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INDEX CRIMES IN THE PHILIPPINES: AN ECONOMETRIC STUDY

By

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Introduction

Crime is defined as an act committed or omitted in violation of a public law forbidding or commanding it.[1] The National Statistical Coordination Board of the Philippines defines index crimes as crimes which are sufficiently significant and which occur with sufficient regularity to be meaningful. Included in this category are the following crimes: murder, physical injury, robbery, theft and rape.[2] All other crimes are classified as non-index crimes.

Erlich developed a theory of participation in illegitimate activities and tested it against data on variations in index

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[1] Bouvier's Law Dictionary, Rawle's Third Revision, Vol I, p. 729 as quoted in Luis B. Reyes, The Revised Penal Code: Criminal Law Book One, 12th ed., Manila: Rex Book Store (1981), p. 1.

[2] National Statistical Coordination Board, Republic of the Philippines, 1986 Economic and Social Indicators (1987), p. 254.

crimes across states in the United States.[3] This paper is an attempt to test the same theory against variations in index crimes across provinces in the Philippines in 1990. The theory seems to be applicable to the data that we obtained.

Erlich stated the following regarding his theory:[4]

> "Much of the search in the criminological literature for a theory explaining participation in illegitimate activities seems to have been guided by the predisposition that since crime is a deviant behavior, its causes must be sought in deviant factors and circumstances determining behavior. Criminal behavior has traditionally been linked to the offender's presumed unique motivation which, in turn, has been traced to his presumed unique structure, to the impact of exceptional social or family circumstances, or to both ... Our alternative point of reference, although not necessarily incompatible, is that even if those who violate certain laws differ systematically in various respects from those who abide by the same laws, the former, like the latter, do respond to incentives. Rather than resort to hypotheses regarding unique personal characteristics and social conditions affecting respect for the law, penchant for violence, preference for risk, or in general preference for crime, one may separate the latter from measurable opportunities and see to what extent illegal behavior can be explained by the effect of opportunities given preferences."

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[3] Isaac Erlich, " Participation in Illegitimate Activities: A Theoretical and Empirical Investigation," Journal of Political Economy, 81, (3 May/June), 521-565.

[4] Isaac Erlich, "Participation in Illegitimate Activities: A Theoretical and Empirical Investigation," pp. 521-522.

The microfoundation for most of the econometric work on aggregate crime models is Becker's utilitarian model, as pointed out by Taylor who said:[5]

> "Becker's (1968) utilitarian model of criminal behavior, along with a number of modifications and extensions, has served as the 'micro-foundation' for most of the econometric work on aggregative crime models. While the utilitarian approach to criminal behavior can be traced back at least to Bentham, the economic models introduced by Becker improve on earlier work by making explicit and emphasizing the inherent uncertainty associated with decisions to engage in criminal activity. Applying the expected utility approach to criminal decision making, Becker is able to derive a number of empirically testable propositions about criminal behavior."

On this point, Erlich said:[6]

> "My analysis goes beyond that of Becker and other previous contributions in several ways. First, it incorporates in the concept of opportunities both punishment and reward-costs and gains from legitimate and illigitemate pursuits - rather than the cost of punishment alone, and attempts to identify and test the effect of their empirical counterparts ... Second, it links formally the theory of participation in illegitimate activities with the general theory of occupational choices by presenting the offender's decision problem as one of an optimal allocation of resources under uncertainty to competing activities both inside and outside the market sector, rather than as a choice between mutually exclusive activities."

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[5]John B. Taylor, "Econometric Models of Criminal Behavior: A Review," in J.M. Heineke (ed.), Economic Models of Criminal Behavior, Netherlands: North Holland Publishing Company (1978), p. 36.

[6]Isaac Erlich, "Participation in Illegitimate Activities: A Theoretical and Empirical Investigation," p. 522.

The plan of this paper is as follows: Erlich's model of law enforcement and crime and its test against variations in index crimes in the United States are presented in Sections 1 and 2, respectively. Section 3 is about index crimes, criminal laws and the prison system in the Philippines. Section 4 is on our test of Erlich's theory against variations in index crimes across provinces in the Philippines in 1990.

Section 1

Erlich's Model of Law Enforcement and Crime

A. Optimal Participation in Illegitimate Market Activities: Erlich's One-Period Uncertainty Model

Erlich assumed the following:

1. An individual can participate in two market activities: i, an illegal activity and l, a legal one, and must make a choice regarding his optimal participation in each at the beginning of a given period;
2. No training or other entry costs are required in either activity, neither are there costs of movement between the two;
3. The returns in both activities are monotonically increasing functions of working time;
4. The probability of apprehension and punishment is independent of the amount of time spent in i and l and time is proportionally related to any other direct inputs employed in the production of market returns;
5. The individual maximizes the expected utility of a one-period consumption prospect.

