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Robbery, Economic Incentives and Deterrence: An Intercountry Analysis for 1997

by

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ABSTRACT

Causes of crime were sought in individual's characteristics, sociological aspects and illicit drug use. Since the pioneering work of Gary Becker (1968), economists have analyzed determinants of crime from the perspective of the offender's rational decision to participate in illegal activities. Cross section data for 1997 were used in this paper to examine intercountry differences in effects of economic incentives and deterrence on robbery rates at national levels. Significant negative effects of the total convicted for robbery /total prosecuted for robbery, a proxy for the probability of being apprehended and punished due to this crime, were found. The finding of an inducing impact of income inequality is consistent with that of Fajnzylber , Lederman, and Loayza, (2000) who analyzed social and economic determinants of robbery and homicide rates (at national levels) in a sample of about 45 countries for homicide and 34 countries for robbery. They used a generalized method of moments (GMM) estimator applied to dynamic models of panel data covering the period 1970-1994. These results are in accordance with Erlich's theory that an increase in the probability of being apprehended and punished has a deterrent effect on offenders and that offenders, as a group, respond to incentives in much the same way that those who engage in strictly legitimate activities do as a group. The decision to participate in crimes involving material gains as an occupational choice is deemed consistent with evidence of positive association between income inequality and the rate of crimes against property.

ROBBERY, ECONOMIC INCENTIVES AND DETERRENCE:
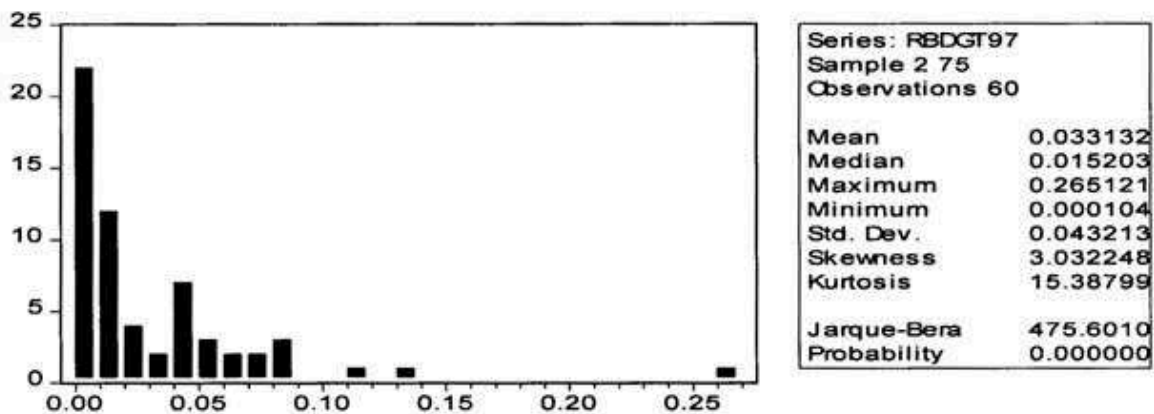**AN INTERCOUNTRY ANALYSIS FOR 1997**

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INTRODUCTION

Robbery refers to the taking away of property from a person overcoming resistance by force or threat of force. This definition is deemed applicable to many legal codes in the United Nations' Surveys on Crime and Criminal Justice Systems.

The frequency distribution of the number of recorded robberies/the grand total of recorded crimes in 60 countries for which data are available for 1997 is shown in figure 1. On the average, recorded robberies were then 3.31% of the grand total of recorded crimes in these countries. They ranged from a minimum of 0.0104% to a maximum of 26.5% of the grand total of recorded crimes. The distribution of the number of recorded robberies per 100,000 inhabitants (RBP97) of the same countries in the same year is shown in figure 2. On the average, there were 64.9 of these cases, ranging from a minimum of 0.11 to a maximum of 322.49 per 100,000 inhabitants. 8 of these countries were classified as low income, 30 as middle income and 22 as high income countries by the World Bank.[1]
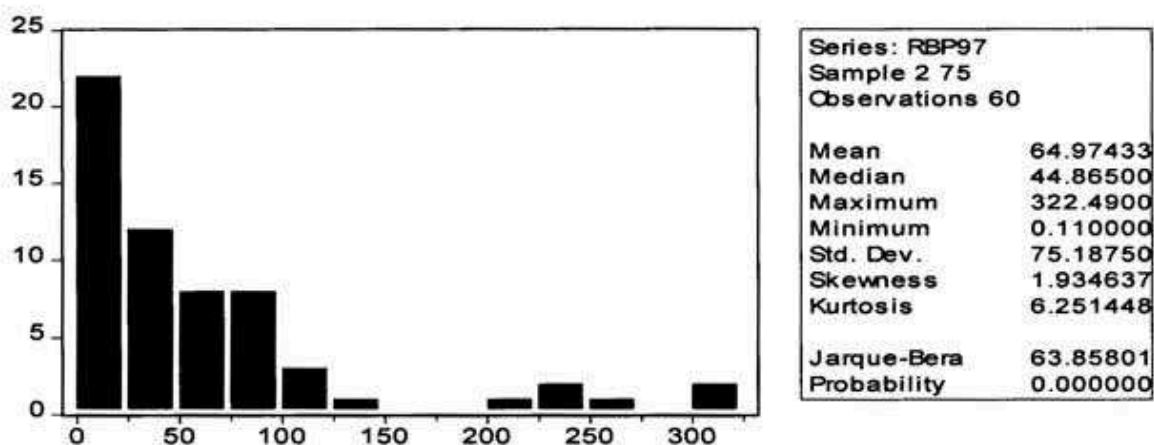
Figure 1
TOTAL RECORDED ROBBERIES/GRAND TOTAL OF RECORDED CRIMES

Series: RBDGT97	
Sample 2 75	
Observations 60	
Mean	0.033132
Median	0.015203
Maximum	0.265121
Minimum	0.000104
Std. Dev.	0.043213
Skewness	3.032248
Kurtosis	15.38799
Jarque-Bera	475.6010
Probability	0.000000

(RBDGT97 = Total recorded robberies in 1997/Grand total of recorded crimes in 1997)

