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The Dynamic Relationship between Crime and Economic Growth in Nigeria

Abstract

Crime is a major impediment to economic growth and development in Nigeria despite measures taken to reduce it. There is, however, currently no major statistical analysis of how crime affects economic growth in that country. This study examines the link between crime and growth based on the theory of rational choice and empirical data. Exogenous and endogenous growth models are employed, and include deterrence variables. The period examined is 1970–2013 and estimation is done using the autoregressive distributed lag model. The results of our study show that crime affects economic growth at a 1% and 10% level of significance. In other words, crime imposes the costs of prosecution and punishment on the citizens and country, which influences the growth of the economy. Given our results, we suggest that police and the system of justice should be strengthened. Indeed, this may be necessary if the development target stated in Nigeria vision 20: 2020 is to be reached.

Keywords: crime, economic growth, crime deterrence, autoregressive distributed lag model
JEL: O40, O43, K42

Introduction

Economic losses coupled with the loss of human lives and property in Nigeria are frequently mentioned in the literature, especially in sources originating from the Federal Government and its various agencies, the African Development Bank and the United Nations Office on Drug and Control. These sources identify crime as the main cause of economic losses. For instance, the Federal Government of Nigeria in 2014 claimed that theft, fraud, corruption, and violence constituted a major challenge on the economy and financial budget. Large sums of money were lost to criminals through fraud and forgery [Central Bank of Nigeria (CBN), 2013]. Smuggling, sabotage, kidnapping, theft and violence have negatively affected the revenue of the Government [Ahmed, 2013]. In an attempt to reduce crime, Nigeria's Federal Government has ensured that more police officers will be recruited. Funding for internal security will be increased, more crime fighting agencies will be created, and the Money Laundering Prohibition Act (MLPA) will be enacted by the Federal Government [Network on Police Reform in Nigeria, 2010; Omoniyi, 2014 and CBN Annual Report, 2011]. Despite of these efforts, the crime rate increased from 65.93% to 66.28% in 2011 and 2012 respectively and subsequently increased to 66.45% in 2013. This rise in crime was accompanied by a decline in real economic growth from 5.41% to 4.98% in 2006 and 2010 accordingly and to 2.60% in 2013 [World Bank Indicator, 2016]. This decreases the Nigeria's ability to meet the 13.8% average growth rate and per capita income of 4,000 USD by the year 2020 stated in Vision 20:2020 [National Planning Commission, 2010].

Given the costs that crime imposes on the economy there is a need to investigate the link between crime and economic growth in Nigeria. Most economic literuture has focused on corruption in Nigeria [Aliyu, Elijah, 2008; Odubunmi, Agbelade, 2014]. In addition, the relationship between deterrence and economic growth (based on income growth) has not been examined in Nigeria. This study assesses the impact of crime and deterrence economic growth in Nigeria, using the bounds test dynamic approach to cointegration.

Literature Review

The literature on this topic provides ample evidence that crime affects and distorts economic growth [Mauro, Carmeci, 2007]. Burnham, Feinberg and Husted [2004] examined the rate of property and violent crimes on the growth of income and concluded that there is weak evidence that violence affects growth. More frequently, studies conclude that additional work is needed to better understand this link. Lack of data has influenced study results of, for example, Enamorado, López-Calva and Rodríguez-Castelán [2014]. Analysis of the date that is available relies on the panel data or time series methods [Burnham et al., 2004; Mauro, Carmeci, 2007; Pan, Widner, Enomoto, 2012; Kumar, 2013; Goulas, Zervoyianni, 2013; Enamorado et al., 2014].

This analysis is based on time series data to study the relationship between crime and economic growth in Nigeria [Burnham et al., 2004; Mauro, Carmeci, 2007; Pan et al., 2012; Kumar, 2013; Goulas, Zervoyianni, 2013; Enamorado et al., 2014], which is critical to addressing both of these issues [Mauro, Carmeci, 2007].

In an attempt to minimize crime, Becker [1968] hypothesized that the behavior of individuals' participation in a legal or illegal business is best understood as an attempt to satisfy basic needs. This conclusion speaks to incentives. Participation in an illegal activity is expected if profits are higher than those obtained from legal activity, and vice versa. In addition, a potential criminal considers becoming engaged in illegal activity based on the environment, level of protection, and likelihood of harming society members. To reduce the risk associated with taking part in the crime, the criminal needs to gather information about potential outcomes and future probabilities. According to Becker [1968] the cost of crime to individuals and society is their disruption of economic activities and diversion of developmental funds. Moreover, public response to rising crime is a call for increased policing that, in turn, increases the social cost of damages and governmental costs of apprehension and convictions. Hence, the theory of rational choice confirms that increases in crime will increase social loss [Becker, 1968; Ehrlich, 1973; Bourguignon, 1999].