Let $W_l(t_l)$ = net return from the individual's legal activity, where t denotes the time input

$W_i(t_i)$ = net return from the individual's illegitimate activity

p_i = the subjective probability that the individual would be apprehended and punished for participation in the illegal activity; $1 - p_i$ is the probability that the individual can get away with crime.

$F_i(t_i)$ = the discounted (pecuniary and nonpecuniary) value of the penalty for the individual's illegitimate activity and other losses (including the possible loss of his loot)

t_c = the amount of time devoted to consumption or non-market activity

X_s = the stock of a composite market good (including assets, earnings within the period and the real wealth equivalent of nonpecuniary returns from legitimate and illegitimate activity), the command over which is contingent upon the occurrence of state s (s can either be a, apprehension and punishment at the end of the period, or b, getting away with crime)

W' = the market value of the individual's assets (net of current earnings), including his borrowing opportunities against earnings in future periods, and is assumed to be known with certainty, given the state of the world in the beginning of each period.

Thus,

$$X_a = W' + W_i(t_i) - F_i(t_i) + W_l(t_l) \qquad (2.1)$$

is obtained with probability p_i and

$$X_b = W' + W_i(t_i) + W_l(t_l) \qquad (2.2)$$

is obtained with probability $1 - p_i$. The problem is to maximize the individual's expected utility,

$$E\,[U\,(X_s,\ t_c)] = (1 - p_i)U\,(X_b,\ t_c) + p_i\ U(X_a,\ t_c) \qquad (2.3)$$

subject to the wealth constraints given by equations (2.1) and (2.2), a time constraint,

$$t_o = t_i + t_l + t_c \qquad (2.4)$$

and nonnegativity requirements,

$$t_j \geq 0\ , \quad j = i,\ l,\ c \qquad (2.5)$$

The Kuhn-Tucher first order optimality conditions in this case are as follows:

$$\frac{\partial E(U)}{\partial t} - \lambda \leq 0$$

$$\left(\frac{\partial E(U)}{\partial t} - \lambda\right) t = 0 \qquad (2.6)$$

$$t \geq 0$$

where t stands for the optimal values of each of t_i, t_l and t_c and λ is the marginal utility of time spent in consumption. From these conditions, Erlich deduced the following:

1. A sufficient condition for entry into i – regardless of attitudes toward risk – is that the marginal expected return in i exceed that in l. The converse would imply specialization in l.

2. Whether offenders are likely to specialize in illegitimate activity is an aspect of their attitudes toward risk, as well as their relative opportunities in alternative legitimate and illegitimate activities.

3. Whether in equilibrium, crime pays or does not pay in terms of expected (real) marginal return is simply a derivative of an offender's attitude toward risk since, in equilibrium the expected marginal returns from crime would exceed, be equal to, or fall short of the marginal return from legimate activity, depending on whether the offender is a risk avoider, risk neutral or risk preferrer, respectively.

Erlich extended his analysis to cases with n states, possibly including employment and unemployment in 1. Erlich said that, viewed under the light of his model, recidivism is not necessarily the result of an offender's myopia, erratic behavior, or lack of self-control, but may rather be the result of choice dictated by opportunities.

B. Some Behavioral Implications

Erlich pointed out the following as comparative statics implications of his model:

1. An increase in either p_i or f_i ($= dF_i/dt_i$), ceteris paribus, reduces the incentive to enter and participate in illegitimate activity because it increases the expected marginal cost of punishment, $p_i f_i$. If the

offender is a risk preferrer and yet partly engaged in legitimate activity, an increase in the average penalty per offense might not deter his participation in crime. Such participation might even increase.

2. An increase in the marginal or average differential return from illegal activity, $w_i - w_l$, resulting from an increase in (real) illegitimate payoffs or a decrease in (real) legitimate wages, ceteris paribus, can generally be shown to increase the incentive to enter into or allocate more time to illegitimate activity.

3. An increase in the probability of unemployment has an ambiguous effect on the incentive to assume the greater risk involved in additional illegitimate activity if offenders are risk avoiders.

4. A decrease in t_c, the amount of time allocated to nonmarket activities (including schooling), is likely to generate a positive scale effect on participation in i and l provided that the indifference map is invariant to changes in t_c.

