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A Time Series Analysis of the Trend of Crime Against Property in Oke-Ogun Region of Oyo State, Nigeria

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Abstract
Temporal variation in spatial crime occurrence has been a topical issue in environmental criminology and criminal justice research, especially in the area of generating early warning systems for preparedness against crime. However, the concentration of research effort on urban crime pattern with unjustified neglect of regional crime impedes the search for analytical explanations and effective strategies to eradicate crime. Hence, this study examined fluctuant pattern of property crime in Oke-Ogun region of Oyo State, Nigeria. It also assessed direction and incidence speed of the crime in the area. This is with a view to understanding the influence of changes in time (year factor) and other factors (a faulty system of education, erosion of traditional values, porous border, and unemployment among others). over property crime occurrence in the region. Crime reports were collated from the Nigerian Police records on nine typologies of property crime from 2005 to 2012. The geo-analytical techniques employed to examine temporal variations in crime were exponential trend smoothing technique with a smoothing constant of 0.3 and the least-squares trend analytical technique. Regression and correlation coefficients represented by "b" and "r" respectively were used to determine the changing rate of the crimes over the period of year under investigation. Analysis showed that out of the nine crime types that were analysed, three crimes were found to exhibit a rising trend with the effluxion of year while six exhibited a declining trend. Aggregately, crime against property had downward sloping trend lines. The negative values associated with (b = - 93.04, r = - 0.62) property crime confirmed the negative lapse rates and inverse relationships. The coefficient of determination (r^2) in this case is 0.3969. However, the study concluded that 39.69% of variations in the level of property crime were influenced by changes in year and 60.31% was explained by other factors which included a faulty system of education, erosion of traditional values, porous border, and unemployment among others.

Keywords: temporal variation, property crime, region, Oke-Ogun, Nigeria

Introduction
Generally, the overall public apprehension of security crisis and the attendant crime in Nigeria has to do with crime on property and persons. Needless to say, the dominant perception of insecurity in Nigeria today is that fears for personal and private safety and safety of property in particular arising from purely criminal activities such as armed or unarmed robbery, house and store breakings, just to mention a few. Crime, as Omisakin (1998) expresses, "is a social menace, an undeniable stigma to national image and a significant source of threat to people's safety and wellbeing".

Temporal variations in crime are a topical issue in criminological research, and they are among of the least understood topics in the field of environmental criminology and criminal justice, especially in the area of generating early warning systems for preparedness against crime. Over and over, attempts at understanding various aspects of crime have been carried out in different disciplines. Spatial and/or temporal dimension of crime are also obvious but often less considered in most of attempts at understanding various aspects of crime by non-geographers and other non-spatial planners and analysts. Such attempts are in the works of Adejumobi, *et al* (2009), Obudho and Owuor (1994); and Odekunle (1982). The attempts have almost always tried to establish, a clear link between mental life,

modernization, socialisation and increasing level of criminality with little or no reference to temporal dimension to explain how crime vary with time in a particular area. Nevertheless, until recently, the literature on spatial criminology has almost exclusively focused on cities with little efforts on regional problems and the attempts on crime studies include the works of Aust and Simmons (2002), Jones (2003), Mawby (2006), Adeboyejo, and Abodunrin (2007), Okoko (2008), Ahmed (2010) and Adigun (2012). Hence, analysis of regional crime occurrence has been relatively neglected and so the literature on regional crime and justice is comparatively sparse. However, those attempts sometimes can conceal patterns of crime variations in some locations and it must be understood here that solutions to crime phenomena in an environment lie in understanding the spatial variation in crime trend and prevention for planning and management of security operations.

The regional concept holds that the surface of the earth can be marked off into spatial units or areal levels of distinctive character (Omuta and Onokerhoraye, 1986). Okafor (2004) holds that regions are portions of territory each of which is internally homogenous (or largely so) with regard to some attributes. In the context of regional planning, these attributes could be unemployment, agricultural output, industrial output, school environment, infant mortality just to mention a few. Regions are defined on the basis of some significant attributes. Thus, the component parts of a region usually have some similarity in terms of the attributes on the basis of which the region is defined. However, regions are not arbitrarily defined or demarcated areas. Regions are supra urban areas comprising rural and urban environments.

