CHAPTER 5

FERTILITY DISPARITIES AMONG THE DISTRICTS OF ASSAM

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5.1 Introduction

In the preceding chapter we have observed the consequences of TFR and CFR in PPR as well as fertility of Hindu and Muslim women. It is important to observe in the analysis that the PPR of Muslim women increases more rapidly than the Hindu. This anomalous increase of PPR will be a core component in understanding the fertility disparity among the districts of Assam in this chapter. The demographic variable like disproportion of fertility includes in vital statistics. It is at central importance in demographic analysis as births are a vital factor of population growth. It also provides important information about women reproductive performance and manner. Population size and growth in a country influence the situation of economy, policy, culture, education and environment.

The study of religion wise changes in fertility of Assam is important because of its religious heterogeneity. There are enormous disparity in behavior and outlook of two major religions i.e. Hindu and Muslim [28]. Significant disparities have been found in respect of religion wise development. It may also be noted that there is an inter district demographic disparities in the growth of population in Assam [25]. In this chapter an attempt has been made to study the disparity of fertility in district wise as well as religion wise. Based on statistical data available in census report, the total investigation has been made. Marriage and age at marriage is two fundamental determinants which can control the birth rate [49]. The proportion of married women in the reproductive age group is much higher in the developing countries. The demographers are agreed on the fact that the birth rate depends largely upon what proportion of married women are there in the first half of the reproductive period. For developing countries like India, urban-rural fertility differentials are prominent. It gives a major differential in national and state level.

Kinsley Davis [28] has shown that before partition of India, there was hardly any difference between the religious communities in the average fertility level. However, both Couple Fertility and Mysore Population Study gave evidence to the fact that religious faith of a person had something to do with her achieved fertility. In both the studies it was observed that the Muslim out-paced the Hindus and the Hindus out-spaced the Christians in this number game.

5.2 Analysis and Results

The disparities of fertility of Assam have been studied with the available data from census report. The study is based on secondary data pertaining to the demographic variables of the different districts. Fourteen important indicators have been selected for the study. In this study, Principal Component Analysis (PCA) has been used (SPSS) to measure district wise development differential at various principal components levels as well as the aggregate level of development. Principal Component Analysis is a multivariate statistical technique to find a few uncorrelated linear combinations of original variables which can be used to summarize the data, loosing as little information as possible. In mathematical term, an initial set of n correlated variables are formed [16]. Here, say from a set of variables X_1 through to X_n

$$PC_{1} = a_{11}X_1 + a_{12} X_2 + \ldots + a_{1n}X_n$$

$$PC_{m} = a_{m1}X_1 + a_{m2} X_2 + \ldots + a_{mn}X_n$$

Wherea_{mn} represents the weight for the m^{th}principle components and the n^{th} variable.

Principal Component Analysis creates uncorrelated components or indices. Each component is a linear weighted combination of the initial variables. The uncorrelated property of the components is highlighted by the fact are orthogonal. The weights for each principal component are given by eigenvectors of the correlation matrix. The variance λ for each principal component is given by the eigen value of the corresponding eigenvector. The components are ordered so that the first component (PC_1) explains the largest possible amount of variation in the original data, subject to the constraint. Again, the second component (PC_2) is completely uncorrelated with the first component and explains. But it is less variation than the first component, subject to the same constraint. Here, analysis is made to reduce the number of variables into a few ones that can explain most of the variance of the original data set. The index value is computed for demographic disparities and for classification of districts. The demographic indicators are mentioned below.

List of Indicators and Variables used for the study:

1. Hindu Population (HPOP) : X_1
2. Muslim Population (MPOP) : X_2
3. Hindu Sex (HSEX) : X_3
4. Muslim Sex (MSEX) : X_4
5. Crude Birth Rate for Hindu (HCBR) : X_5
6. Crude Birth Rate for Muslim (MCBR) : X_6
7. Total Fertility Rate for Hindu (HTFR) : X_7
8. Total Fertility Rate for Muslim (MTFR) : X_8
9. Hindu Male Literacy (HML) : X_9
10. Hindu Female Literacy(HFL) : X_{10}
11. Muslim Male Literacy(MML) : X_{11}
12. Muslim Female Literacy (MFL) : X_{12}
13. Hindu Child Women Ratio (HCWR) : X_{13}
14. Muslim Child Women Ratio (MCWR) : X_{14}

The indicator values are estimated from 2011 Census of Assam. Based on these demographic indicators the mean, standard deviation, range, maximum and minimum values are presented in Table 5.1.

