THE PRODUCTION OF PROPERTY-RELATED CRIMES IN KENYA: AN ECONOMETRIC INVESTIGATION

BY

KENNETH OPIYO OLOO

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THIS RESEARCH PAPER IS MY ORIGINAL WORK AND HAS NOT BEEN PRESENTED FOR A DEGREE IN ANOTHER UNIVERSITY

OLOO, KENNETH OPIYO

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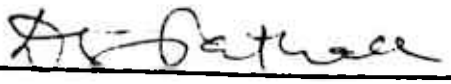
DR. ALOYS B. AYAKO



PROF. DATTUPRASAD S. PATHAK

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ABSTRACT

This paper studies factors that determine the production of property-related crimes in Kenya with a view to prescribing policies that may lead to reduction in the crime rate. Policy makers have been prescribing various deterrence measures aimed at slowing down the growth of the crime rate to no avail. We suspect this failure emanates from lack of knowledge on the true effects of these deterrence measures on the crime rate. We consequently specified and estimated a model for the production of property-related crimes using TSLS on time series data afor the period 1963-1987, tested for effectiveness of selected deterrence and incapacitation variables on the production of property crime and drew policy implications for control of property-related crimes.

The most important findings of the study are that increased probability of imprisonment and increased deployment of policemen serve as effective deterrents to crime while increased severity of punishment does not deter criminals contrary to the widely held belief that it does. In terms of policy, the study suggests less use of severity as a deterrence measure, increased expenditure in the police force and a drive towards more equitable income distribution.

CHAPTER ONE

INTRODUCTION

1:1 BACKGROUND

Crime is defined as departures of actual from prescribed behaviour (Stigler, 1972). Crimes constitute violations of a country's written laws which are designed to protect persons and their property. Crime may be committed against property (also referred to as property-related crime) or against persons. Property-related crimes are production offenses resulting in violation of economic regulations and most often involving illegal changes in property ownership. The crime control process involves reporting of crimes, apprehension of suspects, trial in courts of law, and finally, punishment if a suspect is proved guilty (Le Grand and Robinson, 1985). The incidence of crime and its control has been and still is a major socio-economic and political problem to many countries over the world. This problem which is serious in developed countries becomes an enigma in developing countries where it is compounded by high rates of population growth and worsening economic circumstances. High incidence of crime implies that more resources are devoted to its control and even more to rehabilitation and accommodation of prisoners.

There was a 55 percent increase in prison population in Kenya between 1962 and 1968 (Economic Survey, 1984). During the same period, the total people sentenced to imprisonment increased by 107 per cent. The financial implications of such rapid increases in prison population in terms of creating enough training opportunities for inmates in prison industries and especially with regard to accommodation are well appreciated by Kenyan policy makers. It costs K£200 to maintain one prisoner annually (Development Plan, 1978/83). This cost which was expected to rise is higher than the cost of rehabilitating one prisoner. The financial burden of maintaining prisoners in Kenya is large considering that the daily average number of prisoners in Kenyan prisons is approximately 24,000 inmates.

In 1970, property-related crimes were 7,433 compared to 3,592 against persons in urban areas. In rural areas, there were, in the same year, 7,565 crimes against property as compared to 6,876 against persons (Muga, 1975). Statistics from other years show that crimes against property have tended to be higher than those against persons. In 1970, property-related crime alone accounted for 50 percent of all crimes committed in the country.

In Kenya, interventionary measures to contain increasing crime have taken the form of increased investment in the police force, judiciary and prisons (See Table 1 below). Other indirect measures to contain crime in the country have included increased investment in education to enhance job creation, investments in the informal sector, provision of more specialised training to the police to combat increasing sophistication in crime, improvement of police communications networks especially radio, and increased police involvement on discussions relating to new projects e.g. establishment of housing estates.

TABLE 1

DIRECT EXPENDITURE IN CRIME CONTROL

(K£)

PERIOD	POLICE	JUDICIARY	PRISONS
1963/64	4,229,000	144,100	1,661,100
1964/65	4,799,200	203,600	1,599,650
1965/66	4,810,200	307,000	1,664,310
1966/67	4,801,200	316,100	1,814,500
1967/68	5,521,700	322,500	2,028,700
1968/69	5,133,700	392,500	2,327,400
1969/70	5,283,500	412,700	2,361,000
1970/71	5,555,200	356,900	2,487,200
1971/72	6,512,000	426,000	3,067,590
1972/73	7,005,300	451,000	3,424,755
1973/74	7,437,400	453,200	3,490,483
1974/75	8,279,769	490,900	3,509,483
1975/76	9,470,859	578,200	4,079,183
1976/77	10,573,429	682,000	4,225,337
1977/78	11,704,144	767,600	4,940,884
1978/79	15,483,680	1,053,500	6,129,212
1979/80	15,483,680	1,173,000	6,603,024
1980/81	18,243,621	1,145,500	7,685,790
1981/82	22,047,955	1,581,600	8,187,300
1982/83	26,641,984	1,712,700	9,468,300
1983/84	24,908,415	1,449,700	10,094,200
1984/85	29,466,169	1,749,000	11,439,700
1985/86	31,013,029	1,633,000	11,596,110
1986/87	32,068,708	1,792,000	13,025,930
1987/88	41,211,687	1,697,000	13,791,317

SOURCE: Republic of Kenya, Reccurrent Expenditure (Various Issues)

1:2 THE RESEARCH PROBLEM

As has already been observed, Kenya has been experiencing rising crime incidence with increased allocation of resources to its control in the form of more police stations where crimes can be reported, policemen to enhance apprehension of criminals, courts and court personnel, prisons and prisons personnel, etc. The interventionary efforts at crime control in Kenya have not yielded much positive results. Crime rate (Crimes per 10,000 people) rose from 0.75 to 1.5 for burglary, 1.97 to 2.69 for theft and 0.22 to 0.59 for robbery between 1965 and 1986. This may be explained by sub-optimal interventionary measures which in turn may be explained by under-dose of measures and/or incorrect crime supply framework for crime in Kenya implying that resources invested in crime control may be over-utilized or under-utilized. Furthermore, in the absence of such data, it is not possible to evaluate and monitor the performance of the crime interventionary efforts. The proposed study is a modest attempt at filling the existing information gap in crime control, especially property-related crime in Kenya.

1:3 OBJECTIVES OF THE STUDY

The main objective of the study is to formulate a production model for analyzing determinants of property-related crime in Kenya. The specific objectives of the study are to:-

i) Specify and estimate a model for the production of property-related crime using time series data for the period 1963-1987.

ii) Test for effectiveness of selected deterrence and incapacitation variables on the production of property-related crime in Kenya.

iii) Use results in (i) to draw policy implications for control of property-related crime in Kenya.

