ISSN: 2349-2147

Modern Research Studies

An International Journal of Humanities and Social Sciences
An Indexed & Refereed e-Journal
www.modernresearch.in

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Volume 3, Issue 2
June 2016

pp. 232–251

Email: editor@modernresearch.in
mrsejournal@gmail.com

ISSN: 2349-2147
Modern Research Studies:
An International Journal of Humanities and Social Sciences

Examining Rural-Urban Gap in Infant Mortality Rate in Assam: An Empirical Analysis

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Abstract: Providing quality health facilities to its citizens has remained a big challenge for every country in the world. The problem is more serious for countries in the developing world. Infant mortality rate is regarded as an important and sensitive key indicator of health status of a community. India has been able to achieve significant reduction in infant mortality rate in last few decades, but there are considerable rural-urban variations in the progress. Assam in north eastern region of India has also experienced considerable variations in health care facilities in urban and rural areas. With this background, the present study tries to examine the trend of rural-urban gap in infant mortality rate in Assam in comparison with national trend. Rural-Urban Disparity Index is constructed to assess rural-urban gap in infant mortality in the state as well as in the national level. Since identification of the factors is pertinent for adopting policies for reduction of this gap, the paper also attempts to identify the factors behind variations in infant mortality in rural and urban areas. It is found in the study that rural-urban gap is more prominent in Assam than in the national average. The Literacy Rate, Monthly per Capita Consumer Expenditure, and Female Work Participation Rate are factors influencing infant mortality rate in the state.

Keywords: Infant Mortality Rate, Rural-Urban Gap, Rural-Urban Disparity Index, Assam

Introduction

Providing quality health facilities to its citizens has remained a big challenge for every country in the world. The problem is more serious for countries in the developing world. Progress in this regard has remained painfully slow, and concerns of the countries in ensuring health facilities are reflected in the reports of different international agencies like United Nations. In particular, reduction of child mortality and improvement of maternal health have been recognized as important goals in the Millennium Development Goals (MDG) of United Nations Organisation.

Infant Mortality Rate (IMR) is regarded as an important and sensitive key indicator of health status of a community. Decline in the level of infant mortality is a useful indicator of development in any society. India has been able to achieve significant reduction in IMR in the last few decades, but there are considerable rural-urban variations in the progress due to a number of factors. In 2010, as against a figure of 31 in urban India, infant mortality rate was much higher at 51 for rural India (Registrar General India 2012). Reduction of this gap in providing health services is one of the toughest challenges faced by the country today. As these disparities can significantly increase overall infant deaths, the challenge for equal accessibility of healthcare services in rural and urban areas raises serious questions for the policy-makers.

The identification of the factors behind variations in the infant mortality in rural and urban areas is important for adopting policies for reduction of this rural-urban gap. Various studies have discussed the problem of IMR and factors affecting the IMR. One study examines the determinants of infant and child mortality variations in Jordan, Yemen, Egypt, and Tunisia using data from surveys. The analysis considers biological correlates of mortality – mother's age, birth order, birth interval, and previous infant loss – and several social factors such as mother's and father's education, mother's residence, father's occupation, and mother's work experience since marriage. Among the socioeconomic characteristics, the education of the mother and rural-urban residence are found to affect infant survival. The study finds that in childhood, among the demographic factors, only birth interval shows

a significant effect on mortality. The risk of child mortality decreases considerably with the increase in the birth interval. The analysis of the effect of breastfeeding on mortality clearly shows the beneficial effect of breastfeeding on the infant's survival, especially during the early months of life (Adlakha and Suchindran 1985).

In India, researchers conducted a household survey of 1050 infants in an urban slum, and rural and urban areas of Jodhpur Region (Rajasthan) to determine IMR and its correlation with various socioeconomic and demographic factors (Gupta et al. 1991). They found that four most significant quantifiable factors that could be changed to reduce IMR are maternal age (IMR increases with maternal age of 30 years and older), parity (IMR increases with parity), literacy (IMR is higher among illiterates than literates), and low socioeconomic status [SES] (IMR increases as SES decreases).