Table 5.1: Indicators and Demographic Variables

Sl.No	Indicators	Variables	Mean	S.D	Range	Maximum	Minimum
1	HPOP	X_1	63.89	21.97	75.55	95.47	19.92
2	MPOP	X_2	30.51	24.69	77.71	79.67	1.96
3	HSEX	X_3	957.97	14.55	66.25	985.86	919.62
4	MSEX	X_4	944.56	31.93	66.88	971.44	804.55
5	HCBR	X_5	15.38	1.36	5.30	17.93	12.63
6	MCBR	X_6	21.22	4.38	13.93	27.94	14.01

7	HTFR	X_7	1.73	0.244	1.00	2.20	1.20
8	MTFR	X_8	2.74	0.688	2.20	3.70	1.50
9	HML	X_9	55.15	1.100	3.52	57.10	53.58
10	HFL	X_{10}	44.85	1.100	3.52	46.42	42.90
11	MML	X_{11}	55.56	1.69	7.38	60.23	52.85
12	MFL	X_{12}	44.43	1.69	7.38	47.15	39.77
13	HCWR	X_{13}	151.17	23.34	86.55	193.80	107.25
14	MCWR	X_{14}	245.43	61.81	186.49	312.53	126.03

Source: Census Report of India, Government of India, 2011

It has been observed that the mean of Crude Birth Rate (CBR) of Hindu is 15.38 and that of Muslim is 21.22, i.e. the CBR of Muslim is greater than that of Hindu. In the observations it has also been found that the CBR of Hindu varies between17.93 (Cachar district) and 12.63(Baksa district) while for Muslims it varies between 27.94(Bongaigaon district) and 14.01(Jorhat district). It indicates the high CBR mean of Muslims. The same results have been drawn for TFR and Child Women Ratio. From these observations we may summarize that in the said area, the fertility rate for Muslim is high than the Hindu community. It is seen that there is wide variation in the selected indicators. The Correlation matrix has been prepared for the selected demographic indicators which are shown in Table 5.2. Calculation has been made using SPSS.

Table 5.2: Calculated Correlation Matrix

Variables	X_1	X_2	X_3	X_4	X_5	X_6	X_7	X_8	X_9	X_{10}	X_{11}	X_{12}	X_{13}	X_{14}
X_1	1													
X_2	-.964	1												
X_3	-.218	.312	1											
X_4	-.181	.354	.558	1										
X_5	.107	-.145	-.333	-.276	1									
X_6	-.794	.700	.266	.105	-.118	1								
X_7	.011	.007	-.181	-.095	-.088	-.039	1							
X_8	-.130	.042	-.017	-.139	-.235	.024	.003	1						
X_9	.426	-.569	-.329	-.425	-.011	-.134	-.104	.110	1					

X_{10}	-.426	.569	.329	.425	0.11	.134	-.104	-.110	-1	1				
X_{11}	-.017	-.127	-.388	-.728	.106	.138	.314	-.028	.484	-.484	1			
X_{12}	.017	.127	.388	.728	-.106	-.138	-.314	.028	-.484	.484	-1	1		
X_{13}	.261	-.377	-.196	-.305	.247	-.036	-.019	.205	.566	.566	.327	-.327	1	
X_{14}	-.734	.670	.321	.240	-.225	.923	.043	.088	-.073	.073	.131	-.131	.085	1

It is obtained from the Table 5.2 that, the CBR of Muslims(X_6) and Child Women Ratio of Muslims(X_{14}) are highly correlated with each other which is 0.923. Similarly, Population of Muslim(X_2) and Child Women Ratio of Muslims(X_{14}) are also highly correlated which is 0.670. The other indicators are also positively or negatively correlated to each other. The eigen values and the percentage of variance explained by the principal components derived from the correlation matrix R are represented Table 5.3.

