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IMPACT OF FEMALE LITERACY ON IMR, CBR & TFR IN INDIA

Ashis Kr. Mukherjee* & Moumi Laha**
* Department of Economics, Nistarini College, Purulia, West Bengal
** Student of J. K. College, (Economics Hons.), Purulia, West Bengal

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Abstract:

Literacy and Education are the key variables for economic development. Education and better literacy level have a positive impact on the health parameters, higher productivity, higher income, human freedom, increased participation in community life etc. In India it has been found out that illiterate women face more deprivation in life than literates. They have high levels of fertility rate and also a high level of mortality rate. Different studies found out that infant mortality rate and crude birth rate are inversely related to mother's educational level. In this Study We have attempted to understand the nature of this inverse relationship. Data on infant mortality rate (IMR), crude birth rate (CBR), Total Fertility Rate (TFR) and the female literacy on 24 Indian states were collected. The change in the female literacy rate, Crude Birth Rate, Total Fertilty Rate and the IMR between consecutive censuses was determined. The analysis suggests that female literacy is more effective in reducing Infant Mortality Rate as well as Crude Birth Rate and Total Fertility Rate.

Key Words: Infant Mortality Rate, Crude Birth Rate, Total Fertility Rate & Female Literacy.

1. Introduction:

Literacy and Education are the key variables for economic development in this country. But there is a wide gender disparity in India's literacy rate .According to 2011 census male literacy rate of India is 82.14% whereas female literacy rate is 65.46%. So there is a large gap between male and female literacy. If females are illiterate then this has a direct and negative impact on the economy. When a girl or a woman is uneducated, the entire family has to bear the burden of her illiteracy. Education and better literacy level have a positive impact on the health parameters, higher productivity, higher income, human freedom, increased participation in community life etc. In India it has been found out that illiterate women face more deprivation in life than literates. They have high levels of fertility and also mortality. They also suffer from malnutrition and all other health related problems and these are due to lack of literacy. Among the benefits of education in women are many and varied; one prime benefit is healthier children. Different studies found out that infant mortality rate are inversely related to mother's educational level. By Infant Mortality Rate (IMR) we mean is the number of infant deaths per 1000 live births .On the other hand Crude Birth Rate is the number of live birth per year and is almost always reported per 1000 living people. In this paper main focus given on female education and its impact on Infant Mortality Rate as well as Crude Birth Rate and Total Fertility Rate.

2. Objectives of the Study:

The main objectives of the study are:

- To analyse the change in Female Literacy Rate during the census period 1991 to 2011.
- To analyse the change in Infant Mortality Rate during the decades 1991 to 2011.
- To analyse the change in Crude Birth Rate during the decades 1991 to 2011.
- To analyse the change in Total Fertility Rate during the decades 2001 to 2011.
- To analyse the inverse relationship between Female Literacy Rate and Infant Mortality Rate.
- To analyse the inverse relationship between Female Literacy Rate and Crude Birth Rate.
- To analyse the inverse relationship between Female Literacy Rate and Total Fertility Rate.

3. Sources of Data and Methodology:

In this study we use secondary data. We use Census of India data published by government of India from 1981- 2011. Apart from this a number of articles published in various National and International journal have also been consulted for the purpose. We also used the website http://planning commission.gov.in. Due to lack of availability of data we neglet some states and consider only 24 states. In this analysis we have considered four important variables which are Female Literacy Rate, Infant Mortality Rate, Total Fertility Rate and Crude Birth Rate. We have calculate separately the correlation coefficient between Female Literacy Rate and Infant Mortality Rate and the correlation coefficient between Female Literacy Rate and Crude Birth Rate by using the formula:

$$r = \text{Cov}(x, y) / S_x S_y$$

Where S_x , S_y are the standard deviations of x and y respectively.

We also use different statistical tools like, t-test, F-test etc. We use multiple regression analysis taking infant mortality rate as dependent variable and total literacy and female literacy as independent variables.

