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Urban-rural unemployment and crime in India: a panel data analysis

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Abstract: The primary purpose of this paper is to empirically investigate the effect of urban and rural unemployment on various violent and property crimes across 35 states and union territories of India between 1993 and 2017. We have employed a dynamic panel data (DPD) model – the system generalised method of moments (SGMM) for attaining reliable and unbiased results. The DPD model is preferable as it accounts for inertial effects of crime. The findings showed a positive association between urban unemployment and theft. Rural unemployment appeared to be an insignificant factor in determining the incidence of crime in India. The lagged values of the dependent variables are significant for murder, robbery, burglary and theft, confirming the inertial effect of crime. The current study also discusses the possible reasons for the above-mentioned association between economic variables and various types of crime.

Keywords: crime; unemployment; panel data; generalised method of moments; GMM; socio-economic; India.

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1 Introduction

Crime is a negative externality that has an adverse effect on the welfare of society and the quality of life. Crime inflicts economic, monetary, and social costs, causes a sense of fear, and proliferates insecurity, which deteriorates the well-being of people (Hazra, 2020). Crime also diverts resources from legal activities to illegal ones, reducing the scope for more investments and consumption (Carboni and Detotto, 2016). Apart from the generally known reasons for crime, it is possible that economic factors can influence the incidence of crime in any society. Economic, structural and societal forces, such as unemployment, education, inequality, or other ingrained processes within a society, appear to catalyst crime levels (Sahu and Mohanty, 2016). The economic literature suggests that criminal activity is primarily motivated by net relative benefits that can be attained from illegal activities compared to legal means (Becker, 1968). In this regard, unemployment can be considered as a potential economic factor that can substantially affect the incidence of crime in a society.

The relationship between unemployment and crime lies at the core of economic theories of crime, which aim to explain whether and how unemployment would affect crime rates (Cook and Zarkin, 1985; Howsen and Jarrell, 1987). The study on such a link between economic factors and crime became a serious topic of discussion since Becker's (1968) economic theory of crime. Becker (1968) pointed out that potential criminals weigh the costs and benefits of committing a crime. Individuals can generate income either from criminal activities or from labour markets based on the relative gains that they can attain from both activities. Therefore, crime occurs when economic gains from criminal activities outweigh those from legal employment, generating a lower opportunity cost of crime, thus motivating people to involve in criminal activities (Becker, 1968; Howsen and Jarrell, 1987).

Although it is true that many crimes are acts of impulse or rage, the rationality of human behaviour makes individuals to try maximise their utility, formulating a choice between legal and illegal activity. Researchers have suggested that the unemployed are more likely to commit a crime as the opportunity cost of crime decreases in the absence of job opportunities (e.g., Ehrlich, 1996; Saridakis and Spengler, 2012). Consequently, illegal activities become more appealing when the payoff for participating in legal market activity deteriorates for an unemployed individual. Unemployment can also have a motivational effect, especially during economic troubles making individuals commit crimes to maintain their livelihood (Cantor and Land, 1985). Therefore, economic theory predicts that individuals will partake in illegal activities as soon as the maximised expected utility is highest for that option (Becker, 1968; Ehrlich, 1973). In other words, engaging in illegal activities depends on whether the relative monetary rewards are large enough from the illegal means and the extent of efficiency of a country in maintaining strict law and order policies.

On a theoretical note, the relationship between unemployment and crime may go either way. One hypothesis would be that high unemployment implies a restriction on the availability of legal activities and thus reduces the opportunity cost of engaging in crime. This is because unemployment will adversely affect individual income, which deprives individuals of their normal livelihood (de Blasio et al., 2016; Dix-Carneiro et al., 2016; Hazra and Cui, 2018). Brenner (1976) then argued that failure to maintain a certain standard of living due to unemployment could lead some individuals to indulge in criminal activities. Thus, a positive correlation would be predicted between

unemployment and crime. However, unemployment may be viewed not only as an indicator of the number of individuals who are out of work but also as a more general measure of economic activity. In this case, unemployment may also have a negative effect on crime since it could increase guardianship of property due to lower participation in productive activities and reduce the potential opportunities to commit a crime. It may reduce the incidence of certain types of crimes, especially property crimes, and the subsequent crime rate. Therefore, the net effect of the rate of unemployment will rely on which effect is stronger, opportunity or motivation, and could be positive, negative, or even zero (Han et al., 2013).