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[1] See World Resources Institute, World Resources 2000-2001, Washington D.C,p.311.
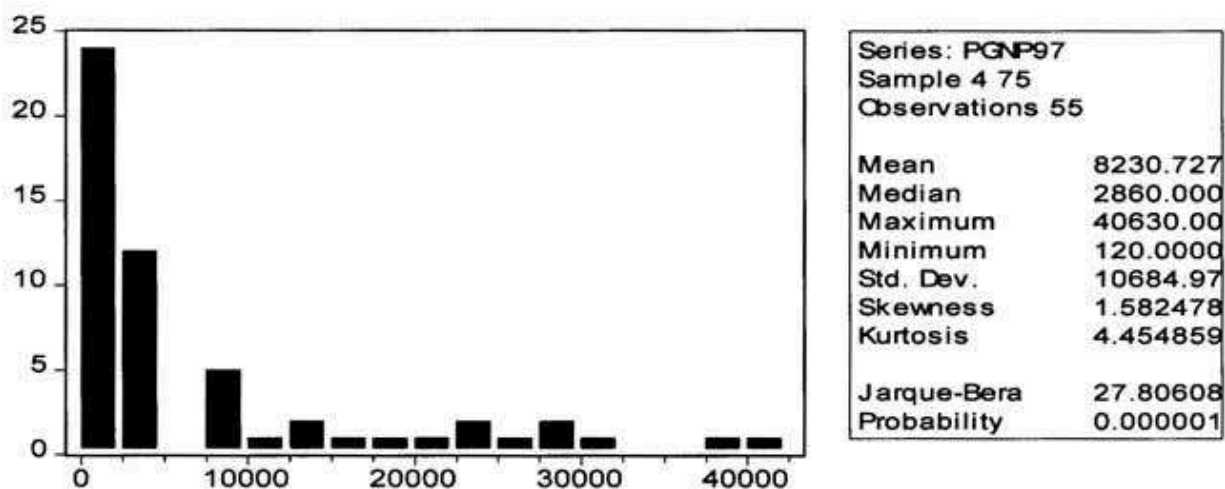
Figure 2
TOTAL RECORDED ROBBERIES PER 100,000 INHABITANTS
OF COUNTRIES WHICH ARE INCLUDED IN FIGURE 1

Series: RBP97	
Sample 2 75	
Observations 60	
Mean	64.97433
Median	44.86500
Maximum	322.4900
Minimum	0.110000
Std. Dev.	75.18750
Skewness	1.934637
Kurtosis	6.251448
Jarque-Bera	63.85801
Probability	0.000000

(RBP97 = Total recorded robberies per 100,000 inhabitants in 1997)

The frequency distribution of per capita gross national product (PGNP97) in 55 of these countries in 1997 is shown in figure 3. They had a mean of $8,230 and ranged from $120 to $40,630. Five high income countries, whose RBP97 were 1.56, 3.35, 46.03, 69.87 and 75.02, are not among these countries.

Figure 3
PER CAPITA GROSS NATIONAL PRODUCT OF 55 COUNTRIES
WHICH ARE INCLUDED IN FIGURES 1 AND 2

Series: PGNP97	
Sample 4 75	
Observations 55	
Mean	8230.727
Median	2860.000
Maximum	40630.00
Minimum	120.0000
Std. Dev.	10684.97
Skewness	1.582478
Kurtosis	4.454859
Jarque-Bera	27.80608
Probability	0.000001

(PGNP97=Per capita gross national product in 1997, in US$)

The objective of this paper is to examine issues concerning intercountry differences in effects of economic incentives and deterrence on robbery rates in 1997. The first section is about the United Nations' Surveys on Crime and Criminal Justice Systems, the source of data on crime statistics for this paper. The second section provides a brief review of research on causes of crime, which were sought in individual's characteristics, sociological aspects, and illicit drug use. Since the pioneering work of Gary Becker (1968), economists have analyzed determinants of crime from the perspective of the offender's rational decision to participate in illegal activities, on the basis of a cost-benefit analysis. The regression equations are presented in the fourth section. The model includes as explanatory variables of the robbery rate 1) measures of income disparities (the gini index, the percentage share of income or consumption held by the poorest 10%, the percentage share of income or consumption held by the poorest 20%, or the percentage share of income or consumption held by the highest 10%) 2) the per capita gross national product 3) the annual increase in GNP per capita averaged over the period 1970 to 1995   4) the total convicted for robbery /total prosecuted for robbery and 5) the rate of drug offenses (the total drug offenses per 100,000 inhabitants). Evidences of the following were found: 1) significant positive effects of the per capita gross national product   2) robbery inducing impact of income inequality   3) significant negative effects of the average annual increase in GNP per capita   4) significant negative effects of the probability of conviction   5) positive effects of the rate of drug offenses on the robbery rate.

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SECTION 1
THE UNITED NATIONS' SURVEYS ON CRIME
AND CRIMINAL JUSTICE SYSTEMS

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The United Nations' Survey of Crime Trends and Operations of Criminal Justice Systems started in 1977 and covered five-yearly intervals from 1970. Their most important sources of data are official national criminal statistics, including criminal justice statistics maintained in administrative records. The crimes that are included in the survey are homicide, assault, rape, robbery, theft, burglary, fraud, embezzlement, drug offenses and bribery. Transnational crimes, which emerged as leading issues of the 1990s, are not among them. They include illicit trafficking in arms, drugs, children, women, immigrants, body organs, cultural artifacts, flora and fauna, nuclear materials and automobiles; terrorism; bribery, corruption and fraud, and money laundering. According to the Center for International Crime Prevention, no systematic method of accounting for these crimes yet exists at the international level and few countries record them separately in their official statistics. It further states that:[2]

> " Transnational crimes are very complex crimes, composed of many smaller crimes. They are thus extremely difficult to count. . .
>
> Organized crime now operates on a vast, global level. For example, the theft of cars, which was once a traditional crime of concern only to a particular country, is now a transnational crime

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[2] Graeme Newman (Editor), Global Report on Crime and Justice, United Nations Office for Drug Control and Crime Prevention, Center for International Crime Prevention, Oxford University Press, New York, 1999.

because cars are stolen with a view for sale on the international illicit market.

The direction of illicit marketing is usually from the developing world to the developed world where demand is highest. The exception is luxury cars which, for example, are stolen in Western Europe and shipped to Eastern Europe and the Russian Federation.

Very often illicit trade is mixed in with the licit trade, producing significant grey areas where it is difficult to identify illicit activities."

SECTION 2
CAUSES OF CRIME

A. INDIVIDUAL'S CHARACTERISTICS

Causes of crime were sought in deviant factors and circumstances determining behaviour because crime was considered a deviant behaviour. Erlich (1973) wrote:[3]

"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 behaviour, its causes must be sought in deviant factors and circumstances determining behaviour. Criminal behaviour 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. (for an overview of the literature see, e.g., Taft and England [1964] "

A literature survey identifying factors that have a causal effect on the recorded levels of post-World War II recorded violent crime and domestic burglary and summary of quantifications of effects of significant explanatory variables on violent crimes can be found in Marris and Voltera Consulting (2000)[4]

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[3] Ehrlich, I. (1973), "Participation in Illegitimate Activities: A Theoretical and Empirical Investigation," Journal of Political Economy, 81(3): p.521. (See also Taft, D.R., and England, R.W., Jr., Criminology, 4th ed., New York: Macmillan, 1964.)

[4] Robin Marris and Volterra Consulting, "Survey of the Research on the Criminological and Economic Factors Influencing Crime Trends," December 2000, http://www.volterra.co.uk/docs/crimerlm.pdf

B. SOCIOLOGICAL ASPECTS

The classic sociological explanation of deviant criminality, that of Robert Merton (1949),[5] explicitly stated that it was caused by blocked opportunities and explicitly predicted that crime rates would tend to be higher in societies where opportunities were most unequal.