Another study empirically tests for factors affecting infant mortality rates. Based on a cross-sectional model, the results show that fertility rates, female participation in the labour force, per capita GNP, and female literacy rates significantly affect infant mortality rates. Surprisingly, government expenditure on healthcare, as a percentage of GNP, does not play a major role in determining infant mortality rates (Zakir and Wunnava 1997).

Chowdhury (1988) has suggested that there is a dual causality between infant mortality rates and fertility rates. He believes that when a woman has multiple pregnancies the chances of her child's survival are significantly reduced. A woman may thus decide to bear more children in the hope that at least some will stay alive. Studies (Bhattacharya et al. 1995 and Winegarden and Bracy 1995) have shown that fertility rates and infant mortality rates are closely related.

Another analysis considers background (mother's tribe, religion, and current place of residence), demographic (mother's age, age at marriage, number of children ever born, and duration of breast feeding), and socioeconomic (maternal and paternal education and occupation, and household income) variables. A multivariate analysis using Ordinary Least Squares (OLS) regression model is carried out to obtain the net

effect of each factor on mortality in that study. The results indicate that maternal education and occupation, duration of breast feeding, number of children ever born, current place of residence, and household income affect mortality significantly (Bailey 1988).

Therefore it is important to measure rural-urban gap in IMR in different contexts. Given wide variations in mortality levels among different states, such analyses should be location-specific. Such location-specific like rural-urban analyses are necessary for the state and will serve useful purpose for design of policy (Agnihotri 2001).

The available information shows that Assam in north eastern region of India has also experienced considerable variations in healthcare facilities in urban and rural areas. This gets reflected in the variation of IMR in urban and rural Assam which are 36 for urban areas and 60 for rural areas respectively (Registrar General India 2012).

In Assam only a few studies have been found about the IMR in the state and the study related to the factors affecting IMR in rural and urban areas are scanty. With this background it is pertinent to examine the trend in rural-urban gap in the infant mortality in the state in comparison with national trend.

As adopting policies for reduction of this disparity depends crucially on identification of the factors, the paper also attempts to identify the factors behind variations in infant mortality in rural and urban areas. From the foregoing analysis the factors affecting the IMR in the context of the state are demographic changes, socioeconomic inequality, and availability of health resources. The paper takes help of available secondary data on Total Fertility Rates (TFR), Literacy Rates (LR), Female Workforce Participation Rates (FWPR), and Monthly Per Capita Consumption Expenditure (MPCE) and examines the factors responsible for variation in the level of IMR in urban and rural areas with the help of regression analysis.

Objectives of the Study

The objectives of the study are:

1. To examine the trend in rural-urban gap in the infant mortality in Assam in comparison with national trend.

2.To determine the factors affecting the IMR in rural and urban areas in the state.

Data Source and Methodology

The study is based on the secondary data collected from various sources like Registrar General of India, National Sample Survey Organisation, Census Reports, etc. Detailed sources are furnished in respective places.

A retrospective study design was used to collect yearly data for Assam covering the period from 1991 to 2013.

The Rural Urban Disparity Index (RUDI) is developed to assess the rural-urban gap in IMR in the state as well as in the national level. Following the method used in calculating rural urban disparity in Afghanistan Rural Development Report by AIRD (2006), the RUDI is constructed as follows

$$RUDI = \left(1 - \frac{I_R}{I_U}\right) * 100$$

Here, I_R is the index of the IMR for rural areas and I_U is the index of the IMR for urban areas. RUDI is calculated for IMR in rural and urban areas of the state separately. Indices are calculated for available data by taking the formula as follows:

I = (Actual value- Minimum value)/ (Maximum value- Minimum value)

Where, the maximum and minimum values for IMR in rural and urban areas are taken separately over a period from 1991 to 2013 as given in the appendix.

In selecting the maximum and minimum values of IMR for rural and urban areas, the maximum values are taken as the values for the worst performing states, and minimum values are taken as the values for best performing states in the country for the respective years.

As higher values for IMR is unfavorable for the society, the inverse of the index of this negative indicator is taken for calculation as stated by India's Social Development Report, 2006 (Council for Social Development 2006, 219).

