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Analysis of Growth and Identifications of the Determinants of Crime against Women: Insight from India

By Shrabanti Maity¹ and Sucharita Roy²

Abstract

The pattern of growth of crime against women across 19 Indian states during the period 2001- 2015 reveals that states like West Bengal and Assam have the largest growth rate of crime against women, while Tamil Nadu shows negative growth, suggesting an efficient utilisation of crime control measures by the state. While exploring the role of different socioeconomic factors that largely influence crime against women, by using econometric analysis it has been identified that female education and the size of the female Scheduled Caste (SC) and Scheduled Tribe (ST) population have strong positive roles in increasing crime against women but the sex ratio, urbanization, and female workforce participation has a negative impact on it. The prevalence of power relation and intersectionality of crime against women can be addressed through appropriate structural policy.³

Keywords: Crime against women, Growth rate, Sex ratio, Female literacy rate, Cuddy–Della Valle (1978) index, Multiple regression.

Introduction

‘Violence against women is the last refuge of disgusting immoral men’
Kristian Goldmund Aumann (2016).⁴

At the World Human Rights Conference, Vienna (1993), gender-based violence was first recognized as a human rights violation. The United Nations (1993) has defined *violence against women* as ‘any act of gender-based violence that results in, or is likely to result in physical, sexual or psychological harm or suffering to a woman, including threats of such acts, coercion or arbitrary deprivations of liberty, whether occurring in public or private life’. At the Fourth Conference of Women in Beijing, (1995), violence against women was defined as ‘a physical act of aggression of one individual or group against another or others’. According to the Asia Pacific Forum on Women, Law and Development, (APWLD, 1990) and Schuler (1992), gender violence is defined as ‘any act involving use of force or coercion with the intent of perpetuating or promoting hierarchical gender relations’. However, crime against women in India as published by the National Crime Records Bureau (NCRB) is broadly classified under two categories, i) the

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³ *JEL Classification:* B54, C01, C21, J16.

⁴<https://www.goodreads.com/author/quotes/4794641>. Kristian Goldmund Aumann

crimes under the Indian Penal Code⁵ (IPC) and ii) the crimes under the Special and Local Laws (SLL)⁶.

According to the NCRB data, crimes against women in India have more than doubled over the past ten years, though recent data reveals that crime against women in 2015 fell slightly by 3.1 per cent. Since the absolute number of crimes against women is still huge, such a fall can be considered as insignificant. Over the last decade, 2.24 million crimes were reported, and more significantly, 26 crimes against women are reported every hour, which means approximately one complaint every two minutes. India is thus one of the 10 worst countries for women in the world. In fact, the present scenario of violence against women in India is much more concerning than projected in the recorded data. Many actions of violence are misinterpreted in the context of the definition of crimes, and many others are unreported and/or underreported due to the social stigma prevalent in Indian society. These reasons contributed to India's high value on the Gender Inequality Index, 0.524, which places the country at the bottom 20 per cent ranking. From 2012 to 2015 the crime rate against women has increased from 6.4 per cent to 11.5 per cent, reminding us of cases of extreme brutality, such as the "Nirbhaya Rape Case" (December 2012) and the "Asifa Bano Rape Case" (January 2018). Thus, it is critical to investigate the trend of crime against women in India for a period of 10 years, to surface the role of the various socioeconomic factors responsible for such a trend. The present study undertakes this initiative.

The basic causes of increase in crime against women are manifold and complex. Crime against women is mostly found to be related to social status, communal, ethnic and caste identities. Women are treated as private property, to be protected by men of the particular family, social, communal and caste groups, (Kannabiran, (1996); Dasgupta, (1989); Desai and Krishnaraj, (1987)). According to Ghosh, (1991), Sharma, (1994), Shakshi, (1995), Chikarmane, (1999) and Gurumurthy, (1998), urban mafias, those behind smuggling, drug dealing and liquor rackets often seek political refuge and are to a great extent responsible for the criminalization of politics. Such violence directly affects women and other marginalized groups in society. The 'criminalization of politics' in terms of caste, religion and ethnic identities, causes increased crime against women in India (Karat and Agnihotri, 1993; Karat, 1998). The most commonly mentioned cause of violence against women is patriarchy, defined as a social system in which men are placed above women. A study by Mukherjee, et al., (2001), attempted to correlate crime rates to socio-economic variables such as the female to male (sex) ratio, work participation, and literacy rates among females by using a statistical and spatial analysis of the state/district level data on crimes against women compiled by the National Crime Records Bureau (NCRB), India. Banerjee and Basak, (2018), further considered additional relevant factors such as, yearly per-capita net state domestic product, the growth rate of per-capita net state domestic product, the number of police stations per lakh (hundred thousand) population for each state, and the degree of urbanization, to be related to crime against women. Women's movements in India have centrally been focussed around the category of gender regarding patriarchy, sexual violence, oppression, domestic subordination, and the like through the lens of class and caste. Sometimes low caste women are also from lower classes, and thus are victims of patriarchy and sexual violence from men of both their own castes and by that of upper castes and upper classes.

⁵The crimes under the Indian Penal Code (IPC) are, i) Rape, ii) Kidnapping and abduction for specified purposes, iii) Homicide for Dowry Death or their Attempts, iv) Torture – Both mental and Physical, Molestation, Sexual Harassment, Importation of Girls.