4. Results and Discussion:

4.1 Female Literacy Rate and Its Change in the Decades 1991-2011:

Table 1: Female Literacy Rate and its change

States	Female Literacy Rate			Literacy Rate Change	
	1991	2001	2011	1991-01	2001-11
Uttar Pradesh	25.3	42.2	59.2	16.9	17
Maharashtra	52.3	67	75.4	14.7	8.4
Bihar	22.9	33.1	53.3	10.2	20.2
West Bengal	46.5	59.6	71.1	13.1	11.5
Madhya Pradesh	28.8	50.3	60	21.5	9.7
Tamil Nadu	51.3	64.4	73.8	13.1	9.4
Rajasthan	20.4	43.9	52.6	23.5	8.7
Karnataka	44.3	56.9	68.1	12.6	11.2
Gujarat	48.6	57.8	70.7	9.2	12.9
Andhra Pradesh	32.7	50.4	59.7	17.7	9.3
Odisha	34.7	50.5	64.3	15.8	13.8
Arunachal Pradesh	29.7	43.5	59.5	13.8	16
Goa	67.1	75.4	81.8	8.3	6.4
Haryana	40.5	55.7	66.7	15.2	11
Himachal Pradesh	52.1	67.4	76	15.3	8.6
Kerala	86.2	87.7	91.9	1.5	4.2
Manipur	47.6	60.1	73.1	12.5	13
Meghalaya	44.8	59.6	73.7	14.8	14.1
Mizoram	78.6	86.7	89	8.1	2.3
Nagaland	54.7	61.5	76.6	6.8	15.1
Punjab	50.4	63.4	71.3	13	7.9
Sikkim	46.7	60.4	76.4	13.7	16
Tripura	49.6	64.9	83.1	15.3	18.2
Chandigarh	72.3	76.5	81.3	4.2	4.8

Table 1 depicts the data on female literacy rate in the decades 1991 to 2011 and the change in the female literacy rate between the consecutive census. According to 2011 census Kerala is the state where literacy rate is high and Rajasthan is the state where literacy rate is low. In Kerala female literacy rate is 91.9% whereas in Rajasthan the female literacy rate is 52.6. The rate of change of female literacy is high in Bihar and in Mizoram the rate of change of female literacy is low. In Bihar rate of change of female literacy is 20.2% whereas in Mizoram the rate of change in female literacy is 2.3. The states Uttar Pradesh, West Bengal, Karnataka, Gujarat, Odisha, Arunachal Pradesh, Haryana, Manipur, Meghalaya, Nagaland, Sikkim and Tripura have higher female literacy rate. The rate of change of female literacy is greater than 10%. The other state shows a rate of change of female literacy less than 10%.

4.2 Infant Mortality Rate and its Change in the Decades 1991-2011:

Table 2: Infant Mortality Rate and its change

States	Infant Mortality Rate			Change in IMR	
	1991	2001	2011	1991-01	2001-11
Uttar Pradesh	89	84	57	5	27
Maharashtra	58	49	25	9	24
Bihar	70	57	44	13	13
West Bengal	67	59	32	8	27
Madhya Pradesh	107	94	59	13	35
Tamil Nadu	53	44	22	9	22
Rajasthan	81	79	52	2	27
Karnataka	60	54	35	6	19
Gujarat	69	59	41	10	18
Andhra Pradesh	49	43	43	6	0
Odisha	108	90	57	18	33
Arunachal Pradesh	83	61	32	22	29
Goa	34	28	11	6	17

Haryana	55	40	44	15	-4
Himachal Pradesh	75	45	38	30	7
Kerala	37	18	12	19	6
Manipur	36	31	11	5	20
Meghalaya	76	58	52	18	6
Mizoram	58	41	34	17	7
Nagaland	55	39	21	16	18
Punjab	54	43	30	11	13
Sikkim	57	43	26	14	17
Tripura	78	64	29	14	35
Chandigarh	46	44	20	2	24

