Journal of Economics and Development Studies
June 2016, Vol. 4, No. 2, pp. 219-228
ISSN: 2334-2382 (Print), 2334-2390 (Online)

Published by American Research Institute for Policy Development
DOI: 10.15640/jeds.v4n2a17
URL: https://doi.org/10.15640/jeds.v4n2a17

Crime Dependency on Punishment: Evidence on Economic Growth in Nigeria

Adenuga Fabian Adekoya[1] & Nor Azam Abdul Razak[2]

Abstract

This work examines the link between punishment and economic growth. To show how punishment influences the Nigerian economy, crime was interacted with punishment and its impact on economic growth is examined. Besides, the relations among crime, punishment, and economic growth were explained in the context of the rational choice theory discussed in Becker (1968). In testing the theory's proposition, data from 1970 to 2013 was analysed with the autoregressive distributed lag model of Pesaran (2001). Moreover, the results indicate that crime is harmful to economic growth and punishment improved economic growth in short run. Also, the crime dependency on punishment shows a negative value of 0.582 on economic growth. The negativity of crime dependency on punishment shows that punishment is not efficient in promoting economic growth, but rather a social loss to the economy through the occurrence of crime in Nigeria. This study suggests a reform in legal and enforcement systems in the country for a reduction in social loss coming from punishment due to crime occurrence. The improvement in the legal system would reduce the congestion of prison inmates, and thus save the cost of keeping suspects in the prison without trials for long.

Key words: crime, growth, punishment, deterrence, crime dependency, bounds test.

I. Introduction

There is a common belief that the use of punishment to deter crime would probably reduce crime. This belief is supported by the rational choice theory which asserted that the amount of punishment would increase the cost of crime (Becker, 1968). This idea was emphasised by Ehrlich (1973) which stated that severity in punishment in the prevalence of income inequality would serve as a caution to the lower income people, and possibly reduce their level of involvement in criminal activities. Also, with supporting evidence, Bodman and Maultby (1997) asserted that existence of punishment has greater chances of reducing crime, and Witt and Witte (2000) viewed that prison institutions would help in reducing the level of crime. However, the use of punishment demands more resources in the society through public and private expenditure. That is, prison services have been affected by the scarcity of funds.

For instance, Vigne and Samuels (2012) observed that due to the constraint of fiscal resources and overpopulation of inmates, the financial costs of prison services are becoming unstainable. Besides, Define and Arvanites (2002) affirmed that incarceration through imprisonment has weak control over crime reduction and that the uses of imprisonment are not effective on all types of crime. In addition, the uses of prison have not been sufficient to reduce the growth in population that commits crime (Kovandzic & Vieratitis, 2006). Moreover, the reduction of crime through security expenditure may face stringent financial measure based on tax imposed by crime in a long period of time, and consequently, the security production may be reduced which would increase crime positively (Mauro & Carmeci, 2007).

[1]Ph.D. Student, School of Economics, Finance and Banking, Universiti Utara Malaysia Sintok 06010, Malaysia.
[2]Senior Lecturer, School of Economics, Finance and Banking, Universiti Utara Malaysia Sintok 06010, Malaysia.

In addition, the combats of crime through public expenditure provide more hindrance to economic growth (Enamorado, Lopez-Calva and Rodríguez-Castelán, 2014). Furthermore, the result of considering the interaction of crime with public spending in Goulas and Zervoyianni (2015) provides support to Ehrlich (1973) that social loss would arise due to the tax imposed by crime. Hence, the consequences of punishment resulting to social loss especially as regard economic growth remain vacuous in the literature. This study provides the missing evidence of how crime interacted with punishment affects economic growth.

Theoretically, the theory of rational choice emphasises that individuals partake in legal or illegal activities to satisfy their basic needs. For an individual to partake in illegal activities, such individual would weigh the gains of committing a crime against the gains in legal activities. That is, the excess of gains in illegal activities over legal activities would then serve as incentives for the individual to commit a crime. This is in addition to criminal's knowledge of the environment on the level of security measures provided by the society. The consideration of the environment would assist him to reduce the risk that is associated with involvement in crime activities in the environment. Moreover, the cost of committing a crime determined the risks associated with crime through measure available to deter crime. Becker (1968) argued that the reduction of crime would require deterrence measures of arrest, conviction, and punishment which would tax the society. Consequently, this serves as a diversion of resources from welfare programmes and result in social loss. Hence, 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 and Bourguignon, 1999).

