Determinants of crime rates: Crime Deterrence and Growth in post-liberalized India

Mousumi Dutta and Zakir Husain

Economics Departmet, Presidency College, Calcutta, Institute of Development Studies Kolkata

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DETERMINANTS OF CRIME RATES
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Mousumi Dutta
Reader, Economics Department, Presidency College,
86/1 College Street, Kolkata 700 073, India.
Tel: (9133) 22852261/(91)9830627937. Fax: (9133) 24481364
Email: dmousumi@hotmail.com

Zakir Husain
Associate Professor, Economics, Institute of Development Studies Kolkata
Email: dzhusain@gmail.com

Abstract

Becker's analysis of crime and punishment has initiated a series of theoretical and empirical works investigating the determinants of crime. However, there is a dearth of literature in the context of developing countries. This paper is an attempt to address this deficiency. The paper investigates the relative impact of deterrence variables (load on police force, arrest rates, charge sheet rates, conviction rates and quick disposal of cases) and socio-economic variables (economic growth, poverty,, urbanization and education) on crime rates in India. State-level data is collected on the above variables for the period 1999 to 2005.Zellner's SURE model is used to estimate the model. Subsequently, this is extended by introducing endogeneity. The results show that both deterrence and socio-economic factors are important in explaining crime rates. However, some of their effects are different from that observed in studies for developed countries.

Keywords: Crime, Deterrence, Growth, India, SURE Model.

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BIOGRAPHICAL SKETCH

Mousumi Dutta (Husain):

Mousumi Dutta (Husain) is a Post Graduate in Economics from Calcutta University, specializing in econometrics. Sections from her doctoral thesis on built heritage of Calcutta were published in Journal of Cultural of Cultural Heritage, Tourism Management and Indian Economic Review. She is currently working on gender and health related issues.

Zakir Husain:

Zakir Husain has worked extensively on social issues relating to the concern of under-privileged sections like minority communities and women. He has published in journals like Environment & Development Economics, Ecological Economics, Sustainable Development. He has served as Senior Consultant in the Prime Minister's High Level Committee and is currently also Member, State Planning Board.

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1. Introduction

Crime degrades quality of life in many ways. It limits movement, thereby impeding access to possible employment and educational opportunities; it also discourages the accumulation of assets. As crime makes people risk averse, it retards entrepreneurial and other economic activity. Crime is also more 'expensive' for poor people in poor countries, as it (particularly violent crimes) can lead to medical costs and loss of productivity that poor people in developing countries are ill equipped to bear (UN, 2005). From a macro perspective, crime undermines the ability of the state to promote development.[1] High crime rates can drive out foreign and domestic investment[2] as well as skilled or high productive labor. Further, certain industries, like tourism, are especially sensitive to crime rates.

Controlling crime rates, therefore, is particularly important in developing countries like India where large sums are spent on establishing and maintaining the police force and judicial system. Such intervention will be effective only if they are based on an understanding of crime and the factors determining crime rates. Consequently research that identifies determinants of criminal behavior and explores the relationships existing between criminal activity and different socio economic variables has substantial policy relevance.

Initial theories of crime emphasized on the effect of poverty and social deprivation on crime rates (Shaw and McKay, 1942, Clowrad and Ohlin, 1960, Merton, 1968). Fleisher

(1963, 1966) pioneered the study of criminal behavior among economists. He argued that crime rates are positively associated with unemployment and low income levels. Ehrlich (1973), too, showed that low income levels led to high crime rates.

Becker (1968), however, argued that a criminal should be viewed, not as a helpless victim of social oppression, but a rational economic agent. Like any other people, the potential criminal weighs costs/risks and benefits when deciding whether or not to commit crime:

> "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 the severity of punishment" (Becker, 1968: 176).

Among other important issues examined were the effects of police presence, convictions, and the severity of punishment on the level of criminal activity (Becker, 1968, Ehrlich, 1973, 1975, 1996). This led to the development of deterrence theory, arguing that potential crimes evaluate both the risk of being caught and the associated punishment. The empirical evidence from developed countries confirmed that both factors have a negative effect on crime rates.

Following these theories, a substantial body of empirical literature has originated in developed countries, attempting to identify determinants of crime. Similar studies have rarely been undertaken in developing countries. In fact this paper is possibly the first attempt to undertake a rigorous econometric analysis of determinants of crime in India.

The objective of this paper is to examine the impact of deterrence and socio-economic variables on crime rates in Indian states after the economic liberalisation of the 1990s. In particular, we seek to verify whether the theories of crime originating in developed countries are relevant in developing countries.