Given the possible influence of unemployment on crime, this paper aims to study the relationship between urban-rural unemployment and crime in India. Although several studies were conducted to study the unemployment-crime relationship, most of those studies were based on the data from developed countries like the USA, the UK and other developed countries of Europe. Relatively few studies were conducted by taking the data from developing countries. Moreover, studies that focus on India are very limited in the literature, and such studies only focus on the overall crime rate and its relationship between socio-economic variables. Unlike existing studies, we focus on different types of violent crime and property crime, and their relationship with urban-rural unemployment, thus shedding light on the crime-unemployment relationship in the Indian context. Moreover, this paper contributes to the literature by examining the determinants of crime rates, focusing specifically on urban-rural unemployment amongst India's states and union territories. To the best of our knowledge, this is the first attempt to study the relationship between different types of violent and property crime and urban-rural unemployment in India. In view of the fact that criminal activities impose a substantial economic and social cost, it is of paramount importance to understand the determinants of crime to control and prevent the incidence of crime.

2 Review of literature

Several empirical studies investigating the impact of unemployment on crime exists in economic literature (e.g., Gould et al., 2002; Imrohoroglu et al., 2004; Raphael and Winter-Ebmer, 2001; Shi and Wu, 2010; Wong, 1995). There is a general assumption that higher unemployment rates are positively associated with higher crime rates, and various empirical studies have confirmed this assumption (e.g., Elliot and Ellingworth, 1996; Levitt, 2001; Raphael and Winter-Ebmer, 2001; Reilly and Witt, 1996; Witt et al., 1998). However, empirical studies also suggest a negative or negligible relationship between crime and unemployment (Imrohoroglu et al., 2004; Phillips and Land, 2012; Shi and Wu, 2010). All these studies indicate that the relationship between unemployment and crime may go either way. The direction of the relationship can be positive, negative, negligible or even insignificant, as found in certain studies. It often depends on the characteristics of the area of study, the level of development, and the types of crimes being investigated.

Despite the theoretical attention, much of the empirical work examining the relationship between crime and unemployment are focused on developed economies. Costantini et al. (2018), Lin (2008), Gould et al. (2002) and Raphael and Winter-Ebmer (2001) have conducted study using US data and concluded a statistically significant

positive association between unemployment rate and property crime. Detotto and Pulina (2013) and Buonanno (2006) suggested a significant and positive effect of unemployment on the crime rate in Italy. Using Swedish data, Öster and Agell (2007) concluded that general unemployment has statistically significant positive impacts on crime. Altindag (2012) reported a positive relationship between unemployment and property crimes for country-level panel dataset from Europe. Wu and Wu (2012) used panel data of the UK regions to conclude that unemployment and income inequality are significant explanatory variables for crimes motivated by economic gain. Andresen (2012) examined the unemployment and crime relationship in a Canadian city using a neighbourhood level hybrid modelling and suggested that in the long run, both property crime and violent crime increases with an increase in unemployment. Bennett and Ouazad (2020) found direct relationship between unemployment and crime in Denmark. Recher (2020) investigated the impact of unemployment on property crime in Croatia using country-level yearly panel data. The results suggested that unemployment has a significant positive effect on property crime.

Although the studies mentioned above suggest a positive association between unemployment and crime, there are studies that suggest a negligible or negative relationship between unemployment and crime rate (e.g., Allen, 1996; Britt, 1997; Cook and Zarkin, 1985; Phillips and Land, 2012). Cantor and Land (1985) stated a contrasting negative impact of unemployment on crime rates. The rationale behind their argument was that during economic distress, a rise in the unemployment rate leads to a decrease in median family income, which discourages a person from committing a crime. Imrohoroglu et al. (2004) used a dynamic equilibrium model and suggested that the effect of unemployment on crime is negligible. Choe (2008) found no statistically significant effect of unemployment on crime rates using a US state-level dataset from 1995 to 2004. Fallahi et al. (2012) and Phillips and Land (2012) concluded that the rate of burglary is significantly lower during recessions indicating a negative relationship between unemployment and crime rate. Janko and Popli (2015) have done an error correction model using national and regional level Canadian data to examine the link between economic activity, measured by the unemployment rate, and crime rates. Their results suggested no long-run relationship between incidence of crime and unemployment. Furthermore, they found a significant negative short-run association with the unemployment rate for select property crimes.