Moreover, the theory encourages the use of enforcement in curbing crime, but due to limited resources, the society could result to use punishment. The use of punishment can be in terms of fine and imprisonment but while fines increase the financial stand, the option of imprisonment reduces it (Becker, 1968). Also, it was noted by Stigler (1974) that not all crimes have the chances of fines, consequently criminals would be imprisoned subsequent to their arrest and conviction. Thus, the idea of arrest and conviction in imprisoning criminals provides more evidence of public funds to finance the prison services (Stigler, 1974). Therefore, the provision of prison services would become a burden to the society, but then little evidence is available to show how the burden of punishment (through imprisonment) affects economic growth especially in Nigeria.

Previous work that interacted crime with deterrence and other variables has shown that deterrence variables were more efficient in improving economic variables, a position which this study differs a bit by following Goulas and Zervoyianni (2015). In interacting morality with the offense, Svensson (2013) showed that the level of offending was significantly affected by morality dependency on offending in the circumstance of low morale. Likewise, when corruption was interacted with financial development in a cross-country study of 30 countries by Batabyal and Chowdhury (2015), it was found that the interaction term is significant and positively affects various income levels considered. Moreover, the interaction of corruption with income was noted to have affected the savings rate and cause more income gap in West African region. This is because the interaction of corruption with income produces a significant and negative effect on the savings rates in the West African region (Abu, Karim & Aziz, 2015). Also, Goulas and Zervoyianni (2015) observed that the occurrence of crime in a society ensures more strains to the public resources because of the needs to provide more safety measures to the public. The study provides that crime dependency on public spending significantly and negatively affects economic growth in Mexico. Nevertheless, this study noted the contribution of the previous studies, but space has not been given to crime dependency on punishment on how it affects economic growth.

2. Punishment as crime deterrence measures in Nigeria

The offenders' punishment is captured by prison admission being for those offenders waiting for trials and whom their cases were prosecuted and convicted, all things being equal. Also, the treatment of offenders while they are in prison requires fund services which are taxed by crime. Consequently, prison and imprisonment in the country gulped 0.97% and 1.20% of the total expenditure in 2011 and 2012 accordingly based on the report of the Prison Services of 2012 in Nigeria. The increase in funds would probably be due to prison admission that increased from 4.79% in 2011 to 15.27% in 2012. However, in the wake of current democratisation in Nigeria, the growth in prison admission stood at -12.42%, -0.95% and -12.03% in 2000, 2001 and 2002 respectively. But as time went by, the growth in prison admission reduced in 2007 by 17.96% and became worse in 2009 and 2012 by 9.93% and 15.27% accordingly. The worse period of prison admission was in line with the increase in the crime rate from 64.62% to 66.09% in 2009 and 2011 respectively and later to 66.51% in 2012.

Besides, economic growth became worse in 2011 and 2012 (see Figure 1). This means that punishment as a social cost to the society may seem right but it can be argued that prison also generates funds to the government purse as noted by this study in the course of the investigation. This is because the government expects the Prisons Services to generate revenue to the government purse. The revenue comes from the industries and farms owned by the institutions which made use of the convicts' labour services (Alemika, 1993). Notwithstanding, the sum generated through prison was discovered to be a huge deficit when compared to the amount spent based on 2011 and 2012 annual report of the Prison Services.