Deprivation Theory regards economic inequality as a source of violent crime. Relative deprivation can cause frustration and anger that unloads itself in violent crime.[6]

A review of literature on sociological aspects affecting the incidence of crime, namely: social capital and the involvement of peers in criminal activities can be found in Fajnzylber, Lederman, and Loayza (2000).[7]

1) SOCIAL CAPITAL

Putnam (1993)[8] defined social capital as "features of social organization, such as trust, norms, and networks, which can improve the efficiency of society in facilitating coordinated actions. Dilulio (1996)[9] argued that its depletion was possibly related to the prevalence of high crime rates in the U.S. As supportive evidence of its role, Freeman (1986)[10] found a strong relationship between church attendance and a lower probability of arrest for youth. Similarly,

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[5] Merton, R. (1949), Social Theory and Social Structure, Free Press, New York,

[6] Hagan, John & Ruth D. Peterson, eds., 1995. Crime and Inequality. Stanford, CA: Stanford University Press. See also Neumayer, Eric (May 2004), "Is Inequality really a Major Cause of Violent Crime? Evidence From a Cross- National Panel of Robbery and Violent Theft Rates," http://econwpa.wustl.edu:8089/eps/le/papers/0312/0312002.pdf

[7] Pablo Fajnzylber, Daniel Lederman, and Norman Loayza, "Crime and Victimization: an Economic Perspective", May 8, 2000, http://www.lacea.org/meeting2000/PabloFajnzylber.pdf . (Fajnzylber: Universidade Federal de Minas Gerais. Lederman: World Bank. Loayza: Central Bank of Chile and World Bank; This paper was prepared for presentation at the 1st Meeting of the Latin America Economic Policy Review, New York, May 12 and 13,2000.) See also Economica, 1,1,219-278, 2000.

See also Pablo Fajnzylber, Daniel Lederman and Norman Loayza, " What Causes Violent Crime?" European Economic Review, Volume 46, Issue 7, July 2002, Pages 1323-1357.

[8] Putnam, Robert D. (1993). Making Democracy Work: Civic Traditions in Modern Italy, Princeton, NJ: Princeton University Press.

[9] Dilulio, John J. Jr. (1996), "Help Wanted: Economists, Crime and Public Policy." Journal of Economic Perspectives 10: 3-24.

[10] Freeman, Richard. (1994). "Crime and the Job Market." National Bureau of Economic Research Working Paper 4910. Cambridge, Massachusetts.

Glaeser and Sacerdote (1999);[11] found that the percentage of female-headed households was responsible for almost 30% of the city-crime effect in the US. It was considered the most important observable characteristic of urban residents in the explanation of city crime rates thereat.

2) INVOLVEMENT OF PEERS IN CRIMINAL ACTIVITIES

Using a survey of Boston disadvantaged youths, Case and Katz (1991) found that an individual's propensity to commit crimes rose when his peers were also engaged in criminal activities.[12] This empirical finding was modeled by Glaeser, Sacerdote and Scheinkman (1996), who argued that both the cost of crime and the taste for it were determined by local social interaction between criminals, their peers and family members.[13]

C. ILLICIT DRUG USE AND PROPERTY CRIME PROBLEMS

Increase in involvement in property crime following commencement of regular drug use was found by Dobinson and Ward (1985, 1987)[14], Dobinson and Poletti (1988)[15], and by Kaye, Darke and Finlay-Jones (1998);[16]

Juveniles incarcerated for property crime who were heavy users of cannabis had high self-reported levels of involvement in shoplifting, motor vehicle theft and break and enter crimes,

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[11] Glaeser, Edward, and Bruce Sacerdote. (1999). "Why Is There More Crime in Cities?" Journal of Political Economy 107: S225-S258.

[12] Case, A.C. and L.F. Katz, (1991). "The Company You Keep: The Effects of Family and Neighborhood on Disadvantaged Youths." National Bureau of Economic Research Working Paper 3705. Cambridge, Massachusetts.

[13] Glaeser, Edward, Bruce Sacerdote, and Jose Scheinkman. (1996). "Crime and Social Interactions." Quarterly Journal of Economics 111: 507-548.

[14] Dobinson, I. & Ward, P. (1985), "Drugs and Crime: A Survey of NSW Prison Property Offenders 1984," NSW Bureau of Crime Statistics and Research, Sydney.

Dobinson, I. & Ward, P. (1987), "Drugs and Crime Phase II: A Study of Individuals Seeking Drug Treatment," NSW Bureau of Crime Statistics and Research, Sydney.

[15] Dobinson, I. & Poletti, T. (1988), "Buying and Selling Heroin," NSW Bureau of Crime Statistics and Research, Sydney.

[16] Kaye, S., Darke, S. & Finlay-Jones, R. (1998), 'The onset of heroin use and criminal behaviour: Does order make a difference?', Drug and Alcohol Dependence, vol. 53, pp. 79-86.

as found by Salmelainen (1995)[17]. She also found that they were more likely to cite 'money for drugs' as their reason for offending.

Injecting drug use has been identified as one of the principal risk factors for child neglect, a prominent risk factor for later involvement in crime (Weatherburn & Lind, 1997;[18] Widom, 1989;[19] Salmelainen, 1995; Smith & Thornberry, 1995[20]). Weatherburn and Lind estimate that every increase of 1,000 in the number of neglected children results in an additional 266 juveniles subsequently becoming involved in crime

Violence associated with illegal drugs also comes from competition among drug sellers and importers for control of illegal drug markets. Much of the violence, intimidation and corruption associated with illegal drugs stems from the market itself. Illicit drug dealers have no legal remedies open to them to enforce the payment of debts, to resolve disputes, or to counter employee dishonesty. Like other markets for illegal products and services, they are therefore frequently characterised by violence, bribery, intimidation and extortion (Kleiman, 1992).[21]

A review of literature on these problems can be found in Weatherburn, Topp, Midford and Allsopp (2000).[22]

D.   PARTICIPATION IN ILLEGAL ACTIVITIES AS A RATIONAL DECISION

Marris and Voltera Consulting (2000) noted that "the most significant development in Criminology during the past century has been the replacement of the perception of the criminal as a

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[17] Salmelainen, P. (1995), "The Correlates of Offending Frequency: A Study of Juvenile Theft Offenders in Detention," NSW Bureau of Crime Statistics and Research, Sydney.

[18] Weatherburn, D. & Lind, B. (1997), "The impact of Law Enforcement Activity on a Heroin Market", Addiction, vol. 92, no. 5, pp. 557-569.

[19] Widom, C. S. (1989), "Child abuse, neglect, and violent criminal behaviour", Criminology, vol. 27,

[20] Smith, C. & Thornberry, T.P. (1995), "The relationship between childhood maltreatment and adolescent involvement in delinquency", Criminology, vol. 33, no .4, pp. 451-481.

[21] Kleiman, M.A.R. (1992), Against Excess: Drug Policy for Results, Basic Books, New York.