⁶ The crimes under the Special and Local Laws (SLL) are, i.) Immoral Traffic Act, ii) Dowry Prohibition Act, iii) Indecent Representation of Women, iv) Sati Prevention Act, v) Domestic Violence Act.

According to the National Commission for Women ‘in the commission of offences against scheduled caste (Dalit) woman the offenders try to establish their authority and humiliate the community by subjecting their women to indecent and inhuman treatment, including sexual assault, parading naked, using filthy language etc.’⁷ Further, Dalit women have been subjected to rape, molestation, kidnapping, abduction, homicide, physical and mental torture, immoral traffic and sexual abuse. The NCRB data records reveal that more than four Dalit women are raped every day in India⁸. However, issues of Dalit women have been ignored largely by academia, feminist organisations, and other human rights groups in India. In fact, Intersectionality Theory, (Crenshaw, 1991) helps us to predict that women, particularly Dalit women are soft targets for crime. A number of studies, including Dey, (2012), have investigated the appropriateness of Intersectionality theory in the Indian context and have found the theory to be valid for India.

In addition, the increasing use of the internet has significantly influenced the distribution of and access to pornography in India. According to a web metrics firm⁹, internet access in India has grown from 5 million in 2004 to 40 million in 2007 and continues to grow at a rate of 17 per cent a year. Moreover, accessing pornographic material has also increased with 12 per cent of internet websites being related to pornography, and viewers were estimated to spend roughly 3000 to 4000 total dollars per second (Pope, et al., 2007). Younger individuals were found to be more likely to use the internet both for viewing pornographic material and chatting about pornography (Traeen and Nilson, 2006). Supporting to the dictum of the well-known feminist, Morgan (1978), ‘Pornography is the theory; rape is the practice’, internet usage is associated with a substantial increase in reported incidences of rape and other sex crimes (Bhuller, et al., 2013). Their results suggest that the direct effect of the internet on sex crimes is positive, plausibly due to increased consumption of pornography. A number of laboratory experiments show a positive relationship between pornography and sexual aggression (Zillman, 1982, Allen, et al., 1995), in particular violent pornography (Donnerstein and Berkowitz, 1981). Math, et al., (2014), have examined the relationship between the consumption of pornography and the subsequent increase in sexual violence in the Indian context. Such studies are also consistent with the view of Dworkin, (1981), who argues that pornography not only constitutes violence against women; it constitutes the main conduit for such violence, of which rape is at once the prime example and the central image. However, other laboratory experiments suggest the contradictory view that pornography consumption leads to sexual relief and hence offsets sexual aggression (Posner, 1992; Donnerstein, et al., 1975).

Driven by the above studies, the objectives of the present paper are twofold: initially we have made an attempt to study the pattern of growth of crime against women across different states in India during the period 2001- 2015 using NCRB data; second, the paper explores the role of a number of socioeconomic factors such as male to female sex ratios, the female literacy rate, urbanisation, digitalisation, and the under-five infant mortality rate, etc., that largely influence crime against women in different states of India. Earlier studies did include some of these factors in their analysis, but in the present paper we explore the impact of additional, relevant factors, to examine their influence on current rates of crime against women. The novelty of the present paper lies in its novel examination of the trend of crime against women in India over the period 2001- 2015, and at the same time unlike other existing studies, identifies multiple

⁷20 years SC and ST (Prevention and Atrocities Act), Report Card, Coalition for strengthening of SC and STs (Prevention of Atrocities) Act, April 2010, p10.

⁸National Crime Records Bureau, Government of India. <http://www.ncrb.gov.in/>.

⁹: http://www.comscore.com/Press_Events/Press_Releases/2009/11/

relevant socioeconomic factors influencing the significant rise in crime against women in India over the ten-year period.

The paper is organised as follows: the first section includes an introduction which investigates the related literature and justification of this study. In the second section, we illustrate the data relating to the study. Section 3 presents the methodology and the econometric model. Section 4 offers an analysis of the empirical results followed by a discussion of those results. Finally, section 5 concludes the present study.

Data Collection

The present study was conducted on the basis of secondary data. Data on the rate of crime against women for each state over the period 2001-2015 has been collected from the 'National Crime Records Bureau¹⁰' (NCRB), India. The sources of the data on sex ratio are the 'Ministry of Home Affairs, Government of India and the Ministry of Statistics and Programme Implementation, Government of India'. Data on internet subscriptions indicated as digitalisation was collected from Lok Sabha Unstarred Question No. 416 dated 25.02.2015 and Lok Sabha Unstarred Question No. 329, dated on 12.08.2015. Data on the female literacy rate, the Scheduled Castes (SC) and Scheduled Tribes (ST) population, under-five infant mortality rate male to female ratio, urbanisation and female work participation rate are all based on the last available census report (2011).

Methodology

In this section, we will discuss the methodology and the econometric model to address the said objectives of the study.

Growth Rate of Crime against Women

In order to determine the growth rate of crime for the different states of India, time series data are collected from the National Crime Record Bureau over the time period 2001 to 2015. While dealing with the time series data estimation, it is required that data should be stationary. Otherwise, the estimators will not be reliable for prediction and policy prescriptions. Therefore, in order to check the stationarity of the time series data, two non-parametric tests are used, viz., Augmented Dicky Fuller Test and Phillips Perron Test. The test equations in two cases are presented below.