1:4 RATIONALE (JUSTIFICATION) FOR THE STUDY

It has been recognized that crime prevention requires research into the causes of crime (Development Plan, 1978/88), and to this effect, a research unit was to be established under the Ministry of Home Affairs. It has further been noted that it is more expensive to maintain a prisoner than to rehabilitate him. Evidence from annual budgets indicate rising expenditure on crime control activities. Since no empirical studies have been conducted to determine factors that influence

the aggregate production of crime, the implication is that planners do not have explicit criteria to apply in allocating investments in crime control activities and hence these resources may not be utilized efficiently. Results of the proposed study would provide a rationalized framework for allocation of expenditure to crime control. The results would also enable planners to identify the most efficient expenditure mix, that will make 'crime not pay'. Lastly, the results of the study would stimulate research activity in the hitherto ignored subject.

CHAPTER TWO

LITERATURE REVIEW

2:1 INTRODUCTION

Crime which has traditionally been the concern of sociologists and psychologists has turned more and more into the realm of economics since the pioneering article by Becker (1968). There is now growing literature on crime (See Stigler, 1970, 1973; Ehrlich, 1973, 1981; Wolpin, 1980; Sjoguist, 1973; and others) as an economic choice problem. In Kenya, however, literature on crime is very limited (See Ryan, 1979; Omukoko, 1987) inspite the growing crime problem in the country. Our review of the literature is organized in terms of theoretical and empirical literature.

2:2 THEORETICAL LITERATURE

Crime, an important economic activity or industry, had been neglected by economists due to the general belief that it was immoral and did not warrant serious attention by economists. Becker (1968) analyzed criminal behaviour as an extension of the economists usual analysis of choice with risk. Since then literature on crime has followed the economists usual analysis of choice and has been invariably based on time allocation models. The individual economic agent is assumed to be rational and will respond to opportunities in

such a manner as to maximize returns to the use of his time. A person will therefore commit an offense if the expected utility to him exceeds that he could get by using his time and other resources on other activities (Becker, 1968; Stigler, 1970; Ehrlich, 1981; etc). The major source of difference in the literature has been the specification of the analytical models.

Becker (1968) saw the commission of an offense as resulting into social loss to society which (society) consequently formulates a measure of the social loss (L) from offenses and finds those expenditures and punishments that minimize the loss. He argues that the more is spent on policemen, court personnel and specialized equipment to combat crime, the easier it is to discover offenses and convict offenders. Becker allows that society has to decide on the crucial issue of how many offenders should go unpunished since resources available to society is scarce. The argument here is that increased expenditure on crime control will increase costs of crime commission and hence reduce utility of time allocated to crime commission. From this analysis, a function can be derived that relates the number of offenses by any person to his probability of conviction, punishment if convicted and other variables such as income available to him in legal and illegal activities, the frequency of nuisance arrests and his willingness to commit an illegal act. Becker specified the following model:

$L = D(O) + (P,O) + bfo$

where O is the level of criminal activities i.e. the number of offenses, D is the net cost of damage to society from offenses, C is the cost of apprehension and conviction of offenders, P is the probability of apprehension and conviction, f is the punishment per offense, L is the social loss from offense function, bf is the social cost of an offense that is cleared by conviction.

Becker concluded that fines conserved resources, compensated society and punished offenders and were consequently preferable to probation, punishment and parole which were costly both to society and offenders. On the other hand, a shift in the form of punishment, say, from a fine to imprisonment would tend to reduce the number of offenses at least temporarily.[1]

The implication from Becker's analysis is that the decision on how much to spend on crime control is also a decision on how much crime will be supplied. The policy variables which are directly subject to social control include amount spent in combating offenses, punishment per offense for those convicted,

the form of punishment chosen, probability of conviction for any particular offense, the level of income available in law abiding activities, expenditure on education or even a shift in the form of punishment meted out.

Stigler (1970) views the act of commission of offense as either of consumption or production for income. A production offense includes theft, smuggling and other violations of economic regulations (hence property-related crimes are production offenses). Stigler asserts that the income objective is paramount in offense to property. He postulates that the supply of offenses will, in equilibrium, have the following properties:-

i) Net returns are equalised, allowance being made for risk and cost of special equipment required in commission.

ii) The determinants of supply of offense which are subject to social control are:-

a) the structure of penalty by offense

b) the probability of detection for each offense

c) costs of conduct of the offending activity e.g. the cost of burglarising can be increased by installing burglar-proofed doors.

iii) The penalties and chances of detection are increasing functions of the enormity of the offense.

The offending activity is seen as providing a variety of products which are in themselves demanded by society. The costs of production of offenses are the ordinary expenses of the offenders plus the penalties imposed by society. The industry will operate at a scale and composition of output set by competition of offenders and cost of producing offenses. Stigler postulates that the fraction of crimes completed successfully or the probability of successful completion of one crime is a decreasing function of the amount of expenditure undertaken by society to prevent and punish the crime. Hence, the expenditure on prevention and reinforcement should yield a dimunition of offenses, at the margin equal to the return upon resources in other areas. An increment of expenditures yields a return in reduced offenses. Stigler concludes that the widespread failure to adopt rational enforcement of laws has been due often and perhaps usually to a lack of understanding of the need for and nature of rational enforcement.

Ehrlich (1981) proposes that the supply of offenses of any given type $S(\bar{\Pi})$ where $\bar{\Pi}$ is the monetary net return, and is expected in general to be a non-decreasing function of the expected net return per offense:

$\Pi = d - pf$ where, d denotes an individual's differential pay-off from illegitimate over an alternative e.g. legitimate activity net of all the direct costs involved in carrying out the offense and pf denotes his expected direct or opportunity cost due to the criminal sanction imposed (f) which may be a fine and p denoting probability of apprehension.
Formally,

$$S'(\Pi) > o$$

Ehrlich in this formulation assumes that attitude towards risk is neutral. To enable aggregation of individual supply functions, he further assumes that the net return per offense is identical for each offender. The aggregate frequenty of offenses $q = S(\Pi)$ is then a non-decreasing function of the net return per offense. This proposition emanates from the assumed existence of a distribution of individual preferences for participation in illegitimate activities which can be represented by a density function of critical entry returns which are sufficient to induce different individuals entry into the market for offenses. It can be deduced therefore that the more condensed the frequency distribution of critical entry returns about particular values of Π, the more elastic will be the aggregate supply of offenses about these values.

The theoretical literature so far reviewed has analyzed the decision to commit an offense in the framework of the traditional choice problem and has summarized the consequences of time consuming illegal activities in-terms of a distribution on wealth alone. Such a model is mis-specified for it does not allow for incorporation of moral and ethical considerations (psychic costs). Block and Heineke (1975) have specified a model which incorporates psychic costs into the analysis and their results show that the 'wealth only' analysis is just a special case in their model. Their analysis is restricted to the supply of property crimes which Stigler (1970) has referred to as production offenses. They consider an individual who is confronted with two wealth generating activities, legal activity (labour) and illegal activity (theft) and denote time spent in labour as (L) and time spent in theft and (T). They postulate that an individuals evaluation of his well-being will be a function of time spent generating wealth and the level of his wealth.