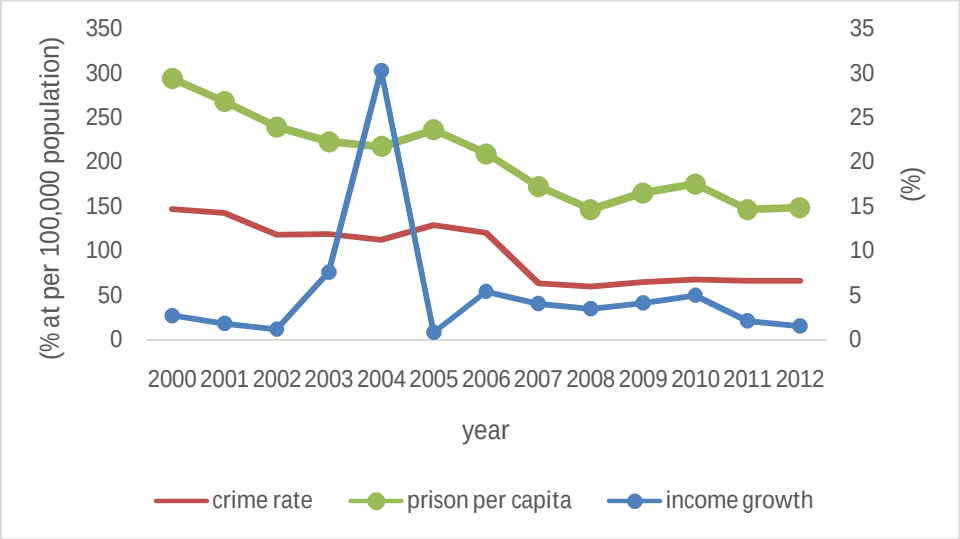


Figure 1: Crime dependency on prison

Sources: NBS, 2012; CBN, 2013; World Bank Indicator, 2016

This study contributes to the literature through its novel idea of providing the effects of punishment as an economic loss based on its interacting capacity with crime. Thus, this study would serve as a caution to the policy makers when considering to deter crime through imprisonment because policy on punishment would tax the society. Besides, if the punishment would tax the society at the instances of crime occurrence, previous studies have not discussed crime interaction with punishment on economic growth to the best knowledge of this work. The following questions are raised to be able to examine the extent of crime dependency on punishment in Nigeria:

i. What is the effect of punishment on economy growth in Nigeria?
ii. In what direction would crime dependency on punishment affect economic growth in Nigeria?

3. Methodology

3.1 Data source and description

The real per capita income for the whole population was obtained from the World Bank Indicator (2016). The crime data was obtained from the Nigeria Police and Nigeria Bureau of Statistics (NBS). While education and unemployment data were from NBS, the punishment variable as proxied by prison inmates' admission data was obtained from the Nigeria Prison Services and NBS. In addition, domestic investment was captured by gross fixed capital formation and was obtained from the Central Bank of Nigeria (CBN). Moreover, in order to investigate the crime dependency on punishment, the crime rate was interacted with prison admission per capita and, in order to overcome the multicollinearity problem, the actual interaction term data was obtained by using ordinary least squares method (see Abu, Karim & Aziz, 2015). The variables investigated are described in statistical practice and defined as shown in Table 1.

Table 1: 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 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	Gross capital formation in millions Naira(₦) in ratio 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
PA	44	120.9533	55.51995	38.96894	263.9846	Prison admission per 100,000 population
CR*PA	44	-3962.1	12293.68	-15450	49262.39	Residual of crime and PA interaction

3.2 Model specification

This study employs the exogenous growth model discussed in Mauro and Carmeci (2007) to investigate the link between crime dependency on punishment and economic growth in Nigeria. Also, a meaningful contribution is made by this study in extending the growth model to study punishment as a deterrence variable to crime. The model in equation 1 and 2 were specified and consequently analysed through the bounds test approach. These two models were specified to show the effect of punishment on economic growth, and the second model focuses on the crime dependency on punishment. Also, the real per capita income ($RGPC_t$) measured economic growth as found in Mauro and Carmeci (2007). This is in addition to education(EES_t), unemployment(UNE_t) and the ratio of investment to gross domestic product ($GFCR_t$). The deterrence variable of punishment was based on Becker (1968) and its proxy by prison admission per capita(PA_t). Besides, the interaction variable is indicated by $CR * PA_t$. Moreover, π_1 and π_2 are constant parameters; $\gamma_1, \theta_1, \gamma_4$ and $\theta_4$measure the elasticity's of crime and unemployment on economic growth negatively. Also, γ_2 and θ_2, γ_3 and θ_3; γ_5 and θ_5, and θ_6 are expected to measure the elasticity's of investment, education, punishment and crime interacted with punishment on economic growth positively. Finally, ε_t and μ_t denote the residuals in the respective models.

$$lnRGPC_t = \pi_1 + \gamma_1 lnCR_t + \gamma_2 lnGFCR_t + \gamma_3 lnEES_t + + \gamma_4 lnUNE_t + \gamma_5 lnPA_t + \varepsilon_t \quad (1)$$

$$lnRGPC_t = \pi_2 + \theta_1 lnCR_t + \theta_2 lnGFCR_t + \theta_3 lnEES_t + + \theta_4 lnUNE_t + \theta_5 lnPA_t + \theta_6 CR * PA_t + \mu_t \quad (2)$$

3.2 Unit roots

Following the conventional means in the literature to possibly avoid spurious regression, this study tests the presence of unit roots. In particular, this study employs the Augmented Dickey-Fuller (ADF) and Phillip-Perron (PP) tests. The results of the unit root tests are presented in Table 2.