[22] Don Weatherburn, Libby Topp, Richard Midford and Steve Allsopp (2000) "Drug Crime Prevention and Mitigation: A Literature Review and Research Agenda," Published by the NSW Bureau of Crime Statistics and Research, Attorney General's Department, Sydney, Australia, http://www.lawlink.nsw.gov.au/bocsar1.nsf/files/r49.pdf/$file/r49.pdf (Don Weatherburn, NSW Bureau of Crime Statistics and Research; Libby Topp, National Drug and Alcohol Research Centre, University of New South Wales, Richard Midford, National Drug Research Institute, Curtin University; Steve Allsopp, Centre for International Health, Curtin University, Next Step Specialist Drug and Alcohol Services, New South Wales Bureau of Crime Statistics and Research)

'deviant' with the idea that he or she is a 'rational' person, albeit with untypical circumstances or preferences." They trace the utilitarian basis of modern Criminology and Economics of Crime as follows:

> ". . ..in 1764, at the hands of Cesare Beccaria, the science of criminology was founded. Publishing his famous essay at the age of 26, Beccaria anticipated by more than 20 years the general outlook of Jeremy Bentham. He was probably the first person to suggest a link between crime and economic inequality and certainly the first to argue that principles of punishment should be based on deterrence rather than retribution.
>
> Bentham, as is fairly well known, saw criminal behaviour as merely the consequence of the 'pleasure principle', which today economists call 'expected utility maximization': a person committed a crime because it resulted in pleasure. 'If they differed from non-criminals, it was with respect to their location or comprehension of the relevant sanction systems'. Again, in modern language (of economics or of 'rational' criminology) criminals 'deviate' by having 'abnormal' preferences (utility functions).
>
> . . . once one is seized of the idea of the existence of a quantity of personal utility one is naturally led to employ it as a means of also explaining individual behaviour. Thus the picture of the reasoning criminal, first suggested by Becker, elaborated by his pupil Ehrlich and surveyed by Clarke and Cornish, implies that a 'rational' person will choose from among the actions open to them the subset which maximises their own utility. A person deciding whether or not to commit a crime will balance the expected gains if undetected against the risk of being detected and experiencing, instead of gain, a punishment." [23]

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[23] See Clarke, R. and Cornish, D. (1987), "Understanding Crime Displacement: an Application of Rational Choice Theory," Criminology, 23.

Becker, Gary. S. (1968). "Crime and Punishment: An Economic Approach." Journal of Political Economy 76: 169-217. Reprinted in Chicago Studies in Political Economy, edited by G.J. Stigler. Chicago and London: The University of Chicago Press, 1988.

Ehrlich, I. (1973), "Participation in Illegitimate Activities: A Theoretical and Empirical Investigation," Journal of Political Economy, 81(3): 521-65.

Ehrlich, I. (1996), "Crime, Punishment and the Market for Offences", Journal of Economic Perspectives, 10: 23-67.

In his Nobel lecture, Becker stated that the economic way of looking at human behavior is a "method of analysis, not an assumption about particular motivations, . . .which assumes that individuals maximize welfare as they conceive it. . ." Regarding crime, he writes that "rationality implies that some individuals become criminals because of the financial and other rewards from crime compared to legal work, taking account of the likelihood of apprehension and conviction, and severity of punishment."[24]

In Erlich's one-period uncertainty model of optimal participation in illegitimate market activities, he assumed that:

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 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

$1 - P_i$ = 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 nonmarket 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)

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[24] Becker, Gary S. (1993), "Nobel Lecture: The Economic Way of Looking at Behavior." Journal of Political Economy 101: 385-409.

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,

$$X_a = W' + W_i(t_i) - F_i(t_i) + W_l(t_l)$$ (3.1)

is obtained with probability P_i and

$$X_b = W' + W_i(t_i) + W_l(t_l)$$ (3.2)

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

$$E[U(X_s, t_c)] = (1 - P_i)U(X_b, t_c) + P_i U(X_a, t_c)$$ (3.3)

Subject to the wealth constraints given by equations (3.1) and (3.2), a time constraint,

$$t_o = t_i + t_l + t_c$$ (3.4)

and nonnegativity requirements,

$$t_j \geq 0, \quad j = i, l, c$$ (3.5)

The following are behavioral implications of this 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, $P_i f_i$.

2. If an offender had a neutral attitude toward risk and was only interested in the expected value of his wealth prospect, the magnitude of his response to a 1% increase in either P_i or f_i would be the same, for equal percentage changes in each of these variables have the same effect on $P_i f_i$. The deterrent effect of an increase in the marginal or average penalty per offense can be shown to exceed or fall short of that of a similar increase in the probability of apprehension and punishment if the offender is a risk avoider or a risk preferrer, respectively. Moreover, 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. This result is not inconsistent with an assertion often made by writers on criminal behaviour regarding the low, or even the positive effect of punishment on the criminal propensities of some offenders.

3.   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.

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SECTION 3
INTERCOUNTRY EVIDENCE
FOR 1997

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A. THE DATA

The data on per capita gross national product, gini index and distribution of income or consumption were obtained from the World Development Indicators and World Resources 2000-2001.[25]

The total recorded per capita robberies, the total drug offenses per capita, grand total of recorded per capita crimes, number of prosecuted and convicted persons due to robbery were obtained from the Sixth United Nations Survey of Crime Trends and Operations of Criminal Justice Systems, which covered the years 1995 to 1997. Underreporting of crime is a problem. Soares found that it was negatively correlated with the level of development.[26] Fajnzylber, Lederman, and Loayza (2000) noted that it was most pronounced for low-value property crime (e.g., common theft) and for crimes carrying a social stigma for the victim (e.g., rape) and that robberies were more likely to be reported than other property crimes given that robberies include a violent component, thus giving victims an additional reason to report the crime.

B. ECONOMETRIC METHODOLOGY

The ordinary least squares procedure was used in estimating the regression equations. The empirical counterpart in this paper of Erlich's theoretical construct is as follows:

THEORETICAL CONSTRUCT	EMPIRICAL COUNTERPART
$Q/N)_i$, the crime rate of category i	The number of total recorded robberies per 100,000 inhabitants (The robbery rate)
P_i, the average offender's subjective probability that he will be apprehended and punished for his engagement in crime category i	The total convicted for robbery /total prosecuted for robbery

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[25] The World Development Indicators and the World Resources 2000-2001 were published by the World Bank and the World Resources Institute, Washington D.C., respectively.

[26] Soares, Rodrigo Reis. 1999. "Development, Crime and Punishment: Accounting for the International Differences in Crime Rates." Mimeo. University of Chicago.

THEORETICAL CONSTRUCT	EMPIRICAL COUNTERPART
Y_i, the average potential illegal payoff	Per capita gross national product
Y_i-Y_l, the differential return from crime	The gini index, the percentage share of income or consumption held by the poorest 10% , the percentage share of income or consumption held by the poorest 20%, or the percentage share of income or consumption held by the highest 10%

C. RESULTS

In the model, the robbery rate (the total recorded robberies per 100,000 inhabitants) is the dependent variable and the following are the explanatory variables : 1) measures of income disparities (the gini index, the percentage share of income or consumption held by the poorest 10%, the percentage share of income or consumption held by the poorest 20%, or the percentage share of income or consumption held by the highest 10%) 2) the per capita gross national product 3) the annual increase in GNP per capita averaged over the period 1970 to 1995   4) the total convicted for robbery /total prosecuted for robbery and 5) the rate of drug offenses (the total drug offenses per 100,000 inhabitants).