Theoretically, it has been argued that there exists a close and positive relationship between crime occurrence and ecological area in any space economy (Sampson, 1995; La Grange 1999). In same way, the extricable relationship between the physical attributes of Oke-Ogun area, and the prevalence of various types of crime incidence cannot be over-emphasized. Oke-Ogun region has geographical peculiarities with possible implication for incidence of crime prevalence Oke-Ogun region is porous and remains an open countryside. The strategic location of Oke-Ogun area as a transit point to the northern and south-western Nigeria and Republic of Benin makes it prone to criminality and a choice for the research. Locational crime studies on Oke-Ogun and some other borderlands in Nigeria are too few. However, the study examined pattern, direction and relative speed of crime against property in Oke-Ogun region of Oyo State in southwestern Nigeria. This is with a view to assessing the variations in the frequency of crime against property and determining the association between crime frequency and year in the region.

Materials and Methods

The study area is Oke-Ogun region in Oyo State. Oke-Ogun region is the north-western area of Oyo State, and is made up of ten local government areas in the northern and north-western parts of Oyo State, Nigeria. Geographically, Oke-Ogun approximately stretches between latitudes $07^{o}\ 28^{'}$ and $08^{o}\ 38^{'}$ North and longitudes $03^{o}\ 02^{'}$ and $04^{o}\ 44^{'}$ East (Figure 1.).

Oke-Ogun shares boundary with Kwara State in the North, in the South by Ogun State, Ibarapa North and Ibarapa East local government areas; in the East by Atiba and Oyo West local government areas, and in the West by Republic of Benin. Oke-Ogun area is a borderland consisting of ten local government areas. The ten LGAs are districted into three zones, namely;

(i) Border zone: This comprises Saki West, Atisbo and Iwajowa local government areas. The local government areas within this zone share boundary with the Republic of Benin

(ii) Near border zone: This comprises Saki East, Itesiwaju, Kajola and Iseyin local government areas. These local government areas share boundary with the local government areas sharing boundary with the Republic of Benin. This implies that they are indirectly connected to the border.