Table 2 depicts the data on Infant Mortality Rate in the decades 1991 to 2011 and the change in the Infant Mortality Rate between the consecutive census. According to 2011 census Madhya Pradesh is the state where infant mortality rate is high and Goa and Manipur is the state where infant mortality rate is low. In Madhya Pradesh infant mortality rate is 59% whereas in Andhra Pradesh the infant mortality rate is 0%. The rate of change of infant mortality is high in Madhya Pradesh and Tripura and in Andhra Pradesh the rate of change of infant mortality is lowest. In Madhya Pradesh and Tripura rate of change of infant mortality is 35% whereas in Mizoram the rate of change in infant mortality is -4%. The states Uttar Pradesh, West Bengal, Karnataka, Gujarat, Odisha, Arunachal Pradesh, Haryana, Manipur, Meghalaya, Nagaland, Sikkim and Tripura have higher female literacy rate. The rate of change of female literacy is greater than 10%. The other state shows a rate of change of female literacy less than 10%.

4.3 Crude Birth Rate and Its Change in the Decades 1991-2011:

Table 3: Crude Birth Rate and its change

States	**Crude Birth Rate**			**Change in CBR**	
	1991	**2001**	**2011**	**1991-01**	**2001-11**
Uttar Pradesh	35.7	32.1	27.8	3.6	4.3
Maharashtra	26.2	20.7	16.7	5.5	4
Bihar	30.7	31.2	27.7	-0.5	3.5
West Bengal	27	20.6	16.3	6.4	4.3
Madhya Pradesh	35.8	31	26.9	4.8	4.1
Tamil Nadu	20.8	19.1	15.9	1.7	3.2
Rajasthan	35	31.1	26.2	3.9	4.9
Karnataka	26.9	22.2	18.8	4.7	3.4
Gujarat	27.5	25	21.3	2.5	3.7
Andhra Pradesh	26	21	17.5	5	3.5
Odisha	28.8	23.5	20.1	5.3	3.4
Arunachal Pradesh	30.9	22.2	19.8	8.7	2.4
Goa	16.8	14.2	13.3	2.6	0.9
Haryana	33.1	26.8	21.8	6.3	5
Himachal Pradesh	28.5	21.2	16.5	7.3	4.7
Kerala	18.3	17.3	15.2	1	2.1
Manipur	20.1	18.3	14.4	1.8	3.9
Meghalaya	32.4	28.3	24.1	4.1	4.2
Mizoram	17	15.7	16.6	1.3	-0.9
Nagaland	15.8	13.5	16.1	2.3	-2.6
Punjab	27.7	21.2	16.2	6.5	5
Sikkim	22.5	21.6	17.6	0.9	4
Tripura	24.4	16.1	14.3	8.3	1.8
Chandigarh	13.9	16.3	15	-2.4	1.3

Table 3 depicts the data on Crude Birth Rate in the decades 1991 to 2011 and the change in the Crude Birth Rate between the consecutive census. According to 2011 census Uttar Pradesh is the state where birth rate is high and Tripura is the state where birth rate is low. In Uttar Pradesh crude birth rate is 27.8% whereas in Tripura the crude birth rate is14.3%. The rate of change of crude birth rate is high in Punjab and in Goa the rate of change of crude birth rate is low. In Punjab rate of change of crude birth rate is 5% whereas in Goa the rate of change in crude birth rate is 0.9%. The states Uttar Pradesh, West Bengal, Karnataka, Gujarat, Odisha, Arunachal Pradesh, Haryana, Manipur, Meghalaya, Maharashtra, Bihar, Madhya Pradesh, Tamil Nadu, Rajasthan, Andhra Pradesh, Himachal Pradesh, Kerela and Punjab have higher crude birth rate. The rate of change of crude birth rate is greater than 2%. The other states show a rate of change of crude birth rate less than 10%.