Augmented Dicky Fuller Test:

¹⁰“NCRB was set-up in 1986 to function as a repository of information on crime and criminals so as to assist the investigators in linking crime to the perpetrators based on the recommendations of the Tandon Committee to the National Police Commission (1977-1981) and the MHA's Task force (1985). Subsequently, NCRB was entrusted with the responsibility for monitoring, coordinating and implementing the Crime and Criminal Tracking Network & Systems (CCTNS) project in the year 2009. The project connects 15000+ police stations and 6000 higher offices of police in the country. NCRB also deals with associated work of Cyber Crime Prevention against Women & Children (CCPWC) through this portal. NCRB also compiles and publishes National Crime Statistics i.e., Crime in India, Accidental Deaths & Suicides and also Prison Statistics. These publications serve as principal reference point by policy makers, police, criminologists, researchers and media, both in India and abroad. NCRB has been conferred with Silver award during Digital India Awards 2016 under Open Data Championship category from the Government of India for uploading Crime Statistics since 1953 on Govt. Portal” (Retrieve from: <http://ncrb.gov.in/>).

$$\Delta Y_t = \delta Y_{t-1} + \sum_{i=1}^n \gamma_i \Delta Y_{t-i} + u_t \quad (1)$$

Phillips Perron Test:

$$\Delta Y_t = \delta Y_{t-1} + u_t \quad (2)$$

In both cases the hypothesis to be tested is $H_0 : \delta = 0$ and the corresponding test statistic

$$\text{is } \hat{\tau}_\delta = \frac{\hat{\delta} - \delta}{SE(\hat{\delta})}.$$

After conducting the stationarity test, the growth rates of crime against women were calculated for different states of India by using the following regression equation:

$$\ln Y_t = \alpha + \beta_i t + u_t \quad (3)$$

The expression $[\exp(\beta_i) - 1] * 100$ will yield the percentage growth rate for the i -th state over the time period 2001 to 2015.

Measurement of instability

To reveal the true picture of the growth rate of crime across states, it is better to investigate any instability in the growth rate. However, there is no consensus in the literature regarding the measurement technique of instability (Lim, 1991; Maizels, 1994). In this paper we use the Cuddy–Della Valle, (1978), index of instability to measure the instability in the growth rate of crime against women across Indian states. The Cuddy–Della Valle index is defined as follows:

$$I_x = CV \times \sqrt{1 - \bar{R}^2} \quad (4)$$

Where, CV is the coefficient of variation and \bar{R}^2 is the corrected or the adjusted coefficient of multiple determination of the trend function that best fits the series of crimes committed against women over time across states. If, $\bar{R}^2 < 0$, unadjusted R^2 is considered to calculate the index.

Econometric Model

In order to identify the factors influencing crime against women across Indian states, regression analyses are considered where there are eight independent variables and the rate of crime against women is the dependent variable. The details of specifications of the variables are presented in table 1. It is noteworthy that in the line of the Intersectionality Theory variables, such as sex–ratio, the number of SC female population and the number of ST female population are considered in order to figure out their influence on the rate of crime against women in India.

Table-1: Description of variables used in regression

Variable name	Variable description
Rate of crime against women (Y)	Rate of crime against women as given in NCRB data
Sex ratio (X_1)	Number of female population per thousand male population.
Literacy (X_2)	Number of literate female population as defined in Census,2011
SC(X_3)	Number of SC female population as in Census,2011
ST (X_4)	Number of ST female population as in Census,2011
Urbanization (X_5)	Percentage of total population residing in urban area according to census 2011
Digitalization (X_6)	Number of population using internet facility. .
U5IMR male to female ratio (X_7)	Male to female ratio of infant mortality rate under 5 years of age.
Female Work Participation Rate (X_8)	Number of female population engaged in income earning work, as in cense 2011.

Source: Authors' own specification

The corresponding regression equation is presented below:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + \beta_8 X_8 + u \quad (5)$$

Where,

- Y = Rate of crime against women
- β_i = regression coefficients, $i = 0, \dots, 8$
- X_1 = Sex ratio
- X_2 = Literacy rate
- X_3 = Percentage of Scheduled Caste population
- X_4 = Percentage of Scheduled Tribe population
- X_5 = Percentage of urbanisation
- X_6 = Percentage of digitalisation
- X_7 = Under five Infant Mortality Rate male to female ratio
- X_8 = Female work participation rate.
- u = disturbance term.

For the purpose of estimation, ordinary least squares (OLS) method is used and for that reason heteroskedasticity of the error term and the presence of multicollinearity among the independent variables has been checked. For the purpose of regression, cross-section data is used, that is, data across Indian states for the year 2015. Hence Autocorrelation test is not practiced.

Results and Discussion

In this section, we consider the results related to the specified objectives of the study. Initially, we interpret the results of the interstate growth rate of crime against women during the period 2001- 2015; subsequently we discuss the results of the regression analysis.