Methodological Issues Involved

The Empirical Model

From the review of literature some factors are found affecting the IMR in both rural and urban areas and the following factors can be taken in the context of the state:

Total Fertility Rates (TFR): Studies (Chowdhury 1988; Bhattacharya *et al*. 1995 and Winegarden and Bracy 1995; Measham et al. 1999) have shown that fertility rates and infant mortality rates are closely related. Therefore total fertility has been taken as one of the possible important factors influencing IMR in the state. TFR might affect infant mortality rates in a positive way; the relationship is therefore expected to be positive.

Literacy Rates (LR): Female literacy rates significantly affect infant mortality rates (Adlakha and Suchindran 1985; Bailey 1988**;** Gupta et al. 1991). The literacy rate has been chosen because educated mothers are more likely to be aware of nutrition and their children's health (Gubhaju 1986). Due to non-availability of rural-urban break up time series data for female literacy for the state, data for overall literacy rates are used here. Here the relationship between IMR and LR is expected to be negative.

Female Workforce Participation Rates (FWPR): A study empirically tests for factors affecting infant mortality rates and the results show that female participation in the labour force significantly affects infant mortality rates (Gupta et al. 1991). Another study results indicate that maternal education and occupation affect mortality significantly (Bailey, 1988). Therefore, Female Workforce Participation Rate (FWPR) in the labour force has been taken as one of the possible important factors affecting IMR in the state and has a negative relationship with IMR. Initially as female participation in the labour force increases, IMR increases owing to lack of childcare services. After a point, IMR starts to decrease with the concurrent economic development brought about by increased female participation in the economy (Zakir and Wunnava 1999).

Monthly Per Capita Consumer Expenditure (MPCE): Bailey (1988) considers household income as one of the important determinants of

IMR. In the context of the state MPCE is taken as the proxy variable of income due to non-availability of rural-urban break up income data. The variable MPCE is used to capture a tapering-off effect of MPCE on IMR. The relationship of MPCE with IMR is hypothesized to be negative implying that an increase in monthly per capita expenditure decreases IMR at a decreasing rate.

To examine the influential factor of IMR in rural and urban areas a log-linear multiple regression model is constructed in the study. In the model, the IMR was the dependent variable and TFR, LR, FWPR, and MPCE were the main determinants.[1]

The log-linear multiple regression model is constructed as follows:

$$lnIMR_{ti} = b_0 + b_1(\ln \text{IMR})_{ti-1} + b_2(\ln\text{TFR})_{ti} + b_3\,(lnLR)_{ti} + b_4\,(lnFWPR)_{ti} + b_5\,(lnMPCE)_{ti} + u_{ti} \quad \text{---------(1)}$$

where IMR_{ti-1} is the lag variable of IMR_t variable with one year lag.
t = 1991 to 2009 and i = rural and urban areas.

The variable IMR is found non-stationary when the model is tested for stationarity.[2] Taking first differences the variable is made stationary before estimating the parameters. The method of Ordinary Least Squares (OLS) is applied for estimation of the parameters after making all the variables stationary in the log-linear multiple regression model. Infant Mortality Rate (IMR) is regressed on Total Fertility Rate (TFR), Literacy Rate (LR), Female Workforce Participation Rate (FWPR), and Monthly Per Capita Consumer Expenditure (MPCE). The results are shown in Table 3 and Table 4. After estimating the parameters, the regression diagnostic test, called the Ljung-Box (LB) or Portmanteau Test is also carried out to test if the residuals of the regression are white noise or that it has some autocorrelation still left.[3]

[1] The raw data for the dependent and independent variables for rural and urban areas are given in the appendix Table 5 and Table 6 respectively.
[2] A time series is stationary if the mean, variance and auto covariance (at various lags) remain the same no matter at what point we measure them; i.e they are time invariant (Gujarati, D., and N. Sangeetha 2007).
[3] The Ljung-Box (LB) or Portmanteau test is better for small samples than Box-Pierce Q test (Gujarati, D., and N. Sangeetha 2007).

RESULTS AND DISCUSSION

Trend in Rural-Urban Disparity in the Infant Mortality in Assam in comparison with National Trend

The trend in rural-urban disparity in the infant mortality in Assam in comparison with national trend is presented in Table 1. The table presents the fact that rural-urban gap in IMR in the state is more prominent than in the country. In almost all the study period the rural-urban disparity in Assam is shown more than the country average which definitely raises serious concern. The IMR of the state in rural areas falls by 1.70 per cent whereas the IMR in the country average in rural areas falls by 2.92 per cent during the study period. Similarly the IMR in urban areas in Assam falls by 1.18 per cent whereas the IMR in the country average falls by 2.89 per cent in the same period. Therefore it can be easily inferred that improvement in health condition in the state is slow in comparison with the country.