5. The effect of uncompensated changes in various legitimate and illegitimate opportunities on the extent of participation in illegitimate activities is generally expected to be greater on offenders who participate in such activities on a part-time basis than on those who specialize in such activities.

6. The effect of compensated and even uncompensated changes in legitimate market wages on the extent of participation in i may be lower than that of changes in illegitimate payoffs.

Since crimes against the person may be motivated primarily by hate or passion, rather than self-enrichment, Erlich considered these crimes as nonmarket activities and pointed out the following comparative statics implications of his model on them:

1. An increase in the probability and severity of punishment would deter crimes against the person for the same reasons they were expected to deter participation in crimes against property.
2. In contrast to crimes against property, a decrease in t_c due to specific exogenous factors is likely to produce a negative scale effect on participation in crimes against the person simply because less time could then be spent on all nonmarket activities.
3. An improvement in legitimate earning opportunities that increases the total amount of time spent at work may reduce participation in crimes against the person even if it did not increase the cost of such crimes relative to other nonmarket activities.

C. Erlich's Simultaneous-Equation Model of Crime and Law Enforcement

Given his one-period uncertainty model cited above, Erlich specified an aggregate supply of offenses equation of the following form, where the subscript j refers to crime category j:

$$(\frac{Q}{N})_j = A\, P_j^{b_{1j}}\, F_j^{b_{2j}}\, Y_j^{c_{1j}}\, Y_l^{c_{2j}}\, U_l^{d_j}\, V^{e_j}\, \exp(\mu) \qquad (2.7)$$

where

$(\frac{Q}{N})$ = the crime rate: the number of offenses per capita

P = an average offender's subjective probability that he will be apprehended and punished for his engagement in crime

F = the average cost of punishment

Y_j = average return from crime category j

Y_l = average return from legitimate activities

U_l = the average probability of unemployment in legitimate activities

V is a vector of environmental variables, A is a constant and μ is a random error which is assumed to be normally distributed.

Erlich argued that P and F may not be exogenous since they are determined by the public's allocation of resources to

law-enforcement activity and by the level of crime itself and that the expenditure on law enforcement, in turn, is likely to be affected by the rate of crime and the resulting social loss. To insure consistent estimates of equation (2.7), he added the following equations to form a simultaneous equation model of crime and law enforcement:

1) a production function of direct law enforcement activity by police and courts,

$$P = B\left(\frac{E}{N}\right)^{\beta_1} \left(\frac{O}{N}\right)^{\beta_2} Z^{\delta} \exp(\epsilon) \qquad (2.8)$$

2) a public demand function for expenditures on law enforcement activity,

$$\left(\frac{E}{N}\right)_t = \Gamma L \left(\frac{O}{N}\right)^{\tau} \left(\frac{E}{N}\right)_{t-1}^{1-\tau} \exp(\epsilon) \qquad (2.9)$$

where

$\left(\frac{E}{N}\right)_t$, $\left(\frac{E}{N}\right)_{t-1}$ = current and 1 year-lagged per capita amount of resources allocated to law enforcement activity

L = potential loss to victims of crime

$\beta_1 > 0$ since an increase in law enforcement activity can be expected to result in a

Section 2

Test of Erlich's Theory Against Data on Variations in Index Crimes in the United States

Erlich applied the framework that he developed above in a regression analysis of variations in index crimes across U.S. states in 1960, 1950 and 1940 with the following empirical counterparts of his theoretical constructs:

Theoretical Constructs	Empirical Counterparts
1. $(\frac{O}{N})_j$	The number of offenses known to the police to have occurred in a given year per 100,000 (state) population; Erlich said that since reporting a crime is time consuming and may involve psychic and other disadvantages, an underreporing of crime is expected, especially in the case of milder offenses where the various costs of reporting may exceed its benefits [the potential recovery of stolen property, the collection of insurance benefits, or vengeance].
2. P_j	The objective probability that a single offense will be cleared by the conviction of an offender; Since judicial statistics on the number of convictions on a statewide basis was not available to Erlich, he computed the ratio of the

number of commitments to state (and in the case of theft, also federal) prisons in a given state to the number of offenses known to have occurred in the same year $(\frac{C}{Q})_j$.

