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Revisiting the economic theory of crime A state-level analysis in India

Pranav Raj¹ and Md Mizanur Rahman^{2*}

Abstract: The economic theory of crime tends to suggest that deterrence variables have a significant impact on crime rates in a society. From an economic perspective, criminals are rational economic agents who weigh the likelihood of being arrested and apprehended before committing a crime. An increase in the likelihood of arrest and apprehension should deter criminals as it increases the expected costs of committing crimes. This paper revisits the behavioral links between deterrence variables and crime rates in the Indian context. Empirically, we draw on state level data for India in 2001–2014 and employ the system GMM estimator technique to support our claims. The study reports that deterrence factors (probability of arrest and apprehension) have a perverse impact on India's crime rates. The paper reveals that an increase in the probability of deterrence variables does not lead to a reduction in crime rates, indicating a fundamental flaw in India's corrective mechanisms. The research recommends penal system reform in order to accurately reconfigure the behavioral links between deterrence variables and crime rates.

Subjects: India (studies of); Criminology - Law; Criminology and Criminal Justice; Crime Control; Economics

Keywords: crime; economic growth; deterrence; socioeconomic determinants; panel-data; system GMM

1. Introduction

Crime, in its broadest sense, is any act of deviation that is against the law. According to World Health Organization (Organization, W. H, 2015), violence is defined as “the intentional use of physical force or power, threatened or actual, against oneself, another person, or against a group or community, that either result in or has high likelihood of resulting in injury, death, psychological harm, maldevelopment or deprivation”. In whatever city, region, or country, crime is a harmful social phenomenon (Wilson, 2015). The consequences of crime on a society are theoretically well established in the academic literature. Crime and fear of crime have deleterious effects on people's quality of life. It restricts movement, which in turn limits access to potential educational and employment opportunities. Currently, crime is a major socioeconomic problem for all governments, especially those in developing countries. Even after controlling for other growth determinants, a cross-sectional study conducted by the World Bank in 2008 revealed that crime hinders economic growth in developing economies (Bank, W, 2007). It has also been shown in similar studies (Peri, 2004; Cardenas, 2007; Daniele, 2009; Goulas & Zervoyianni, 2012; Islam, 2014; Jamshed et al., 2020) that crime is a barrier to economic development.

Although not new, the reasons why people commit crimes and what the primary factors are that lead to criminal behavior in a community are still up for debate. Scholars from a variety of social scientific fields, including sociology, economics, criminology, and psychology, are very interested in

the complexity of crime, its persistence across time, and its presence in human society. There is a wealth of theoretical and empirical research on the origins and causes of crime, which has shown a wide range of interconnected and nuanced elements. Sociologists have offered several ideas, such as anomie (Durkheim, 1964), social disorganization (Shaw & McKay, 1942), conflict (Vold, 1958), and the broken window hypothesis (Wilson & Kelling, 1982), to explain the etiology of criminal behavior. Crime, in the eye of sociologists, is a social fact that stems from social constructs, and the prevailing social conditions are seen as the root of the problem. As potential predictors of crime, social exclusion, economic hardship, deprivation, poverty, inequality, gender, race, unemployment, population, injustice, and other social factors appeared. Psychologists have looked at delinquency issues from several angles, including the influence of genetics, early life experiences, cognitive styles, personality factors, and more. Among the many theories put forth by psychologists, some of the most widely accepted include the behavioral theories, cognitive theories, humanist theories, biological theories, and social psychology theories. Following the works of Becker (1968), and Ehrlich (1973), economists have used a rational choice-based micro-theoretic framework to explain such criminal tendencies. According to economic theories, criminals like any other rational economic agents are utility maximizers who weigh expected costs and returns before engaging in illegal activities. According to this framework, deterrence factors like the probability of being apprehended and convicted as well as the nature and severity of the punishment are crucial in explaining criminal behavior in any region or nation. However, the scope of this essay does not provide a comprehensive investigation of all these theories, therefore we will just discuss economic theories of crime.

In recent times, like other developing economies, India has witnessed a rise in incidence of crimes. India, a developing economy, and host to world's second largest population, offers an interesting example to analyze the main arguments of economic theory of crime. The Global Peace Index Report¹ places India in the list of 30 countries most affected by violence and it estimated that crime costs India approximately 6% of its Gross Domestic Product (GDP). Crime can be broadly divided into three categories: crime against persons, which includes murder, rape, kidnapping, and abduction; crime against property, which includes robbery, dacoity, burglary, thefts, etc.; and economic offenses, which include money laundering, bribery, corruption, etc. In India, the Criminal Procedure Code divides crimes into two heads: cognizable and non-cognizable. Cognizable offenses are further subdivided into crimes falling under Indian Penal Code (IPC), or under the Special and Local Laws (SLL). We only consider IPC cognizable offenses for this study. Under the federal structure of the Union of India, maintenance of law and order is a state subject. As a result, there are wide inter-state variations in incidences of crime, reporting and registering of crime records. In addition, the states vary greatly from one another in terms of economic growth, topography, sociodemographic makeup, culture, and resource accessibility, all of which have a big impact on crime rates. We have considered states as unit of analysis, for we believe that a disaggregated analysis reveals a clearer picture.

As per the economic theory of crime, deterrence variables have a significant impact on crime rates in a society. From an economics perspective, criminals are rational economic agents who weigh the likelihood of being arrested and apprehended before committing a crime. An increase in likelihood of arrest and apprehension should deter criminals as it increases the expected costs of committing crimes. This paper revisits the behavioral links between deterrence variables and crime rates in the Indian context. Empirically, we draw on state level data for India in 2001–2014 and employ the system GMM estimator technique to support our claims. We employ dynamic panel data-based system GMM estimation approach to arrive at empirical results. Panel data allow for study of individual dynamics and control for individual unobserved heterogeneity (Witt et al., 1999; Bruderl, 2005; Poveda, 2012; Belloumi, 2013). In addition, compared to time-series analysis and descriptive statistics, the use of panel data is more informative because it allows for more degrees of freedom, more variability, and less collinearity, and so its estimates are more efficient.