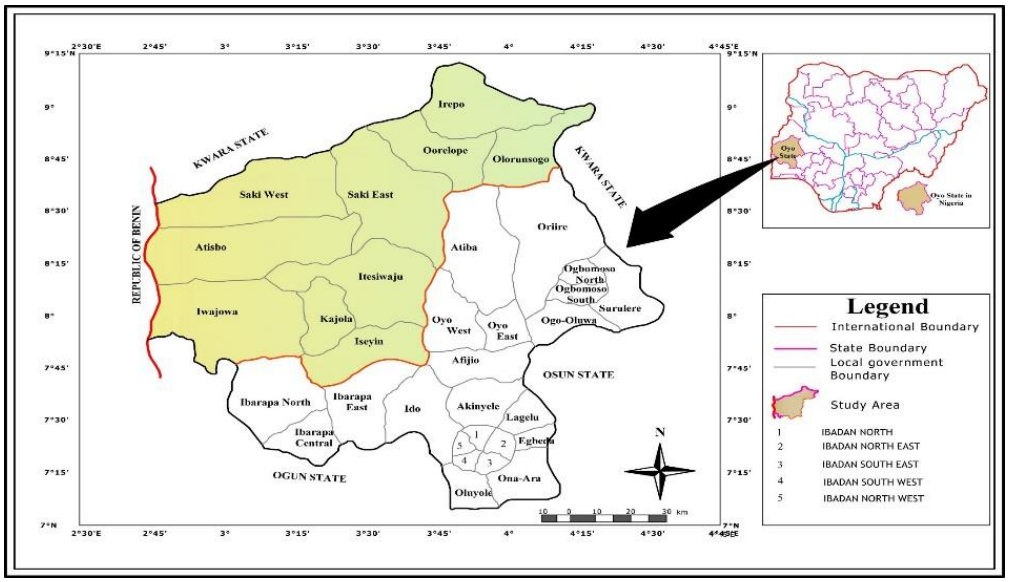

Figure 1: Oke-Ogun Region, Oyo State

(iii) Far border zone: It comprises Orelope, Olorunsogo and Irepo local government areas. These local government areas share boundary with Kwara State which shares boundary with the Republic of Benin. Also, these local government areas are indirectly connected to the border. The people of Oke-Ogun are mostly Yoruba. The regional accent of Oke-Ogun is called "Onko". Some ethnic groups like Ibaruba, Filani, Aketepe, and foreigners from Republic of Benin and Togo are found practising agriculture in the area.

Police records on crime against properties in the study area collected from Oyo State Police Headquarters were used. Temporal variation in nature of crime in Oke-Ogun region from 2005 to 2012 was examined using the exponential smoothing and least square techniques to present the spatial crime information in a graphical format for understanding the rampant trend of crime in the region. The mathematical characteristics of the exponential smoothing trend analysis is given as:

$$\mathbf{T_n = \alpha\ (\varnothing) + (1- \alpha)\ (\beta)} \qquad (1)$$

Where: $\mathbf{T_n}$ = new trend or predicted trend value; $\boldsymbol{\alpha}$ = a smoothing constant; $\varnothing$ = actual value for current period; $\boldsymbol{\beta}$= trend value for last period.
In this technique, the trend value for the first data is the same as the value for the first raw data. For subsequent data, the trend value was calculated using the formula. The commonly used smoothing constant ranges from 0.3 to 0.5, and a smoothing constant of 0.3 was used in this study. The exponential smoothing technique was used to smoothen pattern of crime fluctuation (bring out the rising or falling trend of crime). The Least-Squares technique was used to explain pattern and rate of crime. It was used to obtain regression line that gave the clearest picture of the rising or falling pattern of crime, and determine the linear relationship between years under investigation and their crime incidence. The mathematical characteristics of the least-square techniques is given as:

$$y = a + bx \qquad (2)$$

Where: y = predicted future crime incidence; a = slope intercept, the value of y when x = 0;
b = regression coefficient, constant, representing the amount of change in y that corresponding to a change of one (1) unit in year x = year

For predictive purposes, mathematical models were generated from regression analysis. Regression coefficient (b) and Pearson's product-moment correlation coefficient (r) were employed to determine the speed (strength of the rate of decrease or increase) of crime with the efflux of time in the study

area. The percentage contribution of x (period of year) to variation in y (level of crime occurrence) is determined using the coefficient of determination (r^2). r^2 in this case is got by simply squaring "r" value then multiplied by 100 Therefore r^2 is $100 \times r^2$

Results and Discussions

Temporal Variations in Crime against Property in Oke-Ogun

Data on incidences of crime against property in Oke-Ogun from 2005-2012 were plotted as a time-series data with a view to establishing the trend of crime against property cases over the years under study (Table 1). The exponential smoothing trend line was able to give the picture of a falling trend in Oke-Ogun. However, the rate of decline was swift (Fig.2). This was attested to by the low and negative values of the regression and correlation co-efficient (r = - 0.62), meaning that with time the frequency of crime against property decreased in the area and the relationship between level of crime occurrence with the efflux of time was very high and direct. The coefficient of determination (r^2) in this case is 0.3969. Therefore 39.69% of variations in the level of property crime was influenced by time factor (changes in year). So, 60.31% was explained by other factors. The least squares model is given in this equation 5.

$$y = 1428.8 – 93.036x \quad (3)$$

The model implies that a unit increase in year would bring about 93.036 units decrease in the case of crime against property in Oke-Ogun region.

