Crime against Women and Human Development: Do they have co-movements in Indian States?

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Abstract

Crime against women is a vibrant issue in the literature of development economics whose control becomes the one of the principal agendas of the policy makers as it creates social disturbances and delays in reaching sustainable developmental objectives. Although there are some studies on the impacts of that type of crime upon economy at country levels, there is no such studies at Indian state levels particularly when the issue of human development is considered. The present study aims to intercept in this juncture through investigating whether crime against women and HDI maintain co-movements over the period 1995-2018 along with their short run causal interplays for the major states and union territories of India. It arrives at the conclusion that there is long run relation between HDI and crime rates only for four states, namely, Bihar, MP, Punjab and TN. However, the results of the causal interplays in the short run show that there is unilateral causality between the two for seven states, namely, AP, MP, Maharashtra, Rajasthan and UP, Assam and Odisha. The relatively rich, educated and healthy people are probably associated with the increasing crime rates against women in these two states.

Keywords: *Crime; women; HDI; SDG; cointegration; causality; Indian states*

Introduction

According to the United Nations (2005), violence against women brings huge economic costs to any society in a country irrespective of its level of growth and development. The negative impact on women's participation in education, employment and civic life undermines poverty reduction in particular and the other sectors in general. It results in loss of employment and productivity, and it drains resources from social services, the justice system, health-care agencies, and employers. The direct cost of the health system, counselling and other related services, the justice system, child, and welfare support, as well as indirect costs, such as lost wages, productivity and potential, are just a part of what societies pay for violence against women. As such, violence against women is a clear barrier to sustainable development. This has been acknowledged in the recently adopted Agenda 2030 for Sustainable Development.
Attainment of overall development of a nation needs, among others, zero crime rate against women. As has been mentioned in the United Nations' sustainable developmental goals, out of the seventeen agendas, gender equality is one of them and to maintain such equality, the other agendas are to be performed side by side. As a special feature of overall development, human development is a measure through which the impacts of the abolitions of crime and violence against women can be assessed. To measure human development, there is a popular

index, human development index (HDI), which incorporates three principal components, per capita income, life expectancy and education. To have good HDI score, the nations have to make progress in gender equality and low violence against women since the negative consequences of these two make the women section of the society ill in physical and mental health, low life span, social distress, among others. Therefore, it can be said that there can be co-movements of HDI and crime against women in the long run across the economies and provinces of a particular economy. The present study aims to intercept in this juncture through investigating whether crime against women and HDI maintain co-movements over the period 1995-2018 along with their short run causal interplays for the major states and union territories of India.

Brief Literature Review

In a seminal work, Becker (1968), elaborately discussed the optimum level of crime and its control in a mixed economy. The work tried to analyze how many resources and how much punishment should be used to enforce different kinds of legislation. It 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 a crime. The study concluded that the optimal amount of enforcement was dependent on, among other things, the cost of catching and convicting offenders, the nature of punishments and the responses of offenders to changes in enforcement. Ehrlich (1973) developed a theory of participation in illegitimate activities and tested against data on variations in index crimes across states in the United States where the investigation was dealt directly with the interaction between offense and defense: crime and collective law enforcement. The study indicated the existence of a deterrent effect of law-enforcement activity on all crimes and a strong positive correlation between income inequality and crimes against property. In a related study Ehrlich (1975) attempted to analyze the relation between education and crime by concentrating on the role education might have in determining such opportunities. It suggested that education did not have a uniform effect on illegitimate and legitimate opportunities but had an effect which varies according to the complementarity of schooling and legitimate training with inputs employed in producing legitimate and illegitimate returns. It is established in some studies such as Gneezy and Rustichini (2000) that penalty against any unlawful activity promotes the magnitudes of the activity and reduction or waiving of this penalty leads to no reduction in the activity.