Likewise, in a dynamic approach to the economics of crime, Mauro and Carmeci [2007] confirmed that the illegal activities of organized crime requires firms to monitor their activities, which increases their costs. This imposes a de facto tax levied on business that reduces profits, decreases return on capital and wages, and pulls tax revenue towards providing security production, which divert resources from development. Consequently, economic output would be reduced due to criminal activity.

This study extends the economic literature by testing the exogenous and endogenous growth models offered by Mauro and Carmeci [2007] using income and its growth rate. Using data for Nigeria, we analyze the negative impact of crime on income growth (which is not included in Mauro and Carmeci [2007]) and extend these growth models to include the deterrence variables of prosecution and punishment. This has not been tested for any country, and the economic impact of punishment has not been studied in the context of growth.

Criminal Activities in Nigeria

Table 1 presents crime in Nigeria in the period 1970–2013. Column one categorizes crime by type (i.e., against a person (A), against property (B), and against lawful authority (C)).

TABLE 1. Crime types 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			
		1970–81	1981–91	1992–02	2003–13	1970–81	1981–91	1992–02	2003–13	1970–81	1981–91	1992–02	2003–13
Murder	A	1324	1729	1721	5608	0.68	0.56	0.76	4.44	81.06	–11.85	31.59	53.42
Assault	A	48859	52350	42958	21260	24.94	16.81	18.92	16.82	26.36	22.65	–45.75	–32.16
Armed Robbery, robbery and extortion	B	1742	1367	2269	2771	0.89	0.44	1.00	2.19	19.41	–35.24	72.90	–16.59
Burglary, House and Store Breaking	B	15935	28604	16762	9088	8.13	9.19	7.38	7.19	16.28	44.46	–63.22	–8.37
False Pretence/Cheating	B	5107	10319	11879	7470	2.61	3.31	5.23	5.91	139.97	226.21	–43.07	–3.10
Arson	B	967	2642	1365	1012	0.49	0.85	0.60	0.80	295.58	–15.20	31.99	11.07
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
Overall crime		195890	311349	227071	126385	100.00	100.00	100.00	100.00	56.20	19.16	–46.57	–26.69

Note: above elaboration should not be cited without making reference to the author.

Source: own elaboration.

Column two shows the average number of crime types to overall crime. Column three focuses on the average share of crime types to overall crime, and column four indicates the average growth of crime types. Assault was the highest average crime in each examined period, with values of 24.94 in 1970–1981, 16.81 in 1981–1991, 18.92 and 16.82 in 1992–2002 and 2003–2013 respectively. Burglary was the second, and reached values of 8.13, 9.19, 7.38 and 7.19. Murder and arson increased 53.42% and 311.07% in the period 2003–2013. Likewise, bribery and corruption increased by 511.11%.

The intensity of crime in Nigeria has been described by, Adekoya and Abdul Razak [2016]. They noted that the government have made several efforts to reduce it, including the Police reform in 2006, establishing the Economic and Financial Corruption Commission, Independent Corrupt Practices and Other Related Offences Commission, and recognition given to the Nigeria Civil Services and Defense Corps in the early 2000 s. The number of personnel in the Nigeria Police Force increased by 19.03% between 2003 to 2007, and 16.32% between 2007 to 2010, respectively [Network on Police Reform in Nigeria, 2010 and Nigeria Bureau of Statistics, 2012]. Funds allocated to the Economic and Financial Corruption Commission were decreased 23% in 2012 from the ₦13.8 billion Naira allocated in 2011, but of the Independent Corrupt Practices and Other Related Offences Commission were increased 11.1% in 2012, from a 2011 baseline of ₦3.6 billion Naira [Omoniyi, 2014]. The government also provided the military with modern equipment and arms to combat the insurgency, which engages in criminal behaviors and, more generally, increased the annual expenditure on internal security as a percentage of total expenditures from 5.47% in 2005 to 6.96% and 9.13% in 2008 and 2012, respectively [Central Bank of Nigeria, 2012]. Prison maintenance and imprisonment in the country accounted for 0.97% and 1.20% of the total expenditure in 2011 and 2012 in Nigeria [The Prison Services of 2012].