The paper is arranged as follows. Section 2 presents some statistics on crime rates in India. This is followed by a discussion of the methodology in Section 3. We clarify the basis for selecting the variables used in the analysis and the nature of hypothesized relation of these variables with crime rates. This is followed by a justification of the econometric method. Section 4 presents the results, and extends the basic model by incorporating endogeneity. The paper concludes by discussing the implications of the findings.

3. Data Sources and Methodology

3.1 Crime in India

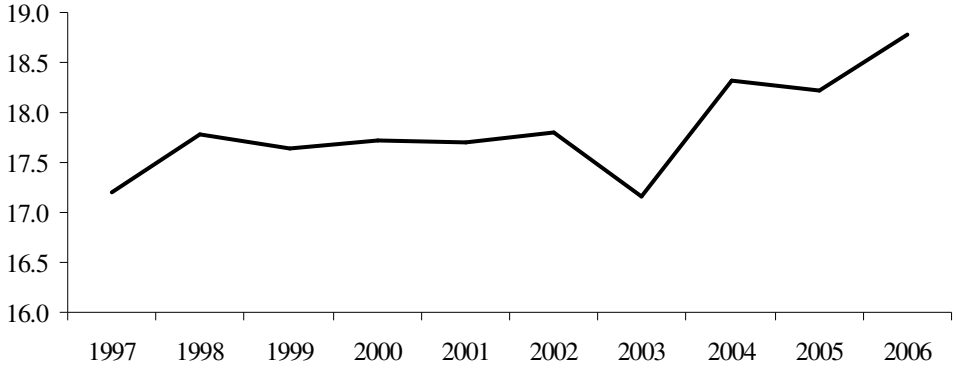
In India, the Criminal Procedure Code divides crimes into two heads: cognizable and non-cognizable. In the case of cognizable crimes, the police has the responsibility to take prompt action on receipt of a complaint or of credible information. This action constitutes visiting the scene of crime, investigating the facts, apprehending the offender and producing the offending persons before the appropriate court of law. Cognizable crimes are again sub-divided as those falling under either the Indian Penal Code (IPC), or under the Special and Local Laws (SLL).[3] Non-cognizable crimes, on the other hand, are left to

be pursued by the affected parties themselves in Courts. The police force initiates investigation into such crimes except with magisterial permission.

Following literature, this paper considers only IPC crimes. The reason is that the motivations and enforcement mechanism for SLL crimes are different from that of IPC crimes. In India statistics on crime are published annually by the National Crime Records Bureau, under the Ministry of Home Affairs. State-wise data is available on number of different crimes committed, enforcement mechanism and judicial institutions in a standardized format.

An analysis of the trend in crime rate over the study period reveals an overall increasing trend, with a sharp decrease in 2003 (Fig. 1). The rate of increase however is modest – 9.2% between 1997 and 2006. This represents an annual increase of only 0.9%.

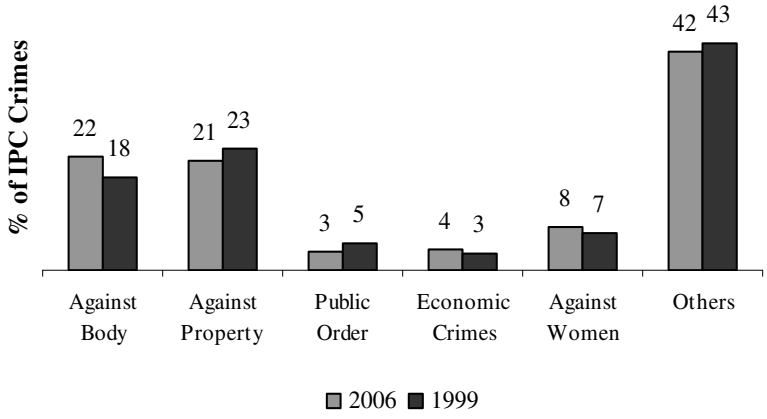
Fig. 1: Trends in IPC in India - 1999 to 2006



Over time, the nature of crime has not changed drastically (Fig. 2). A comparison of the share of major types of crime committed in total IPC crimes in 1999 and 2006 shows marginal differences. Violent crimes and property related crimes remain the domiant

form of criminal activity in both the years. The largest increase has been for crimes against body (murder, attempt to murder, culpable homicide, kidnapping and abduction, etc.). There has also been a slight increase in economic crimes (criminal breach of trust, cheating and counterfeiting) and crimes against women, while property-related crimes (dacoity, robbery, burglary, theft, etc.) and crimes against public order have fallen by about 2%.