3. F_j The average time actually served by offenders in state prisons for crime j before their first release.

4. U Census estimates of yearly unemployment rates in the civilian labor force; According to Erlich, alternative estimates used have been the unemployment rate of urban males in the age group 14-25 and 35-39 and that another way was by introducing census estimates of labor force participation rates with unemployment rates. Erlich used the labor force participation rate of civilian urban males in the age group 14-24.

5. E/N The per capita yearly expenditure on police activity by state and local governments; Data on expenditures on courts by local governments were not available on a statewide basis. Erlich said that to some extent, variation in private self-protection might have been accounted for by the variation in schooling level of the adult

population across states. He and Becker pointed out that the latter is positively related to optimal expenditures on the former.[7]

6. $Y_i - Y_l$ The percentage of families below one-half of the median income in a state (income inequality), denoted by X.

7. Y_i The median value of transferable goods and assets or family income across states (affluence), denoted by W.

8. Y_l The mean income level of those below the state's median.

Erlich's findings, among others, on U.S. conditions are as follows:

1. The rate of specific crime categories varied inversely with estimates of the probability of apprehension and punishment by imprisonment and with the average length of time served in state prisons.
2. Crimes against property (robbery, burglary, larceny and auto theft) varied positively with the percentage of families below one-half of the median income and with the median.

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[7]Erlich I. and Becker G.S., "Market Insurance, Self-Insurance and Self-Protection," Journal of Political Economy, 80, No. 4 (July/August, 1972), 623-48.

income; In contract, these variables were found to have relatively lower effects on the incidence of crimes against the person (particularly murder and rape).

3. All specific crime rates were positively related to the percentage of nonwhites in the population.
4. Possibly, not age per se, but the general opportunities available to offenders determined their participation in crimes against property.
5. The effect of the unemployment rate on the supply of offenses was not significant.
6. The labor force participation rate had a significant negative effect on crimes against the person. Its effect on crimes against property was inconclusive.

Erlich also estimated an aggregate production function of law enforcement activity (equation 2.8) via two stage least squares procedure using data from 1960 and found the following:

1. The probability of apprehending and convicting felons was positively related to the level of current expenditure on police and negatively related to the crime rate.
2. The productivity of law enforcement activity was negatively affected by the size and density of the population and positively affected by the extent of relative poverty, the schooling level of the adult population and the proportion of nonwhites.

3. P appeared to be lower in states with a greater proportion of juveniles.

Section 3

Index Crimes, Criminal Laws and Prison System in the Philippines

A. Index Crimes in the Philippines in 1990

In 1990, index crimes constituted 64% of the total volume of crimes in the Philippines. The percentage distribution then of these index crimes was as follows:[8]

	Percentage Distribution		Number of Cases
1. Crimes against Persons		49%	28,127
a. physical injury	29%		16,647
b. homicide	10%		5,740
c. murder	10%		5,740
2. Crimes against Property		49%	28,127
a. theft	31%		17,795
b. robbery	18%		10,332
3. Crimes against Chastity (Rape)	2%		1,148
Total	100%		57,402 9/

[8]Source: Public Information Office, Headquarters, PC-INP, Camp Crame, Quezon City, "The National Crime Situation," (mimeographed).

[9]This figure was arrived at by adding the number of index crimes by province for 1990, as reported by the Production Branch, Directorate for Intelligence, Camp Crame, Quezon City. We computed the number of cases per index crime category in this column using the reported percentage distribution in the preceding column. Based on these figures, the number of non-index crimes in the Philippines in the same year was about 32,288, making a total of 89,690 index and non-index crimes then. Since the same report states that 74% of the cases reported nationwide were solved, we deduce that 66,371 of the said cases were solved while the rest, or 23,319 cases, were not solved.

B. Philippine Criminal Laws

Criminal law, the branch of public law which defines crimes and provides for their punishment, has the following purposes:[10]

(1) to reform

(2) to deter others

(3) to prevent the offender from committing further crimes

(4) to defend the state against crimes

(5) to set an example.

Gross stated the following:[11]

> "The criminal law itself consists of penal laws and principles of criminal jurisprudence. A penal law establishes a rule of conduct that most often prohibits (but sometimes requires) a designated act. In addition, a penal law prescribes a penal sanction that may be imposed for violation of the rule. Principles of criminal jurisprudence guide judgments as to whether a rule has been violated, whether there should be criminal liability if there has been violation, what the extent of such liability should be."

According to Reyes, the sources of Philippine criminal law were as follows:[12]

1. The Revised Penal Code (Act No. 3815) and its amendments.

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[10]Jose N. Nolledo, The Revised Penal Code, 1984 6th edition, National Book Store, Inc., (1984), p. 1.