Methodology

Data

In this study we rely on annual time series data from 1970 to 2013. Real gross domestic per capita and real gross domestic per capita growth data were obtained from the World Bank Indicator [2016], while data sources for other variables are from Nigeria. Crime information comes from the Nigeria Police and National Bureau of Statistics (NBS); secondary education enrolment, unemployment rates and prosecution data are obtained from various NBS publications; gross fixed capital formation is based on various Annual Reports of the Central Bank of Nigeria; and prison admission is obtained from the Nigeria Prison Services and NBS. Our descriptive statistics and definition of variables are presented in Table 2.

TABLE 2. Descriptive statistics and definition of variables

Variables	Observations	Mean	Std. Dev.	Minimum	Maximum	Definition
RGPC	44	249452.4	57950.87	172402.7	370004.2	Real GDP per capita
GRPC	44	1.718182	7.912494	−15.45820	30.34220	Real GDP per capita growth
CR	44	238.5275	116.5941	59.80187	474.3379	Crime recorded per 100,000 population
GFCR	44	0.129077	0.080810	0.036600	0.296900	Ratio of gross capital formation in millions Naira (₦) to GDP
EES	44	3844359.	2616512.	310054.0	9835240.	Enrolment of secondary education
UNE	44	8.506818	6.610963	1.800000	27.40000	Annual unemployment rate
PR	44	144.7402	87.27442	16.76648	324.8790	Prosecution per 100,000 population
PA	44	120.9533	55.51995	38.96894	263.9846	Punishment proxy by Prison admission per 100,000 population

Source: own elaboration.

Theoretical Framework

Becker [1968] examined the consequences of crime on the society; due to crime (*CR*) the society would bear more weights of damages (*D*); more cost of arrest and conviction of offenders (*PR*); an increase in the social cost of punishment (*PA*); which represent a crime tax on the society resulting in social loss of wealth (*RGPC*). Thus, Becker developed the following model to examine the social loss of crime within the society:

$$RGPC_t = f\left(D_t, PR_t, PA_t, CR_t\right) \tag{1}$$

The social loss function created by Becker (1968) was modified by Bourguignon (1999) by dividing the social loss according to crime (*CR*) into three components: (i) the cost of pain associated with the economic cost of crime – *PN* – which is seen as the direct cost of crime in terms of physical and psychological pain experienced by the victims; (ii) the cost of preventing crime and the cost incurred on judicial system – *PR*; and (iii) the implicit cost of sanctions (*PA*) on convicted criminals, representing forgone earnings due to imprisonment. Bourguignon [1999] concluded that the social loss per capita (*RGPC*) associated with crime rate can be expressed as follows:

$$RGPC_t = f\left(PN_t, PR_t, PA_t, CR_t\right) \tag{2}$$

The static model was further developed into a dynamic version by Mauro and Carmeci [2007] to study the relation between the poverty trap of crime and unemployment. The model is dynamic because it considers the price of wage setting, differenced with respect to time and technology. Technology allowed adoption of the labor market imperfection assumption in endogenous growth by Romer [1986] and the standard neoclassical exogenous growth by Solow [1956]. The distinction between these models is that the endogenous growth considers increasing return to scale in technology, while exogenous growth focuses on the constant returns to scale in technology. For the exogenous model, the log of output per capita is used and determined outside the model; for the endogenous one output per capita growth was determined within the model. The study results favor the exogenous growth model. In the two models, Mauro and Carmeci [2007] took into consideration the effect of low income and income growth as a poverty trap in the society due to crime rates, as crime is detrimental to income due to the tax which it imposes on the society. That is, an increase in the crime return permanently reduces the rate of growth in the economy through poor growth. This is represented by equation 3 and 4. Equation 3 indicates the reduced form of exogenous growth model while equation 4 describes the endogenous growth model as follows:

$$RGPC_t = f\left(AA_t, UNE_t, CR_t\right) \tag{3}$$

$$GRPC_t = f\left(AA_t, UNE_t, CR_t\right) \tag{4}$$

In equation 3, $RGPC_t$ and $GRPC_t$ is the output and output growth of the economy respectively; AA_t is the return to asset, the asset returns are considered to be asset accumulation in terms of physical resources ($GFCR_t$) and human resources (EES_t); UNE_t is the rate of unemployment in the society, and CR_t is the crime rate which they proxy by homicide rate.