$U = (L, T, W)$ where, U is the agents Von Neuman-Morgenstern utility indicator and W represents wealth, with $U_W > 0$, $U_L < 0$ and $U_T < 0$. By including L and T explicitly, we may be able to analyse the role of moral and ethical considerations which may constrain the labour-theft decision.

If for an individual:-

(a) $U_L - U_T > 0$ for all T, L and W, he is said to have a preference for honesty. If such an individual is also risk-averse, then the necessary condition for $T > 0$ is that returns to illegal activity be greater than expected costs (where costs consist of the average penalty plus legal opportunities forgone). For this condition to be also sufficient for $T > 0$, returns must be sufficiently high to outweigh the psychic disadvantage of participating in illegal activity. Increasing legal opportunities until 'crime does not pay' will deter this group of offenders.

(b) $U_L - U_T < 0$, he is said to have a preference for dishonesty. If such an individual is also risk - averse, making 'crime not pay' may not deter him.

(c) both preference for risk and dishonesty is displayed, making crime not pay may not deter him.

They conclude that the time allocation between L and T will depend not only on the agent's behaviour towards risk and returns but also upon the relative moral and ethical considerations i.e. psychic costs. This differs from the earlier views that preference for risk and relative returns alone determine the degree of specialization. On the supply

effects of increased payoffs to crime, enforcement and penalties, Block and Heineke (1975) conclude that we do not have adequate information to be able to sign them unambigously due to the fact that the wealth effect is unsigned.[2]

2:3 EMPIRICAL LITERATURE

Economic models of property crime have almost all been based on the time allocation approach. Sjoguist (1973) tested the hypothesis that under some conditions, criminals can be treated as rational economic beings assumed to behave in the same economic manner as any other individual making an economic decision under risk. He employed a Von Neuman - Morgenstern Utility function and developed a model in which an individual must allocate his time between legal and illegal activities so as to maximize expected utility. His model was as follows:

$$TC/I = ar^{b}P^{c}W^{d}L^{f}X^{g}$$

where TC is total amount of time spent in illegal activities and is measured by the number of crimes against property; I is the population of the community; r is the probability of arrest; conviction and punishment; P is the total cost of illegal activities (fines, loss of earnings, etc.); W is the total gain from legal activities measured by the annual labour income to manufacturing workers; L is the total gain from illegal activity; X is the index of variables which measure taste; and a_0, a_1, a_3, a_4, and a_5 are constants.

Sjoguist tested the model by running regression on loglinearized form of the equation for cross-sectional sample of communities. He concluded that an increase in the probability of arrest and conviction and an increase in the cost of crime (punishment) result in a decrease in the number of major property crimes committed[3].

Ehrlich (1973) developed a theory of participation in illegitimate activities and tested it against data on variations in crimes across states in the US. He used a state preference approach to behaviour under uncertainity. His investigation dealt with interaction between crime and law enforcement. His model for supply of offenses was:

$$O/N = AP^{b1} F^{b2} Y_1^{c1} Y_2^{c2} U^{d} V^{e} E^{m}$$

Where A is a constant, P is an average offenders subjective probability that he will be apprehended and punished, F is the average cost of punishment for a specific crime category, Y_1 is return to illegitimate activity, Y_2 is return to legitimate activity, U is the average probability of unemployment in legitimate activity, V is a vector of environmental variables, (e.g. the effect of urbanization as proxy for population density) M is the random errors of measurement and other stochastic effects and is assumed to be normally distributed, O is the number of offenses known, N is the state population.

His empirical results were that:

(a) the rate of specific crime categories varies inversely with the probability of apprehension and punishment by imprisonment and with average length of time served in prison.

(b) the crimes against property vary positively with the percentage of families below one-half of the median income and with the median income.

(c) the productivity of law-enforcement activity is found to be negatively affected by the size and density of population.

Mathur (1978) postulated that people are rational and do respond to incentives whether they pursue legitimate or illegitimate activity. He tested the hypothesis that offenders do respond to incentives whether provided by the legal system or by market conditions. This is equivalent to testing the hypothesis that certainty and severity of punishment deter criminal behaviour. He also considered the possibility of deterrence measures like certainty and severity of punishment being complementary or inversely related to each other. He investigated the following simultaneous equations model:-

$$C = C(P, S, I, G, NW, SH, W, U, D)$$

$$P = P(S, E, C, N, N^2, NW)$$

$$E = E(C, R)$$

where C : Crime rate per 100,000 of population, E: Certainty of punishment obtained by dividing the number of admissions to prison for an offense by the number of reported crimes, S: Severity of punishment, I: Median income, G: Gini coefficient to measure income inequality, NW: Percentage of non-whites in the population, SH: Median years of schooling completed by persons 25 years old and over, W: Percentage of white collar inhabitants, U: percentage unemployed, N: population and N^2 is population squared in millions, D: Dummy variable with zero for North and 1 for South, R: Per capita general revenue of the city government.

Equations were estimated using cross-sectional data for the years 1960 and 1970 by TSLS method. The findings of this study were that expenditure on police does not represent a definitive deterrent to crime nor does it enhance certainty of punishment. Certainty and severity of punishment are effective deterrents to most crimes. It was also found that the more severe the punishment the lesser is the probability that a criminal on the average will be punished. The findings suggest that the criminal justice system would be well advised to pay more attention to the certainty of punishment as certainty is more important than severity.

Holtman and Yap (1978) have disaggregated property crime as robbery, burglary and larceny offenses and used TSLS estimation for state data in 1970. The point of departure of this study from others is that it examines the deterrent effect of punishment while at the same time recognizing the possibility of substitution among crimes. Consequently, he examines the effect of both own-punishment level and punishment levels for substitute offenses on the offense rate for a specific crime. He comes up with the policy prescription that reducing imprisonment for some crimes might as well reduce the total cost of crime. It is for example shown that reducing the punishment for larceny may increase the number of larceny offenses committed. However, it may also reduce the number of robberies and burglaries enough to make the net property gain to the community positive.

Goldberg and Nold (1980) investigate the effect of private enforcement on the burglary rate. The proxy for private enforcement in this study is the reporting of crimes to the police. Since reporting increases chances of apprehension and conviction, reporting should deter potential offenders. He specified his model as below:

$$Bi = Bi\ (Li,\ Pi^{R},\ Pi^{C},\ Fi)$$

where Li is the expected gross return from burglarizing the i^{th} household. P_iR is the probability that the i^{th} household will report the burglary to the police. Pi^C is the conditional probability that given the burglary is reported to the police, the burglar will be apprehended and punished for the burglary of the i^{th} household. Fi is the level of punishment for burglarizing the i^{th} household.

