Recidivism and Crowding as Determinants of Spatial Expansion in Correctional Architecture: A Translog Analysis of the Cases of Nigeria and New York

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Abstract
This paper dealt with the empirical analysis of the vicious cyclical relationship which exists between the chronic problem of recidivism and the apparent intractable problem of crowding in correctional facilities. It was a study on how the variable, recidivism, feeds into the problem of Crowding which leads in turn to increased demand for more space in correctional facilities and engenders increased design and construction activity with considerable cost implications.The negative effects of recidivism and crowding in correctional facilities are palpable and often culminate in inmate disturbances in these facilities. These disturbances invariably lead policy makers to search for solutions. These solutions would necessarily include actions that are designed to ameliorate crowding and recidivism. A popular approach that seems to be the preferred panacea is the spatial expansion program that involves design and construction of new correctional facilities and the rehabilitation of existing ones. The principal schools of thought in penology have gestated from Retributivism to Utilitarianism. This trend has meant that prison design and construction activities have followed the transition .from fulfilling the Retributivist policy goals to fulfilling the Utilitarian policy goals. Whereas Retributivism advocates punishment of the offender for the sake of punishment itself, Utilitarianism advocates rehabilitation of the offender while he is incarcerated. While Retributivists see punishment as an end in itself, utilitarians see it as a means to an end. This basic difference between these two schools of thought has influenced correctional policies including policies determining spatial expansion of correctional facilities.The method of analysis involves development of a transcendental logarithmic (TRANSLOG) model. The model was estimated using Ordinary Least Squares method, with crowding and recidivism as the dependent variables and capital construction, alternatives to incarceration expenditures, crime rates, rehabilitation, unemployment, age, and education as independent variables.The results of the study show that alternatives to incarceration are more effective in reducing crowding in correctional facilities than capital construction programs. The results also show that crime rates are positive determinants of crowding. However, while rehabilitation programs are negative determinants of recidivism in New York, they constitute positive determinants of recidivism in Nigeria.
Keywords: Design, Construction, Crowding, Recidivism, Correctional Architecture

2.0 INTRODUCTION
2.1 General Statement of the Problem
This paper is based on the proposition that the problems of $_{crowding}$ and *recidivism* in correctional facilities tend to engender increased demand for more facility space. Thus, the ubiquitous increase in expenditures on design and construction of these facilities witnessed in recent times have a tendency to assume a cyclical pattern, where the dependent variables tend to feed into the apparent chronic insatiable demand for correctional facility space. Space, itself, is an architectural component which has significant cost implications.

Recidivism and Crowding in United States Facilities
In the United States, for instance, a boom in the correctional facility construction occurred in response to the riots that took place in several correctional facilities in the 1970s due to crowded (over-crowded) conditions. The particular riot, which exposed the nation to the perils and perniciousness of the crowded conditions in correctional facilities, was the riot which occurred in September 1971 in Attica Correctional Facility, in Upstate, New York, USA. This tragedy resulted in 43 (forty three) inmate deaths.

This incident spurred the authorities to respond, resulting in judicial directives to reduce crowding in various state facilities.

The idea of recidivism as a determinant of crowding is an extension of the argument that crime rate is a determinant of crowding. This argument appears somewhat obvious and stems from the perception of recidivism as a pertinent factor that influences crime rates. In other words, crime is measured not only with data emanating from crimes committed by first time offenders but also includes data resulting from the offenses of repeat offenders. Indeed, available data on crime indicate that about 90 percent of all federal and state prisoners in the United States have had a record of crime before committing the act that led to their current incarceration (Dye 1981). This trend alone, establishes a direct relationship which can be considered fundamental to crime, recidivism, and crowding.

Recidivism and Crowding in Nigerian Facilities

In Nigeria, crowding as a problem in correctional facilities dates back to the turn of the nineteenth century (Awe in Elias 1968). Inmate riots, due to crowding (over-crowding) and other bad conditions, occurred in Lagos Broad Street Prison in 1952 and 1953. Whereas this facility was designed for an occupancy load of 300 inmates, it contained a population of 714 inmates. In response to the riots, the British Colonial Administration at the time demolished the physical structure, replacing it with a much larger facility.

In 1985, inmates in another Lagos correctional facility engaged in riots, protesting the unsanitary and crowded conditions prevalent in the facility (West Africa, October 1985).

This paper begins with a problem statement. Here, the concept of spatial expansion and the corresponding construction expenditure increases as a faltering solution to the problems of correctional facility crowding and recidivism are reviewed.

Section Two is a broad review of relevant literature in corrections, covering the specific variables of crowding, recidivism, capital construction, alternatives to incarceration, rehabilitation, crime rates, unemployment, ethnicity and age. Section Three is a discussion of the hypotheses proffered for this study. These were developed from the literature.

Sections Five and Six are discussions of the method of research used for the study. This includes data gathering and analysis, employing the method of regression analysis using ordinary least squares for evaluating the various variables included in the hypotheses. In Section Six, we introduce the method of Translog functions for solving our model. This was done after it was detected that some of the hypotheses were not empirically testable due to co-linearity. These sections also include the results and discussion of the empirical work. In Section Seven, we make conclusions about this study and analyze its implications for policy.

3.0 LITERATURE REVIEW

Crowding

Literature from the field of environmental psychology provides ample insight into crowding.

For instance, "Density intensity" theories (Levy 1979) define crowding as the situation in which the individual is exposed to high density. According to this view, being crowded has an enhancing effect on feelings and behavior that is independent of its effective impact or stressfulness. Research in this area, supports the idea that high density may have both aversive and positive consequences and that the effect of "being crowded" may be independent of a person's subjective evaluation of "feeling crowded" (Levy 1979).

In another set of theories, called the "felt discrepancy" theories, it is posited that crowding is an experience perceived by the individual, a "felt discrepancy" between the person's desired and actual environments. This discrepancy can be experienced as restricted movement, scarce resources, security threats, lack of availability of meaningful roles, or infringement on privacy. Within this realm, crowding may be conceptualized as a phenomenological experience which arises when the demand for space exceeds the available supply (Stokols 1972), as a motivational state involving the restriction of behavioral choice (Ittelson et al. 1970) or as the desire for increased privacy (Altman 1975) or for reduced social stimulation (Baum and Valins 1973; Desor 1972; Milgram 1970). In order to reduce the salience of this perceived crowding, people may use cognitive, perceptual and behavioral methods of coping; stress may occur if coping strategies are unsuccessful. This stress may result in social withdrawal (Baum, Ries and O'Hara 1974; Bickman, Teger and Gabrielle 1973; Valins and Baum 1973), selective inattention (Saegert 1977), lowered task performance (Corah and Boffa 1970; Glass and Singer 1972), and **aggression against the physical environment or against, others** (Marrero and Markowitz 1977). **This may be especially true in restricted environments where there is little change to avoid stress and little perceived control over the environment**.

There is a direct connection between the phenomena of crowding and privacy. Privacy, according to Altman (1974), is "the selective control over access to the self or to one's group". Further, Goffman (1961) and Jourard (1966) have tried to demonstrate the critical role of privacy for the self-identity and self-esteem of institutional residents.

Still another set of theories of crowding derives from various socio-cultural determinist views of the environment. Among these views is one that sees crowding in terms of "manning", the amount of manning being the ratio of behavioral settings to the number of residents available to maintain those settings. Manning is based on the assumption that all behavioral settings have essential tasks or functions that are associated with specific requirements.

One of the proponents of this idea is Wicker (1976) who submits that crowding is an "over-manned" condition in which the number of eligible participants exceeds the personnel capacity of the available behavior settings in a system. Wicker suggests that the degree of manning in a behavior setting may be more critical in determining the individual's perception of crowding than the physical parameters or available space supply. Therefore, even in low density conditions, an over-manned setting will cause greater degrees of felt crowding due to the scarcity of meaningful roles which one might occupy.

3.1.1 Capital Construction Programs

Of some significance to this study is literature that deals with expansion of correctional facility construction as a solution to the crowding problem. Before delving into this corpus of work, we note that the idea of correctional facility construction has as its primary objective the provision of more space for incarceration purposes. From 1970 to 1980, correctional capital construction expenditures in the United States rose from 74 million dollars to 450 million dollars. By 1982 this amount had increased to 946 million dollars (Dodge 1982). A survey conducted by the U.S. Department of Justice indicated that 47 out of the 50 U.S. states were in the process of building new correctional facilities. As the following literature will show, the propensity to build new correctional facilities has an obvious relationship to crowding and judicial practices (Abt Associates 1980; Nardulli 1983; Finn 1984). The study by Abt Associates found that prisons are "capacity driven", meaning that the greater the capacity of the penal system, the greater the rate of incarceration.

3.1.2 Alternatives to Incarceration

Among the programs that have been suggested as possible alternatives to incarceration are: intensive probation, restitution, community service and house arrest.