Model Specification

To analyze the above-described relations, this study employs the exogenous and endogenous growth model in Mauro and Carmeci [2007] in equations 3 and 4. The exogenous and endogenous growth model is represented in linear form as indicated in equation 5 and 6. While the growth model focuses on homicides in Italy as a variable affecting economic growth, this study considers overall crime rate (CR_t) in Nigeria in relation to growth. Additionally, economic growth was measured by real GDP per capita ($RGPC_t$) in terms of exogenous growth while real GDP per capita growth ($GRPC_t$) is used to describe the endogenous growth model. Both, physical and human investment, as well as labor policy, were included in the growth models. We rely on a proxy for physical and human investment and labor policy using a ratio of gross fixed capital formation to GDP ($GFCR_t$), secondary enrolment (EES_t) and annual rate of unemployment (UNE_t) respectively. We also expand models used in the literature by adding the deterrence variables of prosecution (PR_t) and punishment proxy by prison admission (PA_t) based on the theory of rational choice proposed by Becker [1968]. However, in the two growth models specified in equation 5 and 6, π_1 and π_2 are constant parameters; β_1 and γ_1 are the elasticity effects of CR_t on growth which are expected to be negative. Likewise, β_4 and γ_4 indicate the negative elasticity effects of UNE_t. In addition, β_2, γ_2 show positive the effect of education on growth while β_3 and γ_3 , β_5 and γ_5, β_6 and γ_6 describe how $GFCR_t$, PR_t and PA_t affect growth accordingly. Also, ε_t and μ_t show the residual in each of the model and ln is the log of variables.

$$lnRGPC_t = \pi_1 + \beta_1 lnCR_t + \beta_2 lnEES_t + \beta_3 lnGFCR_t + \\ + \beta_4 lnUNE_t + \beta_5 lnPR_t + \beta_6 lnPA_t + \varepsilon_t \quad (5)$$

$$GRPC_t = \pi_2 + \gamma_1 lnCR_t + \gamma_2 lnEES_t + \gamma_3 lnGFCR_t + \gamma_4 lnUNE_t + \\ + \gamma_5 lnPR_t + \gamma_6 lnPA_t + \mu_t \quad (6)$$

Unit Root

To measure the impact of crime on economic growth in the long-run sing time series data, stationarity test is crucial. That is, non-stationary series data must be made stationary through the means of integration at the level I(0) or at the difference I(1). Therefore, the means of integration at the level I(0) or at the difference I(1) were carried out using Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) unit root tests. Those tests are also done using automatics based on Schwartz Bayesian criterion with maximum lag9 for ADF; and Newey-West automatic using Bartlett kernel for PP. Besides, the null hypothesis states that the series has a unit root and the rejection of this null hypothesis states that the series is not having a unit root. Series is stationary based on the MacKinnon [1996] as specified in E-view 9.5. Thus, these results and the decisions are presented in Table 3.

TABLE 3. **Unit Root 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	
lnRGPC	–0.261	–6.067***	–0.461	–6.069***	I(1)
GRPC	–5.909***	–8.614***	–5.930***	–14.136***	I(0)
lnCR	–2.756	–8.522***	–2.730	–8.473***	I(1)
lnEES	–2.299	–8.024***	–2.304	–7.889***	I(1)
lnGFCR	–0.603	–6.095***	–1.227	–5.432***	I(1)
lnUNE	–1.483	–5.902***	–1.516	–5.910***	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%.

Source: own elaboration.

Estimation Procedure of Bounds Test

The work of Pesaran, Smith and Shin [2001] proposed the autoregressive distributed lag model (ARDL) as the appropriate option for estimating cointegration among variables where the variables are having mixture of integration order I(0) and I(1), and where they mutually exclusive I(0) and I(1), but it does not consider variables with I(2). In addition, the ARDL model usually resolves the problem of simultaneity/endogeneity in socioeconomic variables due to its in-built dynamic tool. The dynamism is based on the transformation of the variable at the period of one lag in the model using the optimal lag length. The transformation of the variables is done using Akaike information criterion due to the small sample size used in this study. Likewise, Liew [2004] confirmed that the Akaike information criterion is best in determining the optimal lag length for variable when using small sample size. Moreover, to minimize the autocorrelation in the residual, it is better to determine the optimal lag length [Shyh-Wei, 2009]. In addition, the ARDL Model is well-suited to estimate small sample variables without any negative impact on the results [Narayan, 2005]. Based on the results of the unit roots test, variables are integrated with I(0) and I(1). It is noted here that variables in exogenous growth model are purely I(1) while that of endogenous growth model are a mix of I(0) and I(1). Thus, this study employed autoregressive distributed lag model (ARDL) to determine the joint movement of variables due to the mixture of integration, and its advantages over other cointegration tests. Moreover, to carry out the bound test, equations 5 and 6 are transformed into ARDL framework, shown in equations 7 and 8, respectively. This transformation helped establish the presence of cointegration as suggested by Engle and Granger [1987] that variables in a model must move together theoretically. Hence, the lag selection specified in this study are ARDL(1, 0, 1, 2, 1, 0, 1) for model I, and ARDL(1, 0, 1, 0, 1, 0, 1) for model II based on the Akaike Information Criterion (see Table 5 for criterion values) using automatic lag selection of 2 and 1 in E-views 9.5 as the case may be.