Table 1: Trend Values for Crime against Property

Year	Empirical values	Tn = α (∅) + (1- α) (β)	Y = a + bx
2005	1187	1187	1335.77
2006	1138	1172.3	1242.74
2007	1147	1164.71	1149.71
2008	1719	1331	1056.68
2009	665	1131.2	963.65
2010	902	1062.44	870.62
2011	644	936.91	777.59
2012	679	589.54	684.56

Source: Field Research, 2014

The Trend of Individual Property Crime

Armed Robbery

The rate of decrease of armed robbery cases in the number of years as examined by exponential smoothing and the least-square techniques is given in Table (2). However, the relationship between the frequency of armed robbery and the effluxion of years was strong though indirect. This is attested to by the high and negative values of the regression and correlation coefficients (b = -1.5952) and (r = - 0.73) respectively. The implication is that the trend of armed robbery was decreasing at a very rapid speed. The regression model in equation (.4):

$$y = 34.429 – 1.5952x \quad (4)$$

The model implies that a unit increase in year would bring about 1.5952 units decrease in the case of armed robbery in Oke-Ogun region.

Table 2: Empirical and Predicted Frequencies of the Trend of Armed Robbery

Year	Empirical values	Tn = α (∅) + (1- α) (β)	Y = a + bx
2005	39	39.00	32.83
2006	27	35.40	31.24
2007	28	33.18	29.64
2008	27	31.33	28.05
2009	25	29.43	26.45
2010	26	28.40	24.86
2011	20	25.88	23.26
2012	26	25.92	21.67

Source: Field Research, 2014

Burglary

Info-graphic trend of burglary cases in Oke-Ogun was observed to be moving upward (Table 3). This is attested to by the low and positive values of the regression and correlation coefficients (b = +1.5357) and (r = + 0.03) respectively. The implication is that the trend of burglary in Oke-Ogun increased at a very slow speed as the years increased and there was a low positive association between crime occurrence and year. The regression model in equation (5) corroborates this.

$$y = 253.21 + 1.5357x \quad (5)$$

The model implies that a unit increase in year would bring about 1.5357 unit increase in the case of burglary in Oke-Ogun region.

Table 3: Trend Values for Burglary

Year	Empirical values	Tn = α (∅) + (1- α) (β)	Y = a + bx
2005	174	174.00	254.75
2006	211	185.10	256.28
2007	252	205.17	257.82
2008	585	319.12	259.35
2009	88	249.78	260.89
2010	374	287.05	262.42
2011	123	237.84	263.96
2012	274	245.69	265.39

Source: Field Research, 2014

Theft and Stealing

The empirical data, when plotted on a coordinate axis, showed a fluctuation of the cases, but the negative values associated with the regression and correlation coefficients respectively (b = - 70.11) and (r = - 79) tespectively confirm the negative lapse rate and an inverse relationship. However, the speed of decline. (b = - 70.12) was swift as the year increased.

$$y = 677.35 – 70.107x \quad (6)$$

The model implies that a unit increase in year would bring about 70.107 units decrease in the case of theft and stealing in Oke-Ogun region.

Table 4: Trend Values for Theft and Stealing

Year	Empirical values	Tn = α (∅) + (1- α) (β)	Y = a + bx
2005	465	465	607.24
2006	630	514.50	537.14
2007	566	529.95	467.03
2008	567	541.07	396.92
2009	139	420.45	326.82
2010	131	333.62	256.71
2011	265	313.03	186.60
2012	132	258.72	116.49

Source: Field Research, 2014

House Breaking

There was observed a fluctuation of the cases (Table 5). However, the regression technique was far more explicit in depicting the rising trends of house-breaking cases in Oke-Ogun. This increasing trend, though very slow was confirmed by a weak positive correlation coefficient value (r = + 0.22) and the regression coefficient (b = + 3.3)

$$y = 157.5 + 3.33x \quad (7)$$

The model implies that a unit increase in year would bring about 3.33 units increase in the case of house breaking in Oke-Ogun region