Chesney, Hudson and McLagen (1978) studied the nationwide trend of restitution programs and found only 40 formal programs, while Harris (1979) found more than fifty community-service programs in California alone and Hudson and Galaway (1979) reported eighty two adult programs emphasizing restitution and community service.

3.2 Recidivism

Recidivism can be defined as the reversion of an individual to criminal behavior after he or she has been convicted of a prior offense, sentenced, and (presumably) corrected (Maltz 1984).

Much of the research effort dealing with recidivism has used it as a measurement of the success or failure of various correctional programs. Although in this study the interest is in the effects of recidivism (as an explanatory variable) on crowding and the effects of other explanatory variables on recidivism (as a dependent variable), reviewing this literature will help shed some light on the trends of thought relative to this concept. The idea of recidivism as a determinant of crowding is an extension of the argument that crime rate is a determinant of crowding. This argument appears somewhat obvious and stems from the perception of recidivism as a pertinent factor that influences crime rates. In other words, crime is measured not only with data emanating from crimes committed by first time offenders but also includes data resulting from the offenses of repeat offenders. Indeed, available data on crime indicate that about 90 percent of all federal and state prisoners in the United States have had a record of crime before committing the act that led to their current incarceration (Dye 1981). This trend alone, establishes an inextricable relationship which can be considered fundamental to crime, recidivism, and crowding.

3.2.1 Rehabilitation

The effectiveness of rehabilitation programs in corrections has been measured using recidivism. Clarke (1970) and others (e.g. Wilson 1983), referring to such studies on recidivism argued that correctional institutions are "schools of crime", implying that rehabilitation programs are ineffective. Challenging this notion, Gendreau and Leipciger (1977) measured the recidivism rates for a sample of young adult offenders in the Canadian province of Ontario. They examined the recidivism rates for a sample size of 775 male first incarcerates sentenced to provincial reformatory between 1970 and 1972. Their finding was that only 6.7 percent of the sample showed a failure (i.e. received a prison sentence of two years or more), indicating a very high rate of success.

Related to the study by Gendreau and Leipciger, although of slightly earlier date, is the study by Rovner-Pieczenik (1970). In the study, "Project Crossroads", Rovner-Pieczenik evaluated the effectiveness of this project in reducing recidivism and found that recidivism was substantially decreased for the participant group (when compared with a control sample), the decrease being attributable to the favorably terminated participants.

3.2.2 Unemployment

There is ample body of literature to establish an association between unemployment, crime and recidivism. Many sociological researches dealing with social class/unemployment/income and its relationship to crime and delinquency have found fairly consistent positive relationships between unemployment rates and indicators of prosperity and crime.

Schuessler and Slatin (1964), using factor analysis, found income and unemployment rates as measures of social class to be only "loosely related" to crime, while anomic factors (not including income variables) and minority factors were more strongly related to property and personal offenses, respectively. On the other hand, Glaser and Rice (1959) using age-specific data find a consistent positive correlation between unemployment and crime and among persons 20-45 years old, but weak negative correlations between unemployment and delinquent behavior.

Fleisher (1966), in a follow-up study using Glaser and Rice's data, posits that unemployment rates are positively correlated to property crime for all age groups. He attributes Glaser and Rice's failure to find consistency across age groups as due to the effects of war and trend variables.

3.2.3 Age

Literature is available to indicate that there is an association between recidivism and youth. Hirsch (1984) has posited that young people commit most of the violent crimes in America and that the evidence supporting this assertion is reflected in the fact that in 1979 alone, 57 percent of all arrests for violent crimes in the U.S. were of criminals under the age of twenty-five and one fifth were under eighteen. As indicated earlier, empirical studies on recidivism were done by Fishman (1977) using data on variables such as age, race, and education. Fishman's study showed that of the sample subjects, more clients aged 20 years or younger recidivated, with a greater number of arrests and with crimes that were more serious, than did clients who were 21 years or older.

In a study examining the characteristics of inmates incarcerated in Nigerian prisons, Obi (1981) found that age is definitely a factor in crime in Nigeria. He found that 86 percent of the inmates are between 16 and 35 years of age. Obi tried to establish a connection between unemployment, urban conditions, age and crime. To this end, he suggests that immediately after secondary education at age 18, the Nigerian youth leaves his home village for the city in search of work. As they leave, unprepared by their environments for playing urban adult roles, they become vulnerable candidates for illegitimate 'activities. Moreover, their departure to cities enhances the perception of them by their families who perceive the city as areas of opportunity and progress. This perception, of course, puts enormous pressure on these youths as they try to oblige their dependents. As these feelings grip these young adults they rationalize crime and some end up in prison (Bloch and Niederloffar 1958; Obi 1981).

3.2.4 Ethnicity

Studies have been done in the United States to establish an association between crime and ethnicity. Much of this study has attempted to show that a disproportionate number of blacks and Hispanics are involved in crime. This effort has been supported by some statistical evidence, which tends to suggest that blacks are involved in violent crimes both as victims and as offenders. It appears that while blacks constitute only about 12 percent of U.S. population they, however, make up 48 percent of the prison population (Hirsch 1984).

Wolfgang and Cohen (1970) studied the Relationship between crime and race, with specific reference to black involvement in crime and indicated that "--examination of many studies in many cities throughout the country over time spans and by specific offenses, by age, sex, and race, shows consistently that black adult crime and juvenile delinquency rates, measured by arrests, are higher than white rates". Skogan (1979) supported this finding, by establishing a strong correlation between the volume of crime and the black population at the neighborhood level.

Although the authenticity of these conclusions may be grounded in statistical evidence, they fail to address the political and social ramifications of this phenomenon. For example, there is evidence (Silberman 1978) that the high proportion of black incarceration may not necessarily mean that blacks have greater disposition to criminality but that they are victims of adverse race relations. Being placed in this situation, blacks are more frequently arrested and convicted for the slightest infringement of the law that whites may not be arrested for.

3.2.5 Education

Researchers have attempted to establish a correlation between intelligence and/or educational attainment and crime. Although the popular notion is that there may be a causative link between dropping out of school and delinquency behavior, some systematic studies (Bachman et al. 1971; Elliot and Voss 1974; Toby 1983) have shown that while there may be an association between the variables, dropping out of school does not cause delinquency. The studies were conducted independently, one in California, the other in the nation as a whole, yet the results were identical. In both cases, the higher delinquency rate of the dropouts was found to precede their dropping out of school. In the national study the rate remained at the same high level after the students dropped out of school; in the California study, delinquency actually declined somewhat after the students left.

4. HYPOTHESES

Data are available to make definitive statements about crowding, recidivism and other related variables. Consequently, we have defined crowding in correctional institutions in terms of available space per inmate ratio. We have defined it in terms of spatial density, since this seems to be the definition that more accurately quantifies the problem and therefore renders it more measureable.

4.1 Hypothesis One

<u>Alternatives to incarceration programs are more effective in reducing crowding in correctional facilities than capital construction programs.</u>

Perhaps capital construction program in corrections is one of those variables that have been greatly affected by recidivism and crowding and the consequent search for solutions by policy makers (Petersilia and Greenwood 1978; Harriman and Straussman 1983; Nardulli 1983; Finn 1984). Policy makers in a bid to resolve the crowding problem, often resort to increasing the design capacity of the prison system. Providing more prison space, of course, engenders increasing capital expenditures.

Some research (British Home Office Research Unit 1975; Institute of Policy Analysis 1979) have shown that

alternatives to incarceration programs are effective in keeping offenders out of prison, indicating that they are more effective than incarceration programs in rehabilitating offenders. Based on this argument we hypothesize that alternatives to incarceration programs are more effective in reducing crowding in correctional facilities than capital construction programs.

Expressed symbolically, we write:

$C = f(E_1, E_2); \frac{\partial c}{\partial E_1} > \frac{\partial c}{\partial E_2}$

Where C is crowding, E_1 is capital construction expenditures, and E_2 is alternatives to incarceration expenditures.

4.2 Hypothesis Two
Recidivism is a positive determinant of crowding in correctional facilities.

The idea of recidivism as a determinant of crowding is an extension of the argument that crime rate is a determinant of crowding. This argument appears somewhat obvious and stems from the perception of recidivism as a pertinent factor that influences crime rates. In other words, crime is measured not only with data emanating from crimes committed by first time offenders but also includes data resulting from the offenses of repeat offenders.

It is for this reason that we hypothesize that recidivism, measured by re-incarceration, is a positive determinant of crowding in correctional facilities. Within the realm of this argument, we further state that recidivism as an outgrowth of crime is necessarily related to crowding, such that an increase in the former variable generates a positive response in the latter variable.

Expressed symbolically, we state that:

$C = f(v); \frac{\partial C}{\partial V} > 0$; where C is crowding and V is recidivism.