$$\Delta lnRGPC_t = \pi_1 + \beta_1 lnRGPC_{t-1} + \beta_2 lnCR_{t-1} + \beta_3 lnEES_{t-1} + \beta_4 lnGFCR_{t-1} + \beta_5 lnUNE_{t-1} + \beta_6 lnPR_{t-1} + \beta_7 lnPA_{t-1} + \sum_{i=1}^{p} \alpha_1 \Delta lnRGPC_{t-i} + \sum_{i=0}^{p} \alpha_2 \Delta lnCR_{t-i} + \sum_{i=0}^{p} \alpha_3 \Delta lnEES_{t-i} + \sum_{i-0}^{p} \alpha_4 \Delta lnGFCR_{t-i} + \sum_{i=0}^{p} \alpha_5 \Delta lnUNE_{t-i} + \sum_{i=0}^{p} \alpha_6 \Delta lnPR_{t-i} + \sum_{i=0}^{p} \alpha_7 \Delta lnPA_{t-i} + \varepsilon_t \tag{7}$$

$$\Delta GRPC_t = \pi_2 + \gamma_1 GRPC_{t-1} + \gamma_2 lnCR_{t-1} + \gamma_3 lnEES_{t-1} + \gamma_4 lnGFCR_{t-1} + \gamma_5 lnUNE_{t-1} + \gamma_6 lnPR_{t-1} + \gamma_7 lnPA_{t-1} + \sum_{i=1}^{p} \tau_1 \Delta GRPC_{t-i} + \sum_{i=0}^{p} \tau_2 \Delta lnCR_{t-i} + \sum_{i=0}^{p} \tau_3 \Delta lnEES_{t-i} + \sum_{i-0}^{p} \tau_4 \Delta lnGFCR_{t-i} + \sum_{i=0}^{p} \tau_5 \Delta lnUNE_{t-i} + \sum_{i=0}^{p} \tau_6 \Delta lnPR_{t-i} + \sum_{i=0}^{p} \tau_7 \Delta lnPA_{t-i} + \mu_t \tag{8}$$

Thus, the error correction model within the ARDL framework is specified as follows in equations 9 and 10 where $\alpha_1, \alpha_2, \alpha_3, \alpha_4, \alpha_5, \alpha_6, \alpha_7$, and $\tau_1, \tau_2, \tau_3, \tau_4, \tau_5, \tau_6$ and τ_7 indicate the short-run dynamics coefficients. The speed of adjustment is denoted by ψ in a restricted short-run dynamics equation. The error correction model (ecm_{t-i}) in this study is estimated as presented in equations 11 and 12 for income and income-growth model respectively where π_1 and π_2 is constant.

$$\Delta lnRGPC_t = \sum_{i=1}^{p} \alpha_1 \Delta lnRGPC_{t-i} + \sum_{i=0}^{p} \alpha_2 \Delta lnCR_{t-i} + \sum_{i=0}^{p} \alpha_3 \Delta lnEES_{t-i} + \sum_{i-0}^{p} \alpha_4 \Delta lnGFCR_{t-i} + \sum_{i=0}^{p} \alpha_5 \Delta lnUNE_{t-i} + \sum_{i=0}^{p} \alpha_6 \Delta lnPR_{t-i} + \sum_{i=0}^{p} \alpha_7 \Delta lnPA_{t-i} + \psi ecm_{t-i} + \varepsilon_t \tag{9}$$

$$\Delta GRPC_t = \sum_{i=1}^{p}\tau_1 \ \Delta GRPC_{t-i} + \sum_{i=0}^{p}\tau_2 \Delta lnCR_{t-i} + \sum_{i=0}^{p}\tau_3 \Delta lnEES_{t-i}$$
$$+ \sum_{i-0}^{p}\tau_4 \Delta lnGFCR_{t-i} + \sum_{i=0}^{p}\tau_5 \ \Delta lnUNE_{t-i} + \sum_{i=0}^{p}\tau_6 \ \Delta lnPR_{t-i} + \sum_{i=0}^{p}\tau_7 \Delta lnPA_{t-i}$$
$$+ \psi ecm_{t-i} + \mu_t \quad (10)$$

$$ecm_{t-i} = lnRGPC_t - (\beta_1 lnCR_t + \beta_2 lnEES_t + \beta_3 lnGFCR_t + \beta_4 lnUNE_t + \beta_5 lnPR_t$$
$$+\beta_6 lnPA_t + \pi_1) \quad (11)$$

$$ecm_{t-i} = GRPC_t - (\gamma_1 lnCR_t + \gamma_2 lnEES_t + \gamma_3 lnGFCR_t + \gamma_4 lnUNE_t + \gamma_5 lnPR_t$$
$$+\gamma_6 lnPA_t + \pi_2) \quad (12)$$