Additionally, we employ system GMM estimator over other estimations methods available for panel data models. The primary justification for using the system GMM estimator is that it is based on fewer assumptions about the underlying data generation process and that it handles endogeneity problems by generating internal instruments, which eliminates the need for externally valid instrumental variables for the instrumented variables in the analysis (Anser et al., 2020). Given that crime has a large negative impact on the welfare of a society, it is the role of the state to enact rules and regulations that mitigate the negative impacts of criminal behavior, since obtaining a zero-crime rate is unlikely. The foundation of a successful policy framework for reducing crime rates should be a comprehensive understanding of the nature and causes of crime. Only if such interventions are based on an understanding of crime and the variables affecting crime rates will they be successful. In this regard, this study seeks to systematically review the factors influencing India's crime rates by using the states as unit of analysis. Thus, this research aims to address a gap in the literature about the socioeconomic factors that influence criminal behavior in India.

The overall structure of the paper consists of six sections. Following this is a discussion of theoretical and conceptual issues, then a section on research methods, and a section on trends and patterns of crime in India. The economic model of crime will be developed further in the fourth section, which will then be followed by empirical results and discussions. The final section concludes with policy recommendations.

2. Theoretical issues

For early contract theorists, most notably hobbes,² the rule of law meant in the first instance the provision of security. If the economic agents do not feel secure about their lives, it makes little sense to talk about the security of property or enforcement of contracts. Adam Smith in his monumental work on *Wealth of Nations* observed that accumulation of property attracts criminal offenses and necessitates government protection against it. In a similar vein, Jeremy Bentham considered the calculation of both the offender's behavior and the optimal enforcement for the legal authorities. However, until Becker's seminal work on crime and punishment (1968), the economic theories of crime did not pay much attention to it. Becker (1968) attributes this neglect on the part of economists to a belief that criminal activity is too immoral to warrant systematic scientific study. Becker's theory of criminal behavior based on rational choice provides the theoretical framework for the economics of crime. In his choice-based microeconomic framework, Becker advanced the theory that, like any rational economic agent, criminals weigh the financial benefits of committing crimes against those of lawful employment, considering the likelihood of being apprehended and convicted as well as the severity of punishment, before engaging in illegal activity. Simply put, criminals are utility maximizers and their decision to commit a crime is driven by rational considerations as opposed to social anomalies and unique personality traits.

In Becker's theory of criminal behavior, criminal activities, Criminal activities, as measured by the number of offenses, are dependent on deterrence variables such as chance of arrest and conviction, severity of punishment, etc. An individual commits a crime if the expected costs of crime (deterrence factors) are less than that of expected returns (monetary and non-monetary gains) arising out of criminal activities. Ehrlich (1973) on participation of individuals in non-market, legal and illegal activities extended Becker's paradigm by incorporating income distribution, unemployment, income levels, and schooling and their effects on criminal propensity. The study finds that distribution of income and income levels has a bigger impact on criminal behavior than unemployment does. Additionally, schooling as a proxy for educational attainment has a negative impact on delinquent behaviors. The two theories of Becker (1968), and Ehrlich (1973) serve as the cornerstone for empirical investigations on the economics of crime.

Fleisher (1963) stated that unemployment and low income are positively correlated with crime rates. In England and Wales, Wolpin (1978) establishes an inverse link between crime rates and clearance rates. Moreover, he discovered that higher police expenditures were not correlated with

higher clearance rates or lower crime rates. In their attempts to establish an empirical association between unemployment and crime rates, researchers have come to conflicting conclusions. According to Cantor and Land (1985), the counteracting forces of increased motivation for crime and diminished opportunity brought on by unemployment could affect crime rates both positively and negatively. Addressing this “consensus of doubt”, Chiricos (1987) highlighted the conditional nature of unemployment and crime relationship. His study found evidences in favor of existence of a positive and significant association between property crimes and unemployment, but not between violent crimes and unemployment. He also observed that increasing the availability of work may reduce property crimes. Marselli and Vanninni (1997) developed a crime equation utilizing a panel dataset of Italian regions from 1980 to 1989. According to the findings of the study, the unemployment rate, the value of government-initiated public works, and the proportion of persons employed in the service sector influenced crime rates. The likelihood of being captured had a bigger influence on crime reduction than the severity of sanctions, according to their findings. Bourguignon et al. (2003) discovered, using a simple theoretical model and panel data from seven Colombian localities, that a specific aspect of income distribution, as opposed to the standard metrics of inequality, increases the rate of property crime in a society. Teles (2004) proposed a connection between inflation and criminal activity. He highlighted the impact of monetary and fiscal policy on crime. Specifically, he observed that although monetary policy promotes crime via inflation, fiscal policy does the same through government spending.

Tang (2009) discovered a long-run link between inflation, unemployment, and crime rates using a cointegration approach for the Malaysian economy from 1970 to 2006. The study indicated that increase in unemployment and inflation positively impacted Malaysia’s crime rates. On a similar line, Gillani et al. (2009) discovered in their study on the causes of crime in Pakistan from 1975 to 2007 that unemployment, poverty, and inflation all affect crime rates positively. Using a cointegration methodology to examine the causes of crime in Turkey from 1965 to 2009, Halicioglu (2012) concludes that money appears to be the most influential factor in both violent and nonviolent crime rates, although divorce and unemployment were also shown to be relevant. According to Ali and Haider’s (2015) research on the socioeconomic determinants of crime in Pakistan, population density and unemployment rate have a positive and substantial effect on crime. In addition, they demonstrated that levels of education and remittances are negatively correlated with crime in the selected Pakistani province. Lobont et al. (2017) analyzed the impact of socioeconomic variables on the crime rate in Romania from 1990 to 2014. The results indicate that wealth disparity and urban agglomeration are significant variables leading to crime in Romania. In Africa, Blackmore (2003) examines the elements that lead to crime in nine South African provinces over a period of 8 years. Several factors, including population, unemployment, drug use, and per capita income, influence the quantity of crime in these provinces. Using an error correction modeling approach for the years 1981 to 2015, Igbinedion and Ebomoyi (2017) concluded that crime rates and unemployment, and inflation in Nigeria are positively correlated. The study also revealed an inverse association between crime rates and educational achievement. Bun et al. (2019) observed that increase in probability of arrests and apprehension is more influential in reducing crime rates than that of certainty of punishments. Bhuller et al. (2020) showed that prison terms combined with employment programmes have a dampening effect on crime rates. Abramovaite et al. (2022) found that certainty of detection plays a significant role in reducing acquisitive crime but effects of severity of punishments on crime rates are ambiguous.