The estimated regression equations are presented in tables 1-3. The scatterdiagrams indicate that the functional form should have the reciprocals of per capita gross national product, the total convicted for robbery /total prosecuted for robbery and the rate of drug offenses in lieu of them. Their relationships with the robbery rate are non-linear.

1) BASIC ECONOMIC DETERMINANTS

Of the 15 countries in tables 1 and 2, 2 were low income, 6 were middle income and 7 were high income, 6 of which were industrialized. Of the 26 countries in these tables, 4 were low income, 10 were middle income and 12 were high income, 9 of which were industrialized. One country from Sub-Saharan Africa is among all of them.

In equations 1-4, the coefficients of the gini index are positive and significant. These are consistent with the finding of Fajnzylber, Lederman and Loayza (2000)[27]. Analyzing the determinants of national crime rates across countries covering the period 1970 to 1994 in a sample of 45 countries for homicides and 34 countries for robberies, they found income inequality as measured by the gini index a significant positive determinant of national robbery and homicide

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[27] Pablo Fajnzylber, Daniel Lederman, and Norman Loayza, "Crime and Victimization: an Economic Perspective", May 8, 2000.

TABLE 1
OLS REGRESSION ESTIMATES*

DEPENDENT VARIABLE: RBP97, THE TOTAL RECORDED ROBBERIES PER 100,000 INHABITANTS IN 1997

		pgnp	gpgnp	DRGP97	SHH10		P		n	R²	F / p
1	coefficients	-97.7572	-56,468.8400	6.0802		-9.6198	7.1802		15	0.7639	8.0900
	t statistics	-1.4359	-3.0983	3.2440		-1.8506	2.6647				
	p values	0.1816	0.0113	0.0088		0.0940	0.0237				0.0035
2	coefficients	-124.6551	-84,870.0700	6.7313		-13.7741	7.3084	272.3332	15	0.8212	12.9000
	t statistics	-1.9346	-3.5880	3.8206		-2.5697	2.9550	1.6975			
	p values	0.0850	0.0059	0.0041		0.0302	0.0161	0.1238			0.0000
3	coefficients	-120.3291	-53,592.4700	6.0294			7.0346	47.0855	26	0.6405	9.3519
	t statistics	-2.6573	-3.0793	4.2920			2.9819	0.4075			
	p values	0.0147	0.0057	0.0003			0.0071	0.6878			0.0002
4	coefficients	-115.7835	-49,680.1600	5.9361			7.0481		26	0.6376	12.9029
	t statistics	-2.6897	-3.4892	4.3665			3.0462				
	p values	0.0134	0.0021	0.0002			0.0059				0.0000
5	coefficients	-127.6640	-60,588.7400		8.7307	-9.0091	7.2268		15	0.7752	8.6212
	t statistics	-1.7395	-3.3467		3.3995	-1.7847	2.7502				
	p values	0.1126	0.0074		0.0068	0.1081	0.0205				0.0028
6	coefficients	-145.2960	-83,868.5400		9.2340	-12.5162	7.3586	225.5312	15	0.8156	7.9596
	t statistics	-2.0410	-3.5007		3.7261	-2.2849	2.9309	1.4034			
	p values	0.0716	0.0067		0.0047	0.0482	0.0167	0.1940			0.0040
7	coefficients	-156.3767	-53,936.6900		9.0667		6.9270		26	0.6683	14.7785
	t statistics	-3.2885	-3.8866		4.7821		3.1271				
	p values	0.0034	0.0008		0.0001		0.0049				0.0000
8	coefficients	-157.5963	-55,189.8500		9.0932		6.9250	15.5512	26	0.6686	10.5937
	t statistics	-3.1896	-3.2978		4.6663		3.0558	0.1414			
	p values	0.0044	0.0034		0.0001		0.0060	0.8889			0.0001

* pgnp = GNP per capita, the gross national product converted to US dollars and divided by the population.
  gpgnp = the annual increase in GNP per capita averaged over the period 1970 to 1985.
  P = total convicted for robbery/total prosecuted for robbery
  DRGP97 = total recorded drug offenses per 100,000 inhabitants in 1997
  SHH10 = percentage share of income or consumption held by the highest 10%
  n = sample size

TABLE 2
OLS REGRESSION ESTIMATES*

DEPENDENT VARIABLE: RBP97, THE TOTAL RECORDED ROBBERIES PER 100,000 INHABITANTS IN 1997

#									n	R²	F
9	coefficients	258.7345	-52,059.2900	-44.5820		-11.9976	6.4897		15	0.6793	5.2942
	t statistics	3.5367	-2.4698	-2.2600		-2.0143	2.0327				
	p values	0.0054	0.0331	0.0474		0.0717	0.0695				0.0149
10	coefficients	288.6593	-86,292.5900	-55.0891		-17.1133	6.3975	322.1329	15	0.7542	5.5233
	t statistics	4.1309	-3.0410	-2.8585		-2.7146	2.1713	1.6568			
	p values	0.0026	0.0140	0.0188		0.0238	0.0580	0.1320			0.0134
11	coefficients	199.6315	-41,472.6400	-37.7049			6.9176		26	0.5084	7.5851
	t statistics	3.8870	-2.5539	-2.8765			2.5460				
	p values	0.0008	0.0181	0.0088			0.0184				0.0012
12	coefficients	202.2471	-46,116.7300	-38.9759			6.8782	55.0458	26	0.5122	5.5130
	t statistics	3.8330	-2.2869	-2.8386			2.4813	0.4035			
	p values	0.0010	0.0327	0.0098			0.0216	0.6907			0.0034
13	coefficients	289.6382	-53,204.4800		-22.9222	-11.2048	6.9827		15	0.7089	6.0877
	t statistics	3.8080	-2.6472		-2.5779	-1.9658	2.3250				
	p values	0.0034	0.0244		0.0275	0.0777	0.0424				0.0095
14	coefficients	320.9798	-87,230.5000		-27.5953	-16.1735	7.0365	321.2462	15	0.7845	6.5521
	t statistics	4.5080	-3.2994		-3.2532	-2.7518	2.5831	1.7768			
	p values	0.0015	0.0092		0.0099	0.0224	0.0295	0.1093			0.0078
15	coefficients	232.3189	-43,939.7300		-19.6680		7.2066		26	0.5458	8.8125
	t statistics	4.2290	-2.7962		-3.2810		2.7805				
	p values	0.0003	0.0105		0.0034		0.0109				0.0005
16	coefficients	235.6554	-49,054.7200		-20.3104		7.1788	60.4129	26	0.5504	8.4265
	t statistics	4.1777	-2.5209		-3.2440		2.7191	0.4620			
	p values	0.0004	0.0199		0.0039		0.0129	0.6488			0.0015