Table 2: Unit Roots Tests

	Augmented Dickey-Fuller (ADF)		Phillip-Perron (PP)		Decisions
Variables	Level Intercept and trend	1ST Difference Intercept and trend	Level Intercept and trend	1ST Difference Intercept and trend	
$lnRGPC$	-0.261	-6.067***	-0.461	-6.069***	I(1)
$lnCR$	-2.756	-8.522***	-2.730	-8.473***	I(1)
$lnGFCR$	-0.603	-6.095***	-1.227	-5.432***	I(1)
$lnEES$	-2.299	-8.024***	-2.304	-7.889***	I(1)
$lnUNE$	-1.483	-5.902***	-1.516	-5.910***	I(1)
$lnPA$	-2.649	-7.424***	-2.672	-7.460***	I(1)
$CR * PA$	-3.486*	-6.885***	-3.235*	-14.774***	I(0)

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

3.3 Bounds Test Approach

Pesaran, Smith and Shin (2001) showed that time series variables with a mixture of I(0) and I(1) can be handled by the auto-regressive distributed lag(ARDL) model. Besides, the ARDL model has enormous advantages over other co integration tests like the Johansen-Juselius test. This is because other co integration tests do not take care of the endogeneity problem that usually occurred among socioeconomic variables. The ARDL model resolves the endogeneity problem by taking the lagged of variables in a model and dynamically transforming the model as shown in equations 3 and 4:

$$\Delta lnRGPC_t = \pi_1 + \gamma_1 lnRGPC_{t-1} + \gamma_2 lnCR_{t-1} + \gamma_3 lnGFCR_{t-1} + \gamma_4 lnEES_{t-1} + \gamma_5 lnUNE_{t-1} + \gamma_6 lnPA_{t-1} + \sum_{i=1}^{p} \tau_1 \Delta lnRGPC_{t-i} + \sum_{i=0}^{p} \tau_2 \Delta lnCR_{t-i} + \sum_{i=0}^{p} \tau_3 \Delta lnGFCR_{t-i} + \sum_{i-0}^{p} \tau_4 \Delta lnEES_{t-i} + \sum_{i=0}^{p} \tau_5 \Delta lnUNE_{t-i} + \sum_{i=0}^{p} \tau_6 \Delta lnPA_{t-i} + \varepsilon_t \ldots\ldots\ldots (3)$$

$$\Delta lnRGPC_t = \pi_2 + \theta_1 lnRGPC_{t-1} + \theta_2 lnCR_{t-1} + \theta_3 lnGFCR_{t-1} + \theta_4 lnEES_{t-1} + \theta_5 lnUNE_{t-1} + \theta_6 lnPA_{t-1} + \theta_7 CR * PA_{t-1} + \sum_{i=1}^{p} \varphi_1 \Delta lnRGPC_{t-i} + \sum_{i=0}^{p} \varphi_2 \Delta lnCR_{t-i} + \sum_{i=0}^{p} \varphi_3 \Delta lnGFCR_{t-i} + \sum_{i-0}^{p} \varphi_4 \Delta lnEES_{t-i} + \sum_{i=0}^{p} \varphi_5 \Delta lnUNE_{t-i} + \sum_{i=0}^{p} \varphi_6 \Delta lnPA_{t-i} + \sum_{i=0}^{p} \varphi_7 \Delta CR * PA_{t-i} + \mu_t \ldots\ldots (4)$$

Besides, this helps in avoiding the problem of serial correlation (Shyh-Wei, 2009). In addition, to ensure the dynamic transformation of the model, the Akaike Information Criterion (AIC) was used based on its better result for small sample size (Liew, 2004). Based on AIC, the lag selection were determined and specified as ARDL (1, 0, 0, 1, 1, 1) and ARDL (1, 0, 0, 1, 1, 1, 1). Moreover, the study found that the series in the two models were co integrated by F-statistic in the bounds test based on E-views 9.5 in Table 3. The F-statistic allows for a joint test of series in the model at one period of lag which is indicated in equations 3 and 4 where the null hypothesis of no co integration for equation 3 is $H_0 : \gamma_1 = \gamma_2 = \gamma_3 = \gamma_4 = \gamma_5 = \gamma_6 = 0$; for equation 4, $H_0 : \theta_1 = \theta_2 = \theta_3 = \theta_4 = \theta_5 = \theta_6 = \theta_7 = 0$.

Table 3: Bounds Test for growth models

	Model IARDL(1, 0, 0, 1, 1, 1)				**Model II ARDL(1, 0, 0, 1, 1, 1, 1)**			
F-statistic	3.258*				3.144*			
Level of Significance	90%		95%		90%		95%	
Bounds	I(0)	I(1)	I(0)	I(1)	I(0)	I(1)	I(0)	I(1)
Critical Values	2.08	3.00	2.39	3.38	1.99	2.94	2.27	3.28
K	5				6			

Note: F-statistics are significant at 1% (***); 5% (**) and 10% (*) appropriately. * indicates the bound at which each model was significant in order to show if there is co integration among the dependent variable and the repressors. Model I is the growth model with punishment and model II is growth model with interaction.