We extend the literature by examining the impact of unemployment on crime in developing countries, even though studies on developing countries are limited. Huang and Chen (2007), Edlund et al. (2008) and Cheong and Wu (2015) reported positive association between unemployment and crime rate using Chinese data. These results were contradicted by Shi and Wu (2010) as they concluded that there exist a negative correlation between crime and unemployment in China. Chen (2008), using unemployment data from Taiwan, empirically showed an inverse relationship between employment and crime against property. Using panel data from Iran, Haddad and Moghadam (2011) established a positive association between unemployment and property crimes. Bharadwaj (2014) observed a negative correlation between unemployment and property crime in India. While Khan et al. (2015) obtained a positive relationship between unemployment and the crime rate in Pakistan. Hazra and Cui (2018) analysed the relationship between crime, inflation, unemployment, and real GDP per capita in India using national data and the VAR model. They observed that macroeconomic indicators, especially unemployment, can significantly affect crime in

India. Later on, Hazra (2020) examined the determinants of crime in India using panel data from 2010 to 2016 across 32 states and union territories. The results suggested that the unemployment rate is crucial in explaining some categories of crime.

The literature discussed above depicts that the crime-unemployment relationship produces a mixed result suggesting the possibility of positive, negative or insignificant association of these two variables. This is also true for developing countries. The results depend significantly on the nature and characteristics of the area considered for the study. Thus, it is crucial to study each country separately, irrespective of the level of economic development and the efficiency of the legal system to formulate policies to prevent the occurrence of criminal conduct.

3 Data and variables

Annual data for crime was obtained across 28 states and seven union territories of India for a period of seven years between the time periods 1993 and 2018 from the annual reports released by the National Crime Records Bureau (NCRB) of India. This data is based on the complaints filed with the police all over the country. The various crime rates are obtained by normalising the total recorded crime in each category by 1,000 populations residing in each state. We examine five crime rates, categorised into:

1 violent crime that includes murder, rape and robbery

2 property crime that includes burglary and theft.

The present study emphasises on violent crime and property crimes as other categories of crime are deemed less significant than crimes committed against people and their property (Andresen, 2012). Moreover, the cost associated with violent offences and crime against properties is significantly higher than the other categories of crime (Brand and Price, 2000). Hence, we consider three types of violent crime – murder, rape and robbery, and under the classification of property crime, we consider burglary and theft.

The unemployment data were drawn from NSSO Employment and Unemployment Survey Reports, NITI Aayog, and Periodic Labour Force Survey (PLFS), NSO. The unemployment figures are the sum of principal status and subsidiary status. The drawn data on unemployment represents rural and urban unemployment for each Indian state and union territory. The unemployment rate is defined as the proportion of unemployed (per 1,000) for persons aged 15–59 years according to the usual principal status approach for each state and union territories.

Following the previous literature, we also include a set of standard socio-economic and demographic variables that are likely to be associated with incidence of crime. We have taken educational attainment, level of income measured using real per capita net state domestic product (NSDP), social sector expenditure (SSE), and population as the set of socio-economic, and demographic control variables in this paper. We have also considered the pendency percentage of cases filed with police stations across states and union territories as a proxy of the efficiency of the police force.

To measure educational attainment, we have extracted the data on the number of students enrolled in primary school during the years considered for the study, taken from the Department of Higher Education, Ministry of Human Resource Development. This

data shows the number of students who attained the primary level education and can be considered literate.