Summary statistics of the rate of crime against women across states over time

The analysis of the summary statistics of the crime rate against women is simple but capable of identifying the present scenario of the crime against women across Indian states and provides a preliminary idea about the crime rate against women for different states of India. Table-2 presents the summary statistics of the crime rate against women across Indian states during the period 2001- 2015. The highest mean rate of crime against women is obtained for Assam (33.2) followed by Tripura (29.4) and Andhra Pradesh (27.4). The table reveals that two north-eastern states top the list in terms of the mean rate of crime against women. However, mean crime rate is not enough to know the appropriate status of the women, hence discussion related to mean and CV (as we are comparing across states) are needed. When the lower crime rate against women of any state is accompanied by a lower CV, it indicates possible sustainability in the achievement of the state in lowering the crime against women. The lowest mean crime rate against women is obtained for Bihar (10.5) but is accompanied with high CV (42.4) implying that lower crime rate is only temporary and may not be sustainable in the long run. The lowest CV (18.4) is obtained for Jammu & Kashmir and Madhya Pradesh with corresponding mean crime rate as 22.1 and 24.8 respectively. This means although the mean is high, lower CV ensures that the crime rate against women will not exceed the mean value drastically in the near future. However, the performance of Uttaranchal regarding crime rate against women is quite satisfactory where both the mean rate of crime against women and CV are low that is 11.4 and 18.5 respectively. Hence, it can be predicted that in Uttaranchal low crime rate against women will be sustained in the long run. On the contrary, both Assam and Tripura having top two values of mean rate of crime against women also seems to have high CVs such as 53.1 and 44.4, implying that, these states not only has high mean rate of crime against women but will also remain so in near future. Again, the situation in West Bengal and Orissa do not seem to be satisfactory, where the high mean crime rates against women, 22.8 and 20.3 is accompanied with high CVs, 48.2 and 46.9 respectively. It is clear that the rates of crime against women in Assam, West Bengal, Orissa, Tripura and Bihar lack proper control measure which might worsen the situation in these states in near future, where as in Jammu and Kashmir, Madhya Pradesh, Uttaranchal and Gujarat crime rate is thought to be well-controlled.

Table-2: Summary statistics of the rate of crime against women across states over time

States	Mean	Std. Dev	CV	Maximum	Minimum
Andhra Pradesh	27.4	5.7	20.7	37.9	18.1
Assam	33.2	17.7	53.1	72.2	15.5
Bihar	10.5	4.4	42.4	23.1	6.5
Gujarat	13.9	2.7	19.3	20.2	10.4
Haryana	23.1	6.1	26.2	34.7	16.1
Himachal Pradesh	15.1	3.1	20.1	21.7	11.7
Jammu & Kashmir	22.1	4.1	18.4	29.1	16.4
Karnataka	14.2	4.1	28.9	22.7	9.9
Kerala	24.6	5.7	23.3	33.8	17.1
Madhya Pradesh	24.8	4.6	18.4	37.7	21.3
Maharashtra	15.3	4.4	28.8	26.1	11.2
Orissa	20.3	9.5	46.9	40.6	4.8
Punjab	11.2	3.8	33.6	18.9	7.6
Rajasthan	26.9	8.0	29.8	43.7	18.9
Tamil Nadu	11.2	2.5	22.4	16.3	8.5
Tripura	29.4	13.0	44.4	46.5	4.3

Uttar Pradesh	11.5	3.1	27.0	18.1	7.4
Uttaranchal	11.4	2.1	18.5	16.7	8.6
West Bengal	22.8	11.0	48.3	41.5	8.2
India	17.9	4.7	26.3	27.2	13.0

Source: Authors' own calculation based on NCRB data

The mean values of the corresponding states are not the authentic indicator of the status of crime against women over the years. It can be inferred that controlling crime against women by some states are inconsistent which implies that even if mean crime against women are low, it may not persist in the long run. In order to have an appropriate idea of the actual status of crime against women, a growth analysis accompanied by instability test for the listed states are conducted. But to start with, it is required to perform the stationarity test of the series under study.

The stationarity test of the series is conducted in order to have an idea whether the series is appropriate to perform the empirical analysis. As mentioned earlier both Augmented Dickey-Fuller and Phillips Perron non-parametric tests are performed for this purpose and are given in table-3.

Table-3: Results associated with Unit Root test

States	First Difference				Level			
	Augmented Dickey-Fuller test statistic		Phillips-Perron test statistic		Augmented Dickey-Fuller test statistic		Phillips-Perron test statistic	
	t-Statistic	Probability	t-Statistic	Probability	t-Statistic	Probability	t-Statistic	Probability
Andhra Pradesh	-3.885	0.014	-3.885	0.014	-1.612	0.451	-1.612	0.451
Assam	-5.021	0.002	-5.385	0.001	-0.110	0.930	0.564	0.982
Bihar	-4.158	0.009	-12.584	0.000	-2.636	0.109	-2.558	0.124
Gujarat	-3.296	0.044	-2.703	0.102	-1.116	0.672	-1.456	0.525
Haryana	-4.515	0.005	-4.549	0.004	-0.584	0.845	-0.500	0.864
Himachal Pradesh	-4.533	0.005	-5.737	0.001	-1.519	0.495	-1.459	0.524
J& K	-3.800	0.016	-3.800	0.016	-1.318	0.590	-1.338	0.581
Karnataka	-3.651	0.022	-3.587	0.024	0.336	0.971	0.336	0.971
Kerala	-2.922	0.070	-2.927	0.069	-1.393	0.555	-1.393	0.555
Madhya Pradesh	-3.331	0.037	-2.655	0.103	-1.879	0.331	-0.997	0.723
Maharashtra	-3.335	0.035	-3.335	0.035	0.714	0.988	0.835	0.991
Orissa	-5.805	0.001	-10.418	0.000	-2.934	0.067	-2.934	0.067
Punjab	-2.760	0.093	-5.892	0.001	0.517	0.979	-0.116	0.930
Rajasthan	-3.480	0.027	-3.460	0.028	-0.013	0.942	0.154	0.958
Tamil Nadu	-2.804	0.095	-7.036	0.000	-2.717	0.096	-2.702	0.098
Tripura	-5.302	0.001	-11.359	0.000	-3.422	0.028	-3.447	0.027
Uttar Pradesh	-3.249	0.040	-4.012	0.011	-0.743	0.804	-0.743	0.804
Uttaranchal	-4.888	0.003	-10.655	0.000	-2.326	0.178	-2.326	0.178
West Bengal	-3.767	0.017	-3.773	0.016	-2.378	0.165	-2.992	0.060
India	-2.632	0.091	-4.825	0.003	0.452	0.978	0.867	0.991