[11]Hyman Gross, A Theory of Criminal Justice, New York: Oxford University Press, (1979), p. 4.

[12]Luis B. Reyes, The Revised Penal Code; Criminal Law Book One, p. 1.

2. Special laws passed by the Philippine Commission, Philippine Assembly, Philippine Legislature, National Assembly, the Congress of the Philippines, and the Batasang Pambansa, which are penal in nature.

According to Nolledo, the Revised Penal Code, which took effect on January 1, 1932 and which has governed the country on penal matters for more than fifty (50) years, may be superseded soon by the New Code of crimes. He further stated the following:[13]

"Theories that underlie criminal law are:

(1) The classical or juristic theory which considers man as 'essentially a moral creature with absolutely free will to choose between good and evil' and teaches that man should answer 'for wrongful acts as long as such free will remains unimpaired.' This theory is punitive and retributive. Our Penal Code follows this theory.

(2) The positivist or realistic theory which teaches that man is 'subdued occasionally by a strange and morbid phenomenon which constrains him to do wrong in spite of or contrary to his volition.' It believes that in crime, man is the primary factor and that crime can be checked only by thorough and personal investigations by social scientists. It is a reformative theory and lays stress on man as a social danger."

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[13]Jose N. Nolledo, The Revised Penal Code, 6th edition (See the Preface, p. 1).

C. The Philippine Prison System

According to the Technical Panel on Crime Prevention and Criminal Justice,[14]

> "There are more than 1,500 confinement facilities in the Philippines. Of this number, seven (7) are national prisons under the direct supervision and control of the Director of Corrections, seventy-seven (77) are provincial jails administered by the provincial governors who are under the Department of Local Government and assisted by jail wardens, 60 are city jails and 1,467 are municipal jails - both types administered by the Integrated National Police."

The same Panel stated that National Prisoners serve sentences of more than three years while the rest serve sentences of three years or less, with provincial prisoners having a lower limit of 6 months and 1 day.

The distribution of prisoners in the Philippines in 1989/1990 was as follows:

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[14]Technical Panel on Crime Prevention and Criminal Justice, National Police Commission," Position Paper for the Republic of the Philippines," 8th UN Congress on the Prevention of Crime and the Treatment of Offenders, Havana, Cuba, August 27-Sept. 7, 1990 (mimeographed), p. 29.

Type of Prisoner	Number of Prisoners	Percentage of Prisoners Awaiting Trial/Detained	Period
Municipal/city[15] prisoner	14,525	88%	Jan.-Dec. 1990
Provincial[16] prisoner	9,611	88.47%	As of Sept. 1989
National prisoner[17]	13,624		(Monthly ave. in 1990)
Total	37,760		

According to the Bureau of Corrections, the distribution breakdown of national prisoners in 1990 was as follows:

Prison/Penal Farm(PPF)	Monthly Average Inmate Population	Percent Share
New Bilibid Prison	7,406	54%
Iwahig PPF	2,090	15%
Davao PPF	1,897	14%
Sablayan PPF	703	5%
San Ramon PPF	759	6%
Leyte Regional Prison	464	4%
Women's Correctional	305	2%
Total	13,624	100%

[15]Source of Information: Office of Jail Management, PNP, Camp Crame, Quezon City.

[16]Source of Information: NAPOLCOM, Department of Interior and Local Government.

[17]Source of Information: Bureau of Corrections, Department of Justice, "Bureau of Corrections 1990 Annual Report." The same report states that in 1990, a total of 2,593 inmates were escorted to court for trial. This number represents 19% of the reported monthly average of national prisoners in the same year.

The following are stated in the same report of the Technical Panel on Crime Prevention and Criminal Justice:[18]

> "Institutional congestion is regarded as the most acute problem needing priority attention in corrections. This is true in city and municipal jails, largely because many detainees cannot afford to post bail. The prolonged detention of an offender who cannot post bail is exacerbated when the defense or prosecution is allowed to unduly postpone the hearing of cases. With the unrealistic scheduling of cases, the piecemeal resetting of trial, and inadequate number of judges, the problem is further compounded."

As of December 1990, a total of 11,151 wanted persons (81.85% of the monthly average number of national prisoners in 1990 and 29.53% of the estimated total number of prisoners in the same year) was reported by the Office of the Directorate for Intelligence, PNP, Camp Crame, Quezon City, which also defined such persons as follows:

> "(a) Persons with warrants/orders of arrest issued by either civil or military courts and other competent authorities;
>
> (b) Escapees from military and police detention centers and other penal institutions;
>
> (c) Parole violators with recommitment orders;
>
> (d) AFP/INP personnel wanted for desertion and by court martial."