4.3 Hypothesis Three
Crime rates are positive determinants of crowding in correctional facilities.

Although some studies (Petersilia and Greenwood 1978; Nardulli 1983) have shown that the relationship is not always positive, several studies (Sagi and Wellford 1968; President's Commission 1968; Ferdinand 1970; Wellford 1973; Blumstein and Nagin 1975; Fox 1976) have indicated that prison population increases with increase in crime rates. It is on this basis that we hypothesize that crime rates are explicit positive determinants of crowding in correctional facilities.

Expressed symbolically, we write:

$C = f(R); \frac{\partial C}{\partial R} > 0$

Where C is crowding and R is crime rates.

4.4 Hypothesis Four
Rehabilitation programs, if properly implemented in correctional facilities, can be effective in reducing recidivism.

Rehabilitation programs have been tested by measuring their effects on recidivism, suggesting that the goal of rehabilitation is to reduce recidivism (Von Hirsch 1976). We, therefore, hypothesize that rehabilitation programs, if properly implemented in correctional facilities can be effective in reducing recidivism.

Expressed symbolically, we write:

$V = f(E_3); \frac{\partial V}{\partial E_3} > 0$

Where V is recidivism and E_3 is expenditures on rehabilitation programs.

4.5 Hypothesis Five
Unemployment is a positive determinant of recidivism.

Much of the economic literature dealing with crime has tried to establish a positive association between unemployment, crime and recidivism. This phenomenon is evident in economic trends where times of economic recession/depression accompanied by high unemployment rates have been shown to be related to high crime rates (Guttentag 1968; Bogen 1965; Gansemer and Knowles 1964; Allison 1972; Hoch 1974; Brenner 1976; Fleisher 1966; Singell 1967; Sjoquist 1973; Hemley and McPheters 1974; Hemley 1972). Based on this belief, we offer the hypothesis that unemployment is a determinant of recidivism.

Expressed symbolically, we write:

$V = f(L); \frac{\partial V}{\partial L} > 0$

Where V is recidivism and L is unemployment rates.

4.6 Hypothesis Six
Nonwhite inmates have greater tendency to recidivate than white inmates.

For whatever the reasons may be, evidence suggests that some ethnic groups in the United States have a tendency

to commit crimes and recidivate, more so than others. There are also indications that some ethnic groups have the propensity to commit certain types of crimes at a greater proportional frequency than others (Taylor 1931).

Based on the findings that Black and Hispanic ethnic groups have a tendency to commit more crimes than whites (Taylor 1931; Reckless 1940; Wolfgang and Cohen 1970; Skogan 1979), we offer the hypothesis that

Ethnicity is a determinant of recidivism, where nonwhite inmates have greater tendency to recidivate than white inmates.

Expressed symbolically we write,

$V = f(NW); \partial V/\partial NW > 0$

Where V is recidivism and NW are non-white inmates.

4.7. Hypothesis Seven

Educational attainment of an inmate determines whether he/she recidivates, such that non-high school graduates are more inclined to recidivate than high school graduates.

Intelligence/Educational attainment has been found to be related to crime. Goddard (1926), Zeleny (1933), and Root (1928) for example found high correlation between intelligence and crime. Other studies have also found relationships between dropping out of school and crime (Bachman et al. 1971; Elliot and Voss 1974; Toby 1983). Indeed, available data on crime in New York City indicate that four out of every ten (2/5) New York City residents fail to graduate from high school and disproportionate number of these affected belong to minority ethnic groups (Jeffries 1986). Further evidence on these data suggests that persons who drop out of high school have a higher crime rate than high school graduates (Toby 1950; Schafer and Polk 1967). Other studies done outside of the USA show the same results, indicating that school dropouts commit more crimes than school graduates (Obi 1981).

Based on these findings, we hypothesize that educational attainment of an inmate is a determinant of whether he/she recidivates, such that non-high school graduates are more likely to recidivate than high school graduates. Expressed symbolically we write:

$V = f(H); \partial V/\partial H > 0$

Where V is recidivism, H is non-high school graduate.

4.8 Hypothesis Eight

Age of an inmate is a determinant of whether he/she recidivates, such that younger inmates are more likely to recidivate than older inmates.

Related to education and ethnicity as factors influencing recidivism is the age of an inmate. Hirsch (1984) has indicated that based on FBI data, 57 percent of all arrests for violent crimes in the United States in 1979 were of criminals under the age of twenty-five and one fifth were under eighteen. Similarly, Obi (1981) found that over 86 percent of inmates in Nigeria are between the ages of sixteen and thirty-five years old.

Other researchers have similarly found some correlation between age and recidivism, each time indicating that younger ex-offenders have a greater tendency to recidivate than older ones (Fishman 1977; Baverly 1959, 1964, 1968; Glaser and O'Leary 1966).

Based on these findings we hypothesize that the age of an inmate determines whether he/she recidivates. Expressed symbolically it can be written:

$V = f(G); \frac{\partial V}{\partial G} > 0$

Where G, is age under 25 years and under 30 years for Nigeria and New York, respectively.

It is these hypotheses that we shall be testing in the next section in order to lend empirical content to this research.

5. RESEARCH METHODOLOGY

The analytic technique applied for this research uses a modeling approach for estimating the effects of the specified explanatory variables on the dependent variables of crowding and recidivism.

There are two primary objectives for identifying these variables for measurement. First, we want to develop a systematic approach for estimating the effects of correctional policies on crowding and recidivism. Secondly, we want to measure the effects of other relevant variables on crowding and recidivism. For this purpose, an econometric model was developed in order to put empirical content to the *a priori* assumptions outlined in the hypotheses section. Our sample of observation is from 1965 to 1985 (a period of 21 years). Two types of computer software packages, namely, **Soritec** and **Shazam** were used for solving the model.

5.1 The Variables

The equations of the model consist of two kinds of variables:

i. Dependent variables and
ii. Explanatory variables.

The dependent variables include crowding rates and recidivism rates. These are stochastic variables. The

explanatory variables include capital construction expenditures, alternatives to incarceration expenditures, rehabilitation program expenditures, unemployment, ethnicity, education, ethnicity, age, recidivism rates and crime rates. These variables are non-stochastic. Measuring each of these variables is important for understanding the nature of the data used for estimating the model.

An attempt to estimate the model using a large number of variables resulted in multi-co-linearity. Consequently, the number of the explanatory variables for the crowding equation, for both Nigeria and New York, was limited only to capital construction expenditures, alternatives to incarceration expenditures and crime rates. With respect to the recidivism equation, the relevant explanatory variables were limited to rehabilitation programs, unemployment rates, education and age. The model was then reformulated and re-estimated employing these variables. A discussion of the various forms of the model will follow later.

5.1.1 Crowding

There are two methods of determining crowding in correctional facilities. These two derive from two sets of psychological theories of crowding that were reviewed in the literature section. The first of these theories, density intensity theories, define crowding as the situation in which the individual is exposed to high density, or in which he is "being crowded".

The second set of theories, felt discrepancy theories, define crowding as an experience perceived by the individual, a felt discrepancy between the person's actual and desired environments. This discrepancy can be experienced as restricted movement, scarce resources, security threats, lack of availability of meaningful roles, or infringement on privacy.

The American Correctional Association publishes elaborate standards recommended for providing living space for inmates in correctional facilities. Depending on the type of facility, a specified area of livable space, including recreational facilities and toilet facilities are recommended. Consequently, standards differ between minimum security facilities and general confinement facilities. Generally, 50 ft^2 (4.65 m^2) per inmate is required for work-release (minimum security) facilities and 60 ft^2 (5.57 m^2) per inmate is required for general confinement facilities.

For our purposes, crowding rate is determined as the proportion of the difference of current inmate population on design capacity. In order to determine crowding rate, the facility housing design capacity (determined using ACA standards) is subtracted from current inmate population of the facility and the resulting difference is divided by design capacity. This result is the crowding rate. In this study, however, the unit of analysis is not individual facilities as such, but the cumulative of facilities existing in each system.

5.1.2 Recidivism

Standards for measuring recidivism vary, depending on who is doing the measurement. Some of the definitions that have been used in the past include: arrest, reconviction, recommitment to prison, parole violation, parole suspension, parole revocation, offense, abscondsion, and probation violation.

Recidivism is normally measured in terms of the time interval between two events: time of release and time of recidivism.

For the purpose of this study, defining recidivism will be limited to re-incarceration or return to prison. We use this approach because available data on recidivism were, apparently, gathered on this basis. For this definition, the time interval runs from date of release to date of return to prison, as opposed to date of arrest that led to the prison sentence. As indicated in the literature section, the follow-up time for recidivism due to return to prison varies from six months to five years in some cases. For this study, we limit the follow-up time to one year. This choice was determined by data limitations as full information on recidivism available in the records of the two entities under study are based on one year follow-up time. Annual recidivism rates, for the purpose of this analysis, are determined as the proportion of recommitments on releases. In other words, in order to determine recidivism rates, number of inmates returned to prison during a follow-up period is divided by number of inmates released during the same period.