Source: Authors' own calculation based on NCRB data

The results of both the tests reveal that t statistics are not significant at the permissible level. Hence, the unit root is present at the level, implying the fact that the time series data of growth rate of crime against women is non-stationary over the study period, 2001-2015. However, it has been observed that t statistics turns out to be significant at the permissible level for the first difference, which suggests that the unit root is absent and the growth rate of crime against women becomes stationary for the first difference. Thus, in accordance to the outcome of the stationarity test, we analyse the growth rate of crime against women on the basis of the data with the first difference.

Growth and Instability Measurement

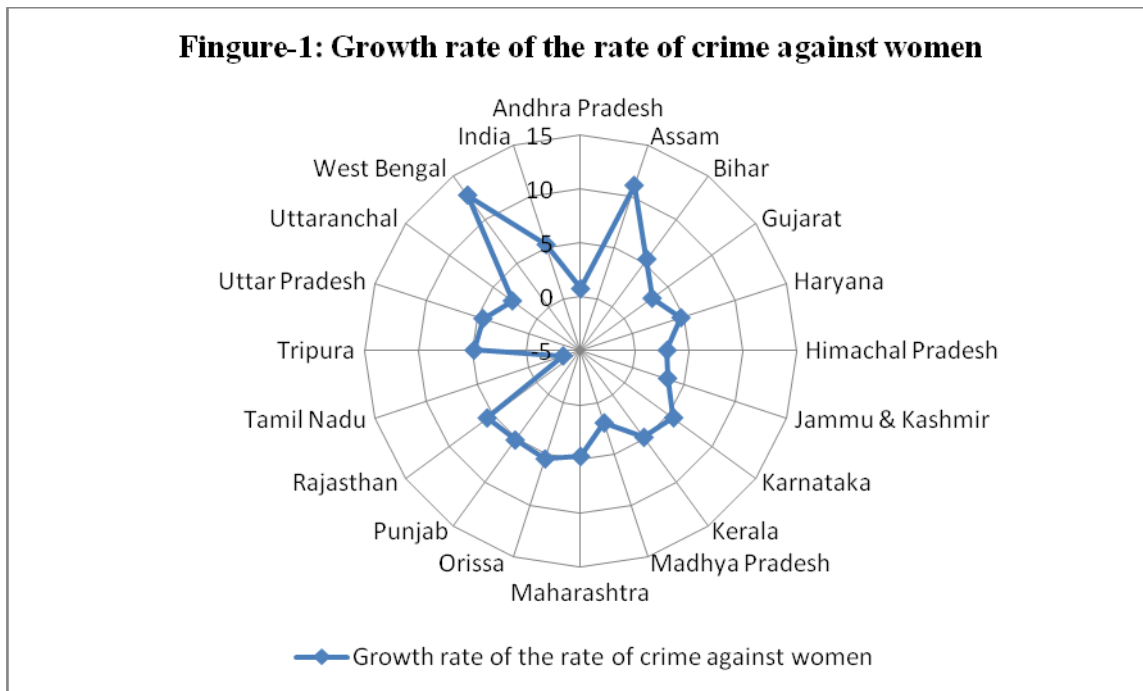
The achievement of the Indian states in controlling crime against women can be judged by calculating the growth rate of crime against women over the stipulated time period 2002-2015. The result related to the growth rate of crime against women for each state is presented in table-4. As shown in table-4, the highest growth rate of crime against women is obtained for West Bengal (12.748) followed by Assam (11.047). On the contrary, the lowest growth rates are obtained for Tamil Nadu (-3.311), Andhra Pradesh (0.695), Madhya Pradesh (2.081) and Uttaranchal (2.783). These results are consistent with the results as revealed in the summary statistics in table-2.

Table-4: Growth and instability of the Incidence of crime against women across states and India

States	Coefficient	Prob	\bar{R}^2	Growth Rate	Cuddy -Della Valle Index, I_X
Andhra Pradesh	0.007	0.087	0.021	0.695	20.504
Assam	0.105	0.000	0.874	11.047	18.885
Bihar	0.053	0.009	0.380	5.427	33.395
Gujarat	0.031	0.001	0.542	3.186	13.044
Haryana	0.046	0.000	0.751	4.754	13.106
Himachal Pradesh	0.030	0.003	0.467	3.001	14.702
Jammu & Kashmir	0.034	0.000	0.702	3.447	10.037
Karnataka	0.055	0.000	0.816	5.642	12.366
Kerala	0.048	0.000	0.850	4.969	9.032
Madhya Pradesh	0.021	0.027	0.272	2.081	15.712
Maharashtra	0.047	0.000	0.686	4.834	16.118
Orissa	0.054	0.075	0.165	5.586	42.909
Punjab	0.052	0.001	0.583	5.287	21.728
Rajasthan	0.055	0.000	0.798	5.661	13.385
Tamil Nadu	-0.034	0.003	0.474	-3.311	16.214
Tripura	0.047	0.096	0.042	4.848	43.418
Uttar Pradesh	0.044	0.001	0.537	4.481	18.391
Uttaranchal	0.027	0.004	0.452	2.783	13.657
West Bengal	0.120	0.000	0.948	12.748	10.959
India	0.052	0.000	0.878	5.287	9.190

Source: Authors' own calculation based on NCRB data

In fact, Tamil Nadu is the only Indian state which shows a negative growth rate of crime against women. The growth rates of crime against women are also presented graphically for the ease of comparison.