Table1: Rural-Urban Gap in IMR in Assam in comparison with India

Year	Assam		India		Rural-Urban Gap		Difference between Rural-Urban disparity for Assam and India
	Rural	Urban	Rural	Urban	Assam	India	
1991	83	42	87	53	-41	-34	-7
1992	83	50	85	53	-33	-32	-1
1993	84	60	82	45	-24	-37	13
1994	78	76	80	52	-2	-28	26
1995	78	50	80	48	-28	-32	28
1996	79	37	77	46	-42	-31	-11
1997	79	37	77	45	-42	-32	-10
1998	80	36	77	45	-44	-32	-12
1999	79	36	75	44	-43	-31	-12
2000	78	35	74	44	-43	-30	-13
2001	77	34	72	42	-43	-30	-13
2002	73	38	69	40	-35	-29	-6
2003	70	35	66	38	-35	-28	-7
2004	69	38	64	40	-31	-24	-7
2005	71	39	64	40	-32	-24	-8
2006	70	42	62	39	-28	-23	-5
2007	68	41	61	37	-27	-24	-3
2008	66	39	58	36	-27	-22	-5
2009	64	37	55	34	-27	-21	-6
2010	60	36	51	31	-24	-20	-4

2011	58	34	48	29	-24	-19	-5
2012	58	33	46	28	-25	-18	-7
2013	56	32	44	27	-24	-17	-7
CAGR(%) from 1991 to 2013	-1.70	-1.18	-2.92	-2.89			

Source: Registrar General of India, Sample Registration System Bulletin for the period from 1991 to 2013.

RUDI is constructed to assess the disparity in IMR in rural and urban areas. The values of rural-urban disparity index (RUDI) for the state and the country are presented in Table 2. From the calculated values of RUDI for the state in comparison with the RUDI values for the national level shows more rural-urban disparity in the state than in the national average in almost all the period from 1991 to 2013 except in 1993, 1994, 1995, 2007, 2010 and 2011. In 1993, 1994 and 1995 the RUDI values are negative due to the fact that the IMR value in urban area in the state is also as high as in rural area in the state.

Table 2: Values of Rural-Urban Disparity Index (RUDI) for the State and the Country

Years	RUDI value in Assam	RUDI value in India
1991	26.13	1.28
1992	20.57	16.15
1993	-25.44	7.55
1994	-74.39	-4.51
1995	-24.35	9.87
1996	44.67	17.75
1997	43.35	20.12
1998	45.20	16.86
1999	45.90	19.43
2000	50.80	23.26
2001	42.34	14.91
2002	23.95	13.46
2003	28.49	14.91
2004	25.29	12.58
2005	27.04	13.64
2006	15.33	9.87
2007	9.38	9.52

2008	14.07	8.05
2009	21.17	16.00
2010	12.31	12.58
2011	14.06	20.13
2012	20.00	16.46
2013	24.44	27.33

Factors affecting the IMR in Rural and Urban areas in the state

The results of the regression model constructed for rural and urban areas are presented in Table 3 and Table 4. Table 3 presents the results of the multiple regression model for rural areas.

Table 3: Results of the Multiple Regression Analysis for Factors affecting IMR in Rural Areas

Variables	Estimated Coefficients	t-statistic
Constant	3.5224* (0.9772)	3.60
TFR	- 0.0922 (0.1020)	-0.90
LR	-0.1350** (0.0581)	-2.32
FWPR	-0.0374** (0.0156)	-2.40
MPCE	-0.0838* (0.0248)	-3.38
R^2	0.5895	
$F(n_1=5, n_2=12)$	3.45**	

Note: figures in the parentheses show standard error of the coefficients.
*indicates significant at 0.01 level; ** indicates significant at 0.05 level; *** indicates significant at 0.10 level.

