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Understanding the nature of Demographic Transition and Population Cohort in India

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Abstract

The purpose of this study is to investigate the trend of demographic transition in India. In addition to this, the study explores the nature of population cohort in India. The study is completely based on secondary data compiled from the United Nation Reports, World Bank Reports and Census of India, different issues. The study found that India is now in the third stage of demographic transition. With the process of demographic transition, the fertility rate and mortality rate becomes smaller, which increases the share of the aged population in the country. It is observed that the share of the older population was 8.3 per cent and it is expected to rise up to 12.6 per cent in 2025 as per census 2011. Moreover, it is also seen that the share of the elderly female is more in comparison to the elderly male in India. Finally, the study concludes with suitable policy prescriptions.

Keywords: *Demographic Transition; Population Ageing; Population Cohort; Feminisation of ageing, India.*
JEL Classification: *C26; J10; J11; J18; J19*

1. Introduction

Population ageing is a worldwide phenomenon. It is a demographic process through which the demographic structure of the country gives greater weight towards the elderly population (Bloom, et al., 2010). It occurs when the median age of a country or region rises due to an increase in the life expectancy, decrease in fertility and increase in mortality etc. It is the most emerging issue which occupies the attention of many scholars and many countries, especially in developed countries. In fact, the process of population ageing has started also in developing countries. But there is a time lag in case of developing countries due to the variation in various factors like fertility, mortality, migration and life expectancy etc. It is worth to be mentioned here that the fertility, mortality, migration and life expectancy etc., are the factors which influence the process of ageing in any country.

In India, the process of population ageing also has started gradually (Singh, 2013; Bloom, et al., 2010; Panigrahi, 2007). It is faster in the southern state of India than the northern state

(Ponnapalli, et al., 2013) and among them, Kerala is the leading state (Gulati, 1993). In fact, the population ageing is relatively faster in developed states than developing states of India due to variation in the level of economic development (Acharjee, and Dutta, 2013).

The most significant reason behind the population ageing in India is the process of demographic transition. Demographic transition is the movement or shifting from high birth rate and high death rate to low birth rate and low death rate. The significant reasons for the increase in the life expectancy of Indian people are falling birth rates and death rate in both rural and urban areas of all the states. Along with this access to primary health centres, health personnel, medicines, roads, schools, etc., also contributed in increasing the life expectancy of Indian people (Vasant, 1994; Chakrabartiand Sarkar, 2011; Indira, 1999). Thus as a result of a fall in the fertility and the mortality, the proportion of the aged population has started to rise (Reddy, 1996). The consequences relating to elderly population are the critical aspects in recent time. Ageing involves various social and economic consequences and implications, like dependency, vulnerability, public health expenditures, pension schemes, and living arrangements (Sinha, 2017).

In India, the proportion of working age group to 65 and above for both males and females are high in rural areas compare to urban areas (Bharatiand Singh, 2013). In India, the aged people are not able to meet their basic requirements due to low-income earnings (Prakash, 2005). Because of their low income, they could not able to access proper medical facilities, proper food, and shelter etc., for their better livelihood. Due to this unhealthy lifestyle and lack of health facilities, the Indian elderly suffer from various health diseases. Health problems for aged groups are relatively higher than younger age groups and besides physical health problems; they also suffer from poor mental health because of senility, neurosis, and extent of life satisfaction (Rajan, 2006; Rao, 1981). The most common health problems aged people face include eyesight, hearing, joint pains, nervous disorders, weakness, heart complaints, asthma, tuberculosis, skin diseases, urinary problems and others (Prakash, 2005; Balamurugan and Ramathirtham, 2012). However, health problems are relatively high for elderly women compared to men (Balamurugan and Ramathirtham, 2012). Among all the state health problems for both male and female aged people are highest in Kerala and West Bengal while it is lowest in the case of Gujarat (Syam, 2011).

Given this background the objectives of the present study are twofold: firstly, to investigate the trend of demographic transition; secondly, to explore the nature of population cohort in India.

The structure of this study is as follows: Section 2 deals with the discussion of the data sources of this study and methodology. Results are analysed in section 3. Finally, section 4 concludes.

2. Data and methods

2.1. Data

The study is completely based on secondary data compiled from the United Nation Reports,

World Bank Reports, and Census of India, different issues. The data on age wise population from 1960 to 2016 are collected from World Bank Reports. On the other hand, the data on CBR, CDR, and population growth rate are collected from the United Nation Reports for the period of 1961-2011.

2.2. Methods

In this section, we are going to discuss the methods we have used to investigate each of the said objectives one by one.

2.2.1. Impact of natural change on population growth

The first objective of our study is to investigate the process of demographic transition in India. Birth and deaths are the natural causes of population change. The difference between the birth and the death rate of any country is called Natural Change. It is calculated by subtracting the death rate from the birth rate, that is,

Natural Change = Birth Rate – Death Rate

(1)

In order to find the process of demographic transition, we have estimated the impact of Natural Change (NC) on population growth rate (PGR).For better understanding; we have presented the definitions of the included variables in table-1.

Table 1: Definition of the variables

Variables	Definition
Population growth rate (PGR)	Refers to an increase in a country's population during a period of time, usually one year. It reflects the number of births and deaths during the period and the number of people migrating to and from a country.
Natural change (NC)	refers to absolute increase in the number of population of a country, which is calculated as the difference between the birth rate and the death rate of a country or place during a particular period of time

Source: Compiled from World Bankand United Nation Report

In order, to understand the impact of natural change (NC) on population growth rate (PGR), we considered a simple two variables linear regression model as follows:

$$Y_t = \alpha + \beta X_t + u_t \quad (2)$$

Where α is the intercept term, β is the slope coefficient, *Y* represents percentage change population size, *X* represents natural change, and u represents error component. The equation (2) represents a straight line relationship. As we are not using a log-linear regression equation we can expect the elasticity to be changed over time. The estimated value of the slope coefficient can be utilised to calculate the "*natural change elasticity of population growth*".

This calculated value of the elasticity will help us to understand the impact of natural change on population growth. In fact, a significant positive value of the coefficient β, indicates apositive elasticity and vice- versa. The formula for calculating the "*natural change elasticity of population growth*" is given below:

$$e_{NCPG} = \frac{\%\ change\ in\ Population\ Growth}{\%\ change\ in\ Natural\ Change} = \frac{d(\ln PG)}{d(\ln NC)} \quad (3)$$

Where e_{NCPG} = *natural change elasticity of population growth*

Moreover, in order to explore the nature of population cohort we have used tables and figures.

3. Analysis of results

The results obtained by using the above-mentioned methodology are discussed in this section.

3.1. Demographic transition in India

Demographic transition refers to the movement from high birth and death rates to low birth and death rates as a country develops from a pre-industrial to an industrialised economic system. It involves five stages: Stage1- high stationary stage characterised by high birth and death rate, Stage2- early expanding stage characterised by very high growth of population as birth rate is very high compared to death rate, Stage3- late expanding stage characterised by high growth rate population and birth rate is higher than death rate, Stage4- low stationary stage characterised by stationary growth population, and Finally, Stage5- declining stage characterised by negative growth of population as death rate is higher than birth rate.

In order to investigate the trend in demographic transition, we consider simple regression model and regress natural change (NC) on population growth rate (PGR). But, as the variables are time series variables, we need to check the stationary property before estimating the regression model. This is so because if the data are not stationary then the results will not be reliable and can't be used for the prediction purpose. In order, to check the stationarity of both time series data, viz., natural change (NC) and population growth rate (PGR) we use the Augmented Dickey-Fuller test. From the table-2 it can be seen that both variables are stationary at levels. This implies that there is no unit root problem.

Table 2: Augmented Dickey-Fuller Unit root test

Variables	t Statistic	p-value
population growth	-4.16***	0.009
Natural Change	-2.32**	0.021

Source: Authors' own calculation based on World Bank and United Nation Report

We now present the regression result in table-3. The methodology for this result is discussed

in the earlier methods section. The OLS estimator of the slope coefficient is presented in table-3.

Table 3: Regression result

Variables	Estimated coefficient β	SE	t-statistics	p- value	r^2
Impact of natural change on population growth	0.109	0.001	105.308	0.000	0.99

Source: Authors' own calculation based on World Bank and United Nation Report
*Note: ***significant at 1% level*

The regression result shows that natural change positively influences population growth.
In order, to identify the demographic transition in India we next calculate the "*natural change elasticity of population growth*" by using the estimated β coefficient. The formula for calculating "*natural change elasticity of population growth*" is presented in equation (3). The calculated values of the elasticity are presented in table-4. The table divulges that the "*natural change elasticity of population growth*" is fluctuating over time. During the time period, 1961 to 1966 e_{NCPG} showed an increasing trend. It then shows a sharp decline during the time period 1967 to 1977. Again, during 1979 1984 e_{NCPG} shows an increasing trend. During the time period, 1990 to 1996 e_{NCPG} remains static with a value 1.066 and/ or 1.067. The e_{NCPG} shows an increasing trend during the time period 1997 to 2008. After that, it again shows a decreasing trend.

Table 4: Impact of change in Natural Change on Population Growth

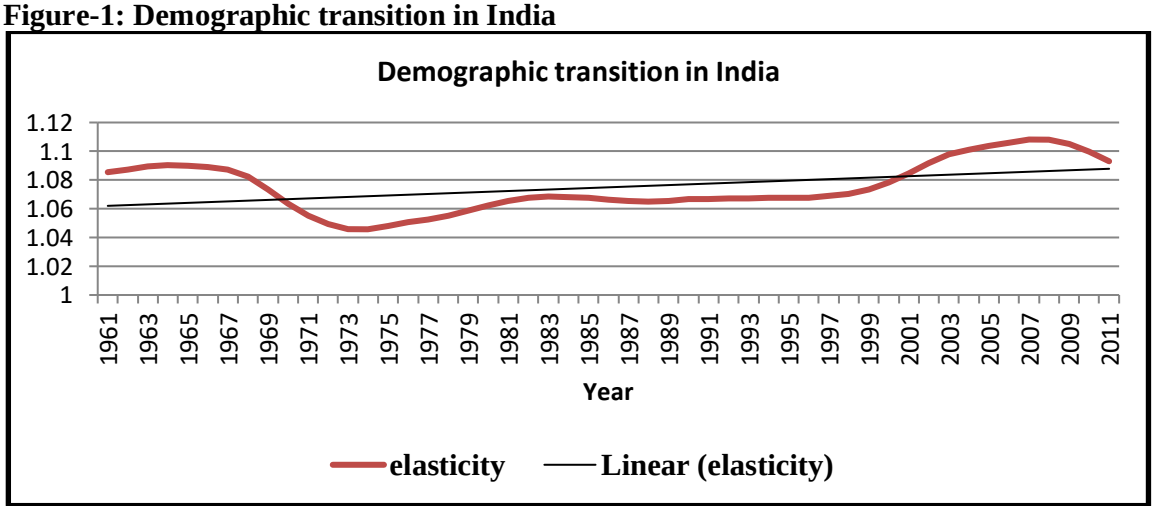
Year	Natural Change Elasticity of Population growth	Year	Natural Change Elasticity of Population growth
1961	1.085	1987	1.065
1962	1.087	1988	1.064
1963	1.089	1989	1.065
1964	1.090	1990	1.066
1965	1.089	1991	1.066
1966	1.088	1992	1.067
1967	1.087	1993	1.067
1968	1.082	1994	1.067
1969	1.073	1995	1.067
1970	1.063	1996	1.067
1971	1.055	1997	1.068
1972	1.049	1998	1.070
1973	1.046	1999	1.073

1974	1.045	2000	1.078
1975	1.047	2001	1.084
1976	1.050	2002	1.091
1977	1.052	2003	1.097
1978	1.055	2004	1.101
1979	1.058	2005	1.103
1980	1.062	2006	1.105
1981	1.065	2007	1.108
1982	1.067	2008	1.108
1983	1.068	2009	1.105
1984	1.068	2010	1.099
1985	1.067	2011	1.092
1986	1.066	-	-

Source: Authors' own calculation based on World Bank and United Nation Report

We next plot the elasticity figures in order to identify the demographic transition of India. The figure-1 depicts the demographic transition in India. During the 19th century, we observe a stationary picture of population growth, because of balance births over deaths. In the late 1800s, population growth slowly accelerated. In 1871, India's population was reached almost to 255 million. During that period India's population growth was contributed by the high-fertility and high-mortality. Duringthe early 20th century India's population grew quite slowly.

Figure-1: Demographic transition in India



Source: Authors' own calculation based on World Bank and United Nation Report

In the above diagram, the pattern of the growth rate of India follows condition or stages of demographic transition. We can observe that demographic transitionrepeatsa similar trend over the study period. The pattern of values of elasticity (e_{NCPG}) during 2001-2011 is similar to that of 1961-69.

The period before 1962 may be regarded as the first stage of demographic transition because in this period both birth rates and death rates were very high. The main reasons for such high birth rates were illiteracy, lack of knowledge for proper family planning and birth control measures etc. Further, the period 1962 was characterised as an agricultural based society and children were considered as economic assets which were another reason for such a high birth rate. In that period, death rates were also very high as medical facilities were very rare and that period was characterised by periodic famines, outbreaks of lethal diseases such as cholera and smallpox, and endemic parasitic diseases such as malaria etc. Thus, in the period 1962, the gap between birth and death were almost zero and growth rate of population was stationary.

The second stage of demographic transition in India had started in the late 1960s. This period was characterised by the very high growth of population as the birth rate was higher than the death rate. The reduction of the death rates during this period was achieved because of the innovation of the medical facilities but birth rates remained high. As a result, the gap between birth rate and death rate increased significantly which accelerated the growth of population. Another important reason for that accelerated growth of population was the preference of a male child over a female child by the Indians'. The preference for male child caused more baby birth in the form of an unwanted girl child. Thus the period between 1963 and 1981 may be regarded as the second stage of demographic transition. This stage of demographic transition is termed as the early expanding stage.

The third stage of demographic transition in India was started in the late of 1980s. The growth rate of population was relatively lower than the earlier periods after 1990. During that period both birth rates and death rates showed a declining trend. But the gap between birth rates and deaths were still positive. Between 1991 and 2011, the population growth rate had significantly decreased due to the fall in the birth rate. This might because of the fact that approximately 25 percent Indians over the age of seven became illiterate (2011 census). Most importantly, during that time period, female literacy rate exceeded the male literacy rate. Further, people were familiar with the importance of birth control and the availability of various measures to control birth rates had also improved. On the contrary, the death rate had also reduced because of the improvement in various health and medical facilities. However, the reduction in the birth rate was higher than that of death rate and as a result, the gap between birth rate and death rate had started declining. This decline in population growth was achieved by various efforts and population control policies adopted by the government of India from time to time. One of the successful policies was "*National Population Policy 2000*".

3.2. The nature of population cohort in India

Population ageing is one of the serious issues in the recent period. Many developed countries are approaching an era of the ageing population due to an increase in longevity, a decrease in mortality rates and a decrease in fertility rates (Harper and Leeson, 2009). The decline in population growth has been visible since the mid-1970s when the adult working-age population in several countries outpaced child population (Mason and Lee, 2011). The process is now rapidly approaching to the developing world, and where India is not an exception. The table-5 represents the age wise distribution of population in India.

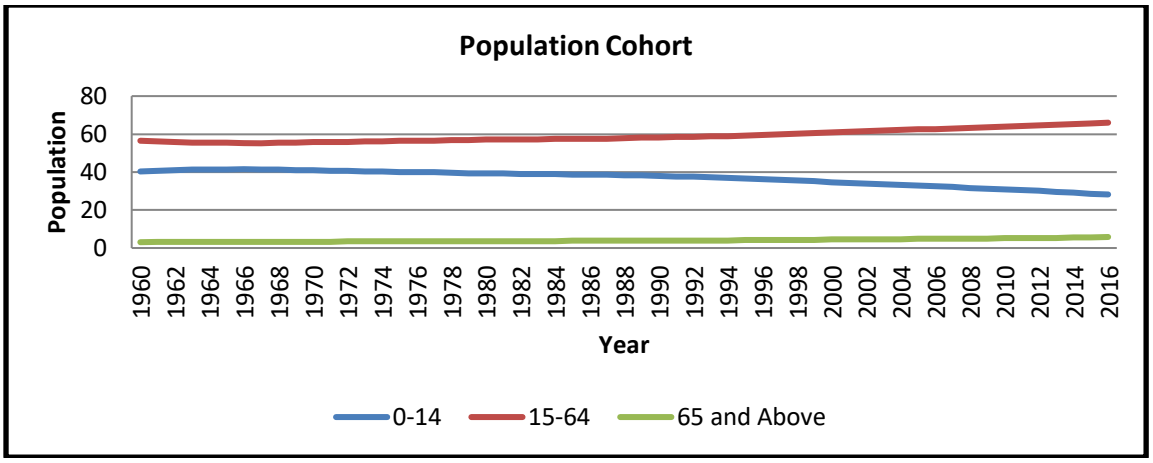
Table 5: Age wise distribution of population (in percentage)

Age group	0-14	15-64	65 and Above	Total
1960	40.30	56.63	3.05	100
1965	41.41	55.35	3.23	100
1970	40.84	55.83	3.31	100
1975	40.06	56.44	3.49	100
1980	39.24	57.12	3.62	100
1985	38.72	57.54	3.72	100
1990	37.92	58.24	3.82	100
1995	36.62	59.31	4.06	100
2000	34.73	60.86	4.39	100
2005	32.78	62.44	4.76	100
2010	30.89	63.99	5.11	100
2015	28.65	65.70	5.63	100
2016	28.19	65.99	5.80	100

Source: Compiled from World Bank

It is seen from the table-3 that, the share of the 65 and above population in the total population has increased from 3.05 to 5.8 percent and that of the share of 15- 59 age group has increased from 56.63 to 65.99 percent during 1960 to 2016. While at the same time the share of the 0-14 age group decreases from 40.3 to 28.19 percent. Population ageing is directly reflected in the population cohort. The population cohort was more or less static in the pre-independence period. But in recent times, the cohort suggests that the share of people in the age group 65 and above has started increasing from the early years of the last century. The same result is presented in terms of the figure-2.

Figure 2: Population Cohort



Source: Authors' own calculation based on World Bank and United Nation Report

A close perusal of the figure reveals that in India, over the study period the share of the elderly population in the total population is gradually increasing. On the contrary, the share of the working adult population in the total population (within the age-group 15-64) is declining over time. Finally, the share of the very young age (within the 0-14 age-group) population in the total population remains almost static over the study period. These indicated that, India is approaching towards the ageing era.

3.3. Sex-wise composition of the population

In order, to understand the elderly male-female population composition in India we consider the sex-wise age-specific distribution of population. This will enable us to understand the composition of the elderly population in India. The sex-wise composition of the population is presented in table-6.

Table 6: Sex-wise composition of population (in percentage)

Age group	Male				Female			
	0-14	15-64	65 and Above	Total	0-14	15-64	65 and Above	Total
1960	40.24	56.83	2.92	100	40.36	56.42	3.20	100
1965	41.45	55.43	3.11	100	41.37	55.26	3.36	100
1970	40.80	55.95	3.23	100	40.89	55.70	3.40	100
1975	39.97	56.61	3.40	100	40.15	56.25	3.58	100
1980	39.16	57.32	3.51	100	39.32	56.92	3.75	100

1985	38.69	57.71	3.59	100	38.75	57.36	3.87	100
1990	37.96	58.36	3.67	100	37.89	58.11	3.99	100
1995	36.81	59.33	3.85	100	36.43	59.28	4.28	100
2000	35.07	60.83	4.08	100	34.36	60.89	4.73	100
2005	33.26	62.37	4.36	100	32.27	62.52	5.19	100
2010	31.39	63.92	4.68	100	30.35	64.06	5.57	100
2015	29.14	65.69	5.16	100	28.13	65.72	6.13	100
2016	28.67	65.98	5.33	100	27.68	66.00	6.31	100

Source: Compiled from World Bank

A close perusal of table-6 reveals that among the age group 65 and above the share of the elderly female population is more in comparison to the elderly male population. On the contrary, in the age group 0-14 years, the proportion of male is higher than that of the female population. This indicates the sign of "*feminisation*" of ageing emerged in India. The "*feminisation*" of ageing is a process which occurs when the numbers of female veteran exceed the numbers of veteran male. This is mainly because of the better survival chances of veteran women relative to men, the sex ratio changes with age in favour of the former (Dutta, 2012). We can observe a faster rate of "*feminisation*" in the case of most of the developed countries of the world. The increase in the female older population involves various health and social consequences. Thus, the increasing proportion of women among the oldest old therefore confers some degree of urgency in scoping and planning health care services of the future (Richmond, 2008).

4. Conclusion

From this discussion, it is found that the process of demographic transition is playing a dominant role in changing population size and it is also observed that the pattern of population repeated over time. The study also discloses that India is now in the third stage of demographic transition. This implies that the Indian people are now more or less concern about the importance of small family and family planning. However, the trend in the growth of population is still positive in India and it is mainly influenced by the crude birth rate than crude death rate (Sinha, and Maity, 2017). Thus, the increase in population is actually reflected by an increase in the aged population.

India is the highest populated country in the world. With the process of economic development, the fertility rate and the mortality rate become smaller, which increases the share of the aged population in the country. According to census 2011, the share of the older population was 8.3 per cent, which is expected to rise up to 12.6 per cent in 2025. It is seen that the share of the 65 and above population in the total population has increased from 3.05 to 5.8 per cent and the share of 15- 59 age group has increased from 56.63 to 65.99 per cent during 1960 to 2016. While at the same time the share of the 0-14 age group decreases from 40.3 to 28.19 per cent. Moreover, if we observe the sex wise composition of the aged

population, it is seen that the share of the elderly female is more than that of an elderly male. The concept of population ageing involves many economic and social consequences. In recent times, India is experiencing a very fast process of population ageing. Even if India's population is still young in comparison to the developed countries but in absolute term, India is the second highest elderly populated country after China. So it may be stated that there is an urgent need to pay serious attention to the issues of population ageing and on the socio-economic effects of ageing. Further, the government should introduce suitable policies to enhance care and support for the elderly. The government should also take necessary steps to solve the emerging problems of the elderly.

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Gender-based Crime and Economic Growth in India

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Abstract

The present study attempts to investigate the present status of total crimes against women across Indian states and to investigate the relationship between the rate of crime against women and economic growth in India for the period 1988-2016. In order to investigate the relationship between economic growth and rate of crime against women the 'Granger Causality' technique is applied along with standard econometric tools like unit root test and co-integration test. The results show that the rate of crime against women is continuously rising in India. The results also reveal that Rate of Crime against women has a negative impact on GDP per capita in the long-run. Finally, the study concludes that more fundamental economic and social changes are necessary to enhance the autonomy and power of women.

Keywords: *Crime against women, Granger Causality Relation, economic growth, unit root test, GDP per capita.*

JEL Classification: *J16, C22, K14*

1. Introduction

Crime against women is a serious global problem and a threat to gender equality in the present day world. Crime against women which is a serious form of Crime caused by several socioeconomic factors and has far-reaching impacts that hinder in achieving developmental goals of a country. Development in true sense cannot be attained with gender inequality. Crimes against women occur when a family member, intimate partner, ex-partner or any unknown person attempts to physically or psychologically dominate another. This may be of physical violence, emotional violence, economic violence, stalking etc. All types of violence lead to serious social and economic consequences. This problem needs special attention and care so that proper steps can be taken to overcome this obstacle of development by bringing gender equality.

Many attempts have been made to define crime, but till date, it is not possible to discover the most scientific definition of crimes against women. According to NCBR (2013,2014 and

2015) "...although women may be victims of any of the general crimes such as 'murder', 'robbery', 'cheating', etc., only the crimes which are directed specifically against women are characterised as 'crimes against women'. Various new legislations have been brought and amendments have been made in existing laws with a view to handle these crimes effectively. These are broadly classified into two categories, viz.,

1. The crimes under the Indian Penal Code (IPC)
2. The crimes under the Special & Local Laws (SLL)

Under the first category Rape (Sec. 376 IPC), Attempt to commit rape (Sec 376/511 IPC), Kidnapping & abduction of women (Section 363,364,364A, 366 IPC) etc., are the major crime heads whereas for the second category, the Dowry Prohibition Act, 1961, the Protection of women from Domestic Violence Act, 2005, the Immoral Traffic (Prevention) Act, 1956 related to women only etc., are included" (NCBR, 2013, 2014 and 2015).

Among various crimes, a crime against women is one of the greatest obstacles to gender equality. It obstructs women to secure their fundamental rights to equal protection under the law and the right to life and liberty. Types of such crimes are: pushing, shaking, throwing something at her, slapping, arm twisting, hair pulling, punching, kicking, dragging, beating, trying to choke or burn her on purpose, and threatening her or attacking her with a weapon, forcing women to perform sexual activity without her will, forcibly taking her money and wealth etc.

Woman in the Vedic age was enjoying a higher status. She was the nerve – centre of the domestic work and was its empress. Domestic happiness and conjugal happiness are constant topics mentioned in the Rig Veda. But nowadays violence affects the lives of millions of women and girls in all socio-economic classes around the world. The basic reasons for a crime against women are- their inferior status in a male-dominated society educationally, economically, politically and socially. Besides, there are also so many reasons like more awareness in women of their rights in the form of access to "Mahila Courts", legal cells and crime cells for women help directly or indirectly to encourage women to register their complaints. "Low rate of punishment of guilty" caused by a lack of evidence and lack of guidance, loopholes in existing laws are some of the reasons for the rise in crime against women. "Law Pertaining to the Problem of Violence", "International Conventions", "the Constitution" and various other legal provisions provide certain rights for women but these laws are not properly implemented.

Till date, various studies have been undertaken to study the relationship between crimes against women and economic growth and many scholars tried to estimate the direct and indirect costs of crime on the society. Though the number of studies, which examine the impact of crime against women on economic progress, are growing a clear conclusion on the association between them has not been defined.

Crimes against women had increased day by day and lack of proper reporting was responsible for less and inappropriate studies on regional variations of crimes (Mukherjee, et al., 2001). Again working women were the main victims of violence outside the home and in regions having high female ratios had low rates of crimes against women (Mukherjee, et al., 2001). Low and declining sex ratios in India were the results of the strong preference of sons

of most of the families (Oldenburg, 1992). In India, districts with higher sex ratio had a lesser rate of violence against women (Dreze, and Khera, 2000). The social norms and practices, as well as the existing police system, were responsible for large scale wives abasements in India (Martin, et al., 1999). Among other factors, the patriarchal societal system and outdated cultural norms play an important role in Crimes against women in India (Visaria, 2000). Because of the absence of proper empowerment works women were not able to work for their physical, psychological and financial wellbeing (Chacko, 2003). Traditional patriarchal social system, various cultural and political factors were responsible for the high rate of crime against women in developing countries of the world (Ahmed, 2005). In India, there were various deterrence and socioeconomic variables which lead to a rise in crime rates against women and their effects were different in India compared to the developed nations (Dutta, and Hussain, 2009). This is because, in the Indian society, women had always been considered as the weaker and vulnerable section and implementation of laws granting rights to women had been so neglected and slow that they were far lagged behind men in terms of social, economic and political aspects (Mangoli and Tarase, 2009). Factors like population density, Sex ratio, Literacy Rate and Per capita income played an utmost important role in determining the crime rate against women in India (Gupta and Sachdeva, 2017).

In aggregates, various studies have been carried out to understand the pattern and causes of crimes against women and their association with economic growth (Ojog, 2014). However, no such specific studies have been carried out for India. Though Debnath and Das, (2017), tried to study the nexus between crime and economic affluence in India the nexus between crimes against women and economic growth have not studied yet.

Given this background, the purpose of the study is to investigate the linkage between the rates of crime against women in India with economic growth. The rest of the study is organised in following ways: section 2 deals with concept and methodology, section 3 deals with the detail discussion of the data, methodology and detail specification of variables; section 4 presents the estimation and empirical results; finally, in section 5 the conclusion and discussion of the study is presented.

2. Concept and Methodology

According to NCBR (2013,2014 and 2015) although women may be victims of any of the general crimes such as ‘murder’, ‘robbery’, ‘cheating’, etc., only the crimes which are directed specifically against women are characterised as ‘crimes against women’. Various new legislations have been brought and amendments have been made in existing laws with a view to handle these crimes effectively. These are broadly classified into two categories, viz.,

1. The crimes under the Indian Penal Code (IPC)
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In order to investigate the relationship between economic growth and rate of crime against women we have considered the 'Granger Causality Relation'. The "Granger Causality" test is a statistical hypothesis test for determining whether one-time series is useful in forecasting another, first proposed in 1969. This test is a very popular method for causality analysis in time series due to its computational simplicity. Granger stated that regressions ordinarily reflect mere correlations, but causality in economics could be tested for by measuring the ability to predict the future values of a time series using prior values of another time series.
A time series X is said to Granger-cause Y if it can be shown, usually through a series of t-tests and F-tests on lagged values of X (and with lagged values of Y also included), that those X values provide statistically significant information about future values of Y.

3. Model Specification

This study hypothesized that crime against women has a statistically significant negative impact on economic growth. In this section, an attempt has been made to specify models for the hypothesis concerning the impact of the rate of crime against women on the economic growth of India.
Following Ojog, (2014), we will consider the following two regression equations:

$$\ln(Economic\ Growth) = \alpha + \beta \ln(Rate\ of\ \ Crime\ against\ Women) \quad (1)$$

Control variables for the model are stated below in the lines of Ojog, (2014):

Control variables:

1. Population Growth (PG)
2. Saving (S)
3. Social Sector expenditure (SSE)
4. Manufacturing export (ME)
5. Medium and high technology export (MHTE)
6. FDI inflows (FDI)
7. Trade openness (TO)

4. Data and Variables

This section deals with the details discussion of the data sources and specifications of the variables used for the estimation of the regression equations.

4.1. Data

This research work is conducted on the basis of the secondary data. Data are compiled from the following sources: "Crime in India" published by "National Crime Records Bureau", "Census of India" published by "Office of Register General of India", "Open Government Data" published by Niti Aayog, The World Bank database, etc.

4.2. Variable:

In order to investigate the relationship between economic growth and rate of crime against women we have considered the '*Granger Causality Relation*'. The dependent and the independent variables for the regression are as follows:

The dependent variable

Economic Growth is the dependent variable and it is defined as *GDP per capita growth*. Gross domestic product (GDP) is the pecuniary value of all the finished goods and services produced by all the resident producers within the borders of a country, usually computed on an annual basis, and which includes any product taxes and excludes the subsidies in the value of the goods (The World Bank Group, 2014).

The independent variable

ln(Rate of crime against women) is the independent variable and it is computed as the natural logarithm of a total number of crimes recorded by the police. *In order to test the hypothesis,* according to the study of Goulas and Zervoyianni, (2012) data on the ***rate of crime against women*** is going to be used, but due to relatively high numbers in the crime data, the variables will be logarithmized. The natural logarithm (Ln) transformation is used in order to reduce the fluctuations, make the pattern of the ***rate of crime against women*** variable more interpretable and be able to reach conclusions that broaden beyond the data itself. Moreover, the variable is transformed in order to normalize the residuals. Using the Ln, the initial variable is replaced in order to change the configuration of a distribution. Each data point of the variable ***rate of crime against women*** is replaced with the transformed value ***ln(rate of crime against women)***, where logarithm to base *e*, express the base of an irrational number *e*, which has an approximate value of 2.7183. All the data on crime against women is expressed in terms of crime rate against women and it was retrieved from the NCRB.

Control variables

Savings, depicted as savings as a rate of GDP, represents the capital stock. The data has been retrieved from *The World Bank* database (The World Bank Group, 2014).

Population Growth is the exponential rate of growth of midyear population from year t-1 to t, expressed as a percentage and the data for this control variable was retrieved from *The World Bank* (The World Bank Group, 2014).

Openness to Trade is defined as trade, which is the sum of imports and exports of goods and services, and it is computed as a percentage of GDP (The World Bank Group, 2014). Crime is expected to decrease the quantity of goods and services traded, due to lowering the available human and financial resources for manufacturing the products. As a result this will have a negative effect on economic growth. The data on trade has been retrieved from *The World Bank* (The World Bank Group).

FDI inflow is defined as foreign direct investment (FDI) inflows and is computed as a percentage of gross domestic product (GDP).

Technological Change is represented through high-technology exports, products with high research and development intensity, which are measured as a percentage of manufactured exports (The World Bank Group), etc.,

The details specifications and the descriptions of the variables are presented in table-1.

Table-1: Lists of variables

Variables	Definition
Rate of crime against women	Although Women may be victims of any of the general crimes such as 'Murder', 'Robbery', 'Cheating', etc, only the crimes which are directed specifically against Women are characterised as 'Crimes Against Women'. Various new legislations have been brought and amendments have been made in existing laws with a view to handle these crimes effectively. These are broadly classified under two categories. **The Crimes under the Indian Penal Code (IPC)** Rape (Sec. 376 IPC), Kidnapping & Abduction for specified purposes (Sec. 363 - 373 IPC) , Homicide for Dowry, Dowry Deaths or their attempts (Sec. 302/304-B IPC), Torture - both mental and physical (Sec. 498-A IPC) , Molestation (Sec. 354 IPC), Sexual Harassment (Eve Teasing) (Sec. 509 IPC), Importation of girls (up to 21 years of age) (Sec. 366-B IPC). **The Crimes under the Special & Local Laws (SLL**) Although all laws are not gender specific, the provisions of law affecting women significantly have been reviewed periodically and amendments carried out to keep pace with the emerging requirements. The gender specific laws for which crime statistics are recorded throughout the country are - Immoral Traffic (Prevention) Act, 1956, Dowry Prohibition Act, 1961, Indecent Representation of Women (Prohibition) Act, 1986, Sati Prevention Act, 1987.
GDP per capita (constant 2010 US$)	Gross Domestic Product (GDP) Per capita growth, GDP is the pecuniary value of all the finished goods and services produced by all the resident producers within the borders of a country, usually computed on an annual basis, and which includes any product taxes and excludes the subsidies in the value of the goods (The World Bank Group, 2014).
Population Growth	***Population Growth*** is the exponential rate of growth of midyear population from year t-1 to t, expressed as a percentage and the data for this control variable was

	retrieved from *The World Bank* (The World Bank Group, 2014).
Saving	Savings as a rate of GDP, represents the capital stock. The data has been retrieved from *The World Bank* database (The World Bank Group, 2014).
Social Sector expenditure	Social Sector expenditure refers to total program expenditure including on benefits and on administrative costs. Program level expenditure is expressed as a % of GDP of the respective year and is aggregated by harmonizes program categories (unconditional cash transfers, conditional cash transfers, social pensions, school feeding, in kind transfers, fee waivers, public works and other social assistance) for all social assistance programs (expenditure on social insurance and labour market programs is not yet available).
Manufacturing export	% of manufactured exports data retrieved from The World Bank Group
Medium and high technology export	Export products with high R&D intensity such as aerospace, computers, pharmaceuticals, scientific instruments and electrical machinery (% of manufactured exports data retrieved from The World Bank Group)
FDI inflows	*FDI inflow* is defined as foreign direct investment (FDI) inflows and is computed as a percentage of gross domestic product (GDP).
Trade Openness	Openness to Trade is defined as trade, which is the sum of imports and exports of goods and services, and it is computed as a percentage of GDP (The World Bank Group, 2014).