Sequel to the above, the bound test is used to determine the existence of cointegration in the long-run using the F-test statistic. This F-statistic tested the joint significance of the coefficients at one period of lag as shown in equations 7–8. The null hypothesis of no cointegration shows that $H_0 : \beta_1 = \beta_2 = \beta_3 = \beta_4 = \beta_5 = \beta_6 = \beta_7 = 0$ (implies non-existence of cointegration) and the alternative $H_0 : \beta_1 \neq \beta_2 \neq \beta_3 \neq \beta_4 \neq \beta_5 \neq \beta_6 \neq \beta_7 \neq 0$ where at least one of the β_1 to $\beta_7 \neq 0$ (implies the existence of cointegration). Thus, β_1 to β_7 in equation 7 is similar to γ_1 to γ_7 in equation 8. The criteria for cointegration is that the F-statistic test value cannot be below or in between the I(0) and I(1) bounds but must be above I(1). In this study, the non-rejection of the null hypothesis (no cointegration exist) is rejected at the appropriate level of significance at 10% and 1%. Table 4 shows the appropriate bounds used in the study based on E-views 9.5.

TABLE 4. Bounds test for the existence of cointegration

	Model I ARDL(1, 0, 1, 2, 1, 0, 1)			Model II ARDL(1, 0, 1, 0, 1, 0, 1)		
F-statistic	3.168*			7.298***		
Level of Significance	90%		95%		99%	
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					

Note: the ** indicate the bound where each model is significant in order to show if there is a long-run relationship or not among the dependent variable and the regressors.

Source: own elaboration.

Empirical Results

The results of the bounds test show a significance of 10% for model I and 1% for Model II. This shows that the F-statistic in each model is greater than the critical upper bound value. For instance, the F-statistic (3.168) in model 1 is greater than the critical values of 1.99 and 2.94 for I (0) and I (1) respectively at 10% level of significance. Similarly, in Model 2, F-statistic of 7.298 is greater than the upper bound critical value of 3.99 at 1% level of significance. Thus, the comprehensive results for the bounds test are presented in Table 4. Moreover, following the favorable results of the bounds test, this study proceeded to examine the long-run and short-run relationship between the variables. The results are presented in Tables 5 and 6.

In model 1, exogenous growth is considered along with crime and other determinates. The exogenous growth is measured using income or GDP per capita. The long-run showed that the crime rate had a negative impact on economic growth at the 1% level of significance. That is, 1% increase in crime committed per 100,000 would negatively reduce economic growth by 0.642%. The negative relation is provided by Becker [1968] and other studies that focused on crime rate [Goulas, Zervoyianni, 2013; Pan et al., 2012]. Moreover, gross fixed capital formation improves economic growth at a 1% level of significance by 0.257%. This result is in line with Shahbaz, Arouri and Teulon [2014]. Prosecution as a deterrence variable to crime indicates a positive relation with economic growth at the 10% level of significance, which means that when prosecution of criminals is increased by 1%, economic growth improved by 0.261%.

In addition, the short-run result shows that crime negatively affects economic growth at the 5% level of significance. Education is found to reduce economic growth at the 1% level of significance, that is, when education increases by 1% economic growth is reduced by 4.297%. This negative relationship between education and economic growth supports Irugbe [2013] and Asiedu [2014]. The positive impact of prosecution and punishment at the 10% level of significance on growth means that if deterrence institutions thrive economy performance can be enhanced. Increasing the level of prosecution and punishment by 1% improves economic growth by 0.075% and 0.079%, respectively. Likewise, Próchniak [2013] showed that the presence of viable institutions helps enhance economic output. In addition, the error correction model (ECM_{t-1}) is –0.355 and it is significant at a 1% level of significance. This shows that there is an adequate feedback mechanism that could restore the model back to equilibrium. For instance, the model would be restored in a year by 35.5%. In addition, where the full adjustment is 100%, it would take 2.81 years to adjust any deviation in the short-run. That means any disequilibrium in the model would take 2.81 years to return to the long run equilibrium relationship.