In Table 3, the R^2 value of the model is found to be 0.5895 indicating good fit to the data. The F-statistic for overall regression is also significant at 0.05 per cent level. Thus, on the whole, the results obtained from the analysis are credible.

The coefficient of the variables Literacy Rates (LR) has come out to be statistically significant at 0.05 levels and Monthly Per Capita Consumption Expenditure (MPCE) has come out to be statistically

significant at 0.01 levels. Moreover, Female Workforce Participation Rates (FWPR) has come out to be statistically significant at 0.05 levels. It indicates that Literacy Rates and Monthly Per capita Consumer Expenditure and mother's participation to work are the important factors affecting the IMR in rural areas during the periods under study. The other variable Total Fertility Rates has come out with a negative sign and not come out to be statistically significant. Therefore it can be inferred that increase in literacy rate will be more likely to reduce the IMR in rural areas in Assam. Income level of the people, whether the mother is working or not are also the important factors influencing the infant mortality in rural areas in the state. The factor of number of children in the family is less important in rural areas in the state to reduce the IMR as TFR has not come out as significant factor.

Table 4 presents the results of the multiple regression model for urban areas in the state.

Table 4: Results of the Multiple Regression Analysis for factors affecting IMR in Urban Areas

Variables	Estimated Coefficients	t-statistic
Constant	-0.7790 (5.7827)	-0.13
TFR	-0.0634 (0.6817)	-0.09
LR	0.6833 (1.4048)	0.49
FWPR	0.2454 (0.2130)	1.15
MPCE	-0.1986 (0.2165)	-0.92
R^2	0.3316	
$F(n_1=5, n_2=12)$	1.19	

Note: figures in the parentheses show standard error of the coefficients.

In Table 4 the R^2 value of the model is found to be 0.3316 indicating not very well fit to the data. The F-statistic for overall regression is also not significant.

No factor is found to be statistically significant in the above model. This may be due to the reason that there are many factors affecting the infant mortality rates in urban areas in the state and in the present study only four factors are taken.

Limitation of the Study

The limitation of the study is non-availability of the rural-urban break up data for the state. The present study has taken out with the available break up data only. Field study of cross section data may provide valuable insight in this regard.

Policy Implications

The present study can be viewed as a research contribution to the effort to address the issue of rural-urban gap in infant mortality rate in Assam, a comparatively backward state of India. The main policy suggestions emerging from the findings are summed up as follows:

- Since rural-urban gap is more prominent in Assam than the national average, it is a challenge for the policy makers to ensure equal accessibility of health care facilities in both rural and urban areas. As more than 85 per cent of the population is still living in rural areas, the overall development of the state cannot be ensured unless rural development takes place. Rural-urban disparity significantly increases overall infant deaths in the state. Recently, the various schemes like NRHM are initiated by the government for rural health; but those need to be implemented properly. Proper monitoring on the part of the government and awareness about the programmes on the part of the common people are needed in this regard.
- As identification of the factors is important for the policy makers for reduction of the IMR, therefore, determination of the factors behind high infant mortality in rural and urban Assam is very important. As Literacy Rate, Monthly Per Capita Consumer Expenditure, Female Work Participation Rate are found significant in predicting the factors influencing IMR in rural areas in the state, Government should give importance in spreading education which will make them capable and

efficient to be engaged in income generating opportunities especially to the womenfolk in the state to reduce infant mortality in rural areas. Infant mortality in rural areas can be reduced by increasing income level of the people and by providing more employment to the female.

Conclusion

From the study of rural-urban gap in infant mortality in Assam in comparison with national trend it is clear that the gap in IMR in the state is more prominent than in the country. It can also be easily inferred from the discussion that improvement in health condition in the state is slow in comparison with the country. RUDI is constructed to assess the rural-urban disparity empirically and RUDI values further validate the above results.

From the examination of the factors influencing IMR in rural and urban areas it is clear that the variables Literacy Rate, Monthly Per Capita Consumer Expenditure, Female Work Participation Rate are useful in predicting the factors influencing IMR in rural areas in the state. The results show that increase in literacy rate will be more likely to reduce the IMR in rural areas in Assam. Income level of the people, whether the mother is working or not are also important factors influencing the infant mortality in rural areas in the state. Other variable Total Fertility Rates is not significant in rural areas in Assam. This may imply that how many children in the family are less important in rural areas in the state to reduce IMR.