4.4 Total Fertility Rate and its change in the decades 1991-2011:

Table 4: Total Fertility Rate and its Change

States	Total Fertility Rate		Change in TFR
	2001	2011	2001-2011
Uttar Pradesh	4.5	3.4	1.1
Maharashtra	2.4	1.8	0.6
Bihar	4.4	3.6	0.8
West Bengal	2.4	1.7	0.7
Madhya Pradesh	3.9	3.1	0.8
Tamil Nadu	2	1.7	0.3
Rajasthan	4	3	1
Karnataka	2.4	1.9	0.5
Gujarat	2.9	2.4	0.5
Andhra Pradesh	2.3	1.8	0.5
Odisha	2.6	2.2	0.4
Arunachal Pradesh	2.5	2.1	0.4
Goa	1.4	1.4	0
Haryana	3.1	2.3	0.8
Himachal Pradesh	2.2	1.8	0.4
Kerala	1.8	1.8	0
Manipur	2	1.5	0.5
Meghalaya	3.7	2.8	0.9
Mizoram	1.7	1.6	0.1
Nagaland	1.3	1.7	-0.4
Punjab	2.4	1.8	0.6
Sikkim	2.4	1.6	0.8
Tripura	1.7	1.4	0.3
Chandigarh	1.9	1.6	0.3

Table 4 depicts the data on Total Fertility Rate in the decades 2001 to 2011 and the change in the Total Fertility Rate between the consecutive census. According to 2011 census Bihar is the state where fertility rate is high and Tripura and Goa is the state where fertility rate is low. In Bihar total fertility rate is 3.6% whereas in Tripura and Goa the total fertility rate is 1.4%. The rate of change of total fertility is high in Uttar Pradesh and in Goa and Kerela the rate of change of total fertility is low. In Uttar Pradesh rate of change of total fertility is 1.1% whereas in Goa and Kerela the rate of change in total fertility is 0. The states Uttar Pradesh, West Bengal, Haryana, Meghalaya, Sikkim, Maharashtra, Bihar, Madhya Pradesh, Rajasthan and Punjab have higher total fertility rate. The rate of change of female literacy is greater than 0.5%. The other state shows a rate of change of total fertility less than 0.5%.

4.5: Relation between Infant Mortality Rate, Female Literacy Rate, and Total Literacy Rate: To analyse the relation among IMR, Female Literacy rate and Total Literacy Rate we regress IMR on Total Literacy Rate and IMR on Female Literacy Rate separately. We consider IMR as dependent variable and Total Literacy Rate and Female Literacy Rate as independent variable. We take the data in the year 2011 and each state was taken as the unit for linear regression analysis. The result of the regression analysis is as follows:

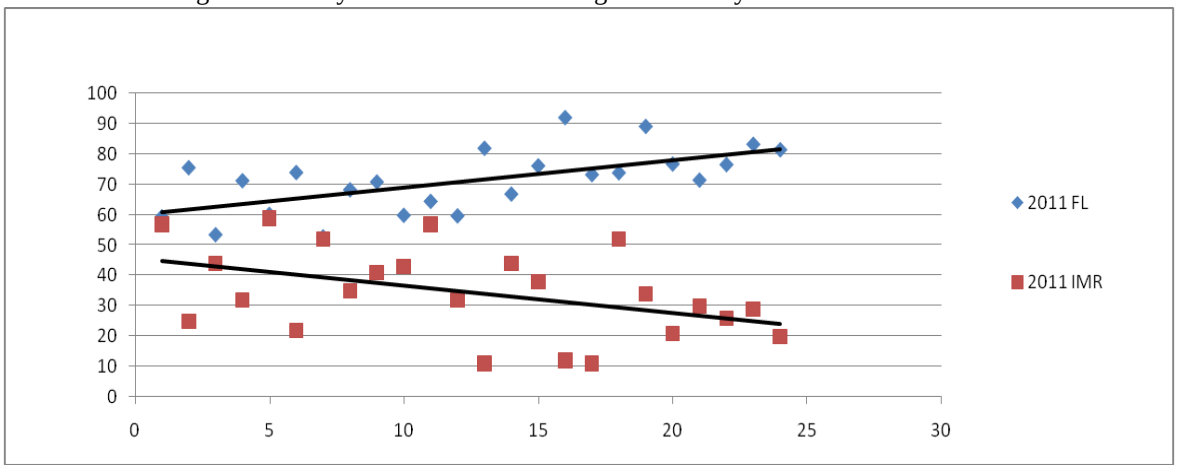

Figure 1: Scatter Diagram and Trend Line of Female Literacy Rate and IMR in 2011

Table 5: Linear Regression Result

Dependent Variable	Literacy Rate	Slope	p-value	R^2 value
IMR	Total	-1.22	0.000316	0.45
	Female	-0.969	0.00018	0.48

From the regression result we see that there is an inverse relationship between IMR and total literacy rate, IMR and Female Literacy Rate. The slope of -0.969 for Female Literacy versus IMR suggest that every 1% increase in female literacy is associated with fall in IMR by 0.969 live births. 48% of the variability in IMR was explained by this relationship as suggested by the R^2 value. It is also statistically significant. Again the slope of -1.22 for Total Literacy Rate versus IMR suggest that every 1% increase in Total literacy Rate is associated with fall in IMR by 1.22 live births. 45% of the variability in IMR was explained by this relationship as suggested by the R^2 value. It is also statistically significant.

From the scattered diagram we see that the trend line for IMR in the year 2011 shows a decreasing trend whereas the trend line for Female Literacy Rate shows an increasing trend. In other words as female literacy increases IMR decreases and there is an inverse relationship between IMR and Female Literacy Rate.

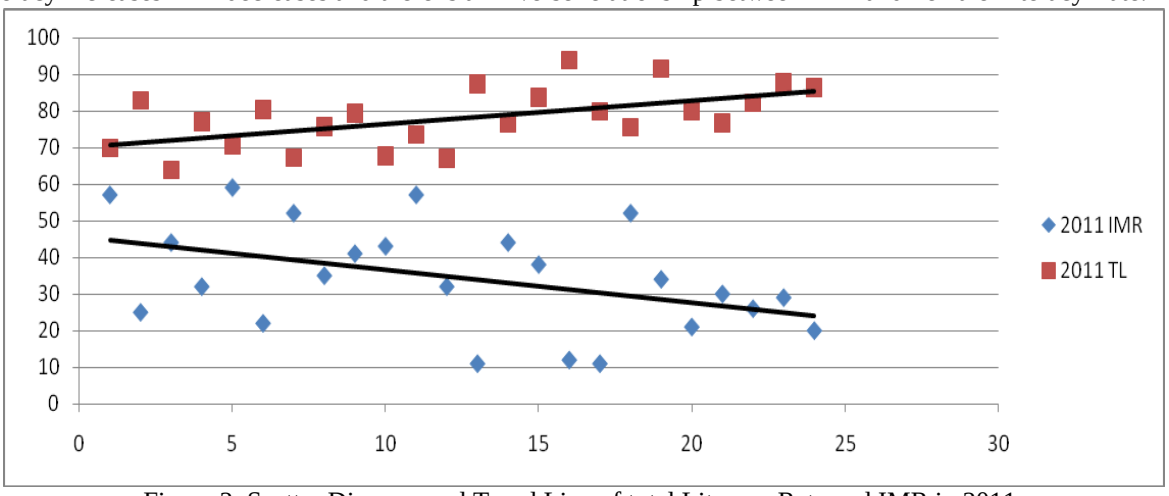

Figure 2: Scatter Diagram and Trend Line of total Literacy Rate and IMR in 2011

From the figure we see that the trend line for IMR in the year 2011 shows a decreasing trend whereas the trend line for Total Literacy Rate shows an increasing trend. In other words as Total literacy rate increases IMR decreases and there is an inverse relationship between IMR and Total Literacy Rate.