Although theoretical arguments indicate that crime has a significant impact on an economy’s capacity for growth, the empirical findings so far have produced mixed evidence. Studies have shown both a statistically significant and negative impact of crime on economic growth (Greenbaum and Tita, 2004; Cardenas, 2007; Peri, 2004; Mehlum et al., 2004; Sandler & Enders, 2008; Detotto and Otranto, 2010, Enamorodo et al., 2014) as well as no statistically significant relationship between crime and growth (Narayan and Smyth, 2004; Mauro and Carmeci, 2007; Mauro, 1995; Goulas & Zervoyianni, 2012). Some inherent issues persist in establishing a causality

relationship between crime and economic growth literature. Crime records often suffer from twin problems of underreporting and underestimation (Dreze & Khera, 2000). There is an inherent bias in underreporting of incidents in such collected data because these records primarily come from police. Similarly, Cochran and Chamliun (2000) pointed out measurement issue as an important hindrance to establish a clear association between economic indicators and crime measures.

Few works have studied the elements that influence crime rates within the setting of the Indian economy. Dreze and Khera (2000) used cross-sectional analysis with ordinary least squares and the instrumental variables method for 319 districts in India in the year 1981. They found that literacy was the only one of the developmental variables that had a statistically significant coefficient. This was determined by using cross-sectional analysis (literacy, urbanization, and poverty). In addition, they discovered a substantial inverse relationship between the rates of homicide and the proportion of females to males in the population. Their research also showed that districts with higher rates of homicide also have higher percentages of people who belong to scheduled castes or scheduled tribes. Dutta and Husain (2009) examined the effect of deterrence factors and socioeconomic variables (Urbanization, Inequality, and Poverty) on crime rates for Indian states from 1999 to 2005 using a panel-based Seemingly Unrelated Regression (SUR) model. The study's conclusions showed that theories of criminal behavior that originated in developed nations have little application to emerging economies like India. They also found that crime rises in tandem with economic growth and that both inequality and poverty continue to have little bearing on crime rates.

The literature that was reviewed for this essay demonstrates beyond a shadow of a doubt that crime, which is a multifaceted concept, is influenced by a variety of socioeconomic factors, such as deterrence factors, income levels, multidimensional inequality, unemployment, poverty, and social exclusion, in addition to cultural and family background, religion, education, gender, urbanization, population density, and other factors. The empirical investigations that the researchers have conducted have made use of a variety of approaches to estimating, including cross-sectional analysis, time-series analysis, and panel data methods. The several approaches of estimation that are presently accessible each come with their own individual complement of benefits and drawbacks. However, for the purpose of this study, we have employed dynamic panel data-based system GMM estimation approach to arrive at empirical results.

3. Research methods

A disaggregated analysis in the context of the Indian economy, in our opinion, is more appropriate given the significant differences in crime rates observed across states. Therefore, states were chosen as the unit of analysis in this study. India, a union of states, consists of twenty-eight states and eight union territories. In our sample, we have selected 20 states and the union territory of Delhi. We have selected these sample states primarily for two reasons: First, data on remaining eight states and other union territories are discontinuous and not available for the study period (2001–2014). Second, the selected sample constitute the representative sample for India as they, collectively, contribute approximately nine-tenth of reported crime rates in the country. Following states were considered for the study. Bihar, Jharkhand, Uttar Pradesh, Madhya Pradesh, Odisha, Rajasthan, Punjab, Andhra Pradesh, Maharashtra, Gujarat, Goa, Himachal Pradesh, Uttarakhand, Karnataka, Tamil Nadu, Kerala, West Bengal, Chhattisgarh, Haryana, Assam, and Union Territory of Delhi. The selected states account for approximately 90% of reported crimes in India. Additionally, they contribute more than nine-tenth of overall GDP of India. Hence, the sampled states constitute a representative sample. The period of the study is from 2001 to 2014. The study hypothesizes that deterrence factors and socioeconomic factors both enter as explanatory variables in the production function of crime rates. Below is an explanation of why we chose to include these variables in our analysis:

Deterrence Variables: Following Becker's paradigm (Becker, 1968), the deterrence variables (probability of arrest, probability of conviction upon arrest etc.) enter supply function of offenses

via its impact on expected costs to a criminal activity. An increase in arrest probability, charge sheeting rate (disposal of reported cases by police) result in higher expected costs of engaging in illegal activities and lower expected returns from crime. Hence, these variables enter with an expected negative sign. Also included as a deterrence factor is no. of IPC offenses per civil policemen for this variable represents workload of police. An increase in workload of police is expected to decrease the probability of arrests and apprehension and hence enters the supply function with an expected positive sign.

Socioeconomic Variables: As outlined in the earlier section, there are a host of socioeconomic variables that enter as determinants of crime rates (Lochner, 2004; Buaonanno and Montolio, 2008; Buaonanno et al., 2009; Omotor, 2010; Haggard and Tiede, 2011; Malik, 2016; Lee and Son, 2016). The lack of data available at the state level prevents us from including all the suggested variables, even though we would have liked to do so to assess their relevance to the Indian economy. In our analysis, we have included the following socioeconomic variables.

- (i) Population Density: Population density refers to the number of people living in an area persquare kilometer. Nolan et al. (2004) argues that an increase in number of people living per unit land area increases the chances of crime. An increase in population density of a region leads to neighborhood disorders, decrease in social cohesion, increased social tension, loss of employment opportunities all of which increases the chances of criminal propensity (Gibbons, 2004). Hence, population density enters the supply of offenses function with an expected positive sign.
- (ii) Secondary School Enrolment: Higher level of educational attainment increases the market returns from legal activities and hence increases the opportunity cost of criminal activities (Gottfredson, 1985; Barro, 2000). This increase in opportunity cost decreases the expected returns from crime and hence it is argued that educational attainment proxied by percentage of population having secondary school enrolment enters the supply function with an expected negative sign. It has also been observed that majority of the offenders have low educational attainment, therefore education enters as a determinant of crime rates in this study.
- (iii) Female-to-male ratio per 1000 population: Dreze and Khera (2000) in their study found a strong and robust relationship between homicide rates and female-to-male ratio in the population. The justification for including this variable comes from the finding that there are significantly more male offenders in the population than there are female offenders. This variable thus enters our analysis with an anticipated negative sign.
- (iv) Real Per Capita State GDP: Following Fleisher (1966) and Ehrlich (1973), we have considered real per capita state Gross Domestic Product (constant at 2004–05 prices) as a proxy for economic condition. From an economics perspective, more crimes result from increased economic activity, so the variable enters the crime function with an expected positive sign.