However, no factor is found to be significant influencing IMR in urban areas in the state. There may be some other factors affecting the infant mortality rates in urban areas in the state. In the present study, only four factors are taken into account. Therefore, it needs further investigation into the other factors affecting IMR in urban areas in the state.

Efforts to reduce infant mortality rates in India appear to have reached a plateau in recent years. To achieve this, it is necessary to disaggregate the mortality data to identify groups or regions with high IMR levels and to intensify efforts to reduce mortality among these sections.

References:

Adlakha, A.L., and C.M. Suchindran. 1985. "Factors affecting Infant and Child Mortality", *Journal of Biosocial Science*, 17.4:481-96.

AIRD-Afghanistan Institute for Rural Development. 2006. *A Proposal for Afghanistan Rural Development Report.* Accessed July 26, 2007. http://www.mrrd.gov.af/aird/RDR%20Proposal%20of%20Afganistan%20%Rural%20Development.

Agnihotri, Satish B. 2001. "Infant Mortality Variations in Space and Time Analysis of West Bengal Data." *Economic and Political Weekly,* September 8-14, 36 (36): 3472-79.

Bailey, Mohamed. 1988. "Factors Affecting Infant and Child Mortality in Rural Sierra Leone." *Journal of Tropical Pediatrics*, 34.4: 165-168.

Bhattacharya, B., K. K. Singh, & U. Singh. 1995. "Proximate Determinants of Fertility in Eastern Uttar Pradesh." *Human Biology*, *67*.6: 867-86

Chowdhury, A.R. 1988. "The Infant Mortality– Fertility Debate: Some International Evidence." *Southern Economic Journal*, *54*.3: 666–74

Council for Social Development. 2006. *India Social Development Report*. New Delhi: Oxford University Press.

Datt, Gaurav. 1998. "Poverty in India and Indian States: An Update." *Indian Journal of Labour Economics, 41.2*: 191-212.

Gubhaju, B.B. 1986. "Health Problems in Nepal: With Special Reference to Infant and Child Health." *Asian Profile*, 14: 165–74.

Gujarati, D. and N. Sangeetha. 2007. *Basic Econometrics*, 4th Edition. New Delhi: Tata McGraw-Hill.

Gupta, R., B.D. Gupta, R.N. Singh, and S.C. Mehta. 1991. "Infant Mortality-Critical Analysis of Factors and New Approach for calculation of IMR." *Indian Journal of Maternal and Child Health*, 2.3: 72-8.

Mehta, Arun C. 2005. *Elementary Education in Urban India- Where do we stand?* New Delhi: NIEPA.

Measham, A.R., K.D. Rao, D.T. Jamison, J. Wang, & A. Singh. 1999. "The performance of India and Indian States in reducing infant mortality and fertility, 1975-1990." *Economic and Political Weekly*, May 29, 34.22: 1359-67.

NIEPA. 2005. Analytical Table. New Delhi: National Institute of Educational Planning and Administration (NIEPA).

NSSO.1996. *Key Results on Household Consumer Expenditure, 1993-94,* Report No.401, NSS 50th Round, Government of India.

NSSO.2000. *Choice of Reference Period for Consumption Data base on NSS 51st, 52nd, 53rd, 54th Round,* Report No.447, Government of India.

NSSO.2000. *Household Consumer Expenditure in India-Key Results,* Report No.453, Ministry of Statistics and Programme Implementation, September.

NSSO.2006. *Status of Education and Vocational Training in India,2004-05*, NSS 61st Round, Report No.517, December.

NSSO.2008. *Household Consumer Expenditure in India, 2006-07,* Report No.527, NSS 63rd Round, Ministry of Statistics and Programme Implementation, October.

NSSO.2010a. *Household Consumer Expenditure in India, 2007-08,* Report No.530, NSS 64th Round, Ministry of Statistics and Programme Implementation, March.

NSSO.2010b. *Education in India: 2007-08,* Report No.532, NSS 64th Round, Ministry of Statistics and Programme Implementation, May.

NSSO.2010c.Employment and Unemployment Situation in India, 2007-08, Report No.531, NSS 64th Round (July 2007 – June 2008), Ministry of Statistics and Programme Implementation, May.