4.6 Relation between Total Literacy Rate, Female Literacy Rate and Crude Birth Rate: To analyse the relation among CBR, Total Literacy Rate and Female Literacy Rate we regress CBR on Total Literacy Rate and CBR on Female Literacy Rate separately. In this analysis we take CBR as dependent variable whereas Total Literacy and Female Literacy as independent variable in each cases. Each state was taken as the unit for linear regression analysis. The results of the regression analysis are as follows:

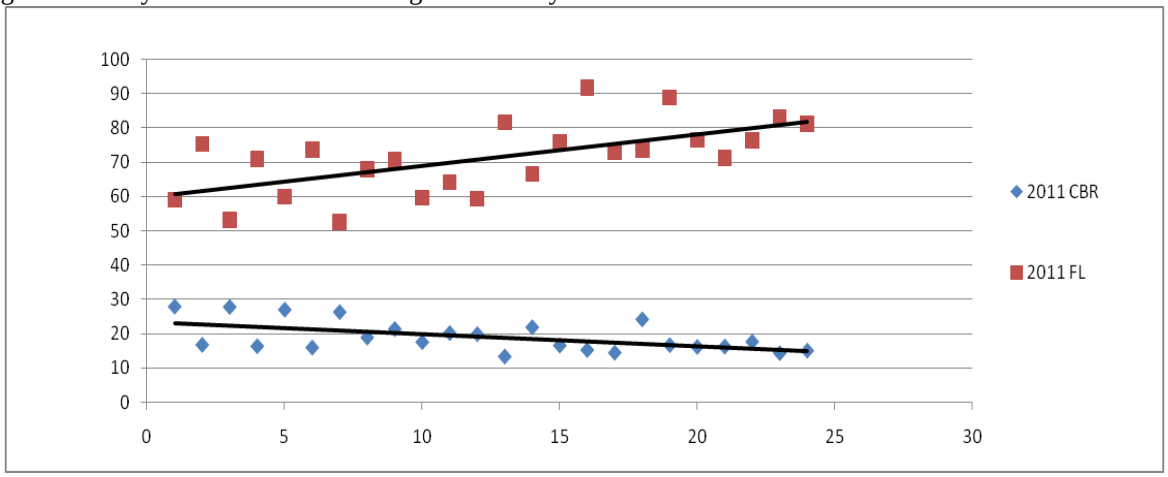

Figure 3: Scatter diagram and Trend line of Female Literacy Rate and CBR in 2011

Table 6: Linear Regression Results

Dependent Variable	Literacy Rate	Slope	p-value	R^2 value
CBR	Total	-0.414	3.71E-05	0.55
	Female	-0.33	1.61E-05	0.58

From the regression result we see that there is an inverse relationship between Total Literacy Rate, Female Literacy Rate and IMR. The slope of -0.33 for Female Literacy versus CBR suggest that every 1% increase in female literacy is associated with fall in CBR by 0.33/000 live births. 58% of the variability in CBR was explained by this relationship as suggested by the R^2 value and it is also statistically significant. Again the slope of -0.414 for Total Literacy Rate versus IMR suggest that every 1% increase in Total literacy Rate is associated with fall in IMR by 0.414/000 live births . 55% of the variability in IMR was explained by this relationship as suggested by the R^2 value. It is also statistically significant.

From the scattered diagram we see that the trend line for CBR in the year 2011 shows a decreasing trend whereas the trend line for female literacy shows an increasing trend. In other words as female literacy increases CBR decreases and there is an inverse relationship between CBR and Female Literacy Rate.