* pgnp = GNP per capita, the gross national product converted to US dollars and divided by the population.
 gpgnp = the annual increase in GNP per capita averaged over the period 1970 to 1995.
 P = total convicted for robbery/total prosecuted for robbery
 DRGP97 = total recorded drug offenses per 100,000 inhabitants in 1997
 SHLOW10 = percentage share of income or consumption held by the poorest 10%
 SHLOW20 = percentage share of income or consumption held by the poorest 20%
 SHH10 = percentage share of income or consumption held by the highest 10%
 n = sample size

TABLE 3
OLS REGRESSION ESTIMATES*

DEPENDENT VARIABLE: RBP97, THE TOTAL RECORDED ROBBERIES PER 100,000 INHABITANTS IN 1997						
No.		Constant		DRGP97	n	R²	T
17**	coefficien	78.6770		-156.5369	44	0.0723	3.4307
	t statistic:	5.9395		-1.8522			
	p values	0.0000		0.0707			0.0707
18	coefficien	73.6603		-138.8032	60	0.0477	2.9034
	t statistic:	6.5881		-1.7039			
	p values	0.0000		0.0937			0.0937

DEPENDENT VARIABLE: ln RBP97, THE NATURAL LOGARITHM OF RBP97						
No.		Constant	lnDRGP97		n	R²	F
19**	coefficien	1.6282	0.5552		44	0.1399	7.1591
	t statistic:	2.4252	2.6757				
	p values	0.0195	0.0104				0.0104
20	coefficien	2.4043	0.2621		60	0.0656	4.0700
	t statistic:	4.6651	2.0174				
	p values	0.0000	0.0483				0.0483

*DRGP97 = total recorded drug offenses per 100,000 inhabitants in 1997
n = sample size

**For countries whose DRUGP97 was less than its mean, which was equal to 103.7113 per 100,000 inhabitants

rates and cited the observation in Neapolitan (1997)[28] and LaFree (1999)[29] "to the effect that the most robust finding in cross-national crime research has been the positive relationship between income inequality and homicides.

The alternative measures of income disparities also had significant impacts on the robbery rate. The coefficients of the percentage share of income or consumption held by the highest 10% are positive and significant in equations 5-8. Consistent results can be found in equations 9-12 and 13-16 where the coefficients of the percentage share of income or consumption held by the poorest 10% and the percentage share of income or consumption held by the poorest 20%, respectively, are negative and significant. Fleisher (1966)[30] and Erlich (1973), pioneers in studying the effects of income levels and income disparities on the incidence of crime, found significant crime-inducing impact of income inequality. Erlich's interpretation of this result is that greater income inequality is an indication of a larger absolute differential between payoffs from legal and illegal activities.[31]

The coefficients of the reciprocal of per capita gross national product are negative and significant, implying positive effects of the per capita gross national product on the robbery rate. These are consistent with the finding of significant positive effects of income on violent crimes of Carr-Hill and Stern (1973), Erlich (1973), Witt et al (1998) Danziger and Wheeler (1975), Cohen(1980), Harries (1999) and Field (1990)[32] which were reviewed by Marris and Volterra

[28] Neapolitan, Jerome L. (1997). Cross-National Crime: A Research Review and Sourcebook. Westport, Connecticut: Greenwood Press.

[29] LaFree, Gary. (1999). "A Summary and Review of Cross-National Comparative Studies of Homicide." In M. Dwayne Smith and Margaret A. Zahn, eds., Homicide: A Sourcebook of Social Research. Thousand Oaks, CA: Sage Publications.

[30] Fleisher, Belton M. (1966). "The Effect of Income on Delinquency," American Economic Review 56: 118-137.

[31] See also Chiu, W. Henry, & Paul Madden, 1998. "Burglary and Income Inequality," Journal of Public Economics 69(1): 123-141.

Ehrlich, I. (1973), "Participation in Illegitimate Activities: A Theoretical and Empirical Investigation," Journal of Political Economy, 81(3): 521-65.

Kelly, Morgan, 2000. "Inequality and Crime," Review of Economics and Statistics 82(4): 530-539.

Soares, Rodrigo Reis, 2002. "Development, Crime, and Punishment: Accounting for the International Differences in Crime Rates," manuscript, Chicago, IL: University of Chicago, http://www.wam.umd.edu/~soares/academic.htm.

[32] Carr-hill, R. and Stern, N. (1973), "An Econometric Model of the Supply and Control of Recorded Offences," Journal of Public Economics, 2:289-318.

Cohen, J. et al (1980), "Property Crime-Rates in theUnited States: a Macro-Dynamic Analysis," 1927-1977; with ex ante forecasts for mid-1980s, American Journal of Sociology, 86 (1): 90-118.

Danziger, S and Wheeler, D. (1975), "The Economics of Crime: Punishment or Income Redistribution," Review of Social Economy, 33: 113-

Consulting (2000). In its Global Report on Crime and Justice, the Center for International Crime Prevention noted that "the prevalence of both property crime and violent crimes is related to problems of economic hardship among the young no matter what region and that where more people are economically deprived, crime rates are higher."[33] A negative effect from city average family income on young males arrest rates was found by Fleisher (1966), who argued that the ambiguity of the effect on crime of higher levels of income is due to the correlation of income with both the opportunity cost and the expected payoff from crime.

The coefficients of the annual increase in GNP per capita averaged over the period 1970 to 1995 are negative. They are significant at the 5% level for samples of 15 countries in equations 2, 6, 10 and 14. These are consistent with the finding of Fajnzylber, Lederman and Loayza (2000). Using the GDP growth rate as proxy for employment and economic opportunities in general, they found that economic growth had a crime-reducing effect and that stagnant economic activity induced heightened criminal activity. Examining empirical evidence on the relationship between inequality, poverty and crime, Bourguignon (1999)[34] noted the "apparent evidence that strong economic recessions are generally accompanied by significant increases in crime which often prove irreversible at the time the economy goes back to its long-run growth path. Macro-economic volatility at the same time as inequality could thus be a cause for high criminality."

2) **DETERRENCE**

Sufficient data on the severity of punishment are not available. The total convicted for robbery /total prosecuted for robbery is used in this paper as proxy for the subjective probability of being apprehended and punished for participation in robbery. In all of the estimated regression equations in tables 1 and 2, the coefficients of the reciprocal of this variable are positive. With the exception of those in equations 9 and 10, which are significant only at the 6.95% and 5.8% levels, respectively, they are significant at the 5% level, implying a negative effect of the total convicted for robbery /total prosecuted for robbery on the robbery rate. These are evidences of a deterrent effect on robbery of the probability of being apprehended and punished.

Field, S. (1990), "Trends in Crime and Their Interpretation: a Study of Recorded Crime in England and Wales," Research Study No. 119, London, HM Stationary Office

Harries, R. (1999), "Modelling and Predicting Property Crime Trends," Research Study No. 198, London, Home Office.