Source: Authors' own calculation based on the calculation of table-3

However, the analysis of growth is incomplete without the instability analysis. Lower growth rate of crime for a state, if accompanied with a higher value of the instability index, implies that such a low rate is not likely to persist. That is, the achievement of the state will not be sustainable. Amongst various instability indices, Cuddy-Della Valle Index, (I_x) is used to measure the instability. Table - 4 also presents the Cuddy-Della Valle Index, (I_x) values of instability. The lower the value of I_x , the higher will be the stability. From the results in table-4, it is clear that the value of I_x is low in states like Kerala (9.032), West Bengal (10.959), Jammu and Kashmir (10.037) as compared to other states. Thus, the growth rates of these states can be considered to be stable implying that low growth rates of crime against women will be retained in Kerala and Jammu and Kashmir, while the high rate of growth in West Bengal will remain high over the period. However, the value of I_x is very high in the states like Tripura (43.418), Orissa (42.909) and Bihar (33.395). Thus, it is clear that even though the growth rate of crime against in these states is moderate; these rates are unlikely to be sustained in the long run. Since I_x gives the reflection of the true growth rate.

Econometric Model

In this section, an attempt has been made to identify the factors responsible for crime against women. The rate of crime against women is considered as the dependent variable and factors like sex ratio, female literacy rate, number of SC and ST in the population of each state, urbanisation, digitalisation, infant mortality rate under age five, and female work participation rate are considered the independent variables affecting crime against women. The analysis is performed by considering cross-section data of the year 2015 related to the above variables for the 19 states of India. The rate of crime against women for each of the 19 states is the dependent

variable (Y) for the regression. The descriptive statistics of regress and regressor are presented in table-A1 in appendices.

The OLS estimation technique was used and the compatibility of the data for OLS is tested by conducting heteroskedasticity and multicollinearity tests. Both pre-estimation tests results ensure that OLS can be used for the purpose of estimation (see table A2 and table A3). The regression results are reported in table 5.

Table-5: Factors influencing crime rate of different states as well as in India

Variables	Coefficients	Standard Error	t	Standardised Coefficient (Beta)
Sex ratio (X_1)	-0.10*	0.05	-1.95	-0.55
Literacy (X_2)	0.01***	0.00	2.81	0.56
SC(X_3)	0.30	0.34	0.88	0.26
ST (X_4)	0.34***	0.12	2.83	0.83
Urbanization (X_5)	-0.29*	0.15	-1.88	-0.14
Digitalization (X_6)	-0.11***	0.03	-4.22	-0.23
U5IMR male to female ratio (X_7)	-1.77	1.68	-1.05	-0.29
Female Work Participation Rate (X_8)	-0.82*	0.46	-1.80	-0.51
Constant	-6.18	17.40	-0.36	
ANOVA				
Number of observations	20			
R^2	0.5143			
\overline{R}^2	0.4610			

Source: Authors' own calculation based on NCRB, Planning Commission and Census data

Note: *significant at 10% level, **significant at 5% level, ***significant at 1% level

The results regarding the relationship of each of the independent variables with the rate of crime against women are explained distinctly in the following sections.

Female Education and Crime against Women

According to the present study, the female literacy rate has a positive relationship with crime against women at the 1 per cent level. Education is considered as the most important instrument for enhancing the status of women in society. However, the relationship between the status of women and violence against them is paradoxical. Education empowers women; however, The Centre for Women's Development Studies in New Delhi reveals that domestic violence depends largely on patriarchal attitudes and not on women's educational levels. Visaria's (1999) survey in Gujarat showed a negative relationship between female literacy and domestic violence against women. Ahuja (1998), by contrast, showed that there is no significant relationship between the education level of the couple and domestic abuse against women. In the present study, since the data we used are of reported crimes against women, it can be inferred that high female literacy rates would increase the reporting of the crime implying a positive relationship between high female literacy rates and crime against women.

Size of ST female population and violence against women

As mentioned earlier the vulnerability of the SC and ST female population is largely neglected by academicians. The present econometric study, however, observes that crime against women has a strong correlation with the ST female population with a 1 per cent significance level. Sometimes, low caste women are also from a lower class, and thus are subjected to patriarchal norms and sexual violence from men of both their own castes and by that of upper castes and upper classes. They are also denied vital social services like education, health care, etc., unlike middle caste/class and upper caste/class women (Mazumdar, 2003¹¹). The statistical significance of the estimated coefficient of this variable actually supports Intersectionality Theory, as mentioned earlier.