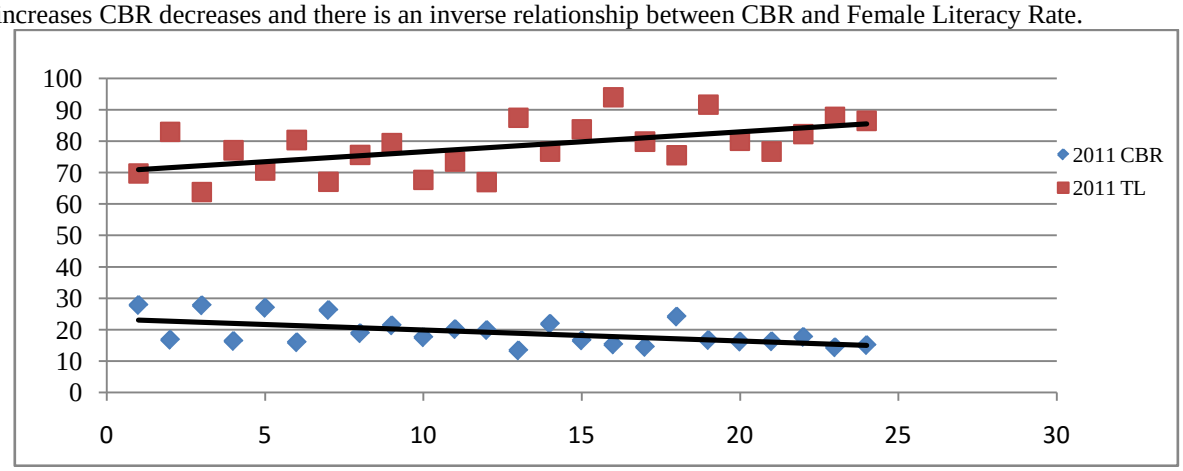

Figure 4: Scatter diagram and Trend line of Total Literacy Rate and CBR in 2011

From the figure we see that the trend line for CBR in the year 2011 shows a decreasing trend whereas the trend line for Total Literacy Rate shows an increasing trend. In other words as Total literacy rate increases CBR decreases and there is an inverse relationship between CBR and Total Literacy Rate.

4.7 Relation between Total Literacy Rate, Female Literacy Rate and Total Fertility Rate: To analyse the relation among TFR, Total Literacy Rate and Female Literacy Rate we regress TFR on Total Literacy Rate and TFR on Female Literacy Rate separately. In this analysis we take TFR as dependent variable whereas Total Literacy and Female Literacy as independent variable in each cases. Each state was taken as the unit for linear regression analysis. The result of the regression analysis are as follows:

Table 7: Linear Regression Results

Dependent Variable	Literacy Rate	Slope	p-value	R^2 value
TFR	Total	-0.056	9.915-E-07	0.51
	Female	-0.045	5.38E-05	0.53

From the regression result we see that there is an inverse relationship between Total Literacy Rate, Female Literacy Rate and TFR. The slope of -0.045 for Female Literacy versus TFR suggest that every 1% increase in female literacy is associated with fall in TFR by 0.045/000 live births. 53% of the variability in TFR was explained by this relationship as suggested by the R^2 value and It is also statistically significant.

Again the slope of -0.056 for Total Literacy Rate versus TFR suggest that every 1% increase in Total literacy Rate is associated with fall in TFR by 0.056/000 live births . 51% of the variability in TFR was explained by this relationship as suggested by the R^2 value. It is also statistically significant.