In addition, the ARDL framework contains both the long-run and short-run dynamics. The short-run dynamics is captured by the error correction model. Here, the short-run dynamics are provided in equations 5 and 6 for model I and II and are shown by $\tau_1, \tau_2, \tau_3, \tau_4, \tau_5 and\ \tau_6$ and $\varphi_1, \varphi_2, \varphi_3, \varphi_4, \varphi_5, \varphi_6 and\ \varphi_7$. Also, the speed of adjustment is denoted by ψ, and $\pi_1\ and\ \pi_2$ are constants.

$$\Delta lnRGPC_t = \pi_1 + \sum_{i=1}^{p} \tau_1 \ \Delta lnRGPC_{t-i} + \sum_{i=0}^{p} \tau_2 \Delta lnCR_{t-i} + \sum_{i=0}^{p} \tau_3 \Delta lnGFCR_{t-i} + \sum_{i-0}^{p} \tau_4 \Delta lnEES_{t-i} + \sum_{i=0}^{p} \tau_5 \Delta lnUNE_{t-i} + \sum_{i=0}^{p} \tau_6 \Delta lnPA_{t-i} + \psi ecm_{t-i} + \varepsilon_t \ \ldots \ldots (5)$$

$$\Delta lnRGPC_t = \pi_2 + \sum_{i=1}^{p} \varphi_1 \ \Delta lnRGPC_{t-i} + \sum_{i=0}^{p} \varphi_2 \Delta lnCR_{t-i} + \sum_{i=0}^{p} \varphi_3 \Delta lnGFCR_{t-i} + \sum_{i-0}^{p} \varphi_4 \Delta lnEES_{t-i} + \sum_{i=0}^{p} \varphi_5 \Delta lnUNE_{t-i} + \sum_{i=0}^{p} \varphi_6 \Delta lnPA_{t-i} + \sum_{i=0}^{p} \varphi_7 \Delta CR * PA_{t-i} + \psi ecm_{t-i} + \mu_t \ \ldots (6)$$

4. Results and Discussion

Following the result of the unit root tests, the joint movements of the variables were tested using the F-statistic in the bounds test approach. The results of the F-statistic indicate that the estimated coefficients were significant at the 10% level of significance. The results of the two models are presented in Tables 4(long-run estimates) and 5 (short-run estimates).

In the long-run estimates, crime shows an adverse effect on economic growth at the 5% and 1%levels of significance in model 1 and II respectively. That is, an increase in crime by 1% reduces economic growth by 0.464% and 0.582% in the 2 models. This result supports the hypothesis in rational choice theory that crime generates asocial loss of capital (Bourguignon, 1999). In addition, it supports the results in Detotto and Ontranto (2010), Goulas and Zervoyianni (2015) and Mauro and Carmeci (2007). Besides, crime made business to shrink by reducing their output which lowers the profitability of investors in a crime environment (Mauro and Carmeci, 2007). Also, Mehlum, Moene and Torvik (2005) proved theoretically that crime reduces business activities, and consequently causes stagnancy in the economy.

Moreover, the crime situation in Nigeria may be different in terms of what is obtained in other countries like Mexico (Pan, Widner & Enomoto, 2012) and South Africa (Demombynes & Özler, (2005), but the common trend is that crime builds up tension that creates a negative impact on the economy. In addition, the negative impact of crime on the economy may be due to the weak role performed by the educational system in the country and the non-significance of punishment. For instance, education shows a negative sign which is contrary to the result in Goulas and Zervoyianni (2015), but this outcome supports Irugbe (2013) and Asiedu (2014). However, the interacted variable ($CR * PA$) as the variable of interest in this study is positive and significant at the 10% level of significance (see model II).In spite of its significance, this study interest goes beyond that because this work intends to consider the level of dependency of crime on punishment to achieve better economic growth.