5.1.3 Capital Construction Expenditures

Data on capital construction programs are taken from budgetary publications of New York and Nigeria. The expenditure amounts were adjusted using Consumer Price Index (CPI) in order to account for inflation. The base year used is 1967. Currency units used are the U.S. dollar for New York and the naira for Nigeria. Since data on expenditures are kept on fiscal year basis, attempt has been made to pro-rate these values for the purpose of obtaining the expenditures for the calendar year.

Data on capital expenditures include funds appropriated and expended by the correctional systems on capital projects. These projects include design and construction activities initiated either for the purpose of extending the useful life of an existing facility or for the purpose of providing a completely new facility. Ordinary everyday maintenance expenditures or minor rehabilitation projects are excluded.

5.1.4 Alternatives to Incarceration Expenditures

Similar to capital expenditures, these expenditures are based on calendar year and constant values. The currency units are equally the dollar for New York and the naira for Nigeria. We define alternatives to incarceration as

punishment other than incarceration imposed by the courts on a convict. The data used here include expenditures on probation, restitution, community service and house arrest. Most of the available data show that the greater proportion of this amount was spent on probation. This is because this option is more traditional and older .than the other alternatives.

5.1.5 Rehabilitation Program Expenditures
Rehabilitation programs include educational programs, vocational training programs, recreational programs, industrial training programs, ministerial services and any other program designed for the enrichment of the inmate's stay in prison. The express purpose of these programs is for rehabilitating the inmate, to make him a better citizen. Usually, it is expected that beneficiaries of these programs should escape recidivism.

Similar to capital construction expenditures and expenditures on alternatives, these expenditures are measured in constant monetary values (1967) in order to account for inflation. They are also based on calendar year.

5.1.7 Crime Rates
Data on crime rates are published by the Federal Bureau of Investigation (FBI). These data as they apply to New York will be utilized. The Nigeria Police Force also publishes similar data. Data on crime rates are based on selected offenses known to the police and include murder and manslaughter, rape, assault, robbery, burglary, larceny, and auto theft. Crime rates are usually measured in terms of these offenses committed per 100,000 population. We use crime rates to measure the hypothesis that rising crime rates determine crowding in correctional facilities.

Unemployment Rates
We include this variable in the model as a way of measuring the effects of adverse economic conditions on recidivism. Unemployment rates then are determined by calculating the percentage of the civilian labor force that is out of work. These data, however, can be misleading, in that they do not account for those members of the labor force who work part-time because they could not find full-time work and those people who unsuccessfully sought employment and, discouraged by their efforts, dropped out of the labor force. Nevertheless, since economic conventions consider this method of measurement acceptable, it will be deemed equally reasonable and valid for this study.

5.1.10 Age
Age is used to measure the effects of youth on recidivism. This is because much has been said in both popular and academic literature to associate this variable with rising crime rates. For New York, this is determined as the proportion of total inmate population who are under 30 years old. For Nigeria it is determined as the proportion of total inmate population who are under 25 years old. These categories are predicated by the methods of data tabulation utilized by the respective correctional system.

5.2 Data Collection
In any research effort, the data collection process can quickly assume either of two approaches, namely, using data emanating from either a primary or a secondary source. The process can also involve a combination of both of these two approaches. Usually, where data are already available, the need for going to a primary source for information is eliminated. In this study, both types of data are utilized.

Moreover, it appears that there are two kinds of data that become necessary for an empirical work of this nature. They are:
1. Soft data and,
2. Hard data

While the soft data consist of the corpus of narrative and theoretical information necessary for formulating the basic ideas, the hard data include those real numbers that make up the major ingredient for the empirical analysis.

Since the subject of this study deals, essentially, with public policy, all of the data sources are governmental agencies. To this extent, the data on crowding, recidivism and inmate characteristics for Nigeria were obtained from the Nigerian Prisons Service and for New York, they were obtained from the New York State Department of Correctional Services and the Parole Division. All of the data on correctional expenditures for Nigeria were obtained from the Nigeria's Ministry of Finance while those for New York State were obtained from the New York State Division of Audit and Control.

Our sources for crime rates were the Nigerian Police Force and the Federal Bureau of Investigation for Nigeria and New York, respectively.

As indicated earlier, our sample of observation consists of time series data for 21 years, beginning from 1965 to 1985.

6. SPECIFICATION AND ESTIMATION OF THE TRANSLOG MODEL
6.1 Translog Functions
The objective of reformulating the model in the Translog form is to focus our analysis on a few relevant variables

at a relatively high degree of complexity. To this end, the Translog form has the superior attribute of providing the facility for determining the different order effects that may be apparent in a statistical relationship involving a few stochastic dependent and non-stochastic explanatory variables. Some of these effects are invisible while others are visible. The visible or simple effects consist of the total effects. The invisible effects consist of the first order or short run effects, the second order or long run effects and cross or interactional effects. Unlike the visible effects, the invisible effects are partial effects. The first order effects are the effects that occur in the short run. The second order effects are the effects that hold in the long run. They are marginal. The cross or interactional effects represent the effects that hold when the variables interact with each other. This effect could hold either in the long run or short run. The total effects are the sum or aggregate of all the effects and represent the overall effects in both the short and long run. This unique attribute of the Translog lacks in the multiple regression model.

The following form of the Translog model shall now hold for this study:

$$LogC = c_0 + \alpha_1 logE_1 + \alpha_2 logE_2 + \alpha_4 logR + {1/2}_{\alpha_{11}} (logE_1)^2 + {1/2}_{\alpha_{22}} (logE_1)^2 + {1/2}_{\alpha_{44}} (LogR)^2 + \alpha_{12} logE_1 logE_2 + \alpha_{14} logE_1 logR + \alpha_{24} logE_2 logR \quad ....(6.1)$$

$$logV = v_0 + \beta_1 logE_3 + \beta_4 logG + \beta_5 logL + {1/2}_{\beta_{11}} (logE_3)^2 + {1/2}_{\beta_{44}} (logG)^2 + {1/2}_{\beta_{55}} (logL)^2 + \beta_{14} logE_3 logG + \beta_{15} logE_3 logL + \beta_{45} logG logL ...... (6.2)$$

The final form of the model shall then consist of equations 6.1 and 6.2. The following section is a discussion of these estimates.

6.2 Estimation of the Translog Form of the Model

The explanatory variables included in the crowding equation of the Translog function are capital construction expenditures, alternatives to incarceration expenditures and crime rates. For the recidivism equation, expenditures on rehabilitation programs were identified as the most relevant variables for both New York and Nigeria. These variables were identified using the method of stepwise backward regression, where all the explanatory variables were included in one multiple regression and then rejected one at a time. Following is a discussion of the resulting estimates.

6.2.1 Estimation of the Translog Crowding Functions

Tables 6.1 and 6.2 show the results of estimating the Translog crowding equations for both New York and Nigeria.

TABLE 6.1

OLS ESTIMATES OF CROWDING ELASTICITIES FOR NEW YORK (DERIVED FROM TRANSLOG FUNCTIONS)

CROWDING ELASTICITY

VARIABLES			COEFFICIENT	
	1st order effects	2nd order effects	Cross effects	Total effects
E_1	152.35	82.02	-232.06	2.31
E_2	155.75	-16.71	-137.46	1.59
R	-331.49	390.62	-54.42	4.71

E_1 = Capital Const. Exp.
E_2 = Alt. to Incarceration Exp.
R = Crime rates

TABLE 6.4

OLS ESTIMATES OF CROWDING ELASTICITIES FOR NIGERIA (DERIVED FROM TRANSLOG FUNCTIONS)

CROWDING ELASTICITY

VARIABLES			COEFFICIENT	
	1st order effects	2nd order effects	Cross effects	Total effects
E_1	24.19	15.38	-37.12	2.46
E_2	-47.27	-0.46	48.81	1.09
R	166.28	-198.16	32.66	0.78

6.2.1.1 Estimates of Crowding Elasticity for Hew York

A review of the data illustrated in table 6.1 shows that the results are reasonable. Our primary concern is with the total effects which constitute the test for the *a priori* expectations. This effect is especially important because it is a measure of cumulative or aggregate dependence. We are equally concerned with the first order, second order and interactional effects. These, unlike the total effects, are partial effects. The first order effects, as noted above, are the short run effects. The second order effects are long run effects. They are marginal. The cross effects are due to interaction of more than one explanatory variables.

A look at the column for total effects of table 6.1 reveals that these numbers are relatively small in magnitude

and positive in sign. This result is reasonable and as far as E_1 and E_2 are concerned, it is consistent with *a priori* expectations and acceptable. The total effect of R is also positive and consistent with *a priori* expectation.

With respect to first order effects, the numbers are relatively large. The first order elasticity for capital construction expenditures is not only large but also positive. The first order elasticity for alternatives to incarceration expenditures is equally large and positive. In fact, this elasticity is almost equal in size to the first order elasticity for capital construction expenditures. On the other hand, although the first order elasticity for crime rates is very large, it is negative in sign.