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[18]Technical Panel on Crime Prevention and Criminal Justice, "Position Paper for the Republic of the Philippines," p.29.

Section 4

Analysis of Index Crime Variation Across Provinces in the Philippines in 1990

A. Aggregate Supply of Offenses Functions in the Philippines in 1990: The Effect of the Probability of Punishment, Income and Income Inequality

Using cross-section data, we estimated equation (2.7), an aggregate supply of offenses function, for the Philippines in 1990 using the Ordinary Least Squares (OLS) and Two Stage Least Squares (TSLS) procedures. Our desire to do likewise for earlier years was frustrated by the following constraints on data availability:

1. Records on expenditures for police operations were allegedly destroyed by a fire which hit the PNP Headquarters building during the December 1989 coup attempt. (Like Erlich, we were not able to take into consideration expenditures on courts in our investigation. The Philippine judiciary centralized its court operations since the term of President Marcos and therefore, could not give a provincial breakdown of court expenditures.)
2. Data on the number of provincial prisoners are not reported regularly by the provinces' respective jail wardens. The latest data on them are for September 1989. The last ones prior to these are for the 1970s.

The unavailability of the 1990 data on population, housing and some social statistics constrained us to use the available ones for 1988 or 1989 as estimates. To the extent that variations

in these variables in 1988 or 1989 did not differ significantly from those in 1990, the former approximates the latter. For the same reason, we used the only available data on the number of provincial prisoners as of September 1989 as estimates for the values of the same variable in 1990. The following data for 1990 were also not available:

1. The number of municipal, provincial and national prisoners per crime category;
2. The provincial breakdown of national prisoners; What was available was the 1990 Intake Record, a record of daily admissions at the Inmate Reception and Educational Center, National Bilibid Prison, Muntinlupa. This record contains infomation on the provinces in which prisoners were sentenced. It enabled us to classify 3871 [19/] national prisoners who were admitted in the National Bilibid Prison, Muntinlupa from various courts in 1990 or 28.41% of the 13,624 (monthly average) national prisoners during the same year.
3. The average length of imprisonment; The reports that were submitted to the PNP Computer Center in Camp Crame contained no information on the duration of sentence (in resolved cases), the commencement of the sentence and the length of service of prisoners before their release

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[19]The Bureau of Corrections 1990 Annual Report states that 4,156 prisoners were admitted by the same Bureau from the Courts in 1990.

from jail; Thus, we were not able to incorporate in our investigation an estimate of the average cost of punishment by imprisonment borne by the prisoners.

4. The number of offenses per crime category; When we requested them, the PNP Computer Center had not yet finished collating its 1990 statistics. Since the number of prisoners per crime category was also unavailable, we were not able to estimate supply of offenses functions for each crime category.

5. The total expenditure on police activity; Information on some of them were not made available for security reasons. The provincial breakdown of some of them were not available because of centralization of some operations.

Despite our limitations, we attempted to obtain at least some tentative estimates of equation (2.7) for the Philippines in 1990 with the following province-specific empirical counterparts of Erlich's theoretical constructs:

$\frac{Q}{N}$ = the index crime volume per capita in 1990.

C = an estimate of the number of prisoners apprehended and convicted due to index crimes = the sum of the following:

(1) the number of prisoners admitted at the National Bilibid Prison in 1990;

(2) the number of prisoners in provincial jails as of September 1989;

(3) the number of prisoners in municipal and city jails as of December 1990.

W = mean annual income of families in 1988

X = percentage of families in 1988 whose annual income was less than one half of the mean annual income of families

A_{15-24} = percentage of males aged 15-24 years to household population aged 7 years and over as of July 1989

E_d = the number of out-of-school youth, aged 15-24 years, as a percentage of household population aged 7 years and over as of July 1989

U = the unemployment rate as of October 1990

L = the labor force participation rate as of October 1990

M = the ratio of males aged 7 years and over to females aged 7 years and over as of July 1989

E = government expenditures on police operational activities excluding police expenditures on intelligence, civil relations and logistical requirements, which are all in support of operations.