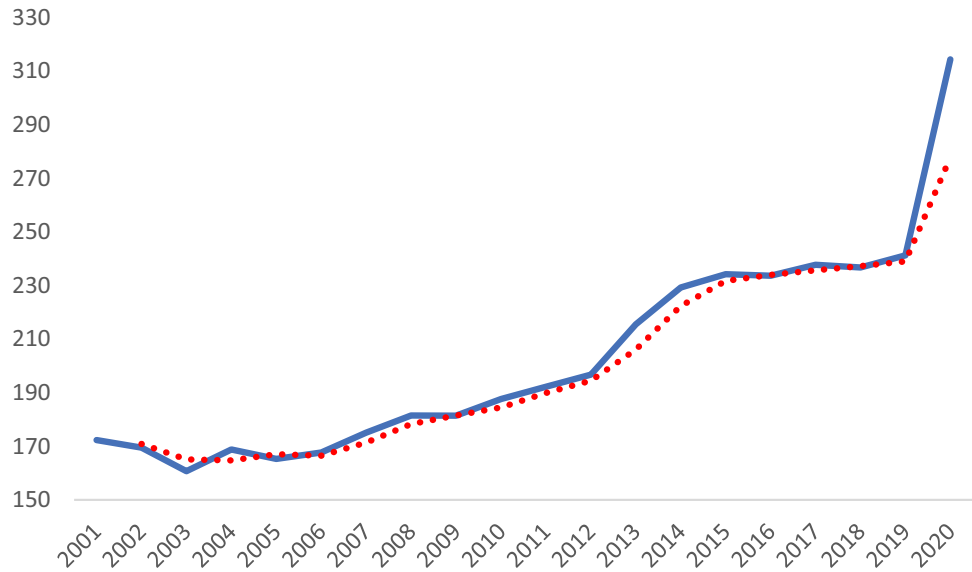
To account for endogeneity issues arising out of relationship between arrest rates, charge sheeting rates, real income per capita and crime rates, this paper incorporates a lagged adjustment process. The inclusion of lag values for deterrent variables also accounts for the reality that an offender's perception of risk (likelihood of arrests and apprehension) changes over time rather than instantaneously. Assuming all the offenders to be homogeneous, the behavioral function of crime rate can be expressed as:

$$CR_{i,t} = F(AR_{i,t-1}, CH_{i,t-1}, IPC_{i,t}, INC_{i,t-1}, PD_{i,t}, SR_{i,t}, EDU_{i,t}, \mu_{i,t}) \quad (1)$$

where subscript *i* refers to state and *t* for year; $CR_{i,t}$ is rate of total cognizable offenses, $AR_{i,t-1}$ is the number of arrests per 100,000 population, $CH_{i,t-1}$ is the charge sheeting rate of offenses,³ $IPC_{i,t}$ is number of IPC cases per civil policemen, $PD_{i,t}$ is population density, $SR_{i,t}$ is female-to-male ratio per 1000 population, $EDU_{i,t}$ is secondary school enrolment, and $\mu_{i,t}$ is a portmanteau

Figure 1. Trend of Rate of Total IPC Cognizable Offenses in India (2001–2020).

Note: The red dotted line is a two-year moving average representation of annual trend of rate of total IPC cognizable offenses. Source: NCRB (National Crime Records Bureau), Government of India. Retrieved data on the 15 August 2022. www.ncrb.gov.in



variable for other socioeconomic factors not included in the analysis and it is a white noise series.

The data on deterrence factors for all the states have been taken from annual publications of National Crime Records Bureau (NCRB, India).⁴ Real per capita state GDP data is taken from Handbook of Statistics on Indian Economy, published by Reserve Bank of India (RBI).

4. Trends and patterns of crime in India

We present a trend analysis of total crime rates,⁵ crime against people (includes kidnapping and abduction, and homicide rates), and crime against property (includes robbery, dacoity, burglary/ house-breaking, thefts) in Figures 1–3, for the period 2001–2020.

As can be seen in Figure 1 above, the rate of IPC cognizable offenses in India for the period 2001–2020 reveals an increasing trend. A sharp increase in crime rate is also observed for the year 2020.

Figure 2. Trend of crime against persons in India (2001–2020).

Source: NCRB (National Crime Records Bureau), Government of India. Retrieved data on the 15 August 2022. www.ncrb.gov.in

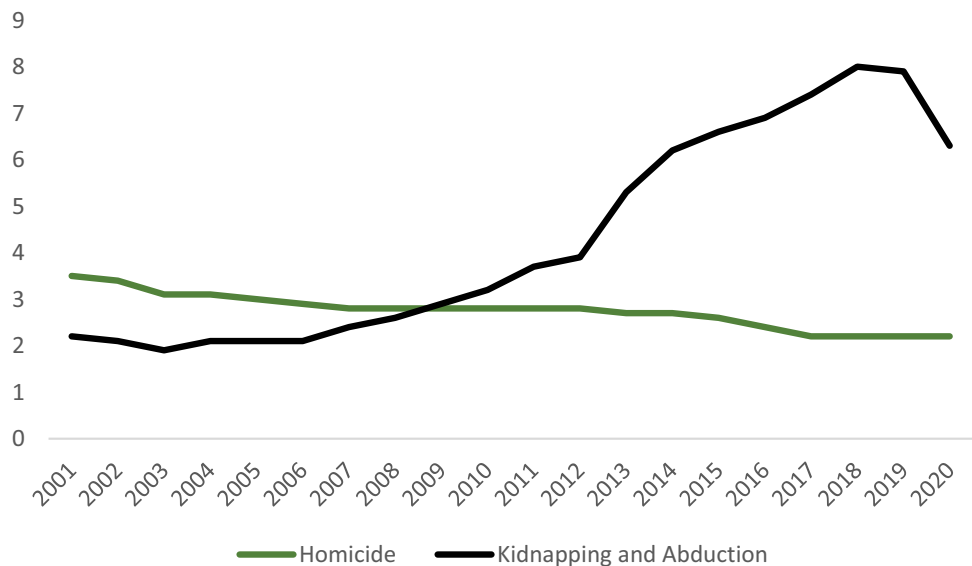


Figure 3. Trend of crime rates against property in India (2001–2020).