With regard to second order elasticity, the magnitude of the coefficients is still large for E_1 and R. These two elasticity are also positive. The second order elasticity for E_2, on the other hand, is not only relatively small, but also negative.

A review of the column for cross effects reveals an equally interesting pattern. The effects of the three variables are all negative and relatively large in magnitude. The elasticity for capital construction expenditures, E_1, is very large and negative. The elasticity for alternatives to incarceration expenditures, E_2, is similarly large and negative. Although not quite as large as those of E_1 and E_2, the interactional effect elasticity for crime rates, R, is large and similarly negative.

Perhaps, in order to better understand these results, it may be helpful to compare them in terms of sign and magnitude. Let us start by examining the first order effects and the total effects. We shall then compare the first order and second order effects.

The result clearly shows that the first order effects are very large relative to the total effects. Expressed more precisely, it is observable that the first order effect for E_1 is about seventy-six times the total effect. The first order effect for E_2 is nearly one hundred times the total effect, while the first order effect for R is over seventy times the total effect.

With respect to the sign of the elasticity, we observe that while the sign of the first order and total effects of E_1 and E_2 is the same (it is positive), the sign of the first order effect of R differs from that of its total effect. The first order effect of R is negative, while the total effect is positive.

It appears from this result that the magnitude and sign of the total effects tend to depend on the size and sign of the second order and interactional effects. Hence, the seeming tendency for the total effect to be considerably reduced in magnitude relative to first order effect. This phenomenon can also account for the change in sign of R from negative at first order effect to positive at total effect.

Comparing the first order and second order effects shows that with respect to E_1 and E_2, the first order effects are considerably large. While the sign of the first order and second order effects for E_1 is the same (positive), the sign for first order and second order effects for E_2 differ. While the former is positive, the latter takes on a negative value. The result for R, on the other hand, differs. With respect to R, while the first order effect is negative, the second order effect is positive. However, both effects (first order and second order) are comparatively large, although the second order effect is considerably greater than the first order effect.

A review of the results of the cross or interactional effects reveals an equally interesting pattern. It can be observed that these effects, similar to the first order effects, are considerably large in magnitude. The sign, however, is consistently negative for all the variables under study.

From this result, it can be observed that the total or visible effects are much more stable than the partial or invisible effects. Unlike the total effects, the partial effects are more sensitive.

Do these results mean anything at all and can they be considered reasonable for this study? To answer this question, one must submit that there is no doubt of the results ability to highlight, for the first time, new information about the dependence of crowding on capital expenditures, alternatives to incarceration and crime. The results are reasonable and do offer some explanation as to the intrinsic meaning of this dependence.

Let us examine this result more thoroughly. We start again with the total effects. *A priori*, the expectation with respect to capital construction expenditures, E_1, and alternatives to incarceration expenditures, E_2, was that E_1 would be greater than E_2. This result is consistent with this expectation and is supported by previous research findings (British Home Office Research Unit 1975; The Institute of Policy Analysis 1979; Abt Associates 1980; Nardulli 1983), which have tried to show that correctional capital construction programs have a tendency to be positively deterministic of crowding and that alternatives to incarceration programs are more effective in reducing crowding in correctional facilities than capital construction programs. The study by Abt Associates suggested that as more prison space is made available through increased correctional capital expenditures, rates of incarceration increase, leading to more crowding. Abt Associates suggested that this trend is made possible by the relative inclination of judges to impose sentences of incarceration with greater frequency when spaces are available than when they are scarce. Nardulli's study also found this positive effect to be true, even though the data set used for each study was different. With regard to alternatives to incarceration programs, the studies by the British Home Office and The Institute of Policy Analysis indicated high success rates for these programs.

This result is especially noteworthy because of the aggregate nature of the effects. Unlike the first order effects, the total effects could hold at any time period. This quality, lends a very strong support to our assertions

about the effects of these two variables. Simply stated, it implies that a correctional policy that advocates increasing correctional capital expenditures without serious consideration for alternatives to incarceration programs may not be successful. Rather than reduce crowding in correctional facilities, such a policy may actually increase it.

With respect to first order effects, it is evident that the crowding elasticity is very large as compared to the total effects. E_1 is positive but not greater than E_2. This seems to suggest that the first order effects of capital expenditures and alternatives to incarceration expenditures on crowding are positive. This also suggests that in the short run, capital construction expenditures may be more effective in reducing crowding than alternatives to incarceration expenditures. However, in the long run, this effect clearly changes, with the elasticity for E_1 becoming far greater than the elasticity for E_2. This is really interesting and the difference in the magnitude of these two elasticity vividly portrays the difference between the first order or short run effects and the second order or long run effects. It appears that the long run effects, in this instance, clearly represent the stronger effect. In short, while in the short run, capital construction expenditures may be more effective than alternatives to incarceration expenditures, in the long run, alternatives to incarceration expenditures are much more effective than capital construction expenditures. Since second order effects are marginal effects, this result could mean that even though alternatives to incarceration expenditures may be less effective at the onset (short run), as crowding reaches optimum levels, alternatives to incarceration expenditures becomes effective on any additional or incremental units of crowding.

This effect changes when these variables interact with each other or other variables. The result shows that the interactional effects of capital construction expenditures and alternatives to incarceration expenditures on crowding are both negative, indicating that both variables could decrease crowding, however E_1 would be more effective than E_2. Although this result may be possible, the result of the total effect does diminish its importance. This is because, as indicated earlier, while the first order, second order and interactional effects are partial effects, total effects are cumulative effects and are much more stable. The fact that the total effects are stable leads one to accept them as the more valid result. The partial effects show the latent source of these effects.

With respect to crime rates, R, the total effects are similarly small. The sign is positive and consistent with *a priori* expectations and previous research. What this means is that increasing crime rates do have a tendency to increase crowding. However, the first order effect is very large and negative, meaning that in the short run, increasing crime rates may not cause crowding to increase. The second order effect differs significantly from the first order effect, it is positive. In terms of magnitude, the elasticity is very large, in the same scale as the first order effect. This means that in the long run, increasing crime rate could result in increases in crowding. It could also mean that although crime rates on the onset do not necessarily lead to crowding, as crowding reaches optimum levels, any additional input of crime rates would result in crowding. When interacting with other variables, however, the effect is negative, suggesting again that increasing crime rate may not necessarily result in increasing crowding in correctional facilities.

To summarize, consistent with *a priori* expectations, the results of estimates of crowding elasticity for New York suggest that at total effects, alternatives to incarceration expenditures are more effective in reducing crowding in correctional facilities than capital construction expenditures. The results, however, indicate that the partial effects, except for the second order effects, differ slightly. The result also shows that consistent with *a priori* expectation, the total effects of crime rates on crowding are positive; indicating that increases in crime rates could result in increases in crowding in correctional facilities. However, the partial effects, except for the second order or long run effects, are different.

Although the first order, second order and interactional effects of these explanatory variables constitute important indicators of the deterministic relationship that is the subject of measurement in this study, their nature as measures of partial effects renders them relatively inferior to the total effects, which constitute the measures of aggregate or cumulative effects. As can be observed from these results, the total effects are stable, suggesting that these variables can constitute universal determinants of crowding. The partial effects are more sensitive, and only provide one the basis for understanding the underlying source of the total effects.

6.2.1.2 Estimates of Crowding Elasticity for Nigeria
Examining the results of the total effects of table 6.2 indicates that these are very small in magnitude and positive. Comparing capital construction expenditures, E_1, with alternatives to incarceration expenditures, E_2, reveals that the former is significantly greater than the latter. This is a very reasonable result and is consistent with *a priori* expectation. Crime rates, R, are equally very small and positive. This is also consistent with *a priori* expectation.

If we compare total effects with first order effects as we did for New York, we find that the estimates of crowding elasticity at first order effects are considerably larger in magnitude than those of the total effects. Although the figures are much larger at first order effects, the results are comparable to those of total effects. For instance, E^1 is still greater than E_2 and R is still positive.

With respect to second order effects, E_1 is still greater than E_2, however, R takes on negative value. The interactional effects are also relatively large. However, E_2 is now much greater than E_1. The interactional effect of R, although significantly reduced in size relative to second order effects, is now positive.

To further appreciate these results, let us compare the total effects with the first order effects relative to size. One observes that with respect to E_1, the first order effect is nearly ten times the total effect. Regarding E_2, the first order effect is almost forty four times the total effect and with respect to R, the first order effect is over two hundred times the total effect.

Do these results mean anything at all? Are they reasonable? The evidence seems to suggest that they are not only meaningful but also very reasonable.