Table 5.3: Calculated eigen values and percentage of variations

Variance Components	Initial eigen values		
	Total	% of Variation	% of Cumulative
1	4.842	34.588	34.588
2	3.138	22.416	57.004
3	1.621	11.576	68.580
4	1.204	8.600	77.180
5	1.041	7.435	84.615
6	0.772	5.515	90.130
7	0.583	4.167	94.298
8	0.342	2.440	96.737
9	0.249	1.778	98.515
10	0.168	1.201	99.716
11	0.033	0.233	99.949
12	0.007	0.051	100.00
13	0.001	0.016	100.00
14	0.001	0.013	100.00

The reason for computing first five principal component corresponding to the eigen value greater than 1, is that they are together explain 85 percent variation of the data. The first, second, third, fourth and fifth components respectively explains 34.6 percent, 57.0 percent, 68.6 percent, 77.2 percent and 84.6 percent of the total variation the data. This is done with the SPSS. The weight of the principal component corresponding to the first five eigen values computing by using the correlation matrix are presented in Table 5.4.

Table 5.4: Calculated Weight of Principal Component Matrix

Variables	Components				
	d_1	d_2	d_3	d_4	d_5
X_1	-0.671	-0.664	0.125	-0.070	0.164
X_2	0.793	0.512	-0.159	0.003	-0.093
X_3	0.599	-0.067	0.422	-0.031	0.279
X_4	0.712	-.331	0.337	0.044	0.292
X_5	-0.253	-0.076	-.0529	0.660	0.005
X_6	0.481	0.781	0.120	0.196	0.115
X_7	-0.181	0.238	-0.200	-0.686	0.124
X_8	-0.034	0.146	0.431	-0.130	-0.852
X_9	-0.799	0.210	0.455	0.019	0.159
X_{10}	0.799	-0.210	-0.455	-0.019	-0.159
X_{11}	-0.616	0.668	-0.253	-0.133	0.079
X_{12}	0.616	-0.668	0.253	0.133	-.0079
X_{13}	-0.562	0.218	0.382	0.431	-0.049
X_{14}	0.465	0.774	0.284	0.115	0.151

Thus the Principal Component d_1, d_2, d_3, d_4 and d_5 are given by the matrix equation as follows:

$$D=W^T * Z \tag{5.1}$$

Where D is matrix of order 5x1, having five elements viz. principal components

i.e.

$$D=\begin{bmatrix} d_1 \\ d_2 \\ d_3 \\ d_4 \\ d_5 \end{bmatrix}$$

Here, W is the matrix of 14x5 whose elements are shown in Table-5.5 and W^T is the transpose of it. Z is matrix of 14x1 having 14 elements of standardized normal variables,i.e.

$$Z_i = (X_i - \mu_i)/\sigma_i \ ,$$

where, μ_i is the mean and σ_i is standard deviation of variables x_i. The variables for different indicators are recorded in different units of measurement. These are transformed to standard normal to make them free of the units of measurement. The Table 5.5 represents the value of Principal Component of 27 districts, which are analyzed with the help of MATLAB software.

The districts are arranged in the chronological order as:

Kokrajhar[1], Dhuburi[2], Goalpara[3], Barpeta[4], Morigaon[5], Nagaon[6], Sonitpur[7], Lakhimpur[8], Dhemaji[9], Tinsukia[10], Dibrugarh[11], Sibsagar[12], Jorhat[13], Golaghat[14], Karbi-Anglong[15],DimaHasao[16], Cachar[17], Karimganj[18], Hailakandi[19],Bongaigaon[20], Chirang[21], Kamrup[22], Kamrup (M) [23], Nalbari[24], Baksa[25] , Darrang[26], Udalguri[27].

Table 5.5: Principal Component values for the districts

Districts Code	d_1	d_2	d_3	d_4	d_5	$\bar{d}$
[1]	-1.727	1.652	2.146	0.392	-0.459	0.401
[2]	3.084	4.020	-0.123	0.038	-0.462	1.311
[3]	7.461	1.242	1.589	0.823	-1.468	1.930
[4]	5.413	3.353	-1.131	-0.954	-0.661	1.204
[5]	6.776	0.044	2.609	-0.436	-0.935	1.612
[6]	5.990	-0.141	0.055	1.572	-1.022	1.291
[7]	-1.013	0.400	1.779	0.039	0.500	0.341
[8]	0.350	-0.845	-0.084	2.571	0.472	0.493
[9]	-7.954	0.858	0.266	-1.210	0.439	-1.520
[10]	-7.716	-1.912	0.188	1.284	-0.396	-1.710
[11]	-7.410	-2.420	-0.265	0.856	-0.414	-1.930
[12]	-0.608	-6.006	0.513	-0.134	-1.417	-1.530
[13]	-0.220	-6.300	-0.491	-0.530	-0.787	-1.666
[14]	-0.637	-5.003	0.536	-0.124	-0.475	-1.141
[15]	-7.218	2.024	1.435	0.782	-0.223	-0.640
[16]	-13.278	5.824	-2.192	0.156	-1.714	-2.241
[17]	1.167	-0.654	-1.417	0.284	-0.093	-0.142
[18]	4.202	2.283	-1.036	0.495	-0.052	1.178
[19]	1.656	2.160	-1.270	0.792	0.365	0.741
[20]	5.301	1.520	-1.696	1.535	1.877	1.707
[21]	-0.955	1.416	1.254	0.375	2.537	0.925
[22]	0.946	0.569	-2.145	-0.284	1.273	0.072
[23]	-0.110	-4.749	-3.756	-1.206	0.135	-1.937
[24]	0.530	0.446	-1.489	-2.457	-0.494	-0.693
[25]	-1.915	0.134	1.934	-2.286	1.784	-0.070
[26]	3.815	2.708	-0.803	-1.394	-0.067	0.852
[27]	-1.680	0.803	2.904	-1.010	0.172	0.238