Using both the Ordinary Least Squares (OLS) and Two Stage Least Squares (TSLS) procedures, we obtained the following results with t statistics in parentheses:

(OLS): $\ln \frac{Q}{N} = -8.79 - 0.76 \ln \frac{C}{Q} - 0.04 \ln W$

$(-4.23) \quad (-9.71) \quad (-0.23)$

$+ 0.40 \ln X$, $\quad \bar{R}^2 = 0.58$, $N = 67$, $F = 31.43$

(2.48)

(TSLS): $\ln \frac{Q}{N} = -7.75 - 1.13 \ln \frac{C}{Q} - 0.23 \ln W$

$(-3.14) \quad (-8.35) \quad (-1.05)$

$+ 0.56 \ln X$, $\quad \bar{R}^2 = 0.50$, $N = 64$, $F = 21.74$

(3.01)

We note the following in both of these equations:

I. A significant negative effect of $\frac{C}{Q}$, an estimate of the subjective probability of being apprehended and punished, on the crime rate; As pointed out by Erlich, such negative effect can consist of a deterrent effect and a preventive effect of imprisonment on the crime rate, the latter being due to the separation of offenders from potential victims. The 1990 Annual Report of the Bureau of Corrections contains the following data on recidivism as extracted from its inmate admissions for the last 4 years:

	1987	1988	1989	1990
% 1st Offenders Admitted	90%	92%	95%	95%
% Ex-Convicts or Returnees Admitted	10%	8%	5%	5%

The Philippine Technical Panel on Crime Prevention and Criminal Justice stated the following:[20]

> "It would be advisable to maximize the reformation and rehabilitation programs and services of the Bureau of Corrections, where recidivism is practically nil (indicating significant success in the positive reintegration of former offenders into the main-stream of society), by applying these to other custodial entities, such as the provincial, city and municipal jails."

We might, therefore, add a possible third source of a negative effect of imprisonment on the crime rate, namely: the result of reformation and rehabilitation efforts on prisoners, if there are any.

2. A significant positive effect of X, an estimate of the differential return from crime $Y_i - Y_l$;

3. The effect of W, representing affluence, on the crime rate is negative but not significant. We pointed out in section 2 that W is a measure of Y_i, the average potential illegal payoff, and that X is a measure of the differential return from crime $Y_i - Y_l$. Increasing W, with X held constant, would imply increases in both Y_i and Y_l. Y_i and Y_l have opposite effects on the crime rate. A negative effect of W on the crime rate implies that the negative

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[20]Technical Panel on Crime Prevention and Criminal Justice, National Police Commission," Position Paper for the Republic of the Philippines," p. 34.

effect of Y_I dominated the positive effect of Y_i on the crime rate. Furthermore, we pointed out Erlich's observation above that in the case of crimes against the person, which is opproximately 50% of the index crimes in our empirical investigation, an improvement in legitimate earning opportunities that increases the total amount of time spent at work may reduce participation in said crimes.

B. Aggregate Supply of Offenses Function in the Philippines in 1990: The Effects of Unemployment, Labor Force Participation and Age Composition

To estimate the effects of unemployment, labor force participation and age composition on the crime rate, we included U, L and A_{15-24} in equation (2.7) and obtained the following results using OLS (t statistics are in parentheses):

$$\ln \frac{Q}{N} = \underset{(-2.92)}{-9.59} - \underset{(-9.44)}{0.77} \ln \frac{C}{Q} - \underset{(-0.24)}{0.05} \ln W + \underset{(2.21)}{0.38} \ln X$$

$$- \underset{(-0.23)}{0.03} \ln U + \underset{(0.36)}{0.21} \ln L + \underset{(0.21)}{0.07} \ln A_{15-24}, \quad \bar{R}^2 = 0.59, \; N = 65, \; F = 16.14$$

The said variables do not seem to have significant effects on the crime rate.

C. Production Function of Direct Law-Enforcement Activity by Police

To estimate the effectiveness of public outlays on police in determining the probability of apprehending and punishing felons, $P = C/Q$, we estimated equation (2.8) via 2SLS procedure. Following Erlich's procedure, we regressed Q/N and E/N on the set of exogenous variables (W, X, U, A_{15-24}, M, N and E_d in our case) in the first stage. In the second stage, we regressed P on $\frac{Q}{N}$ and $\frac{E}{N}$ and on other environmental variables and obtained the following results, with t statistics in parentheses:

$$\ln \frac{C}{Q} = -17.22 + 0.59 \ln \frac{E}{N} - 1.17 \ln \frac{Q}{N} + 0.51 \ln N$$
$$(-2.31) \quad (0.98) \quad (-1.92) \quad (1.30)$$

$$+ 0.57 \ln X - 0.09 \ln E_d - 0.27 \ln A_{15-24}, \quad \bar{R}^2 = 0.44$$
$$N = 65$$
$$(2.87) \quad (-0.32) \quad (-0.51) \quad F = 9.57$$