***Source**: Authors' own specification based on World Bank and NCRB data, Maity, and Sinha, (2018) specification.*

Hence our specified model may be presented by the following equations:
The table -1 shows the list of endogenous and exogenous variables for the study. Here GDP per capita is the dependent variable; the rate of crime against women are the independent variables. The control variables are: population growth, saving, social sector expenditure, manufacturing export, medium and high technology export, FDI inflows and trade openness.

4. Results

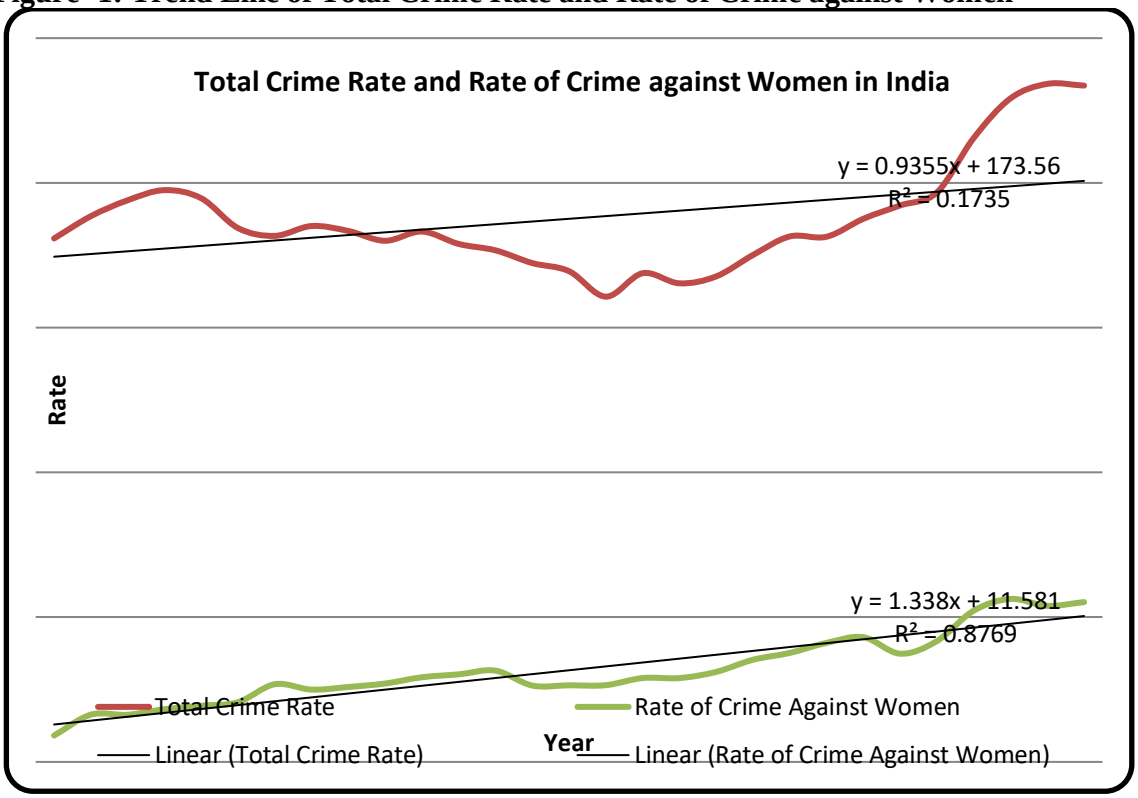
This section contains the analysis of results where we are presenting the discussion of the

estimated results in the form of the trend line and tables showing general pattern and direction of the time series data, a summary of the features of the data on dependent and independent variables and the relationship among variables respectively.

4.1. Trend Line

Two linear trend lines are drawn below to visually show the general pattern and direction of the time series data on total crime rate and rate of crime against women for the period 1988-2016. Data are compiled from the following sources: 'Crime in India' published by 'National Crime Records Bureau', 'Census of India' published by 'Office of Register General of India'.

Figure -1: Trend Line of Total Crime Rate and Rate of Crime against Women



Source: *Authors' own calculation based on NCRB data*

It is clear from the figure-1 that the linear trend line of total crime rate shows a continuous rise from the period 1988-1993, after that, that is, from 1993-2003 if shows a falling trend. It again starts rising from 2003-2016. On the other hand, the trend line of the rate of crime against women is continuously rising from the period 1988-2016 indicating rate of crime against women is continuously rising in India.

4.2. Descriptive statistics

Descriptive statistics of the concerned variables are used in table-2 to summarise the features of the data on dependent and independent variables respectively. This table is constructed to describe the measures of central tendency namely, mean, median, maximum and minimum as well as one measure of dispersion i.e., standard deviation of the dependent and independent variables: rate of crime against women, GDP per capita (constant 2010 US$), population growth, saving, social sector expenditure, manufacturing export, medium and high technology export, FDI inflows and trade openness.

Table-2: Descriptive statistics

Variables	Mean	Median	Maximum	Minimum	S.D	Observations
Rate of rime against women	31.650	28.970	56.300	9.100	12.165	29
GDP per capita (constant 2010 US$)	961.397	801.508	1861.491	500.013	413.611	29
Population Growth	1.666	1.696	2.143	1.148	0.311	29
Saving	31.195	29.765	41.001	23.896	5.032	29
Social Sector expenditure	4.550	3.546	11.030	1.434	3.031	29
Manufacturing export	70.853	72.039	79.203	61.877	5.116	29
Medium and high technology export	22.930	21.546	34.000	16.091	5.143	29
FDI inflows	1.106	0.872	3.657	0.028	0.909	29
Trade Openness	0.343	0.288	0.577	0.146	0.140	29

Source: *Authors' own calculation based on World Bank and NCRB data*

It is clear from table-2 that the average value of the rate of crime against women for the period 1988-2016 is 31.650 and 961.397 for GDP per capita (constant 2010 US$). Averages for other controlled variables are also calculated. In the table median, maximum and minimum as well as one measure of dispersion i.e., the standard deviation of the dependent and independent variables are also shown. The value of the standard deviation of the rate of crime against women for the same period is 12.165 and 413.611 for GDP per capita (constant 2010 US$). All results are calculated for 29 observation, these observations are for 29 years that is from 1988-2016.

4.3. Unit root test for total crime rate, rate of crime against women and GDP in India

Unit root test is carried to check whether the time series variables: Rate of crime against women and GDP in India are non-stationary and possess unit roots. In time series literature, the Random Walk Model is also known as a unit root process. If we rewrite

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

As $Y_t = \rho Y_{t-1} + u_t$ (2b)

If in (3b), $\rho = 1$, we face non-stationarity meaning the variance of Y_t changes over time.

For checking the presence of the variables: rate of crime against women and GDP in India Augmented Dickey-Fuller Test and Phillips-Perron test have been carried out for three models as follows:

$$Y_t = Y_{t-1} + u_t \quad (3a)$$

$$Y_t = \beta_1 + Y_{t-1} + u_t \quad (3b)$$

$$Y_t = \beta_1 + \beta_2 t + Y_{t-1} + u_t \quad (3c)$$

The first step of the analysis is to investigate the time series properties of the variables. If the data under analysis are non-stationary, the results of regression analysis obtained in a traditional manner would not be reliable. For this purpose we use ADF and Phillips-Perron test estimators are used to check the stationary process of the data series. The results of the test are reported in Table -3.

Table-3: Unit root test results for Rate of crime against women and GDP in India

Model	**Augmented Dickey-Fuller Test**				**Phillips-Perron test**			
	ln(Rate of crime against women)		**ln(GDP)**		**ln(Rate of crime against women)**		**ln(GDP)**	
	Level	1st Diff	Level	1st Diff	Level	1st Diff	Level	1st Diff
$Y_t = Y_{t-1} + u_t$	2.124 (0.990)	-7.102 (0.000)	12.249 (1.000)	-5.219 (0.001)	2.194 (0.992)	-6.964 (0.000)	10.566 (1.000)	-5.022 (0.002)
$Y_t = \beta_1 + Y_{t-1} + u_t$	-3.033 (0.044)	-8.089 (0.000)	2.865 (1.000)	-3.570 (0.013)	-3.019 (0.045)	-8.693 (0.000)	3.031 (1.000)	-3.555 (0.014)
$Y_t = \beta_1 + \beta_2 t + Y_{t-1} + u_t$	-5.219 (0.001)	-7.748 (0.000)	-1.670 (0.737)	-4.613 (0.005)	-0.788 (0.364)	-8.258 (0.000)	-1.736 (0.707)	-4.593 (0.005)
Diagnostic Test Results								
	ln(Rate of crime against women)		**ln(GDP)**		**ln(Rate of crime against women)**		**ln(GDP)**	
	AIC		AIC		AIC		AIC	
	Level	1st Diff	Level	1st Diff	Level	1st Diff	Level	1st Diff
$Y_t = Y_{t-1} + u_t$	-1.066	-1.695	-4.901	-4.502	-1.695	-1.695	-4.901	-4.502
$Y_t = \beta_1 + Y_{t-1} + u_t$	-1.353	-4.043	-4.989	-	-	-	-4.989	-4.793

				4.973	1.352	1.843		
$Y_t = \beta_1 + \beta_2 t + Y_{t-1} + u_t$	-1.784	-1.772	-5.079	-4.942	-1.065	-1.772	-5.079	-4.798

Source: *Authors' own calculation based on World Bank and NCRB*
** Probabilities are given in the parenthesis.*

Table-3 shows the results of the Augmented Dickey-Fuller Test, Phillips-Perron test and AIC criterion of VAR Lag Order Selection Criteria for two variables: GDP and rate of crime against women in India. This table reveals that the chosen variables of our study are stationary at first difference and are non- stationary at level. Both the Augmented Dickey-Fuller test and the Phillips-Perron test confirm this phenomenon. The results of Augmented Dickey-Fuller test for Rate of Crime Against Women shows in the no-trend model the value of t statistic 2.124 with probability 0.990 falls to -7.102 with probability 0.000 after 1st difference the AIC criterion also falls from 3.856 to -3.964 meaning the rejection of the null hypothesis that the model has a unit root. Similarly, all models show rejection of null hypotheses having unit root after the 1st difference.

4.4. Johansen Co-integration test and VAR Lag Order Selection Criteria results

Johansen Co-integration test is done to check whether the time series variables: Rate of crime against women and GDP in India are cointegrated or not.

Johansen Co-integration test is a procedure for testing co-integration of time series. This test permits more than one co-integrating relationship so is more generally applicable than the Engle-Granger test which is based on the ADF test for unit roots in the residuals from the single co-integrating relationship. Results of the test are given in table 4.

Table-4: Johansen Co-integration Test results for rate of crime against women in India

Rank	Eigen value	Trace Statistic	Probability**	Max-Eigen Statistic	Probability**
None (r = 0)	0.378	16.822	0.082	12.801	0.192
At most 1 (r ≤ 1)*	0.138	4.021	0.045	4.021	0.045

Source*: Authors' own calculation based on World Bank and NCRB data*
Note*: * denotes rejection of the hypothesis at the 0.05 level*
***MacKinnon-Haug-Michelis (1999) p-values*

Table-4 suggests the existence of one co-integrating relation between the variables rate of crime against women and GDP in India, that is, both variables are I(1). This table is also indicating the rejection of the null hypothesis of having no co-integration for the variables GDP and rate of crime against women in India or the existence of at most 1 co-integration.

VAR Lag Order Selection Criteria are the three initial measures that are adapted for selecting the appropriate' lag length' in the time series data on the variables: Rate of crime against women and GDP in India. The three criterions used are- Akaike info criterion, Schwarz

criterion and Hannan-Quinn criterion. The results are shown in table-5.

Table-5: VAR Lag Order Selection Criteria for GDP and rate of crime against women in India

Variables	Lag	Sequential modified LR test statistic	Final prediction error	AIC	SIC	HQIC
Endogenous variables: ln(GDP), ln(Rate of crime against crime)	0	NA	1.16e-05	-5.703	-5.127	-5.532
Exogenous variables: Constant ln(PG) ln(S) ln(SE) ln(ME) ln(MHTE) ln(FDI) ln(TOI)	0	NA	1.08E-05	-5.794	-5.026	-5.565
	1	28.039*	2.91E-06*	-7.147*	-6.187*	-6.861*
	2	0.281	4.07E-06	-6.869	-5.717	-6.527

Source: Authors' own calculation based on NCRB data

Note: * indicates lag order selected by the criterion

Table-5 suggests that the permissible maximum lag length for our analysis will be 1.

4.5. The causal relation between economic growth and rate of crime against women

The cointegrating equation gives long-run relationships between two variables but does not shed any light on short-run dynamics although its existence indicates that there must be some short term forces that are responsible for keeping the long-run relationship intact. Thus there is a need for constructing a more comprehensive model which combines short-run and long-run dynamics, known as Error Correction Model (ECM). In order to understand the short run and long run dynamics of the relationship between the rate of crime against women and population growth, we have used her ECM. The result of the ECM is reported in the table-6.

Table-6: Vector Error Correction Model for analysing the linkage between rate of rime against women and economic growth in India

Dependent Variable	Independent Variable	Coefficient	t-statistic	ECT	t-statistic	Control Variables	Coefficient	t-statistic
		Long Run Relation						
GDP per capita (constant 2010 US$)	**Long Run Relation**					Population Growth	-0.2042**	-2.0911
	Crime Rate against Women	-1.0185**	-2.2727	-0.2207**	-2.1891	Saving	0.2180*	3.7242
						Social Sector expenditure	0.1189***	1.8307
						Manufacturing export	0.6471*	9.6583
	Constant	-3.3124	---	---	---	Medium and high technology export	0.3420	0.7535
	Short Run Relation					FDI inflows	0.0832*	1.7349
						Trade Openness	0.4337	0.9854
	D(LNCRW(-1))	-0.0254	-0.4058			Constant	-0.2919	-0.6541
						R^2	0.7539	
						$\bar{R}^2$	0.6810	
	D(LNCRW(-2))	-0.0015	-0.0389			Akaike AIC	-5.2111	
						Schwarz SC	-4.5821	

Source: *Authors' own calculation based on World Bank and National Crime Records Bureau Data*

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

The result of the table suggests an error correction mechanism in the long-run between the rate of crime against women and economic growth in India adjusted for control variables

like-population growth, saving, social sector expenditure, manufacturing export, medium and high technology export, FDI inflows and trade openness. The error correction term is a negative and statistically significant implying tendency for endogenous variables to return to long-run equilibrium.

The insignificant values of the estimated coefficients suggest that we are unable to establish any short-run relationship between economic growth and the rate of crime against women. The high value of R^2 above 0.75, means the model is a statistically good fit. The negative and the significant value of the ECT suggest a long run meaningful equilibrium relationship between economic growth and rate of crime against women.

We also conduct block exogeneity Wald tests to understand the causality between economic growth and rate of crime against women in short-run.

Table-7: VEC Granger Causality/Block Exogeneity Wald Tests result for rate of crime against women in India

Null hypothesis: Non-casuality	χ^2	**df**	**Prob**	**Coefficient of ECM**	**t-statistic**
$\Delta lnGDP \Rightarrow \Delta$lnCRW	0.1943	2	0.9074	-0.2207**	-2.1891
$\Delta lnCRW \Rightarrow \Delta$lnGDP	0.0643	2	0.9684		

Source: Authors' own calculation based on World Bank and National Crime Records Bureau Data

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

The table reveals that the null hypothesis of no causal relationship between economic growth and the rate of crime against women in both directions is accepted in the short run. This result supports our earlier findings of table-6.

We next consider the identification of the existence of the long run relationship between the variables economic growth and rate of crime against women and also the direction of the relations. For this purpose we have used "Pairwise Granger Causality Test" and the test resulted is presented in table-8.

Table-8: Pair wise Granger Causality Test for rate of crime against women in India

Null Hypothesis	**F-Statistic**	**Prob**	**Observations**
ln(CRW) does not Granger Cause ln(GDP)	20.0537*	0.0001	28
ln(GDP)does not Granger Cause ln(CRW)	0.1563	0.696	

Source: *Authors' own calculation based on World Bank and National Crime Records Bureau Data*

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

The table discloses a unidirectional relationship between economic growth and the rate of crime against women. The null hypothesis that the *ln(CRW) does not Granger Cause ln(GDP)* is rejected at 1 per cent level while the relationship *ln(GDP)does not Granger*

Cause ln(CRW) is accepted because of lack of evidence against it. Thus we can conclude from the table-8 that there is a long run meaningful unidirectional relationship between economic growth and the rate of crime against women.

5. Discussion and Concluding Remarks

One of the most important findings here is that total crime rate shows a continuous rise from the period 1988-1993, after that from 1993-2003 it shows a falling trend. It again starts rising from 2003-2016. On the other hand, the trend line of the rate of crime against women is continuously rising from the period 1988-2016 indicating the rate of crime against women is continuously rising in India. Again the rate of crime against women influences GDP per capita negatively in the long-run. However, we do not find any short-run meaningful relationship between economic growth and the rate of crime against women. Thus to conclude, the study reveals that the rate of crime against women has a negative significant impact on GDP per capita. The existence of such linkages suggests that there is an urgent need to control the rate of crime against women to ensure non-interrupted economic growth. The result is quite obvious because any kind of social disturbances will have a strong negative impact on economic growth. Women are an integral part of society and any form of crime against her will destroy the base of any society and that will obviously affect the economic growth process. This result is alarming in the sense that if we want non-interrupted economic growth we have to take initiatives to control the rate of crime against women. Such initiatives not only reduce the rate of crime against women but also help in achieving the targeted high rate of economic growth. However, in this study, only one-way relationship between the rate of crime against women and GDP per capita is examined. The extensive research plan is to study the nexus between economic growth and the rate of crime against women. In fact, it is true that further research is necessary to investigate whether more fundamental economic and social changes are essential to enhance the autonomy and power of women in India to control the rate of crime against women as well as to promote economic growth.

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Conflict of Interest

The authors declared that they have no conflict of interest.

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Status of Child Health in India: A State Level Analysis

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Abstract

Health is the state of physical, mental and social well-being and does not only mean an absence of illness or disease. Child health is a multi-dimensional issue. In this paper, health status of children is analyzed using several dimensions and indicators to investigate the intensity and inequality which exists across the states in India taking resort to NFHS 3rd and 4th round data and have found that the infant mortality rate, under five mortality rate and malnourished children have significantly decreased overtime. Infant vaccination program, Vitamin A supplement program, maternity care, childhood treatment disease, women literacy rate and maternity care significantly reduces infant mortality rate whereas underage pregnant women do positively and significantly affect the infant mortality rate. In 2015-16, the top five states having the highest percent were Madhya Pradesh, Jharkhand, Bihar, Uttarakhand and Chhattisgarh while Kerala, Jammu and Kashmir, Manipur, Nagaland, and Mizoram had the lowest percent of child mortality and malnourishment.

Key Words*: Infant Mortality Rate, Under Five Mortality Rate, Malnourished Children*

JEL Classification*:*H51, I14, I18

1. Introduction

Healthy children are more likely to become healthy adult. Health is a basic component of human development, and hence determines society's well-being. It is a means to empower the deprived sections of society and thus an important element in the strategy for poverty alleviation. Thus, in recent years there has been an increased focus on issues that affect children and on improving their health. The vital statistics like crude birth rate, crude death rate, infant mortality rate, and life expectancy at birth provide the base for information on the health status (Sengupta 2016) and human development of any state. Access to preventive and protective health care enhances entitlements of the poor by enabling steady employment, improving productivity and facilitating demographic transition. A country or states performance depends a lot on the health of its populace. Not only does it improve efficiency but it is also an indicator of an all-round performance of the nation. For a country like India where the achievement of better child health is a daunting task, the consequence of ignoring the problem of child health seems very disastrous. The present state of child health situation in India does not present a rosy picture in front of our policy makers. Health is the state of physical, mental and social well-being and does not only

mean an absence of illness or disease. The right to health is closely linked to other fundamental human rights, most notably access to potable water and adequate hygiene. All children have the right to timely access to appropriate health services. Measuring the status of health of a country or a state is a complex process. It is a multifaceted phenomenon which has been difficult to model and estimate. It becomes further complicated due to disparities among various states of India. India is home to the largest number of children in the world, significantly larger than the number in China. The country has 20% of the 0-4-year child population of the world (world population prospects: 2008). The analysis of the situation of children in India would be incomplete without paying attention to the disparities that exist between and within states, and the inequalities that persist among different subgroups of the population.

Literature Review

Bhatia et al (2006) analyzed the concept of demand side financing and recommends piloting of a competitive voucher scheme as a mechanism for RCH services in India. *Borooah et al (2014)* presents econometric estimates regarding the relative strength of personal and household circumstances in determining the likelihood of utilizing the programmer's services. The paper also suggests a trade-off between quality and utilization by hypothesizing that the poor quality of services leads upper-caste mothers to exit the ICDS market and seek these services elsewhere. Maity et al (2019) revealed that the percentage share of underweight, stunted and wasting children have decreased in districts with higher women literacy rate and concentration of AWCs. *GanotraKomal (2016)* explained that India losses its children by institutionalizing child labour in family-based occupations under the age of 14 years and permitting the employment of children in many hazardous occupations. *Maitra P. and Ranjan Ray (2013)* analyzed four interrelated child health indicators in West Bengal namely child malnourishment (measured by the rates of stunting and wasting), prenatal, infant, and child mortality rates and concluded that effective policy interventions are required to delink maternal health from child health. Maity et al (2019) have detected the important vaccinations necessary to overcome serious diseases suffered by the children and have observed that the percentage of children receiving those vaccination in West Bengal have increased in recent time. *SinhaDipa (2015)* explained that the Rapid Survey on Children conducted in 2013–14 shows patchy progress between 2005–06 and 2013–14 in maternal and child health indicators and calls for greater investments in health and nutrition within a more comprehensive approach. Basar et al (2018) considers socio economic as well as demographic factors to be responsible for the incidence of nutritional insecurity. They found that the lack of per capita cultivable land is the major cause of nutritional insecurity in the Jangalmahal Region. Basar et al (2018) observed that the incidence of food insecurity is inversely related to increase in year of schooling, age of the head, per capita cultivable land and is directly related to employment status and choice of consumption basket.

Research Gap

From the existing literature most of the researcher had primarily focused on the infant and child mortality levels. Some of them concentrated on specific immunization programme for child Health. Most of them gave importance to gender gap i.e. girl children discrimination because they fail to access the improved health infrastructure and nutritional support. But they didn't concentrate much on the other crucial aspect of child Health. A detailed critical evaluation of

children health status considering the family health across states in India has not been adequately done. A comprehensive state level analysis is important encompassing all the basic dimensions of Children Health. So, the present work tries to address some of above-mentioned gaps in the existing literature in a systematic manner. Moreover, the concept of Child health can be taken as a multi-dimensional concept. Therefore, in this paper Health status of children is analyzed using several dimensions and indicators. With this end in view, to investigate the intensity and inequality of health status of children across the states in India, we have considered two indicators of multifaceted health status of children.

Child Mortality

- Infant mortality rate (IMR)
- Under-five mortality rate (U5MR)

Child Nourishment

- Percentage of Children under 5 years who are stunted (height-for-age.
- Percentage of Children under 5 years who are wasted (weight-for-height).
- Percentage of Children under 5 years who are severely wasted (weight-for-height).
- Percentage of Children under 5 years who are underweight (weight-for-age).
- Percentage of Children age 6-59 months who are anaemic.

Database

The present study is mainly based on the secondary data. Data has been collected from the National Family and Health Survey i.e. NFHS-3(2005-06) & NFHS-4(2015-16). And have also used states fact sheet reports of NFHS 3 & NFHS-4 of all states of this two round Survey.Here the selection of the indicators is to some extent context specific.

Methodology

The methodology used for the data analysis is simple. All the required statistical tools have been used for effective analysis of the data. The details of the methodology in the study are as follows.

A) Dimension Index:

It has been used extensively in the human development studies. Dimensional Index is calculated for each Sub indicator of a Corresponding dimensions and then arithmetic mean of all DI of a corresponding Indicator are taken as GDI. To calculate the Dimensional Index minimum and maximum values have been selected for each indicator from all states of India. Performance in each dimension is expressed as a value between 0 and 1 by applying the following general formula:

Dimensional Index (DI), of each indicator is calculated as –

$$\text{DI} = \frac{Actual\ \ value\ - Minimum\ \ Value}{Maximum\ \ \ value\ - Minimum\ \ Value}$$

$$\text{Group Dimensional Index (GDI)} = \sum \frac{Sum\ \ of\ \ DI'S}{No\ of\ \ sub\ \ indicator}$$

B) Pooled regression model has been used. The entire data set is a combination of cross section as well as time series data. Strata-12 software packages have been used for

pooled regression analysis**.**

2. Status of Child Health across States of India

The status of child health across states of India is analyzed on the basis of infant mortality rate (IMR), under-five mortality rate (U5MR), stunting, wasted and severely wasted children, underweight children and anaemic children.

2.1 Infant mortality rate (IMR)

IMR is one of the primary indicators of children health status in a specific zone. Data on infant mortality rate has been taken per 1000 live births. Infant mortality is defined as infant (less than one year) deaths per thousand live births. The level of mortality is very high in the first few hours, days & weeks of a child born. In 2005-06, IMR was extremely high (more than 60 percent) in the states namely Uttar Pradesh, Chhattisgarh, Madhya Pradesh, Bihar, Jharkhand, Assam, Arunachal Pradesh, Rajasthanand Odisha. There are only three states where IMR is found to be less than 25 percent. These states were Haryana, Goa and Kerala. In 2015-16, infant mortality rate (IMR) was highest in Uttar Pradesh (more than 60 percentage) followed by Chhattisgarh and Madhya Pradesh. There were only six states where IMR was found to be less than 25 percent. These states were Kerala, Goa, Tamil Nadu, Manipur, Arunachal Pradesh and Maharashtra (Table 1).

2.2 Under-five mortality rate (U5MR)

Another important indicator of children health status is Under-five-mortality rate. The Under-five mortality rate denotes the number of children (0-5 year) born in a specific year who died before reaching the age subjected to current age specific mortality rates per 1000 live births. In 2005-06, U5MR of child varied from 3 per cent (Haryana) to 96 percent (Uttar Pradesh). U5MR was highest in Uttar Pradesh among other states followed by Madhya Pradesh, Jharkhand, Odisha, and Chhattisgarh in 2005-06 whereas it was (U5MR) lowest in Kerala and Goa. In 2015-16, it varied from 3.8 in Haryana to 78 in Uttar Pradesh. Uttar Pradesh remained in the highest position in this regard followed by Madhya Pradesh and Chhattisgarh whereas it was lowest in Kerala, Goa, Manipur, Tamil Nadu and Maharashtra (Table 1).

2.3 Stunting, Wasted and Severely Wasted children

Stunting is defined as the percentage of children aged 0 to 59 months whose height for age is less. Stunting starts from pre-conception when an adolescent girl and who later becomes mother is undernourished and anaemic; it worsens when infants' diets are poor, and when sanitation and hygiene are inadequate. In India, 48 percent of children under age five years were stunted (too short for their age), 20 percent were wasted (too thin for their height), and 6 percent of children were underweighted in 2005-06. The prevalence of stunting was highest in Uttar Pradesh.Madhya Pradeshon the other hand has the highest levels of wasting and Meghalaya has the highest levels of severely wasted children.The issue of Stunting was higher among children in rural areas than in urban areas. In 2015-16, the prevalence of stunting was highest in Bihar followed by Uttar Pradesh andJharkhand. Even though there has been reduction in the percentage of stunted

children in every state but Bihar had relatively higher percentage than Uttar Pradesh which had the worst condition a decade ago. Jharkhand had the highest percent of children who were wasted and severely wasted. Kerala and Goa managed to have the least percent of stunted children in both 2005-06 and 2015-16. The prevalence of stunting and under-weight has decreased since 2005-06, especially for stunting which declined from 48 percent in 2005-06 to 38 percent in 2015-16. Over this same time period, the prevalence of wasting has remained more or less the same (Table 1).

Table 1 Percentage of IMR, U5MR, Stunted Children and Wasted Children across States in India, 2005-06 and 2015-16

	(IMR)		(U5MR)		stunted		wasted	
Name of the States	2005-06	2015-16	2005-06	2015-16	2005-06	2015-16	2005-06	2015-16
Andhra Pradesh	54	35	63	41	38	31.4	15	17.2
Arunachal Pradesh	61	23	88	33	43.3	29.4	15.3	17.3
Assam	66	48	84	56	46.5	36.4	13.7	17
Bihar	61	48	84	58	55.6	48.3	27.1	20.8
Chhattisgarh	71	54	90	64	52.9	37.6	19.5	23.1
Goa	14	13	20	13	25.6	20.1	14.1	21.9
Gujarat	50	34	61	43	51.7	38.5	18.7	26.4
Haryana	9.5	9.3	3	3.8	45.7	34	19.1	21.2
Himachal Pradesh	36	34	42	38	38.6	26.3	19.3	13.7
Jammu & Kashmir	45	32	51	38	35	27.4	14.8	12.1
Jharkhand	69	44	93	54	49.8	45.3	32.3	29
Karnataka	43	28	54	32	43.7	36.2	17.6	26.1
Kerala	15	6	16	7	24.5	19.7	15.9	15.7
Madhya Pradesh	69	51	93	65	50	42	35	25.8
Maharashtra	37	24	46	29	46.3	34.4	16.5	25.6
Manipur	30	22	42	26	35.6	28.9	9	6.8
Meghalaya	44	30	70	40	55.1	43.8	30.7	15.3
Mizoram	34	40	53	46	39.8	28	9	6.1
Nagaland	38	29	65	37	38.8	28.6	13.3	11.2
Odisha	65	40	91	49	45	34.1	19.6	20.4
Punjab	42	29	52	33	36.7	25.7	9.2	15.6
Rajasthan	65	41	85	51	43.7	39.1	20.4	23
Sikkim	34	29	40	32	38.3	29.6	9.7	14.2
Tamil Nadu	30	21	35	27	30.9	27.1	22.2	19.7
Tripura	51	27	59	33	35.7	24.3	24.6	16.8
Uttarakhand	42	40	56	47	44.4	33.5	18.8	19.5
Uttar Pradesh	73	64	96	78	56.8	46.3	14.8	17.9
West Bengal	48	27	59	32	44.6	32.5	16.9	20.3
India	57	41	74	50	48	38.4	19.8	21
Maximum	73	64	96	78	56.8	48.3	35	29
Minimum	9.5	6	3	3.8	24.5	19.7	9	6.1

Sources: NFHS (2005-06) and (2015-16)

2.4 Underweight Children

The indicator of underweight (weight for age) together with the indicator of stunting (height for age), wasting (weight for age) and severely wasted (weight-for-height) reveals a better picture of nutritional status of children. Nutrition problem are substantial in every state in India. Table 2 represents state wise percentage of children who were underweight. In 2005-06, it varied from 60 percent in Madhya Pradesh to 19.7 percent in Sikkim. Among the states, underweight was highest in Bihar and Jharkhandwhereas it was lowest in Sikkim follow by Mizoram, Kerala, and Manipur. In 2015-16, percentage of underweight children varied from 11.9 per cent in Mizoram to 47.8 per cent in Jharkhand. Even though Kerala and Goa had the least percentage of stunted and wasted children but it had relatively higher percentage of underweight children. Among the four worst performing states in 2005-06, two states were still in the top position in 2015-16 namely Bihar and Jharkhand and the remaining two states were Madhya Pradesh and Uttar Pradesh whose condition has improved considerably (Table 2).

Table 2 Percentages of Severely Wasted, Underweight and Anaemic Children across States in India, 2005-06 and 2015-16

	Severely Wasted		Underweight		Anaemic	
Name of the States	2005-06	2015-16	2005-06	2015-16	2005-06	2015-16
Andhra Pradesh	6.4	4.5	30	31.9	71	58.6
Arunachal Pradesh	6.1	8	32.5	19.5	56.9	50.7
Assam	4.0	6.2	36.4	29.8	69.4	35.7
Bihar	8.3	7.0	55.9	43.9	78	63.5
Chhattisgarh	5.6	8.4	47.1	37.7	71.2	41.6
Goa	5.6	9.5	25	23.8	38.2	48.3
Gujarat	5.8	9.5	44.6	39.3	69.7	62.6
Haryana	5.0	9	39.6	29.4	72.3	71.7
Himachal Pradesh	5.5	3.9	36.5	21.2	54.4	53.7
Jammu & Kashmir	4.4	5.6	25.6	16.6	58.5	43.3
Jharkhand	11.8	11.4	56.5	47.8	70.3	69.9
Karnataka	5.9	10.5	37.6	35.2	70.3	60.9
Kerala	4.1	6.5	22.9	16.1	44.5	35.6
Madhya Pradesh	12.6	9.2	60	42.8	74	68.9
Maharashtra	5.2	9.4	37	36	63.4	53.8
Manipur	2.1	2.2	22.2	13.8	41.1	23.9
Meghalaya	19.9	6.5	48.8	29	63.8	48
Mizoram	3.6	2.3	19.9	11.9	43.8	17.7
Nagaland	5.2	4.2	25.2	16.8	NA	21.6
Odisha	5.2	6.4	40.7	34.4	65	44.6
Punjab	2.1	5.6	24.9	21.6	66.4	56.6
Rajasthan	7.3	8.6	39.9	36.7	69.6	60.3
Sikkim	3.3	5.9	19.7	14.2	58.1	55.1

Tamil Nadu	8.9	7.9	29.8	23.8	64.2	50.7
Tripura	8.6	6.3	39.6	24.1	62.9	48.3
Uttarakhand	5.1	6	42.4	39.5	73.9	63.2
Uttar Pradesh	5.3	9	38	26.6	60.7	59.8
West Bengal	4.5	6.5	38.7	31.5	61	54.2
India	6.4	7.5	42.5	35.7	69.4	58.4
Maximum	19.9	11.4	60	47.8	78	71.7
Minimum	2.1	2.2	19.7	11.9	38.2	17.7

Sources: NFHS (2005-06) and (2015-16)

2.5. Anaemic Children

Anemia is characterized by lack of adequate amount of hemoglobin in the blood. Anemia in young children results in increased morbidity from infectious diseases, and it can result in impairments in coordination, cognitive performance, behavioral development, language development and scholastic achievement.Thus, prevalence of anemic is considered as an indicator to assess the nutritional status of children. In India, percentage of anemic children has declined considerably from 69.4 per cent in 2005-06 to 58.4 percent in 2015-16. Among the states, percentage of anemic children varied from 38.2 percent in Goa to 78 percent in Bihar in 2005-06 whereas in 2015-16, Mizoram had relatively lesser percentage of anemic children and Haryana had the highest percentage. Every state showed a reduction in the percentage of anemic children over the considered decade except Goa where there was increment in the percentage by 10 percent point. (Table 2).