It has been observed in the preceding section that the mean values of d's are negative. Therefore, it will be proper to compute indices from the value of by using transformation which makes them to lie between 0 and 100. For Index Value the following form can be used:

$$l_i = [\ \{\bar{d}_{(i)} - \text{Min}_{(i)}\} / \{\text{Max}_{(i)} - \text{Min}_{(i)}\}\ ] \times 100 \qquad (5.2)$$

The index value for each district is given in Table-5.6.

Table 5.6: District wise Index Value

District Code	$\bar{d}$	Index
[16]	-2.241	0.000
[23]	-1.937	7.287
[11]	-1.930	7.446
[10]	-1.710	12.724
[13]	-1.666	13.798
[12]	-1.530	17.044
[9]	-1.520	17.286
[14]	-1.141	26.384
[24]	-0.693	37.120
[15]	-0.640	38.388
[17]	-0.142	50.318
[25]	-0.070	52.061
[22]	0.072	55.452
[27]	0.238	59.431
[7]	0.341	61.903
[1]	0.401	63.341
[8]	0.493	65.547
[19]	0.741	71.490
[26]	0.852	74.154
[21]	0.925	75.920

[18]	1.178	81.989
[4]	1.204	82.606
[6]	1.291	84.683
[2]	1.311	85.174
[5]	1.612	92.375
[20]	1.707	94.672
[3]	1.930	100.000

The classification of the districts has been made on the basis of calculated index values. Here, the percentiles of Normal distribution are used to classify the districts of Assam. The values have been categorized by the following:

Table 5.7: Categorized the districts based on fertility indicators

Low	Less than [($\bar{d}$- 0.6745 x σ)]	[Less than -0.903]
Middle	[($\bar{d}$ - 0.6745 x σ) to $\bar{d}$]	[-0.903 to 0]
High	[$\bar{d}$ to ($\bar{d}$ + 0.6745 x σ)]	[0 to 0.835]
Very High	More than [($\bar{d}$ + 0.6745 x σ)]	[More than 0.835]

Finally, the classification has been presented in Table 5.8.