Results provide strong support for the hypothesis that victim-specific self-protection efforts like the probability of reporting burglars will deter the potential burglar(s). This is an important observation since it leads directly to a policy where increased access to police stations could in itself lead to reduced property crimes.

The most recent study reviewed written by Corman, Joyce and Lovitch (1987) uses vector autoregressive techniques (VAR) to estimate the inter relationships between unemployment, arrests, police, demographics and property-related felony crimes in New York city from 1970 to 1984. This method is used to estimate a dynamic structure in which all the relevant variables are endogeneous to avoid problems imposed by identification requirements experienced when ordinary regression techniques are used.

VAR is used as a tool for empirically confirming or refuting the relevance of the various hypothesized relationships and is not an alternative for estimation of structural models. Tests of 'Granger Causality'[4] are carried out and it is found that lagged values in the arrest rate explain current values of the crime rate while the reverse is not true and, hence, it is concluded that arrests deter crimes. Unemployment is found to influence the crime rate weakly while increases in the police per capita has no impact either on the crime rate or arrest rate.

2:4 OVERVIEW OF THE LITERATURE

Most of the studies reviewed above have approached the study of property-related crime from the point of view of an individual faced with a time allocation problem between legal and illegal activities. Crime is seen as an economic activity undertaken to either create wealth or income. It is assumed that the individual economic agent (criminal) is rational and will consequently choose a mixture of the two activities in proportions that enable maximization of returns to the use of time. Whereas most authors agree that there is an economic decision made by a criminal, they do not agree on the nature of the choice problem. Some see it as discrete while others see it as a continous choice problem. Those who see it as a discrete choice problem take an either/or view based on relative returns to legal and illegal activity. Those who

believe in the continous choice view hold that individuals will choose a mixture of legal and illegal activities that enable maximization of returns. This group of theorists consequently argue that there exists a continous distribution of critical entry returns that induces different individuals participation in illegitimate activities.

The variables that have been used in the theoretical and empirical literature on crime can be categorized as psychic and economic variables. Whereas psychic or moral variables have only been used in the theoretical literature (due to difficulty in empirical measurement) economic variables have been used in both type of literature. The most commonly used economic variables include net returns to legal activity, arrest and convictions rate (often referred to as certainty of punishment), the size of police effort, percentage of male population in the crime prone age groups, income inequality (often measured by either the Gini coefficient or the proportion of population with incomes below a national average), average population rate of urbanization and average length of time spent in prisons (often referred to as severity of punishment), percentage of non-whites in the population (often used in studies set in highly racial societies), expenditure on education or median years of schooling completed by persons in the population, population growth rate and per capita general revenue.

Except for a few exceptions, almost all the empirical studies have specified single equation models and have almost invariably used simple linear regression to estimate the specified models. In a few of these studies, a simultaneous equations model has been specified and TSLS has been used to estimate models. The most outstanding exception to the use of the above mentioned techniques has been the use of Vector Autoregressive techniques (VAR) to estimate a specified model. Although VAR would be useful for refuting or confirming the relevance of the various hypothesised relationships due to its limited specification requirements, it is criticised for its limitations when modelling and subsequent estimation is aimed at establishing structural forms. This technique would be very interesting as it would enable us to establish causal relationships in the supply of property-related crime, but since our objective is to provide a structural model for property-related crime an alternative technique will be chosen based on identification and data requirements.

Most of the studies have used cross-sectional data. The major reason has been the fact that most countries do not have a long history of data collection and hence time series data is not available. It is also recognized that over long periods of time, there may be important structural changes that may render time series analysis useless. Another difficulty with time series data worth mentioning is that connected with determination of functional forms i.e. whether linear or

non-linear, etc. Advances in econometrics though has led to the development of methods that have succeeded in eliminating these problems to levels that enable efficacy in the results obtained. In view of these developments, this study will use time series data. Furthermore in a study using national data aggregates, it would be unrealistic to expect a linear functional form and hence it will be reasonable to assume a non-linear relationship and consequently, log-linearisation techniques will be employed to simplify estimation. The need to linearize the function would infact not arise if the model is non-linear in variables but linear in parameters (Wonnacott and Wonnacott, 1979; Maddala, 1977).

Most of the empirical studies show that increase in the probability of arrest and conviction and an increase in the cost of crime results into a decrease in the number of the major property crimes committed. It is also shown that the certainty and severity of punishment have an inverse relationship implying a trade-off between the two variables. Due to the possibility of substitution among crimes, it is shown that reducing punishment for some property crime categories may increase the probability of their occurrence but may also lead to a positive net property gain to the society. Stated differently, reducing punishment levels for some crimes might well reduce the total cost of crime though not necessarily the number of crimes committed. Increasing chances of reporting increases chances of apprehension and conviction

and should, hence, deter potential offenders. Other findings are that lagged values of the arrest rate explain current values of the crime rate while the reverse is not true and, hence, it is concluded that arrests deter crimes in almost all cases. Unemployment is found to influence the crime rate although in some studies, the relationship is found to be weak.

The present study unlike most of the previous ones which were based on individual behavioural models will consider the choice facing society on how much crime to tolerate within given resource constraints. It is therefore intended that the specified model introduce government revenue within the context of a simultaneous equations model to be specified. As has been pointed out, most of the studies are highly aggregative in both exogeneous and endogeneous variables. In the present study, an attempt will be made to disaggregate property crimes into theft, breakings and robbery. This is done to enable a comparative study of these crime categories. The assumption made here is that the different crime categories respond differently to identical explanatory variables.

CHAPTER THREE

METHODOLOGY AND DATA

3:1 MODEL SPECIFICATION

The econometric model presented in this section is a disaggregated version of that developed by Mathur (1978). The model by Mathur has been slightly modified to make it relevant to Kenyan realities. The modifications include:-

i) the exclusion of variables such as percentage of non-whites in the population and a dummy variable for North-South which were introduced to capture racial and regional dichotomies explicit in the United States but not pronounced in Kenya.

ii) the use of the expenditure on education to measure know-how unlike in the Mathur study where the median years of school completed by persons 25 years old and over was used to measure know-how.

iii) the introduction of urbanization to capture the effects of population density.

The disaggregated model is presented below:-

NCi = NCi (PIMPi, SP, AI, EXPED, E) 2:1:1

PIMPi = PIMPi (PEXP, SP, NCi, POP, URB, U) 2:1:2

PEXP = PEXP (TGR, NCi, Z) 2:1:3

Where NCi is the reported crime rate for the i^{th} crime type (i = 1,2,3 for robbery, breakings and theft respectively).

PIMPi is the probability of imprisonment for the i^{th} crime. This variable is also referred to as the certainty of punishment.

SP is the severity of punishment and is given by the average time to be spent in prison by those sentenced to imprisonment. The median will be used as a proxy.

AI is the yearly average income.

PEXP is the yearly per capita expenditure on the police force.

POP is yearly population size of the country.

URB is the rate of urbanization. This is a proxy for population density.