Consequently, this work uses the mean approach (i.e. $\partial RGPC_t / \partial CR_t = \theta_1 + \theta_6$ * mean of PA_t does not equal zero) and obtains a negative value of -5.804. Besides, Goulas and Zervoyianni (2015) showed that when the sum of these coefficients is equal to zero, the results of crime dependency of $x's$variable should not be rejected.Also, their study noted that the use of public expenditure in fighting crime caused strain to the public. Moreover, the result in this work tells us that crime imposes a social cost on the economy due to the funds or resources used for punishment through the Prison Services. The funds serve as a tax that crime imposes on the country, and it diverts resources meant to promote growth policy in the country. Thus, crime imposes a stringent tax as a constraint to the welfare of citizens in the country due to its adverse effect on economic growth and development. This is because in equation 1, the marginal effect of crime on growth (∂lnRGPC/∂lnCR = γ_1) is -0.464 when crime is not interacted punishment. In addition, when crime is interacted with crime in equation 2, the marginal effect of crime on growth (∂lnRGPC/∂lnCR = $\theta_1 + \theta_6$*mean of PA) became -0.5804. The reduction of marginal effect of crime on growth from –0.464 to -0.5804 showed that curbing crime with punishment is not effective.

However, the results in the short-run estimates show that crime is significant in lowering economic growth at 10% and 5% in the model I and II respectively. That is, when there is 1% increase in crime rate, economic growth reduced by 0.106% and 0.150% in model II and I respectively. This result notwithstanding, the punishment shows positive significance result at 1% and 10% in the model I and II.

Thus, the role of deterring crime through punishment is only significant in improving economic growth in the short-run. In addition, education impacted negatively on economic growth at 1% level of significance in the two models. Moreover, the results on education may not be a surprise due to various challenges facing education in the country. For instance, the government allocation to education annually is far below 20% of the national budget and 5% of the total GDP as recommended by UNESCO in Dakar (Balogun, 2015). A challenge has made for the Nigerian to further their higher education in foreign countries as noted in National Bureau of Statistics (2015).

In comparing the long and short run results in model 1, this study found that crime impacts on growth is more in the long run than in the short run. In addition, the negative impacts of education on growth are felt only in the short run. In addition, punishment has impacts that are more significant on growth only in the short run. Moreover, in model II crime impacts strongly on growth in the long than in the short run, and the negative impacts of education on growth is felt in the long and short run when compared to the result in model 1. In addition, punishment impacts on growth are similar to what is obtained in model 1. Besides, the interacted variable has reduced crime in the long run when compared to the short run.

Table 4: Estimates of the growth models in the long-run relationship using ARDL Model

	Model I		**Model II**	
	ARDL(1, 0, 0, 1, 1, 1) (growth-crime with prison)		ARDL(1, 0, 0, 1, 1, 1, 1) (growth-crime with interaction)	
Variables	Coefficients	t-statistics	Coefficients	t-statistics
$lnCR$	-0.464	-2.042**	-0.582	-3.212***
$lnGFCR$	0.024	0.108	0.051	0.389
$lnEES$	-0.301	-1.270	-0.259	-1.910*
$lnUNE$	0.257	1.229	0.161	1.438
$lnPA$	0.006	0.050	-0.157	-1.184
$CR * PA$			0.000013	1.988*
$Constant$	19.026	4.543***	20.032	6.694***
	Diagnostics Tests			
Tests	**Value**	**Prob**	**Value**	**Prob**
$Kurtosis$	4.414		5.160	
χ^2_N	7.275	0.026	13.811	0.001
χ^2_{FF}	1.184	0.245	1.294	0.205
χ^2_{SC}	4.876	0.087	0.212	0.644
χ^2_H	6.033	0.736	5.410	0.909
$Adj\ R^2$	0.937		0.942	
AIC^*	-2.668		-2.713	
BIC	-2.259		-2.221	
HQ	-2.517		-2.531	

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.

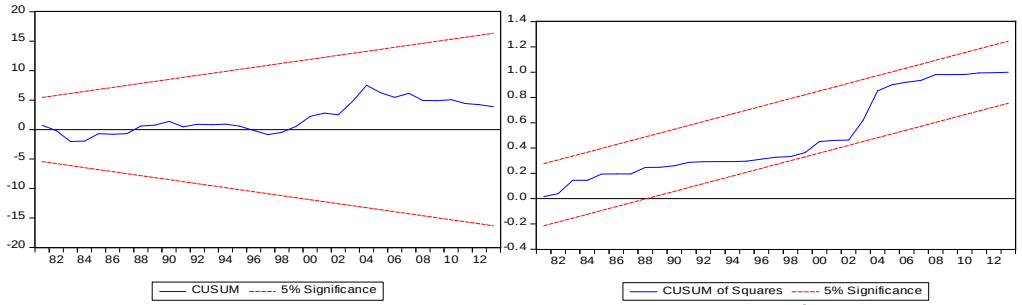
Table 5: Estimates of the growth models in the short-run relationship using ARDL Model