The data on real per capita NSDP is extracted from National Statistical Office, Ministry of Statistics and Programme Implementation, Government of India. NSDP is defined as a measure of the volume of all goods and services produced within the boundaries of the state during a given period of time after deducting the wear and tear or depreciation, accounted without duplication. The real per capita NSDP taken for the study indicates the state-wise per capita NSDP at constant prices. It is considered as a proxy for the real per capita income of different states and union territories. The base year for all per capita nSDP data used in this study is 2004–2005.

The data on SSE is taken from Reserve Bank of India database. The SSE includes expenditure on social services like education, health and other social sectors. SSE indicates the amount spend by various states and union territories in order to improve the quality of life of the people.

The population data used in this study is the 'projected mid-year population' published by the NCRB annually based on the census data published every ten years. Another crucial control variable considered for the empirical estimation is the pendency percentage as a proxy of police efficiency. Pendency percentage is the percentage of the number of cases pending investigation at the end of the year to the total number of cases registered that year. Here in the study, we have only considered the pendency percentage of IPC crimes as crimes defined under this category are serious in nature and far more important than other types of crime. Moreover, data reliability is reasonable in the case of IPC crimes as it is accurately reported and disposed. The summary statistics of the dependent variables and all the independent variables considered for the study are given in Table 1.

Table 1 Descriptive statistics for dependent and independent variables

	Mean	*Standard deviation*	*Min.*	*Max.*
Murder	3.154812	1.824866	0	16.4
Rape	3.251464	3.279051	0	16.2
Robbery	2.069456	1.965936	0	14.2
Burglary	11.93515	8.695397	0	52.3
Theft	40.65397	84.49625	4.4	1,000.4
Urban unemployment	66.58723	48.28561	1	286
Rural unemployment	41.2906	47.83898	2	400
NSDP (in rupees)	75,181.8	57,257.67	10,349.76	368,685
SSE (in crores)	13,127.1	29,660.61	0.9	170,190
School enrolment	483,739.7	744,956.2	401	5,241,660
Population (in lakhs)	329.43	424.7159	0.6	2230
Police pendency	32.54	19.34739	2.7	97.1

Notes: Dependent variables are rate of murder, rape, robbery, burglary and theft. Independent variables are urban unemployment rate, rural unemployment rate, NSDP, SSE, school enrolment (primary), population and police pendency percentage.

4 Econometric model

The present study put forward an econometric methodology that examines the effect of urban-rural unemployment on different types of violent and property crimes in India. To estimate the crime model, panel data analysis is used for state-level data on different types of violent crime, property crime and other explanatory variables for the Indian states and union territories. We apply a dynamic panel data (DPD) econometric model – system generalised method of moments (SGMM) to extract more accurate, reliable and unbiased estimates of the effect of urban-rural unemployment on various types of crime in India. The complete econometric specification of our empirical model is as follows:

$$CRM_{i,t} = \alpha_0 + \alpha_1 CRM_{i,t-1} + \alpha_2 U_{i,t} + \alpha_3 X_{i,t} + \eta_i + \eta_t + \varepsilon_{i,t}$$

where $CRM_{i,t}$ is the crime rate at time t, $CRM_{i,t-1}$ is the lagged value of crime rate, $U_{i,t}$ is the vector of unemployment variables (urban and rural unemployment), $X_{i,t}$ is the vector of the set of control variables (including socio-economic, demographic and law enforcement variables), η_i is unobserved state fixed effects (FEs), η_t is time FEs and $\varepsilon_{i,t}$ is typical idiosyncratic error component with zero mean and constant variance. The subscripts i and t indicate the name of the Indian state and time period, respectively. Following Kelly (2000), all the variables (except the time trend) were transformed into logarithms, which mean the estimated coefficients are in the form of elasticities.