Witt, R. et al (1998), "Crime, Earnings Inequality and Unemployment in England and Wales," Applied Economics Letters, 3: 263-267.

[33] Graeme Newman (Editor), Global Report on Crime and Justice, United Nations Office for Drug Control and Crime Prevention, Center for International Crime Prevention.

[34] Bourguignon, François, "Crime, Violence and Inequitable Development," http://www.worldbank.org/research/abcde/washington_11/pdfs/bourg.pdf, Paper prepared for the Annual World Bank Conference on Development Economics, Washington, D.C., April 28-30, 1999.

Erlich (1973) found that rates of specific crime categories varied inversely with estimates of the probability of apprehension and punishment by imprisonment (measured by the number of offenders imprisoned per offenses known to have occurred) and with the average cost of punishment (measured by the average time actually served by offenders in prison). Levitt found significant effects on crime of the following measures of deterrence: size of prison population, the number of police per capita and conviction rates.[35] Perceptual deterrence studies have found that self-reported criminality was lower among people who perceived the sanction risks as higher (eg Grasmick & Bursik, 1990;[36] Paternoster & Simpson, 1997).[37] Significant negative effects of measures of deterrence on crime are cited in the Summary of Quantifications of Marris and Volterra Consulting (2000). Among them are those of Carr-Hill (1973), Witt and Reilly (1996), Marvell and Moody (1996) and Danziger and Wheeler (1975).[38]

Fajnzylber, Lederman and Loayza (2000) found significant negative effects of both the police presence and the death penalty, their proxies for deterrence, on the homicide rate. They found that the death penalty had no significant effect on robbery but the number of police relative to the size of the population had a positive and significant effect on this crime.

The probability of apprehension may be perceived as low by individuals living in areas with high crime rates because the resources spent in apprehending each criminal tend to be low, as argued by Sah (1991)[39] In such event, an increase in the probability of apprehension and punishment due to the high crime rate can lead to a higher crime rate because of the low perception of the probability of apprehension. Erlich (1973) noted that in a riot, for example, the probability of apprehension of individual rioters, as well as of offenders committing other crimes, decreases considerably below its normal level due to the excessive load on local police units. According to him, this is a source of external economies in criminal activity. Weatherburn, Topp, Midford and

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[35] Levitt, Steven. (1996). "The effect of Prison Population Size on Crime Rates: Evidence from Prison Overcrowding Litigation." Quarterly Journal of Economics 111: 319-352.

Levitt, Steven. (1997). "Using Electoral Cycles in Police Hiring to Estimate the Effect of Police on Crime." American Economic Review 87: 270-290.

Levitt, Steven. (1998). "Why Do Increased Arrest Rates Appear to Reduce Crime: Deterrence, Incapacitation, or Measurement Error?" Economic Inquiry 36: 353-372.

[36] Grasmick, H.G. & Bursik, R.J. Jr 1990, "Conscience, significant others and rational choice: Extending the deterrence model", Law and Society Review, vol. 24, pp. 837-861.

[37] Paternoster, R. & Simpson, S. (1997), "Sanction threats and appeals to morality: Testing a rational choice theory of corporate crime", Law and Society Review, vol. 30, pp. 549-584.

[38] Witt, R. and Reilly, B. (1996), "Crime, Deterrence and Unemployment in England and Wales," Bulletin of Economic Research, 28 137-9.

MarvelL, T. and Moody, C. (1996), "Specification Problems, Police Levels and Crime Rates," Criminology, 32: 609-638.

[39] Sah, Raj. (1991). "Social Osmosis and Patterns of Crime." Journal of Political Economy 99: 1272-1295.

Allsop (2000) noted the suggestion of some studies that short and long term effects of formal sanctions differ because their deterrent effect arises principally from the social stigma caused by their imposition. Fear of stigma depends on punishment's being a rare event. A criminal record cannot be socially isolating if it is commonplace. Policies which are effective in the short term may erode the foundation of their deterrent effect over the long term if they increase the proportion of the population affected by this stigmatisation.

A possible interaction between severity and certainty of punishment was pointed out by Ross and La Free (1986)[40]. Where the likelihood of punishment is very low, the potential offender discounts the risk of even more severe penalties as negligible. When charges attract harsher penalties, defendants fight them more aggressively, prosecutors are more willing to plea bargain, and judges and jurors are less willing to convict (Ross, 1976).[41] Weatherburn, Topp, Midford and Allsopp (2000) stated that "When this occurs, we cannot expect formal changes in sanction severity to exert any deterrent effect. Furthermore, even if formal changes in sanction severity or increases in sanction certainty do have an impact on actual sanction severity or certainty, we cannot expect a deterrent effect unless these changes produce an increase in *perceived* sanction severity or certainty."
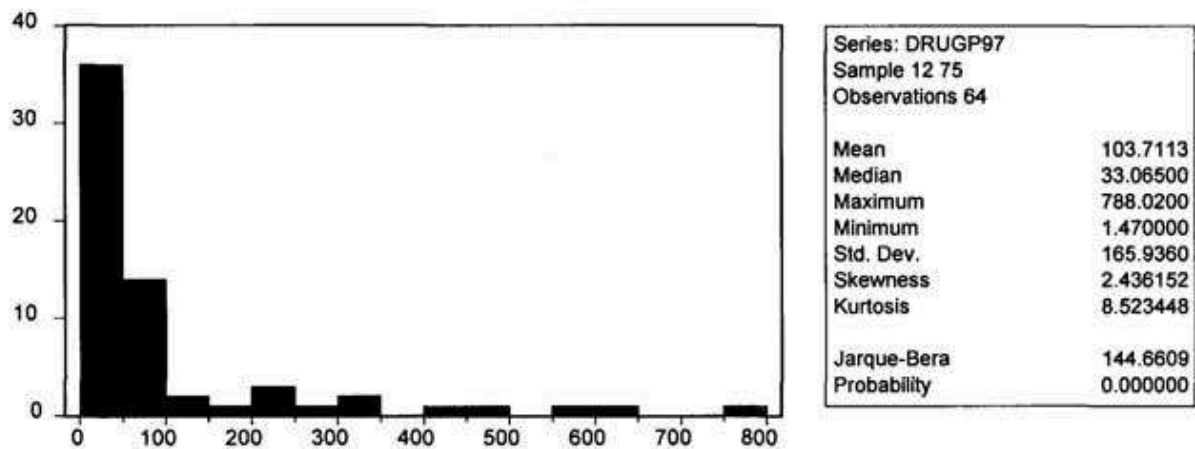
3. DRUG OFFENSES

In the United Nations' Survey of Crime Trends and Operations of Criminal Justice Systems, drug crimes "refer to intentional acts that may involve cultivation, production, manufacture, extraction, preparation, possession, offering for sale, distribution, purchase, sale, delivery on any terms whatsoever, brokerage, dispatch, dispatch in transit, transport, importation and exportation of drugs and psychotropic substances. Some countries may wish to refer to the provisions of the Single Convention on Narcotic Drugs of 1961 and other regulations adopted in pursuance of the provisions under the Convention on Psychotropic Substances of 1971." Based on the sixth of these surveys, the distribution of the total recorded drug offenses per 100,000 inhabitants of 64 countries for which data were available in 1997 is as shown in figure 4. They had a mean of 103.7 and ranged from a minimum of 1.47 to a maximum of 788.