In the studies related to a specific developing economy Dutta and Husain (2009) 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 Indian states for the period 1999-2005. The results show that both deterrence and socioeconomic factors are important in explaining crime rates. In another study, Cui and Hazra (2017) examined the relationship between crime, GDP per capita, inflation, and unemployment rate in India for the period 1991-2015 using the Johansen cointegration test and confirmed the presence of cointegration relationship between the variables. The Toda-Yamamoto Granger causality test suggests that all the macroeconomic variables can significantly affected the crime level in India, and vice versa. The study of Das and Mukherjee (2018) with a different flavourtried to identify the significance of several socioeconomic factors upon terrorism, namely, refugee population, access to good sanitation facilities, youth unemployment rate, percentage of education expenditure to GDP, percentage of military expenditure to GDP, per capita GDP and political

stability in the panel of seven South Asian countries and China for the period 2002-2016. By applying both static and dynamic panel models, the study observed that all of the selected variables explained the terrorism index with expected signs. Whether social sectors' spending have long run associations with HDI has been investigated by Das, Mandal and Patra (2019). It investigates the same in individual and panel of states in India for 1995-2016. Using cointegration, causality and error correction mechanism for the individual and panel of states, it observes that there are long run relations between the two for majority of the states but the panel data results through VECM show that both the indicators have long run associations and there are causal interplays from social sector spending to the HDI.

But there is a dearth of studies in the area of the inter link between HDI, socioeconomic factors etc. with crime against women. There has been a series of literature on the effect of crime against women in female headed families such as in Kelly, 2000; Demombynes and Ozler, 2005, among others. The study of Cano-Urbina and Lochner (2017) on US schools shows that there are significant effects of schooling attainment on the probability of incarceration and that increases in average schooling levels reduce arrest rates for violent and property crime but not white-collar crime such as crime against women. Aizer (2010) established that reduction in wage gap leads to reduction in gender gap which further leads to low crime rates against women in USA. This study has alternative implication that increase in wage gap is the cause of crime against women. The study by Wolf et al (2014) shows that in the low and middle-income countries, income inequality is related to homicide, robbery, and self-reported assault and in high-income countries, urbanicity is significantly associated with official assault. Ahmed and Mesbah (2017) find that state income inequality increases intimate partner violence as well as violence by anyone other than her partner in India. Hence, inequality is an issue which explains HDI as well as crime against women. In a recent study by Krüsselmann et al (2021) that firearms have been connected to higher rates of interpersonal violence leading to homicides. Firearms in the country are usually held by the rich class of the society and their connections to homicides make us to informed that rich persons are highly associated to crime rates.

But the existing literature so far reviewed does not have such study which particularly focuses on the inter link between HDI and crime rates against women at the Indian provincial level. The present study tries to fill the gap in the literature by means of taking up an initiative to investigate whether crime against women and HDI are with long run associations and short run interplays.

Theoretical Concept

To establish a theoretical networking between HDI and Crime it is first required to understand the main components of HDI and their associations with the crime rates. HDI is formulated by three indicators, PCGDP (Y), health factors (H) and education factors (E) where H+E constitute the human capital stock. On the other hand, crime rates (C) affect HDI through Y, H and E, keeping all other determinants of crime as fixed. Hence,

$$HDI = f(C)$$

where $dHDI/dC \neq 0$.

Again,

$$C = f(Y, H, E) \text{ with } dC/dY \neq 0,\ dC/dH \neq 0 \text{ and } dC/dE \neq 0.$$

The $\neq$ symbol making the directions of the effects as positive and negative have serious implications. Increase in Y may lead to increase or decrease in crime rates. The same for H

and E. These means, rich, healthy and educated people may be associated with crime against women. The causes lie within different socio-economic and judicial factors which will be detailed in the analysis section.Therefore, Y, H, E affect C through their own as well as cross effects. That means-

$$\frac{\dot{C}}{C} = \frac{\dot{Y}}{Y} + \frac{\dot{H}}{H} + \frac{\dot{E}}{E} + \frac{(\dot{YH})}{YH} + \frac{(\dot{YE})}{YE} + \frac{(\dot{HE})}{HE} + \frac{\dot{YHE}}{YHE}$$

Hence,

$$\frac{\dot{HDI}}{HDI} = \frac{\dot{C}}{C}$$

Data and Empirical Methodology

The study on the linkages between HDI and crime against women across the major 15 states and Delhi as union territories (UTs) for the period 1995-2018uses data on HDI from Global Data Lab and the data on crime against women of National Crime Record Bureau (NCRB).Crime rates are measured in total number of incidences of crime against women. The length of the data starts from the year 1995since the data on HDI is available from the year 1995. Further, the study considers 15 states since the crime rates in these states constitute around 90 per cent of total crime in India. The HDI contains three major components, per capita GSDP (gross state domestic product), life expectancy and education, the last two represent the human capital stock of the states and the first one is the capacity to maintain livelihoods of the states' people. The 15 major states are Andhra Pradesh (AP), Assam, Bihar, Gujarat, Haryana, Karnataka, Kerala, Madhya Pradesh (MP), Maharashtra, Odisha, Punjab, Rajasthan, Tamil Nadu (TN), Uttar Pradesh (UP) and West Bengal (WB). The data on the newly constructed states− Jharkhand, Chhattisgarh, Uttarakhand and Telangana State have been merged to the data of their mother states to make synchronizations of the data.