TGR refers to per capita total government revenue.

E,U AND Z are error terms. The error terms will absorb psychic variables not included in the model.

Equation 2:1:1 is the crime supply equation.

Equation 2:1:2 is the production function of the criminal justice system and

Equation 2:1:3 is the demand for policy equation. Below is a brief discussion of the three equations.

3:2 THE CRIME SUPPLY EQUATION

The crime rate of the i^{th} crime committed will be a function of the probability of imprisonment (PIMPi) for the i^{th} crime type, the severity of punishment (SP), the average income, the level of income inequality, the level of know-how and the level of unemployment. It is expected that the higher the PIMP, the lower will be the crime rate since offenders detest confinement in jail.

Hence, $\partial NCi / \partial PIMPi < 0$

The severity of punishment is expected to have an inverse relationship with the crime rate. The more severe the punishment, the more costly the commission of the crime to the offender and hence the less likely the commission of the offense. We expect that:

$$\partial NCi/\partial SP < 0$$

The effect of AI on the crime rate cannot be predicted unambigously. On the one hand, the higher AI, the more attractive will be legal activity compared to illegal activity implying a reduction in crime rate as people shift to legal activity. On the other hand, the higher the AI, the higher the level of transferable wealth in the community. This enhances potential pay-offs to illegitimate activity. Hence, we expect

$$\partial NCi/\partial AI \gtrless 0.$$

It is difficult to predict the effect of increased know-how (measured by expenditure on education) on the crime rate. While it enables criminals to execute better plans, it may also invoke a higher moral obligation in potential criminals. Hence we expect,

$$\partial NCI/\partial EXPED \gtrless 0$$

The higher the level of unemployment, the higher will be the crime rate since the unemployed have more time to devote to the commission of crime. A high rate of unemployment also implies a high dependency ratio which in its turn implies impoverishment. Impoverishment provides potential offenders suitable motive for committing property crimes. Hence, we expect,

$$\partial NCi/\partial UN > 0$$

3:3 THE PRODUCTION FUNCTION FOR THE CRIMINAL JUSTICE SYSTEM

The certainty of punishment (measured by PIMP) is a function of police effort (measured by per capita police expenditure), the severity of punishment, the crime rate and the size and density of population.

We expect per capita police expenditure to have a positive impact on PIMPi. It is argued that the higher the per capita police expenditure (PEXP), the greater the efficiency in the police force. This implies that more offenders are arrested, charged, tried and punished. We expect

$$\partial \text{PIMPi} / \partial \text{PEXP} > 0.$$

The effect of severity of punishment (SP) on PIMP is a disputed issue. Some scholars hold that maximum deterrence occurs when punishment is certain and severe (Bailey and Smith 1965) hence implying a positive relationship while other scholars (Jeffrey, 1965) argue that severity of punishment can be gained only by sacrificing PIMP. This argument implies that an inverse relationship exists between SP and PIMP. Hence we expect that;

$$\partial \text{PIMPi} / \partial \text{SP} \gtrless 0.$$

The higher the crime rate, Ceteris Paribus, the more offenders will be arrested, tried and consequently imprisoned. We expect;

$$\partial \text{PIMPi}/\partial \text{NCi} > 0.$$

The effect of size and density (rate of urbanisation) on PIMPI cannot be determined unambigously. On the one hand, a large and dense population makes it easy for offenders to elude police dragnets and may be an incentive to commit property offense i.e. the high chance of getting away encourages potential criminals. On the other hand, if the population cooperates with the police, the offenders will have difficulty in eluding the police as they will be exposed to many potential informers. Hence, we expect;

$$\partial \text{PIMPi}/\partial \text{URB}, \quad \partial \text{PIMPi}/\partial \text{POP} \gtrless 0.$$

The third equation in the model is included due to interdependence of crime rate and per capita police expenditure. The per capita total government revenue acts as an institutional constraint.

3:4 ESTIMATION METHODOLOGY

The specified model is mathematically complete as it contains 3 equations and 3 endogeneous variables. Before we can decide on which estimation method to use, we check for both order and rank conditions for identification.

3:4:1 Order Condition

Formally, an equation is identified by the order condition if the total number of variables excluded from it but included in other equations is at least as great as the number of endogeneous variables of the system less one.

Suppose G = total number of endogeneous variables

K = Number of total variables in the model (endogeneous and predetermined)

M = Number of variables, endogeneous and exogeneous, included in a particular equation.

Then the order condition for identification may be expressed as:

$$(K-M) \geq G-1$$

Where K-M represents excluded variables and G-1 represents the total number of endogeneous variables less one. If K-M=G-1, then the equation is exactly identified and if K-M > G-1, the equation is over-identified.

TABLE 2
ORDER CONDITION FOR IDENTIFICATION

Equation	K	M	G	(K-M)	G-1	Identification status
2:1:1	9	5	3	4	2	Over-Identified
2:1:2	9	6	3	3	2	Over-Identified
2:1:3	9	3	3	6	2	Over-Identified

From Table 2, all the three equation are over identified by order condition.

3:4:2 Rank Condition for Identification

The rank condition for model identification states that: in a system of G equations, any particular equation is identified if and only if it is possible to construct at least one non-zero determinant of order (G-1) from the coefficients of the variables excluded from that particular equation but contained in the other equations of the model.

To be able to check if the rank condition is met coefficients of variables in equation 2:1:1, 2:1:2 and 2:1:3 will be represented by a_i, b_i and c_i, respectively.

TABLE 3

RANK CONDITION FOR IDENTIFICATION

EQUATION	NC	PIMP	SP	AI	EXPED	PEXP	POP	URB	TGR
2:1:1	1	$-a_1$	$-a_2$	$-a_3$	$-a_4$	0	0	0	0
2:1:2	-1	1	$-b_2$	0	0	$-b_2$	$-b_3$	$-b_4$	0
2:1:3	$-C_1$	0	0	0	0	1	0	0	$-C_2$

By striking out the row of coefficients of the equation being checked and the columns with non-zero coefficients, we are left with coefficients of variables not included in the particular equation, but contained in other equations of the model.