Source: NCRB (National Crime Records Bureau), Government of India. Retrieved data on the 15 August 2022. www.ncrb.gov.in

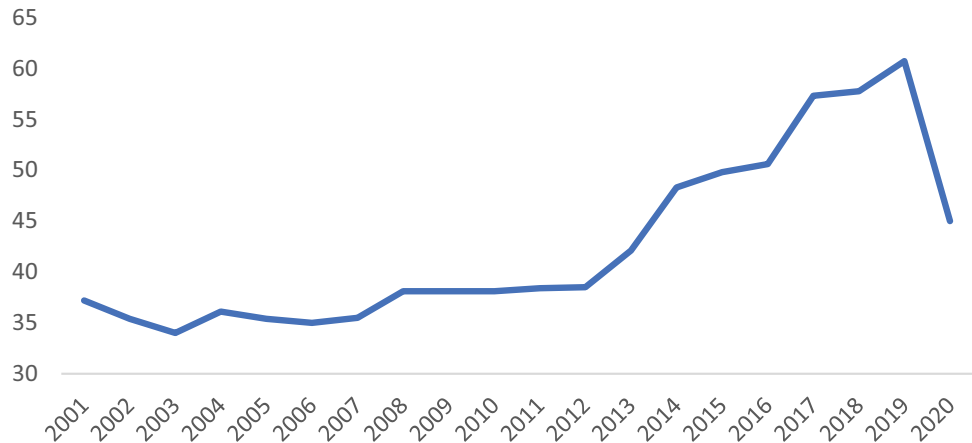


Figure 2 demonstrates analysis of rate of crimes against persons (homicide rates and kidnapping and abduction rates). While homicide rates have been on decline, the rate of kidnapping and abduction has alarmingly increased during the same period of study. Additionally, while the rate of homicides has decreased, the absolute number of homicides has not decreased considerably. As a result, the observed decline is more likely due to the impact of population growth.

In Figure 3, we present an analysis of trend of crimes against property. There is a clear upward trend in rate of offenses against property which includes robbery, dacoity, housebreaking/burglary, and thefts. Rise in offenses against property affirms the economic theory of crime that states offenses against property rise as economic activities increase.

Given that law and order is a state subject in India, we present the average annual rate of IPC cognizable offenses and homicides for the sample states in Figures 4 and 5.

We have combined murders, attempted murders, and culpable homicides that do not amount to murder in the homicide rates for each state. Figure 4 shows the aggregate IPC cognizable offenses

Figure 4. Average rate of Total IPC Cognizable Offenses for Sample States (2001–2020).

Source: NCRB (National Crime Records Bureau), Government of India. Retrieved data on the 15 August 2022. www.ncrb.gov.in

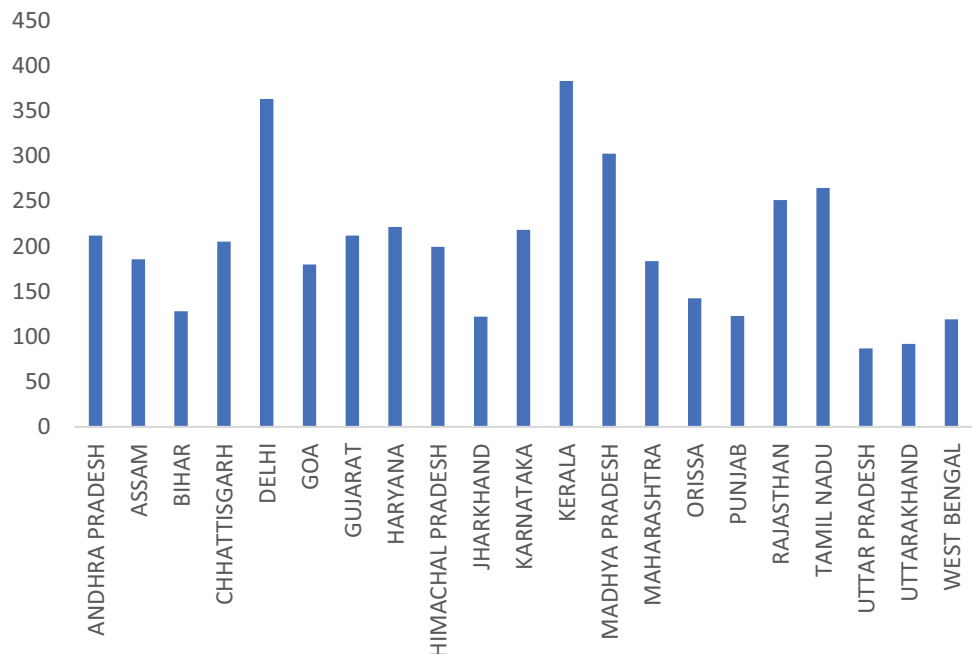
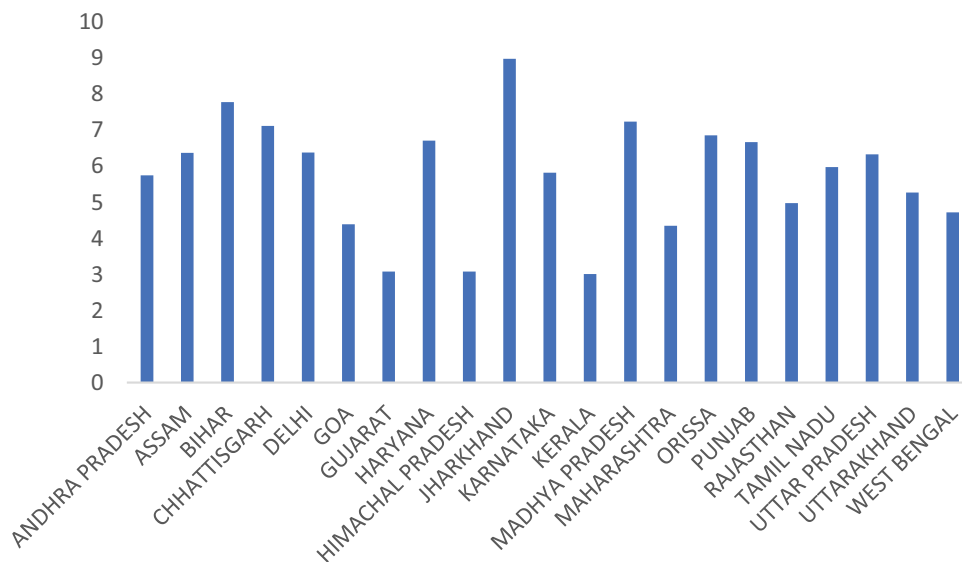


Figure 5. Average Homicide rates for Sample States (2001–2020).