Fig. 2: Changes in Type of Crime - 1999 & 2006



2.2 Crime Function

The hypothesis of this paper is that crime rates depend upon the deterrence effect and on the socio-economic structure. These two variables may be further decomposed into the following variables:

1) **Deterrence Variables**: Deterrence variables like probabilities of being arrested and convicted determine the expected returns from crime (Becker, 1968, Ehrlich, 1973, 1975, 1996, Grogger, 1991). Since these probabilities represent costs to criminals, their expected signs are negative.

Now, the probability of being arrested depends on police performance. It may be captured by indicators like number of policemen per 1,000 of population, number of

IPC cases per civil policeman (representing load on the police force), rate of arrest (per thousand population), charge sheets filed as percentage of cases in which investigations were completed (probability of being charge-sheeted after committing a crime). On the other hand the probability of conviction depends on judiciary performance – conviction rates (proportion of cases tried resulting in convictions, representing the probability of being punished) and percentage of IPC cases disposed off within six months (speed in which punishment will occur). These data are also available in the annual publication by the National Crime Records Bureau. A list of data sources is given in the Appendix.

2) **Socio-Economic variables**: The following socio-economic variables have been included in the analysis:

a) Economic Growth: While Fleisher (1963, 1966) and Ehrlich (1973) considered the level of growth as a proxy for the level of economic prosperity, Bennett (1991) argues that the rate of growth is also important as it determines the generation of opportunities. He also finds that significant non-linear effects may be present. Figures on State Domestic Product at factor cost (constant at 1993-94 prices) published by CSO has been used in this paper as a measure of economic growth.

More important than growth (or growth rate), however, is the quality of growth. This is captured through poverty levels, urbanization and level of education.

b) Inequality: Criminal activities are determined by economic motivations. Such motivations may be created by a sense of frustration, or an "envy effect" (Kelley, 2000). A higher income inequality also means a worsening of legitimate earning opportunity, hence there is a possibility that a rise in income inequality would

increase crime – not only by creating potential criminals, but also potential victims having material goods worth seizing [Fleisher (1966), Ehrlich (1973), Chiu and Madden (1998), Burdett et. al (1999), Imrohoroglu et al. (2000, 2001), Kelly (2000), Fajnzylber et al. (2002), Burdett and Mortensen, (1998), Juhn, Murphy and Pierce (1993), Pratt and Godsey (2003)].

c) Urbanization: The structural transformation from a predominantly rural economy to an urban one caused by multiple forces (of which industrialization is an important one) may increase the crime rate through different channels. For instance, increased levels of migration from rural to urban areas and attempts of elite groups to modernise may stimulate an increase in criminal activities (Fisher, 1987). Urbanisation leads to congestion and insanitary living conditions. This generates social tension and leads to eruptions of violence and crime, particularly in communities characterized by diversity (UN, 2005). The process of urbanization may also lead to elimination and marginalization, driving out people from the legal market economy, so that they are forced into criminal activities for their livelihood. The rate of urbanization is also important (UN, 2005). Rapidly urbanizing areas may have more unstable population[4] and little sense of community. This may lead to erosion of traditional collective socio-religious norms controlling crime (UN 2005).

d) Education: Higher levels of educational attainment raise skill and abilities and are associated with higher returns in the labor market, thereby increasing the opportunity cost of criminal behavior (Freeman, 1991, 1996, Grogger, 1995, 1998, Lochner and Moretti, 2001). Education may also have a 'civilization

effect', by improving moral stance and promoting the virtues of hard work and honesty (Fajnzylber et al 2002, Usher, 1997).

This paper considers the proportion of people having at least middle class level of education in each state – available from the 2001 Census.

2.3 Choice of Econometric Model

The hypothesized form of the crime rate function therefore takes the following form:

$$CRATE = \phi(PM\_D, IPC\_PM, AR1, CSR1, CVR1, LPCSDP, URBAN, MEDU, INEQ) \quad [1]$$

when, CRATE: Number of IPC crimes per '00,000 population

PM_D: No. of police men per '000 square kilometer

IPC_PM: No. of IPC cases per civil policeman

AR1: Number of arrests in IPC cases per '00,000 population in previous period

CSR1: Percentage of IPC cases investigated in which charge sheets were filed in previous period

CVR1: Conviction rate in previous period

PCSDP: Log of Per capita SDP at factor cost (constant price 1993-94)

URBAN: Urbanization level

MEDU: Percentage of persons with at least middle level of education

INEQ: Value of Gini coefficient for expenditure levels

While most econometric analysis of crime rates assume that current values of deterrence variables affect the crime rate, this paper incorporates a lagged adjustment process. The reason is that potential offenders can observe the values of deterrence-related variables

(AR, CSR and CVR) realized in the previous period, and estimate the probability of being apprehended and punished in the current period based on these observations.