For equation 2:1:1, we can form the following determinants of order (G-1);

$$A_1 = \begin{vmatrix} -b_2 & -b_3 \\ 1 & 0 \end{vmatrix} = b_3 \neq 0$$

$$A_2 = \begin{vmatrix} -b_2 & -b_4 \\ 1 & 0 \end{vmatrix} = b_4 \neq 0$$

$$A_3 = \begin{vmatrix} -b_2 & 0 \\ 1 & -c_2 \end{vmatrix} = b_2c_2 \neq 0$$

For equation 2:1:2, we form

$$B = \begin{vmatrix} -a_3 & 0 \\ 0 & -c_2 \end{vmatrix} = a_3c_2 \neq 0$$

and for equation 2:1:3, we form

$$Z_1 = \begin{vmatrix} -a_1 & -a_2 \\ 1 & -b_2 \end{vmatrix} = a_1b_2+a_2 \neq 0$$

$$Z_2 = \begin{vmatrix} -a_2 & -a_3 \\ -b_2 & 0 \end{vmatrix} = -a_3b_1 \neq 0$$

We conclude that all three equations are identified by rank condition. Since all three equations are overidentified by order condition, we can use either two stage least squares (TSLS) or maximum likelihood estimation (MLE) to estimate the model. Since TSLS has been established as the simplest solution to the problem of overidentification (Wonnacott and Wonnacott, 1979), it is used in this study. It shall be

noted that MLE and TSLS are only limited information estimators[5]. Ordinary Least Squares (OLS) estimation cannot be used since in the presence of, simultaneity, it yields inconsistent estimators (Pindyck and Rubinfeld, 1981).

3:5 DATA: TYPE AND SOURCE

3:5:1 DATA DESCRIPTION

i) Available information on police expenditure and education expenditure relates to fiscal years whereas other variables used in the regression relate to calendar years. The appropriate forecasts are obtained from the arithmetic mean of current and one year lagged expenditures on police and education.

ii) The crime rate of a specific crime category is measured as the number of crimes known to the police to have occurred during a given year per 10,000 of population. Some crime categories have a higher cost of reporting than other costs of the crime to the victim. In such cases, we expect under-reporting of crimes. We will consequently assume that percentage reporting errors are random and hence use crimes known to police as a proxy to the true crime rates.

iii) The probability of imprisonment (PIMP) is measured as the ratio of those imprisoned for the various crime categories to the number of such crimes known to the police.

iv) The severity of punishment (SP) is defined here as the median time period to be served by those committed to imprisonment. It is assumed that the relative variation in SP also reflects the relative variation in the severity of other punitive measures imposed for the same crime and hence SP serves as a suitable proxy to the severity of punishment.

v) Per capita average income (AI) is measured by gross domestic product (GDP) divided by population for every year. This is the proxy for legal income or gains from legitimate activity. It can also be interpreted as the cost of imprisonment.

vi) Since our model is based on the time allocation models already discussed, the crime rate (used as a proxy to time allocated to criminal activity) is assumed to be monotonically non-decreasing with respect to amount of time and other materials used in committing crime. The crime rate is consequently a proxy for the amount of time spent on criminal activities.

3:5:2 DATA SOURCES

The data was obtained from the following secondary sources for the period 1963-87:-

i) Statistical Abstracts

ii) Republic of Kenya - Ministry of Home Affairs Annual Report on the Administration of Prisons (various issues).

iii) Economic surveys (various issues).

iv) Development plans.

v) Recurrent expenditure estimates (various)

vi) IMF: International Financial Statistics (various issues)

vii) UN: African Statistical Year book (various issues)

CHAPTER FOUR

ANALYSIS OF REGRESSION RESULTS

4:1 THE CRIME PRODUCTION

Three crime supply equations have been estimated for theft, burglary and robbery, respectively. The results are summerized in tables 4, 5 and 6 below. The dependent variable in the three equations is NCi.

TABLE 4

TSLS ESTIMATION RESULTS OF THE THEFT EQUATION

Variable	Intercept	PIMP	SP	AI	EXPED
Coefficient	5.8	-0.13*	0.12*	-0.73	0.31**
t-ratio	1.04	-0.46	2.067	-1.017	1.59

R^2 = 0.52 F = 5.0 D.W = 1.92
S.E. of Regression = 0.13
Sum of squared residuals = 0.31
* Significant at 5% level
** Significant at 10% level

Coefficients without any of the above symbols were not significant at 10% level.

Table 4 shows that the coefficient of SP and PIMP are statistically significant from zero at the 5% level while that of EXPED is significant from zero at the 10% level. The coefficient of the rest of AI is significant from zero at 10% level. R^2 has taken a value of 0.52 implying that 52% of variations in theft rate are explained by PIMP, SP, AI and EXPED. From the results, we reject the null hypothesis that the joint effect of PIMP, SP, AI and EXPED on theft rate is zero at the 5% level. Equivalently, we reject the null hypothesis that R^2 is equal to zero at the 5% level. Hence, we conclude that the independent variables in the model adequately explain variations in the theft rate at 5% level.

TABLE 5

TSLS: ESTIMATION RESULTS OF THE BURGLARY EQUATION

Variable	Intercept	PIMP	SP	AI	EXPED
Coefficient	-4.93	-0.83*	0.19**	0.41**	-0.03*
t-ratio	-0.58	-2.46	1.91	0.37	-0.08

R^2 = 0.64 F = 8.14
DW = 1.82 S.E. of Regression = 0.2
SSR = 0.84

From table 5, it is seen that the coefficients of PIMPi and EXPED are statistically significant from zero at the 5% level.

The coefficients of SP and AI are significantly different from zero at the 10% level. R^2 is 0.64 implying that 64% of variations in burglary rate are explained by the independent variables. From the results, we reject the null hypothesis that the joint effect of PIMPi, SP, AI and EXPED on burglary rate is zero at 5% level.

TABLE 6

TSLS ESTIMATION RESULTS OF THE ROBBERY EQUATION

Variable	Intercept	PIMP	SP	AI	EXPED
Coefficient	-8.35	-0.37	0.097	0.88	-0.15
t-ratio	-0.31	0.41	0.29	0.25	-0.15

R^2 = 0.11 F = 0.556
D.W = 2.11 S.E. Regression = 0.69
SSR = 8.6

In table 6, it is shown that none of the coefficients of the variables PIMPi, SP, AI and EXPED is significantly different from zero at the 10% level. R^2 has taken the value 0.11. From the results, we cannot reject the null hypothesis that the joint effect of the independent variables shown in the table on the robbery rate is zero at the 5% level. We hence conclude that the independent variables in the model do not adequately explain variations in the robbery rate. A possible explanation for this discrepancy in the results may be that robbery is

difficult to separate from offenses against the person and hence our figure for the robbery rate may include other offenses against the person e.g. assault (this may make the specified model inadequate to analyse robbery).