Model I: ARDL(1, 0, 0, 1, 1, 1) (growth-crime with prison)			Model II: ARDL(1, 0, 0, 1, 1, 1, 1) (growth-crime with interaction)		
Variables	Coefficients	t-statistics	**Variables**	Coefficients	t-statistics
$\Delta lnCR$	-0.106	-1.939*	$\Delta lnCR$	-0.150	-2.611**
$\Delta lnGFCR$	-0.024	-0.695	$\Delta lnGFCR$	0.003	0.114
$\Delta lnEES$	-0.211	-3.624***	$\Delta lnEES$	-0.204	-3.689***
$\Delta lnUNE$	-0.049	-1.430	$\Delta lnUNE$	-0.050	-1.526
$\Delta lnPA$	0.072	2.940***	$\Delta lnPA$	0.055	1.900*
$\mathbf{CointEq}(-1)$	-0.178	-5.320***	$\Delta CR * PA$	0.000001	0.733
			$\mathbf{CointEq}(-1)$	-0.272	-5.949***

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

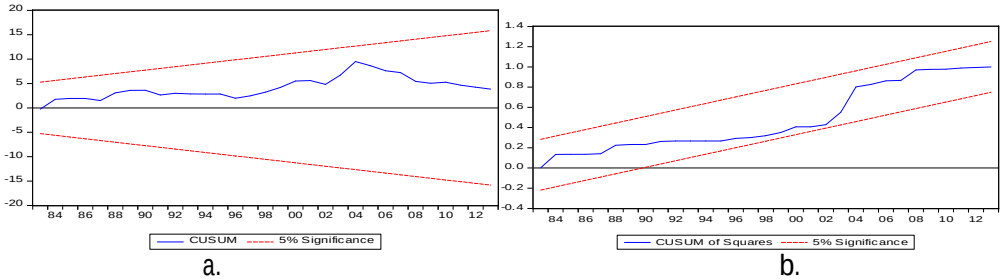
The results in the model I and II are robust and reliable for formulating policy on crime in the country. This is due to the results of various diagnostics tests carried out. These tests are normality test; functional test; serial correlation test; heteroscedasticity test and stability tests. In the testing normality, the study fails to reject the null of normality because the excessive of Kurtosis in the study shows that the model is normal following Saridakis (2011). Moreover, the results of other post-tests show that there is no serial correlation based on observed R^2 probabilities at 5% in the tests of LM of Breusch-Godfrey serial correlation. Also, using the observed R^2 probabilities in tests of Breusch-Pagan-Godfrey Heteroskedasticity, there is no presence of heteroskedasticity in the models at 5%. Besides, the functional form of Ramsey RESET test shows that there is no absence of misspecification at 5%.

In addition, the parameters in the study are stable over time as they move together based on the result of the stability tests (Pesaran & Pesaran, 2009). The stability test comprises of the cumulative sum and the cumulative sum of squares. The results of the cumulative sum and the cumulative sum of squares in Figure 1 and 2 reveal that the two models passed the test at 5%.



a. b.

Figure 1: Stability test for model I



a. b.

Figure 2: Stability test for model II

5. Conclusion

Owning to the crime situations in Nigeria and the use of deterring it with punishment, this study examines it impact on economic growth. In addition, this study recognises the role played by the government in using punishment through the Prison Services to deter crime, but it should be noted that the effectiveness of punishment would only help the economy in the short-run. This is based on the statistical evidence on the crime dependency on punishment in the previous section. With no doubt, the government generates money through the Prison Services, but not at a profit margin. Thus, in order to ensure the maximum use of punishment through the Prison Services, the legal and enforcement systems through the act of conviction and prosecution should be made vibrant in terms of implementation. Their vibrancy would ensure prompt dispense of justice to criminal and civil cases without delay. Thus, the effectiveness of prosecution coupled with prompt administration of justice would help to decongest the inmates, and consequently encourage cost-savings measure of not keeping inmates unnecessarily in prison without trials.

References

Abu, N., Abd Karim, M. Z., & Aziz, M.I., A. (2015). Low savings rates in the economic community of West African States (ECOWAS): the role of corruption. *Journal of Economic Cooperation and Development*, 36(2), 63-90.

Alemika, E. E. O. (1993). Trends and conditions of imprisonment in Nigeria. *International Journal of Offender Therapy and Comparative Criminology*, 37(2), 147-162.

Asiedu, E. (2014). Does Foreign Aid In Education Promote Economic Growth? Evidence from Sub-Saharan Africa. Journal of African Development, 16 (1), 37-59.

Balogun, A. D. (2015). The Effects of Public Sector Corruption on Educational Development in Nigeria: Challenges and Alternative Measures. *Research on Humanities and Social Sciences*, 5(9), 136-157.