3. Group Dimension Index of Child Mortality across States of India

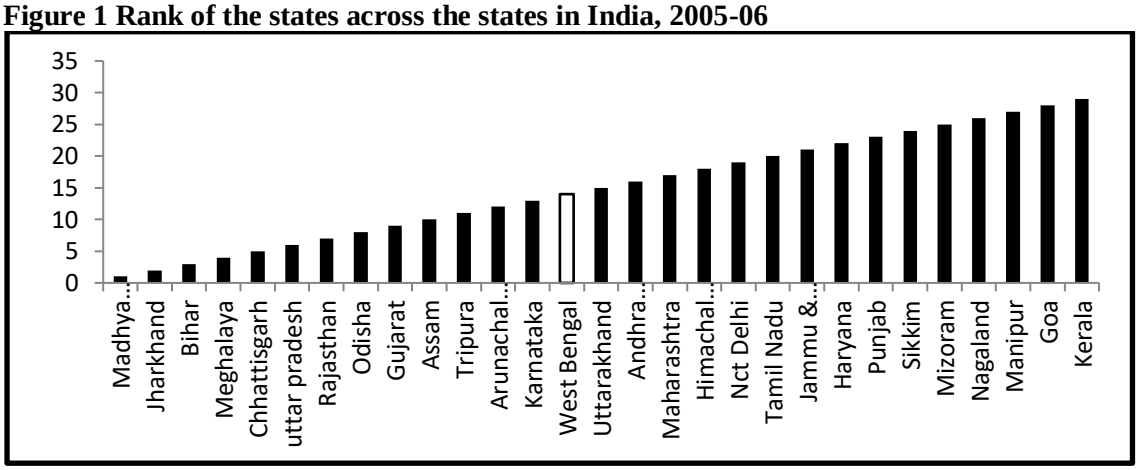
The Dimension Index (DI) of each indicators of Child mortality and Nourishment are calculated for the years 2005-06 and 2015-16. The indicators of child mortality as mentioned above were IMR and U5MR whereas the indicators of nourishment are stunted, wasted, severely wasted, underweight and anaemic. After taking the average of all DI of the dimensions, we obtain Group Dimension Index (GDI). With the help of GDI value, we obtained the rank of the states in 2005-06 and 2015-16. Here, greater value of GDI implies that the states were having higher percentage of child mortality and undernourished children and lower value implies that the state have lower percentage of child mortality and undernourished children. Highest value corresponds with rank 1(Table 3).

Table 3 Group Dimension Index of Child Mortality and Nourishment across states in India, 2005-06 and 2015-16

	2005-06				2015-16			
	Mortality	Nourishment	Total	Rank	Mortality	Nourishment	Total	Rank
Andhra Pradesh	0.67	0.41	0.49	16	0.5	0.49	0.49	16
Arunachal Pradesh	0.86	0.42	0.55	12	0.34	0.46	0.42	19
Assam	0.88	0.45	0.58	10	0.71	0.47	0.54	12
Bihar	0.84	0.78	0.8	3	0.73	0.78	0.77	4
Chhattisgarh	0.95	0.61	0.71	5	0.82	0.64	0.69	6
Goa	0.13	0.21	0.19	28	0.12	0.48	0.38	22
Gujarat	0.63	0.59	0.6	9	0.51	0.79	0.71	5
Haryana	0	0.53	0.38	22	0.03	0.68	0.49	17
Himachal Pradesh	0.42	0.43	0.42	18	0.47	0.33	0.37	24
Jammu & Kashmir	0.54	0.31	0.38	21	0.45	0.3	0.34	25
Jharkhand	0.95	0.81	0.85	2	0.67	0.97	0.88	1
Karnataka	0.54	0.5	0.51	13	0.38	0.76	0.65	8
Kerala	0.11	0.21	0.18	29	0.02	0.27	0.2	28
Madhya Pradesh	0.95	0.87	0.89	1	0.8	0.84	0.83	2
Maharashtra	0.45	0.48	0.47	17	0.32	0.7	0.59	10
Manipur	0.37	0.19	0.24	27	0.29	0.1	0.16	29
Meghalaya	0.63	0.86	0.8	4	0.45	0.55	0.52	13
Mizoram	0.46	0.22	0.29	25	0.58	0.06	0.21	27
Nagaland	0.56	0.18	0.29	26	0.42	0.19	0.26	26
Odisha	0.91	0.51	0.63	8	0.6	0.54	0.56	11
Punjab	0.52	0.27	0.34	23	0.4	0.4	0.4	20
Rajasthan	0.88	0.54	0.64	7	0.62	0.72	0.69	7
Sikkim	0.39	0.25	0.29	24	0.39	0.37	0.38	23
Tamil Nadu	0.33	0.43	0.4	20	0.29	0.48	0.43	18
Tripura	0.63	0.52	0.55	11	0.38	0.4	0.39	21
Uttarakhand	0.54	0.48	0.5	15	0.58	0.6	0.59	9
Uttar Pradesh	1	0.58	0.7	6	1	0.69	0.78	3
West Bengal	0.6	0.46	0.5	14	0.37	0.55	0.5	15

Sources: NFHS (2005-06) and (2015-16)

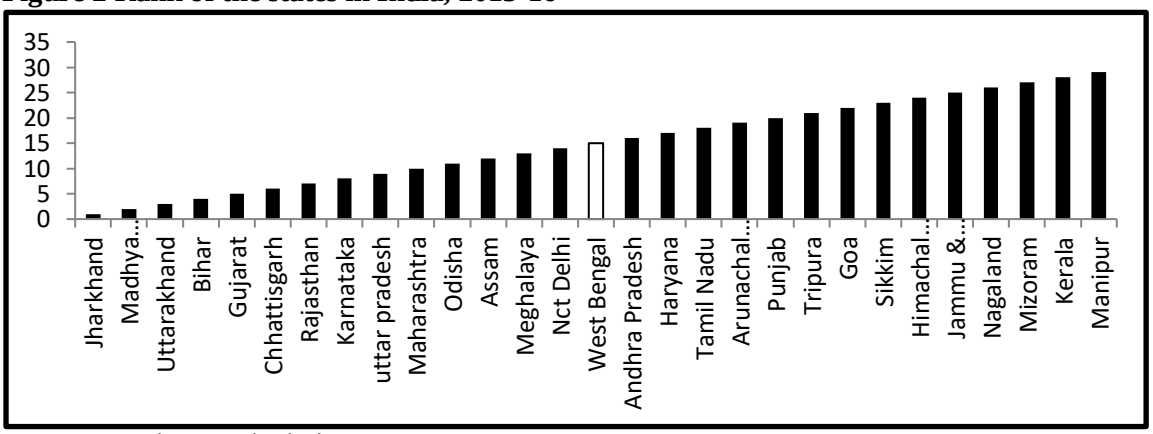
Figure 1 Rank of the states across the states in India, 2005-06



Sources: Author's calculation

The ranking of states on the basis of percentage of child mortality and nourishment in 2005-06 and 2015-16 are shown in figure 1& 2. In 2005-06, the top five states having the highest percent of child mortality and nourishment were Madhya Pradesh, Jharkhand, Bihar, Meghalaya and Chhattisgarh. Among them three states remained in the top five states namely Madhya Pradesh, Jharkhand and Bihar while another two states were Uttarakhand and Chhattisgarh in 2015-16. Whereas Jharkhand replaced Madhya Pradesh implying that the relative condition of Jharkhand has deteriorated. The bottom five states were Kerala, Goa, Manipur, Nagaland, and Mizoram in 2005-06. In which four states still remain in better position and only Jammu & Kashmir replaced Goa in 2015-16. The condition of Goa has deteriorated in this regard as its rank has reduced from 28th to 22nd whereas West Bengal's position increased from 14th to 15thover the decade.

Figure 2 Rank of the states in India, 2015-16



Sources: Author's calculation

4. Analysis of Child Mortality and Nourishment

To analyze the status of child health across states in India,pooled data regression model is used. Due to availability of data only for two distinct years this model will be more appropriate. In the present study, the data consist of 28 states for the years 2005-06 and 2015-16. Here we have considered Group Dimension Index of infant vaccination program, women literacy rate, maternity care, treatment of child disease, percentage of underage pregnant women and underweight women as independent variable.Along with these variables we have also considered time dummy variable (TD) to check whether the overtime status of child health has increased or not. These variables are selected based on the perception that they have considerable impact on the variation in child health and also on the basis of the availability of data. No serious problem of multicollinearity was observed in the correlation coefficient matrix obtained by considering all the dependent and the independent variables. Thus, we proceed further by framing the model and analyzing it.

Model-1

Here we have regressed infant mortality rate on infant vaccination program, women literacy rate, percentage of underage pregnant women and underweight women and have also considered time dummy. The Pooled Regression Model is specified as follows:

$$\boldsymbol{IMR_{it} = \alpha_0 + X1_{it} + X2_{it} + X3_{it} + X4_{it} + TD + \varepsilon_{it} ----(1)}$$

Where,

IMR = percentage of Infant Mortality Rate across states in India

α_0= constant

X1 = Group Dimension Index of infant vaccination program

X2 = women literacy rate

X3 = percentage of underage pregnant women

X4 = percentage of healthy women

TD = time dummy (takes '0' for 2005-06 and '1' for 2015-16)

'I'=1 to 28 (28 states of India)

't'= 1 ,2 (2005-06 and 2015-16)

ε_{it} = Random error term

Table 4 Results of Pooled Regression Model to Explain the Variation of IMR

	Coefficient	Std. Err.	T stat	P>t	
X1	-0.316	0.101	-3.14	0.003	Number of observations = 56,
X2	-0.617	0.125	-4.95	0.000	F (5, 50) = 17.62
X3	0.111	0.294	-0.38	0.070	Prob > F = 0.0000
X4	-0.171	0.167	-1.02	0.311	R-squared = 0.628
TD	-16.842	3.818	-4.41	0.000	Adjusted R-squared = 0.593
Constant	129.569	12.046	10.76	0.000	

Here,infant vaccination program, women literacy rate and time dummy variable are negatively and significantly related to the infant mortality rate whereas underage pregnant women positively and significantly affects the infant mortality rate. It implies that if the infant vaccination

programme and women literacy rate increases then infant mortality rate will decrease.Statistical significance of time dummy variable implies that infant mortality rate has significantly decreased overtime. If underage pregnant women increase then infant mortality rate will also increase. Model is also found to be statistically significant. (Table 4)

Model-2

Here we regress under five mortality rates on under five ages child vaccination program, Vitamin-A supplementation, women literacy rate, percentage of underage pregnant women overweight women and materiality care in the last five years. We have also considered a time dummy. The Pooled Regression Model is specified as follows

$$\boldsymbol{U5MR_{it} = \alpha_0 + X1_{it} + X2_{it} + X3_{it} + X4_{it} + X5_{it} + X6_{it} + TD + \varepsilon_{it}} \qquad (\mathbf{2})$$

Where,

U5MR = percentage of Under Five Mortality Rate across states in India

α_0= constant

X1 = Group Dimension Index of under-five ages child vaccination program

X2 = percentage of children under five years received vitamin- A supplementation.

X3 = women literacy rate

X4 = percentage of underage pregnant women (15-19 years)

X5= percentage of healthy women

X6 = Group Dimension Index of materiality care in last five years.

TD = time dummy (takes '0' for 2005-06 and '1' for 2015-16)

'I'=1 to 28 (28 states of India)

't'= 1 ,2 (2005-06 and 2015-16)

ε_{it} = Random error term

Table 5 Results of Pooled Regression Model to Explain the Variation of U5MR

Variables	Coefficient	Std. Err.	T stat		
X1	-0.509	0.181	-2.81	0.007	
X2	-0.330	0.196	1.68	0.098	
X3	-0.724	0.171	-4.23	0.000	Number of observations = 56
X4	-0.510	0.411	-1.24	0.220	F (7, 48) = 16.75
X5	-0.241	0.218	-1.1	0.275	Prob > F = 0.0000
X6	-24.702	16.677	-1.48	0.014	R-squared = 0.7010
TD	-32.348	8.338	-3.88	0.000	Adjusted R-squared = 0.6592
Constant	185.492	19.345	9.59	0.000	

This model executes that under five ages child vaccination program, vitamin supplement program, women literacy rate, materiality care and time dummy variable are negatively and significantly related to the under-five mortality rate implying that if the Under-five ages child vaccination program, Vitamin-A supplement program, women literacy rate and maternity care increase then under five mortality rates will decrease. Statistical significance of time dummy variable implies that under five mortality rates have significantly decreased overtime. (Table 5)

Model 3

Here we regress percent of malnourished children on under five ages child vaccination program, Vitamin-A supplementation, childhood treatment for disease, women literacy rate, percentage of underage pregnant women, percentage of women below the body mass index, overweight women and materiality care in the last five years. We have also considered time dummy. The Pooled Regression Model is specified as follows:

$$\boldsymbol{Y_{it} = \alpha_0 + X1_{it} + X2_{it} + X3_{it} + X4_{it} + X5_{it} + X6_{it} + X7_{it} + X8_{it} + TD + \varepsilon_{it}} \qquad (3)$$

Where,

Y_{it} = percentage of Malnourished children across states in India

α_0= constant

X1 = Group Dimension Index of under-five ages child vaccination program.

X2 = percentage of children under five years received vitamin- A supplementation.

X3 = Group Dimension Index of childhood treatment disease.

X4= women literacy rate.

X5 = percentage of underage pregnant women

X6 = percentage of women Body Mass Index below normal.

X7= percentage of healthy women

X8 = Group Dimension Index of materiality care in last five years.

TD = time dummy (takes '0' for 2005-06 and '1' for 2015-16)

'I'=1 to 28 (28 states of India)

't'= 1 ,2 (2005-06 and 2015-16)

ε_{it} = Random error term

Table 6 Results of Pooled Regression Model to Explain the Variation of Malnourished children

Variables	Coefficient	Std. Err.	T stat	P>t	
X1	-0.003	0.002	-1.36	0.179	Number of observations = 56
X2	-0.004	0.002	1.75	0.087	F (9, 46) = 9.44
X3	-0.270	0.159	1.7	0.097	Prob > F = 0.0000
X4	-0.006	0.002	-2.77	0.008	R-squared= 0.6390
X5	0.004	0.004	0.88	0.385	Adjusted R-squared = 0.5713
X6	0.009	0.003	2.8	0.007	
X7	0.005	0.003	1.48	0.144	
X8	-0.020	0.179	-1.12	0.068	
TD	-0.202	0.088	-2.29	0.026	
Constant	0.855	0.268	3.19	0.003	

This model explains that under five ages child vaccination program, Vitamin-A supplement program, childhood treatment disease, women literacy rate, materiality care and time dummy variable are negatively and significantly related to the malnourished children. Whereas women

BMI below normal and overweight women are positively and significantly related to the malnourished children. If the states have better access to under five ages child vaccination program, Vitamin-A supplement program, childhood treatment disease and increase in materiality care services then percent of malnourished children will decrease in the corresponding states. Higher percent of women literacy rate means that the states have lower percentage of malnourished children. Statistical significance of time dummy variable implies that malnourished children have significantly decreased overtime (Table 6).

5. Concluding Observations

This paper concludes that there has been considerable reduction in infant mortality rate, under five mortality rate and malnourished children overtime. Infant vaccination program, women literacy rate have a significant role in reducing infant mortality rate whereas with the increase in the underage pregnant women there is increase in the infant mortality rate. If the states have better access to Under-five ages child vaccination program, vitamin supplement program, materiality care services and women literacy rate then under five mortality rates will also decrease. If the states have better access to Under five ages child vaccination program, vitamin supplement program, childhood treatment disease, and materiality care services then the percent of malnourished child will decrease in the corresponding states. Higher percent of women literacy rate means the states have lower percentage of malnourished children. If the states have greater percentage of women whose BMI is below normal and overweight women then we can say that percentage of malnourished children will increase in the states. In 2015-16, the top five states having the highest percent were Madhya Pradesh, Jharkhand, Bihar, Uttarakhand and Chhattisgarh while Kerala, Jammu and Kashmir, Manipur, Nagaland, and Mizoram had the lowest percent of child mortality and nourishment. Thus, this paper managed to critically evaluate the status of child health across states of India encompassing all the basic dimensions of Children Health.

6. Policy Recommendation

We have observed that some factors have significant impact on improving child health namely women literacy rate, percentage of healthy women, maternity care, infant vaccination program, treatment of childhood disease etc whereas some variables have adverse impact on child health like percentage of underage pregnant women, percentage of women having BMI below normal etc. In this regard numerous policies can be taken to overcome the problems faced by children in their early age. To mention a few are:

i. Since women's literacy plays a crucial role in reduction child mortality and also in improving overall health status of a child, policies must be taken to educate as well as to empower women.
ii. As we have seen health of a women has a direct association with the health of the child, therefore necessary programme must be undertaken by the government to improve the health condition of the women including organizing health and awareness programme at regular intervals.
iii. We have also seen that the condition of children are worst in the rural areas as compared to urban areas. Therefore, National Rural Health Mission programme need to be given more

emphasis and its proper implementation need to be addressed at regular interval.

iv. Programme related to child health like child vaccination programme, immunization programme need to be undertaken by the government efficiently.

v. The orthodox believes be it social, religious etc. acts as constraint for children to get the vaccination on time need to be removed by organizing frequent awareness programs and encouraging the mothers to provide their child with the required vaccines.The bitter truth is that numerous policies are already taken by the government in this regard but due to loops in its implementation the target is yet to be achieved. So, focus must be in proper implementation of the programme undertaken for overcoming the mentioned problems.

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Crime in India: A State Level Analysis

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Abstract

The present study attempts to understand the growth of Crime against children, Crime against women and other types of crime over the period 2001-02 to 2014-15. The relative performance with respect to All India as well as the position of the sample states are tried to be found out in terms of all the three crimes. The result suggests that the growth rate of all the crimes considered is highly fluctuating over the entire sample period. For crime against children, Tamil Nadu ranks the first and Uttar Pradesh ranks the least. For crime against women, Assam ranks the first and Tamil Nadu ranks the least. Considering the other crimes, West Bengal ranks the first and Rajasthan ranks the least.

***Key words**: Crime, Crime against Women, Crime against Children, Other Crime*

1. Introduction

Crime certainly is widespread everywhere in all countries in heterogeneous form. The occurrence of crime in India is increasing at frightening rate with a devastating distribution of population. It is very significant to mention that according to NCRB data of 2016, total crimes were recorded to be 2.97 million on the other hand crime rates was observed to be 379 crime per lakh population. Specifically, the murder count rose from 53 to 59, kidnapping for money increased from 1 to 3 and the rape cases also moved up from 240 to 243. Talking about, domestic violence as death cases due to dowry, it also felt a lift from 14 to 19.

The current hour call is every citizen of the country should participate and be aware of their functioning in establishing a safe and secure society at large. Thus analysis of crime is very much needed.

The Criminal Procedure Code in India divides crimes into two heads: cognizable and non-cognizable. Cognizable crimes can be again sub-divided as those falling under either the Indian Penal Code (IPC), or under the Special and Local Laws (SLL). The present study is concerned with only IPC crimes.

The survey of literature reveals that there are few empirical studies to assess crime against women, children and other crimes in India. In this connection mention should be made of names like Furnell, Steven & Samantha, Dowling (2019), Hazra, Devika & Zhen Cui (2018), Steven and Philips (2014), Wani (2014), Bhradwaj (2014), Sharma (2013), Kumar (2013), Chaudhary (2013) among others.

In their paper, Furnell, Steven & Samantha, Dowling (2019) reviewed current evidence that cyber crime exists in several dimensions, with costs and harms that can be similarly varied.

There is also a sense that, moving forward, the "cyber" label will become somewhat redundant as many crimes have the potential to have a technology component. Hazra, Devika & Zhen Cui (2018) examined the relationship between crime, inflation, unemployment, and real GDP per capita in India and suggests that macroeconomic indicators, especially unemployment, can significantly affect crime in India. Steven and Philips (2014) discussed the impact of Economic crisis on crime within the context of the United Nations. It presents the result of a unique cross national analysis that aims to investigate the possible effect of economic stress on crime. Wani (2014) concluded with some recommendation for the government of India advising to facilitate child-friendly system for juveniles in conflict with law and children in need have care and protection. Bharadwaj (2014) concluded that theoretical and empirical evidence on the nexus between crime and socio economic indicators. He also empirically inspects the role of economic growth, unemployment, urbanization and quality of legal system play in including property related crimes. Sharma (2013) displayed crime against the historically marginalized scheduled castes and Schedule tribes (SC/ST) by the upper castes in India. Using the official district level crime data for the period 2001-10 a positive association between crimes and expenditure of SC/ST vis-à-vis the upper castes of the economic gap between in caste based crime is found. Kumar (2013) empirically examined the causality between crimes rates and economic growth using state level data in India. He observed that there is a negative and statistically significant relationship between the violent crimes and growth rate of per capital income. The result shows that crime has an important effect on economic performance. Chaudhary (2013) displayed domestic violence as one of the most common crime against women which is inextricably linked to the perpetuation of patriarchy. As concluded by Chaudhary that domestic violence may have a wider and deeper impact in life of the victims. A proper societal legal environment has to be built to make the houses safe and secure for the women.

The literature review on crime in India suggests that some work has been done on taking specific crime and also crime as a whole. But all the studies mainly focused on all India. Therefore study using state level data and analyzing the states separately is practically lacking in the literature.

The present study is in the footsteps of earlier studies in India. It is different from earlier studies in the sense that it covers all the major states and tried to analyze the trend in crime rate for all the states separately. Thus the present study is an attempt to fill the gap in the existing literature.

The major objectives of the present study are to understand the trend in growth of different crimes like Crime against children, Crime against women and Other crimes in the 17 major selected states of India. Side by side it will be interesting to find out the relative performance as well as the position of 17 major selected states w.r.t. All India in terms of Crime against children, Crime against women and other crimes.

The rest of the paper is structured in the following manner:

Section 2 outlines the data source and the methodology of measuring the growth rate of each of the variables like crime against women, children and other crimes. The results of estimation are reported in section 3. Section 4 concludes.

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2. Methodology and the data

This section presents the methodology and the data used in the analysis.

2. 1 Methodology

For measuring the growth rate of each of the variables like crime against women, crime against children and other crimes, the following specifications have been used:

Year to Year Growth rate which is obtained from $(Y_t - Y_{t-1})/Y_{t-1}$

Y_t is the magnitude of the variable in period t, Y_{t-1} is the magnitude of the variable in period t-1, $Y_t - Y_{t-1}$ is the difference in the magnitude of the variable in period t and t-1.

Compound Annual Growth Rate is defined as $(Y_n/Y_o)^{(1/n)}-1$

Where Y_n is the magnitude of the variable in period n and Y_o is the magnitude of the variables in base period 0 and n denotes number of periods.

2.2 Data

Secondary data from the period 2001-02 to 2014-15 on Crime against women which includes Rape, Kidnapping & abduction, Dowry Death & cruelty by husband or his relatives, Other crimes like assault on women with intent to outrage her modesty, insult to the modesty of women, importation of girls from foreign country, Crime against children which includes Rape of Children, Kidnapping and Abduction of Children and Other crimes against children like infanticide, feticide, murder of children, abetment of suicide, exposure and abandonment, procuration of minor girls, buying of girls for prostitution and also Other Violent Crimes like Murder, Theft &Robbery, Cyber crime and Human Trafficking have been used.

Major seventeen states of India considered in the present study are Andhra Pradesh (AP), Assam (AS), Bihar (BI), Gujarat (GU), Haryana (HA), Himachal Pradesh (HP), Jammu & Kashmir (J&K), Karnataka (KA), Kerala (KE), Madhya Pradesh (M.P), Maharashtra (MA), Odisha (OD), Punjab (PU), Rajasthan (RA), Tamil Nadu (TN), Uttar Pradesh (UP) and West Bengal (WB). The sources of data are The National Crime Record Bureau (NCRB), Ministry of Home Affairs [http://ncrb.nic.in/], Crime- statistical year book India by National sample survey Office (NSSO) and various issues of crime in India [data.gov.in]

3. Results of analysis

The results of estimation of the growth rate of crime against women, crime against children and other crime for the different states in India using year to year growth rate are discussed in Tables 1, 2 and 3. Also the relative performance of the 17 major selected states with respect to (w.r.t.) All India in terms of Crime against children, Crime against women and other crimes are presented in Table 4. Ranking of the states in terms of Crime against Children, Crime against Women and Other Crime are made in Table 5. The results of compound annual growth rate are presented in Table 6.

3.1. Results of Year to year growth rate

The results of estimation of the growth rate of crime against women, crime against children

and other crime for the different states in India using year to year growth rate are presented in Table 1, Table 2 and Table 3 respectively.

Table 1: Year to Year Growth Rate of Crime against Women

	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15
AP	0.15	-0.03	0.03	0.10	0.03	0.15	-0.03	0.06	0.07	0.04	0.00	0.16	-0.50	-0.04
AS	0.20	0.04	0.07	0.06	0.13	0.01	0.19	0.20	0.19	0.00	0.18	0.29	0.10	0.22
BI	0.07	0.03	0.37	-0.26	0.12	0.12	0.15	0.02	-0.04	0.21	0.10	0.21	0.13	-0.10
GU	-0.07	0.07	0.08	0.02	0.15	0.13	0.04	-0.07	0.02	0.08	0.08	0.28	-0.12	-0.28
HA	0.29	-0.05	0.03	-0.03	0.11	0.01	0.11	0.03	0.05	-0.01	0.09	0.51	-0.01	0.05
HP	-0.06	-0.13	0.13	-0.04	0.00	0.29	-0.04	-0.03	0.08	-0.03	-0.09	0.62	0.03	-0.15
J&K	0.22	0.07	0.02	-0.03	0.13	0.04	-0.09	0.14	0.00	0.20	0.06	0.05	-0.05	0.01
KA	0.03	-0.05	-0.07	0.12	0.00	0.08	0.05	0.14	0.12	0.09	0.08	0.16	0.16	-0.09
KE	0.07	-0.03	0.15	0.04	0.12	0.04	0.04	-0.01	0.18	0.19	-0.03	0.03	0.01	-0.15
MP	0.05	-0.05	0.05	-0.04	-0.01	0.07	-0.03	0.06	0.04	0.01	0.01	0.31	0.30	-0.16
MA	-0.10	0.00	0.08	0.10	0.08	0.03	0.06	-0.05	0.05	0.00	0.04	0.52	0.07	0.17
OD	-0.11	0.03	0.06	0.19	0.09	0.07	0.14	-0.02	0.05	0.11	0.27	0.18	0.03	0.17
PU	-0.03	0.03	-0.18	0.01	0.14	0.20	-0.02	0.00	0.08	-0.07	0.23	0.54	0.09	-0.02
RA	-0.01	-0.02	0.11	-0.11	0.11	0.10	0.02	0.19	0.05	0.09	0.06	0.32	0.12	-0.10
TN	-0.03	-0.09	0.05	-0.07	-0.25	0.20	-0.08	-0.16	0.11	0.03	0.04	0.04	-0.15	-0.08
UP	-0.23	-0.18	0.21	-0.04	0.10	0.28	0.12	-0.01	-0.13	0.12	0.04	0.38	0.18	-0.08
WB	0.04	0.24	0.30	0.08	0.08	0.29	0.26	0.11	0.12	0.12	0.06	-0.04	0.28	-0.13

Source: Authors calculations form the data of Crime in India (The National Crime Record Bureau (NCRB))

Table 1 shows the year to year growth rate of crime against women. The table reveals that for all the major states considered there are negative values in some of the financial years. It can be revealed that the growth rate for all the sates showed a fluctuating pattern during the sample period 2001-02 to 2014-15. It can be noted that the growth rates are not only fluctuating over the entire period but also showed negatives values in some of the financial years.

Table 2: Year to Year Growth Rate of Crime against Children

	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15
AP	0.23	3.39	-0.09	-0.28	0.46	0.08	-0.12	0.30	0.06	0.21	0.03	0.13	-0.20	-0.03
AS	-0.22	0.36	0.11	8.48	0.27	-0.34	0.10	-0.76	3.48	0.20	0.66	0.32	1.67	1.05
BI	-0.31	-0.02	0.05	0.95	-0.43	9.23	0.13	0.33	0.81	0.21	0.30	-0.45	0.43	-0.15
GU	0.24	-0.06	0.20	0.05	0.17	0.14	-0.03	-0.10	0.04	0.12	0.17	0.56	0.55	0.13

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HA	-0.35	0.22	-0.43	1.28	0.24	-0.30	-0.17	0.31	-0.14	-0.08	2.63	0.62	0.55	0.28
HP	0.11	0.20	-0.16	0.42	0.04	0.11	0.36	0.08	0.11	0.06	0.02	0.61	0.09	0.02
J&K	0.50	0.17	-0.29	0.63	0.49	-0.69	-0.62	0.80	-0.06	0.47	0.60	0.88	1.81	0.46
KA	0.58	0.02	0.63	0.01	0.45	-0.04	0.46	-0.21	0.33	-0.18	1.62	0.55	1.52	0.16
KE	0.64	-0.56	1.02	0.07	0.43	-0.12	0.13	0.07	0.02	1.44	-0.09	0.42	0.27	0.00
MP	0.63	0.14	0.37	0.02	0.06	0.09	-0.01	0.09	0.06	-0.11	0.18	0.60	0.83	-0.15
MA	0.15	0.08	0.14	0.01	0.23	-0.05	0.00	0.07	0.13	0.03	0.03	0.85	0.27	0.72
OD	-0.18	1.50	-0.08	-0.33	0.79	0.31	-0.30	0.38	0.00	0.62	0.33	1.69	0.96	0.17
PU	0.31	0.14	0.05	0.09	0.56	0.60	-0.26	0.87	-0.14	-0.01	0.41	0.52	0.32	0.04
RA	-0.06	0.18	0.68	0.44	0.64	0.32	-0.02	0.15	-0.06	0.13	0.21	0.60	0.34	-0.05
TN	1.21	0.31	1.22	-0.27	0.23	0.25	0.51	-0.05	0.28	0.14	0.12	0.15	0.98	0.11
UP	-0.51	-0.07	0.13	-0.06	-0.02	0.27	0.81	-0.24	-0.24	1.36	0.10	0.63	-0.96	-0.31
WB	0.05	-0.15	0.39	0.15	0.83	-0.16	0.42	-0.06	0.82	0.65	0.18	0.48	-0.81	0.30

Source: Authors calculations form the data of Crime in India (The National Crime Bureau Record (NCRB)

The year to year growth rate of crime against Children is presented in Table 2. The table reveals that for all the major states considered the growth rates are not only fluctuating over the sample period 2001-02 to 2014-15 but also showed negatives values in some of the financial years.

Table 3: Year to Year Growth Rate of Other Crime

	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15
AP	-0.08	0.05	0.02	-0.03	0.11	-0.09	-0.02	-0.01	0.01	0.08	-0.05	-0.01	-0.45	-0.02
AS	-0.03	0.07	-0.03	-0.12	-0.02	0.00	0.03	-0.15	0.05	0.11	0.92	-0.43	0.15	-0.07
BI	0.03	-0.03	0.10	-0.13	0.00	-0.08	-0.01	0.02	0.02	0.06	0.18	-0.02	0.09	0.04
GU	0.76	-0.43	-0.08	-0.08	0.01	0.05	0.07	-0.08	0.01	0.02	0.06	0.02	-0.09	0.08
HA	-0.04	-0.10	-0.02	0.21	0.19	0.07	0.02	0.07	0.12	-0.02	0.02	-0.02	0.14	0.01
HP	0.03	-0.06	-0.07	-0.01	0.04	0.09	-0.04	-0.02	0.02	-0.14	-0.03	0.03	-0.04	-0.15
J&K	-0.09	-0.02	-0.08	-0.10	-0.09	-0.13	0.15	-0.12	0.33	-0.30	-0.03	0.17	-0.10	-0.19
KA	0.04	-0.14	0.06	0.02	0.04	-0.07	0.10	0.06	0.15	-0.02	0.05	-0.04	0.00	-0.03
KE	-0.02	-0.12	-0.04	-0.02	-0.01	0.14	0.08	0.01	0.02	0.22	0.02	-0.06	-0.34	-0.01
MP	-0.01	-0.13	0.00	0.00	-0.03	0.06	0.04	-0.05	-0.01	-0.03	-0.03	-0.06	0.07	0.04
MA	-0.03	-0.06	0.04	0.07	0.07	0.06	0.11	-0.07	0.06	0.05	0.15	0.15	-0.07	-0.02
OD	0.10	-0.08	0.00	0.05	-0.03	0.18	0.28	-0.18	0.05	0.04	0.15	0.00	0.02	0.03
PU	-0.04	-0.03	0.06	0.02	0.15	-0.01	0.04	0.06	0.07	-0.05	0.03	-0.17	0.01	0.00

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RA	-0.24	-0.29	-0.09	-0.15	-0.11	0.05	-0.06	-0.02	-0.05	-0.07	-0.02	0.09	0.09	-0.08
TN	-0.10	-0.13	-0.08	-0.15	-0.14	0.27	0.13	0.00	0.17	0.10	0.01	-0.02	-0.02	-0.04
UP	-0.21	-0.33	0.31	-0.04	-0.06	0.00	-0.06	0.00	-0.01	0.18	0.03	0.07	0.02	-0.03
WB	-0.11	0.05	0.01	0.02	0.00	0.24	0.35	0.21	0.01	-0.06	0.11	0.01	0.19	0.08

Source: Authors calculations form the data of Crime in India (The National Crime Bureau Record (NCRB)

Table 3 shows the year to year growth rate of Other Crime. The table reveals that for all the major states considered the growth rate showed a fluctuating pattern during the sample period 2001-02 to 2014-15. It can be noted that the growth rate are not only fluctuating over the entire period but also showed negatives values in some of the financial years.

As the results of estimation of year to year growth rate of crime against women, children and other crimes for the different sample states are fluctuating over the entire period and also showed negatives values in some of the financial years, simple arithmetic mean (AM), standard deviation (SD) and coefficient of variation (CV) for the entire sample period are calculated to have an idea about the actual situation of these variables.

3.1.1 Relative performance of the sample states with respect to All India in terms of Crime against children, Crime against women and other crime

The relative performance of the 17 major selected states w.r.t. All India in terms of Crime against children, Crime against women and other crimes can be understood from Table 4. The criteria for Good Performing states, Medium Performing states and Bad Performing states have been defined as under:

Good performer	Medium Performer	Bad Performer
• AM-low, SD-low, CV-low	• AM-high a) SD-high, CV high b) SD-high ,CV-low c) SD-low, CV-high • AM-low a) SD-high, CV high b) SD-high ,CV-low c) SD-low, CV-high	• AM-high, SD-low, CV-low

Table 4: Relative performance of the sample states with respect to All India in terms of Crime against children, Crime against women and other crime

Variables	Good Performing	Medium Performing	Bad Performing

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	states	states	states
Crime against Women	AP,GU,HP,MP and UP	AS, J&K, KA, MA, RA and WB	BI, HA, KE, OD, PU and TN
Crime against Children	AP, J&K, and UP	KA, OD, PU, TN, RA and WB	AS, BI, GU, HA, HP, KE, MP and MA
Other crime	AS, GU, KA and TN	HA, J&K, OD and PU	AP, BI, HP, KE, MP, MA, RA, UP and WB

In case of Crime against Women, the Good Performing states are AP, GU, HP, MP and UP. The performance of AS, J&K, KA, MA, RA and WB are medium. The maximum crime can be found in BI, HA, KE, OD, PU and TN.

For Crime against Children, least crime is found in AP, J&K, and UP. The performance of KA, OD, PU, TN, RA and WB are medium. The maximum crime can be found in AS, BI, GU, HA, HP, KE, MP and MA.

In case of Other crime, maximum crime can be seen in AP, BI, HP, KE, MP, MA, RA, UP and WB. The good performing states are AS, GU, KA and TN. HA, J&K, OD and PU are the medium performing states.