We have 24 data points and the study of long run associations and short run dynamics between HDI and the crime against women should be preceded by testing for stationarity of the two series across all the selected states and UTs.

Unit roots test procedure for individual states

For a data set ($y_{i,t}$,i = 1, 2, …., 16 and t= 1, 2, ..., T), where t denotes time and i denotes cross sections, let us consider the following linear regression set up for unit root test for two versions of the ADF(p) (1979) regression–viz.,

$$\Delta y_{i,t} = \alpha + \beta_i y_{i,t-1} + \Sigma \gamma_{i,j} \Delta y_{i,t-j} + u_{i,t} \quad \text{(p, } j=1\text{)} \qquad \ldots\ldots\ldots\ldots\ldots\ldots(1)$$

for the *without time trend case* and

$$\Delta y_{i,t} = \alpha + \delta_i t + \beta_i y_{i,t-1} + \sum_{j=1}^{p} \gamma_{i,j} \Delta y_{i,t-j} + u_{i,t}$$

$$\ldots\ldots\ldots\ldots\ldots\ldots..(2)$$

for the *with time trend case*.

If β_i=1 is rejected by the ADF statistic, then it is said that the series for the i[th] state is stationary. If this property holds for both the HDI (y) and Crime (x) series, then the regression can be run without the chances of getting spurious results.

The study has examined the existence of long run or equilibrium relation between HDI and Crime by Engel-Granger (1987) cointegration method and short run dynamics by Error Correction Mechanism (ECM) and Granger Causality (1969) techniques.

Cointegration and Error Correction Mechanism for individual states

Cointegration of the series of HDI and Crime gives the long run relation between the two variables. The precondition to have the long run equilibrium relation is that the two series should be integrated of order one (or, I(1)) as per the EG method so that their equilibrium error term is I(0). Regression of a series with I (1) property upon another series with again I(1) property produces spurious results that is harmful to policy prescriptions. Engel and Granger (1987) offered a solution to this problem by introducing the concept of cointegration. If two series *y* and *x* for the i[th] state are I(1) and are related by the following equation as-

$$y_{i,t} = \alpha_i + \beta_i x_{i,t} + u_{i,t} \quad \text{..... (3)}$$

then their linear combination $u_{i,t} = y_{i,t} - \alpha_i - \beta_i x_{i,t}$ will follow I(0) and then both the series of *y* and *x* will be cointegrated or will have long run associations. Thus, a non-spurious long run relation between two series can be obtained by estimating equation (3). After that, the estimated error term as $\hat{u}_{i,t} = y_{i,t} - \hat{\alpha}_i - \hat{\beta}_i x_{i,t}$ is derived. If the series $\hat{u}_{i,t}$ is found to be I(0) or stationary at level then it is said that the series for the i[th] state are cointegrated in EG sense. The estimated coefficients $\hat{\alpha}_i$ and $\hat{\beta}_i$ give the long run equilibrium relation between *y* and *x* whose form for the i[th]state is

$$y_{it} = \hat{\alpha}_i + \hat{\beta}_i x_{it} \quad \text{.....(4)}$$

Testing stationarity of the estimated error term, $\hat{u}_{i,t}$, is checked by the ADF test through estimating the following equation-

$$\Delta\hat{u}_{i,t} = \phi_i \hat{u}_{i,t-1} + \sum_{j=1}^{T} \delta_i \Delta\hat{u}_{i,t-j} + \varepsilon_{i,t} \quad \text{..... (5)}$$

Then the test is done for $\phi_i = 1$ against $\phi_i \prec 1$. If the hypothesis of ϕ = 1 is rejected then it is said that *y* and *x* are cointegrated series and there exists an equilibrium relation between the two.