First, let us examine the meaning of the estimates of the total effects. It can be observed that E_1 is greater than E_2 indicating that alternatives to incarceration expenditures are more effective in reducing crowding in correctional facilities than capital construction expenditures. This is a very strong and important result and is consistent with *a priori* expectation. The importance of this result is underscored by the fact that the total effect, as indicated above, consists in cumulative effect, representing the aggregates of short run, long run and interactive effects. This result, as noted in the foregoing analysis for New York, is supported by previous research findings (British Home Office Research Unit 1975; Institute of Policy Analysis 1979; Abt Associates 1980; Nardulli 1983), which have tried to show that capital construction programs are less effective in reducing crowding than alternatives to incarceration programs.

As regards the crowding elasticity with respect to crime rates, one observes that the total effect, although significantly small, is positive. This result suggests that crowding increases with rising crime rates. This is consistent with *a priori* expectation and previous research (Sagi and Wellford 1968; Ferdinand 1970; Wellford 1973; Blumstein and Nagin 1975; Fox 1976).

Comparing first order effects for capital construction expenditures and alternatives to incarceration expenditures shows some consistency with the results of the total effects. The former variable is greater than the latter. This result indicates that in the short run, alternatives to incarceration expenditures are more effective in reducing crowding in correctional facilities than capital construction expenditures. This result is also evident in the second order effects, showing that in the long run, alternatives to incarceration expenditures are equally more effective in reducing crowding in correctional facilities than capital construction expenditures. This result could also mean that alternatives to incarceration expenditures are not only effective at the onset of crowding, but also at the marginal level. The result is remarkably plausible and constitutes strong support for the theoretical expectations of the total effects. However, the result shows that the interactional effects of capital construction expenditures and alternatives to incarceration expenditures are of the nature that the former variable could be more effective in reducing crowding than the latter variable.

With respect to crime rates, the result shows that the first order effects on crowding are positive. This is consistent with the total effects. It indicates that in the short run, rising crime rates could result in increases in crowding in correctional facilities. However, the second order effects are negative, indicating that in the long run, rising crime rates may not necessarily result in increases in crowding in correctional facilities. In other words, after attaining optimum levels of crowding, crime rates may not contribute to additional units of crowding. Nonetheless, the interactional effects of crime rates on crowding are positive, indicating that when crime rates interact with other variables, they (crime rates) could lead to increases in crowding in correctional facilities.

In conclusion, consistent with *a priori* expectations and previous research, results of estimates of crowding elasticity for Nigeria indicate that the total effects of capital construction expenditures and alternatives to incarceration expenditures are such that the latter variable is more effective in reducing crowding in correctional facilities than the former variable. This result is also the case in both short and long run. However, the interactional effects of these two variables differ from this result.

With regard to crime rates, the results indicate that consistent with *a priori* expectations and previous research, the total effects of this variable on crowding in correctional facilities are positive, suggesting that increasing crime rates could lead to increases in crowding. This result is the same in the short run and at interactional effects. However, the second order effects are different from this result.

As noted in the case of New York, we again state that due to their partial nature, the first order, second order and interactional effects could be considered relatively inferior to the total effects which constitute aggregate or cumulative effects. However, all of the effects should be accepted as important and valid measurement of the deterministic relationship existing in the model. This observation is plausible, considering that each effect deals with a particular aspect of this relationship. Each effect is an important contribution of the Translog functions and the partial effects help reveal the underlying source of the total effects.

6.2.2 Estimation of the Translog Recidivism Functions

TABLE 6.3
OLS ESTIMATES OF RECIDIVISM ELASTICITIES FOR NEW YORK (DERIVED FROM TRANSLOG FUNCTIONS)
RECIDIVISM ELASTICITY

	VARIABLES		COEFFICIENT	
	1st order effects	2nd order effects	Cross effects	Total effects
E_3	-11.84	9.94	1.65	-0.25
G	41.10	2.26	-43.80	-0.44
L	12.81	-2.92	-10.27	-0.38

E_3 = Rehab Exp. L = Unemployment Rates: G =Age 30 & under.

TABLE 6.4
OLS ESTIMATES OF RECIDIVISM ELASTICITIES FOR NIGERIA (DERIVED FROM TRANSLOG FUNCTIONS)
RECIDIVISM ELASTICITY

	VARIABLES		COEFFICIENT	
	1st order effects	2nd order effects	Cross effects	Total effects
E_3	-2.99	2.19	1.26	0.46
G	-58.24	-32.23	89.03	-1.44
L	-11.66	-1.43	12.21	-0.88

E_3 = Rehab. Exp; L = Unemployment Rates; G =Age 25 & Under.

Tables 6.3 and 6.4 illustrate the results of the estimates of recidivism elasticity for New York and Nigeria, respectively.

6.2.2.1 Estimates of Recidivism Elasticity for New York

The results of the estimates of recidivism elasticity for New York with respect to rehabilitation program expenditures, age and unemployment rates are reasonable. We notice from table 6.3 that the total effects are again small in size compared to the partial effects. We also observe that the total effects for these variables are negative. As far as E_3 is concerned, the result of the total effects are consistent with *a priori* expectation and supports previous research findings (Rovner-Pieczenik 1970; Gendreau and Leipciger 1977; Palmer 1978; LeClair 1983).

Regarding first order effects, one observes that E_3 is negative and G and L are positive. When compared to total effects, one observes that the sign of first order effects for E_3 is the same (negative) as total effects. However, the sign of first order effects for G and L is different from total effects. Nonetheless, it can also be observed that the size of first order effects is much greater than that of total effects.

Turning to second order effects, one observes that the sign of the coefficients for both E_3 and G is positive. However, L is negative. One also observes that the first order effects are larger than the second order effects. With respect to interactional effects, one notices that while E_3 is positive, G and L are negative. These effects are also large, when compared to total effects.

What inferences can one derive from these results? It appears that we can infer from the results that the aggregate or cumulative effects of the variables, rehabilitation program expenditures, unemployment rates and age, on recidivism are all negative. This is an indication that consistent with *a priori* expectations, rehabilitation programs are effective in reducing recidivism. This finding supports previous research (Rovner-Pieczenik 1970; Gendreau and Leipciger 1977; Palmer 1978; LeClair 1983) which have measured and shown high success rates for these programs. Rovner-Pieczenik's study, for instance, found a high negative effect on recidivism by a pre-trial rehabilitation program geared towards reducing recidivism. Similarly, Gendreau and Leipciger's study examined the effects of in-prison rehabilitation programs in Ontario and their findings showed strong negative effects. These findings were supported by LeClair, whose study evaluated the effects of rehabilitative furlough programs on recidivism and found strong negative effect.

It is noticeable that the first order effect of E_3 is comparable to its total effect in terms of sign. This is an indication that in the short run, expenditures for rehabilitation programs are effective in reducing recidivism. The first order effect of unemployment rates is positive, indicating that in the short run, rising unemployment rates could lead to increases in recidivism. This result is supported by previous research findings (Gansemer and Knowles 1964; Bogen 1965; Fleisher 1966; Singell 1967; Guttentag 1968; Hemley 1972; Sjoquist 1973; Hemley and McPheters 1974; Brenner 1976), which have documented fairly strong empirical evidence to support the theory that unemployment does have positive effects on recidivism.

Similar to unemployment rates, the first order effects of age is positive, indicating that in the short run when there is a high proportion of inmates who are 30 years old or younger, recidivism rates are high.

The second order effect of E_3 is positive, indicating that in the long run, rehabilitation program expenditures

may not be effective in reducing recidivism. This effect could also mean that rehabilitation program expenditures could be effective in reducing recidivism up to a certain optimum level, at which point any additional or incremental inputs may not be effective.

The second order effect of age is positive, an indication that in the long run when there is a high proportion of inmates 30 years old or younger, recidivism rates are high.

It can be observed that the second order effects of unemployment rates on recidivism are negative. This is an indication that in the long run, unemployment rates may not lead to recidivism. In other words, after reaching optimum levels of recidivism, additional increases in unemployment rates may not result in increases in recidivism.

With regard to interactional effects, one observes that while rehabilitation expenditures elasticity is positive, age and unemployment elasticity are negative. This could be indications that when interacting with one another, rehabilitation program expenditures may not reduce recidivism and that age and unemployment rates may not have positive effects on recidivism.

In conclusion, results of estimates of recidivism elasticity for New York with respect to rehabilitation program expenditures, age and unemployment rates reveal that the total effects are negative. However, estimates of the partial effects are different. The result suggests that rehabilitation programs are effective in reducing recidivism. It also suggests that while on the whole, high proportions of inmates aged 30 years and younger may not mean that there are high rates of recidivism, in the short and long run this would likely be the case. The result also shows that although on the whole, increasing unemployment rates may not lead to high rates of recidivism, in the short run it would do so.

6.2.2.2 Estimates of Recidivism Elasticity for Nigeria

Table 6.4 illustrates the results of estimating recidivism elasticity for Nigeria. A glance at this table reveals that the total effects of rehabilitation expenditures, E_3, are positive. However, the total effects of G and L are negative. With respect to first order effects of E_3, G and L, one notices that these are negative. These effects are comparable to total effects of G and L but not the total effects of E_3. However, the size of the first order elasticity is far greater than the size of the total effects.