3.1.2 Relative position of the sample states in terms of Crime against Women, Crime against Children and Other Crime

The different crimes for the major states are arranged in a series of descending order from highest crime rates to lowest crime rates based on the arithmetic mean values of year to year growth rate. This is done to reveal the position of the states w.r.t. All India accordingly which state ranks the first and is most crime prone and which state is less crime oriented**.**

Table 5: Rank of the sample states in terms of Crime against Children, Crime against Women and Other Crime

States	Ranks (Crime against Children)	Ranks (Crime against Women)	anks (Other Crime)
Andhra Pradesh	8	16	15
Assam	2	1	5
Bihar	3	5	7
Gujarat	15	15	6
Haryana	7	4	2
Himachal Pradesh	16	14	14
Jammu & Kashmir	6	10	16
Karnataka	4	9	8
Kerala	9	12	11
Madhya Pradesh	13	1	13
Maharashtra	14	13	4

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Odisha	5	3	3
Punjab	10	7	9
Rajasthan	11	8	17
Tamil Nadu	1	17	10
Uttar Pradesh	17	11	12
West Bengal	12	2	1

Source: Authors calculations form the data of Crime in India. National Crime Record Bureau (NCRB)

To have an idea about the actual situation of the major states in terms of different crimes, ranking of each state according to the mean is done.

For crime against children, the top most crime prone states are Tamil Nadu, Assam and Bihar whereas Tamil Nadu ranks the first followed by other states. On the other hand, the least crime prone states are Uttar Pradesh, Himachal Pradesh and Gujarat among which ranks Uttar Pradesh the least respectively.

In case of crime against women, the most crime prone states are Assam, West Bengal and Odisha whereas, Assam ranks the first followed by others on the other hand the least crime prone states are Tamil Nadu, Andhra Pradesh, Gujarat, and Himachal Pradesh. Whereas, Tamil Nadu ranks the least among these states.

Considering other crime, the most crime prone states are West Bengal, Haryana and Odisha whereas, West Bengal ranks the first followed by others on the other hand the least crime prone states are Rajasthan, Jammu & Kashmir, Andhra Pradesh and Himachal Pradesh whereas, Rajasthan ranks the least among these states.

3.2 The Results of Compound Annual Growth Rate (CAGR)

The results of compound annual growth rate for crime against women, crime against children and other crimes are presented in Table 6

Table 6: CAGR of Crime against Children, Crime against Women and Other Crime

	AP	AS	BI	GU	HA	HP	J&K	KA	KE	MP	MA	OD	PU	RA	TN	UP	WB
Crime against Children	0.15	0.01	0.05	0.18	0.13	0.19	0.11	0.02	0.12	0.13	0.13	0.03	0.08	0.07	0.03	0.35	0.04
Crime against Women	1.03	0.20	0.41	0.76	0.38	0.71	0.52	0.50	0.58	0.62	0.43	0.34	0.47	0.46	1.67	0.59	0.22
Other Crime	1.86	0.95	0.81	1.03	0.57	1.44	2.06	0.83	1.27	1.15	0.65	0.62	0.92	2.77	1.08	1.31	0.40

Source: Authors calculations form the data of Crime in India. National Crime Record Bureau (NCRB)

The result of Compound annual growth rate of all the different crime i.e. crime against women, children and other crimes have been calculated for the major states. The major states have been compared with each other in terms of different crimes considered which reveals the following:

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For crime against Children, Uttar Pradesh shows highest growth and Assam shows least growth and West Bengal is in 13th position.

Considering crime against women, Tamil Nadu shows highest growth and Assam shows least growth and West Bengal is in 16th position.

In case of other crime, Rajasthan shows highest growth and West Bengal shows least growth.

4. Summary and Conclusion

The present study deals with the measurement of growth rate of Crime against children, Crime against women and other crime during the period of 2001-02 to 2014- 2015.

The results of estimation of year to year growth rate for all the variables considered like crime against women, crime against children and other crime in different major states in India reveals that the growth rate of all these variables showed a fluctuating pattern during the period 2001-02 to 2014- 2015. It can be noted that the growth rate are not only fluctuating over the entire period but also showed negatives values in some of the financial years.

The relative performance of the major sample states in terms of crime against women, crime against children and other crime w.r.t. All India are tried to be understood. Also the different sample states are ranked on the basis of crime against women, crime against children and other crime. In case of crime against children, it is revealed that among the seventeen major states, Tamil Nadu ranks the first and Uttar Pradesh ranks the least. In case of crime against women, it is revealed that among the major seventeen states, Assam ranks the first and Tamil Nadu ranks the least. In case of other crime, it is revealed that among the major seventeen states, West Bengal ranks the first and Rajasthan ranks the least. It is also found that West Bengal is having high rates of crime in case of crime against women and other crime compared to the other sample states.

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On the Relation between Growth of Employment and Output Across States in India

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Abstract

Employment and Output are important elements featured in the economy as their progress is the major driving force behind the development of an economy. The paper observes the state of employment conditions prevailing across the various states in India. States are categorically divided into two parts using the criteria of their contribution in the Net Domestic Product. The relationship between employment and growth in terms of State Domestic Product has also been observed in terms of elasticity and regression analysis separately in order to find out whether the go hand in hand to bring about progress in the economy. Results show a positive relationship between growth of employment and growth of output.

Keywords
Output Elasticity of Employment, Job-loss growth, Employment rate, Growth rate of output.

1. Introduction

a. Introduction

Employment is a major macroeconomic indicator which determines the level of aggregate demand in an economy. In developing countries, lack of employment opportunities force the people to maintain a low standard of living. Thus, the vicious circle of poverty remains in the economy. Countries which start with a low level of capital tend to have low investment owing to which there is low demand followed by low output and thus low employment. Even with high quality of education which is compatible to that of the prosperous western world, job opportunities are marginal. This leads to migration of the highly skilled labour force to the countries inviting them and luring them with the lucrative opportunities and incentive which their home country is unable to afford for all. Employment is the most important engine of growth. Employment creates demand which proved an incentive for producers to increase output. In this paper we shall observe the state of employment conditions prevailing

across the various states in India. It is considered by most observers of the Indian economy that the employment conditions of the country is poor. This context needs proper clarification as presise answers to questions such as the direction of trends of change of the employment scenario, its nature and its relationship with growth is of worth mentioning. This makes research on such a topic a challenge. Among numerous such challenges, the one which need special mentioning is that, the structure of India's economy, as indeed of most developing economies, is fundamentally different from those of the more prosperous and admistratively dominative developed countries. The conceptual tools and statistical indicators used to analyse the employment conditions in those economies are mostly inappropriate for the analysis of employment conditions in developing countries.(Ghosh.A,2016)

Employment and Growth must go hand in hand in order to obtain progress in terms of development.Both are parallel dependent on each other.

In this paper we divide the states into two categories using State domestic Product (the contribution of each state in the Net Domestic Product of the economy).

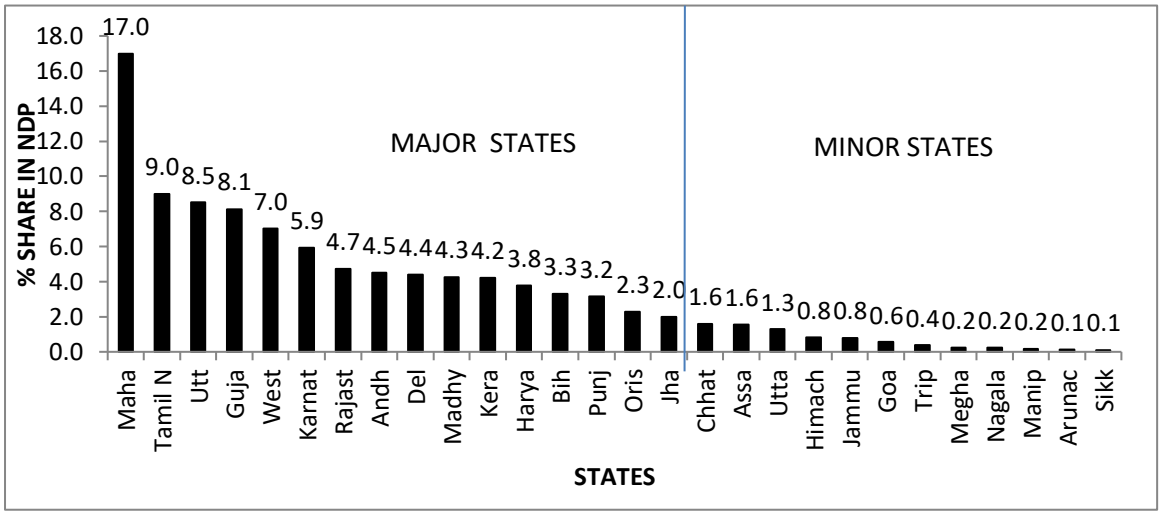
Since the states constitute the country, therefore there must be some relation between the SDP earned by the states and the country's Net Domestic Product. The results obtained on observation of the contribution through to the observed periods are as follows:

- The states contributing a marginal amount near to zero to the GDP throughout and consistently are Arunachal Pradesh,Goa, Manipur, Meghalaya, Mizoram, Nagaland, Tripura.
- Himachal Pradesh, Jammu and Kashmir, Uttar Pradesh and Uttaranchal have been contributing consistently 1% to the NDP.
- Kerala has been contributing consistently 4% to the NDP.
- Tamil Nadu has an increase in contribution to NDP from 8% to 9%.
- Assam contributed 3% in the initial period of observation 1993-94 but from then on its contribution fell to a consistent level of 2%.
- Similar observations were seen for Bihar with a consistent contribution of 3%; Madhya Pradesh (5% to 4%); and Punjab (4% to 3%).
- Odisha had been contributing a regular amount of 3% till 2009-10 but fell in the final observed year in 2011-12 (2%).
- The increase in contribution has been observed in the states of Delhi (3% to 5%); Gujrat (6% to 8%); Maharashtra (16% to 18%), Rajasthan (4% to 5%) , Haryana (3% to 4 %).
- West Bengal and Rajasthan has been contributing somewhat constantly at 7.5% and 4 to 5% respectively.
- Other consistent contributors are Andhra Pradesh at 5%, Chattisgarh at 2% and Jharkhand at around 2% and Karnataka at around 6%.
- Some states had a fall in their contribution in NDP such as Madhya Pradesh (5% to 4%), a significant fall for Sikkim (7% to 4%)

Thus we see that the highest contributor is Maharashtra towards the county's NDP.

There is one thing to be noted here is that a major factor affecting contribution of SDP is the size or the population of the state. Those states with a low population shall be able to contribute only a small amount to the GDP. Other factors affecting are the geographical location, the nature of work available and the climatic conditions interfering with daily life of the people.

Fig 1: Relative Share of Net State Domestic Product to All India NDP in 2013-14.



Source: Calculated from data for the period 1993-94 to 2013-14 related to SDP at factor cost from Central Statistics Office (CSO).

Considering the year 2013-14 and the logic that the major contributors have always been at almost the same level throughout our observed periods, we have divided the states into two major categories i.e. *major states* which include Maharashtra, Tamil Nadu, Andhra Pradesh , Gujarat, Uttar Pradesh, West Bengal, Karnataka, Madhya Pradesh, Bihar, Delhi, Rajasthan, Kerala, Haryana, Punjab, Orissa, and Jharkhand and the *minor states* include Assam , Himachal Pradesh, Goa , Tripura, Meghalaya, Nagaland , Manipur , Arunachal Pradesh, Mizoram ,Chhattisgarh, Uttaranchal, Jammu and Kashmir and Sikkim. The demarcation line that has been set is that the countries contributing below 2% to the Indian NDP is considered to be minor states. A noticeable point is that among the minor states there may be some with high per capita income the reason for which is that those states also have a low population.

b. Objectives of the study

- To observe the trend in Employment rate and its growth across states in India
- To analyse the nature of employment growth across states using output elasticity of employment.

c. Data sources and Methodology

Our study is based entirely on secondary data. The major sources of data are Central Statistical Organisation (CSO) and National Sample Survey Organisation (NSSO). State Domestic Product at constant prices, base being 2004-05 prices is taken from CSO. Worker Participation rate and population is taken from NSSO.

Employment rate:

It is measured by the ratio of the total number of workers to the total population in each state.

Output elasticity of employment and nature of growth:

Output elasticity of employment (OEE) = Growth of Employment/ Growth of output.

The nature of growth is specified by the value of EEO.

Employment Elasticity of Output(EEO) is the reciprocal of OOE.

If, OEE <0, the growth is job loss in nature

0≤ OEE <1, the growth is job-less

OEE ≥1, the growth is job-creating.

Panel Data Regression Model

Panel data regression model is used to analyse the incidence of food insecurity and nutrition insecurity across states of India. The panel data regression model is specified as

$Y_{it} = \beta_1 + \beta_2 X_{it} + \varepsilon_{it}$---------- (1)

i=1,2....29 and t=1, 2,……22 (1993-94 to 2014-15)

Where X_{it} is the matrix of independent variables and(ε_{it}) is the composite error term. ε_{it}consists of two components, where one is the cross section or individual specific error component $(\alpha_i)$and another component varies both time series and cross section observations (η_{it}), i.e.,

$\varepsilon_{it} = \alpha_i + \eta_{it}$

Where $E(X_{it,}\eta_{it}) = 0$, thatimplies that$\eta_{it}$is not correlated withX_{it}.

But $\alpha_i$may be and may not be correlated withX_{it}.

- If α_i is correlated with X_{it} i.e. $E(X_{it,}\alpha_i) \neq 0$, the model is treated as Fixed Effect Model (FEM)
- If α_i is not correlated with X_{it}i.e. $E(X_{it,}\alpha_i) = 0$the model is treated as Random Effect Model (REM)

Advantages of dynamic panel over static panel data are-

Static panel does not take into account the proper dynamics of the model.Static panel cannot take care of the endogenity between the independent variables.Being unobserved, Panel level effects are uncorrelated with the lagged dependent variable making the standard estimators inconsistent.This is where Dynamic Panel data has the capability to rule out these defects..

$\mathbf{y_{it} = \delta y_{i,t-1} + x_{it}\beta + u_{it}}$ i= 1, . . . , N; t = 1, . . . ,T

whereδ is a scalar, $x_{it}$is the independent variable matrix of dimensions $1 \times K$ and β is the co-efficient matrix with dimension $K \times 1$.
We will assume that the uitfollow a one-way error component model ui t = μi+ νi t
μi is time indifferent variable .
whereμi~ iid(0, σ^2_μ) and νi t ~iid (0, σ^2_υ) independent of each other and among themselves. iid implies identically and independently distributed.
Autocorrelation due to the presence of a lagged dependent variable among the regressors and individual effects characterizing the heterogeneity among the individuals is generally observed.
Arellano (1989) finds that for simple dynamic error components models, the estimator that uses differences rather than levels for instruments has a singularity point and very large variances over a significant range of parameter values. In contrast, the estimator that uses instruments in levels, has no singularities and much smaller variances and is therefore recommended. Arellano and Bond (1991) proposed a generalized method of moments(GMM) procedure that is more efficient than the Anderson and Hsiao (1982) estimator,
whileAhn and Schmidt (1995) derived additional nonlinear moment restrictions not exploited by the Arellano and Bond (1991) GMM estimator.

Unit Root Test

The time series variables or the panel variables that are included in a regression model needs to be stationary. It means that an important stability requirement that a data should satisfy is that the means and variances of the variables that are used to obtain the established relationship should remain well-defined constants and also independent of time. In other words, the variables have to be stationary. The need for stationarity is that if the means and variances are changing, the computed t-statistic under the OLS regression fails to converge to their true value as their sample size increases. In this situation, the conventional confidence intervals become invalid and the hypothesis tests cannot be conducted as usual. Consequently, we might end up with the wrong hypothesis that the variables have strong association between them although in reality there might be no such association between the variables. This is known as the problem of Spurious Regression. It is mostly observed that most of the time series data are non-stationary which renders the conclusion of stability of long-run trend growth.
Tests for stationarity: Stationarity of a series can be understood simply by plotting the series over time. If the series shows no tendency to drift upwards overtime, it is stationary in mean. Again it the series starts to gyrate such that overtime the amplitudes of the peak and trough increase, then the series is stationary in variance. For time series data the stationarity has tested with Augmented Dickey Fuller (ADF) Test and Philips-Perron (PP) Test. For Panel Data the stationarity is tested by Levun-Lin-Chu Test, Im. Pesaran-Shin Test, Fisher ADF Test, Fisher PP Test.

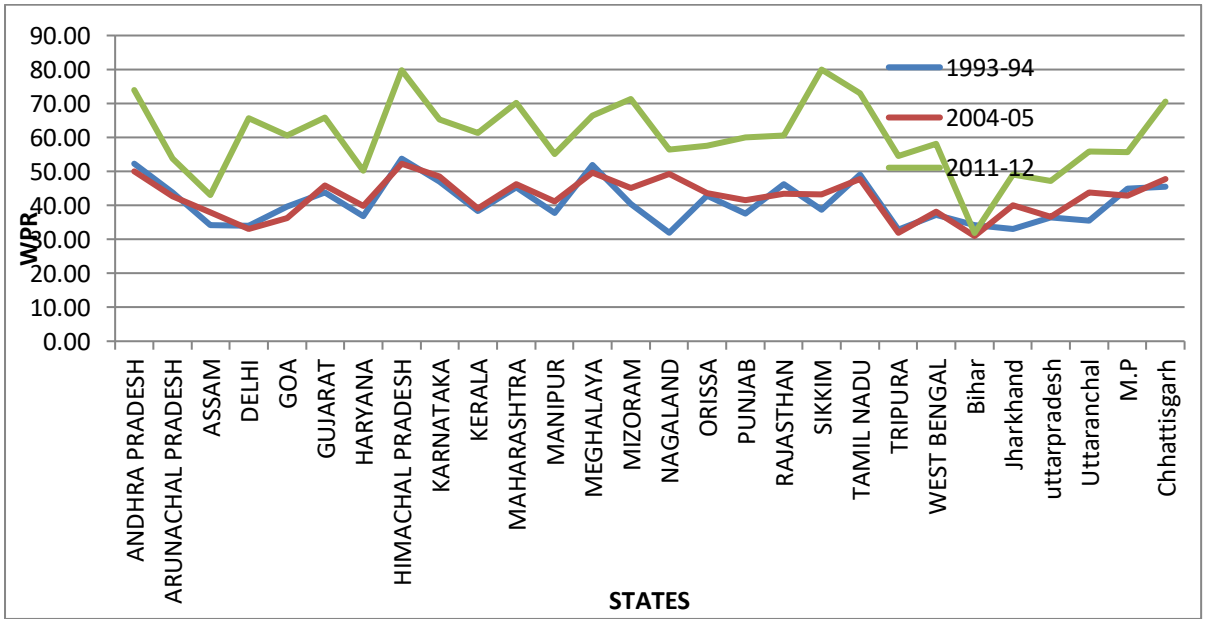
Plan of Study

The rest of the work is divided into five sections. Section 2 deals with Variation in the of employment of states. Section 3 deals with Growth in employment across states. Section 4 deals with Nature of Growth measured by output elasticity of employment. Section 5 deals with explanation the relationship between Growth of Employment and Growth of Output. We end with Summary and Conclusions in Section 6.

2. Variation in the of employment of states

We have provided the values from the NSSO on the number of employed workers in each of the 29 states. Using this we would be able to infer about the Employment Rate or Worker Participation Ratio in the states. The Employment Rate provides us with the information as to the approximate amount of the population who have been able to get employed during the period of observation or the time-period respectively. In the figure of Employment Rate we would be able to plot a trend of three years in order to avoid crowding and identify clearly on observation , the nature of the trend.

Figure 2a. Employment rate (WPR) across states in India, 1993-94 ,2004-05 and 2011-12



Source: Based on calculation of WPR in excel sheet. Data obtained from NSSO rounds.

From the above figure 2a some notable points come into observation.
There has been fluctuations in WPR in the observed periods , but most of them have shown a trend of increase.
In most of the states, WPR has shown quite a substantial rise during 2011-12. Thus may be due to some policy taken by the government to increase employment or due to a substantial increase in growth leading to the increase in employment. Unlike other states, Assam, Bihar and Haryana did not have a substantial amount of increase in employment during the period of 2011-12, but still there trend had evidence of increase.
The rise in employment in Bihar was somewhat consistent leaving aside 2009-10.Steady increase in employment rate was observed in Kerala, Mizoram and Bihar.

3. Growth of employment across states.

Table. 3.1 The Average Annual Growth rate of employment across states of India.

	1993-94 to 1999-00	1999-00 to 2004-05	2004-05 to 2009-10	2009-10 to 2011-12
Maharashtra	3.61	3.12	10.07	6.47
Tamil Nadu	5.13	3.65	11.53	10.23
Uttar Pradesh	1.74	1.38	5.31	4.94
Gujarat	5.12	4.75	10.71	7.59
Haryana	2.89	6.43	8.99	6.06
Karnataka	5.62	2.67	7.75	5.63
Rajasthan	5.49	1.89	6.18	10.92
Andhra Pradesh	3.92	5.88	7.49	4.03
Delhi	4.6	3.21	10.54	4.65
Madhya Pradesh	3.62	-0.57	7.15	5.51
Kerala	4.39	5.82	9.28	5.74
Haryana	2.89	6.43	8.99	6.06
Bihar	1.19	3.41	6.88	11.78
Punjab	2.36	1.77	5.88	4.07
Odisha	2.49	5.06	5.89	3.71
Jharkhand	3.27	2.29	3.27	8.65
Arunachal Pradesh	0.26	7.65	5.37	2.4
Assam	0.19	2.71	4.32	3.27
Chhattisgarh	0.35	4.2	6.07	6.14
Goa	7.61	1.46	4.77	17.82
Himachal Pradesh	5.77	5.23	6.08	6.56
Jammu & Kashmir	1.84	2.31	4.4	4.28
Manipur	3.07	1.62	3.52	0.8

Meghalaya	4.37	4.51	5.4	8.4
Mizoram	6.03	4.1	8.14	4.64
Nagaland	-0.62	4.48	6.67	7.08
Sikkim	2.51	5.97	25.54	10.63
Tripura	6.3	8.08	8.32	7.32
Uttarakhand	0.76	8.89	16.04	9.03

Source: Based on calculation of employment in excel sheet. Data obtained from NSSO rounds

From table 3.1 we can see a rising trend in growth rate which are random fluctuations in nature. The change in growth in each state is unique in it's in own way and has its own reasons for doing so.

Andhra Pradesh has faced a huge rise in 1999-2000 to 2004-05 and had a huge fall from 2004-05 to 2009-10 after which it returned back to its steady state at around 2 %.

In states like Arunachal Pradesh, Bihar , Jharkhand, Goa there has been an initial fall in employment followed by a subsequent rise in employment by double digit followed again by a fall and a rise.

Assam, Delhi, Gujarat has followed a regime of falling employment pattern from double digit to single digit.

Haryana has had a rise followed by a fall.

The only state with a steady rise in employment has been Himachal Pradesh.

Karnataka, Uttar Pradesh, Uttaranchal, Maharashtra have experienced a huge rise followed by a subsequent fall.

Kerala, Mizoram and Punjab are the states has a falling rate of employment but the rates are quite close to one another.

North Eastern states other than Mizoram face a huge rise and then a fall.

States that are subject to fluctuations are Orissa, Rajasthan, Sikkim, Tamil Nadu and Madhya Pradesh.

Few unique features that has been seen by Chattisgarh is a fall and then an increase by more than half in the next year.

Similarly, between the period of 1993-94 and 1999-2000, the number of people employed had almost doubled.

4. Nature of Growth measured by output elasticity of employment

Table 4.1 Nature of employment growth across states in India in the periods 1993-94 to 2011-12

1993-1994 to 2011-12	Rising from Job Loss Growth	At and around Job Less Growth	Tending to More Job growth	Tot. States
Major States	Tamil Nadu,	Maharashtra, Uttar Pradesh,	Jharkhand	16

	Kerala	Gujarat, West Bengal, Karnataka, Rajasthan, Andhra Pradesh, Delhi, Madhya Pradesh, Haryana, Bihar, Punjab, Orissa.		
Minor states	Goa, Jammu and Kashmir	Arunachal Pradesh, Himachal Pradesh, Meghalaya, Mizoram, Sikkim, Tripura, Uttaranchal	Assam, Chhattisgarh, Manipur, Nagaland	13
Total States	4	20	5	29

Source: Based on calculation of output elasticity of employment in excel sheet

By Job loss growth(OEE<0) we mean that there is negative relationship between growth rate of employment and growth rate of output. As there is increase in growth of employment, there is a corresponding fall in growth rate of output. Such a phenomenon is observed in the case where there is diminishing marginal productivity of labour or the workers have the tendency of 'shirking', where they tend to free-ride the benefits while exerting less of the effort. India has a huge amount of disguised employment, which is the most suitable reason applying to the case of Job-loss growth. Another explanation towards this form of growth is the increase in full use of capital intensive technology. In such a case , the increase in growth of output is not at all capable of absorbing the growing employment, thus as growth rate of output increases, the growth rate of employment falls. As per the observations of the data we find that in the observed period of 1993-94 to 2011-12, there are about twenty states who have faced the problem of job loss growth, among which thirteen are major states and seven are minor states. Other than the reasons mentioned above there are also many external factors that cause in the occurrence of such a phenomena.

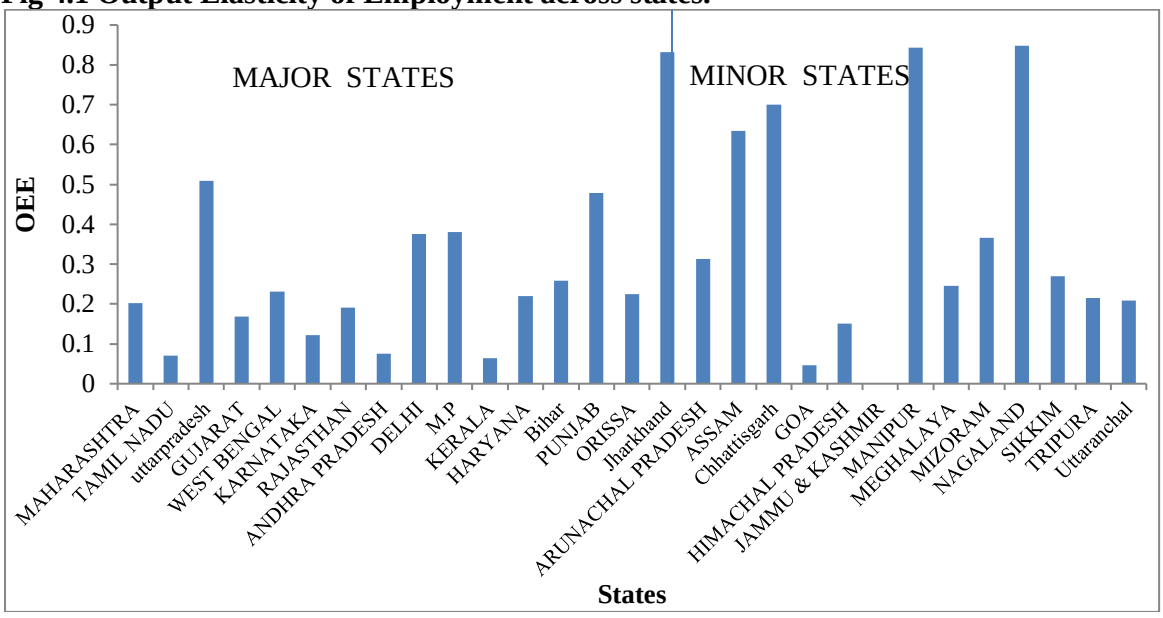
By Job-less growth($0 \leq OEE < 1$), we mean that there is a simultaneous or parallel growth of both per capita income as well as employment, but the growth in employment is much lesser than growth in output. In other words, the nature of output growth is such that it is unable to absorb the generating employment by only a part. There are many factors contributing to this form of growth of which, the earlier mentioned capital intensive technology usage is one of them. This poses a lot of problem especially in developing countries like India, which are mainly labour intensive in nature. As per the observations of the data we find that in the observed study period: 1993-94 to 2011-12, there are about four stateswho have faced the problem of job loss growth, among which two are major states and two are minor states.

More Job growth (OEE>1) is the most favourable of the three. It implies that the creation or the generation of employment is higher than the increase in output growth. This occurs due to increase in labour intensive technology and or the increase in marginal productivity of labour

due to increase in benefits such as insurance, health expenses, better standards of working envioronment and other forms that are provided by the government or the private entrepreneur, who ever be the worker. As per the observations of the data we find that in the observed period of 1993-94 to 2011-12, there are about five states who have received the benefit of job loss growth, among which one was a major states and the other was a minor states.

The above conclusion can also be drawn through the representation of a Bar Diagram as in Figure 4.1

Fig 4.1 Output Elasticity of Employment across states.



Source: Based on calculation of output elasticity of employment in excel sheet

From the above figure 4.1 we can see that the states with the maximum output elasticity of employment are those mentioned in Table 4.1 to have a tendency towards More Job growth, while those with the lowest values as mentioned in the above projected table are the ones rising from Job loss Growth.

5. Explaining the relationship between Growth of Employment and Growth of Output

The inter-relationship among growth rate of employment and Growth of SDP is analysed on the basis of panel data regression model. Regression estimation is done for 29 states and the time period of the entire observed period of our study.

The function of estimation is considered as

OEE= f (GSDP, GRE) or, OEE= $\alpha + \beta$ GRE+γGSDP

Where,

OEE is output elasticity of employment,

GRE is growth rate of employment,

GSDP is growth rate of state domestic product.

Table 5.1The summary of regression analysis used in estimation process

R Square	0.90	Multiple R	0.95
Adjusted R Square	0.89	*F*	113.52
Observations	29.00	*Significance F*	0.00
	Coefficients	*t Stat*	*P-value*
Intercept	0.35	8.27	0.00
GSDP	-0.05	-10.86	0.00
GRE	0.17	12.31	0.00

Source: Based on the regression analysis in Excel.

From the result we observe that the variables have a high significant value.

We now try to find a relationship between growth rate of employment and growth rate of output.

The function of estimation is considered as :

GRE= a+ bGSDP

Table 5.2 The summary of regression analysis used in estimation process

R Square	0.04	Multiple R	0.19
Adjusted R Square	0	*F*	1.01
Observations	29	*Significance F*	0.32
	Coefficients	*t Stat*	*P-value*
Intercept	1.52	2.95	0
GSDP	0.06	1	0.32

Source: Based on the regression analysis in Excel.

We observe a positive but insignificant relationship between the two variables.

Summary

In order to sum up the work, we have learnt a few valuable concepts about the growth patterns of our Indian economy where the main focus has been on the state level. We have divided the 29 states (leaving the newly arrived Telengana from our analysis), into major and

minor states.

We analyzed the employment rate across the states of India. Analysis of growth rate using output elasticity of employment is done and along with it, we also find a positive relationship between growth rate of employment and growth rate of output. As for output elasticity of employment, it is positively and significantly related to growth rate of employment and negatively related to growth rate of per capita SDP.

Our economy is facing the problem of jobless growth as a whole. In other words, there is increase in growth of per capita SDP but this does not generate an additional amount of employment. Growth of percapita State Domestic Product (PCSDP) and employment can be related with convergence in a way that, convergence would be possible in the sense where there is inclusive form of growth. In order to attain inclusive form of growth, there should be an increase in participation, which can be possible with the increase in employment. Thus increasing growth along with increasing employment would lead to convergence across states as predicted from our analysis.

Income of labour enables flow of resources across income classes of people and across the social and ethnic groups. Flows of income across locations are influenced both by assets available and by other modes of creating employment opportunities. However, income generated by employment of migrant labour, facilitates flow of resources across regions for a given regional distribution of capital assets. Employment and equity of income across classes of people and across regions are, therefore, closely related to each other in the long term (Vision 2020, Planning Commission of India).

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Dependency on Lac Cultivation of the Households - A Study of a Village in Purulia District, West Bengal

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Abstract

The present study is an attempt to examine the dependency of the lac cultivating households on the earnings from the lac cultivation. The study also tried to determine the factors responsible for the variation in the relative contribution of the returns from Lac cultivations across the Lac cultivating households. For this purpose a household survey was conducted in the Karmadi village, Purulia district, West Bengal. The study noticed gross earning is moderately responsive to changes in Lac earnings. The volume of land possession of host trees and the total working members in Lac cultivation are found to be the most important factors determining the variation in proportional Lac earning for the sample households.

***Keywords: Lac**, Dependency, Purulia*
***JEL Classification**: Q12, L73*

1. Introduction

Lac is a natural, renewable, bio-degradable, non-toxic resin produced by the tiny insect known as Kerria lacca (Kerr) on the tender twigs of specific host trees viz., Palas, Ber , Kusum, Khair , Peepal etc. The secretions from the insects form a hard continuous encrustation over the twigs. The encrusted twigs are further scraped off, dried and processed. Lac has a wide variety of application in pharmaceutical, paint, electrical, automobile, cosmetic, adhesive, leather, wood finishing and other industries.

There are several forms of lac viz. Stick lac (or crude lac or raw lac), Seed lac, Stick lac (Chowri) ,Shellac, Button lac , Garnet lac , Bleached lac (Chattopadhyay, 2011).Raw lac is the source of three crucial natural and renewable products viz. resin, dye and wax. Now a day it is also used in fruit coating.Lac cultivation is an important source of livelihood resource for poor farmers, which is an assured source of income during drought years (Chattopadhyay, 2011). It is a highly remunerative crop, paying high economic returns to the farmers and also foreign exchange to the country through its export. It has high potential for generating employment for both men and women in forest and sub-forest dwellers in different parts of

the world.

Lac is mainly produced in India, Thailand, Indonesia, parts of China, Myanmar, Philippines, Vietnam, Cambodia etc. and India is the largest producer of lac in the world(ICAR,2016). In India it is cultivated in the sub-hilly tracts of Jharkhand, Chhattisgarh, Madhya Pradesh, West Bengal, Maharashtra, Assam and Odisha. The overall, production of the lac in the country has been estimated to be 18746 tons in 2015-16 (ICAR, 2018). A total 183 lac processing units were functional in the country out of which 114 (with 93 in Purulia) are in West Bengal during the year 2015-16. There are 8 primary and 6 secondary markets existing at national level, in which annual arrival of sticklac was more than 500 tons out of which 3 primary and 1 secondary markets are in West Bengal. In West Bengal the primary markets are in Balarampur, Jhalda and Tulin, whereas the secondary marketsare in Balarampur.

In Purulia district, forest and sub-forest dwellers having only limited areas for cultivation, meagre irrigated land and limited scope of irrigation system mainly depends on rainfall agriculture and the forest for their livelihood. Among small scale industries, the lac industry is another major source of income of this district. Purulia produces 90% of the lac produced in West Bengal. In this district here mainly two types lac produced Rangeeni & Kusumi crop. Lac cultivation generates employment, particularly in the off-agriculture season in Purulia.