Batabyal, S., & Chowdhury, A. (2015). Curbing corruption, financial development and income inequality. *Progress in Development Studies,* 15(1), 49–72.

Becker, G. S. (1968). Crime and punishment: An economic approach. *Journal of Political Economy*, 66(2), 169– 21.

Bodman, P. M., &Maultby, C. (1997). Crime, punishment and deterrence in Australia. *International Journal of Social Economics*, 24 (7/8/9), 884 – 901.

Bourguignon, F., (1999). Crime as a social cost of poverty and inequality: a review focusing on developing countries. *Desarrolloy Sociedad,* 44, 61-99.

Central Bank of Nigeria, (2013). Central Bank of Nigeria Annual Report.The Federal Republic of Nigeria.

DeFina, R. H., & Arvanites, T.M. (2002). The weak effect of imprisonment on crime: 1971-1998. *Social Science Quarterly*, 83(3), 635-653.

Demombynes, G., & Özler, B. (2005). Crime and local inequality in South Africa. *Journal of Development Economics*, 76(2), 265–292.

Detotto, C., & Otranto, E. (2010). Does Crime Affect Economic Growth? *Kyklos*, 63(3), 330–345.

Ehrlich, I. (1973). Participation in illegitimate activities: A theoretical and empirical investigation. *The Journal of Political Economy*, 81(3), 521-565.

Enamorado,T., López-Calva,L.F., & Rodríguez-Castelán, C. (2014). Crime and growth convergence: Evidence from Mexico. *Economics Letters,* 125, 9–13.

Engle, R. F., & Granger, C. W. J. (1987). Co-Integration and error correction: representation, estimation, and testing. *Econometrica*, 55(2), 251-276.

Goulas, E., & Zervoyianni, A. (2015). Economic growth and crime: is there an asymmetric relationship? *Economic Modelling* 49,286 –295.

Irugbe, I. R. (2013). The impact of educational expenditure on economic growth in Nigeria: an error correction specification. *The Social Sciences*, 8 (2), 206-212.

Kovandzic, T., & Vieraitis, L. M. (2006). The Effect of County-Level Prison Population Growth on Crime Rates. *Criminology and Public Policy,* 5(2), 101–32.

Mauro, L., & Carmeci, G.(2007). A poverty trap of crime and unemployment. *Review of Development Economics*, 11(3), 450–462.

Mehlum, H., Moene, K.,& Torvik, R. (2005). Crime induced poverty traps. *Journal of Development Economics,*77, 325–340.

National Bureau of Statistics, (2012). *Social Statistics in Nigeria*. The Federal Republic of Nigeria.

National Bureau of Statistics (2015). *Nigerian Formal Education Sector summary report: 2010- 2012*.Federal Republic of Nigeria (pp 4).

Nigerian Prison Service (2012). *Annual Report*. The Federal Republic of Nigeria.

Pan, M., Widner, B., & Enomoto, C. E. (2012). Growth and crime in contiguous states of Mexico. *Review of Urban & Regional Development Studies*, 24(1-2), 51–64.

Pesaran, B., & Pesaran, M., H., (2009). *Time series econometrics using micro fit 5.0*. Oxford UniversityPress, Oxford, (Chapter 21).

Pesaran, M. H., Shin, Y., & Smith, R. J. (2001).Bounds testing approaches to the analysis of level relationships. *Journal of Applied Econometrics,* 16, 289–326.

Saridakis, G. (2011). Violent crime and incentives in the long-run: evidence from England and Wales. *Journal of Applied Statistics,* 38(4), 647–660.

Shyh-Wei, C. (2009). Investigating causality among unemployment, income and crime in Taiwan: evidence from the bounds test approach. *Journal of Chinese Economic and Business Studies*, 7(1), 115-125.

Stigler, G. J. (1974). The optimum enforcement of laws- essays in the economics of crime and punishment. Gary S. Becker and William M. Landes, eds. National Bureau of Economic Research (pp. 55 - 67).

Svensson, R.. (2013). An Examination of the Interaction between morality and deterrence in Offending: A Research Note. *Crime & Delinquency* XX(X) 1 –16.

Vigne, N. L., & Samuels, J. (2012). The Growth & Increasing Cost of the Federal Prison System: Drivers and Potential Solutions. Urban Institute: Justice Policy Centre.

Witt, R., and Witte, A. (2000) Crime, Prison, and Female Labor Supply', *Journal of Quantitative Criminology*, 16(1), 69-85.

World Bank Indicator. (2016). World Bank Indicator for Development. http://data.worldbank.org/data-catalog/world development-indicator accessed 25 April 2016.