In addition to the existence of long run equilibrium relation between two series, there may also be short run deviations from the equilibrium relation. Such deviations are called errors. It is thus required to test whether these errors get corrected or they move back to the long run relation. If they converge to the equilibrium, then it is said that errors are corrected and if they diverge from the equilibrium then they are not corrected. These short run dynamics vis-

à-vis the long run relation can be modelled by the Error Correction Mechanism (ECM). The ECM for the i[th] state can be written as follows-

$$\Delta y_{it} = a_i + \eta_i \Delta x_{it} + \gamma_i \hat{u}_{i,t-1} + e_{i,t} \quad \ldots\ldots\ldots\ldots\ldots\ldots (6)$$

Here $\hat{u}_{i,t-1}$ stands for the error correction term. If the estimated γ_i is found to be negative and statistically significant then the series is said to be converging and the short run deviations are temporary. On the other hand, if the estimated γ_i is found to be positive and significant then the series is diverging and the deviations among the series are permanent and they are moving away from the equilibrium relation. Finally, if γ_i is insignificant in either its positive or negative values then the series remain in equilibrium relation.

Granger causality test for individual states

In a bivariate model with both the series non-stationary and integrated of order one, the Granger causality test for the i[th]state is done by estimating the following equations in first difference form of the variables including the error correction terms for *y* on *x* and *x* on *y* (Granger, 1969). The equations are:

$$\Delta y_t = \nu_{yx} + \sum_{j=1}^{T_{11}} \alpha_{1j} \Delta y_{t-j} + \sum_{j=1}^{T_{12}} \beta_{1j} \Delta x_{t-j} + \eta_{yx} ECY_{t-1} + u_{1t} \quad \ldots\ldots\ldots\ldots\ldots (7)$$

$$\Delta x_t = \nu_{xy} + \sum_{j=1}^{T_{21}} \alpha_{2j} \Delta y_{t-j} + \sum_{j=1}^{T_{22}} \beta_{2j} \Delta x_{t-j} + \eta_{xy} ECX_{t-1} + u_{1t} \quad \ldots\ldots\ldots\ldots\ldots..(8)$$

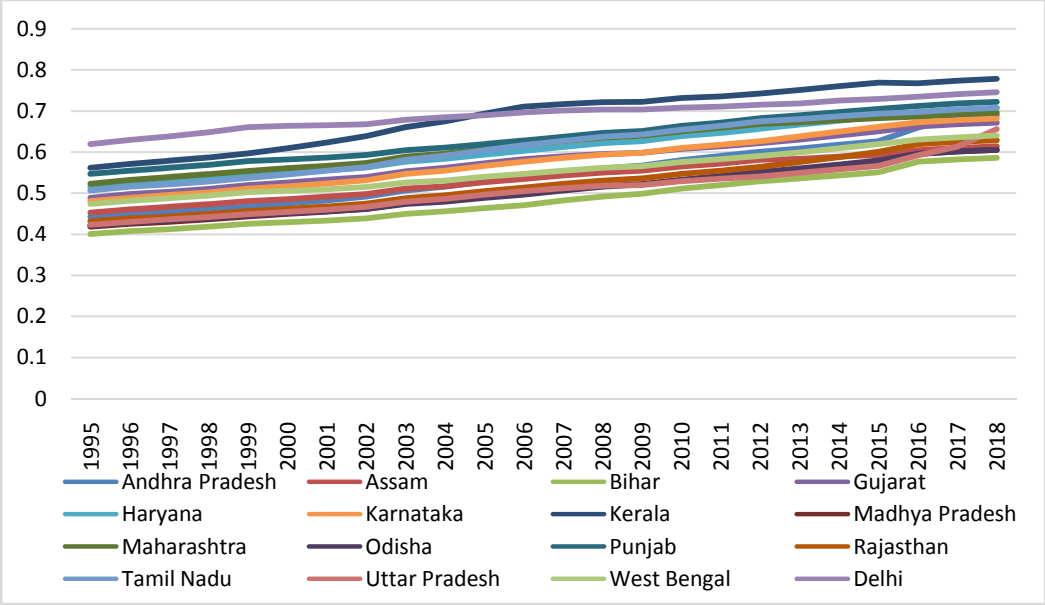
Here Δ denotes the first difference operator; $T_{l\,m}$, *l, m* = 1, 2, 3 denotes the number of lagged values of Δy and Δx that affect the current values of these differenced variables and$u_{lt,}$ are with white noise properties. The parameters η_{yx} and η_{xy}in Equations (7) and (8) are called the adjustment parameters which are required to be negative and significant to justify the error correction feature. ECY_{t-1} and ECX_{t-1} respectively represent the error correction terms. In this present set up the nature or direction of Granger Causality for the whole models is determined by the values of the F statistics where the decisions rules are as follows:
1. If $\beta_{1j} = 0$, for all *j* and $\eta_{yx} = 0$, *x* may be said not to *Granger cause y*. 2. If $\alpha_{2j} = 0$ for all *j* and $\eta_{xy} = 0$, *y* may be said not to *Granger cause x*. 3. If (1) holds but (2) does not, *Granger causality* may be said to be *unidirectional from y to x*. 4. Conversely, if (1) does not hold but (2) does, *Granger causality* may be said to be *unidirectional from x to y*. 5. If both (1) and (2) do not hold, *Granger causality* between *x* and *y* may be said to be *bi- directional or feedback causality*. 6. If both (1) and (2) hold there is no *Granger causality* between *x* and *y*.