Considering the inertial effect of crime (i.e., persistence over time) and feasibility of dynamic panel model which observes small T and large N, we employ an instrumental variable approach for panel data using SGMM suggested by Arellano and Bover (1995) and developed by Blundell and Bond (1998). The use of the DPD model to investigate the effect of urban and rural unemployment on crime is advantageous for several reasons. First, it is possible to account for region-specific unobserved heterogeneity, such as measurement error, institutional characteristics and cultural characteristics. Failure to do so leads to inconsistency and bias in the estimated coefficients. Second, it is possible that crime can have inertial effects leading to the influence of its own lagged value (Fajnzylber et al., 2002). Any inertia in crime rates can be accounted by including lags of the dependent variable as an explanatory variable. The inclusion of lagged endogenous variable as an explanatory variable makes it necessary to adopt an instrumental variable estimation by using a generalised method of moments (GMM) estimator. GMM is a dynamic lagged dependent model that can account for the inertial effects of various crimes considered for the study. Third, GMM is also advantageous as it allows for the use of lagged regressors as instruments, which can solve the problem of endogeneity in the case of some regressors (Ghasemi, 2017) and capture the time persistent effect of independent variables on crime. Furthermore, inconsistency due to reverse causality is also a crucial problem in the estimation process. This can also be solved by the application of a SGMM estimator. Considering the superiority of SGMM in obtaining unbiased and reliable estimation results, we focus on the results obtained using SGMM in our study.

5 Results and findings

This study examines the effect of rural and urban unemployment on violent and property crimes in India. Unemployment rate in India was at a 45 year high in 2017–2018 according to the PLFS data released by the Government of India. It is rational to consider that this decline should be linked to the surge of unemployment rate in both urban and rural areas. The increase in the unemployment rate was more than three times among rural men and more than double among rural women since 2011–2012. In urban areas, the unemployment rate among men was more than twice and has increased twice among women since 2011–2012. Despite the government's support through its various employment programmes, this negative shock must have led to a decline in household earning opportunities in both rural and urban areas. While the employment opportunities declined, incidence of crime was increasing. In 2019, the rate of total violent crime across Indian states was reported as 31.2, while property crimes, theft and burglary were reported as 50.5 and 7.5, respectively. These figures are higher than what was reported five years back in 2015 and this increasing trend is been seen for past few decades.

As initial step we employed FE and random effect (RE) models to compare the results obtained by a dynamic panel model considered for the study. Tables A1 and A2 in Appendix show the results obtained from FE and RE models. We have done the Hausmann test to choose the suitable model between RE and FE. The result of the Hausmann test suggests that the RE estimator is the most suitable model estimator compared to the FE model. However, the main problem with the RE and FE model is that these models cannot account for endogeneity problems or other econometric issues like the non-stationarity of variables. Therefore, we focus on the results estimated using the SGMM method given in Table 2 while interpreting the results. The results obtained by the SGMM are more robust as it captures the lag effect of the dependent variable, unlike the FE and RE model. Furthermore, SGMM estimation can be used for unbalanced panels, multiple endogenous variables, and controlling FEs and time effects.

Table 2 shows the results obtained from the SGMM estimator for murder, rape, robbery, burglary and theft, respectively. Our primary aim is to show how urban and rural unemployment influences various types of violent and property crimes in India. The existing studies on the crime-unemployment relationship suggest a mixed result (Chen, 2018; Fallahi et al., 2012; Hazra, 2020; Janko and Popli, 2015; Raphael and Winter-Ebmer, 2001), indicating the possibility of having a positive, negative or insignificant association between crime and unemployment. Apart from unemployment, we also consider a few socio-economic, demographic and law enforcement variables which may affect different crime rates in India over time. All the specifications are tested for AR(2), Sargan and Hansen tests. The results show that they all pass the tests, and thus the instruments are valid in all specifications. Columns 1 to 5 in Table 2 show SGMM estimation results between dependent and independent variables considered for the study. The lagged value of the dependent variable that indicates the crime inertia is significant for murder, robbery, burglary and theft, confirming the inertial effect of crime. It signifies that the crime taken place in the past years has a significant influence on crime taking place in the current year for murder, robbery, burglary and theft.