From tables 4, 5 and 6 the major findings are that:-

i) The rate of specific crime categories, with virtually no exception varies inversely with estimates of the probability of imprisonment (PIMP). This result confirms our prior expectations. The elasticities are -0.83, -0.37 and -0.13 for burglary, robbery and theft respectively. This implies that 1% increase in PIMP reduces burglary by 0.83%. Robbery by 0.37% and theft by 0.13%. It is shown by these results that PIMP is a more effective deterrent in the case of burglary than the other crime categories.

ii) The severity of punishment (SP) varies positively with all specific crime rates. It takes the value 0.06 for theft, 0.097 for robbery and 0.19 for burglary. Only the theft coefficient is statistically significant from zero at 5% level. The value of these elasticities is very low (approximately equal to zero). This result contradicts our hypothesis that there is an inverse relationship. The result appears

to be unreasonable since it is hard to conceive of a situation where increased SP would lead to higher crime rates.

iii) The effect of average income (AI) on specific crime rates is mixed. It is positive for all crime categories except theft. It is -0.72 for theft, 0.41 for burglary and 0.88 for robbery. This result indicates that the higher the average income, the lower the crime rate for theft and vice versa for other crime categories. Thefts are often petty crimes whose commission does not require that the victim is known to the criminal. Most thefts in Kenya are cases of pick-pocketing (which normally involves people who have never met before). Conversely, robberies and burglaries would be more sensitive to changes in the victims income or income potential since the perpetrators of these crimes choose their victims carefully and observe them over time (they want to reduce the risk of hitting an empty vault!). This result confirms our prior expectations.

iv) The effect of per capita expenditure on education is mixed. It is negative for burglary and robbery but positive for theft. A 10% increase in EXPED leads to 0.313% increase in thefts and 0.025% decrease in burglary. The result in regard to theft is most

interesting. The fact that there is a positive relationship shows that there is a defect in the educational system. Our educational system has been criticised for producing unemployment due to its lack of practical orientation. This has led to the recent implementation of the 8-4-4 system of education which it is hoped will cure this defect. Although there is a negative relationship for robbery and burglaries, the absolute magnitudes of their elasticities is very close to zero. This result may mean that the decision to engage in robbery and burglary is not affected by the educational opportunities available. The results agree with our expectations concerning the effects of education on the crime rates.

4:2 CRIMINAL JUSTICE SYSTEM

The results for the three crime categories are presented in Tables 7, 8 and 9. The dependent variable for these equations is PIMPi.

TABLE 7

TSLS ESTIMATION RESULTS OF THE THEFT EQUATION

Variable	Intercept	PEXP	SP	NC	POP	URB
Coefficient	31.14**	0.013*	0.076	-0.58	-2.17**	1.48**
t-ratio	1.74	0.008	0.7	-0.77	-1.88	1.79

R^2 = 0.66 F = 6.86 D.W = 1.98
SSR = 0.64 S.E. of regression = 0.19

In Table 7, the coefficient of PEXP is statistically significant from zero at the 5% level while those of POP, URB and the intercept term are statistically significant from zero at the 10% level. The coefficients of SP and NC are not statistically significant from zero at the 10% level. R^2 is 0.66 for theft i.e. 66% of variations in PIMP are explained by variations in the independent variables PEXP, SP, NC, POP and URB. We hence reject the null hypothesis that the joint effect of the independent variables on the probability of imprisonment for theft is zero at the 5% level.

TABLE 8

TSLS ESTIMATION RESULTS OF THE BURGLARY EQUATION

Variable	Intercept	PEXP	SP	NC	POP	URB
Coefficient	20.2	1.13*	0.09**	-0.36	-1.546**	1.17**
t-ratio	1.058	0.62	0.71	-0.48	-1.21	1.11

R^2 = 0.78 F = 12.1 D.W = 2.2 SSR = 1.8
S.E. of regression = 0.3

From Table 8, it is seen that the coefficient of PEXP is statistically significant from zero at the 5% level while those of SP, POP and URB are statistically significant from zero at the 10% level. The intercept term and the coefficient of NC are not significant at the 5% level. R^2 is 0.78 for burglary implying that 78% of variations in $PIMP_i$ are explained by variations in the independent variables PEXP, SP, NC, POP and URB. We consequently reject the null hypothesis that the joint effect of the independent variables on the probability of imprisonment for robbery is zero at the 5% level.

TABLE 9

TSLS ESTIMATION RESULTS OF THE ROBBERY EQUATION

Variable	Intercept	PEXP	SP	NC	POP	URB
Coefficient	69.38	1.94*	-0.17	-0.18	-4.89**	3.58**
t-ratio	0.79	0.33	-0.84	-0.11	-0.82	0.84

R^2 = 0.78 F = 11.98 D.W = 2.2 SSR = 1.8
S.E. of regression = 0.3

The major findings regarding the criminal justice system are that:

i) The probability of imprisonment (PIMP) varies positively with per capita police expenditure. The elasticity is 0.013 for theft, 1.13 for burglary and 1.94 for robbery. It can be seen that a 1% increase in per capita police expenditure (PEXP) for robbery would lead to 1.94% increase in PIMP for the same crime, PIMP is more responsive to PEXP in the case of robbery and burglary than in the case of theft. Whereas the response is elastic for robbery and burglary, it is inelastic in the case of theft. A 1% increase in PEXP leads to a meagre 0.013% increase in PIMP. Thefts being less serious crimes, the punishment for theft is usually low as compared to

punishment for robbery and burglary. Since increased PEXP enhances PIMP, increased PEXP is a strong deterrent to robbery and burglary but may not be so in the case of thefts. Furthermore, those who engage in thefts normally do so for their very basic survival. For such people, jail may even prove to be a better alternative since food and accommodation is normally assured in jail.

ii) As expected, the effect of severity of punishment (SP) on PIMP is mixed although highly inelastic. It is 0.17, 0.077 and 0.086 for robbery, theft and burglary respectively. The negative elasticity in the case of robbery may be explained by the fact that robberies are generally a more serious type of crime in Kenya, hence its perpetrators ensure it is very carefully planned and executed. This leads to a low arrest rate and hence a lower PIMP for robbery.

iii) PIMP varies inversely with the crime rate (NC) and population size (POP) while it varies positively with population density (URB). The inverse relationship between PIMP and NC goes against our expectations. The elasticity is -0.58 for theft, -0.36 for burglary and -0.36 for robbery. This result might be a reflection of lack of space in prisons as more people are imprisoned (hence judges are resorting to other means of punishment such as fines).

Space in prisons is indeed a major problem as is exemplified by overcrowded prisons. It is found that POP negatively affects PIMP. We can infer that a large population makes it easy for offenders to elude police dragnets. This leads to less offenders being apprehended, tried and imprisoned. On the other hand, population density (URB) has a positive effect on PIMP. Its elasticity is 1.17 for burglary, 1.48 for theft and 3.58 for burglary. The magnitudes of elasticities with respect to specific crimes show that the effect of URB is elastic. Infact the elasticity with respect to robbery is runaway i.e. 1% increase in URB leads to 3.58% increase in PIMP. Whereas the size of population is inversely related to PIMP, the density of population is positively related to PIMP.

CHAPTER FIVE

CONCLUSIONS AND POLICY IMPLICATIONS

In this chapter, we summarize the main conclusions of the study and policy implications thereof. The chapter is organized into four sections. Section one contains conclusions, section two contains policy implications, section three contains limitations of the study and section four contains suggestions for further research.