Results and Analysis

Graphical view of HDI and crime rates

Before going for the econometric exercise, the study presents the trends of the series for the two selected indicators, HDI and crime rates, to have a view on their movements over the period of study. Figure 1 presents the HDI and Figure the crime rates.

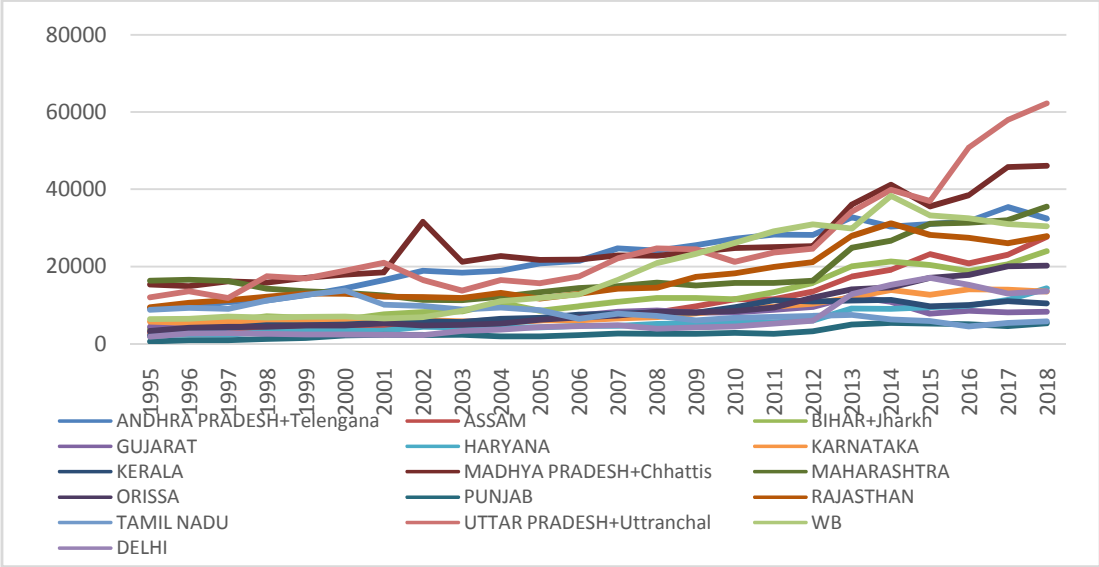
Figure 1. Trends of HDI of the states



Source: Drawn by the authors

It is observed from Figure 1 that the series of HDI for all the countries are showing positive trends over time signifying a good sign for the states. The values for all the states range from 0.4 to 0.78. Uttar Pradesh remain in the trough for all the time and Kerala remain in the top after 2004, replacing Delhi from the top list.

Figure 2. Trends of crime rates of the states



Source: Drawn by the authors

On the other hand, it is observed from Figure 2 that the crime rates of the countries have also increased over time making a gloomy scenario of the states in terms of their overall development. Madhya Pradesh, Uttar Pradesh and Andhra Pradesh are the states occupying top slots in majority of the period and Punjab and Kerala are in the bottom slot in majority of

the period. Tamil Nadu is only the exceptional state producing the good sign where the series for crime rates is declining over time. Hence, for all states except Tamil Nadu, an unusual positive correlation between HDI and crime rates is observed. The usual negative correlation is observed only for Tamil Nadu.