Table 2 Panel data SGMM estimation

	Murder (1)	*Rape (2)*	*Robbery (3)*	*Burglary (4)*	*Theft (5)*
Lagged dependent variable	0.8173727 (0.005)***	–1.34919 (0.551)	0.6909819 (0.013)**	0.8452988 (0)***	0.9826989 (0)***
Urban unemployment	0.0677192 (0.462)	2.1842 (0.357)	–0.0937273 (0.698)	0.0795758 (0.544)	0.3941767 (0.008)***
Rural unemployment	–0.0156264 (0.546)	–1.508659 (0.39)	–0.0690153 (0.604)	0.0837379 (0.509)	0.0357083 (0.754)
NSDP	0.0898773 (0.234)	–0.3244447 (0.726)	0.2101972 (0.346)	0.0694837 (0.239)	0.1081309 (0.02)
SSE	–0.2127182 (0.029)**	0.6518914 (0.776)	–0.0240485 (0.965)	0.0256018 (0.91)	–0.0775191 (0.703)
Primary school enrolment	0.0316633 (0.824)	–1.783879 (0.506)	–0.2117864 (0.393)	–0.1131817 (0.326)	–0.3190021 (0.025)**
Population	0.1267952 (0.399)	0.9752985 (0.692)	0.2562755 (0.492)	0.0717197 (0.648)	0.4276965 (0.003)***
Police pendency	–0.0157658 (0.797)	–0.50596 (0.345)	0.1081099 (0.37)	–0.0841187 (0.175)	0.0205972 (0.6)
Hansen P-value	0. 683	0.842	0.811	0.412	0.582
AR(1) P-value	0.01	0.01	0.000	0.001	0.002
AR(2) P-value	0.769	0.801	0.744	0.838	0.486
Sargan P-value	0.637	0.703	0.656	0.503	0.798

Notes: All the variables are expressed in logs. The probability values are given in the parenthesis. *, ** and *** significance at the 10%, 5% and 1% levels, respectively. Dependent variables are crime rate of murder, rape, robbery and theft. Independent variables are urban unemployment rate, rural unemployment rate, NSDP, SSE, school enrolment (primary), population and police pendency percentage.

One of our main independent variables, urban unemployment, appears to be significant only in the case of theft. The association between rate of unemployment and crime is expected to be significant for property crimes that involve pecuniary benefits (Levitt, 2004; Ehrlich, 1996). The estimated results show a positive association between urban unemployment and theft. The result is in line with the findings of previous studies, which suggests a positive association between property crime and unemployment (Altindag, 2012; Andresen, 2012; Recher, 2020). From the estimated results, a 1% increase in urban unemployment will increase theft by 1.01%. The findings indicate that unemployment significantly influences the incidence of property crime in India except for burglary. A positive association between urban unemployment and property crime may be due to several reasons. First, unemployment reduces the return from legal activities such as loss of wage and other labour benefits, reducing the opportunity cost of involving in illegal activities, inciting the crime rate (Meloni, 2014). Secondly, in urban areas, opportunities to commit illegal activities are much higher as the link between rate of unemployment and crime may be driven by the availability of theft-worthy goods. If goods are theft worthy, the opportunity cost of committing the crime would be lesser motivating unemployed individuals to involve in crimes related to property. The availability of such wealth-storing goods in urban areas increases the expected returns to criminal activity,

leading to an increased crime rate. Moreover, a rise in consumerism in India, due to globalisation and rapid urbanisation, leading to an increase in demand for goods and services, has augmented dependence on criminal/illegal means (Hazra, 2020).

On the other hand, rural unemployment shows a negative association with all types of violent crime and a positive association with all types of property crime. However, the results are insignificant for all types of violent and property crimes considered for the study. The results suggest that rural unemployment is not an influential factor determining the changes in the crime rate in India. This may be due to the fact that India has witnessed widespread migration from rural areas to urban areas in search of a job and better living standards especially when rural unemployment is high. According to Census 2011, out of India's population of 1.2 billion, 377 million people (close to one-third) live in urban areas. When a situation of unemployment increases in rural areas, people will be tempted to move to urban sectors, which reduce the opportunity to commit a crime in rural sectors.

A critical finding from the estimated results indicates that both urban and rural unemployment are not significantly associated with any violent crime taken for the study. This would be due to several reasons. First, being unemployed can induce motivation to earn income illegally, but it does not necessarily increase violent behaviour. This is not entirely surprising since violent crimes are less likely to be economically motivated than non-violent property crimes. Second, the economic gains from committing violent crimes would be lesser, and the opportunity cost of committing the crime to earn a livelihood is high. These findings are in line with the findings of Gould et al. (2002), Hauner et al. (2012) and Janko and Popli (2015), among others, who do not find any significant relationship between different types of violent crime and unemployment.