NSSO.2011. *Employment and Unemployment Situation in India (2009-10),* Report No. 537, NSS 66th Round, Ministry of Statistics and Programme Implementation, November.

Registrar General of India, Sample Registration System Bulletin, 1991 to 2013.

Winegarden, C.R. and P.M. Bracy. 1995. "Demographic consequences of maternal-leave programs in Industrial Countries: Evidence from Fixed-effects Models." *Southern Economic Journal*, *61*.4: *1020–35*

Zakir, M. & P.V. Wunnava. 1997."Factors affecting Infant Mortality Rates: Evidence from Cross-Sectional Data." *Applied Economics Letters*, 6.5: 271–273.

Appendix I

Maximum and Minimum values for IMR in rural areas

1991: Maximum value: 125 (M.P), Minimum value: 17 (Kerala)
1992: Maximum value: 109 (M.P), Minimum value: 17 (Kerala)
1993: Maximum value: 113 (M.P), Minimum value: 15 (Kerala)
1994: Maximum value: 105 (M.P), Minimum value: 16 (Kerala)
1995: Maximum value: 104 (M.P), Minimum value: 16 (Kerala)
1996: Maximum value: 102 (M.P), Minimum value: 13 (Kerala)
1997: Maximum value: 100 (Orissa), Minimum value: 11 (Kerala)
1998: Maximum value: 104 (Orissa), Minimum value: 15 (Kerala)
1999: Maximum value: 100 (Orissa), Minimum value: 14 (Kerala)
2000: Maximum value: 93 (M.P), Minimum value: 14 (Kerala)
2001: Maximum value: 94 (Orissa), Minimum value: 12 (Kerala)
2002: Maximum value: 89 (M.P), Minimum value: 11 (Kerala)
2003: Maximum value: 86 (M.P, Orissa), Minimum value: 12 (Kerala)
2004: Maximum value: 84 (M.P), Minimum value: 13 (Kerala)
2005: Maximum value: 80 (Orissa), Minimum value: 15 (Kerala)
2006: Maximum value: 79 (M.P), Minimum value: 16 (Kerala)
2007: Maximum value: 77 (M.P), Minimum value: 14 (Kerala)
2008: Maximum value: 75 (M.P), Minimum value: 12 (Kerala)
2009: Maximum value: 68 (Orissa), Minimum value: 11 (Goa)
2010: Maximum value: 67 (M.P), Minimum value: 10 (Goa)
2011: Maximum value: 63 (M.P), Minimum value: 6 (Goa)
2012: Maximum value: 60 (M.P), Minimum value: 8 (Goa)
2013: Maximum value: 57 (M.P), Minimum value: 8 (Goa)

Maximum and Minimum values for IMR in urban areas

1991: Maximum value: 74 (M.P, U.P), Minimum value: 16 (Kerala)
1992: Maximum value: 78 (U.P), Minimum value: 13 (Kerala)
1993: Maximum value: 67 (M.P), Minimum value: 8 (Kerala)
1994: Maximum value: 65 (U.P), Minimum value: 14 (Kerala)
1995: Maximum value: 66 (U.P), Minimum value: 13 (Kerala)
1996: Maximum value: 67 (U.P), Minimum value: 16 (Kerala)
1997: Maximum value: 66 (U.P), Minimum value: 15 (Kerala)
1998: Maximum value: 65 (U.P), Minimum value: 17 (Kerala)
1999: Maximum value: 65 (Orissa), Minimum value: 16 (Kerala)

2000: Maximum value: 66 (Orissa), Minimum value: 14 (Kerala)
2001: Maximum value: 62 (U.P), Minimum value: 9 (Kerala)
2002: Maximum value: 58 (U.P), Minimum value: 8 (Kerala)
2003: Maximum value: 55 (U.P, M.P, Orissa), Minimum value: 10 (Kerala)
2004: Maximum value: 58 (Orissa), Minimum value: 9 (Kerala)
2005: Maximum value: 55 (Orissa), Minimum value: 12 (Kerala)
2006: Maximum value: 53 (Orissa, U.P), Minimum value: 12 (Kerala)
2007: Maximum value: 50 (M.P), Minimum value: 10 (Kerala)
2008: Maximum value: 49 (U.P), Minimum value: 10 (Kerala)
2009: Maximum value: 47 (U.P and Chhattisgarh), Minimum value: 10 (Goa)
2010: Maximum value: 44 (U.P and Chhattisgarh), Minimum value: 9 (Goa)
2011: Maximum value: 41 (U.P & Chhattisgarh), Minimum value: 9 (Kerala)
2012: Maximum value: 40 (Meghalaya), Minimum value: 9 (Kerala)
2013: Maximum value: 40 (Meghalaya), Minimum value: 9 (Kerala)