Source: NCRB (National Crime Records Bureau), Government of India. Retrieved data on the 15 August 2022. www.ncrb.gov.in



rate for the chosen states from 2001 to 2020. In Figure 5, the homicide rates for these states have been presented. The surprising lower average rate of total IPC cognizable offenses in those states with high homicide rates (Bihar, Jharkhand, Punjab, Uttar Pradesh, Odisha) is an intriguing aspect of these statistics. Homicide rates are the least underreported offenses, which demonstrates that there are significant differences between the states in terms of recording offenses. In the states with higher overall homicide rates, there has been a noticeable increase in the crime typology of “attempt to commit murders” in recent years.

5. Economic model of crime

We assume that the data generating process for crime rate follows Autoregressive Distributive Lag model (ARDL (p, q)). In ARDL model, the dependent variable is assumed to be a linear function of its own lagged values and the current and past values of other exogenous variables. Autoregressive refers to lagged values of dependent variable as one of the independent variables and distributed lag refers to the lags of other exogenous variables. Here, p refers to number of lags of dependent variable and q for lags of independent variables in the specification. Criminal offenses are known to have an inertia effect, and in order to express this inertia, we included lagged dependent variable as one of the explanatory variables. The model is expressed as follows:

$$\ln CR_{i,t} = \alpha_0 + \alpha_1 \ln CR_{i,t-1} + \alpha_2 \ln AR_{i,t-1} + \alpha_3 \ln CH_{i,t-1} + \alpha_4 \ln INC_{i,t-1} + \alpha_5 IPC_t + \alpha_6 SR_t + \alpha_7 PD_t + \alpha_8 EDU_t + \varepsilon_{i,t} \quad (2)$$

$$\varepsilon_{it} = u_j + \nu_{it}$$

$$E(u_j) = E(\nu_{it}) = E(u_j \nu_{it}) = 0$$

where \ln refers to variables expressed in natural logarithm, the error term $\varepsilon_{i,t}$ is composed of two orthogonal components: $\varepsilon_{i,t} = u_j + \nu_{it}$. u_j allows for time-invariant unobserved heterogeneity in income levels and ν_{it} is a mean zero, serially uncorrelated shock (idiosyncratic shocks) assumed to be independent across states.

The lagged dependent variable $\ln CR_{i,t-1}$ in specification (2) is correlated with the fixed effects (u_j) in the error term, giving rise to the problem of “dynamic panel bias or Nickell’s bias”. In empirical analysis of crime and deterrence variables, problem of reverse causality often appears. This problem is overcome in the analysis by incorporating lagged values of deterrence variables rather than the level values. Also, the system GMM estimator takes into consideration this endogeneity

issue and produces consistent estimates for the variables. In Ordinary Least Squares estimation (OLS), identification of the parameters depends upon crucial assumption of orthogonality of the regressors with the errors. Hence, the problem of dynamic panel bias renders OLS estimation biased and inconsistent. Transformation of data either via differencing or forward orthogonal deviation and use of instrumental variables which are uncorrelated with fixed effects in the error term are two potential ways to overcome the issue of endogeneity. The core mechanism through which Difference GMM works is to apply differencing of the data to expunge fixed effects. The other is to instrument $\ln CR_{i,t-1}$ and any other endogenous variables with variables that are uncorrelated with the fixed effects. System GMM incorporates this strategy (Bond et al. 2010). After obtaining first differences⁶ of data equation (2) can be expressed as:

$$\begin{aligned} \Delta \ln CR_{i,t} = & \alpha_1 \Delta \ln CR_{i,t-1} + \alpha_2 \Delta \ln AR_{i,t-1} + \alpha_3 \Delta \ln CH_{i,t-1} + \alpha_4 \Delta \ln INC_{i,t-1} \\ & + \alpha_5 \Delta IPC_{i,t} + \alpha_6 \Delta SR_{i,t} + \alpha_7 \Delta PD_{i,t} + \alpha_8 \Delta EDU_{i,t} + \Delta \varepsilon_{i,t} \end{aligned} \quad (3)$$

where Δ represents first difference operator.

Note that if the error term in equation 2 is serially uncorrelated, $\Delta \varepsilon_{i,t}$ in equation (2) is necessarily correlated with lagged dependent variable $\Delta \ln CR_{i,t-1}$ and hence usual OLS estimation does not lead to consistent estimation of parameters in equation (3). Consistent estimation is possible, provided $\varepsilon_{i,t}$ is serially uncorrelated, by using lags of endogenous variables ($CR_{i,t}$) from t-2 and earlier and/or using current observations of exogenous variables (Bond et al. 2010).

6. Empirical results and discussion

Even though the analysis does not include unemployment rate due to unavailability of disaggregated data for the study period, a preliminary correlation analysis was performed to investigate the relationship between crime rate at all India level and employment-to-population ratio (obtained from World Bank Database) for the period 1990–2020. The correlation analysis resulted in strong negative relationship between the two variables with a correlation coefficient value of -0.79 . In Figure 6 below, we present a scatterplot of crime rate and employment-to-population ratio for India. This correlation points toward unemployment being as an important determinant of crime rates for Indian economy, however the result should be interpreted with caution as correlation does not imply causation.

Figure 6. Crime rates v/s Employment to Population ratio for India (1990–2020).