However, Model 2 focuses on endogenous economic growth, which is measured by income or GDP per capita growth. The long-run results show that crime affects economic growth negatively at the 10% level of significance, meaning that when the crime rate increased by 1%, economic growth is reduced by 8.788%. Likewise, education and gross fixed capital formation cause reduction in economic growth at the 5% level of significance. When education and gross fixed capital formation increase by 1%, economic growth is reduced by 5.017% and 4.718% respectively. Meanwhile, in the short-run, education and gross fixed capital formation maintain their negative relation with growth at 1% and 10% level of significance accordingly. Punishment became viable in improving growth at the 5% level of significance. This result between punishment and economic growth is consistent with Escriba-Folch, [2007]. The error correction model (ECM_{t-1}) is −1.106 and is significant at a 1% level. This indicates a rapid adjustment of the model to equilibrium in case of deviations that may arise in the arson model over the following year by 110.6%. Besides, distortions in the short-run would be restored in 0.9 years to ensure the long-run equilibrium relationship in the model, when full equilibrium is 100%.

TABLE 5. Estimates of the growth models in the long-run relationship using the ARDL Model

Variables	Model I		Model II	
	ARDL(1, 0, 1, 2, 1, 0, 1) (exogenous growth)		ARDL(1, 0, 1, 0, 1, 0, 1) (endogenous growth)	
	Coefficients	t-statistics	Coefficients	t-statistics
lnCR	−0.642	3.661***	−8.788	−1.951*
lnEES	−0.046	−0.544	−5.017	−2.233**
lnGFCR	0.257	3.228***	−4.718	−2.113**
lnUNE	0.105	1.282	3.846	1.549
lnPR	0.261	2.030*	4.271	1.161
lnPA	0.025	0.407	−1.654	−0.794
Constant	15.608	10.278	93.723	2.291
Diagnostics Tests				
Tests	Value	Prob	Value	Prob
Kurtosis	3.522		4.699	
χ^2_N	0.535	0.765	10.480	0.005
χ^2_{FF}	1.13	0.265	0.136	0.892
χ^2_{SC}	0.563	0.452	0.109	0.740
χ^2_H	12.475	0.408	0.514	0.578
Adj R^2	0.943418		0.296810	
*AIC**	−2.695228		6.689129	
BIC	−2.157378		7.139669	
HQ	−2.498085		6.855274	

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_N in model I and II.

Source: own elaboration.

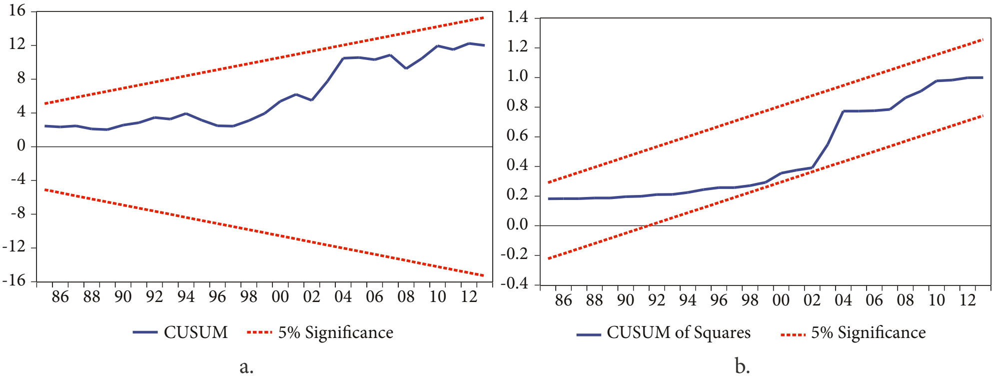
TABLE 6. Estimates of the growth models in the short-run relationship using the ARDL Model

ARDL (1, 0, 1, 2, 1, 0, 1) (exogenous growth)			ARDL (1, 0, 1, 0, 1, 0, 1) (endogenous growth)		
Variables	Coefficients	t-statistics	Variables	Coefficients	t-statistics
Δ*lnCR*	–0.204	–3.031**	Δ*lnCR*	–7.298	–1.038
Δ*lnEES*	–0.249	–4.297***	Δ*lnEES*	–21.359	–3.659***
Δ*lnGFCR*	0.036	1.056	Δ*lnGFCR*	–6.614	–1.780*
Δ*lnGFCR*(–1)	–0.096	–2.483	Δ*lnUNE*	–5.813	–1.579
Δ*lnUNE*	–0.053	–1.614	Δ*lnPR*	0.536	0.124
Δ*lnPR*	0.075	1.770*	Δ*lnPA*	6.651	2.508**
Δ*lnPA*	0.079	3.109*	ECM(–1)	–1.106	–8.118***
ECM(–1)	–0.355	–5.766***			

Source: own elaboration.