Digitalization and crime against women

There are some contradictory results regarding the relationship between internet usage and crime against women. Increasing internet usage has increased consumption of pornography which is found to have a positive impact on increasing sexual violence (Bhulleret al., 2014; Zillman, 1971 etc.). Hald et al., (2014) found a positive association between the consumption of pornography and sexual aggression. On the other hand, a study on sexual crimes in the US across two decades by Northern University Law Professor, Anthony D'Amato (2006), found that states with the least internet access (and thus online porn) saw a 53 per cent rise in rape cases while those with the most access experienced a 27 per cent drop. A study by six researchers at NIMHANS (2014), Bangalore, suggested easy access crimes have indeed increased in the country with still low internet penetration—a meager 19 per cent (as of July 2014) according to Internet Live Stats¹². Based on a study of the Indian scenario, Math et.al., (2014) observed that though there were statistically significant positive correlations between the number of internet users and sexual crime rates, the association was non-significant after controlling for the effects of population growth using regression analysis. However, according to the present study, increase in internet subscription or digitalization has a negative impact on the rate of crime against women with 1 per cent significance. This result creates further contradiction amongst the literature related to digitalization and crime against women.

Sex ratio and crime against women

The sex ratio has a negative impact on crime against women with a 10 per cent level of significance in the present analysis (as shown in table 5). This supports the study by Mukherjee, et al., (2001), which shows crime against women and female-male ratio in the population has a negative relationship; that is, the regions with favourable sex-ratios have in general low rates of crimes against women. In 1996, the World Health Assembly addressed female foeticide as an “extreme manifestation of violence against women” (Sarna, 2003). Declining sex ratios imply that female foeticide and infanticide are on the rise. Thus, higher sex-ratios project that the cultural devaluing of women improves, and violence against women is supposed roll back.

¹¹<https://womenenews.org/2003/11>

¹²<http://www.internetlivestats.com/>

Urbanization and crime against women

Urbanization is generally associated with the loosening of patriarchal restrictions, which can mean that women as individuals and as urban dwellers are less likely to tolerate gender-based violence. Cities also provide more employment opportunities for women making them economically independent, thereby widening their choices for dealing with violence. In turn, formal institutional support is more widespread in cities, where women can more easily seek help to address gender-based violence, Mcilwaine, (2013). Following the same argument, the regression analysis in the present study shows a negative relation between urbanization and crime against women.

Female workforce participation and crime against women

The regression analysis of 19 states in India suggests that female workforce participation has a negative relationship with crime against women (shown in table 5). However, analysis by Mukherjee et.al, (2001) and Banerjee, (2018) found a positive relationship between female workforce participation and crime against women. According to Mukherjee et.al, (2001) working women are supposed to have higher exposures to the risk of violence outside home but Banerjee, (2018) explains this as a reporting effect; that is, increased female labour force participation leads to a significant increase in the reporting of torture cases, molestation cases, and also rape cases. But in contrast to these studies, we can infer that economic independence for women provides greater exposure to crime-controlling measures, both in the workplace and in public places and also offers easier access to media reporting.

Moreover, the value of the standardised coefficient as shown in table 5 implies that the ST female population has a major impact on the growth rate of crime against women. Further, amongst other factors influencing crime against women, digitalization has a large impact on reducing crime against women, whereas high female literacy rates seem to be an important factor in increasing crime against women (where higher reporting can be ensured).

The ANOVA results of \bar{R}^2 and R^2 suggest that the regression results are significant. The explanatory variables considered together, explain almost 50 percent variation in the dependent variable¹³. The post-estimation superiority of the OLS is also checked by using the Variance Inflation Factor (VIF) of the regression (given in Table 6).

Table-6: Variance Inflation Factor (VIF) for the Regression

Variables	VIF	1/VIF
SC(X_3)	1.93	0.517819
ST (X_4)	1.93	0.518659
Literacy (X_2)	1.91	0.524604
Sex ratio (X_1)	1.85	0.541371
Female Work Participation Rate (X_8)	1.79	0.557353
USIMR male to female ratio (X_7)	1.67	0.598561
Urbanization (X_5)	1.57	0.636491
Digitalization (X_6)	1.43	0.698693
Mean VIF		1.76

Source: Authors' own calculation based on NCRB, Planning Commission and Census data

¹³Correlation diagnostic between different variables of the analysis is given in Appendix.

The rule of thumb for the variance inflation factor is that the variables whose VIF values are greater than 10 may merit further investigation. ‘Tolerance, defined as $1/VIF$, is used by many researchers to check on the degree of collinearity. A tolerance value higher than 0.1 and lower than 10 implies the dependent variable could be considered as a linear combination of other independent variables’ (retrieve from <https://www.coursehero.com>). It has been observed that the VIF and tolerance ($1/VIF$) values in Table 6 for all explanatory variables are much lower than 10 and much higher than 0.1 respectively. Thus, the present estimated analysis does not suffer from a multicollinearity problem.

Conclusion and Policy Prescription

It is clear from the results of the growth and instability measurement of crime against women over the period 2001- 2015 that the growth rate of crime against women in Assam and West Bengal are quite high as compared to other states, and at the same time, stable with low values of the Cuddy – Della Valle Index. This implies that the high growth rate of crime against women in these states could possibly be sustained over the period; hence, appropriate policy measures are needed for these states to deal with this problem. It has been observed that, though in states like Bihar, where the growth rate of crime against women is low, it does not seem to be stable over the period with a high value of Cuddy – Della Valle Index. Hence, special attention should be given to these states and policies should be accordingly adopted so that crime controlling performance improves. The performance of Tamil Nadu, Uttaranchal, and Madhya Pradesh regarding growth rate of crime against women are quite satisfactory where low growth rates seem to be maintained over the period with low values of the Cuddy – Della Valle Index.