When it comes to per capita income measured using NSDP, the estimated results show that NSDP is positively associated with theft. 1% increase in NSDP will lead to a 0.19% increase in the rate of theft. The reason for a positive association between NSDP and theft would be due to the fact that the greater is the average income in a country, the greater the returns from committing property crimes. A sound economy can generate higher per capita income and greater consumption of high-value items, which increases the attractiveness of targets (Phillips and Land, 2012). However, the results appeared to be insignificant in the case of murder, rape, robbery and burglary.

For SSE, the result is significant in the case of murder. The estimated results suggest a negative association between murder and SSE. As per the findings, a 1% increase in SSE will reduce murder by 0.03%. However, the results appeared to be insignificant in the case of all other crimes suggesting that SSE is not a significant factor in explaining the changes in the rate of different types of violent and property crime, except incidence of murder in India.

The school enrolment ratio of primary grades shows a negative association with all types of violent and property crime, except for murder. This finding is consistent with many earlier studies which have found similar results (Bell et al., 2016; Hjalmarsson et al., 2015; Huang and Chen, 2007; Lochner and Moretti, 2004; Machin et al., 2011; Meghir et al., 2012; Shi and Wu, 2010; Wong, 1995). However, the results are insignificant for all types of crime except for theft. The estimated results indicate that a 1% increase in school enrolment decreases theft by 0.32%. These findings support the prediction that there is a strong and consistent negative effect of education on property crime. The findings suggest that enhancing the level of education by the government

through improving facilities and opportunities can be an excellent measure to reduce the number of thefts taking place in society.

The demographic variable in our study, population, has a positive association with all types of violent and property crime. However, the result is only significant in the case of theft, suggesting that a higher population leads to higher crime rates for property crimes, specifically theft. The results indicate that a 1% increase in population would increase theft by 0.43%. Finally, our law enforcement variable, pendency rate, which is used as a proxy for police efficiency, appears to be insignificant in the incidence of different types of violent and property crime in India. The results suggest that the rate of clearance of IPC cases does not significantly influence the reduction of the country's crime rate.

6 Conclusions

Given the existing lack of clarity on the association between unemployment and crime, this paper provides an insightful analysis regarding the impact of urban and rural unemployment on various violent and property crimes in India. The study gives a better means of identifying the association between unemployment and crime in India using panel data modelling. We have constructed a dynamic SGMM model using state-level panel data to capture the dynamic phenomenon between crime and unemployment. We use unemployment rates, state income per capita, and SSE as independent variables to represent the economic incentive factors. Furthermore, we have used demographic and law enforcement variables that may have a potential effect on the crime rate. Our empirical findings suggest that urban unemployment has a significant positive association only with theft as a 1% increase in urban unemployment increases theft by 1.01%. However, rural unemployment is not a significant factor in explaining the incidence of violent and property crimes in India. Among other socio-economic, demographic and law enforcement variables considered for the study, NSDP is positively associated with theft, SSE is negatively associated with murder, primary school enrolment is negatively associated with theft, and population is positively associated with theft. However, pendency percentage is insignificant in the incidence of violent and property crime in India.

Even though we can point out several potential reasons for the incidence of crime, the socio-economic impact is quite certain as the evidence for socio-economic gradients in criminal outcomes is manifest. While considering policies to address the socio-economic impacts of incidence of crime, it would seem more appropriate to identify the specific factors associated with the rising crime rate, and these should be addressed directly. Besides, economic conditions in different places would matter differently while influencing the incidence of crime. From a policy perspective, an increase in employment, especially in urban areas, can mitigate the incidence of property crime in India. Indeed, the general assumption is a positive association between crime and unemployment, but several studies differ by suggesting a mixed result. Our findings align with these existing studies indicating that not all types of crimes are influenced by the level of rural and urban unemployment. The current study's findings add weight to the idea that rural and urban unemployment are not having the same kind of effect on the incidence of crime in India. Therefore, it would seem logical to have separate policy measures for reducing crime rates in the country's rural and urban areas.