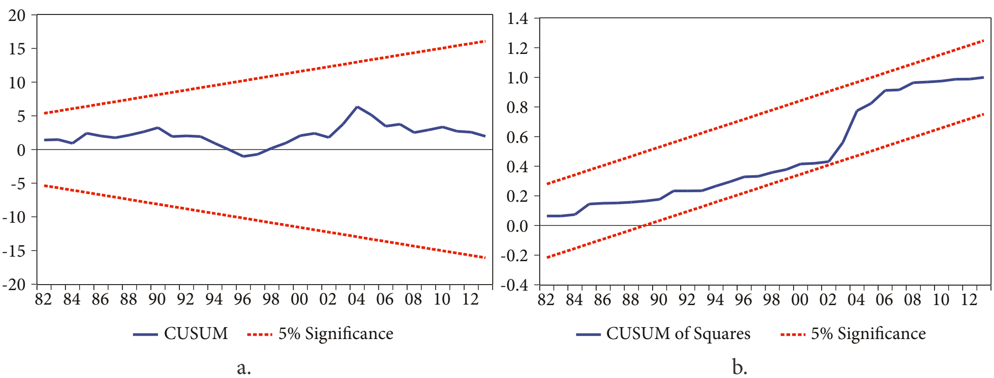
To ensure that the long-run coefficient concluded by the ARDL Models are robust and, consequently, reliable for policy purposes, we conducted diagnostic tests of normality (χ^2_N); functionality (χ^2_{FF}); serial correlation (χ^2_{SC}); heteroscedasticity (χ^2_H) and the structural stability. The results of these tests are presented in Table 5 and Figure 1–2. Moreover, the Jarque-Bera (χ^2_N) is the normality test and only Model 1 passed the test at the 5% level of significance. Nevertheless, the result of the Kurtosis test revealed that the distribution in Model 2 is normally distributed based on the excess of Kurtosis. This is in line with Saridakis [2011]. Ramsey's RESET (χ^2_{FF}) test is used to detect the functional form of the Models specified and all the Models pass the test at the 5% level of significance. In addition, the LM test is the Breusch-Godfrey in our Models. Using the Chi-squared tool we found no serial correlation in each of the two growth models at a 5% level of significance. Meanwhile, the BPG test is the Breusch-Pagan-Godfrey Heteroskedasticity (χ^2_H) test and all models passed this test at the 5% level of significance using the Chi-squared tools. Hence, the structural stability tests of the cumulative sum of recursive residuals (CUSUM) and the cumulative sum of the square of recursive residuals (CUSUMSQ) are applied to establish and analyze the extent of stability in the Models for the long-run relationship. The purpose of stability tests lies in ensuring that coefficients and variances of the disturbance terms do not change with time [Pesaran, Pesaran, 2009]. The structural stability tests were graphically illustrated in Figure 1–2, which show that all models passed the CUSUM and CUSUMSQ tests at the 5% level of significance.

FIGURE 1. Stability Test for Model 1



Source: own elaboration.

FIGURE 2. Stability Test for Model 2



Source: own elaboration.

Conclusion

This empirical study on Nigeria supports the rational choice theory and other empirical evidence that 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. Surprisingly, education has contributed negatively to economic growth both in the long-run and short-run. This negative impact shows that the governmental fund for education is not enough to generate a desired economic growth [Irugbe, 2013]. Due to poor funds, educational institutions lack modern facilities, what influences on the quality of education. Consequently, many Nigerians could not find job, and became frustrated willing to migrate to countries where they could get job opportunities. In addition, domestic investment through gross fixed capital formation increases income but reduces income growth, indicating that Nigeria's growth is driven by consumption and not investment. Crime makes income stagnate or even diminish because it reduces production taking place in the country. Additionally, the prosecution of criminals in Nigeria has weakly promoted growth. This is because the police and judicial system are inadequate resourced. Punishment, as a deterrence variable, positively impacts the economy and growth in the short-run. Consequently, this study suggests that prosecution should be vigorously pursued by improving police and judicial system capabilities through adequate funding and by promulgation of an accountability act for public office holders. In addition, the government should take steps to facilitate a more productive economy that would not only reduce unemployment but also, create a disincentive for crime to occur. Further studies are needed to test whether the nature of the relationship between crime and economic growth is non-linear.

Notes

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