Unit root tests results for the individual states

At first the unit root test for both the series if HDI and Crime for the 16 states and UTs are done by estimating equation (1) and (2) and the test results are depicted in Table 1. The series for all the states are not stationary at their levels (the ADF test statistics are not shown in the table) but are stationary at their first differences except Assam, Kerala and UP. They are second differenced stationary.

Table 1. Unit roots test results for crime rate against women and HDI

Crime Rates at First Differences						HDI at First Differences			
States	ADF	Lag	Prob	Remarks		ADF	Lag	Prob	Remarks
Andhra Pradesh	-7.76	0	0.00	**S**		-3.79	1	0.00	**S**
Assam	-7.73	3	0.00	**S 2nd diff**		-5.44	3	0.00	**S**
Bihar	-3.57	0	0.01	**S**		-4.53	0	0.00	**S**
Gujarat	-4.68	3	0.00	**S**		-3.70	0	0.01	**S**
Haryana	-3.11	0	0.03	**S**		-4.08	0	0.00	**S**
Karnataka	-4.51	0	0.00	**S**		-3.29	0	0.00	**S**
Kerala	-4.22	0	0.00	**S**		-6.05	0	0.00	**S 2nd diff**
Madhya Pradesh	-6.12	0	0.00	**S**		-3.97	0	0.00	**S**
Maharashtra	-3.36	0	0.00	**S**		-3.47	0	0.01	**S**
Odisha	-5.31	0	0.00	**S**		-3.78	0	0.00	**S**
Punjab	-3.44	0	0.02	**S**		-4.76	0	0.00	**S**
Rajasthan	-3.67	0	0.01	**S**		-3.27	0	0.00	**S**
Tamil Nadu	-4.65	0	0.00	**S**		-3.11	1	0.05	**S**
Uttar Pradesh	-4.14	0	0.00	**S**		-7.35	0	0.00	**S 2nd diff**
West Bengal	-5.01	0	0.00	**S**		-4.30	0	0.00	**S**
Delhi	-3.19	0	0.03	**S**		-3.42	0	0.00	**S**

Source: Computed by the authors

As having the I(1) property of both the series for 13 (= 16-3) states and UTs, the test for cointegration between the two series across individual states will not produce spurious regression results and hence the long run associations between HDI and Crime can be examined.

Cointegrationand error correction test results

The Engel and Granger cointegration exercise for HDI and Crime is done by estimating equations (3-5). The states having I(2) property in either of the two series are not considered for cointegration analysis but to the short run analysis. The short run dynamics around the equilibrium relation for all the selected states and UTs has been done by the error correction mechanism by estimating equation (6). All the results have been presented in Table 2. Column 2of the table gives the long run regression coefficient (or the equilibrium coefficient) of HDI upon Crime Rates which shows how much the value of HDI gets changed when one more unit of crime against women is done. Column 3 is designed on the basis of the ADF values of the estimated residuals of the regression of HDI upon Crime rates.

Table 2. EG Cointegration test and error correction results (regression of HDI on Crime)

States	Regression Coefficient	ADF of Residual (Prob.)	EC term(prob)	Remarks- Whether cointegration is present
Andhra Pradesh	0.000009	-1.4(0.56)	-	No
Assam I(2) series	Second diff	-	-	-
Bihar	0.0000095	-3.41(0.02)	0.06(0.31) errors not corrected	Yes
Gujarat	0.000024	-1.19(0.66)	-	No
Haryana	0.000018	-1.07(0.70)	-	No
Karnataka	0.000018	-2.08(0.25)	-	No
Kerala I(2) series	Second diff	-	-	-
Madhya Pradesh	0.0000054	-2.96(0.06)	0.06(0.31) errors not corrected	Yes
Maharashtra	0.0000055	-2.32(0.17)	-	No
Odisha	0.00001	-1.41(0.55)	-	No
Punjab	0.000035	-2.89(0.07)	0.03(0.24) errors not corrected	Yes
Rajasthan	0.0000083	-2.32(0.17)	-	No
Tamil Nadu	-0.000024	-2.90(0.05)	77362(0.01) errors not corrected	Yes
Uttar Pradesh I(2) series	Second diff	-	-	-
West Bengal	0.0000044	-1.44(0.54)	-	No
Delhi	0.0000056	-2.51(0.12)	-	No

Source: Computed by the authors using Eviews

It is observed that out of 16 states and UTs, the significant cointegration exists only for four states, namely, Bihar, MP, Punjab and TN but in no case the errors are corrected. This means, for these four states, the deviations from the long run relations are not temporary. Further, in majority of the selected states, there are no long run associations between HDI and Crime which means, the main components of HDI, PCGSDP, health and education, do not have co-movements with crime against women over the period of the study. But there can be causal interplays between the two in the short run. The following section discusses this issue in line with Granger Causality test.