The findings of this study contribute to a growing body of research that shows the importance of job creation in the prevention of certain types of crime. It also points out that not all crimes can be reduced by generating more employment. Nevertheless, the labour market should accommodate both educated and uneducated people by creating employment opportunities, thus increasing the opportunity cost of involving in criminal activities.

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Appendix

Table A1 FE panel estimation

	Murder (1)	*Rape (2)*	*Robbery (3)*	*Burglary (4)*	*Theft (5)*
Urban unemployment	–0.0108829 (0.865)	0.4327772 (0.00)***	0.2422514 (0.077)*	0.165664 (0.033)**	0.2411931 (0.013)**
Rural unemployment	–0.0498658 (0.226)	–0.1808511 (0.019)**	–0.0984338 (0.260)	–0.07616 (0.125)	–0.1576759 (0.011)**
NSDP	0.0014777 (0.990)	0.4012135 (0.061)*	0.3734102 (0.128)	–0.13407 (0.333)	0.1624974 (0.345)
SSE	–0.0400743 (0.007)***	0.074481 (0.007)***	–0.0479305 (0.126)	0.002235 (0.899)	0.0084164 (0.701)
Primary school enrolment	–0.3524651 (0.068)*	–0.5389368 (0.128)	0.2250149 (0.581)	0.665281 (0.005)***	1.162511 (0.000)***
Population	–0.1965941 (0.396)	1.039299 (0.016)**	–0.1654489 (0.737)	0.116626 (0.675)	0.3859766 (0.265)
Police pendency	0.056384 (0.293)	0.2244757 (0.026)**	0.2794417 (0.015)**	–0.06209 (0.335)	0.0439988 (0.582)
R-square	0.0278	0.0134	0.0192	0.0516	0.002
Rho	0.962	0.918	0.813	0.982	0.987

Notes: All the variables are expressed in logs. The probability values are given in the parenthesis. *, ** and *** significance at the 10%, 5% and 1% levels, respectively. Dependent variables are crime rate of murder, rape, robbery, burglary and theft. Independent variables are urban unemployment rate, rural unemployment rate, NSDP, SSE, school enrolment (primary), population and police pendency percentage.

Table A2 RE panel estimation

	Murder (1)	*Rape (2)*	*Robbery (3)*	*Burglary (4)*	*Theft (5)*
Urban unemployment	–0.0210448 (0.740)	0.4397866 (0.000)***	0.2426611 (0.067)*	0.181646 (0.020)**	0.2670611 (0.006)***
Rural unemployment	–0.0584636 (0.147)	–0.2016778 (0.008)***	–0.10517 (0.215)	–0.08054 (0.108)	–0.1580581 (0.011)**
NSDP	–0.1229934 (0.173)	0.2445475 (0.177)	0.4669817 (0.020)**	0.044951 (0.730)	0.4467125 (0.003)***
SSE	–0.0270471 (0.032)**	0.1045908 (0.000)***	–0.0536075 (0.050)**	–0.00698 (0.686)	–0.0058566 (0.776)
Primary school enrolment	0.0846198 (0.576)	–0.4454385 (0.125)	0.4672756 (0.149)	0.316801 (0.111)	0.6136286 (0.011)**
Population	–0.1073086 (0.461)	0.3948969 (0.161)	–0.2063959 (0.511)	–0.36221 (0.068)*	–0.483469 (0.040)**
Police pendency	0.0891022 (0.051)*	0.1689678 (0.063)*	0.2419327 (0.016)**	–0.0709 (0.262)	0.061255 (0.417)
R-square	0.3476	0.2106	0.1452	0.0503	0.1731
Rho	.6617	0.778	0.7613	0.9179	0.828

Notes: All the variables are expressed in logs. The probability values are given in the parenthesis. *, ** and *** significance at the 10%, 5% and 1% levels, respectively. Dependent variables are crime rate of murder, rape, robbery, burglary and theft. Independent variables are urban unemployment rate, rural unemployment rate, NSDP, SSE, school enrolment (primary), population and police pendency percentage.