5:1 CONCLUSIONS

The causes of crime and its effects is a complex subject involving sociological, psychological, political and economic factors. Consequently, the contribution of economics in this rather complicated scenario requires an appreciation of the various interacting forces. Economists have put a case for government intervention. While most of them agree on the need for government intervention, they are not unanimous on what form this intervention should take. In this study, we have considered the effects of several deterrence variables on crime and the following are the most important conclusions.

1) While the probability of imprisonment is a deterrent to property crimes, the severity of punishment does not appear to be a deterrent as has been shown in this study.

2) The expenditure on police is a strong deterrent to all property crimes and is very highly elastic on the probability of imprisonment.

3) A large population enhances crimes while higher population density enhances solution of crimes.

4) A high average income is a deterrent to thefts but enhances the commission of robberies and burglaries.

5) The most effective deterrent to crime is a high ratio of policemen per person.

5:2 POLICY IMPLICATIONS

From the conclusions of the results presented above, the following six policies for crime control in Kenya are implied:-

The first two policies implied relate to the criminal justice system. Firstly, results of our study show that the probability of imprisonment is inversely related to the crime rate and, hence, we conclude that criminals are risk-averse and can be deterred by increasing the probability of imprisonment. Robbers are found to be most risk-averse. It should be criminal justice policy to increase the probability of imprisonment for robberies and decrease it for thefts. This can be achieved by improving the skill of court prosecutors

through intensive training. Our results further suggest that there is a positive relationship between the probability of imprisonment and severity of punishment except in the case of robbery. There is consequently a case for lowering severity of punishment for robbery as this would lead to a higher probability of imprisonment for robbery while increasing severity for theft and burglary.

Now, we turn to criminal justice policy on the severity of punishment. Policy makers have always emphasized the need for more severe punishment to reduce the occurrence of criminal activities. From results of our study, severity of punishment has been found to be positively related to crime rate although the magnitude of its elasticities with respect to all crime categories is low. This result is contrary to our expectations about the effects of increasing severity. Though unexpected this result suggests that policy makers ought to shift from severity to other types of deterrence measures. Indeed other studies (Mathur, 1978) suggest that severity should be least preferred as a deterrence measure. Le Grand and Robinson (1985) suggests that a fine would be a superior deterrent to crime than increased severity since a fine would not only save society the costs of actually maintaining prisoners (a cost which is quite high in Kenya) but also has a consequence on increased output in the economy since criminals will continue to work as they pay off a fine (indeed they would have to work harder to be able to pay off the fine more quickly).

Furthermore, fines would mean that criminals are not confined in prison together. This will reduce the possibility of criminals learning from each other and hence reduce the possibility of recividism. Fines are also personnally less degrading to individuals than being labelled a 'jail bird'. There is consequently need for policy makers to reduce reliance on severity of punishment as a deterrence measure. When used, severity should be preferred for cases of theft and burglaries than in cases of robberies.

We now discuss the income policy. While a high average income for society is a deterrent to thefts, it enhances the occurrence of robberies and burglaries. The crime rate can only be enhanced perceptibly if there exists a high degree of income inequality together with a high average income within the society. We can consequently suggest that apart from policies that enhance increased productivity and output, there should be emphasis on more equitable distribution of incomes. Unless this is done, society will tend towards more crime (especially robberies and burglaries which have higher absolute income elasticities as compared with thefts). Indeed, the government is already going in the right direction by shifting attention to rural development and increased assistance to the informal sectors.

Two fiscal policies relating to expenditure in education and police have been implied by the study. Whereas an increase in per capita expenditure in education leads to a decrease in robberies and burglaries it leads to an increase in thefts. The logical deduction to make here is that the educational institution has failed to equip school leavers with the tools necessary to survive in the legal job market. The recent change to the 8-4-4 system of education might bring about a desired result because this new system is geared towards creation of small private businesses which will enhance employment. With a legal job, a prospective criminal will have little time to devote to crime. Such people will also lose much in the event of imprisonment. Government policy on education should emphasise practical training. There is need to construct more workshops in schools and increase the supply of technical subject teachers.

We have seen that increased per capita police expenditure enhances probability of imprisonment especially for robbery and burglary. This result is infact expected since we have already seen that robbers and burglars are more risk-averse than thieves. More police effort should consequently be directed at solving burglaries and robberies than at solving thefts. More so, robbery and burglary are more serious crimes and are hence a bigger threat to the economy than thefts which are generally trivial. This result contradicts that by Mathur (1978) who concluded that expenditure on police does not represent a

definitive deterrent to various crimes nor does it enhance certainty of punishment. Mathur's result may be explained by the fact that his study was undertaken in the United States where private provision of security is very popular and criminals have become so advanced in their activities. Policies that would enhance reporting of crimes would lead to remarkable decreases in crime in Kenya as they would improve the productivity of police effort. Such policies would include increasing accessibility to police stations, providing telephones to remote areas, improving transportation to police stations and increasing number of police patrols in various neighbourhoods. Sometimes victims of property crimes hardly report to the police simply because their loss due to the crime was small. People should be educated on the importance of reporting crimes. Indeed, it has been shown by Goldberg and Nold (1980) that the higher the probability of reporting burglaries, the lower the burglary rate. They conclude that victim-specific self-protection efforts like reporting of crimes will enhance the productivity of law enforcement activities without necessarily increasing the probability of apprehension which of course it does increase.

Lastly, our study suggests the following population policy:- Since it has been shown that the probability of imprisonment varies negatively with the size of population and positively with population density. There is a case for intensifying law enforcement activities in densely populated

areas as population increases. On the other hand, there is a strong case for policies aimed at checking the growth of population since such policies would not only reduce the incidence of crime but might lead to improvements in our economy *ceteris paribus.*

5:3 LIMITATIONS OF THE STUDY

1) The study uses data on reported crimes but since not all crimes are reported some findings of the study especially those relating to thefts which are under-reported may not accurately depict the crime situation in Kenya.

2) The study covers only the supply of property crimes. There is need for a more broad based study that examines both demand and supply of crime in a more general context.

3) The study does not consider private crime control which is growing very fast due to the emergence of private security firms.

4) Due to data inadequacy we have been unable to include variables like inequality, unemployment and psychic costs that may strongly influence participation in crime.

5:4 SUGGESTIONS FOR FURTHER RESEARCH

1) There is need for a study which compares the relative efficiencies of public and private law enforcement in view of increasing importance of private law enforcement.

2) There is need for a study to estimate the magnitude of illegal activities or the 'underground' economy as this would assist in determining the size of loss to society from illegitimate activities.

E N D N O T E S

1 People will not commit offenses while they are in prison.

2 This is because we cannot tell whether an individuals degree of risk-aversion increases or decreases for higher levels of wealth. The sign depends on the net effect of diminishing marginal utility and hence on nature of the utility function.

3 Some categories of property crimes may respond differently to increases in these deterrence variables.

4 For a more detailed discussion of this test, see Granger (1969)

5 These are estimators that are invariant to the type of normalization made in an equation. (See Pindyck and Rubinfeld, 1981).

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