We deduce the following from this equation:

1. The per capita outlay on police activity has a positive but insignificant effect on P. This might be due to the fact that we were not able to incorporate in our investigation the unavailable data on police expenditures on intelligence, civil relation and logistical requirements which are all in support of police operations.
2. There seems to be economies of scale in Philippine index crime activities in 1990, which can be considered

significant at approximately 5% level, as shown by the negative sign of the coefficient of ln Q/N and the corresponding t value.

3. The differential return from crime, $Y_f - Y_l$, has a significant positive effect on P. The probability of being apprehended and punished was higher in areas with a greater proportion of poorer families.

4. The effects of population size, age composition and number of out-of-school youth on P do not seem to be significant.

Conclusions and Recommendations

It seems that like Erlich, who admitted the crudeness of the estimates of some of the desired variables in his model and the shortcomings of the data, we can conclude that our empirical investigation lends credibility to his theory on participation in illegitimate activities. The absence of much needed data for a study of this kind in the Philippines should point to the need for them in assisting law enforcers. The Philippine Technical Panel on Crime Prevention and Criminal Justice recognized this need when it stated the following:[21]

> For the effective administration of criminal justice, it has been recognized that crime information system is essential in providing timely and useful information for effective planning research and decision-making. Presently, each pillar of the criminal justice system undertakes its own data collation and storage. All National Uniform Crime Case Reports (NUCCR) are processed at the Constabulary Computer Center of the Philippine Constabulary-Integrated National Police Headquarters. The National Prosecution Service of the Department of Justice compiles data on the profile of case disposition. Computerization of Supreme Court decisions is being generated. In the correctional sector, the Bureau of Corrections (formerly the Bureau of Prisons) processes data on the movement, profile and case records of prisoners; the Board of Pardons and Parole encodes data pertaining to prisoners whose petitions are under processing for parole/executive clemency including crime committed, the sentencing court and penalty imposed on the offender, and those prisoners

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[21]Technical Panel on Crime Prevention and Criminal Justice, National Police Commission," Position Paper for the Republic of the Philippines, pp. 27-28.

petitions are under processing for parole/executive clemency including crime committed, the sentencing court and penalty imposed on the offender, and those prisoners who are under supervision including movements of parolees and pardonees concerned, as well as orders of arrest and recommitment due to violation of parole and pardon; and the Parole and Probation Administration encodes files on probation case loads (probation cases granted, terminated and revoked), supervision of cases and psychological evaluation of probationers, and rehabilitation programs under-taken by different probation field offices for the successful reintegration of offenders into the community. Data from the prosecution, courts and corrections are processed at the National Bureau of Investigation. However, steps are now being taken to integrate all data collation and storage into a unified crime information system using computer technology."

References

Bureau of Corrections, Department of Justice, Republic of the Phillippines, " Bureau of Corrections 1990 Annual Report."

Erlich, I. and Becker, G.S., "Market Insurance, Self-Insurance and Self-Protection," Journal of Political Economy, 80, No. 4 (July/August, 1972).

Erlich, Isaac, "Participation in Illegitimate Activities: A Theoretical and Empirical Investigation," Journal of Political Economy, 81 (3 May/June).

Gross, Hyman, A Theory of Criminal Justice, New York: Oxford University Press, 1979.

National Statistical Coordination Board, Republic of the Philippines, 1986 Economic and Social Indicators.

Nolledo, Jose N., The Revised Penal Code, 6th edition, Manila: National Book Store, Inc., 1984.

Public Information Office, Headquarters, PC-INP, Camp Crame, Quezon City, "The National Crime Situation," (mimeographed).

Reyes, Luis B., The Revised Penal Code: Criminal Law Book One., 12th ed., Manila: Rex Book Store, 1981.

Taylor, John B., "Econometric Models of Criminal Behavior: A Review," in Heineke, J.M. (ed.), Economic Models of Criminal Behavior, Netherlands: North Holland Publishing Company, 1978.

Technical Panel on Crime Prevention and Criminal Justice, National Police Commission, "Position Paper for the Republic of the Philippines," 8th UN Congress on the Prevention of Crime and the Treatment of Offenders, Havana, Cuba, August 27-September 7, 1990 (mimeographed).