The issues related to Lac cultivation and marketing in India have been examined by several studies. For example Pal et.al. (2009) examined Lac cultivation as a risk coping strategy for agriculture in Jharkhand. Pal et.al. (2013) studied the Socio Economics Status of Lac growres in Korba District of Chhattisgarh. Mandal and Sarkhel (2014) deals with the issues of cost of Lac Cultivaton and its profitability for two strains of lac crop Kusumi and Rangeeni in Purulia District. There are other studies on lac cultivation as well. However, to our knowledge there is no such work done towards examining the households' dependency on lac cultivation in the Purulia district. In this context the study will try to examine the dependency on Lac cultivation of households in the Karmadi village of Purulia district, West Bengal. The main objectives of the study are to find out the contribution of the Lac cultivation in households earning and to determine the factors responsible for the variation in this contribution across the Lac cultivating households

2. Profile of Study Area

Karmadi village is located in Jhalda-I block of Puruliya district in West Bengal. It is situated 16.2 km away from sub-district headquarter Jhalda and 61km away from district headquarter Purulia. Ilu Jargo is the gram panchayat of Karmadi village.The total geographical area of village is 101.98 hectares. Karmadi has a total population of 959 peoples. The Karmadi village has population of 959 (with 215 households) of which 473 are males while 486 are females as per Population Census 2011. In Karmadi village population of children with age 0-6 is 109 which make up 11.37 % of total population of village. In 2011, literacy rate of Karmadi village was 69.76 % compared to 76.26 % of West Bengal.

3. Data description

The study is based on a household survey conducted in Karmadi village, Purulia district during the months of March-April 2017. Most of the households in this village earn their livelihood from agriculture activities and selling physical labour. We have randomly collected data from 132 households using a structured questionnaire. It consists of questions on the basic information of the respondents such as household size, education, certain household characteristics, main source of livelihood, annual earnings from Lac, volume of land possession of (Lac insect's) host trees, distance between home to market, types of marketing, their annual family income from all sources etc.

Agriculture is the main source of livelihood for nearly 90% of the respondents. The average monthly income of the sample households is around Rs 3500. 80 per cent of the sample households belong to poor family in accordance to having BPL card at the time of survey. Almost all (90%) of the households in our sample reside in house made by mud and non-concrete material. Only 9 per cent of the sample resides in house made by semi-concrete material & only 1% house made with concrete material. 78 per cent of them have the access to improved sanitation, 94 per cent Household have electricity connection and 91 percent have access to Mobile phone.

In the Karmadi village mainly Kusum, Ber and Palas are the host tress available. The households of the village use to sell the sticklac in the three markets: Kalimati, Jargo and Jhalda (main bazar). The approximate distances of these three markets from the Karmadi village are 4 km, 6 km and 12 km respectively. It was reported during the survey that a number of households use to sell in more than one market simultaneously. Thus median of the set of possible average distances is considered as the critical distance which is 6 km. Kalimati and Jargo are the village markets while Jhalda (main bazaar) is the town market. They adopt both the direct and indirect selling marketing and sometimes rely on the both (direct and indirect) simultaneously.

The variables used in the Econometric analysis of the present study are given in the table 1.

Table 1: Variables Used in the Econometric-Analysis

Variable	Description	Specification
LACERNG	Annual Income from Lac	
GERNG	Annual earnings (from all sources) of household	
VLAND	Volume of land possession of (Lac insect's) host trees	
DST	Distance between home to market	1 if >6km, 0 otherwise
MRK	Type of market where product is sold	0 if village, 0 if town
MRKTN	Mode of marketing	0 if one type , 1 if both types
TWF	Total working members in Lac cultivation	

4. Econometric Models

To examine the dependence of the households on the Lac cultivation the study developed three separate models based on the following two questions:

1) How far does the total income (gross earnings from all sources) be responsive to the earnings from Lac cultivation? (Model 1).
2) Analyse the factors responsible for the variation in the Lac's contribution (earning from lac cultivation) in the total income across the households (Model 2 and Model 3)?

The answer of the question-1 will help to understand the impact of Lac cultivation on households' gross earnings. Lac farming provides subsidiary income to the (lac) cultivating households. However, this extent varies across the households. In this context the question-2 will help to find out the contribution of the lac cultivation in households' gross earning and the factors responsible for the variation in this contribution across the households in the Karmadi village of Purulia district, West Bengal.

Model 1

To answer the first question the study used a double-log regression equation:

$$ln(GERNG) = a + bln(LACERNG) + u \quad (1)$$

The OLS regression method was used and the estimated slope coefficient, (b) measurers the elasticity of *GERNG* with respect to *LACERNG*, that is the percentage change in *GERNG* for a small percentage change in *LACERN*.

Model 2

It analyses the factors responsible for the variation in the Lac's contribution in the total income across the households the following regression model is used:

$$PLACERNG = \beta_0 + \beta_1 VLAND + \beta_2 DST + \beta_3 MRK + \beta_4 MRKTN + \beta_5 TWF + v \quad (2)$$

Where,

$$PLACERNG = \frac{LACERNG}{GERNG} \times 100$$

The OLS regression method is used to find out the individual slope coefficients.

Model 3

From the data set it is evident the proportion of earnings from Lac cultivation to the gross earnings (*PLACERNG*) varies from 10 percent to around 57 percent. It will be interesting to find out, for a household, the factors responsible for *PLACERNG* to exceed a certain threshold level. The data reveals, for the 57 households out of 132 households, earnings from Lac cultivation constitute more than 34 percent of their gross earnings. Following this the

present study assumes the threshold level as 34 percent (average of 10% and 57% in approximate terms). Hence, a new variable y is defined as

$$y = \begin{cases} 1, & PLACERNG > 34 \\ 0, & PLACERNG \leq 34 \end{cases}$$

The logistic regression model is applied to analyse this issue. Based on the logistic cumulative distribution function, the probability of a household having an earning from Lac cultivation constituting more than 34 percent of gross earnings is:

$$p = Pr(y = 1) = \frac{exp(X_i'\beta)}{1 + exp(X_i'\beta)}$$

Where, X_i is a set of predetermined variables and β is the set of parameters to be estimated. After the logit transformation,

$$ln\left(\frac{P}{1-P}\right) = X_i'\beta \quad (3)$$

5. Results and Econometric Analysis

The regression result of the model 1 is summarised below in table 2:

Table-2: Elasticity of Gross earnings with respect to earnings from Lac cultivation

Dependant variable- $ln(GERNG)$	Coefficients	t	p
Intercept	8.644	27.936	0.000
ln(LACERNG)	1.002	7.176	0.000
r-square			0.685
Total Observations			132

As result shows, the elasticity of *GERNG* with respect to *LACERNG* is about 1.002, suggesting that if the earning from Lac goes up by 1 percent, on average, the gross earnings goes up by more than 1 percent. Thus, the gross earning is moderately responsive (moderately elastic) to changes in earnings from Lac cultivation.

The regression result of the model 2 is summarised below in table 3:

Table-3: Factors determining the variation in the contribution from Lac cultivation

Dependant variable - $PLACERNG$	Coefficients	t	p
Intercept	19.6973	4.7242	0.0000
VLAND	4.6436	7.3807	0.0000
DST	2.5127	1.0869	0.2812
MRK	0.5660	0.2646	0.7922

MRKTN	0.7555	0.7358	0.4646
TWF	2.1809	5.7682	0.0025
Multiple R^2	0.7871		
Adjusted R^2	0.7617		
Total Observation	132		

From the regression result (Table 3) it is evident Volume of land possession of host trees and the total working members involved in Lac cultivation are the most important factors determining the variation in proportional Lac earning for the sample households. As *VLAND* goes up by 1 unit, keeping all the other variables constant, *PLACERNG* goes up more than 4.5 times and with the increase in 1 unit of *TWF*, *PLACERNG* on an average increases by more than 2 units, keeping all the other variables constant. The goodness of the model is good.

The regression result of the model 3 is summarised below in table4:

Table 4: Logit Regression results

Dependent Variable - y	Odds Ratio	Coefficient.	$p > \|z\|$
VLAND	2.949	1.0814	0.0121
DST	1.296	0.2592	0.5133
MRK	1.099	0.0944	0.6736
MRKTN	1.004	0.0039	0.5431
TWF	2.672	0.9828	0.0162
constant		8.9025	0.0087
No. of observation	132		
Prob>chi2	0.0005		
Pseudo R2	0.0702		

The model 3 is estimated by maximum likelihood. Econometric results feature 'odds ratios' that are associated with each explanatory variable. The 'odds ratio' indicates how often the event happens, relative to how often it does not, under a certain circumstance.

Results in Table 4 shows that variables *VLAND* and *TWF* are mainly associated with the case that *PLACERNG* exceeds 34 i.e. the earnings from Lac cultivation constitute more than 34 percent of gross earnings. Households that are having much land possession of host trees (higher *VLAND* value) are around 3 times more likely to have earnings from Lac which constitutes more than 34 percent of gross earnings. With other variables remaining constant, if volume of land possession of host trees increases by a unit; on average the estimated logit

increases by around 1.08 units. The relationship between these two is positive and significant. Similarly households that are having higher total working members in Lac cultivation are more than 2.5 times more likely to have earnings from Lac which constitutes more than 34 percent of gross earnings. With other variables remain constant, if total working members in Lac cultivation increases by a unit; on average the estimated logit increases by nearly 1 unit. The other factors like distance from the market, market type and marketing type do not have (individual) statistically significant effect. These factors are not likely to associate with more than 34% contribution of Lac earnings in the gross earnings for the sample households.

6. Conclusion

Lac encrusted twigs is regarded as Non Wood Forest Product (NWFP) of great economic importance. Lac farming provides subsidiary income to the cultivating households. In this context the present study examines the dependency of the lac cultivating households on the earnings from the lac cultivation. The study also tried to determine the factors responsible for the variation in the relative contribution of lac cultivation across the Lac cultivating households. For this purpose, we have conducted a household survey in the Karmadi village of Purulia district. We found that gross earning is moderately responsive to changes in the earnings from the Lac cultivation. Among the factors volume of land under host trees and the total working members involved in Lac cultivation are found to be the most significant in determining the variation in the relative contribution of income from lac cultivation to the total income of the households.

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Factors Affecting the Illegal Mining Activities in Salanpur Coal belt of West Bengal

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Abstract

This study attempts to provide a glimpse of the nature of illegal mining activities in Salanpurcoalbelt in West Bengal.We explore the socio-economic and demographic factors affecting the participation and volume of earning from illegal coal mining. The probability of participation in illegal coal mining along with its volume for the participants have been estimated applying double-hurdle models formulated by Cragg (1971). Salanpurcoalbelt scatters intotwo community development blocks namely Barabani and Salanpur in PaschimBardhaman district, West Bengal. In this empirical study we have purposively selected five villages from each of the two blocks. Among the five villages in each block three aremining villages and others are non-mining villages. The sample includes data of 500 households taking 50 households from each village. Households from each village have been selected using random number table to make the sample stratified random sample. Our systematic analysis reveals that in contrast to elderly, younger generations are more likely to participate in illegal coal mining activities with higher volume. Education is found as a critical factor which increases the likelihood to participate in illegal coal mining but does not affect the volume of illegal activities. Households with agricultural land and/or having cultivation as ancestor's occupation are less likely to participatein illegal coal mining in Salanpurcoalbelt. However, poverty induces the persons to involve in illegal coal mining activity.

Keywords*: Double-hurdle model, Illegal coal mining,Salanpurcoalbelt in West Bengal,*

1. Introduction

Juxtaposed with the legal coal mining sectors, coal mining in illegal way is common in India. Illegal mining refers to the mining which are going on violating any of the provisions of the applicable Acts, Government rules and Orders. Usually illegal mining arises when sites of legal mining are declared as abandoned. Sometimes illegal mining takes place on fresh land. It is reported that there are 450 illegal mining under the sites of CIL. Most of the illegal mining spots in India belong to the purview of three main coal subsidiaries in India viz. CCL,

BCCL and ECL of CIL. In the states of West Bengal and Jharkhand there are 203 illegal mining spots under the area of ECL. Of them, almost one hundred illegal mining sites are operated in West Bengal. The major illegal coal mining areas in West Bengal are Sripur, Sodepur, Salanpur, Satgram, Kenda, Kunustoria, Bankola, Kajora and Pandaveswar areas of ECL(Standing committee on Coal and Steel, 2010-11, Annexure-I: 36). This study is designed to provide a documentof the natureof illegal coal mining activities in Salanpurareawhich is eight kilometer away from Asansol City.Illegal coal mining in this region has an inherent value to the local people, especially tothe poor. It allows themselves to grow within their own capacities and potentialities and to get access to subsistence resources. It is not surprising that, ignoring the ethics and life risk a section of people from local areas participate in illegal coal mining activities for earning their livelihood or for making money. Illegal mining and selling of coal in Indian coalfields is a common parlance. Yet elaborate and systematic study on the causes and consequences of illegal coalmining is mostly absent until recently. This paper tries to explore the socio-economic and demographic factors affecting the participation and volume of earning from illegal coal mining for the households in Salanpur coal belt, West Bengal.

The paper is organized as follows. Section 2 deals with the reviewof literature. Section 3 gives a brief account of the ramifications of the illegal coal mining in Salanpur coal belt. The data sources and methodology of the empirical study has been explained in section 4. Section 5 is dedicated to results and discussions. Finally, the paper is concluded in section 6.

2. Brief Review of Literature

A few studies have been conducted to analyze the different aspect of coal mining both legal and illegal in India and abroad. Lahiri-Dutt (2003)has discussed the nature of informal mining in an established coal mining region, Raniganj, and its impact on local communities. She has reported the coexistence of informal mining with the formal mining sector inRaniganj where “illegal” mining is the lifelineof almost over 5 lakh people. The people engaged in illegal mining are living on the fringes of the monetized economy, earninglivelihood mainly from traditional cultivation and animal husbandry, supplemented by scavenging for coal. Several legal mines also have an illegal counter- part operation, with which the local villagers work regularly. The mining company, the largest land owners, the prime employer and mover of resources in this region prefers to overlook the existence of illegal mining or views it as a law-and-order problem. However, the authorities of formal company, complains frequently to the local district administration regarding “theft” of coal from its premises. Lahiri-Dutt and Willams (2005)have documented that illegal coal mining initiated staying hidden in full scale in the eastern Indian coalfields of Jharkhand and West Bengal about 7-8 years after nationalization and the raising of coal prices. It is now visible and diversified. They have reported that along the highways and other roads in Raniganj coal belt, a common sight now-a-days are bicycles carrying sacks of coal, the bike being used as

an inanimate packhorse with men pushing them instead of pedaling. They have explored the 'black' coal economy describing the nature and extent of coal supplied by bicycle 'wallahs'. Initially they have counted the number of cycles coming into town along critical roads while the other consisted of interviews with administrators, local police, journalists, as well as talks with coal cycle wallahs. The main customers of this 'cycle-wallahs' are local 'chimney bhattas' or brick kilns throughout the dry months and in most cases the cycle-wallahs sell coal to even small customers like individual homes. Most of these 'cycle-wallahs' belong to the local tribal groups. After having lost their traditional livelihood like farming and forestry, the tribal have participated in illegal coal mining activities for earning their livelihoods. Resosudarmo etal. (2009) have highlighted the illegal mining activities in Indonesia. Illegal coal mining in Indonesia means mining business conducted by a person, group of people or company/foundation which has legal entity, but which in its operation does not hold a legal Government permit. In Indonesian, these miners are called *PenambangTanpaIzin*(PETI) that means mining without permission. Illegal mining activities in Indonesia increased significantly following the 1998 economic crisis resulting unemployment and expanded further due to decentralization. They have observedstrong financial incentives for the locals to conduct these illegal mining activities. Illegal coal mining significantly support local livelihoods and contribute to the local economies. It creates more employment than formal mining operations and accommodates those at lower end of the economy. However, alcohol abuse and prostitution are associated with illegal mining. There are also instances of child labour. In Kalimantan about 10 percent of illegal miners are under 17 years old. These children are more susceptible to health risks and accidents as well as physical and psychological problem than their adult counter parts. Goswami and Goswami (2014) have mentioned that the greatest environmental impact of mining in Raniganj and Jharia coalfields has been on the land in the surrounding areas of mining. Mining has degraded the land not only denuding its forest cover and choking up the natural drainage lines, but has also destroyed the agricultural potential of this region. They have also observed that large areas of forest, agricultural land, and grazing land have been converted into colliery colonies or into fallow land due to rapid expansion of the coal illegal coal mining. Thus, illegal coal miningprovide a breeding ground for social, economic, environmental and health problem.In spite of that a large section of households in Salanpur coal belt have engaged themselves in illegal coal mining business having different socio-economic features. The objective of this study is to identify the nature of the illegal activities and causes of the participation of the local people to this illegal activity in the context of Salanpurcoalbelt in West Bengal.

3. Nature of Illegality in Coal Mining in SalanpurCoalbelt

Mining of coal by digging rat holes are the main facet of the illegal coal mining in Salanpur. Rat holes are dug at abandoned coal mines or at fresh land by crating tunnels under the land in about 60-70 feet depths without any scientific knowledge of underground coal mining technique. The illegal miners can also stick to another type of mining by cutting the coal

seam vertically just like creating well, this type of mining is also known as pit mining. The whole system of illegal coal mining is running violating the safety norms followed by the formal underground coal miners. The illegal diggers are often killed by roof falling incidents, or poisonous gas leaking incident or by mine fire incidents. Often,the coal mafias negotiate with the coal miners, the local police administration, the local political leaders and the coal officials, to run their illegal business smoothly. The local police in the name of raids to these illegal operations make an eye wash for local residents by closing the mouth of the rat hole, but the tunnel or rat hole remains as it is. After a few days the miners just reopen the mouth of that rat holes and restart operation. Note that a large part of this illegal coal are supplied at a relatively lower price to the local brick fields or other small and medium scale factories and to the local households by the 'cycle wallahs'.

Illegality also arises when the local police administration seizes coal loaded trucks in their jurisdiction, these seized coal are dumped in the police station. This type of seized coal is called 'zimma' coal. When the stag of 'zimma' coal is overcrowding in the local police station, the local police administrators sell it to some local coal suppliers by issuing a legal challan. However, there is again a possibility of illegality in the marketing of 'zimma' coal. For example, suppose the authority permits a seller to sell a truck of'zimma' coal of Salanpurat Murshidabad and accordingly issue a challan. With that challan the coal suppliers supply coal legally (without any fear of police checking) in the desired destination. In practice, the supplier ofthe 'zimma' coal with a proper challan don't face police checking in the journey due to pact with the policing network. Then using a single challan of 'zimma' coal the coal supplier supply many trucks of illegal coal to Murshidabad.

Sometimes the coal officials are involved in illegal activity. Suppose a factory demands coal say 400 tons from ECL authority. Then ECL authority issues papers of supplying coal of 400 tons to that factory. Usually, the officials supply the coalby trucks or dumpers with formal carrying capacity of 25 ton of coal each in a trip. Then to supply 400 tons of coal 16 trips are required for a truck or dumpers. In the process of supply when coals are loaded from ECL siding, these coal loaded trucks or dumpers are weighted in the weigh bridge. In the weigh bridge the on dutycoal official, called weigh bridge clerk (locally known as 'Kantababu') may make nexus with the supplying factory that each coal loaded truck actually supply 30 tons of coalinstead of supplying 25 tons as per official papers. The extra 5 tons in each trip, which the coal officials including 'Kantababu' supply,is a part of illegal coal mining from legal mines. Thus to supply 400 tons, 80 tons of coals are becoming illegal. This is also another type of illegality in connection with the coal mining which may come from the involvement of coal officials.

4. Methodology and Data Sources

Our second objective is to investigate the factors affecting the decision to participate in

illegal activity and its volume given the positive response towards participation in connection of coal mining. Decision to participate in illegal coal mining activities is a dichotomous variable indicating value '1' for the household having a member participated in illegal coal mining activity, '0' otherwise. The volume of illegal coal mining activity is measured by the percentage of income of the household comes from illegal coal mining activity. It takes value '0' for the non-participants and positive ranging up to 100 for the participants. As participation in illegal coal mining is a binary variable, binary logit or probitmodel is suitable to investigate the responsible factors affecting the probability of household members to participate in illegal coal mining activity. However, in addition to the estimation of the probability of participation we like to estimate the volume of illegal activity done by the participants during the study year. Usually for estimating the volume of illegal activity we apply tobit model. Although the estimation and interpretation of tobit model is straightforward, the main limitation to the tobit model is that it estimates the probability of participation and actual volume of illegal activity given the participationconsidering a single set of explanatory variables. But in practice often different sets of independent variables may determine the positive response toward participation in illegal coal mining and the volume of activities given the positive response, for example duration illegal work definitely determine the volume of illegal activity, while this explanatory variable is totally irrelevant for determining the participation in illegal coal mining. Therefore, we have to be more flexible to estimate the probability of participation along with the volume of illegal activity. As the response for participation and the volume of illegal activity with positive response are determined by two different sets of variableswe formulate Cragg (1971) 'two tier' or double-hurdle model.Double hurdle model estimates the probability of participation in illegal coal mining along with the volume of illegal activity for the participants. It is a two tier estimation tool. In tier one it estimates the decision to participate in illegal coal mining activities and tier two reports the estimate of the volume of illegal activities given the participation considering two different set of explanatory variables.

Given the scope of participation the decision to participate in illegal coal mining for an individual depends on his/her socioeconomic conditions. Literature review and our personal experience find that displacement form the basic livelihood, poverty, family burden, lack of alternative job opportunity, illiteracy and backwardness and trap of network of coal mafia affect the decision to participate and volume of activity in illegal coal mining for a household. With this end in view, we have included eight socio-economic factors as explanatory variable of the model for the decision to participate in illegal coal mining and its volume. The variables age and education level have been considered for checking the role of unemployment, economic status and dependency ratio capture the role poverty and family burden, per capita land holding and father's occupation have been considered for assessing the role of displacement from basic livelihood, inclusion of castes tells the role of backwardness in the decision to participate in illegal coal mining.

We have already defined the two explained variables in our double hurdle model. The selected explanatory variables for the models are specified as follows.

Age of the Respondent: Age is the physical age of the respondent. It is measured in years. In this analysis age of the person has been considered as a categorical variable. The persons aged below 40 years are grouped in 'age group 1'. The persons belonging to age group 40 to 50 years are grouped in 'age group 2'. Finally, the persons older than 50 years are considered in 'age group 3'. Therefore, we have taken two dummies for age group, one for age group1 and another for age group 2. Age group 3 is considered as reference age group for understanding the impact of age group. Dummies for age groups are considered as explanatory variable in both the models.

Education Level of the Respondent: The education level of the person is expected to be a factor affecting the participation in illegal coal mining and the volume of illegal activities. As majority of the households have less the elementary level education this study undertakes education level of the respondent as dummy indicating value 1 for the person having at least primary level education i.e. fifth standard, '0' otherwise. We did not categorize the education level in different levels because there is no sufficient variation in educational qualification for the sample respondents. Education is taken as explanatory variable in both the models with the expectation of negative impact on illegal coal mining activities.

Dependency ratio: It is defined as the proportion of dependents or non-working members to the total members of the family. The dependency ratio in the household is expressed as percentage. This variable is included in both the models.

Economic Status of the Households: Economic status of the households is identified by the information whether the households has BPL card or not. If the household has the BPL card we treat the households as poor otherwise rich. Actually family status is a dummy variable indicating value 1 for the households holding BPL card and '0' otherwise. It is included in the model for participation not in the model for volume of illegal activities. Because the volume of illegal activities for the poor who participated are almost invariant.

Per capita landholding: We have measured the total landholding of a households by adding the agricultural land and non-agriculture land in bigha owned by the household members. The per capita landholding is calculated by dividing total landholding of the family by the family size and measured in bigha (1 bigha = 0.4 acre). This explanatory variable is considered in both the models.

Father's Occupation: In order to gauge the impact of ancestor's occupation on the participation in illegal activity we consider father's occupation as an explanatory variable to determine the decision to participate in mining activities. In the econometric model father's occupation is a dummy variable taking value '1' when the father of the respondent is engaged in cultivation and '0' otherwise. This variable is expected to have a negative effect of the probability of participation in illegal coal mining activities but not a factor to determine the volume of illegal activity. Thus, we consider it as an explanatory for the participation

variable only.

Duration of Participation in Illegal Mining Activity: it the total duration, the respondent is engaged in illegal coal mining and/or selling. It is counted in years. This variable definitely affects the volume of illegal activities so we include it as explanatory variable of the volume of illegal activities to examine explanatory power and magnitude of the effect. However, this variable have no role to determine the participation decision of the respondent.

Caste: Caste of a person is a categorical variable indicating the person belonging to a specific caste, namely General Caste, Other Backward Classes (OBC), Scheduled castes (SC), Scheduled tribe (ST). Therefore, we use three dummy explanatory variables in connection with the social castes of the respondent. These three dummies in our model are Caste-OBC, Caste-SC, and Caste- ST. Caste-OBC takes value '1' if the respondent belongs to other backward classes and '0' otherwise. Caste-SC is equal to '1' if the person belongs to scheduled castes and '0' otherwise. Caste-ST takes value '1' if the responding family belongs to scheduled tribes and '0' otherwise. The category of general castes is the reference categories for analyzing the effect of the dummies for castes. In inclusion of castes help us to examine the role of castes to choose the illegal coal mining as a part of livelihood and in what extent.

In order to estimate the empirical model we have conducted a household survey in Salanpur coal belt. Salanpur coal belt scatters into two community development blocks namely Barabani block and Salanpur block in PaschimBardhaman district, West Bengal. At the first step we have purposively selected five villages from each block. Among five villages in each block three are mining villages and others are non-mining or controlled villages. Mining villages refers to the villages where formal or/and illegal coal mining are situated within 2 km from the selected villages and non-mining villages whereas non-mining villages are 8 to 10 km away from the formal or informal coal mines. The sample includes 500 household data taking 50 households from each village. Households from each village have been selected using random number table to make the sample stratified random sample. The data has been collected from personal interview with the active earning member of the household formulating a structured questionnaire from each selected households.In view of the above sampling designthe field survey in SalanpurCoalbelt area has been conducted during May 2017 to January 2018.

5. Result and Discussion

Basic socio-economic and demographic features of the sample households have been presented in table 1. Average family size of the sample households is four. Average per capita income of the sample households is almost Rs 3500 per month. The average per capita expenditure of the sample household is Rs 1930 per month which is close to median and mode per capita income. That means the economic status of the sample households on an average is satisfactory and is sufficient enough to maintain the daily life. However, from the

table we can observe that average per capita illegal income of the sample household is Rs 830 per month with wide variation. Since the sample households earn a considerable amount (23.71%) from illegal sources, so they want to remain on that occupation. Average education level of the respondent is seventh standard. Majority of the respondent don't have elementary level education. We see that average dependency ratio is quite high (0.69) in the study area. It is reported that the average per capita land holding is 0.59 bigha (1bigha=0.4 acre). Respondents who are engaged in illegal mining whether formal or informal mining, average years of mining is more than 8 years, though it varies from 3 to 18 years.

Table 1 Descriptive Statistics of the Sample Households (n=500)

	Family size	Education level (Year)	Age (Year)	Dependency ratio	Per capita landholdings	Years of Mining	Per capita expenditure	Per head income (Thousand)	Per capita illegal income (Thousand)
Mean	4.176	6.760	46.230	0.694	0.585	8.650	1928.63	3.49	0.83
Median	4.000	7.000	46.000	0.750	0.400	8.000	1629.16	2.12	0.000
Mode	4.000	8.000	45.000	0.750	0.000	8.000	1425.00	2.00	0.00
S.D.	1.000	3.474	8.914	0.110	0.740	3.158	882.008	3.47	1.94
C.V	0.239	51.391	19.282	15.788	126.59	36.50	0.457	0.993	2.344
Mini	2.000	0.000	22.000	0.250	0.000	3.000	816.667	0.91	0.000
Maxi	8.000	19.000	86.000	0.860	5.000	18.00	7000.00	22.50	16.66

Source: Authors' computation based on primary data collected from household survey 2018

Table 2 Frequency Distribution of the Attributes of the Sample Households

Attributes	Frequency	Percent
Economic Status of the Households (BPL Cardholder)	185	37.0
Caste of the Respondent (General)	130	26.0

Caste of the Respondent (OBC)	99	19.8
Caste of the Respondent (SC)	224	44.8
Caste of the Respondent (ST)	47	9.4
Type of village of the households (Mining Village)	298	59.6
Occupation of Father of the respondent (Cultivation)	168	33.6
Occupation of Father of the respondent (Casual labour)	249	49.8
Occupation of Father of the respondent (Self Employed)	38	7.6
Occupation of Father of the respondent (Service holder)	45	9.0
Households having no land (Landless)	231	46.2
Participation in illegal coal mining activity (participation)	168	33.6

Source: Author's computation based on primary data collected from household survey 2018

Table 2 depicts that around 37 percent of the sample households in our study is BPL card holders. Among the sample households 26 percent belongs to General castes, 20 percent belongs to OBC category, 45 percent belongs to SC category and 9 percent belongs to ST category. Sixty percent of the households are from mining villages and the remaining 40 percent from control villages. Data also depicts that almost 34 percent of the respondents' father have the occupation of cultivation, whereas 50 percent of them are casual labour, 7 percent of them are self-employed and 9 percent of them are service holders. So, major portion of the respondent's father has the occupation of casual labour. Almost 46 percent of the households have no land at their disposal. It is observed that one third of the sample households have participated in illegal coal mining business in Salanpur coal belt area.

We now report the estimate of the likelihood of participation in illegal coal mining and its volume given the participation considering selected set of explanatory variables. Table 3 shows the result of double hurdle model for estimating the participation along with the volume of illegal activities. The results of tier 1 are almost identical with the result with estimation of a probit model for participation variable only. It happens due to the separability property of the likelihood function under Cragg's double hurdle model. The primary benefit of using this model is its ability to facilitate post estimation analysis and interpretation. However, it should be noted that separability in estimation does not imply separability in interpretation.

Let us first interpret the result of tier 1. We find the coefficient of the dummies for age statistically significant at 5percent level. If a person in the Salanpurcoalbelt area belongs to age group 1, log likelihood for participation in illegal coal mining activity would be higher by 0.34 points compared to the log likelihood of the person belonging to age group 3 assuming other thing remaining unchanged. The coefficient of age group 2 indicates that log likelihood of the participation in illegal coal mining of the middle aged person is 0.30 points

higher compared to the elderly. Therefore, in contrast to the elderly group, young group of the people in the area under study are more likely to participate in illegal coal mining activities.

The coefficient of the dummy for education of the person is positive and statistically significant. If the person has primary level education, the log likelihood in favour of participation in illegal coal mining will rise by 0.51 point. The probability of participation in illegal coal mining increases if the respondent has at least primary level education. We can interpret the result in such a manner that to participate in illegal coal mining activities described in section 2 as a non-labour worker or manager the persons need some minimum level of education and knowledge to handle different paper works and official connections. Besides for a last few years educated persons don't have any formal employment opportunities as per our observations and from different government reports. That is why;the educated persons are compelled to participate in illegal coal mining in the area under study. However, it does not imply that really educated persons participate in illegal coal mining. This paper fails to capture the real impact of education on the decision to participate in illegal coal mining because they are few in our sample as well as in population in the villages under study.
The coefficient of dependency ratio is found negative but it is statistically insignificant. Therefore, our model did not give sufficient knowledge to understand the impact of the dependency ratio on the log likelihood of the participation in illegal coal mining from the family.

The coefficient of the dummy for father's education (1=cultivation) is reported as negative and significant. If father's occupation of the person is cultivation, the log of likelihood in favour of participating in illegal coal mining would be lower by55 percentage compared to the other occupation of the respondent's father. It means that if the occupation of the respondent's father is cultivation then the probability of participation in illegal coal mining activity would be smallercompared to the probability of participation for the person with father's occupation other than cultivation. The result reveals that father's occupation is an important determinant of the participation in illegal coal mining activities in Salanpurcoalbelt area. The person whose father are engaged in off farm activity like work in mining sector, legal or illegal, there is high chance that his successor is to be engaged in illegal activities. Thus if the person inherit agriculture as occupation they do not interested in illegal coal mining activities in the area under study. Moreover, landholding is an important determinant of the participation in illegal coal mining activity. The coefficient of per capita land holding in tier-1 is statistically significant. One bigha extra per capita landholding reduces the log likelihood in favour of the participation in illegal coal mining by 0.5 point, other thing holding constant.

Table 3 Determinants of the Participation in Illegal Coal Mining Activities and Its Volume

Estimating Cragg'stobit alternative assumes conditional independence Iteration 6: Log pseudolikelihood = -952.9102	Number of observations 500 Wald chi2(10) 78.18Prob> chi2 0			
	Coef.	Robust SE.	z	P>z
Tier1				
Constant	-0.250	0.447	-0.560	0.575
Age of the Person (Below 40 years =1)	0.347	0.180	1.920	0.055
Age of the Person (between 40 years and 50 years =1)	0.302	0.145	2.080	0.038
Education level (At least primary =1)	0.511	0.207	2.470	0.014
Dependency ratio (Percentage)	-0.844	0.572	-1.470	0.140
Per Capita Land holdings(Bigha)	-0.506	0.126	-4.010	0.000
Father's Occupation (Cultivator=1)	-0.552	0.164	-3.360	0.001
Family Economic Status (BPL=1)	0.435	0.134	3.240	0.001
Caste-SC (the respondent belongs to SC=1)	-0.210	0.162	-1.300	0.194
Caste -ST (the respondent belongs to ST=1)	0.370	0.243	1.520	0.128
Caste-OBC (the respondent belongs to OBC=1)	0.206	0.195	1.060	0.290
Tier2				
Constant	30.497	11.520	2.650	0.008
Age of the Person (Below 40 years =1)	12.235	3.670	3.330	0.001
Age of the Person (between 40 years and 50 years =1)	7.941	3.242	2.450	0.014
Education level (At least primary =1)	1.285	4.148	0.310	0.757
Per Capita Land holdings(Bigha)	-13.036	2.290	-5.690	0.000
Dependency ratio (Percentage)	61.711	14.712	4.190	0.000
Duration of participation in illegal mining activity (Years)	1.205	0.279	4.330	0.000
Caste of the respondent (SC=1)	-1.502	2.894	-0.520	0.604
Caste of the respondent (ST=1)	5.345	3.676	1.450	0.146
Caste of the respondent (OBC=1)	0.282	3.262	0.090	0.931
sigma _cons	14.360	1.077	13.330	0.000

Source: Authors' computation based on primary data collected from household survey 2018

Economic status of a family in the mining zone would affect the decision to participate in

illegal coal mining activity. It is expected that the members of the households living in the below poverty line are more likely to participate in the illegal coal mining activities if it is available. The coefficient of the economic status confirms this expectation. The value of the coefficient is 0. 43 which is statistically significant at 1 percent level. It tells us if a person lives in a poor family the log of likelihood in favour of participating illegal coal mining would be higher by 43 percentage compared to that of the persons belonging to non-poor family. Thus, the probability of participation in illegal coal mining for a poor person is higher than that for a non-poor person. We find that the participation in illegal coal mining is invariant for the caste of the person in Salanpur coal belt. Therefore, economic status is more important than social status to take decision to participate in illegal coal mining activities.

Let us now interpret the result of tier 2 of the model. Age is a significant determinant of the volume of illegal coal mining activity given that participation is positive. If the person participating in illegal mining activity belongs to age group 1, volume of illegal activity that is proportion of illegal income is 12 percent higher compared to that for the elderly participated person. This result is statistically significant at 1 percent level. Similarly we can say volume of illegal activities for the middle age group participants is higher than that for the elderly participants. Therefore, age not only influence the decision to participate in illegal activity it also increases the volumes for the younger participants.