Note: The red dotted line is a linear trend fitted to the scatterplots of IPC cognizable offenses and employment-to-population ratio for India. Source: World Bank and NCRB (National Crime Records Bureau), Government of India. Retrieved data on the 15 August 2022. www.ncrb.gov.in

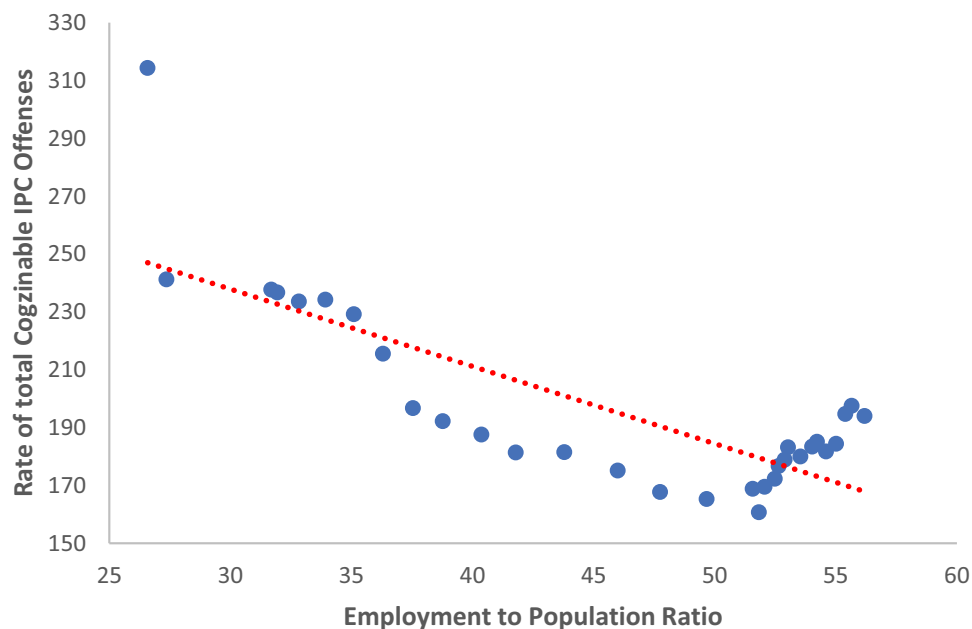


Table 1. IM—Pesaran—Shin (2003) test for unit root in panels

Variable	With Trend	Without Trend	First Difference with trend
Log (Crime rate)	-2.1312**	-0.8422	-3.6532***
Log (Real per capita Income)	-2.2560**	-0.5716	-4.2263***
Log (Arrest rate)	-2.5276***	-1.9497*	-4.2914***
Log (Charge sheet rate)	-3.4297***	-2.6517***	-4.7869***
No. of IPC cases per policemen	-2.5234***	-1.6222	-4.0788***
Female to Male ratio per 1000 population	0.4358	-1.7268	-2.6045***
Population Density	-2.7430***	-2.1355**	-4.2915***
Secondary School Enrolment	-1.9004	-0.5604	-4.0058***

Note: Reported figures are the *W* statistics in Im et.al. (2003). The null hypothesis of the test is that of presence of unit roots in panels where the alternative is one sided. The asterisks * is significant at 10 % level of significance, ** at 5 % level of significance, and *** at 1 % level of significance.

A consistent estimation of system of equations (2) and (3) requires that all the variables entering the model are stationary. To test whether the variables are stationary, we ran panel unit root tests. If the panel data is cross-sectionally independent, panel unit root tests have a significant power advantage over univariate tests. Results of panel unit root tests are presented below in Table 1.

As can be seen above from the Table 1, all the variables except for female-to-male ratio per 1000 population and secondary school enrolment are stationary with trend. Both these variables are stationary at their first differences. Therefore, all the variables used in this study are stationary. We estimated both the fixed effect and the random effect models prior to using the system GMM estimator for the model. The result of the fixed effect model is presented in Table 2.

Based on Hausman (1978) test of specification, fixed effect model was selected for estimation purposes. When there is serial correlation in the error term and endogeneity problems between the explanatory variables and dependent variables, the ordinary least squares estimation technique produces biased and inconsistent results. Therefore, we focus on system GMM estimation results presented in Table 3. In the system GMM estimator, earlier lags of crime rates that are orthogonal to the current error term are used as internal instruments to check for endogeneity. To consider for potential reverse causality between the deterrence variables, income variable and crime rates, we have incorporated lagged values of arrest rates, charge sheet rates, and real per capita income. The other explanatory variables enter purely as exogenous variables in the model.

Along the expected lines, lagged value of real per capita income has a positive and statistically significant impact on crime rates. An increase in real per capita income by one percentage leads to increase in crime rates by 0.19%. According to the economic theory of crime, as economic activities grow, so do the potential victims of criminal activity, which raises the overall crime rate in society (Gaviria, 2000). This finding is in line with the argument that the quality of economic growth matters as merely increasing per capita income level does not necessarily guarantee improvement in overall socioeconomic conditions. As economic growth increases, income inequality rises as well, leaving many people with unmet desires that drive criminal propensity. The empirical results of this analysis also lend support to the idea that population density affects crime rates positively. An increase in population density has a detrimental effect on social cohesion because of overcrowding of areas, and lost income earning opportunities, etc., which encourages criminal activity (Malik, 2016). Abramova et al. (2022) also found that increase in population density leads to increase in criminal activities. The coefficient of female-to-male ratio per 1000 population is negative but statistically insignificant in this

Table 2. Fixed effect model

Dependent Variable: Log Crime rate		
Variables	Coefficients	t-statistics
L.LNC	0.7398739	13.26***
L.LNA	-0.134772	-0.50
L.LNCH	.00215078	0.32
L.INC	.0531744	1.71*
No. of IPC cases per civil policemen	0.0339968	3.63***
Population Density	.000021	1.23
Ratio of female to male per 1000 population	0.0040583	3.16***
Secondary School Enrolment	0.0052763	0.86
Constant	-3.199529	-2.80***
R-Squared	0.7871	
Hausman test of Specification	47.48 (chi sq. statistic)	0.0000 (p value)

Note: The asterisk (***, **, *) show significance at 1 per cent, 5 per cent, and 10 per cent level of significance respectively

study. The inverse relationship between sex ratio and crime rate is in line with the findings of Dreze and Khera (2000). In the Indian context, ratio of male offenders to female⁷ offenders are approximately 85%.