Appendix II

Table 5: Data for the Dependent and Independent Variables for Rural Assam

Year	IMR	TFR	LR	FWPR	MPCE
1991	83	3.6	49.32	17	226.89
1992	83	3.6	45.28	31.3	266.7
1993	84	3.4	69	16.1	154
1994	78	4	67.3	15.9	258
1995	78	3.7	67.3	13.4	305
1996	79	3.4	65	8.5	316
1997	79	3.4	65	9.9	360
1998	80	3.4	65	11.2	338
1999	79	3.3	69	8.7	429
2000	78	3.3	70.8	15.1	426
2001	77	3.2	60.92	12	457
2002	73	3.1	69.6	21.8	537
2003	70	3	69.6	19.7	532
2004	69	3.2	73	16.7	588
2005	71	3.1	73	20.9	543
2006	70	3	73.8	20.7	626
2007	68	2.9	73	15.3	721.37
2008	66	2.80	74.00	15.30	799.00
2009	64	2.80	74.90	25.60	1003.00

Notes:

1. Data for rural and urban MPCE for 1990-91 are the data of mean consumption per month (in Rs.) data (from 1990-91 to 1993-94) at 1973-74 prices. MPCE data of 1983 is used for 1991-92 and data of 1987-88 is used for 1992-93 due to non-availability of the MPCE data for 1991-92 and 1992-93.
2. Labour Force Participation Rate (per 1000) for persons of age 15-59 years according to usual status (Principal Status+Subsidiary Status) is used for the FWPR data in 2009. Principal Status (PS) includes those who either worked or were looking for work for a relatively larger part of the 365 days preceding the date of survey. Subsidiary Status (SS) includes those persons from among the remaining population who had worked at least for 30 days during the reference period of 365 days preceding the date of survey.

Sources

1. Registrar General of India for various years.
2. NSSO (1996), NSSO (2000), NSSO (2000), NSSO (2006), NSSO (2008), NSSO (2010a), NSSO (2010b), NSSO (2010c), NSSO (2011).
3. Government of India (2001), Census Report from www.censusindia.in accessed on 02-08-10
4. Datt, Gaurav (1998)
5. Mehta, C (2005)

Appendix III

Table 6: Data for the Dependent and Independent Variables for Urban Assam

Year	IMR	TFR	LR	FWPR	MPCE
1991	42	2.1	79.39	8	326.8
1992	50	2.1	47.14	14.6	335.5
1993	60	2.5	88	9.3	270
1994	76	2.4	88	9.2	459
1995	50	2.2	86.4	7	469
1996	37	2.1	86.4	9.4	537
1997	37	2.1	87.3	6.4	585
1998	36	2	87.3	7.9	580
1999	36	1.9	86	9.7	818
2000	35	1.8	87.6	11.2	814
2001	34	1.8	85.76	10	789
2002	38	1.8	89	11	883
2003	35	1.8	89	7.3	947
2004	38	1.5	89	11.3	1064
2005	39	1.6	88.3	10.9	1058
2006	42	1.6	87.7	10.1	1352
2007	41	1.5	94	8.7	1368.88
2008	39	1.50	85.70	8.70	1452.00
2009	37	1.60	88.40	14.90	1755.00

Sources: Same as Table 5.

Acknowledgement: The author would like to acknowledge Prof. Saundarjya Borbora, Professor (Economics), Department of Humanities and Social Sciences, Indian Institute of Technology Guwahati and Prof. Mrinal Kanti Dutta, Professor (Economics), Department of Humanities and Social Sciences, Indian Institute of Technology Guwahati for their immense help in this research work.