Table 5: Trend Values for House Breaking

Year	Empirical values	Tn = α (∅) + (1- α) (β)	Y = a + bx
2005	181	181	160.83
2006	122	163.3	164.16
2007	103	145.21	167.49
2008	215	166.15	170.82
2009	116	151.11	174.15
2010	145	149.28	177.48
2011	118	139.89	180.81
2012	140	139.92	184.14

Source: Field Research, 2014

Store Breaking

The analysis established downward slope of the trend lines (Table 6). The negative values associated with both the regression and correlation coefficient (r = - 0.71) was very strong and therefore confirm the negative lapse rate and an inverse relationship, Store Breaking is rapidly declining as the years go by.

$$y = 121.43 – 11.762x \quad (8)$$

The model implies that a unit increase in year would bring about 11.762 decrease in the case of store breaking in Oke-Ogun region.

Table 6: Empirical and Predicted Trend of Store Breaking

Year	Empirical values	Tn = α (∅) + (1- α) (β)	Y = a + bx
2005	87	87	109.67
2006	85	86.40	79.91
2007	85	85.98	86.14
2008	105	91.69	74.38
2009	117	99.28	62.62
2010	46	83.29	50.86
2011	05	59.80	39.10
2012	18	47.26	27.33

Source: Field Research, 2014

Arson /Malicious Damage

The trend of Arson / Malicious damage was characterised by crests and troughs and therefore not quite easy to discern Analysis established downward trend (Table 7). The rate of the decrease of the trend was slow judging by the low values of the regression and the correlation coefficients (r = - 0.40). Regression model generated is

$$y = 19.75 – 0.75x \quad (9)$$

The model implies that a unit increase in year would bring about a 0.75 unit decrease in the case of arson/malicious damage in Oke-Ogun region.

Table 7: Trend value for Arson

Year	Empirical values	Tn = α (∅) + (1- α) (β)	Y = a + bx
2005	19	19.00	19.00
2006	12	16.90	18.25
2007	20	17.83	17.50
2008	24	19.68	16.75
2009	17	18.88	16.00
2010	14	17.42	15.25
2011	10	15.19	14.50
2012	15	15.13	13.75

Source: Field Research, 2014

Forgery

When the information in (Table 8) was plotted graphically the trend of forgery cases in Oke-Ogun area was declining very swift. This is attested to by the very low and negative values of the regression coefficient (b = - 2.34) (equation 8) and the correlation coefficient (r = - 0.90). The least-square model is;

$$y = 35.036 – 2.369x \quad (10)$$

The model implies that a unit increase in year would bring about 2.369 unit decrease in the case of forgery in Oke-Ogun region.

Table 8: Trend values for Forgery

Year	Empirical values	Tn = α (∅) + (1- α) (β)	Y = a + bx
2005	31	31.00	32.67
2006	32	31.30	30.29
2007	29	30.61	27.93
2008	22	28.03	25.56
2009	28	28.02	23.19
2010	18	25.01	20.82
2011	20	23.51	18.45
2012	15	20.96	16.08

Source: Field Research, 2014

False Pretence and Cheating

Analysis established the frequency of false pretence and cheating as the year increased to have been decreasing in the area. (Table 9). However, the actual rate of decline was found to be strongly rapid as confirmed by the negative values associated with correlation coefficient (r = -0.78) of the crime. The least-square model is;

$$y = 129.18 – 11.512x \quad (11)$$

The model implies that a unit increase in year would bring about 11.512 units decrease in the case of false pretence and cheating in Oke-Ogun region.