Now we look at the coefficient of the education of the person. In the first tier it is positive and statistically significant while in the second tier it is positive but insignificant. It indicates that minimum education of household head may induce the person to participate in illegal coal mining activity, but education has no role to determine the volume of illegal activity. Our double hurdle model establishes that per capita landholding not only reduces the probability of participation but it also reduces the volume of illegal activities once the person already participated. Therefore, landholding is an instrument to prevent the household from the participation in illegal coal mining activities.

The key feature of the estimation of double hurdle model is that it can estimate the effect of a variable, which may not influence the decision to participate, on the volume of illegal coal mining activity. In our case the duration of participation in illegal mining activity is such a variable. The coefficient of this variable is positive and statistically significant but magnitude is very low. The value of the coefficient measures that if the duration of participation increases by one year, the volume of illegal activity would increase by 1.2 percent. This result tells us permanent office of the formal mining workers may encourage the persons from formal mining office and outsiders to involve in illegal activities in a greater volume.

It is worthy to note that dependency ratio is immaterial to determine the decision to participation in illegal coal mining but it has a positive significant impact on the volume of

illegal activity given that the person has participated in illegal coal mining activities. Social caste of the person is immaterial to determine the decision to participation as well as the volume of the illegal activity for a household in Salanpur coal belt in West Bengal.

Conclusions

These is no doubt that the presence and running of illegal coal mining activity in Salanpur coal beltleads to huge amount of monetary loss of the government. This loss can be regulated or controlled by adopting suitable monitoring measures jointly taken by local administration and coal mining authority. We have identified the factors that induce persons to engage in illegal coal mining activity. The estimation of the participation and the volume of illegal activity reveal that younger generation is more likely to participate in illegal coal mining activity. The volume of illegal activity is higher for the young generation. Our personal observation note that due to lack of alternative employment opportunity they are compelled to engage themselves in illegal coal mining activities as an easy alternative to ensure employment. Therefore, the government needs to ensure employment of the younger generation for reducing the volume of illegal coal mining activity in the area under study. Secondly, it is proved that poor household members are more keens to engage themselves in illegal coal mining activities. Therefore, different poverty alleviation programmes are needed more extensively in the area under study. Thirdly, per capita land holding is imperative to curb the volume of illegal activity. The respondent with father's occupation cultivation are less likely to be engaged in illegal activities. It may be the case that these persons did not face displacement of basic livelihood and did not fall in social network of coal mafia. Landholding of the household discourage the household member to participate in illegal coal mining activity. Therefore, proper land redistribution and strong policies for avoiding displacement from basic livelihood deserve in this area for arresting the illegal activity in the area under study. It is reported that duration of engagement in illegal activities in formal and informal coal mining sector increase the volume of illegal activities. Thus regular transfer system of the officials may be helpful to curb the illegal activities relating to coal mining in Salanpur coal belt.

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Indo-Bangladesh Trade: The Scenario of Export, Import and Trade Balance

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Abstract

The nature and composition of bilateral trade between India and Bangladesh has changed during the last three decades. Although India's exports to Bangladesh have become more diversified during this period, no significant changes have been observed in the composition of its export basket. Bangladesh's exports to India, on the other hand, remained confined within very few items with a considerable change in its composition with time. Both of them have initiated trade liberalization policies almost at the same time, Bangladesh in 1990 and India in 1991. Trading with Bangladesh, India has enjoyed increasing trade surplus always, but most importantly the growth rate of trade surplus has slowed down with the passage of time. A number of policies have been adopted by both these countries for better performances in their bilateral trade. The econometric analysis of this paper reveals that the GDP of India and the exchange rate policy of India played significant role in determining the volume and direction of trade between these two countries.

***KEY WORDS**: Trade policies, Gross Domestic Product, Exchange Rate, Exports, Imports.*
***JEL Classification**: F14, F40*

1. Introduction

India and Bangladesh, the two neighbouring countries in Asia, is the centre of attraction in foreign trade literature now-a-days. Historically, the most significant years for these two countries are 1947, the year of India's independence, and 1971, when Bangladesh started its journey as an independent country. Initially, both of them were very restrictive in their foreign trade policies. Strict restrictions on imports were imposed and at the same time import substitution policies were adopted with an objective to achieve self sufficiency. Eventually, they felt the importance of opening up their economies for the better performances in foreign trade. As a result, Bangladesh adopted the trade liberalization policy in 1990 and India in 1991, the very next year. Direct controls on trade were replaced by indirect instruments like tariffs and non-tariff barriers to regulate the flow of imports and exports. In 1995 the World Trade Organization (WTO) was established with an objective of

trade cooperation among the member countries. India and Bangladesh are the members of this organization from the time of its establishment.

Continuous reduction in import tariff has been one of the frequently used instruments of trade liberalization by both these countries. After liberalization, Bangladesh has reduced its average tariff rate more aggressively than India till 2013. On an average, effectively applied tariff rate in Bangladesh for Indian products came down from 96.1% (WITS) in 1989 to 12.95% in 2013 and that in India came down from 39.45% in 1990 to 14.14% in 2013 for imports from Bangladesh. From 2014 the situation has changed, when India started to follow the SAFTA agreement and brought down the average tariff rate to almost zero level. From 14.14% in 2013 the average tariff rate was reduced to only 1.09% in 2014 and further reductions have been observed in subsequent years to reach a mere 0.09% in 2017. Bangladesh, on the other hand, although continued with its tariff reduction strategy, but not abided by the SAFTA agreement. A second policy instrument adopted by India and Bangladesh is to encourage foreign enterprises to invest in their land. In this regard India has succeeded to attract a considerable amount of FDI in last three decades. On the other hand, compared to India, Bangladesh has failed to attract a large volume of FDI due to the lack of proper planning. In 2017, FDI in Bangladesh was only 2.15 billion dollar as against 39.97 billion dollar in India. Exchange rate policy is another instrument applied intensively by these two countries after liberalization for fostering exports to each other. Both India and Bangladesh have depreciated their nominal effective exchange rates (NEER) on an average during this period. In real terms, Indian currency lost about 69% and that of Bangladesh lost almost 73% of its value between 1988 and 2017. Many other trade liberalization policies were adopted along with these for their better performances in foreign trade. The list is long enough to mention here in the short span of this paper. Whatever impact the liberalized regime has on Indo-Bangladesh bilateral trade is predominantly unidirectional, favoring Indian exports to Bangladesh (Basher, 2013).

In the past three decades the importance of foreign trade has increased enormously in these two countries. In 1988 the global trade to GDP ratio of India and Bangladesh was 11% and 4% respectively which became 28% for India and 35% for Bangladesh in 2017. Per capita GDP of both these countries have increased many times during this period. Bangladesh's per capita GDP increased by more than five times (from 263.22 $ in1988 to 1516.51 $ in 2017) and India also recorded a similar pace of increment (from 355.41 $ in1988 to 1979.36 $ in2017) with a higher per capita GDP than Bangladesh throughout the last three decades. Regarding global exports by these two countries there has always been a huge difference in favor of India. Nevertheless, one very encouraging fact for Bangladesh is that its global export has increased with a rapid pace in comparison to India during the last three decades. India's global export in 2017 (234 billion $) was almost 17 times more than what it was in 1988 (13.87 billion $), whereas Bangladesh registered a huge 180 times increment (from 0.22 billion $ in 1988 to 39.61 billion $ in 2017) during the same period. India's exports to Bangladesh in recent years have become more diversified than what it was in 1988. On the

other hand, the product range in the export basket of Bangladesh has been very narrow, comprising very few items in it. Bangladesh depends heavily on the export of items from "textile and clothing" category. In 2017, 54.10 % of its total exports to India were from this group. "Bangladesh's exports to India are highly concentrated to a few items… On the other hand, India's exports to Bangladesh are more diversified and export-base is significantly wide" (Rahman, 2005).

As a trading partner, the importance of both these countries to each other has increased over time. Bangladesh's share in India's global trade was 0.56% in 1988 which has grown up to 1.33% (computed from WITS data) in 2017 with a faster acceleration of its share in India's global imports than that in India's global exports. As a result, the growth rate of India's trade surplus with Bangladesh has slowed down with the passage of time. India has to consider this fact with priority to improve the growth rate of trade surplus again. Factors responsible for the present situation are to be identified and for this; a detailed analysis of pattern of trade, changes in composition of trade over time and prospects in trade between these two countries is needed. With this background, the objectives of this paper are:

i) To examine the changes in nature and composition of trade between India and Bangladesh.
ii) To investigate the changes in trade policy and their impact on the trade of the two countries.
iii) To examine the trade balance of India and Bangladesh in the period of trade liberalization and find explanations for the present scenario.

This paper has been arranged as follows: A brief review of literature has been given in section 2. Section 3 describes the methodology used in this paper. Section 4 analyses the changes in nature and composition of trade between these two countries. Section 5 deals with the changes in the trade policies of two countries and their impact on their bilateral trade.

2. Review of Literature

Bangladesh is a labour abundant and capital scarce country. Prior to 1976 Bangladesh's commodity trade was determined almost entirely by economic planning. The trade policy regime of Bangladesh can be divided into three distinct phases (Basher, 2013). The first phase (1972-1975) was characterized by heavy controls on export and import, and extensive price control. The second phase (1976-1990) was marked by a move towards market oriented economy, beginning of de-nationalization, modest tariff reductions, partial withdrawal of quantitative restriction and policy support to the ready-made garments export. The third phase (1990-to date) initiated rapid trade liberalization activities to open up the economy to the world.

The trade policy regime of India since independence, on the other hand, can also be identified into three distinct phases (Panagariya, 2004): 1950-1975, when the trend was toward tighter controls on imports and exports of the country, import substitution was encouraged to restrict

the outflow of foreign currencies; 1976-199, when moderate trade liberalization policies were adopted, especially during the last five to seven years of this phase; and from 1992 onward, when deeper and more systematic liberalization was undertaken.

Intense trade liberalization policies were initiated in these two countries almost from the same time of 1990-1991, although the trade relation between them started much earlier, when they signed the first trade agreement on March 28, 1972. Under this agreement, both countries provided most-favored nation treatment to each other (De, Bhattacharyay, 2007). Since then, the volume of trade between these two countries has grown rapidly, especially after the adoption of liberalization policy by them. From the very beginning of their trade relationship, Bangladesh has always been suffering from deficit in trade balance with India. This persistent trade deficit has become a matter of concern for Bangladesh. Number of studies has been conducted in this regard to short out the causes behind this continuous trade deficit of Bangladesh with India.

Bangladesh has initiated the program of tariff liberalization earlier than India, in the mid 1980s, and the speed of liberalization in Bangladesh is faster than that in India (Rahman, 2005). It has been accused that, over the last several years the high level of tariff by India has been a major constraint in Bangladesh's effort to expand its export. Besides, Bangladesh has not only reduced the tariff at a faster rate but has also maintained a lower tariff regime over a longer period than India (Balaji, 2016). India, as a bigger and stronger partner, should take the initiative so that Bangladesh can get better market access in India for the future relationship between these two countries (Islam, 2017).

Bangladesh imports mainly intermediate goods, raw materials, and capital goods from India which are essential for its production of manufacturing goods. "A high percentage of Bangladesh's import from India is in the nature of inputs (cotton) meant for the production of its main export item (readymade garments); an area in which the country has championed itself" (Balaji, 2016). "Bangladesh's major exports to the world are ready made garments (RMGs). The main raw material for RMGs is cotton. Indian exports to Bangladesh are dominated by cotton which accounted for 28 percent of its total exports to Bangladesh in the FY2012" (Acharya, Marwaha, 2012). Because of Bangladesh's great dependence on imported inputs for its exports, especially for manufacturing exports, low backward linkages of industries, the domestic value addition is also low (Rahman, 2005). Bangladesh has to concentrate on producing these inputs which they are importing from India to build up a strong production base inside the country and achieving self sufficiency.

Exchange rate plays a crucial role in promoting exports of a country. If the currency of the exporting country is devaluated with respect to the currency of its partner, that will make the products of the exporting country relatively cheap in the market of the partner country. The currency of Bangladesh has been consistently depreciated against the US dollar, boosting exports over the years (Acharya, Marwaha, 2012). A different view was given by Rahman in his study, though much earlier in 2005. Both Bangladesh and India depreciated their currencies over the years, but depreciation had been stronger in Indian currency than that of

Bangladesh. Hence Bangladesh's exchange rate policy is inappropriate compared to that of India resulting large trade deficit. India's products became more competitive than that of Bangladesh. Thus India has become successful to divert demand from imported goods to domestic goods (Rahman, 2005).

Indian manufacturing sector is stronger and have diversified product support than Bangladesh's counterpart. This advantageous position along with the advantage of location attract the business community of Bangladesh to import capital machinery, raw materials and finished goods from India causing high import growth of Bangladesh from India (Gazi et al. 2014). Structurally Indian economy is much larger, more diversified and technologically advanced. Indian products now have become globally competitive both in terms of price and quality. Also geographically India is very close to Bangladesh. All these factors have made Indian products very competitive in Bangladesh's market (Hassan 2002). As a result, India's exports to Bangladesh are more diversified and consists of high value added manufactured goods. On the other hand, India's imports from Bangladesh are limited to a few items, as Bangladesh does not have a large supply base to offer a wide variety of products to India. Moreover, Bangladesh lacks capacity to manufacture export quality goods. India itself is a big producer and exporter of most of the products that Bangladesh can export. The obvious result is an increase of trade imbalance between the two nations. (Rahman, 2005; Khan and Ali, 2016).

In modern days, foreign direct investment (FDI) is one of the effective instruments to fulfill the need of investment for the economic development in a poor country, where income and savings are low. Bangladesh in recent years has been trying to attract investors across the world. In order to achieve its goal of becoming a middle income country, the current savings and investments rate need to grow at a much higher rate. In this situation, investments from foreign companies may be helpful in achieving its goal. To increase the GDP growth rate of Bangladesh to 10 percent by 2021, investment rates need to increase to 38 percent level. The main sources of FDIs in Bangladesh are the United States, United Kingdom, Hong Kong, Netherlands and South Korea. India accounted for less than 3 percent of the total investments in FY2011. To remove the weakness of Bangladesh in infrastructural bottleneck, majority of these investments will have to be directed towards removing infrastructural bottlenecks in the areas like energy and power, transportation, urban infrastructure, border infrastructure, Education services and skill development etc. (Acharya, Marwaha, 2012). India, on the other hand, succeeded to attract a fairly larger amount of FDI than Bangladesh during the last three decades. Most of the inflows of investments by the foreign companies in India have been in the service sector.

Making trade between countries easier has become increasingly important for business in today's competitive world. "Excessive document requirements, burdensome customs procedures, inefficient port operations and inadequate infrastructure all lead to extra costs and delays for exporters and importers, stifling trade potential. Trade facilitation tools such as electronic data interchange systems, risk-based inspections, and single windows help

improve a country's trading environment and boost firms' international competitiveness" (Acharya, Marwaha, 2012). One of the most serious problem faced by Bangladesh's exports are existing non-tariff barrier (NTB) from India. "Bangladesh expects India to remove the NTB as it is a major hurdle to their export growth. Some of the obstacles which could be targeted for removal of the NTBs are the requirement of double laboratory test for every consignment of food product, delay in getting these test results, imposition of state tax and strengthening the infrastructural facilities at the authorized Land Custom Stations (LCS)" (Balagi, 2016). Another point has been pointed out by Md. Abul Basher regarding NTB faced by Bangladesh. "Lack of coordination between central and state government's rules and regulations also affects Bangladesh's exports to India. The Directorate General of Foreign Trade (DGFT) of India is not the only authority to impose rules and regulations regarding exports from Bangladesh to India. Even, various state agencies impose different barriers on their own" (Basher, 2013).

India shares more than 4000 kms of land border with Bangladesh. More than 80 percent of trade is carried out through land due to the geographical proximity that the countries share, within this, over 70 percent of trade is carried out through two Land Customs Stations (LCS), Petrapole-Benapole and Ranaghat-Gede. De and Bhattacharya (2007) point out that although both countries have 1 km of road for every 1 sq km, the quality of road is poor. India has a stable broad gauge railway system, whereas that of Bangladesh is unreliable and only 33 percent of it is broad gauge. Most papers suggest that there are immense opportunities in improving infrastructure, especially in the transport segment (Chakraborty 2010, Bhattacharjee 2012, Acharya and Marwaha 2012) for the smooth trade and investment flows between these two countries. Modernization of power, ports, energy, telecommunication, storage facilities on the border are the other important areas of infrastructural development where both these countries, especially Bangladesh has to take care of.

It is postulated that in an open economy, two main determinants of exports of a country are the real exchange rate and foreign (destination country) income. Md. Abul Basher pointed out that Bangladesh has started off a slow but persistent acceleration of growth whereas the India has maintained one of the highest growth rates of GDP in the world for more than a decade. He observed that, Bangladesh's export to India is growing over time, even at a faster rate than its growth to traditional export markets such as the US and EU. In search of the causes behind this he conducted a time series analysis by considering GDP of India and real exchange rate of Bangladesh as independent variables and Bangladesh's export to India as dependent variable. Significant results were found for both of them, namely, real exchange rate of Bangladesh and GDP of India. Devaluation of its own currency and the increment in the GDP of India were found the root cause of accelerated growth rate of Bangladesh's exports to India "It emerges from our econometric exercises (e.g. from Granger causality tests) that the real exchange rate and GDP of India affect the exports of Bangladesh to India…The findings seem to suggest that while Bangladesh's exports to India will continue to increase as a result of growth of the latter's economy all else remaining unchanged,

Bangladesh can also accelerate its exports by improving its competitiveness" (Basher, 2013). One of the important features of Bangladesh-India bilateral trade to be mentioned is that a large volume of informal or unrecorded trade, both in commodities and services, occurs every year, and it is growing despite unilateral or regional or multilateral trade liberalization in these two countries (Pohit and Taneja 2003, Eusufzai 2000). Ever since Bangladesh's independence there has been a substantial informal unrecorded trade across the India-Bangladesh land borders. All the literature on the India-Bangladesh informal trade confirms that this trade is essentially one-way, from India to Bangladesh (World Bank, 2006). Due to the unavailability of informal trade data it is not possible to incorporate a large part of actual trade between these two countries in any time series analysis. Still, it can be argued that the trade deficit of Bangladesh is actually more than what is reflected in its legal trade with India.

Limited literature is available which analyses the trade relation of India and Bangladesh for a long span of time to judge the changes in the nature and composition of trade between these two countries and their consequent effect on trade balance. In this paper time series analyses have been conducted using data from 1988 to 2017 comprising a 30 years span to shed light on these issues. Moreover, majority of the papers have adopted partial approaches in addressing the problems. In the present paper attempt has been made to analyze the trade relation between India and Bangladesh in a comprehensive manner so that the real problems can be identified.

3. Data and Methodology

Section 4 and 5 of this paper is the analytical part of the study. Broadly, there are two phases of our statistical analysis. In the first phase, a comprehensive analysis of trade data from reliable sources has been conducted to assess the changes in nature and composition of trade between India and China. The second phase is the econometric time series analysis to judge the implication of different trade policies adopted by these two countries on their trade performances. Annual data of the selected variables from 1988 to2017 for India and Bangladesh are taken from the official websites of World Integrated Trade Solution (WITS), World Bank, Trade Map Database , IMF and UN Comtrade database. Variables used in abbreviations in this paper are: export of India to Bangladesh (Exp_Ind), import of India from Bangladesh (Imp_Ind), trade balance of India with Bangladesh (Tb_Ind), GDP of India (GDP_Ind), export-import ratio of India with Bangladesh (Expi_Impi_ratio) and real exchange rate of India (R.Exch_rt_Ind).

Four basic equations have been estimated applying OLS method in this paper.

i. $Exp\_Ind_t = \alpha_1 + \beta_1 GDP\_Ind_t + \varepsilon_{1t}$
ii. $Imp\_Ind_t = \alpha_2 + \beta_2 GDP\_Ind_t + \varepsilon_{2t}$
iii. $Tb\_Ind_t = \alpha_3 + \beta_3 GDP\_Ind_t + \varepsilon_{3t}$
iv. $Expi\_Impi\_ratio_t = \alpha_4 + \beta_4 R.Exch\_rt\_Ind_t + \varepsilon_{4t}$

where ε_{1t} , ε_{2t} , ε_{3t} and ε_{4t} are white noise error terms. Before estimating the parameters of

these equations our econometric analysis comprise of three initial steps. The first and second step examines the characteristics of data by unit root test and co-integration test. The unit root tests for all dependent and independent variables are needed to check the stationarity of the series. For the robustness of the conclusions, Augmented Dickey-Fuller (ADF) tests are done in this purpose. As suggested in ADF test, following three models for testing the presence of unit root in a random variable (Y) have been tested with the inclusion of a constant (equation-b below), a constant and linear trend (equation-c below), or neither (equation–a below) in the test regression.

a. $\Delta Y_t = \delta Y_{t-1} + \sum_{i=1}^{m} \gamma_i \Delta Y_{t-i} + u_t$
b. $\Delta Y_t = \alpha + \delta Y_{t-1} + \sum_{i=1}^{m} \gamma_i \Delta Y_{t-i} + u_t$
c. $\Delta Y_t = \alpha + \beta t + \delta Y_{t-1} + \sum_{i=1}^{m} \gamma_i \Delta Y_{t-i} + u_t$

ADF test corrects for presence of serial correlation in the disturbance term by including m lags of the dependent variable (ΔY_t). Following unit root tests the co-integration test is necessary for the variables having integration of order one, i.e., I (1).Two co-integrated series implies that they are having a meaningful long run relationship between them. In this paper, Engel-Granger method is used for testing co-integrating relations for the pairs (Exp_Ind , GDP_Ind) , (Imp_Ind, GDP_Ind), (Tb_Ind , GDP_Ind) and (Expi_Impi_ratio , R.Exch_rt_Ind) separately.

Existence of relationship between variables does not necessarily prove causality, or direction of influence. Granger causality test offer a formal test of the direction of causality between the variables. In the third step of our econometric exercise the causality tests are conducted for above mentioned four pairs of variables for which co-integration tests were done. Finally, for estimating the parameters for each of the regression equations i, ii, iii and vi the OLS technique is applied. All the econometric analysis has been performed using the EVIEWS7 software.

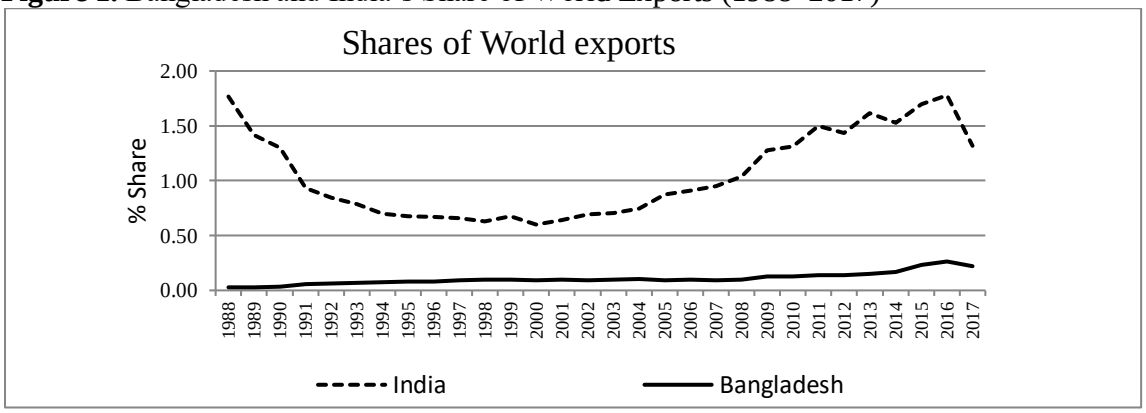
4. Changes in the nature and composition of trade

The volume of world trade has grown at a rapid pace during the last three decades. Total world export in 2017 was almost 23 times than what it was in 1988. Trade performances of different countries are measured by their respective shares in global exports over time. In this regard India has always been a superior performer than Bangladesh during this period. In 1988, India's share of world exports was 1.77% which has become 1.65% in 2017. Although during some years in the middle (from 1991 to 2007) there was a decline in this share below 1. On the other hand, Bangladesh could only manage to contribute not even 0.5% of global exports throughout this period (1988 to 2017). The respective shares of these two countries are shown in figure1. Clearly, India's performance has been much better than that of Bangladesh.

To India, the importance of Bangladesh as an export destination has increased over time. The share of India's global exports went to Bangladesh was 1.29% in 1988 which became 3.07%

in 2017. On the other hand, the share of Bangladesh's global exports destined to India has declined from 4% in 1988 to 1.49% in 2017(calculated from WITS data).This is an indication of greater association of Bangladesh with other trading partners in the world in recent years.

Figure 1. Bangladesh and India's Share of World Exports (1988–2017)



Source: WITS

Shares of different product groups (based on the level of processing) in total exports to the world as well as to the partner country by India and Bangladesh have been computed separately for 1988 and 2017. This will be helpful to assess the changes in composition of exports of each country over time. Respective shares of different product groups for these two countries are given in table 1. Bangladesh is predominately a capital scarce country, which is reflected in its shares of capital good exports to the world as well as to India. In 1988, only 0.3% of Bangladesh's global exports were capital goods and that to India was nil. The corresponding shares in 2017 were 0.39% to the World and 4.29% to India respectively, which are still very negligible. The share of capital goods in India's export basket, on the other hand, has increased over time both to the world and to Bangladesh. In 1988, 6.23% of India's global exports were capital goods, which have become 13.78% in 2017. The corresponding share of these goods to Bangladesh has increased from 19.93% to 22.45% during these two years. In 2017 India exported capital goods worth 1.62 billion $ to Bangladesh and imported it by 0.03 billion $ from there, enjoying a trade surplus of 1.59 billion $.

Bangladesh has made the most remarkable change in its export potentiality of consumer goods during the last three decades. At present almost entire global exports of Bangladesh comprise of these goods. Consumer goods accounted for 42.51% of Bangladesh's global exports in 1988, which has become 95.13% in 2017. As far as exports to India are concern, the share of these goods has increased almost 91 times (0.49% in 1988 to 44.52% in 2017) during this period.

Table 1. Shares of different product groups in total exports by India and Bangladesh (%)

		Capital Goods		Consumer Goods		Intermediate Goods		Raw Materials	
		1988	2017	1988	2017	1988	2017	1988	2017
Share in India's total export to	The World	6.23	13.78	34.32	44.02	42.37	33.2	14.74	8.63
	to Bangladesh	19.93	22.45	17.01	19.61	47.88	43.11	15.03	14.25
Share in Bangladesh's total export to	The World	0.30	0.39	42.51	95.13	16.74	1.68	38.45	2.57
	to India	0.00	4.29	0.49	44.52	61.74	29.68	36.09	21.10

Source: Compiled from WITS data

India also has increased the share of consumer goods in its export basket both to the world as well as to Bangladesh. Its global exports of these goods grew from 34.32% in 1988 to 44.02% in 2017 and to Bangladesh, from17.01% to 19.61% respectively. In 2017, the value of India's consumer goods export to Bangladesh was 1.41 billion $ and imported by 0.26 billion $ from there, with a trade surplus of 1.15 billion $.

With the passage of time, the importance of intermediate goods in the export basket of Bangladesh has declined gradually both to the world and to India. The share of these goods in its global exports has fallen from 16.74% in 1988 to 1.68% in 2017 and that to India from 61.74% to 29.68% respectively. In India's global exports, on the other hand, the share of intermediate goods has fallen from 42.37% to 33.2% and that to Bangladesh from 47.88% to 43.11% during this period. In spite of this downfall, intermediate goods occupy the largest share in India's exports to Bangladesh at present. India exported these goods by 3.11 billion $ to Bangladesh and imported by 0.18 billion $ from there in 2017 with a trade surplus of 2.93 billion $.

Export shares of raw materials by these two countries have also declined both to the world as well as to the partner country. In 1988, the share of these goods in Bangladesh's global exports was 38.45% and came down sharply to 2.57% in 2017. The corresponding export percentages to India were 36.09% and 21.10% respectively. India's global exports of raw materials, on the other hand, have come down from 14.74% to 8.63% and to Bangladesh, from 15.03% to 14.25% between 1988 and 2017. India's export and import values for these goods with Bangladesh in 2017 are 1.03 billion $ and 0.12 billion $ respectively, with a trade surplus of 0.9 billion $.

The export shares of different product groups between 1988 and 2017, given in table 1, reveals the fact that, there has been no considerable change in the composition of India's exports to Bangladesh in 2017 as it was in 1988, whereas, Bangladesh's export composition

for India has experienced a huge change in this period. In 1988 Bangladesh exported mainly intermediate goods and raw materials to India. Almost 98% of its total exports to India were from these two groups. With the passage of time the weightage has shifted and the importance of consumer goods has increased enormously. The share of these goods in the export basket of Bangladesh to India was highest (44.52%) among all in 2017.

Volumes of India's top ten export items and their respective shares in total exports to Bangladesh for 1988 and 2017 are presented in Table 2.1. India's top 10 export items comprise of 81.27% of total exports in 1988, among which the major share is held by the product cotton (HS-52)* at 32.28% from textile and clothing category, followed by machinery and mechanical appliances (HS-84), vehicles (HS-87), different fabric items (HS-60) among others. In 2017 the top 10 export items comprise of 72.37% of total exports to Bangladesh. Export of cotton (HS-52) again occupied the highest share of 24.07% and was followed by vehicles (HS-87), machinery and mechanical appliances (HS-84), Cereals (HS-10) etc.

Top three export items of India to Bangladesh remained unchanged in 2017 as it was in 1988 with the product "cotton" retaining its first position. A close inspection of table 2.1 reveals that the broad category "mineral products" (HS25-26) consisting salt; sulphur; stone; etc (HS-25) which was among the top 10 export items in 1988 has been replaced by "food products"(HS16-24) like Residues and waste from the food industries (HS-23) in 2017. All the other top 10 export items of 1988 and 2017 are falling under the same broad categories of HS two digit classification. This indicates that, the composition of India's exports to Bangladesh has remained almost same during the last three decades.

Volumes of India's top ten import items and their respective shares in total imports from Bangladesh in 1988 and 2017 are presented in Table 2.2. Only 8 import items consisted100% of total imports from Bangladesh in 1988. The highest share among all these imports was held by *HS stands for harmonized system of product classification. HS product classification at two digit labels has been considered in this paper.

Table-2.1: Volume of India's top 10 export items and their respective shares in total exports to Bangladesh in 1988 and 2017

India's top 10 exports to Bangladesh in 1988				India's top 10 exports to Bangladesh in 2017			
HS Code	Product Label	Value Thousand $	% Share	HS Code	Product Label	Value thousand $	% Share
52	Cotton	57614	32.28	52	Cotton	1735277	24.07
84	Machinery, mechanical appliances, nuclear	21217	11.89	87	Vehicles other than railway or tramway rolling	946388	13.13

	reactors				stock, and parts…		
87	Vehicles other than railway or tramway rolling stock, and parts…	13928	7.80	84	Machinery, mechanical appliances, nuclear reactors…	534373	7.41
60	Knitted or crocheted fabric	11044	6.19	10	Cereals	401392	5.57
7	Edible vegetables and certain roots and tubers	10490	5.88	27	Mineral fuels, mineral oils and products…	382832	5.31
40	Rubber and articles thereof	8602	4.82	55	Man-made staple fibres	271334	3.76
25	Salt; sulphur; earths and stone; plastering materials…	6152	3.45	85	Electrical machinery and equipment and parts thereof…	267081	3.71
8	Edible fruit, nuts, peel of citrus fruit, melons	5572	3.12	72	Iron and steel	262422	3.64
27	Mineral fuels, mineral oils and products …	5258	2.95	39	Plastics and articles thereof	210789	2.92
76	Aluminium and articles…	5153	2.89	23	Residues and waste from the food industries…	204675	2.84
Total value of top 10 exports		145030	81.27	Total value of top 10 exports		5216563	72.37
Total exports to Bangladesh		178458	100	Total exports to Bangladesh		7208556	100

Source: compiled from Trade Map Database and UN Com trade Database

the products like paper and paperboard; articles of paper pulp etc. (HS-48) at 43.81%,followed by vegetable textile fibers; paper yarn etc. (HS-53) at 31.32%, raw hides and skins and leather (HS-41) at 13.97%, Animal or vegetable fats and oils (HS-15) at 7.94% among the others. In 2017, top 10 import items of India comprise of 72.60% of total imports from Bangladesh among which products from "Textile and clothing" (HS 50-63) category

like vegetable textile fibers; paper yarn etc. (HS-53) hold the highest share of 20.81%. The next three positions were occupied by the articles like apparel and clothing accessories, not knitted (HS-62), articles of apparel and clothing accessories, knitted (HS-61) and lead and articles thereof (HS-78) respectively.

Table-2.2: Volume of India's top 10 import items and their respective shares in total imports from Bangladesh in 1988 and 2017

India's top 10 imports from Bangladesh in 1988				India's top 10 imports from Bangladesh in 2017			
HS Code	Product Label	Value thousand $	% Share	HS Code	Product Label	Value thousand $	% Share
48	Paper and paperboard; articles of paper pulp…	3873	43.81	53	Other vegetable textile fibres; paper yarn…	122998	20.81
53	Other vegetable textile fibres; paper yarn...	2769	31.32	62	Articles of apparel and clothing accessories…	116354	19.69
41	Raw hides and skins and leather	1235	13.97	61	Articles of apparel and clothing accessories…	41003	6.94
15	Animal or vegetable fats and oils…	702	7.94	78	Lead and articles thereof	34125	5.77
99	Commodities not elsewhere specified	148	1.67	63	Other made-up textile articles; sets; worn clothing..	22400	3.79
8	Edible fruit and nuts; peel of citrus fruit…	57	0.64	27	Mineral fuels, mineral oils and products of their…	20712	3.50
49	Printed books, newspapers, pictures and other products	44	0.50	25	Salt; sulphur; earths and stone; plastering materials	20317	3.44

7	Edible vegetables and certain roots and tubers	13	0.15	72	Iron and steel	20082	3.40
-	-	-	-	52	Cotton	16954	2.87
-	-	-	-	74	Copper and articles thereof	14117	2.39
Total value of top 10 imports		8841	100	Total value of top 10 imports		429062	72.60
Total imports from Bangladesh		8841	100	Total imports from Bangladesh		590995	100

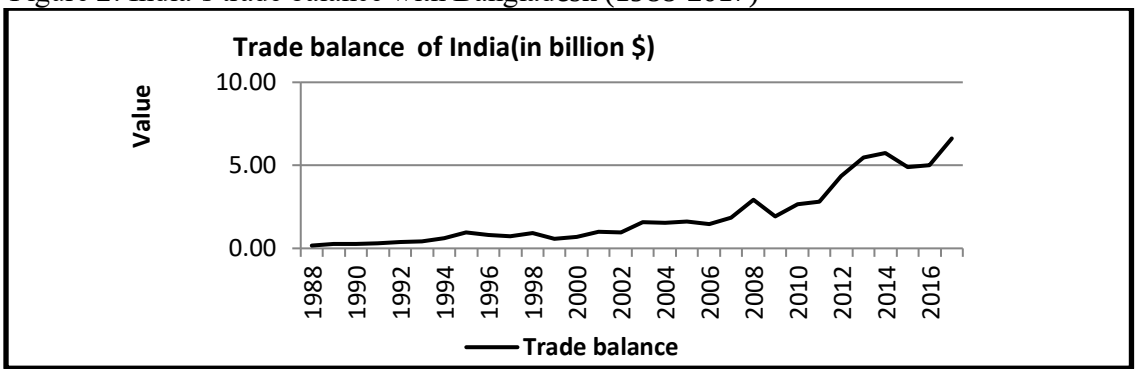
Source: compiled from Trade Map Database and UN Com trade Database

Table 2.2 reveals the fact that exports of Bangladesh to India in 1988 were highly concentrated in very few products. Only 8 items were there in the export basket to India. Not only that, the top 3 items consisted the lion share (89%) of total exports of Bangladesh. In 2017, on the other hand, although the items exported to India were more in number than that of 1988, most of the top 10 items were from two broad categories like "textile and clothing" (HS, 50-63) and "metals" (HS, 72-83). The share of "textile and clothing" was 54.10% and the corresponding share of "metals" was 11.56% of total exports to India in this year. Another noticeable fact is that, among the export items to India in 1988 and 2017 only Hs-53 is the common one. This indicates that, although concentrated in few items, there has been a considerable change in the nature and composition India's imports from Bangladesh during the last three decades.