Again, considering the results obtained from the cross-section study of 19 states in India, we have found that both female literacy and the size of the ST female population have a positive and significant impact on the growth of crime against women. On the basis of the absolute value of the standard coefficient, we have also found that amongst the other 8 variables, the ST female population has the largest implication for growth of crime against women. This result provides strong support to Intersectionality theory, indicating the need for policy instruments which sincerely aim at the protection of the ST female population from such crimes. The female literacy rate has a positive impact on crime against women, supporting the concept of a paradoxical relationship between the status of women and violence against them. However, the analysis suggests that digitalization has a strong negative impact on crime against women, which further adds to the debate related to the impact of digitalization on such crime. Factors such as sex ratio and female work participation rates have negative impacts on crime against women. Though similar studies by Mukherjee, et al., (2001) and Banerjee, (2018), found a positive relationship between female workforce participation and crime against women, the relationship between the sex ratio and crime against women, support our present findings. Thus, in order to control crime against women, policies have to be framed so that the sex ratio improves and at the same time, female work participation increases. It is clear that effective policies dealing with crime against women are more structural in nature than volitional¹⁴. According to the structural criminologists, Hegan and Palloni (1988), ‘crime is a product of power relations’. Results that emerged in our study support the power relations theory of crime, where the ST female population belonging to the lower stratum of society are subject to oppression both by men from

¹⁴Scheingold (1991) has explained that linking volitional and structural criminology is an effort to ‘understand how the political culture of criminal process influences crime control policy’.

their own caste and also by the upper class and are most susceptible to crime. A positive impact of female literacy on crime against women also supports studies which reveal that domestic violence depends largely on patriarchal attitudes and *not* on women's education. Moreover, the findings of this paper also emphasise that factors such as low sex ratio and low female workforce participation seem to increase crime against women, which are largely rooted in patriarchy, based on power relations. All these relations clearly explain both Intersectionality Theory and the power relations theory of crime against women.

A study performed by Chattopadhyay and Dufflo, (2004) reveals that women elected as leaders under the reservation policy invest more in the public good and are more closely linked to women's concerns. Most interestingly, women elected in seats reserved for scheduled castes and tribes make different decisions compared to women elected in general seats and also favour 'women friendly laws' (Figuera, (2005). Thus, in order to deal with both power relations and the intersectionality aspect of crime against women, a structural policy that increases women's representation—specifically, seats reserved for scheduled castes and tribes—in State Legislation can play a significant role in improving the status of women belonging to under caste and under class sections, and also can provide better infrastructure and 'women friendly laws' that can help remove discriminations against women.

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Conflict of Interest

The authors declared that they have no conflict of interest.

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Appendices

Table-A1: Descriptive Statistics of the Regressand and Regressor

Variables	Mean	SD	CV	Maximum	Minimum
Rate of crime against women (Y)	26.67	14.26	53.49	72.24	8.45
Sex ratio (X_1)	948.55	46.24	4.87	1084.00	879.00
Literacy (X_2)	76.10	7.43	9.77	93.91	63.82
SC(X_3)	16.85	6.31	37.47	31.94	6.74
ST (X_4)	8.95	8.61	96.17	31.76	0.00
Urbanization (X_5)	30.11	11.49	38.15	48.45	10.04
Digitalization (X_6)	26.55	55.77	210.02	261.36	2.59
U5IMR male to female ratio (X_7)	0.91	0.08	9.04	1.06	0.79
Female Work Participation Rate (X_8)	25.81	8.02	31.09	44.80	13.90

Source: Authors' own calculation based on NCRB, Planning Commission and Census data

Table-A2: Correlation Diagnostics

Variable	Sex ratio (X_1)	Literacy (X_2)	SC(X_3)	ST (X_4)	Urbanization (X_5)	Digitalization (X_6)	U5IMR male to female ratio (X_7)	Female Work Participation Rate (X_8)
Sex ratio (X_1)	1.0000							
Literacy (X_2)	0.5532	1.0000						
SC(X_3)	-0.0997	-0.0635	1					
ST (X_4)	0.0459	0.0388	-0.3772	1				
Urbanization (X_5)	0.1264	0.3385	-0.0931	-0.1368	1			
Digitalization (X_6)	0.0872	-0.0126	0.036	-0.0124	0.426	1		
U5IMR male to female ratio (X_7)	0.1065	0.2508	0.4541	0.0559	-0.1156	-0.2263	1	
Female Work Participation Rate (X_8)	0.3371	0.056	0.0525	0.4827	-0.1337	0.0889	0.1654	1

Source: Authors' own calculation based on NCRB, Planning Commission and Census data

Table-A3: Heteroskedasticity Diagnostic

Cameron & Trivedi's decomposition of IM-test				Breusch-Pagan / Cook-Weisberg test	
Source	χ^2	df	Prob	Ho: Constant variance	
Heteroskedasticity	20	19	0.3946	chi2(1)	0.11
Skewness	5.45	8	0.7087		
Kurtosis	0.33	1	0.5651	Prob> chi2	0.7419*
Total	25.78	28	0.5851		

Source: Authors' own calculation based on NCRB, Planning Commission and Census data

**Results confirms that the data is not suffering from heteroskedasticity problem*