Table 9: Trend value for false pretence and cheating

Year	Empirical values	Tn = α (∅) + (1- α) (β)	Y = a + bx
2005	150	150.00	117.67
2006	105	136.50	106.16
2007	51	110.85	94.64
2008	92	105.19	83.13
2009	54	89.83	71.62
2010	67	82.98	60.11
2011	51	73.39	48.60
2012	49	66.07	37.08

Source: Field Research, 2014

Unlawful possession

The direction of the trend of unlawful possession was not quite clear with the empirical and exponential smoothing values (Table 10). The rising pattern of the trend was vivid with least squares trend line. Judging by the very low coefficients of the regression and correlation (r = + 0.06) the rate of increase can be said to be very torpid and the relationship between level of crime occurrence and year was very low and direct.

$$y = 40.179 + 0.9048x \quad (12)$$

The model implies that a unit increase in year would bring about 0.9048 unit increase in the case of unlawful possession of contraband and mood-altering substance in Oke-Ogun region

Table 10: Predicted Trend Values for the Crime of Unlawful Possession

Year	Empirical values	Tn = α (∅) + (1- α) (β)	Y = a + bx
2005	41	41.00	41.08
2006	14	32.90	41.99
2007	13	26.93	42.89
2008	82	43.45	43.79
2009	81	54.72	44.70
2010	81	62.60	45.61
2011	32	53.42	46.51
2012	10	40.39	47.42

Source: Field Research, 2014

Summary of Predictions

Among the nine types of crime against property, only three crime types were increasing, albeit at a slow and dilatory pace which was almost imperceptible. Two of the increasing crime types were twin crime. The twin crimes were burglary and house breaking (Table 13). The term 'burglary' is an illegally forceful entry into building in the night while house breaking is an illegally forceful entry into building during the day.

Table 11: Summary of Predictions for Typologies of Property Crime

CRIME AGAINST PROPERTY			
S/N	**CRIME TYPE**	**TREND**	**TREND RATE**
1	Armed Robbery	Decreasing	Very fast (r = - 0.73)
2	Burglary	Increasing	Very slow (r = + 0.03)
3	Theft and stealing	Decreasing	Very fast (r = -0.79)
4	House breaking	Increasing	Slow (r = +0.22)
5	Store breaking	Decreasing	Very fast (r = -0.71)
6	Arson	Decreasing	Slow (r = -0.40)
7	Forgery	Decreasing	Very fast (r = -0.90)
8	False pretence and Cheat	Decreasing	Very fast (r = -0.78)
9	Unlawful possession	Increasing	Very slow (r = +0.06)

Source: Field Research, 2014

The implication of the rising trend of these twin crimes is that there was a very high level of insecurity against pecuniary and other movable material objects kept at home. Concomitantly, the results of a time series analysis of the trend of supra-urban (regional) crime at typologically disaggregated levels in Oke-Ogun have some similarities and differences with urban crime study in Akure as carried out by Okoko (2008). Okoko used Police records from 2001 to 2006 to investigate variations in long term urban crime pattern on theft, burglary, house-breaking, store-breaking, malicious and false pretence. Virtually all these urban crimes but burglary and malicious damage showed a very high rate of increase with the effluxion of years in Akure. Also, the property crime occurrence in Oke-Ogun was at variance with what obtained by Okoko (2008). While property crime in Oke-Ogun showed a fairly fast rate of decline (Figure 2), total crime in Akure exhibited an upward trend with a fairly fast rate of increase. It is evident here that regional environment is distinct from urban environment in ways that affect community policing.