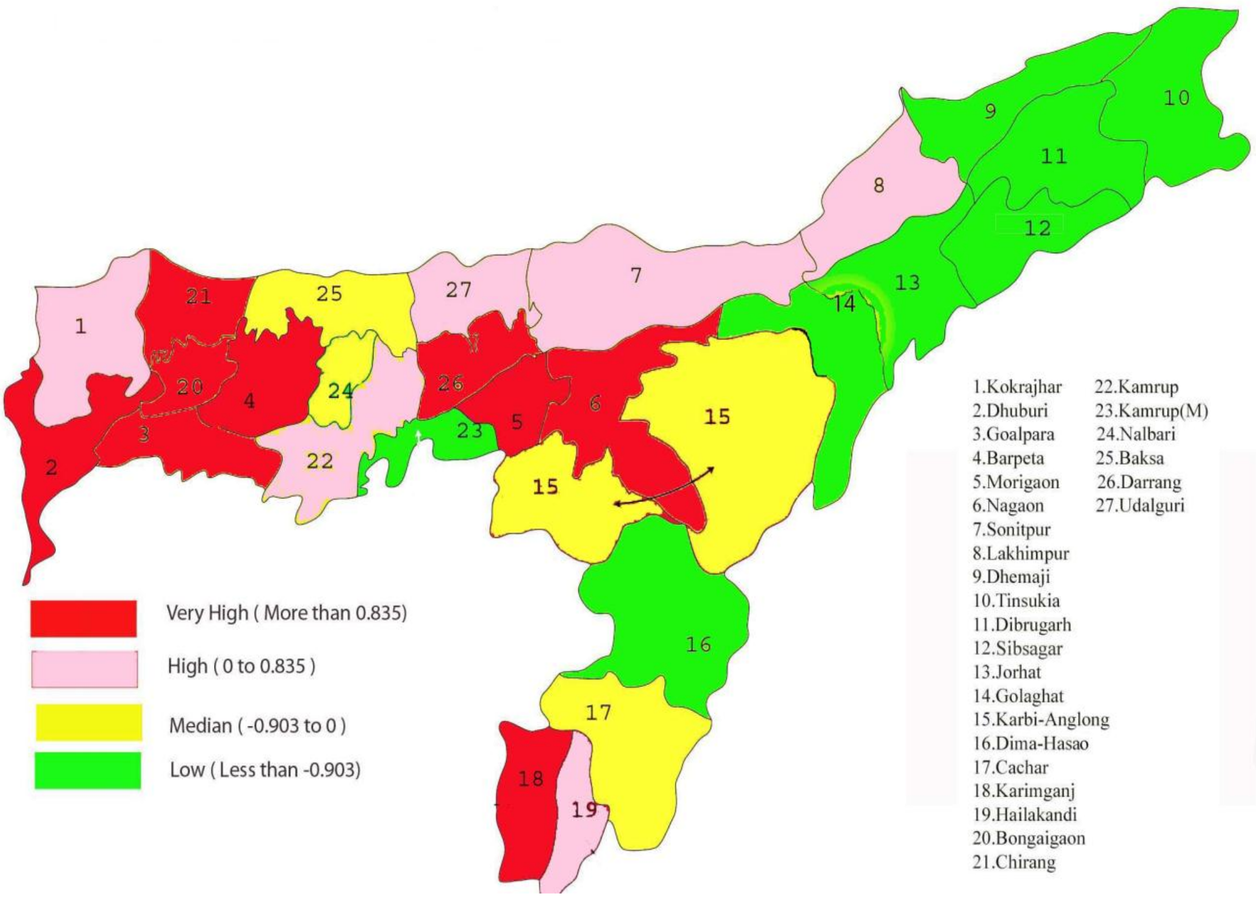
Table5.8: Classification of districts

Low	Middle	High	Very High
[9], [10],[11],[12], [13],[14],[16],[23]	[15],[17], [24],[25]	[1],[7],[8],[19] [22], [27]	[2],[3],[4], [5],[6], [18],[20], [21],[26]

The computed index value of Assam shows that the district DimaHasao[16] has the lowest index while Goalpara[3] stands the highest index. It signifies that the TFR, CBR and CWR for Muslim community is higher in the districts Goalpara[3], Bongaigain[20], Dhuburi[2], Barpeta[4], Nagaon[6], Morigaon[5], Karimganj[18] and Darrang[26]respectively than that of Hindu. Similarly, in upper Assam, the districts Jorhat[13], Dibrugarh[11], Sibsagar[12], Tinsukia[10]and Golaghat[14] have the lower value of TFR and CBR for Hindu community. The TFR for Muslim is high in the Chirang[21] district . Thus an analysis has been made to classify the districts of Assam in accordance with demographic indicators.

The position map of the districts in respect of categorization is shown in Fig.5.1. It may be concluded from the figure that the state Assam has a wide range of disparity in respect of demographic indicators among the districts.

Fig 5.1: Classification of districts of Assam based on demographic indicators



5.3 Conclusion

From the above observations we have come into conclusion that Assam as a whole has large fertility differentials. Fertility of Hindu is declining significantly while that of Muslim is mounting abnormally. Higher CBR of Muslim community in the districts of lower Assam has been observed specifically which may be the significant parameter for the growth of population. Alarmingly higher fertility causes rapid change of population. Higher birth rate and illiteracy [27, 40] are one of the reasons for abnormal growth of the Muslim population in Assam. To find the root cause we need more analysis on the complex interaction between religions, reproduction, and fertility differential in Assam. Wide spread opportunities are found to be there in the field for future research which may cover more and more indicators.