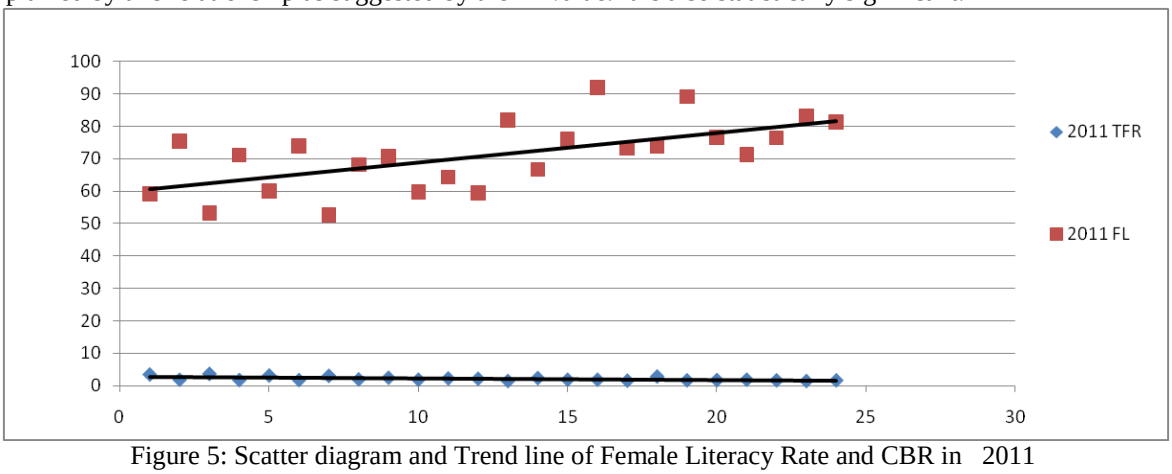

Figure 5: Scatter diagram and Trend line of Female Literacy Rate and CBR in 2011

From the scattered diagram we see that the trend line for TFR in the year 2011 shows a decreasing trend whereas the trend line for female literacy shows an increasing trend. In other words as female literacy increases TFR decreases and there is an inverse relationship between TFR and Female Literacy Rate.

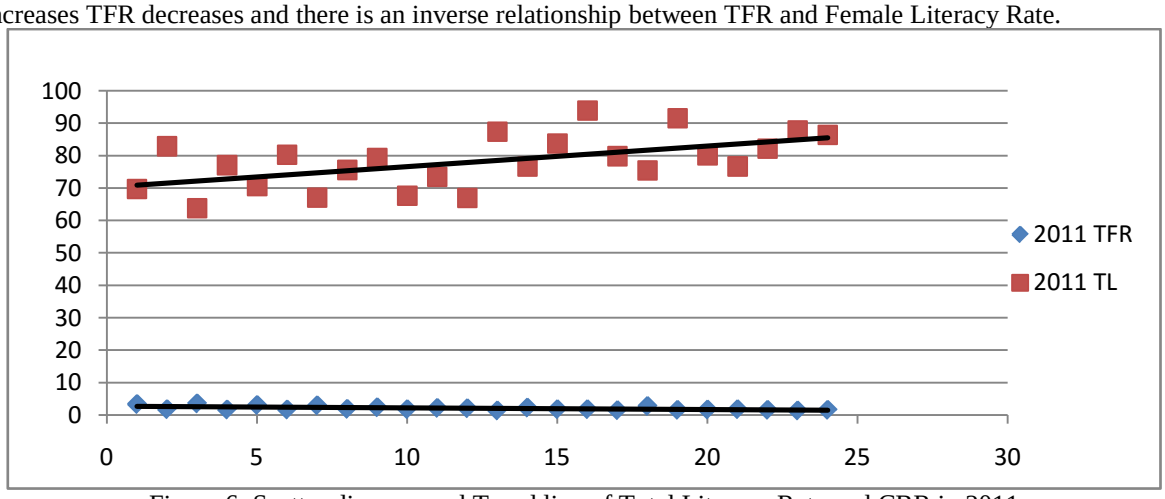

Figure 6: Scatter diagram and Trend line of Total Literacy Rate and CBR in 2011

From the figure we see that the trend line for TFR in the year 2011 shows a decreasing trend whereas the trend line for Total Literacy Rate shows an increasing trend. In other words as Total literacy rate increases TFR decreases and there is an inverse relationship between TFR and Total Literacy Rate.

5. Conclusion:

From the study we say that female literacy is an important determinant to reduce Infant Mortality Rate, Crude Birth Rate and also Total Fertility Rate. Education of women reflected as higher literacy has also been seen to reduce IMRs independent of socioeconomic status or residence in rural or urban areas. Overall, it is highlighted that literacy of women is relatively more important for both population stabilization and lower infant mortality. Our findings suggest that gender equality in literacy must be considered important. In settings where there is a high gap in male and female literacy, health indicators are expected to remain poor despite high overall literacy rates. If females are literate then this has a direct and positive impact on the economy.

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