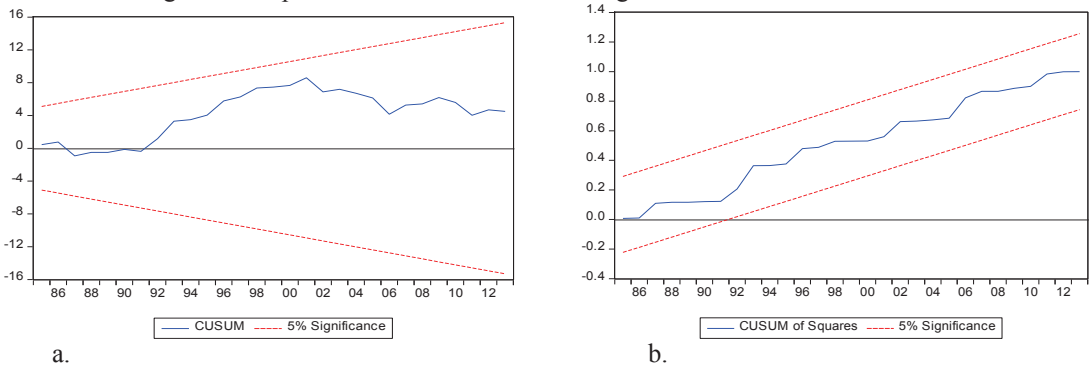
Note: The straight lines represent critical bounds at 5% significance level



a. b.

Figure 2: Stability Test for **Model II**

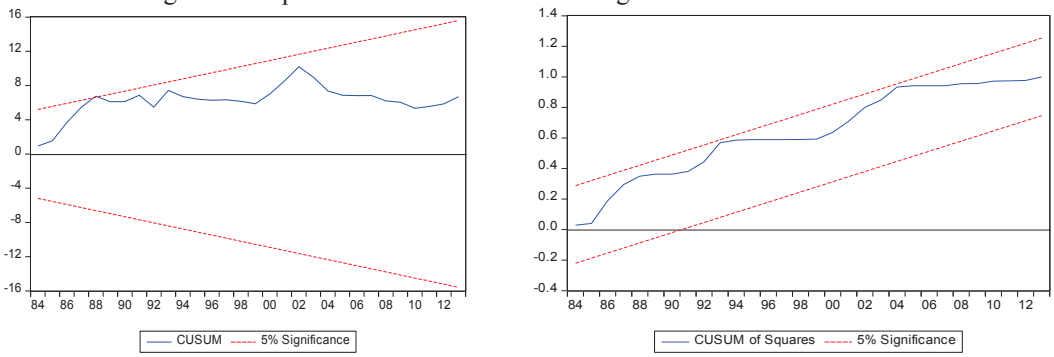
Note: The straight lines represent critical bounds at 5% significance level



a. b.

Figure 3: Stability Test for **Model III**

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



a. b.

Figure 4: Stability Test for **Model IV**

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