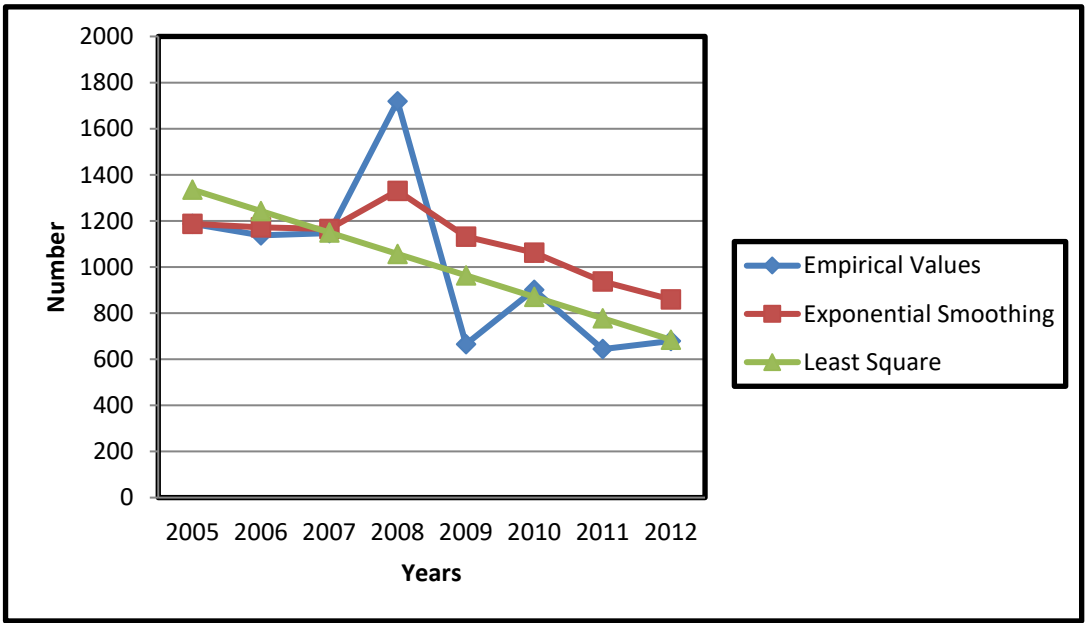

Figure 2: Geo-infographic Trend lines of Total Crime against Property

In general, the property crime occurrence in Oke-Ogun is decreasing at a rapid rate (figure 2) with regression coefficient of (b = - 93.04). However, it could be predicted from the model generated for crime against property that it would take Oke-Ogun area about (nine) 9 years from year 2012 to mitigate the incidence of crime against property into stymied level using least squares model (y = 1428.8 – 93.036x) as given in equation (1). Besides, it was understood from police officers on the behaviours of criminals in response to a specific set of conditions that some criminals might prefer quiet areas and other might prefer busy areas for their nefarious activities. If we are to transfer the

different criminal behaviours on a chart, problem solving for total crime control in a given environment could be impossible due to complications.

Conclusion and Recommendations

The coefficient of determination (r^2) in the case of property crime is 0.3969. However, the study concluded that 39.69% of variations in the level of property crime were influenced by changes in year and 60.31% was explained by other factors. According to the literature review of most area studies of crime based on the routine activity theory and basic systemic model of crime, the crime composition of an area would be a result of the area's ability to develop mechanism of formal and informal control. Therefore, these other factors that bring high crime concentration in Oke-Ogun may be directly related to the inability of households to exercise suitable guardianship, and the reality of the finiteness and limitations of government resources that could be put at the disposal of effective neighbourhood policing. Upward trend in burglary (an illegally forceful entry into building in the night) and house breaking (an illegally forceful entry into building during the day) may be due to far distance of residences from police station and posts, absence of police patrol in new settlements that have scattered newly built houses dotted their landscapes and absence of street light to illuminate the area

For a policy-oriented remark, it is therefore suggested at this time that a concertedly intensified effort and determination must be ensured by the law enforcement officers that crimes are stymied. Efforts should be strategically intensified by the law enforcement officers to ensure that criminals are prevented from gaining forceful entry into residential houses during the day after the people have left home for their daily activities especially in the sub-urban areas that are far from town/village centres and security posts. The same effort should be equally put to check burglary at night coupled with the provision of street light by government to illuminate the ghost zones in the night. The rising trend of unlawful possession in Oke-ogun is portentous of palpable insecurity and a high rate insensate porosity of border areas in Oke-Ogun. Pure border law enforcement agents that are highly trained should man border to check trans-border activities because most of these activities are enormously costly to both the victims and society.

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