Data on major Indian states has been used from 1999-2005. This constitutes a panel data. Econometric theory suggests that in such cases either of the following two forms may be used:

(i) Fixed Effect Model: In this case intercept terms are assumed to be independent of X_{it}. The regression equation in terms of a single explanatory variable can be presented as

$$CRATE_{it} = \alpha_i + \beta X_{it} + u_i \qquad [1a]$$

where α_i are intercept terms that vary across states (or state groups), but remain invariant across time. The OLS method is used to estimate [1a]. Recent works on crime, using panel data, adopt this method (Neumayer, 2003).

(ii) Random Effect Model: Alternately, the intercept terms may be correlated with the explanatory variables. In that case, α_i are modeled as random variables and treated at par with the error term.

$$CRATE_{it} = \beta X_{it} + e_i \qquad [1b]$$

where $e_i = \alpha_i + u_i$. Since the error terms of same cross-sectional units become correlated, though errors from different cross-sectional units are independent[5] – Generalized Least Square (GLS), rather than OLS, should be used to estimate the model.

We argue that neither of these approaches is suitable in the present case. The situation in states like Kerala and Andhra Pradesh (where substantial progress has been made in human development) vary from under-developed states like Bihar, Madhya Pradesh, Rajasthan and Uttar Pradesh, or states like Maharashtra and Gujarat (where the level of industrialization is high, but this has failed to reduce poverty levels). Therefore the regression model no longer remains a single equation, but is transformed into a set of stacked equations (Green, 2002: 615) that can be represented as follows:

$$\begin{bmatrix} y_1 \\ y_2 \\ . \\ . \\ y_m \end{bmatrix} = \begin{bmatrix} X_1 & 0 & . & . & 0 \\ 0 & X_2 & . & . & 0 \\ . & 0 & . & . & . \\ . & . & . & . & . \\ 0 & 0 & . & . & X_m \end{bmatrix} \begin{bmatrix} \beta_1 \\ \beta_2 \\ . \\ . \\ \beta_m \end{bmatrix} + \begin{bmatrix} u_1 \\ u_2 \\ . \\ . \\ u_m \end{bmatrix} \qquad [1c]$$

where y_i, β_i and u_i are vectors and X_i, are matrices for each state group (i =1, 2, …m).

Apparently the individual classical regression equations in [1c] are unrelated. Zellner (1962), however, points out that even these seemingly unrelated regression equations (SURE) may be linked statistically, though not structurally. Such links may be established through subtle interactions if "the response of the dependent variable to an explanatory variable is different for different individuals but for a given individual it is constant over time" (Judge et al, 1985: 539). This will result in random disturbances associated with at least some of the different equations being correlated with each other in a specific way - the disturbances will be independent over time, but correlated across cross-section units. The joint nature of distribution of error terms and non-diagonality of the associated variance-covariance matrix will arise if there are omitted variables that are

common to all equations. For instance, factors like the presence of a common civil code and procedure, spill-over effects of socio-economic developments in states, macro-economic changes in the Indian economy, and so on, may be omitted factors subtly linking the equations for states.

In this situation, estimation of parameters by OLS – which treats the model as a set of distinct equations - may generate consistent, but not efficient, estimators:

> "… treating the model as a collection of separate relationships will be sub-optimal when drawing inferences about the model's parameters. Indeed, … in general the sharpness of these inferences may be improved by taking account of the jointness inherent in the SURE model rather than ignoring it." (Srivastava and Giles, 1986: 2).

In such cases, Zellner (1962) advocates the application of GLS to the stacked model to ensure asymptotic efficiency of the estimators. This method has not been widely used in the study of crime – Pogue's analysis (1986) seems to be the only application of the SURE model.

3. Results and Discussion

3.1 Basic Model

The result for model [1] is given in Table 1. The values of chi-square and the pseudo-R^2 are both high.