Granger causality test results

In order to investigate the causal interplays between HDI and Crime, the well-known Granger causality test been carried out by estimating equation 7 and 8. Table 3 presents the results for the two first differenced series; HDI and Crime for all the states except Assam, Kerala and UP where the causality test results are given for second differenced series (refer to Table 1). There are only seven states where some ways of unilateral causal interplays are observed. The states where HDI makes a cause to the crime rates are Assam and Odisha which means, probably, that the three main pillars of HDI, PCGDP, education and health, have improved over time and they have contributed to increase in crime rates. The relatively rich, educated and healthy people are probably associated with the increasing crime rates against women in these two states. Further, the income increasing trends in the Indian states due may be to

economic liberalization and globalization does not only increase the economic inequality but also hampers in achieving the sustainable developmental goal through women's security and empowerment.

Table 3. Granger causality test results between HDI and Crime Rates

States	Lags	Directions of Causality
H_0: ΔCrime does not cause ΔHDI H_1: ΔHDI does not cause ΔCrime		
Andhra Pradesh	2	ΔCrime→ΔHDI
Assam	3	Δ^2HDI→Δ^2Crime
Bihar	3	No
Gujarat	3	No
Haryana	3	No
Karnataka	3	No
Kerala	3	No
Madhya Pradesh	3	ΔCrime→ΔHDI
Maharashtra	1	ΔCrime→ΔHDI*
Odisha	1	ΔHDI→ΔCrime
Punjab	3	No
Rajasthan	3	ΔCrime→ΔHDI
Tamil Nadu	3	No
Uttar Pradesh	2	Δ^2 Crime →Δ^2 HDI
West Bengal	3	No
Delhi	3	No

Note: * means 10% level of significance

Source: Computed by the authors using Eviews

On the other hand, the remaining five states having unilateral causal interplays observed from crime rates to HDI are AP, MP, Maharashtra, Rajasthan and UP. The figures (1 & 2) on the trends of HDI and crime rates for the period of 1995-2018 depict that both HDI and crime rates of all the states except TN are with positive trends leading to draw positive correlations between human development and crime rates making the causal interplays from crime to HDI absurd. But there are probably some socio-economic reasons to justify the said causal interplays. In India, the present law on the crimes against women in particular and all crimes in general that the criminals are kept under jail custody till verdict and they are provided good quality food, health checkups and education and several entertainment programmes in televisions. Further, those who work inside the jail premises are paid with wages and salaries. Having a long judicial procedure to all sorts of crimes in India, the criminals make earnings and secures good health and education levels which may contribute to improving HDI. Therefore, crime against women may influence HDI and these linkages are justified for the five states, AP, MP, Maharashtra, Rajasthan and UP. The negative correlation between HDI and Crime, which is expected to work in all economies, for TN is explained by the decreasing trend of crime rates and increasing trend of HDI values and it is justified by their strong legal framework and social awareness programmes. The results so far someway admits the results of the study by Wolf et al (2014).

The study does not find any such causal inter plays between the two indicators for the remaining nine states and UTs. Delhi, having the occurrence of the 'Nirbhaya' incidence does not have any such causal interplays among the components of HDI and crime rates, although there is positive correlation between HDI and crime rates against women. These nine states should have other factors in lieu of per capita income, life expectancy and education, the three pillars of HDI, which help in establishing causal relations between them. These may be political, police administration, judicial delays, uncontrolled life styles, urbanization, less awareness campaign, internet uses, narcotics uses, among others, which need to be carefully handled to stop crime against women and to help promoting the achievement of sustainable developmental goals as stipulated by the United Nations and gladly accepted by India to follow.