5. Changes in the trade policies of two countries and their impact on the bilateral trade between India and Bangladesh

In the bilateral trade between India and Bangladesh since 1988, India's position has been very strong always. In 1988, India's export to Bangladesh was 0.18 billion $ and recorded a 40 times increment to 7.21billion $ in 2017. The trade balance of India (see 3rd column of table 3) has always been positive with huge increments in recent years. For Bangladesh, on the other hand, the volume of exports to India in absolute term has been much lower than its imports from India throughout the period. In 2017, Bangladesh exported 0.59 billion $ and imported twelve times more (7.21 billion $) than that from India with a huge trade deficit of 6.62 billion dollars. In spite of this adverse balance of trade situation, an inspiring fact for Bangladesh is that, its export to

Figure 2: India's trade balance with Bangladesh (1988-2017)



Source : WITS

India has grown at a faster rate than its imports from there. In 2017, Bangladesh exported almost 67 times more than what it exported in 1988 to India. The trade balance of India is presented graphically in figure 2. The upward rising curve indicates that the trade balance has grown steadily in favor of India in the last three decades.

India's annual exports per unit imports from Bangladesh (Exp/Imp of India) have been

Table 3. India's balance of trade situation with Bangladesh from 1988 to 2017 (in billion $)

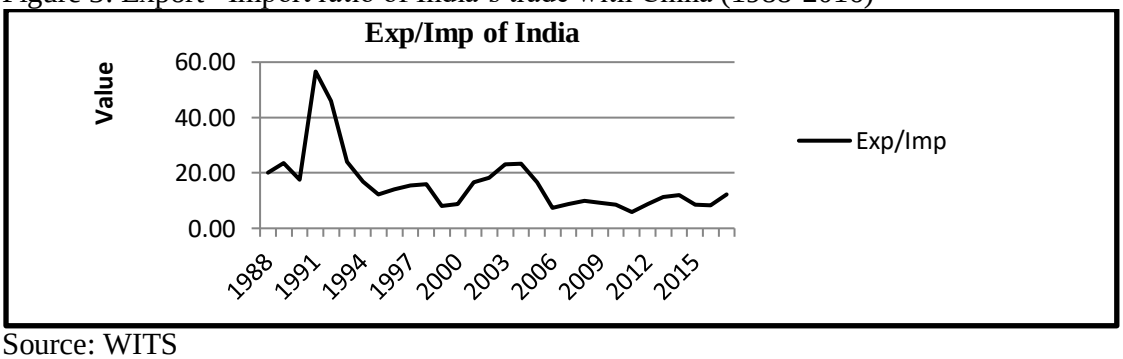
Year	India's exports to Bangladesh	India's imports from Bangladesh	Trade balance of India	Exp/Imp of India
1988	0.1784576	0.00883945	0.17	20.19
1989	0.28230749	0.01196024	0.27	23.60
1990	0.30168211	0.01724272	0.28	17.50
1991	0.32456573	0.00573341	0.32	56.61
1992	0.39695091	0.00861369	0.39	46.08
1993	0.43014522	0.01787363	0.41	24.07
1994	0.64462618	0.03815967	0.61	16.89
1995	1.04586893	0.0856715	0.96	12.21
1996	0.86891629	0.06219494	0.81	13.97
1997	0.7866505	0.05074253	0.74	15.50
1998	0.99528634	0.0624563	0.93	15.94
1999	0.63999907	0.07857784	0.56	8.14
2000	0.77571651	0.08869787	0.69	8.75
2001	1.06304561	0.06412152	1.00	16.58

2002	1.02550179	0.0564287	0.97	18.17
2003	1.65297321	0.07150122	1.58	23.12
2004	1.61302689	0.06911306	1.54	23.34
2005	1.71978865	0.10369849	1.62	16.58
2006	1.6678094	0.22381254	1.44	7.45
2007	2.06379328	0.23331134	1.83	8.85
2008	3.24337589	0.32978208	2.91	9.83
2009	2.17737514	0.23442158	1.94	9.29
2010	3.01657471	0.35789627	2.66	8.43
2011	3.40551554	0.57912545	2.83	5.88
2012	4.9366724	0.56730728	4.37	8.70
2013	5.99394959	0.53075117	5.46	11.29
2014	6.25523493	0.51727911	5.74	12.09
2015	5.52151762	0.63989854	4.88	8.63
2016	5.66879284	0.67709805	4.99	8.37
2017	7.21009952	0.59157573	6.62	12.19

Source: compiled from WITS data

calculated for the selected period and presented in the last column of table 3. Values more than one for this ratio indicate trade surplus for India. As India has enjoyed surplus in trade balance in all the years, the values of this ratio are more than one always. The logarithm of this ratio has been regressed upon time to measure its trend and the coefficient of the independent variable, time, is found negative. With a faster acceleration of India's imports from Bangladesh over its exports, the ratio is having a declining trend over time. In figure 3, this ratio has been presented graphically.

Figure 3: Export –Import ratio of India's trade with China (1988-2016)



Source: WITS

Our above discussion reveals the fact that there is a contrasting feature between the trade balance of India and its export-import ratio with Bangladesh. While the trade balance of India with Bangladesh has grown at a rapid pace during the last three decades, its export-import ratio has declined over time due to faster acceleration of India's imports than its exports to Bangladesh.

In this section, econometric time series analysis has been conducted to identify the factors responsible for the present situation in Indo-Bangladesh trade. Selected macro economic variables, which affect exports and imports of a country, are real exchange rate,* gross domestic product (GDP), tariff rates imposed and net inflow of foreign direct investment (FDI). Yearly time series data of all these variables for India and Bangladesh are taken from reliable sources (mentioned in methodology section of this paper). The econometric analysis has been done in four steps: in the first step, ADF (Augmented Dickey Fuller) test for all the selected variables have been performed to test the stationarity of these series. In the second step, co integration test

* The real exchange rates of India and Bangladesh have been calculated as,

Real exchange of country A with country B = n. exch ^{A}. (cpi ^{B} / cpi ^{A}),

Where, n. exch ^{A} = nominal exchange rate of the currency of country A with us dollar, cpi ^{B} = consumer price index of country B and cpi ^{A} = consumer price index of country A.

has been conducted for the stationary series at first difference to find out the existence of meaningful long run relationship between the variables. In the third stage, Granger causality test has been done to check whether there is any causal relationship between two variables or not. Granger Causality test helps us to identify the direction of causality between the variables. In the last step, Ordinary Least Square (OLS) test has been done to estimate the parameter of relationships. If two series are co-integrated, OLS gives consistent estimator of the relationship between them.

Table 4: Results of Unit Root and Co integration Test (First difference of the variables)

A. Unit Root Test				
a. Level of the variables (Null hypothesis: Variables has a unit root.)				
Variables	Augmented Dickey- Fuller test results			
	Statistics	Critical value at 1%	Critical value at 5%	Probabilities
Exp_Ind	-1.086892	-4.309824	-3.574244	0.9141
Imp_ind	-1.95893	-4.309824	-3.574244	0.5984
Tb_Ind	-1.197634	-4.309824	-3.574244	0.8923
Expi_Impi_ratio	-3.477039	-4.323979	-3.580623	0.0616
GDP_Ind	-0.26573	-4.309824	-3.574244	0.9879
R.Exch_rt_Ind	-2.001808	-4.309824	-3.574244	0.576

b. First difference of the variables (Null hypothesis: Variables has a unit root.)				
Variables	Augmented Dickey- Fuller test results			
	Statistics	Critical value at 1%	Critical value at 5%	Probabilities
Exp_Ind	-4.129352	-2.650145	-1.953381	0.0002
Imp_ind	-4.615982	-2.650145	-1.953381	0.0000
Tb_Ind	-4.13728	-2.650145	-1.953381	0.0002
Expi_Impi_ratio	-4.708973	-2.653401	-1.953858	0.0000
GDP_Ind	-2.757725	-3.689194	-2.971853	0.0773
R.Exch_rt_Ind	-5.153962	-3.689194	-2.971853	0.0003
B. Pairwise Cointegration Test (Null hypothesis: Series are not co integrated)				
Dependent Variables	z-statistics		MacKinnon p values	
Exp_ind GDP_Ind	-15.23953 -14.38939		0.0809 0.1021	
Imp_Ind GDP_Ind	-25.33622 -25.62992		0.0026 0.0023	
Tb_Ind GDP_Ind	-15.54755 -14.40528		0.0742 0.1016	
Expi_Impi_ratio R.Exch_rt_Ind	-26.32879 -8.249784		0.0016 0.4191	

5.1. Unit Root Test (Level and first difference of the variables)

The results of ADF test for the variables at level and at first difference which have given meaningful results till the end of our econometric exercise are summarized in section-A of table 4. Six such variables are export of India (Exp_Ind), import of India (Imp_Ind), trade balance of India (Tb_Ind), export- import ratio of India with Bangladesh (Expi_Impi_ratio),GDP of India (GDP_Ind) and real exchange rate of India (R.Exch_rt_Ind). Except Expi_Impi_ratio , all the other five variables are non stationary at level but stationary at first difference. On the other hand, the export-import ratio of India is found to be stationary at level with significant drift and a trend component in it, i.e, Expi_Impi_ratio is a trend stationary series. The unit root test of this series at first difference shows that the series is again stationary which is free from any trend factor. In other words, Expi_Impi_ratio is a difference stationary series too. As the probability of having a unit root in this series is less in first difference than in level we consider Expi_Impi_ratio as a stationary series at first difference in our model. In all the cases, lag length selection has been attributed to the

software to choose it automatically. Hence, all the six variables are free from the presence of unit root at first difference and therefore, will give reliable and unbiased results.

5.2. Bivariate Cointigration Test

Presence of co-integration for two or more time series suggests that there is a meaningful long run relationship between them. In our model, two variable Engel-Granger co integration tests have been done. Results are shown in section-B of table 4. Export, import and trade balance of India when paired as dependent variables with GDP of India separately, give significant results. If we consider GDP_Ind as dependent variable, it is co-integrated with Imp_Ind only. Export-import ratio of India also gives significant result as a dependent variable when paired with real exchange rate of India. Co-integration results indicate that, as dependent variables, India's export, import and trade balance with Bangladesh are co-integrated with GDP of India, indicating the existence of meaningful long run relationship with them. Export-import ratio of India, as a dependent variable, is also co-integrated with real exchange rate of India.

5.3. Granger Causality test

In the third stage, pair wise Granger causality test has been conducted to identify dependent and independent variables in our model. The null hypothesis for this test is set as; one variable does not cause the other. Rejection of null hypothesis will ensure that the variable in consideration causes the other variable and therefore, can be considered as an independent variable. The results of our causality test are shown in table 5 below. All the four pairs of variables which are found to

Table 5: Results of pair wise Granger Causality test

Null hypothesis	F-Statistic	p-values
GDP_Ind does not Granger Cause Exp_Ind	9.08962	0.0012
Exp_Ind does not Granger Cause GDP_Ind	2.0664	0.1495
GDP_Ind does not Granger Cause Imp_Ind	23.6909	3.E-06
Imp_Ind does not Granger Cause GDP_Ind	1.72256	0.2009
GDP_Ind does not Granger Cause Tb_Ind	8.82555	0.0014
Tb_Ind does not Granger Cause GDP_Ind	1.92566	0.1686
R.Exch_rt_Ind does not Granger Cause Expi_Impi_ratio	2.55401	0.0996
Expi_Impi_ratio does not Granger Cause R.Exch_rt_Ind	0.03245	0.9681

be co-integrated above are put into Granger causality test. In all the cases, one way causal relations have been found. The results give us a clear insight of our model specification. In our model the dependent variables are Exp_Ind, Imp_Ind, Tb_Ind and Expi_Impi_ratio, since, for all these as dependent variables, null hypotheses are rejected.

5.4. Ordinary Least Square (OLS) estimation

In the last step, OLS estimation has been done for four pairs of variables for which the dependent and independent variables are identified in the Granger causality test. Results of all the OLS estimations are presented in table 6 below. Exp_Ind, Imp_Ind and Tb_Ind, all these three variables are found significantly dependent on GDP_Ind. In all these three cases, relationships are found to be positive. This means that, with the increment in the GDP of India, its export, import and trade balance with Bangladesh also have increased individually. The coefficient of the OLS estimation for R_Exch_rt_Ind as independent variable is negative; implying that, with the depreciation of Indian currency over time, Expi_Impi_ratio has declined or, In other words, India has imported at a faster rate from Bangladesh than what has been exported there. A continuous devaluation of rupee in real terms could not produce the desired result for India as Bangladesh depreciated its currency faster than India.

Table 6: Results of OLS estimation

Dependent variable	Independent variable	Coefficient	t-value	Probability
Exp_Ind	GDP_Ind	2760.423	19.31546	0.0000
Imp_Ind	GDP_Ind	303.1674	21.72999	0.0000
Tb_Ind	GDP_Ind	2457.255	17.42546	0.0000
Expi_Impi_ratio	R.Exch_rt_Ind	-0.50358	-3.28388	0.0028

As discussed earlier, the composition of India's exports to Bangladesh remained almost same during the last three decades, whereas, there has been a considerable change in the composition of imports from Bangladesh during this time. Almost 80% of India's exports are industrial inputs which are needed by the manufacturing sector of Bangladesh. The combined share of capital goods, intermediate goods and raw materials in total exports to Bangladesh was 82.84% in 1988 and 79.81% in 2017. On the other hand, India's imports from Bangladesh in 1988 were dominated by Intermediate goods and raw materials. The combined share of these two categories in total imports was 97.83% which came down to 50.78% in 2017. Huge change has been observed in the share of consumer goods imported from Bangladesh. In 1988 the share of these goods was not even 1% (only 0.49%) of total imports, which has become 44.52% in 2017.

In an open economy, the national income is measured by $Y = C + I + G + (X-M)$, where, Y is the national income, C is the consumption expenditure, I represents investment expenditure, G is the government expenditure and (X-M) stands for the trade balance of the country. Our time series results reveal that, keeping all other components constant, with the increment in the GDP of India both exports (X) and imports (M) have increased with a simultaneous

increment in the trade balance (X-M) of India over time. These results can explain the trends present in the 2nd, 3rd and 4th column of table 3. The last column of table 3 shows the export-import ratio of India with Bangladesh. Both exports and imports of India have increased with the passage of time with a greater acceleration in imports than exports. As a result of which the export-import ratio is having a declining trend on an average. In our OLs estimation, this declining trend is explained by the real exchange rate of India. The coefficient of the regression equation has been found negative, which implies that as a result of devaluation in Indian currency the exports of India have increased but at a slower rate than the rate of increment in the imports. The reason behind this is, Bangladesh has devaluated its currency at a faster rate than that of India which made its products relatively cheap than Indian products causing faster acceleration of India's imports from Bangladesh. The result of OLS estimation between Expi_Impi_ratio and R.Exch_rt_Ind explains the declining export-import ratio presented in the last column of table 3 in this way. Although, Bangladesh has been able to achieve a faster growth rate in its exports to India, the volume of its exports is very less as compared to its imports from India. In 1988 Bangladesh imported 20 times more from India than what was exported and in 2017 the import was 12 times more than its export to India.

6. Conclusions

This paper analyses the significant changes that have taken place in the nature, volume and trade balance of Indo-Bangladesh trade during the last three decades. India's pattern of exports to Bangladesh has remained more or less same during the last three decades. Throughout the specified period (1988 to 2017), 80% of India's exports comprise of capital goods, intermediate goods and raw materials. All these products are used as inputs in the manufacturing industries of Bangladesh. Although there has been no considerable change in the composition of India's exports, it has become more diversified at present. Regarding imports from Bangladesh, a considerable change has been observed during the last three decades. In 1988 the largest share of India's imports from Bangladesh was held by intermediate goods followed by raw materials. Together these two categories contributed 98% of total imports from Bangladesh. This composition of imports has changed considerably in 2017. Most remarkable change has been observed in the imports of consumer goods. The share of these goods in total imports has changed drastically from 0.49% in 1988 to 44.52% in 2017. Most of these consumer goods are the products from "textile and clothing" group. Although the composition has changed, India's imports are confined into very few items even in recent years.

Trade liberalization policies were initiated by Bangladesh in 1990 and in 1991 by India. During the last three decades the trade balance between these two countries has been always in favor of India. In absolute term the trade surplus of India has increased continuously. In spite of that there is an area of concern from India's point of view. The growth rate of India's trade surplus has slowed down in recent years due to the greater acceleration of India's imports than its exports to Bangladesh. Different trade policies have been adopted by these

two countries after liberalization for promoting exports to the other country. Bangladesh adopted a faster tariff reduction strategy than India till 2013, after which India took the initiative to reduce it at zero level as per SAFTA agreement. Bangladesh has reduced the tariff rates for industrial inputs at a faster rate than consumer goods for its heavy dependence on imported inputs from India to produce consumer goods.

A second policy instrument which has been very effectively implemented by Bangladesh is devaluating its currency in real terms at a faster rate than India, which has made the products of Bangladesh relatively cheap in Indian market and Indian products dearer in Bangladesh. As Bangladesh is trying to promote its exports of consumer goods to India, the exchange rate policy along with the tariff rate policy seem to be a part of its well planned strategies.

The econometric time series analysis has been conducted to identify most significant factors which are responsible for the volume and direction of Indo-Bangladesh trade. Results of time series indicate that GDP of India and exchange rate of India are two most important factors controlling the trade between India and Bangladesh. Export, Import and the trade balance of India are having positive relationships with GDP of India, where as export-import ratio of India is negatively related with exchange rate of India. As GDP of India has grown, both export and import have also grown with a positive effect on the absolute value of India's trade balance. On the other hand, the Indian currency has been devaluated at a slower rate than that of Bangladesh making Bangladesh's products more competitive in Indian market. As a result of which the growth rate of India's imports has become faster than that of its exports to Bangladesh.

It is worthwhile to mention here that all the empirical and time series analysis are done by taking official data from various reliable sources, although there is a parallel trade practice between India and Bangladesh for which data are not available. It is argued in number of literature that the volume of informal trade between these two countries is quite considerable. Due to the unavailability of data this informal trade is beyond the scope of this paper.

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Public Expenditure and its Impact on Per Capita Income in Indian States

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Abstract

This paper examines the composition of public expenditure and its impact on per capita net state domestic product on some major Indian states. In general, growth means rise of per capita net state domestic product (nsdp) over time. Revenue expenditure is considered to be less productive than capital expenditure. Per capita net state domestic product in some states in India is very high and in some states it is low. The panel regression based on major states in India shows that revenue expenditure has less effect on growth. On the other hand, capital expenditure has significant and positive impact on growth of per capita net state domestic product (nsdp).

1. Introduction

The role of government in various sectors of economic component like education, health, social welfare and economic growth are important issues in public economics and public finance. Which component of government expenditure is more helpful and productive remains a controversial issue in economic literature. The nature and composition of government spending and its impact on economic growth has become an important area of research. There is also a debate on the optimal size of the government. If inequality is high in the society there will be demand for a largergovernment although it may affect economic growth severely. Taxation and public spending are considered as important instruments of redistribution in the society. Though it is not the only mechanism for redistribution, informalisationof the economy and weak governance can be an alternativeroute for redistributive policies (Marjit, Mukherjee and Kolmar,2006). The idea of optimal fiscal policy is somehow ambiguous in less developed countries becausepolitical gain is the main concern in these countries. Though expenditure on less productive heads has adverse impact on economic growth but political stability can coexist with economic stagnation (Sasmal, 2011).

The expenditure on the development of infrastructure like road, irrigation, power generation telecommunication etc. which are lacking in the developing countries is likely to accelerate growth. However,if the governance level is weak and there is corruption and leakage of funds and lack of proper monitoring for the utilisation of funds and implementation of the projects

such expenditures will fail to generate human skill (Sasmal, 2011).Government generally bears two types of expenditures in all forms of its expenditure- revenue expenditure and capital expenditure. Capital expenditure broadly means expenditure on asset creation for economic and social development, repayment of loan and advance of loan for rural and economic services. If public accounts are included in other heads of public expenditure in the capital accounts then inter-state settlement, contingency fund, small savings, provident funds etc., reserve funds, deposits and advances, suspense and miscellaneous, appropriation of contingency fund and remittances are to be included (Handbook of Statistics on State Government Finances, Reserve Bank of India, various issues). Revenue expenditure includes expenditure on wages and salaries allowances, maintenance, pension, interest payment on loan and various payments and transfers in the current account. Some elements revenue expenditure are developmental and some are non-developmental.

Empirical study of the state expenditure policy and its impact on other variables, relationship with National Income and other variables was studied by German economist Adolph Wagner (1890). His theory was explanatory rather than prescriptive in nature. According to Wiseman and Peacock, the aim is to establish generalization about government expenditure, not from postulate about the logic of choice, but rather by inference from historical evidence. Adolph has based his law on increasing state activities on historical facts. The Median voter theory tells that if inequality is high in the society there will be demand for a larger government. Taxation and public spending are considered as important instruments of redistribution in the society (Meltzer and Richard, 1981; Alesinaand Rodrik, 1994; Persson and Tabellini, 1994). The government may adopt the policy of spending more on unproductive or less productive heads even with huge deficit in fiscal balance in the pursuit of political gain (Sasmal, 2011; Marjit,Kolmar and Mukherjee,2001; Marjit and Maity,2006). Although expenditure on less productive head has negative effect on economic growth, political stability can co-exist with economic stagnation (Sarkar,2006).

Banerjee and Newman (1993) and Galor and Zeira (1993) have been put forwarded a counter arguments to show that if redistributive policies can enhance human capital, they can accelerate growth. Barow (1990) in his endogenous growth model with government spending has shown that efficiency of labour will increase if government spends more on productive services and it helps growth. We get mixed results in respect of the question of which component of government expenditure is more productive and growth promoting. Current expenditure of the government is found to be more productive than capital expenditure in the empirical studies based on cross country data by Debrajan (1996); Ghosh and Gregoriou (2008). Barrow (1991) and Chen (2006) have shown that capital expenditure of the government has positive impact on growth. Bruce and Turnovsky (1990) shown that under certain conditions, reduction in public expenditure can improve the fiscal balance in the long run. The deficit in fiscal balance again adversely affects economic growth.

This work observes that though the share of revenue expenditure fluctuates over time but it has an increasing trend in almost all of the cases.Capital expenditure generally makes investment for development of infrastructure. Revenue expenditure on the other hand covers a wide variety of unproductive or less productive expenditures like pension, subsidy, paymentof interest on public borrowing and various social welfare schemes which may not be much effective in promoting economic growth.

The study is restricted to revenue expenditure and capital expenditure of the major states in India. There is no consideration of expenditure of central government. There is no consideration of private sector expenditure or public sector undertakings. The study will take into account the period from 2002 to 2016.Public accounts of public expenditure like- inter-state settlement, contingency fund, small savings, provident funds etc., reserve funds, deposits and advances, suspense and miscellaneous, appropriation of contingency fund and remittances are excluded from capital expenditure.

Objective of the Study:

Objectives of this studies are-
I) toanalyse the share of revenue expenditure andcapital expenditure of the major states in India from 2002 to 2014 .
ii) to study the per capita net state domestic product of these states after three years (2005 to 2016) of spending of revenue expenditure and capital expenditure.
Iv) to examine the impact of public expenditure on per capita income in the major states of India
The whole work has been arranged as follows: the methodology and data have been explained in section 2. Section 3 gives the analysis of net state domestic product (nsdp) and expenditure pattern of the state governments in India. Results of panel regression and their explanations have been presented in section4. Section 5 gives the summary and conclusions.

2. Methodology and Data

In panel regression both Fixed effects model (F.e.m) and Random effects model (R.e.m) have been estimated.
The Fixed effects model equation is :

$$Y_{it} = \beta_0 + \beta X_{it} + \mu_i + \varepsilon_{it}$$

Where Y_{it} is the dependent variable in period t.
And X_{it} is the observed explanatory variable in period t.
$\mu_i$is the unobserved individual characterstics of the ith entity.
$\varepsilon_{it}$is the error term in period t.

In Fixed effects model the observed explanatory variables and unobserved characteristics are correlated.

That is E $(X_{it}, \varepsilon_{it}) \neq 0$

In Random effects model the equation is the same but the observed explanatory variables and unobserved characteristics are uncorrelated.

That means E $(X_{it}, \varepsilon_{it}) = 0$

The Hausman Test has been used to examine the appropriateness of the regression model.

Per capita net state domestic product at constant prices in the major states over time is calculated from 2005 to 2016 taking a lag of three years after government spending although the lag is two for the last slot due to non-availability of data for all the states. Only the non-special category states have been selected for this study because in special category states grants and expenditure of the central government play important role. Naturally the expenditure pattern and its impact on income of the state government cannot be assessed properly.

As per the selection of years for the use of data it can be said that we have taken public expenditure (from 2002 to 2014) in lag of three years to avoid endogeneity.That means, the impact of expenditure is expected to be reflected in income after three years. The years have been chosen depending on data readily available from Handbook of statistics of state government finances of Reserve Bank of India (different editions).

It is possible to take data for the entire period from 2002 to 2016 and in that case we have to go for using the technique of panel cointegration. Definitely if data is analysed for the whole period it will give a more comprehensive picture and the results are likely to be robust. However there are good works in the panel regression using several rounds of data (Debrajan et al.,1996; Ghosh & Gregoriou,2008; Marjit et al.,2013). So following these works we used five rounds of data for panel regression in the study and we have got meaningful results. The purpose of taking per capita net state domestic product (nsdp) in forward lag is to suggest that it will take at least three years to reflect the impact of public expenditure on per capita income. Secondly this procedure will help avoid endogeneity problem. That means it is per capita income that changes due to change in government expenditure not the otherwise.

3.1 Empirical analysis of Net State Domestic product (NSDP) of major States of India

Table 1.Per capita net state domestic product at constant prices (in Rupees) of the major states in India

Major States/Year	**2005**	**2008**	**2011**	**2014**	**2016**
Andhra Pradesh	27179	33733	38556	79174	96374
Assam	17050	18922	21741	44809	52416
Bihar	7588	10297	13149	23223	25950
Chattishgarh	18530	23926	27163	61146	68321
Goa	80844	90409	129397	241081	308823
Gujarat	36102	43685	56634	111370	131853
Haryana	40627	49780	61716	124302	143211
Himachal Pradesh	35806	41666	49203	105241	119387
karnataka	29295	37687	41492	105697	124093
kerala	35492	43644	52808	112444	128550
Madhya Pradesh	15927	19462	23272	44336	53047
Maharastra	40671	50183	61276	114750	133141
Odisha	18194	22963	24542	54211	67522
Punjab	34096	41003	46325	95807	105387
Rajasthan	19445	23356	29612	64522	72072
Tamil Nadu	34126	43193	57093	106189	117806
Uttar Pradesh	13445	15713	18014	34583	38934
West Bengal	23808	27914	32164	54520	61245

Source: Data taken from RBI Handbook of statistics on state government finances (several issues)

From the table it is seen that throughout the years the per capita net state domestic product (nsdp) at constant prices in case of Goa is highest among major Indian states where as in case of Bihar it is lowest. In 2005, Maharastra was second in per capita nsdp and Haryana was third. Then came,Gujrat,Himachal Pradesh, Kerala, Tamil Nadu,Punjab, Karnataka,Andhra Pradesh respectively. The position of West Bengal in per capita nsdp was eleventh among major eighteen states.

In 2008, Maharastra andHaryana performed in the same manner. Then it is Gujarat, Kerala, Tamil Nadu, Himachal Pradesh,Punjab, Karnataka,Andhra Pradesh and West Bengal.

In 2011, in case of per capita nsdp the best performer is Goa. Then it is Haryana, Maharastra, Tamil Nadu,Gujarat, Kerala, Himachal Pradesh, Punjab, Karnataka, Andhra Pradesh, West Bengal respectively.

In 2014, the base year of per capita nsdp at constant prices changed. Previously the base year

was 2004-05, and now it is 2014-15.This year if the performance of various states is taken in a series it will be like Goa, Haryana, Maharastra, Gujarat, Kerala, Tamil Nadu, Karnataka, Himachal Pradesh, Punjab, Andhra Pradesh, Rajasthan, Chattishgarh, West Bengal respectively. The position of West Bengal came in thirteenth position. Previously it was in eleventh position in the last three consecutive years.

In 2016, the performance series is Goa,Haryana, Maharastra, Gujarat, Kerala, Karnataka, Himachal Pradesh, Tamil Nadu, Punjab,Andhra Pradesh, Rajasthan, Chattishgarh, West Bengal respectively. This year also the position of west Bengal in per capita nsdp is thirteen.

So from the above study it is seen that India's 'BIMARU'states are developing but not catching up. Over nearly two decades, the BIMARU states have remained at the bottom, Goa, Maharastra, Haryana Gujarat, Kerala remain at the top. Bihar has remained India's poorest state over the period. Prior to state elections these states,political leader have sought to claim that because of their leadership, their state is no longer in BIMARU states. Coined in the early 1980's by demographer Ashish Bose, the acronym was used for the Northern states contributing significantly to India's population explosion. In 2015, economist Vinita Sharma found that while these states had made progress individually, they had not converged with the Southern states. The richest Indian states resemble upper middle income countries of the world. From the table above it is seen that, West Bengal from 2014, lagged behind the so called BIMARU states.

3.2 Analysis of share of revenue expenditure in total expenditure

Revenue expenditure is a day to day expenditure or current expenditure of the government. Total government expenditure is classified into revenue expenditure and capital expenditure. Revenue expenditure includes all those things, some of which serves developmental purposes though some of these are non-developmental in nature, whereas capital expenditure is mostly developmental because it means asset creation, although some components are non-developmental. Firstly, we can discuss about the share of revenue expenditure in total expenditure then turn to capital expenditure. Total expenditure is the addition of revenue expenditure and capital expenditure including public accounts. As revenue expenditure increases, capital expenditure declines in the annual budget because total fund is constant. The table of share of revenue expenditure in total expenditure is given below-

Table2.Share of revenue expenditure in total expenditure of the major states of India

States/Year	2002	2005	2008	2011	2014
Andhra Pradesh	0.758	0.717	0.765	0.78	0.861
Assam	0.796	0.872	0.815	0.876	0.864
Bihar	0.79	0.787	0.767	0.773	0.766
Chattishgarh	0.81	0.767	0.779	0.788	0.839

Goa	0.833	0.769	0.758	0.788	0.822
Gujrat	0.796	0.744	0.747	0.752	0.473
Haryana	0.883	0.852	0.779	0.805	0.877
Himachal Pradesh	0.777	0.753	0.7	0.802	0.817
Karnataka	0.782	0.802	0.771	0.759	0.806
Kerala	0.87	0.873	0.867	0.856	0.898
Madhya Pradesh	0.767	0.71	0.737	0.653	0.737
Maharastra	0.857	0.761	0.764	0.831	0.856
Odisha	0.755	0.864	0.794	0.823	0.78
Punjab	0.855	0.89	0.856	0.898	0.876
Rajasthan	0.79	0.79	0.798	0.821	0.813
Tamil Nadu	0.852	0.826	0.791	0.766	0.818
Uttar Pradesh	0.783	0.779	0.728	0.806	0.726
West Bengal	0.836	0.767	0.847	0.875	0.842

Source: Data taken from RBI Handbook of statistics on state government finances (several issues)

From the table it is seen that share of revenue expenditure in total expenditure in 2002 in case of Andhra Pradesh is three fourth of total expenditure. We know that revenue expenditure means expenditure on salary, wage, subsidy, allowance, pension etc. It does not help in the process of production and income generation. So spend of lower revenue expenditure means spending of higher capital expenditure. Because capital expenditure and revenue constitute are the two part of total expenditure. In 2002, share of revenue expenditure in total expenditure of Odisha was the lowest, and then it came Andhra Pradesh, Madhya Pradesh, Himachal Pradesh, Karnataka, Uttar Pradesh, Bihar, Gujrat, Chattishgarh, West Bengal etc. In 2002 Haryana spend more on revenue expenditure, then Kerala, Maharastra, Punjab and Tamil Nadu spent accordingly.

In 2005, Madhya Pradesh spent lowest as share of revenue expenditure. Andhra Pradesh, Gujrat, Himachal Pradesh, Maharastra, West Bengal and Chattishgarh came next. Punjab spent most on revenue expenditure in 2005 and Kerala, Assam, Odisha, Haryana, Tamil Nadu spent accordingly.

In 2008, Himachal Pradesh spent lowest as share of revenue expenditure. Uttar Pradesh, Madhya Pradesh, Gujrat, Goa, Andhra Pradesh, Bihar came next. Kerala, Punjab, West Bengal, Assam spent most as share of revenue expenditure in 2008.

In 2011,Madhya Pradesh , Gujrat, Karnataka, Tamil Nadu, Bihar, Andhra Pradesh, Goa spent lowest accordingly as share of revenue expenditure and Punjab, Assam, West Bengal, Kerala, Maharastra spent highest.

In 2114 Gujrat spent lowest among all the states as share of revenue expenditure and Uttar Pradesh, Madhya Pradesh, Bihar, Odisha, Karnataka came next. The highest expenditure as share of total expenditure was done by Kerala, Haryana, Punjab, Assam, Andhra Pradesh, Maharastra, and West Bengal accordingly.

From the above discussion it is seen that West Bengal spent higher as share of revenue expenditure in total expenditure and it is highest in 2011 among all the years. In this year it spent almost .875 as share of revenue expenditure. In case of Madhya Pradesh it spent lowest as share of revenue expenditure among all the years and spent more as capital expenditure so the per capita net state domestic product has increased remarkably and it claim not to be included in BIMARU state now.