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[40] Ross, H.L. & La Free, G.D. (1986), "Deterrence in criminology and social policy", in Behavioural and Social Science: Fifty Years of Discovery, eds N.J. Smelser & D.R. Gerstein, National Academy Press, Washington, D.C, pp. 129-152.

[41] Ross, H.L. (1976), "The neutralisation of severe penalties: Some traffic law studies", Law and Society Review, vol. 10, pp. 403-413.
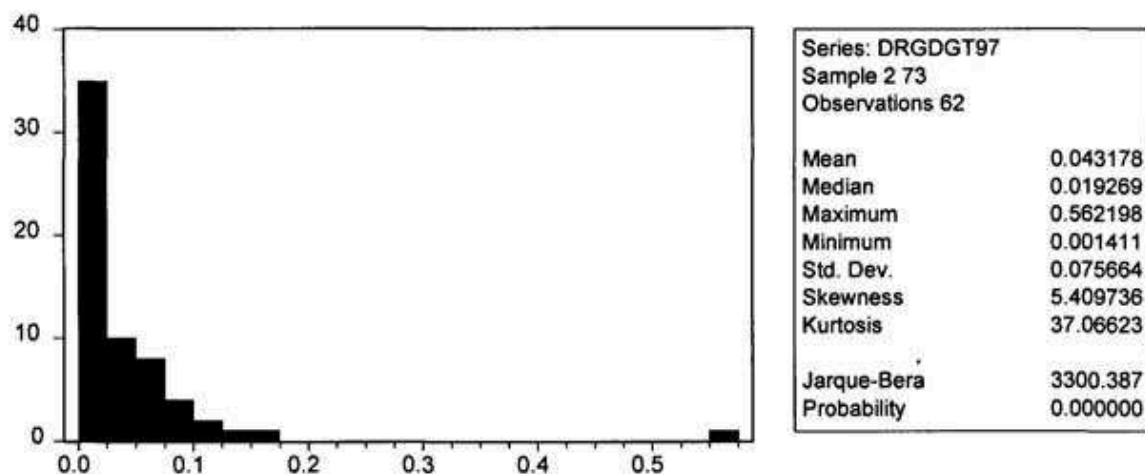
Figure 4
TOTAL RECORDED DRUG OFFENSES PER 100,000 INHABITANTS

Series: DRUGP97	
Sample 12 75	
Observations 64	
Mean	103.7113
Median	33.06500
Maximum	788.0200
Minimum	1.470000
Std. Dev.	165.9360
Skewness	2.436152
Kurtosis	8.523448
Jarque-Bera	144.6609
Probability	0.000000

(DRUGP97 = Total recorded drug offenses per 100,000 inhabitants in 1997)

The frequency distribution of the total recorded drug offenses/the grand total of recorded crimes in 62 countries for which data are available for 1997 is shown in figure 5. On the average, recorded drug offenses were then 4.32 % of the grand total of recorded crimes in these countries. They ranged from a minimum of 0.14% to a maximum of 56.22 % of the grand total of recorded crimes

Figure 5
TOTAL RECORDED DRUG OFFENSES/ GRAND TOTAL OF RECORDED CRIMES

Series: DRGDGT97	
Sample 2 73	
Observations 62	
Mean	0.043178
Median	0.019269
Maximum	0.562198
Minimum	0.001411
Std. Dev.	0.075664
Skewness	5.409736
Kurtosis	37.06623
Jarque-Bera	3300.387
Probability	0.000000

(Drgdgt97= Total recorded drug offenses/grand total of recorded crimes in 1997)

Since the existence of profitable criminal "industries" is an important incentive to commit crimes, Fajnzylber, Lederman and Loayza (2000) focused on one of them, the illegal drug trade, as

a determinant of crime. Analyzing determinants of national crime rates they found significant positive effects of drug production and drug possession on homicide and negative significant effects of the same drug related activities on robbery. Their explanation for this is that homicide can be considered a byproduct of illegal drug activities while robberies may compete for resources with those activities, contradicting the view that the existence of networks of producers and distributors of illegal drugs generates an externality that favors the growth of other criminal activities.

The coefficients of the reciprocal of the rate of drug offenses (the total drug offenses per per 100,000 inhabitants) are not significant for the 15 and the 26 countries which are included in Tables 1 and 2. For different samples of 44 and 60 countries in equations 17 and 18, respectively, the coefficients of the reciprocal of the rate of drug offenses are negative, with p values equal to 0.0707 and 0.0937, respectively. For the same samples, the elasticities of the robbery rate with respect to the rate of drug offenses are positive and significant at the 5% level, as shown in equations 19 and 20. Illegal drug activities could have favored participation in robberies.

These results differ from those of Fajnzylber, Lederman and Loayza (2000) whose work covered the period 1970 to 1994 for about 45 countries for homicides and 34 countries for robberies. 16 (35.5%) of the 45 countries in the homicide regressions and 14 (41%) out of 34 in the robbery regressions belonged to industrialized countries. These samples exclude countries from Sub-Saharan Africa. Cross section data were used in this paper. Countries from Sub-Saharan Africa and smaller percentages of industrialized countries are included in the samples in equations 17-20.

Equations 17 and 19 are for countries whose total recorded drug offenses per 100,000 inhabitants was less than its mean, which was equal to 103.7113. Of the 44 countries in these samples, 8 (18%) were industrialized and 3 (7%) were from Sub-Saharan Africa. 7 (15.9%) of them were low income, 27 (61.4%) were middle income and 10 (22.7%) were high income.

Equations 18 and 20 are for the 60 countries for which data were available. 14 (23%) of them were industrialized and 5 (8%) were from Sub-Saharan Africa. 8 (13.33%) of these countries were low income, 29 (48.33 %) were middle income and 23 (38.33%) were high income.

CONCLUSION

The intercountry examination in this paper of differences in effects of economic incentives and deterrence on national robbery rates using cross section data for 1997 showed significant negative effects of the total convicted for robbery /total prosecuted for robbery, a proxy for the probability of being apprehended and punished due to this crime. The finding of an inducing impact of income inequality is consistent with that of Fajnzylber , Lederman, and Loayza, (2000) who analyzed social and economic determinants of robbery and homicide rates (at national levels) in samples of countries using a generalized method of moments (GMM) estimator applied to dynamic models of panel data covering the period 1970-1994. These results are in accordance with Erlich's theory that an increase in the probability of being apprehended and punished has a deterrent effect on offenders and that offenders, as a group, respond to incentives in much the same way that those who engage in strictly legitimate activities do as a group. The decision to participate in crimes involving material gains as an occupational choice is deemed consistent with evidence of positive association between income inequality and the rate of crimes against property.

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