Conclusion

Attempting to examine a vibrant social and economic issue, whether human development and crime against women are with long run associations and short run interplays in Indian states, the study arrives at the conclusion that there are long run relation between HDI and crime rates only for four states, namely, Bihar, MP, Punjab and TN but the errors in these models are not corrected leading to conclude that there are certain short term factors influencing HDI and crime rates which did impetus to the equilibrium relations. However, the results of the causal interplays in the short run which produce unilateral causality between the two show that there are seven states where such interplays are observed. In two states, namely, Assam and Odisha, where HDI makes a cause to the crime rates are observed which means, probably, that the three main pillars of HDI, PCGDP, education and health, have improved over time and they have contributed to increase in crime rates. The relatively rich, educated and healthy people are probably associated to the increasing crime rates against women in these two states. The remaining five states having unilateral causal interplays are observed from crime rates to HDI are AP, MP, Maharashtra, Rajasthan and UP. There are probably some socio-economic reasons to justify the said causal interplays such as the provisioning of good quality food, health checkups and education within the jail custodies. Further, those who work inside the jail premises are paid with wages and salaries. Hence, having a long judicial procedure to all sorts of crimes in India, the criminals make earnings and secures good health and education levels which may contribute to improving HDI. The remaining nine states and Delhi do not produce any such causal interplays.

References

Ahmed, R. & Mesbah, S. (2017). "Income Inequality and Violence Against Women: Evidence from India," Working Papers 2017-13, University of Alberta, Department of Economics.https://ideas.repec.org/p/ris/albaec/2017_013.html

Aizer, A. (2010). The Gender Wage Gap and Domestic Violence, *American Economic Review*, 100(4). 1847-59, https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4123456/#:~:text=A.&text=Disadvantaged%20women%20face%20much%20higher,of%20Justice%20Statistics%2C%201994

Becker, G. S. (1968). 'Crime and Punishment: An Economic Approach', *Journal of Political Economy*, 76 (2): 169-217

Cano-Urbina, J. & Lochner, L. (2017). The Effect of Education and School Quality on Female Crime, NBER Working Paper, October 22, https://www.nber.org/system/files/working_papers/w24061/w24061.pdf

Cui, Z. &Hazra, D. (2017). Macroeconomic Determinants of Crime: Evidence from India, SSRN Electronic Journal · July, DOI:10.2139/ssrn.3005019

Das, R. C. & Mukherjee, S. (2018). Determinants of Terrorism in South Asia: Insights From a Dynamic Panel Data Analysis, *International Journal of Cyber Warfare and Terrorism* 8(4):16-34

Das, R. C., Mandal, C. & Patra, A. K. (2019). Linkage between social sector's spending and HDI: study on individual as well as panel data of Indian states, *Review of Social Economy*, DOI: 10.1080/00346764.2019.1671605

Demombynes, G. & Ozler. B. (2005). "Crime and local inequality in South Africa." *Journal of Development Economics*, 76, 265-292

Dickey, David A., and Wayne *Fuller* A.(1979). Distributionof the estimators for autoregressive timeseries with a unit root,*Journal of the American Statistical Association*, *74*

Dutta, M. & Husain, Z. (2009). "Determinants of crime rates: Crime Deterrence and Growth in post-liberalized India," MPRA Paper 14478, April, University Library of Munich, Germany

Ehrlich, I., (1973) 'Participation in Illegitimate Activities: A Theoretical and Empirical Investigation'. Journal of Political Economy, 81(3): 521-565.

Ehrlich, I., (1975) 'On the Relation between Education and Crime', in Juster, F.T. (ed.) Education, Income and Human Behavior. McGraw-Hill, New York: 313-337.

Engle, R. F., & Granger, C. W. (1987). Co-integrationand error correction: Representation, estimationand testing,*Econometrica*, *55*

Gneezy, U. and Rustichini, A. (2000). A Fine is a Price, *The Journal of Legal Studies*, 29 (1), January.

Granger, C. W. J. (1969). Investigating causalrelations by econometric models and cross spectralmethods,*Econometrica*, *37*(3)

Kelly, M. (2000). "Inequality and crime." *Review of Economics and Statistics*, 82 (4), 540– 554 (November)

Krüsselmann, K., Aarten, P. and Liem, M. (20121). Firearms and violence in Europe–A systematic review, *Plos One*, 16 (4), e0248955, doi: 10.1371/journal.pone.0248955

United Nations (2005). Crime and Development in Africa. Mimeo. United Nations, New York

Wolf, A., Gray, R. and Fazel, S (2014). Violence as a public health problem: An ecological study of 169 countries. *Social Science and Medicine,*104:220–7