Among the deterrence factors, the coefficient of no. of IPC cases per civil policemen⁸ is positive and statistically significant. As the workload of police officers rises, offenders believe they will get away without being caught, which increases their motivation for criminal activity. Jamshed et al. (2020) observed the important role played by police officers in the investigation procedures of criminal offenses in Pakistan. This also illustrates how the investigation and identification of crimes are greatly hampered by the increased workload of police officers. The coefficient sign of lagged arrest rates and lagged charge sheet rates runs counter to the criminal behavior theories that have been established for developed countries. Studies such as Bun et al. (2019) and Abramovaite et al. (2022) found that increase in probability of arrests and apprehension lead to reduction in crime rates. The findings of this study is in contrast to the observations of these previous research. Moreover, the lagged arrest rate is statistically insignificant while that of lagged charge sheet rate is statistically significant at 10% level of significance. This result shows that lagged charge sheet

Table 3. Dynamic panel-data estimation using a two-step system GMM estimator

Dependent Variable Log Crime rate		
Variable	Coefficients	t-statistics
L.LNC	0.6392433	4.79***
L.LNA	.0835111	0.288
L.LNCH	0.145972	2.49***
L.LNINC	0.1277844	2.54**
No. of IPC cases per civil policemen	.0715156	3.17***
Population density	.0000164	2.27**
Female to male ratio per 1000 population	-0.0000954	-0.20
Secondary School Enrolment	.0112152	1.76*
Constant	-0.7431609	-1.44

Note: The asterisk (***, **, *) show significance at 1 per cent, 5 per cent, and 10 per cent level of significance respectively

Table 4. Diagnostic checks

Test	Coefficients	p-value
Arellano-Bond Test for AR (2) in first difference	0.54	0.587
Hansen Test of Overidentifying restrictions	14.10	0.294
Difference-in-Hansen test of exogeneity of instruments	0.68	0.409
Number of states/groups	21	
Number of Instruments	21	
Number of Observations	294	

rates have the opposite effect of what they are intended to do, which is to dampen crime rates. Several explanations can be advanced for this observation in Indian economy. First, arrests and apprehensions label a person as a permanent offender, restricting his or her access to legitimate employment opportunities (Groggier, 1995; Seiter & Kadela, 2003; Pager, 2003). Additionally, having been arrested for a crime has an impact on how the rest of society perceives that person. This finding is supported by India’s typically high rates of recidivism.⁹ Second, India’s low conviction rate¹⁰ means that even after being charged with a crime, offenders remain out of prisons, which encourages them to continue committing crimes. Third, corrupt practices in Indian prisons makes it difficult for prisoners to discard their criminal tendencies (Dutta & Husain, 2009). Fourth, this points to the corrupt and inefficient practices in the criminal justice system in India, where it is easy for a powerful person to get away with any sort of crimes by influencing the investigating officers during the inquiry process. Jamshed (2018), in his study on corruption in Pakistan Police, pointed out the outdated and inefficient criminal justice system in Pakistan leading to greater acquittals of the offenders. Educational attainment, proxied by percentage of population having at least secondary school enrolment, was found to be positive. The quality of education in India, the relatively low returns on education due to the scarcity of employment opportunities, and the lack of infrastructure in the education sector may all contribute to this finding’s explanation.

Post-estimation, we ran diagnostic tests to check for the robustness of results obtained from the model. Hansen-test of over identifying restrictions does not reject the validity of the instruments used in the analysis. When we estimated the model using the system GMM estimator, the residuals showed negative first order auto correlation statistically significant at 5% significance level. We are unable to rule out the null hypothesis of second order no serial correlation of the differenced residuals, confirming again the appropriateness of the instrumentation. The null hypothesis of exogeneity of instruments is not rejected by difference-in-Hansen test. The total number of instruments is exactly equal to the number of groups. The results obtained from the model are presented in Table 4 below.

7. Conclusions

This study has provided an empirical analysis of socioeconomic determinants of crime rates in India. The study has shown that the deterrence theory of criminal behavior does not apply to India. The classic deterrence theory points to the fact that increases in certainty of punishment lead to reduction in criminal activities. This study found that increase in certainty of detection have not led to reduction in crime rates, indicating a fundamental flaw in the detection and corrective mechanisms in India. We have therefore pointed to the fact that there is a need for penal system reform for the behavioral relationships between deterrence factors and crime rates to be accurately reconfigured. The findings of the study confirm the positive relationship between population density and crime rates. Some of the immediate policy concerns arising from this analysis include the need for proper city planning, universal access to necessities, and infrastructure improvement in densely populated areas. The study’s findings also suggest that improvement in educational

infrastructure are necessary in order to raise the returns on education and, consequently, raise the opportunity costs of criminal activity.

The findings of this study are consistent with economic theories of crime, which contend that as economic activities increase, criminal activities also rise generally. This, however, suggests that India's economic growth is not an equitable one. Since the economic reforms of 1991, India has made impressive strides toward achieving higher economic growth, but economic inequality has also increased significantly, particularly over the past two decades. Additionally, as supported by the empirical findings, an increase in consumerism combined with unfulfilled desires has fueled the criminal propensity in India. A sound policy framework must be built around achieving economic growth through extensive employment generation that bridges the income divide.

Among the lines of research to be developed in this area in context of Indian economy, it would be interesting to conduct empirical investigation of: (a) the relationship between inequality, poverty, unemployment, and crime rates, (b) a disaggregated level of analysis (may be at districts level) to understand the socioeconomic determinants of crime, (c) investigate the relationship between determinants and various typologies of crime.

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Data availability statement

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Notes

1. The report can be accessed via the following link: <https://www.visionofhumanity.org/maps/#/>
2. Thomas Hobbes, one of the great philosophers, proposed the two natural laws that form the foundation of the society. Individuals enter into contract with a sovereign to protect and uphold these natural laws. Early social contract theories first appear with the development of his theory of natural law.
3. Charge sheeting rate is defined as disposal of offenses by Police.

4. The official crime records in India is published by National Crime Records Bureau (NCRB), India. NCRB is the only official agency which publishes annual publication on crimes in India.

5. Crime rate is defined as rate of crime per 100,000 population and is calculated as:

(Total number of offenses/Estimated mid-year Population) * 100,000

6. First differencing in time series analysis means obtaining the difference between two successive values.

7. This statistic is derived from NCRB reports. For each of the states, male offenders are significantly higher in numbers.

8. This can also be seen through the number of policemen per 100,000 population. India lags significantly behind in this statistic, hence workload of each police officer is significantly higher than those of other countries.

9. The average rate of recidivism for these states during the study period is 9.20. This means that approximately 9 per cent of total offenders are old ones (apprehended for more than one time).

10. The average conviction rate for offenses for the sample states is 38.58, a significantly low value compared to other countries.

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