Table 1: Seemingly Unrelated Regression

Equation	Obs	Parms	RMSE	"R-sq"	chi2	P
crate	153	9	40.17941	0.6651	303.91	0.0000

	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
crate						
lpcsdp	55.10487	12.0677	4.57	0.000	31.45262	78.75712
urban	-.1161838	.3696654	-0.31	0.753	-.8407146	.608347
medu	.6106737	.4497421	1.36	0.175	-.2708046	1.492152
ineq	-178.7391	90.52834	-1.97	0.048	-356.1713	-1.306771
pm_d	-.217824	.1092243	-1.99	0.046	-.4318997	-.0037483
ipc_pm	33.15474	3.98676	8.32	0.000	25.34084	40.96865
ar1	11.36068	2.28241	4.98	0.000	6.887236	15.83412
csr1	.7262945	.2492461	2.91	0.004	.2377811	1.214808
cvr1	.699804	.1865921	3.75	0.000	.3340902	1.065518
_cons	-215.9449	48.72119	-4.43	0.000	-311.4366	-120.4531

It can be seen that the coefficients LPCSDP and all the deterrence variables are statistically significant. Analysis of the correlation matrix for the socio-economic variables shows that LPCSDP is highly correlated with URBAN and MEDU; further, these two variables are also strongly correlated with each other. This would imply the presence of multi-collinearity and explain the relatively low t-values observed for these two variables. The correlation between INEQand LPCSDP, on the other hand, is not very high (0.2366).

Table 2: Correlation Matrix of Socio-Economic Variables

	lpcsdp	medu	urban	ineq
lpcsdp	1.0000			
medu	0.5260	1.0000		
urban	0.5497	0.4619	1.0000	
ineq	0.2366	0.0124	0.1512	1.0000

Analysis of the signs of coefficients of socio-economic variables reveals mixed results. Economic growth has actually led to an increase in crime rates. The reason lies in the quality of growth occurring after liberalization. Liberalization operates in many ways:

1. It has increased inequalities, and hence social tension.
2. The capital intensive nature of industrialization has squeezed the growth of employment opportunities for the general public.
3. Rising consumerism has led to a sharp increase in consumer demand. Coupled with restrictions on legal means to satisfy this demand, this may lead to an increase tendency towards relying on criminal means to satisfy this demand.

Simultaneously, rising education levels – without any corresponding increase in economic opportunities for the masses – seems to have led to increasing frustration with legal means of livelihood, and increased crime rates. The increasing employment opportunities created by urbanization, on the other hand, seems to lower crime rates. Although INEQ has a negative coefficient, it is not statistically significant.

The coefficients of deterrence variables, except PM_D, are all positive. While the signs of IPC_PM and PM_D are expected – increasing pressure on the police force, or fewer policemen, will both encourage a potential criminal to think that (s)he can get away with

crime – the positive values of variables like AR1, CSR1 and CVR1 do not match with empirical findings in developed countries.

3.2 Introducing Endogeneity

One possible reason for the unexpected signs of some of the coefficients may be the presence of endogeneity in the model - the deterrence variables both determine and are determined by crime rates (Ehrlich, 1973, 1975, Brier and Fienberg, 1980, Pogue, 1986). For instance, arrest rates is determined by lagged crime rates, while increasing arrest – following complaints before the police – may lead to higher number of charge sheets. Model [1] has to be revised to:

$$CRATE = \phi\ (PM\_D, IPC\_PM, AR1, CSR1, CVR1, LPCSDP, URBAN, MEDU, INEQ) \quad [2a]$$

$$AR1 = \eta\ (CRATE2) \quad [2b]$$

$$CSR1 = \gamma\ (AR1) \quad [2c]$$

where CRATE2: Two period lagged crime rate

The system of simultaneous equations given by [2a] to [2c] has also been estimated using Zellner's SURE model.

Table 3: Seemingly Unrelated Regression with Endogeneity

Equation	Obs	Parms	RMSE	"R-sq"	chi2	P
crate	126	9	21.15155	0.9080	1514.31	0.0000
ar1	126	1	.4128065	0.8568	826.26	0.0000
csr1	126	1	13.63342	0.4295	79.97	0.0000