While the second order effects of E_3 are positive, the second order effects of G and L are negative. Similar to first order effects, these second order effects are larger than the total effects.

With regard to the interactional effects, one observes that the values are also relatively large. It can be readily observed that all of the elasticity are positive.

What can one infer from these results? To answer this question, let us start by analyzing the total effects. E_3 is positive, indicating that increasing rehabilitation program expenditures in Nigeria may not result in a decrease in recidivism rates. The result also shows that increasing unemployment rates in Nigeria may not lead to an increase in recidivism rates. It also shows that the presence of high proportions of inmates 25 years old and younger may not mean a high rate of recidivism.

Analyzing the first order effects, one observes that consistent with previous research, E_3, is negative, indicating that expenditures on rehabilitation programs can be effective in reducing recidivism in the short run. Similar to E_3, G and L are negative. This indicates that in the short run, high proportions of inmates 25 years old and younger may not imply high recidivism rates. The result also shows that in the short run, higher unemployment rates may not lead to high rates of recidivism.

With respect to second order effects, the result indicates that in the long run, rehabilitation programs may not be effective in reducing recidivism. In the long run, high proportions of inmates 25 years and younger may not lead to high rates of recidivism and increasing unemployment may not lead to high rates of recidivism.

The results also show that with regard to interactional effects, the elasticity for rehabilitation program expenditures is positive. This may be an indication that increasing expenditure on such programs when interacting with other variables may not reduce recidivism. However, if interacting with other variables, high proportion of inmates who are 25 years old and younger could lead to high rate of recidivism. This result is consistent with previous research (Baverly 1959, 1968; Glaser and O'Leary 1966; Fishman 1977; Obi 1981). The result also shows that if interacting with other variables, high rates of unemployment could lead to high rates of recidivism. This finding is consistent with previous research (Gansemer and Knowles 1964; Bogen 1965; Fleisher 1966; Singell 1967; Guttentag 1968; emley 1972; Sjoquist 1973; Hemley and McPheters 1974; Brener 1976) and differs from all the other effects, which are negative.

To summarize, results of estimates of recidivism elasticity for Nigeria provide reasonable insight as to various effects of the explanatory variables, rehabilitation program expenditures, age and unemployment. The result shows that on the whole, rehabilitation program expenditures may not be effective in reducing recidivism rates. The result also shows that in years when there is a high proportion of inmates 25 years or younger, recidivism rates may not necessarily be high. It also shows that high unemployment rates may not necessarily lead to high rates of recidivism. Incidentally, these effects do not differ much from the partial effects.

7. CONCLUSIONS AND IMPLICATIONS

One of the objectives of this study has been to develop an econometric model for measuring crowding and recidivism. This study is distinct from previous work on the subject because, for the first time, a unique model specifically targeted at these two variables has been developed. This model is called, *the Translog crowding and recidivism functions.* The model has provided us the ability to obtain some reasonable estimates of the effects of certain specified explanatory variables on crowding and recidivism. This was possible for both New York and Nigeria.

This study has shown how recidivism and crime rates tend to determine crowding and the expansion of construction of correctional facilities in a cyclical fashion.

REFERENCES

Altman, I. "Privacy: A Conceptual Analysis". In D. Carson, Ed., *Man-Environment Interactions: Evaluations and Applications(Pt. 2).* Stroudsbourg, Pa: Dowden, Hutchinson, and Ross, 1974.

Altman, I. *The Environment and Social Behavior: Privacy, Personal Space, Territory and Crowding.* Monterey, Ca: Brooks/Cole,1975.

Armstrong, William L. "Prudent Use of Prison Space: The Sentencing Improvement Act" *Journal of Legislation.* 11:237-48, Summer 1984.

Austin, James and Barry Kisbert, "The Unmet Promise of Alternatives to Incarceration" *Crime and Delinquency.* 28: 374-409, July 1982.

Bachman, Jerald G., Swayzer Green, and Ilona D. Wirtanen, *Youth inTransition, Volume III: Dropping Out-Problem or Symptom?* Ann Arbor, Mich.: Survey Research Center, 1971.

Baron, R. and J. Rodin. "Personal Control and Crowding Stress" in A. Baum, J. Singer and S. Valins, Eds. *Advances in Environmental Psychology.* (Vol. 1). Hillsdale, NJ: Erlbaum, 1978.

Baum, A., R.E.Harpin, and S. Valins "The Role of Group Phenomenon in the Experience of Crowding", *Environment and Behavior.* 7:185-199, 1975.

Baum, A., M. Reiss and J. O'Hara "Architectural Variants of Reaction to Spatial Invasion", *Environment and Behavior.* 6:91-100,1974.

Bickman, L., A. Teger, T. Gabriele, C. McLaughlin, M. Berger and E.Sunaday "Dormitory Density and Helping Behavior" *Environment and Behavior.* 5:465-490, 1973.

Block, H.A. "Economic Depression as a Factor in Rural Crime", Journal of Criminal *Law* and Criminology. 40(4):468-70, November-December 1949.

Blumstein, Alfred and Richard Larson, "Problems in Modeling and Measuring Recidivism", Journal of *Research in Crime* and *Delinquency.* 8(2): 124-132, July 1971.

Blumstein, Alfred, Jacqueline Cohen and Harold D. Miller, "Demographically Disaggregated Projections of Prison Populations", Journal *of Criminal Justice.* 8:1-26, 1980.

Carter, Marshall and Otwin Marenin, "Law Enforcement and Political Change in Post-Civil War Nigeria", Journal of *Criminal Justice.* 9(2):125-49, 1981.

Castillo-Barrantes, J. Enrique, "Prison Substitutes: Present Status and Trends in Latin America", International *Review of Criminal Policy.* 36:47-54, 1980.

Clifford, William "Crime and Culture...and African Study", *Canadian Journal of Corrections,* i: 157-166, 1966.

Clifford, William "Problems of Criminological Research in Africa South of the Sahara", *International Review of Criminal Policy.* (United Nations) 23:11-17, 1965.

Cory, Bruce and Stephen Gittenger *Time to Build: The Realities of Prison Construction.* New York: Edna McConnell Clark Foundation, 1984.

Curran, S. F., R. J. Blatchley and T. E. Hanlon "The Relationship Between Body Buffer Zone and Violence as Assessed by Subjective and Objective Techniques", *Criminal Justice* and *Behavior.* 5(1): 53-62, 1978.

Danser, Kenneth R. and John H. Lamb *Analysis of National Crime Victimization Survey Data to Study Serious Delinquent Behavior Monograph Four: Juvenile Criminal Behavior and its Relations to Economic Conditions.* U.S. National Institute for Juvenile Justice and Delinquency Prevention, Criminal Justice Research Center Washington, D.C., G.P.O., 1981.

Danziger, Sheldon and David Wheeler, "The Economics of Crime: Punishment or Income Redistribution." *Review of Social Economy.* 33(2):113-131, 1975.

D'Artri, D. A. "Psychological Responses to Crowding", *Environment and Behavior.* 7:237-53, 1975.

Dean, L.M., W.M. Pugh and E. Gunderson "Spatial and Perceptual Components of Crowding: Effects on Health and Satisfaction", *Environmental Behavior.* 7:225-37, 1975.

Desor, J. "Toward a Psychological Theory of Crowding", *Journal of Personality and Social Psychology.* 21:79-83, 1972

Delbert, S. Elliott and Harwin L. Voss, *Delinquency and Dropout.* Lexington, Mass.: Lexington Books, 1974.Ehrlich, Isaac "Participation in Illegitimate Activities: A theoretical and Empirical Investigation",

Journal of Political Economy. 81:523-65, 1973.

Elias, T. Oluwale *Groundwork of Nigerian Law.* London: Routeledge and Kegan Paul, 1954.

Elias, T. Oluwale *Law and Social Change in Nigeria.* Lagos: Evans Brothers Ltd., 1972.

Elias, T. Oluwale, ed. *The Nigerian Magistrate and the Offender.* Benin City: Ethiope Publishing Company, 1972.

Elias, T. Oluwale, ed. *The Prison System in Nigeria.* Lagos: University of Lagos Press, 1968.

Engel, Kathleen and Stanley Rothman "Prison Violence and the Paradox of Reform (Effect of Liberalized Programs and Regulations since the 1960s in Men's Prisons)", *Public Interest.* Fall 1983, pp. 91-105

Essex, A.H. "Experiences of Crowding: Illustration of a Paradigm for Man-Environment Relations", *Representative Research in Social Psychology.* 4:207-18, 1973.

Fennell, John T. "Islands of Violence: The Crises of America's Prisons and Jails", *Journal of Social, Political and Economic Studies.* 8:81-91, Spring 1983.

Ferdinand, T. "Demographic Sifts and Criminality." *British Journal of Criminology.* 10:169-175, 1970.