3.3 Analysis of share of capital expenditure in total expenditure

We have already said that capital expenditure is mostly developmental in nature though some components in it are non-developmental. Capital expenditure means asset creation. Expenditure made by the government for creation of capital asset in the economy is categorised as capital expenditure. The table of share of capital expenditure in total expenditure is given below-

Table 3.Share of capital expenditure in total expenditure of the major states in India

States/Year	2002	2005	2008	2011	2014
Andhra Pradesh	0.242	0.283	0.235	0.22	0.139
Assam	0.204	0.128	0.185	0.124	0.136
Bihar	0.21	0.213	0.233	0.227	0.234
Chattishgarh	0.19	0.233	0.221	0.212	0.161
Goa	0.167	0.231	0.242	0.212	0.178
Gujrat	0.204	0.256	0.253	0.248	0.527
Haryana	0.117	0.148	0.221	0.195	0.123
Himachal Pradesh	0.223	0.247	0.3	0.198	0.183
Karnataka	0.218	0.198	0.229	0.241	0.194
Kerala	0.13	0.127	0.133	0.144	0.102
Madhya Pradesh	0.233	0.29	0.263	0.347	0.263
Maharastra	0.143	0.239	0.236	0.169	0.144
Odisha	0.245	0.136	0.206	0.177	0.22
Punjab	0.145	0.11	0.144	0.102	0.124

Rajasthan	0.21	0.21	0.202	0.179	0.187
Tamil Nadu	0.148	0.174	0.209	0.234	0.182
Uttar Pradesh	0.217	0.221	0.272	0.194	0.274
West Bengal	0.164	0.233	0.153	0.125	0.158

Source: Data taken from RBI Handbook of statistics on state government finances

From the table it is seen that share of capital expenditure in total expenditure in 2002 is highest in Odisha. Then Andhra Pradesh, Madhya Pradesh, Himachal Pradesh, Karnataka, Uttar Pradesh, Bihar, Assam, Gujrat came accordingly. In case of West Bengal, it stands twelfth among the states.

In 2005, share of capital expenditure in total expenditure of Madhya Pradesh ishighest among the states.Then it cameAndhra Pradesh, Gujrat, Himachal Pradesh, Maharastra, West Bengal,Goa, Uttar Pradesh, Bihar, Rajasthan respectively.

In case of Himachal Pradesh, share of capital expenditure in total expenditure is nearly onethird and it is the highest in 2008. Uttar Pradesh, Madhya Pradesh, Gujrat, Goa, Maharstra, Andhra Pradesh came accordingly after Himachal Pradesh. The share of capital expenditure in total expenditure in case of west Bengal is meagre and its position is fifteenth among eighteen states.

In 2011 Madhy Pradesh spent most as share of capital expenditure in total expenditure among the states. Then Gujrat, Karnataka, Tamil Nadu, Bihar, Andhra Pradesh, Goa, Chattishgarh, Himachal Pradesh spent accordingly. In this year West Bengal's performance in capital expenditure is very poor.

Gujrat spent above fifty percent of its share of capital expenditure in total expenditure and it is the highest in 2014. Then Uttar Pradesh, Madhya Pradesh, Bihar, Karnataka, Rajasthan Himachal Pradesh, Tamil Nadu came next. West Bengal's position is eleventh in spending capital expenditure.

From the above findings it is seen that throughout the years Madhya Pradesh has spent more as share of capital expenditure in total expenditure and it performed quite well in increasing its per capita net state domestic product. Whereas state like Punjab spent more revenue expenditure as share of total expenditure and it is now a heavily indebted state in India. Even state like Bihar also spent more capital expenditure and its performance is satisfactory.

4. Results of panel regression and Discussion

Panel regression of per capita net state domestic product (nsdp) at constant prices on the share of revenue expenditure and capital expenditure in the total expenditure of the states has been done. Here waves of data are five rounds. Per capita net state domestic product at constant prices has been used as dependent variable. The share of revenue expenditure and capital expenditure in total expenditure have been taken as explanatory variables for the years 2002, 2005, 2008, 2011 and 2014 in panel regression using 5 waves of data. The results of the panel regression are shown in table 4 and 5.

Table 4. Panel Regression of per capita net state domestic product at constant prices on revenue expenditure of the state governments

Group variable: state

Dependent Variable: per capita net state domestic product (nsdp).

Explanatory Variable: revenue expenditure of the state government as share of total expenditure (sh_rev_exp_cons).

Number of groups (states): 18

Number of observations: 90

Time period: 5

Fixed effects (within) regression

R-sq: within = 0.1946
Between =0.3598
Overall =0.0451

F (1, 71) = 17.15

Prob> F= 0.0001

Exp. Variable	Coefficient	t	p > I t I
Sh_rev_exp - .908221	- 4.4*	0.000	
Cons	11.04538	120.37*	0.000

Random-effects GLS regression:

R-sq: within = 0.1946
Between = 0.3598
Overall = 0.0451

Wald chi2 (1) = 13.20

Prob> chi2 =0.0003

Exp. Variable	Coefficient	Z	p >I zI
Sh_rev_exp- .8387203	- 3.63*		0.000
Cons 11.02149	80.32*0.000		

denotes significant at 1% level.

Hausman test accepts random effects model

So we can say that it has less impact on per capita net state domestic product (nsdp).

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Table 5. Panel Regression of per capita net state domestic product at constant prices on capital expenditure of the state government

Group variable: state
Dependent Variable: per capita net state domestic product (nsdp).
Explanatory Variable: capital expenditure of the state government as share of total expenditure (sh_cap_exp_cons).
Number of groups (states): 18
Number of observations: 90
Time period: 5
Fixed effects (within) regression:
R-sq: within = 0.2338
Between =0.0669
Overall =0.0788
F (1, 71) = 21.67
Prob>F= 0.0000

Exp. Variable	Coefficient	t	p > I t I
Sh_cap_exp.	9462636	4.65*	0.000
Cons	10.12837	2.54*	0.000

Random-effects GLS regression:
R-sq: within = 0.2338
Between = 0.0669
Overall = 0.0788
Wald chi2 (1) = 20.37
Prob> chi2 =0.0000

Exp. Variable	Coefficient	Z	p >I zI
Sh_cap_exp.	9200973	4.51*	0.000
cons	10.14502	55.40*	0.000

Denotes significant at 1% level

In both the cases (Fixed effects model and Random effects model) of panel regression of capital expenditure as share of total expenditure, the coefficients are positive and probability is zero. And also F statistics is high. So it is statistically significant.

Since regression has been done as share of total expenditure of states, per capita net state domestic product has been taken as log form because it is a big number. Expenditures have been taken in three years lag so that the effect expenditure is reflected in income growth. Since the coefficient is positive and significant, it means, if the share of capital expenditure is increased, it helps economic growth through infrastructure development and capital formation. As a result, per capita income increases.

5. Summary and Conclusions

This paper examines the composition of government spending and its impact on per capita net state domestic product (nsdp). There are differences of opinion on revenue expenditure and capital expenditure in the government budget in respect of their impact on growth. In general, growth means gradual rise of per capita net state domestic product. Revenue expenditure means day to day expenditure of government. It includes wages and salaries, subsidy, pension, expenses on administrative services, interest payment on public borrowing etc. whereas capital expenditure generally includes investment for long term growth like-power and irrigation, road and railway communication etc. So the general norm is like that the more and more fund of government budget allocated to capital expenditure the growth will be higher and higher. In this study we have excluded public expenditure like inter-state settlement, contingency fund, small savings, provident funds etc., reserve funds, deposits and advances, suspense and miscellaneous, appropriation of contingency fund and remittances are excluded from capital expenditure as it is in the guide lines of Reserve Bank of India.

The study finds larger share of government spending has been allocated to revenue expenditure in Indian states over the years. We have seen that the expenditure on the development of infrastructure like road, irrigation, power generation telecommunication etc. (capital expenditure) which are lacking in some states is likely to accelerate growth. In this study we have broadly taken two types of expenditures in all forms of government's expenditure- revenue expenditure and capital expenditure. Some so called BIMARU states have been increasing their share of capital expenditure and their per capita net state domestic products (nsdp) are increasing. Since productivity of revenue expenditure is low compare to capital expenditure, economic growth will be lower if more money is allocated to revenue expenditure. The panel regression in econometric analysis based on state level data shows that revenue expenditure has low impact on growth whereas capital expenditure has high positive effect.

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A Study on Tank Irrigation Productivity in Saline Zone of South 24 Parganas

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Abstract

Tank irrigation is considered as most important irrigation source, particularly in the dry and saline zones of India. It plays the vital role in improving the yield or productivity in the agricultural sector. The present paper attempts to find the different characteristics of tank irrigation in the saline zones and draw lessons for improving the productivity of tank irrigation. Sixty five water bodies have been selected from five blocks of the district of South 24 Parganas to understand the influencing factors for the tank productivity in saline zones. The regression results show that large command area, proper management and less number of benefited families are responsible for higher tank productivity.

Keywords: Irrigation water; Tanks; Productivity; Saline Zone; South 24 Parganas

Introduction:

Water is the unique gift of nature and as a natural factor it has an important role in human civilization.Being natural resource water cannot be treated as pure public good; sometimes it acts as private good as it is available at private cost (Gatto and Lanzafame, 2005). With the increasing population, the freshwater sources are being exploited all over the world.Groundwater becomes the only source of potable water in the region where fresh surface water is not available (Bhadra et al., 2018). At least, half of the world's population depend on ground water to meet their potable water need (UNESCO, 2015). This ultimately creates an upward pressure, leads to a crisis, conflicts and disagreement among the users. Moreover it generates excessive, unexpected and unhealthy pressure on ecology and environment which ultimately leads to environmental degradation (UN Water Report, 2007).With an increase in the consumption of water resources by 70% and withdrawals of water resources by 15%, agricultural production will be increased by 60% to feed 9 billion people by 2050. Due to this high rate of growth of population, demand for fresh water increases by lips and bound. If demand for the utilization of water resources is increasing at this repaid rate then about 1.8 billion people of this globe will reside in water scarce regions by 2025 (UN Water Report, 2007).India will be declared as water scarce region if per capita availability of fresh water falls to 1000 cubic meter per year (Das, 2009).

Irrigation is the most important factor behind the success of agriculture in Indian economy, because of the geomorphological differences in the different region of the country. Among the irrigation sources, tank irrigation is considered important as it can play a very critical role in the sustainable irrigation development particularly in the dry and saline zones (Jana et al., 2012). There are many advantages of tank irrigation (Gulati, et al. 1994, Palanasai et al 2010, Agarwal 2001, Vaidyanathan 2006 , ADB 2006, Pain et al 2008, Reddy 2009, Jana 2009, Jana et al 2012, Jana and Lise 2013, Jana et al 2018, Reddy et al 2018, Lise et al 2019).Temporal and spatial variation of the rainfall in the country calls for a scientific and environmentally

sustainable irrigation management in the country with a long term perspective. With the introduction of mechanized system of irrigation techniques, India relied much on ground water lifting for irrigation purpose, since independence. But with the threat of global warming, environmental degradation and ground water depletion tank water irrigation through rain water harvesting can plays a significant role in agricultural production in arid and semi-arid region in India. Tanks store the monsoonal run-off which also acts as a recharge of ground water, are utilized for the multidimensional purposes. Tanks as a common property resources are generally used for the purposes of irrigated agricultural, for the domestic uses, for drinking water and for aquaculture. It also helps to restore sustainable ecological balance. In India, tank irrigation has strong historical background in the state of Tamil Nadu, Odisha, Andhra Pradesh, Kerala, Karnataka and West Bengal.

In the rural economy of India, tanks are the life line through which people earned their livelihood. Stakeholders like small farmers, marginal farmers, landless agricultural labourers and women are heavily dependent on the tank for their livelihood. Tanks store this huge runoff and also act as a genuine moderator of flood. So, this century old rainwater harvesting irrigation system is still one of the important sources of irrigation in rural India in dry seasons and acts as an insurance against drought.Basic problems of this irrigation tank are the poor and insufficient maintenance and management of this common only used water bodies from time immemorial. Due to this negligence, siltation, reduction in storage capacity, encroachment, high degree of seepage in the delivery system are commonly seen in the tank irrigation system which is an obstacle in way of utilizing tank irrigation in a sustainable manner. Therefore, there is an urgent need of strong, effective and rational management system for socially, economically, environmentally sustainable use of this tank irrigation system for the better present and future use.For the sustainable management of irrigation system, there is a need to assess the tank productivity. The broad objectives of this study of tank irrigation are:

- To investigate the different characteristics of tank irrigation in the saline zone.
- To understand the overall status of tanks in saline zone.
- To examine the performance of tanks and factors affecting it.

Study Area:

South 24-parganas district is located in saline zone in West Bengal in India. It is situated in the extreme southern part of West Bengal (22º 33' 45" N - 21º 29' 00" N latitudes and 89º 4'50" E - 88º 3'45" E longitudes). The total geographical area of the district is 9960 sq.km. The district is bounded by Kolkata and North 24 Parganas on the North, Sundarban and Bay of Bengal on the South, Bangladesh on the East and Hooghly River on the West.

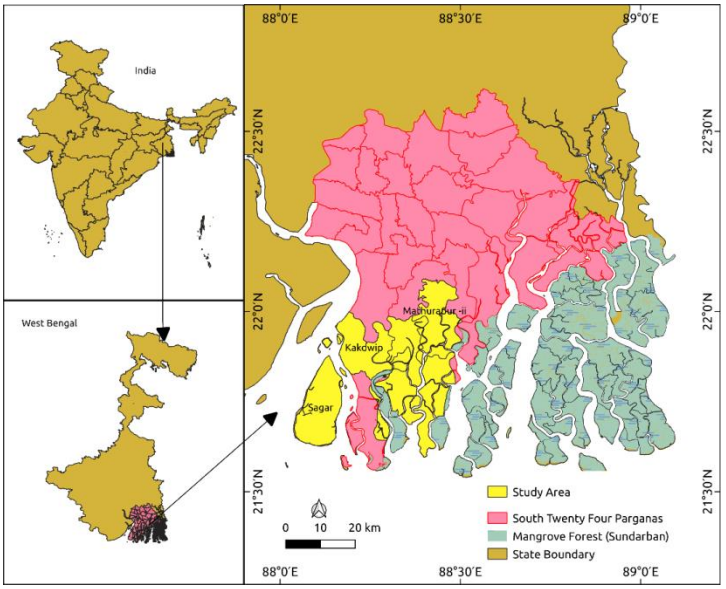

Figure 1. *The study area map of South 24 Parganas*

According to 2011 census, the total population of South 24 Parganas is 8.16 million and growing at an estimated rate of 1.82% per year, which is higher than that of the state of West Bengal (1.38%) and India (1.76%) between 2001 and 2011. People are mainly dependent on agriculture, working as cultivators and agricultural labourers. The major crop grown in the district is rice. The yield rate of rice is 2322 kg per hectare in South 24 Parganas (DSHB, 2011). Along with agriculture, rural people practice multiple secondary livelihood activities such as aquaculture, honey collection, crab collection.

Five blocks of South 24 Parganas district namely Patharpratima, Matharapur-II, Kakdwip, Sagar and Namkhana which are closer to Bay of Bengal have been selected for the study. There is high degree of salinity problem in the ground water and surface water (river water) in the selected blocks. Agricultural activities of these blocks mainly depend on the rain fed surface water irrigation system i.e. tanks (ponds, khal, and beals).

Methodology:

In the present study, total 65 water bodies (Khal = 30 and Tank = 35) have been selected from five blocks of South 24 Parganas (Kakdwip, Mathurapur-II, Sagar, Namkhana and Patharpratima)to understand the controlling factors for the tank productivity in saline zones. To achieve the above mentioned objective, multiple linear regression model has been used for the present study in STATA and SPSS platforms.

Multiple Linear Regression for Determinants of Total Productivity:

Tank productivity is the value of production per acre of irrigated area, which depends on many factors (Jana et al 2012). To understand the influence of different variables/factors on the tank productivity multiple linear regression model has been used in the present study. This model is to find out whether the independent variables have any significant impact on the dependent variable. Based on literature surveys and collected primary data sets, six independent variables – capacity or volume of water body, management, water availability, command area, soil type, beneficiaries have been considered for this study. Due to less variation in the data and sample size, two or three

relevant variables (fishery, tank conditions) haven't been used. In this study, the sample size (cases) is 65 (30 large water-bodies and 35 small water-bodies). The subjects-to-variables (STV) ratio is 10:1 (10 cases per variable), which is fair enough for the study.

The model is represented as follows:

$TOTPODY = bo + b_1CAPCT + b_2MANGE + b_3WTAVL + b_4COMDA + b_5SOLTY + b_6BNFCS$

Where, TOTPODY = Total productivity at tank level (rupees/acre)

CAPCT = Capacity or volume of water body ('000 m^3)

MANGE = Whether management is present for tank (=1 if present, = 0 otherwise)

WTAVL = Water availability for irrigation (months)

COMDA = Command area of tank (acre)

SOLTY = Soil character in the tank command area (=1 if loamy,

0=otherwise)

BNFCS = Number of beneficiaries in tank command area

Results and Discussion:

Based on the collected primary data, the characteristics of water bodies have been discussed in three major parts – (a) tank conditions, (b) extent of irrigation by tanks and (c) tank productivity.

Table 1.*Some Basic Characteristics of the Selected 65 Water bodies*

Characteristics	**Tank (*N* = 35)**	**Khal (*N* = 30)**	**All Water bodies (*N* = 65)**
Area (acre)	0.04	10.27	4.76
Depth of water body (ft.)	11.20	9.50	10.40
Capacity ('000 m^3)	0.62	123.21	57.20
Number of beneficiaries (families)	2.14	223.40	104.26
Water availability (months)	12	8.80	10.50
Command area (acre)	0.92	95.37	44.51
Soil quality (1 = Bad – 5 = Good)	3.70	3.60	3.65
Irrigation water quality (1 = Bad – 5 = Good)	4.26	3.43	3.88
Management	Personal = 35	Government = 29, Community = 1	Government = 29, Community = 1, Personal = 35

Data Source: *Primary Survey, 2018*

Tank Conditions:

The average area of all water bodies is 4.76 acres, whereas it is 0.04 acre for tanks and 10.27 acres for khals. It is observed that average depth of tanks (11.20 ft.) is more than khal (9.50 ft.). The depth of water body is not uniform in all seasons. During rainy season the average depth of all water bodies is 10.04 ft. It is only 4.51 ft. during the time of summer. The age of all water bodies varies from 16 years to 120 years. Large water bodies are more than 100 years old. It is understood that large water bodies were constructed during the British period to manage or overcome from the drought situations.

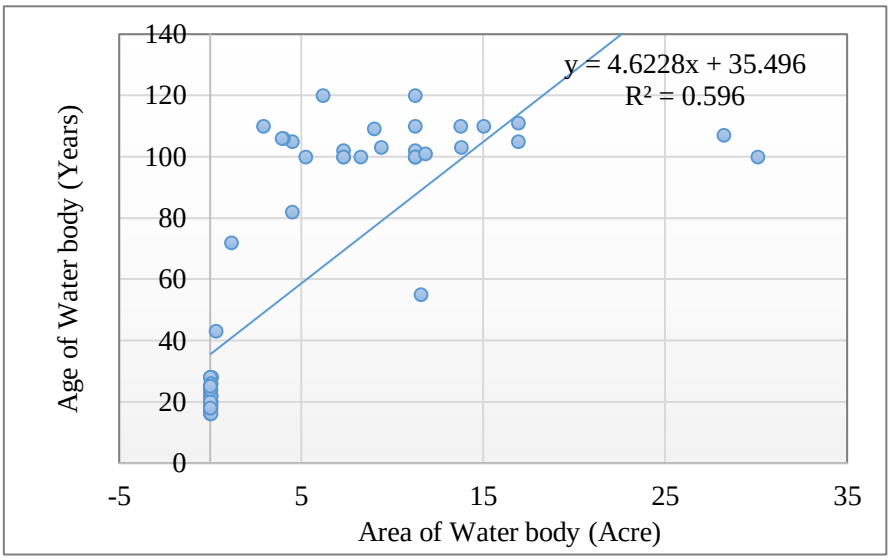

Figure 2.*Age and Size of All Water-bodies*

The capacity or volume of water body has been calculated from area and depth, and it is more than 57000 m^3 (average). This capacity is 123210 m^3 for khals and 620 m^3 for tanks. The average water availability of all water bodies is 10.50 months. During rainy season, 96 percent of total water spread areas are filled with rain water, and it is very low during summer (50%). In the last 10 years, on an average, 90-100% of the tank was filled for 2.1 years; 70-90% was filled for 6.2 years and below 70% was filled for 1.7 years.

Extent of Irrigation by Tanks:

The average command area of all water bodies is calculated as 44.51 acre. *5 No.Gheri Khal* has the highest command area (363.64 acre), whereas *Chapla Khal* shows the lowest command area which is less than 1 acre. Average number of beneficiary farmer families per water body is 104. In other words, on an average, 100 farmer families are benefited from one water body. Khals like 5 No. Gheri, Tetulia, Gajir, Sodial, Jogendrapur and Raidighi give benefit to more than 300 families.

Only 2 families are benefitted from one small tank.

Out of 65 water bodies surveyed, 29 water bodies are managed by the government organisations or departments and 1 water body managed by the community. 30 small water-bodies are owned and managed by famer families. More than 90 percent of all the water bodies are lift irrigation types.

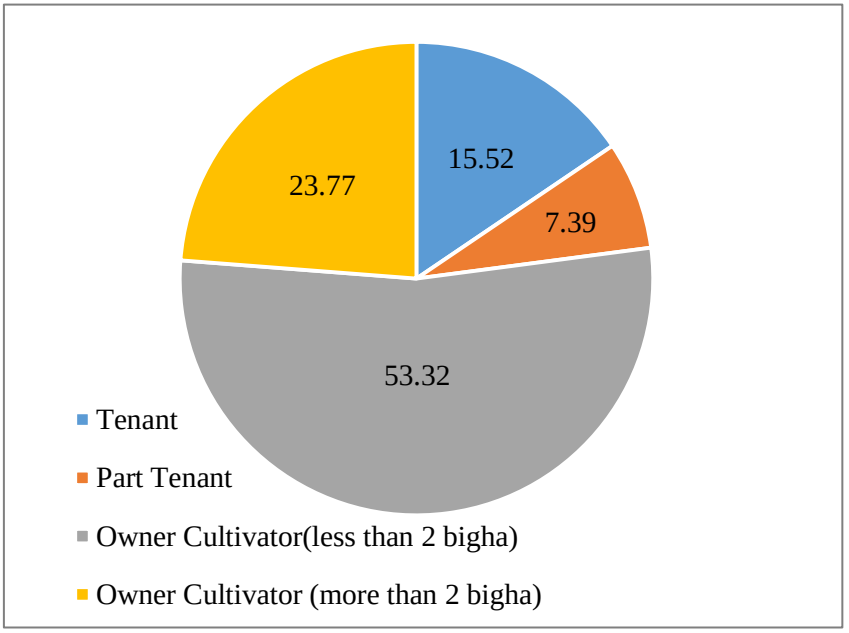

Figure 3.*Type of Farmers in the Tank Command Area*

All farmers, including small and marginal are dependent on tank water irrigation system for cultivation. Owner cultivators (less than 2 bigha) constitute 53.32% of the total farmers in the command area.

Tanks are used for many purposes. Other than irrigation, villagers use tank/khal water for different purposes like domestic uses, fisheries and Plantation. Many families dependent on livestock, keep cows, ducks, goat, and sheep in their homestead which supplements their income. They are rarely used for the family's own consumption. It can be said that all the water bodies in the identified location provides economic benefits to the rural people.

Tank Productivity: The productivity of all water bodies has been measured by the value of production per acre of irrigated area, known as tank productivity. The average irrigated area and production value are 44.51 acres and INR 44, 934 respectively. It is understood that this productivity is related to many aspects of cultivation.

Apart from the tank productivity, tank increases the land value and reduce the yield risk. The average land value for irrigated land is 1.53 lakhs per acre and 1.07 lakhs per acre for non-irrigated land in the study area.The crops grown in tank command area gets the benefit of life-saving irrigation as a result of which the yield loss is reduced. The yield of Kharif paddy is always higher than the crops outside the tank command areas. It is understood that the crop loss due to inadequate rainfall or dry spell is reduced in tank command areas. The primary survey data clearly reveals that tanks are still a crucial component of the rural livelihood of the South 24 Parganas, particularly in the saline zones.

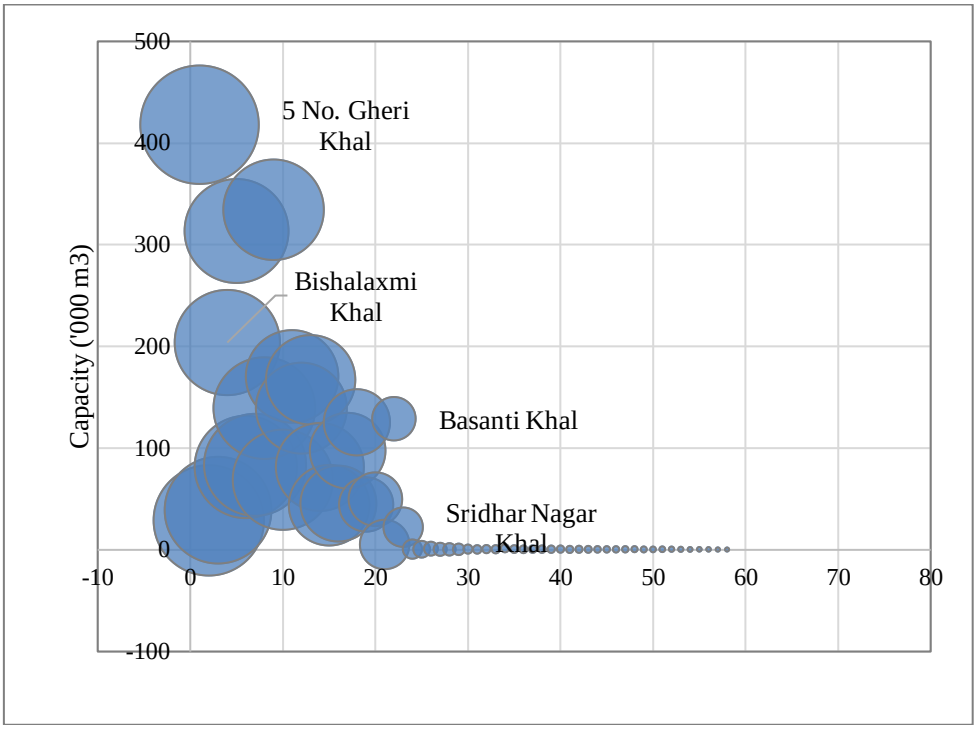

Figure 4.*Bubble Diagram showing Total Productivity (size) and Capacity of All water bodies*

Factors Influencing Tank Productivity in Saline Zone:

To understand the influence of different variables/aspects on the tank productivity multiple linear regression model has been used. Six variables – capacity or volume of water body (‘000 cubic metre), management, water availability (months), command area (acre), soil type, beneficiaries (families) have been considered for this study. The correlation matrix of all selected variables is presented inTable 2. It is found that the selected variables are not highly correlated with each other, which suggests that there is no multi-collinearity issue.

Table 2.*Correlation Matrix of All Selected Variables*

Correlation Matrix						
	Capacity	Beneficiaries	Management	Water availability	Soil type	Command area
Capacity	1.000	.784	-.526	-.642	.513	.729
Beneficiaries	.784	1.000	-.724	-.718	.621	.916
Management	-.526	-.724	1.000	.791	-.400	-.591
Water availability	-.642	-.718	.791	1.000	-.489	-.699
Soil type	.513	.621	-.400	-.489	1.000	.687
Command area	.729	.916	-.591	-.699	.687	1.000
a. Determinant = .004						

Table 3.*Collinearity statistics for Regression analysis*

Model		**Collinearity Statistics**	
		Tolerance	**VIF**
	Capacity	.345	2.901
	Beneficiaries	.206	4.848
	Management	.247	4.045
	Water availability	.257	3.884
	Soil type	.527	1.897
	Command area	.258	3.869
Dependent Variable: Productivity (Rs. /acre)			

The results show that the model is fit and almost 20 percent of variation in the tank productivity is explained by the variables included in the model.

Table 4.*Estimated Regression Coefficients of the Tank Productivity Analysis*

Tank Productivity	*Coefficient*	*Std. Err.*	*t*	*Sig.*	*[95% Conf. Interval]*	
Capacity	-0.041046	0.0227124	-1.81	0.076*	-0.0865099	0.0044179
Management	17.88614	5.94628	3.01	0.004***	5.983368	29.78891
Water availability	1.413835	1.236072	1.14	0.257	-1.060432	3.888102
Command area	0.3177473	0.0516272	6.15	0.000****	0.2144042	0.4210904
Soil type	0.3614115	5.093652	0.07	0.944	-9.834641	10.55746
Beneficiaries	-0.1383478	0.0261886	-5.28	0.000****	-0.1907699	-0.0859257
Constant	21.92468	10.66526	2.06	0.044**	0.5758365	43.27352
Observations = 65; F(6, 58) = 9.35; Prob.> F = 0.0000; R-squared = 0.1941						
**** p < 0.001, *** p < 0.01, **p < 0.05, * p < 0.1						
Data Source: *Estimated from Primary Survey, 2018*						

The results show that the significant variables are beneficiaries with negative coefficient value, and command area, management with positive signs. It can be interpreted that large command area, proper management and less number of benefited families are responsible for higher tank productivity. In the case of other variables, they have expected signs, but are not significant.

It is clear from the regression analysis that management aspect is very important in increasing the tank water productivity. Government, community and personal level initiatives and tank

management activities can influence the productivity and change the socio-economic scenario of the study area. The command area is also expected to positively influence the tank water productivity. If the command area is large then production will be more and if the area is small then production will be less. Families who are dependent on tank water for irrigation and other domestic purposes use water as much as they can do. They are using tank water as public good, and overuse tank water sometimes which reduces the tank water productivity.

In the present analysis, water availability is not significant but it improves the tank productivity. It is quite possible to increase the water availability by improving the catchments and field channels. It is also observed during the survey that few tanks with good structures have the higher water availability. It can be suggested that according to the tank productivity, the tank rehabilitation options are important in improving the tank performance in the district as well as state.

It is true that proper maintenance of water body can increase or improve the productivity. Figure 5 shows the reasons for lack of maintenance of water bodies in the selected locations of South 24 Parganas. Most of the respondents reported that poverty/financial constraints, encroachment, political issue are the main reasons behind the lack of maintenance of water bodies.

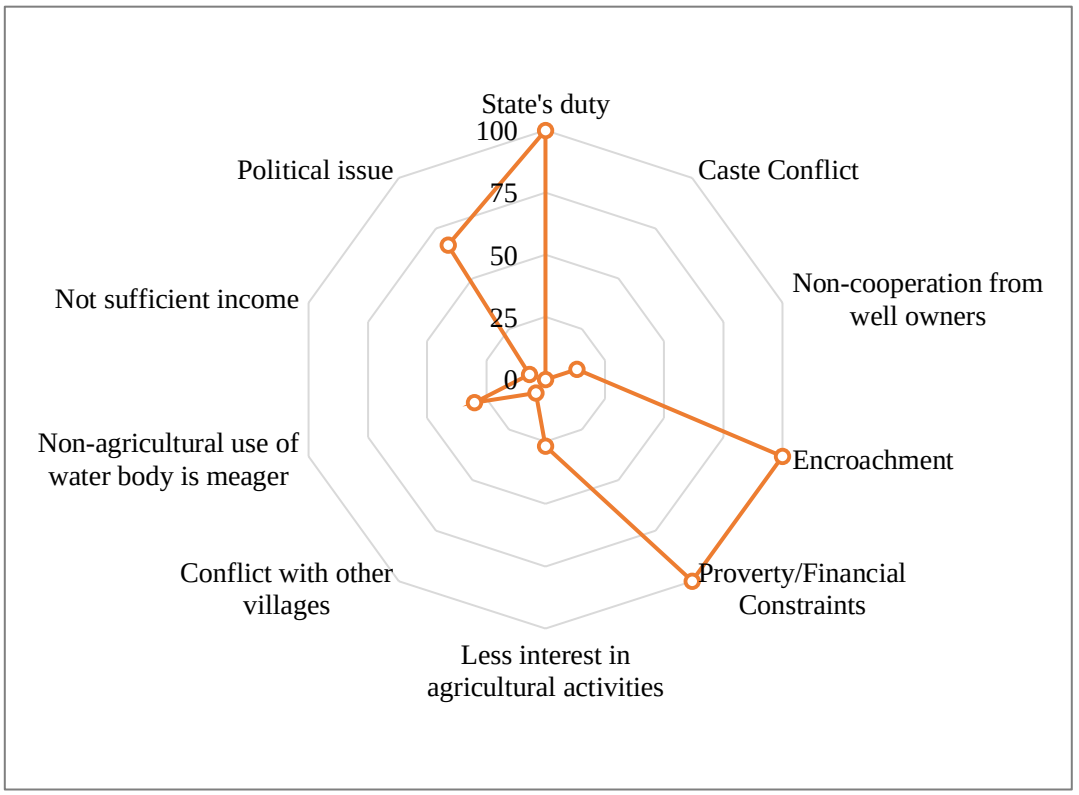

Figure 5.*Reasons for Lack of Maintenance of Water bodies*

The survey reveals that after the renovation of water bodies, the area of cultivation in the command area and value of production will be significantly changed in the study area. The growth rate of production, before and after the renovation of water bodies will be more than 100%. In figure 6, the improvement in average value of production of different crops and items has been

presented.

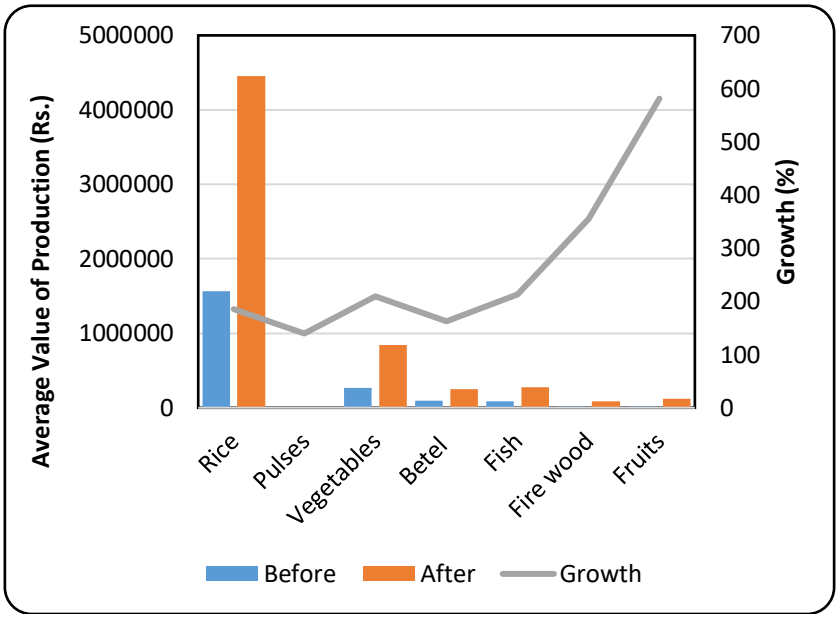

Figure 6. *Productivity Improvement after Water body Renovation*

Conclusion:

Tank irrigation is one of the practices of Indian irrigation system. The study reveals thatlarge command area, proper management and less number of benefited families are responsible for higher tank productivity. Government, community and personal level initiatives in tank management activities can influence the productivity and change the socio-economic scenario in saline zones. The renovation of water body is very much needed to increase the productivity. It can be said that after the renovation of water bodies, the area of cultivation in the command area and value of production will be significantly changed in the study area. For both farmers' and government perspectives, sustainability of irrigation systems is very important in the present days. Well-maintained channels, proper maintenance, adequate water supply, sufficient effort are very much needed in irrigation management. Further study on productivity analysis of all water bodies is needed to know the more about the efficient and inefficient tanks in saline zone of South 24 Parganas. This study will help to the policy makers to develop an implementable, efficient and district level policy for irrigation planning.

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