	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]

crate						
lpcsdp	28.69313	6.036627	4.75	0.000	16.86156	40.5247
urban	-.2032224	.1711119	-1.19	0.235	-.5385955	.1321507
medu	-.2882367	.2163142	-1.33	0.183	-.7122047	.1357313
ineq	-50.53942	45.70085	-1.11	0.269	-140.1114	39.03261
pm_d	-.0241665	.0522156	-0.46	0.643	-.1265072	.0781741
ipc_pm	6.315295	2.410503	2.62	0.009	1.590796	11.03979
ar1	64.24988	2.719007	23.63	0.000	58.92073	69.57904
csr1	-.5768609	.1331665	-4.33	0.000	-.8378624	-.3158593
cvr1	.3429576	.0895689	3.83	0.000	.1674059	.5185094
_cons	-68.1377	25.11722	-2.71	0.007	-117.3665	-18.90886
ar1						
crate2	.0148316	.000516	28.74	0.000	.0138203	.0158428
_cons	-.1436531	.0916594	-1.57	0.117	-.3233022	.0359959
csr1						
ar1	9.865635	1.103216	8.94	0.000	7.703371	12.0279
_cons	49.01142	2.78197	17.62	0.000	43.55886	54.46398

Crime rates, is again found to be positively related to lagged arrest and conviction rates. One reason for this may be that the corruption and malpractices prevailing in most Indian jails makes it difficult for prisoners to discard their criminal tendencies. In fact, conviction often brutalizes persons imprisoned for simple felonies (Piehl and DiIulio, 1995). Further, arrest and convictions typically mark a person as a permanent deviant, reducing his access to legal channels of livelihood (Grogger, 1995, Holzer et al, 2003, Pager, 2003, Seiter and Kadela, 2003). In other words, arrest or conviction may perversely reinforce criminal behavior in many cases, so that criminals get caught in a 'crime trap'.[6] Data from the National Crime Records Bureau reveal that recidivism is quite high - nearly 10 percent of arrested persons had previous criminal records.

Expectedly, the presence of more police personnel per square kilometer[7] and fewer IPC cases per policemen are both associated with lower crime rates. High rates of charge sheeting, too, act as a deterrent, to reduce crime rates.

Among the socio-economic variables, INEQ contuse to remain insignificant. Among the other variables, economic growth increases crime rates, while urbanization and education operate as controlling factors.

4. Conclusion

Our empirical exercise shows that the theory of criminal behaviour originating in the developed countries has limited relevance for developing economies like India. Given the demographic pressure and nature of economic growth the channels through which socio-economic variables and deterrence factors operate in developed countries get blocked or even distorted in developing countries. This leads to causal relationships that do not match with empirical findings for developed countries, implying the need to take into account the specific causal mechanism operating in India while designing crime control measures.

In India, for instance, intervention to control and reduce crime rate has relied on increasing expenditure on the police and judicial systems. This is expected to act as a deterrent by increasing the expected costs of committing a crime – as the probability of getting detected and punished will increase. This is in line with empirical findings for

developed countries, showing that deterrence is likely to have a significant negative impact on crime rates.

However, the results of this econometric analysis show that high conviction rates will actually increase crime rates. This reveals inherent flaws in the criminal detection and corrective system. There is need for reforming the penal system to enable this system to rectify the behavioral pattern of criminals through education and the imparting of technical and vocational training, so that they can return to the mainstream after their release.

Results of this paper show that economic growth and, in particular, its quality, is an important determinant of crime rates. Liberalization of the Indian economy has led to an acceleration of growth; the results of the endogenous model show that this need not reduce crime. This implies that growth process has to be participatory and create opportunities for the entire population in order to control crime rates.

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END NOTES

[1] A study of Brazil estimates that a 10 percent reduction in the homicide rate may raise per capita income by 0.2-0.8 percent over the next five years (World Bank, 2006).

[2] As investors may view crime as sign of social instability, and feel that crime drives up the cost of doing business. Such costs include loss of goods, hiring security guards, building fences, installing alarm systems or security devices, and so on.

[3] SLL include Arms Act, Gambling Act, Excise Act, Indian Passport Act, Copyright Act and so on. See page 27 of Crime in India, 2002 for a complete list.

[4] Rate at which population changes households is high (UN, 2005).

[5] That is $cov(e_{it}, e_{is}) \neq 0$, though $cov(e_{it}, e_{jt})$.

[6] Piehls and DiIulio (1995) cites an estimate of Lawrence Greenfeld (US Bureau of Justice Statistics) that 94% of all State prisoners have either been convicted of a violent crime or been previously sentenced to probation or incarceration. Another study reports that two out of every three parolees re-enter prisons (Little Hoover Commission, 2003). Murray (2007) argues that even children of convicted parents may be social excluded. This may lead to development of criminal tendencies amongst them later on.

[7] Although the coefficient of PM_D is not significant, it appears to be correlated with PM_POP (-0.3308).