Finn, Peter "Judicial Responses to Prison Crowding: While Many Judges Apparently Are Altering Their Sentencing Practices in Response to Inmate Population Increases, There Is No Consensus Among the Judges as to Its Responsibility for Resolving the Prison Crowding Problem", *Judicature.* 67:318-25, February 1984.

Finn, Peter "Prison Crowding: The Response of Probation and Parole", *Crime and Delinquency.* 30:141-53, January 1984.

Fishman, Robert *Criminal Recidivism in New York City: An Evaluation of the Impact of Rehabilitation and Diversion Services.* New York: Praeger Publishers, 1977.

Fleisher, Belton M. "The Effects of Income on Delinquency", *American Economic Review.* 56(5):118-137, March 1966.

Fleisher, Belton M. "The Effects of Unemployment on Delinquent Behavior", *Journal of Political Economy.* 71:543-55, December 1963.

Fleishing, U. "The Social and Spatial Dynamics of a Prison: An Exploratory Study", *Man-Environment Systems.* 3(3):5-17, 1973.

Flynn, E.E. "The Ecology of Prison Violence" In A. Cohen, G.F. Cole and R.G. Bailey, eds. *Prison Violence.* Lexington, Mass.: Lexington Books, 1976.

Fox, D. V. "Intelligence, Race and Age as Selective Factors in Crime", *Journal of Criminal Law and Criminology.* 37:141-152, 1946.

Fox, J. *An Econometric Analysis of Crime Data.* Ph.D. dissertation, University of Pennsylvania, 1976.

Gendreau, Paul and Mary Leipciger *Recidivism and Its Measurement in Ontario.* Ontario: Ministry of Correctional Services, 1976.

Gilbert, A. "Observations About Recent Correctional Architecture", *Prison Journal.* 51(1):7-14, 1971.

Glaser, Daniel and Kent Rice "Crime, Age and Unemployment", *American Sociological Review.* 24(5):679-86, October 1959.

Guttentag, Marcia "The Relationship of Unemployment to Crime and Delinquency", *Journal of Social Issues.* 24(1):105-114, 1968.

Harriman, Linda and Jeffrey D. Straussman "Do Judges Determine Budget Decisions? Federal Court Decisions in Prison Reform and State Spending for Corrections", *Public Administration Review.* 43:343-51, July/August 1983.

Hildreth, A.M., L.R. Derogatis and K. McCusker "Body Buffer Zone and Violence: A Reassessment and Confirmation", *American Journal of Psychiatry.* 127:77-81, 1971.

Hoch, Irving "Factors in Urban Crime", *Journal of Urban Economics.* 1(2):184-229, April 1974.

Johnson, C.A. "Privacy and Personal Control", in D. Carson, ed. *Man-Environment Interaction: Evaluations and Applications.* Strousbourg, PA: Dowden, Hutchinson and Ross, 1974.

Kayode, Oluyemi "Some Notes on Research into Crime and Punishment in Nigeria", *Australia and New Zealand Journal of Criminology.* 11: 241-51, 1978.

Kirk-Greene, Anthony and Douglas Rimmer *Nigeria Since 1970: A Political and Economic Outline.* London: Holmes and Meier, 1981.

Krajick, Kevin and Steve Gettinger *Overcrowded Time: Why Prisons are so Crowded and What Can Be Done.* New York: The Edna McConnell Clark Foundation, 1982.

Krohn, Marvin D. "Inequality, Unemployment and Crime: A Cross-National Analysis", *The Sociological Quarterly.* 17:303-313, 1976.

LeClair, Daniel P. "The Effect of Community Reintegration on Rates of Recidivism: A Statistical Overview of Data for the Years 1971 through 1980. Boston, Ma: Massachusetts Department of Correction, 1983.

McDonald, Douglas *The Price of Punishment: Public Spending for Corrections in New York.* Boulder: Westview Press, 1980.

McReynolds, K.L. "Designing A Correctional Facility: From Program to Space—By A 'Consultative Process'", *Federal* Probation. 41:26-34, 1977.

Megargee, E. I., "Population Density and Disruptive Behavior in a Prison Setting", in A. Cohen, G.F. Cole and R.G. Bailey, eds. Prison *Violence.* Lexington, MA: Lexington Books, 1976.

Mehrabian, A. and J.A. Russell An Approach to *Environmental Psychology.* Cambridge, MA: MIT Press, 1974.

Milner, Alan *The Nigerian Penal System.* London: Sweet and Maxwell,1972.

Molof, Martin J. *Statistical Prediction of Recidivism Among Female Parolees in the California Youth Authority.* Sacramento, Ca: Department of the Youth Authority, 1970.

Nacci, P.I., H.E. Teitelbaum and J.E. Prather. "Population Density and Inmate Misconduct Rates in the Federal Prison System", Federal *Probation.* 41:26-31, 1977.

Nardulli, Peter F., Prison Capacity and Sentencing Severity: A Look at Illinois, Michigan and Pennsylvania. Urbana, II: University of Illinois, 1983.

Nardulli, Peter F., *Prisons, Dollars and Crime.* Urbana, II: University of Illinois, 1983.

New Jersey General Assembly, Corrections, Health and Human Services Committee, *Public Hearing on the Cost of Prison Construction Projects.* Trenton, N.J.: October 24, 1983.

Odekunle, Femi "Capitalist Economy and Crime Problem in Nigeria", *Contemporary Crisis.* 2:83-96, 1978.

Okonkwo, Cyprian 0. and Michael E. Naish *Criminal Law in Nigeria.* Lagos: African University Press, 1964.

Okonkwo, Cyprian, 0. *The Police and the Public in Nigeria.* London: Sweet and Maxwell, 1966.

Paulus, P.B., V. Cox, G. McCain and J. Chandler "Some Effects of Crowding in a Prison Environment", *Journal of Applied Social Psychology* 5:86-91, 1975.

Paulus, P.B., G. McCain and V.C. Cox "Death Rates, Psychiatric Commitments, Blood Pressure and Perceived Crowding as a Function of Institutional Crowding", *Environmental Psychology and Nonverbal Behavior.* 3:107-116, 1978.

Petersilia, J. and P.W. Greenwood "Mandatory Prison Sentences: Their Projected Effects on Crime and Prison Population", *Journal of Criminal Law and Criminology.* 69:604-615, 1978.

Ray, D.W., D. Huntington, J. Ellisor and R. Prytulla "The Effects of Population Density upon Juvenile Inmate Perceptions", *Journal of Humanics.* 6:122-129, 1978.

Rovner-Pieczenik, Roberta *Project Crossroads as Pretrial Intervention: A Program Evaluation.* Washington, D.C.: National Committee for Children and Youth, 1971.

Saegart, S. "High Density Environments: Their Personal and Social Consequences", In A. Baum and Y.M. Epstein, eds., *Human Response to Crowding* Hillsdale, N.J.: Erlbaum, 1978.

Sagi P. and C. Welford "Age Composition and Patterns of Change in Criminal Statistics". *Journal of Criminal Law, Criminology and Police Science.* 59:29-36, 1968.

Schmidt, D.E. and J.P. Keating "Human Crowding and Personal Control: An Integration of the Research", *Psychological Bulletin.* 86:680-700, 1979.

Schumacher, Michael "The N.I.C. Model: A New Tool for Rating Criminals; Can This Lead to Fewer New Prisons", *California Journal.* 14:373-5, October 1983.

Shields, Patricia M. et al. "Using Volunteers in Adult Probation", *Federal Probation.* 46:57-64, June 1983.

Sjoquist, David Lawrence "Property Crime and Economic Behavior: Some Empirical Evidence", *American Economic Review.* 63(3):439-46, June 1973.

Spector, P. "Population Density and Unemployment: Their Effects of Incidence of Violent Crime in the American City", *Criminology.*12 (0:399-401, February 1975.

Stokols, D. "On the Distinction Between Density and Crowding: Some Implications for Future Research", *Psychological Review.* 79:275-77, 1972.

Stokols, D. "The Experience of Crowding in Primary and Secondary Environments", *Environment and Behavior.* 8:49-86, 1976.

Thompson, Roger "Prison Overcrowding", *Editorial Research Reports,* pp. 883-900, November 25, 1983.

Valins, S. and A. Baum "Residential Group Size, Social Interaction and Crowding", *Environment and Behavior.* 5:421-39, 1973.

Wellford, C. "Age Composition and Increase in Recorded Crime." *Criminology.* 11:61-70, 1973.

Wicker, A.W. "Under-manning, Performances and Students' Subjective Experiences in Behavior Settings of Large and Small High Schools", *Journal of Personality and Social Psychology.* 10:255-61, 1976.

Wolfgang, Marvin and Bernard Cohen *Crime and Race.* New York: Institute of Human Relations Press, 1970.

Yeager, Matthew G. "Unemployment and Imprisonment", *Journal of Criminal Law and Criminology.* 70(4):586-88, 1979.