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STATISTICAL EVALUATION OF DEMOGRAPHIC DISPARITIES OF TWO COMMUNITIES OF ASSAM

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ABSTRACT

The study of religious differentials in fertility of Assam is important, because of its religious heterogeneity. There are vast disparities among the districts of Assam relating to growth of population and fertility of two major religions, i.e. Hindu and Muslim. It is observed that there is an inter district disparities in the growth of population in Assam. Significant disparities have been found in respect of religion wise development. Districts have been classified according to different demographic indicators by computing an index using Principal Component Analysis. Based on statistical data available in Census Report, the total investigation has been made.

KEYWORDS: Demographic Indicators, Disparities, Fertility, Religions

INTRODUCTION

The demographic characteristics of a state provide an overview of its population size, composition of territorial distribution, changes therein. Population statistics include indicators that measure the population size, sex ratio, density and dependency ratio, while vital statistics include indicators such as birth rate, death rate, and natural growth rate, life expectancy at birth, mortality and fertility rates. Fertility analysis is of central importance in demographic analysis as births are a vital component of population growth. The study of fertility also provides important information about women reproductive behavior and attitudes. The term fertility relates to the population projection. Population size and growth in a country influence the situation of the economy, policy, culture, education and environment, etc. of this country and determine exploring and cost of natural sources.

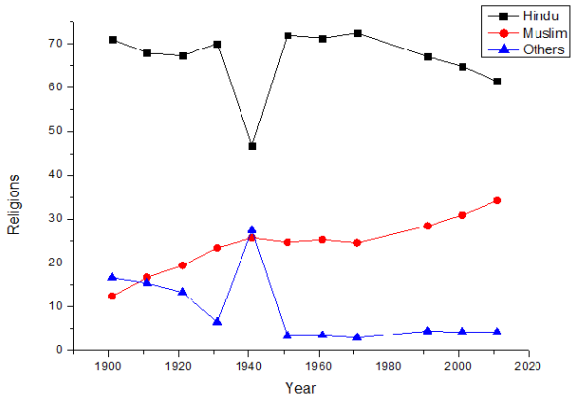
Demographically, the state Assam is characterized by with her population, which is 31 million compared to all India total 1210 million as per 2011 census. Population density of Assam is calculated as 397 per sq. km which is little high compare to national figure 382 per sq. km. In the census report of 2011, it is seen that the highest growth of population at the district level is Dhubri which is 24.44. The analysis is based on district level census data of Assam. The analysis shows that the proportion of Muslims has been rising rapidly in some districts whereas the Hindu population is declining and losing their share in all the districts of Assam.

The term fertility is directly influenced by a set of sociology and biological factors. The women's age is directly related to fertility. The age at marriage has been observed as an important factor associated with high fertility. According to Kulkarni and Alagarajan [2005], fertility is the major factor in population growth differentials between Hindus and Muslims. As Muslims are more illiterate and poor, particularly in rural areas, it is necessary to look into why they don't utilize the services provided by the government. The spectacular decline in fertility in Iran and Bangladesh in recent years gives us a pathway to follow in India. Davis [1951] noted that child- woman ratios of Muslims in undivided India were

about 12-14 percent higher than among Hindus. Bhat and Zavier [2005] conclude with an assessment of the implications of the current demographic trends for the future population sizes of the two religious groups.

Religion and Fertility in Assam

The issue of differentials in population growth and fertility among the major religious communities of Assam, particularly Hindus and Muslims, continues to be intensely debated. It is a fact that the share of Muslims in the total population of India, particularly in Assam has been rising slowly over the past century. Muslims have been growing at a higher rate than the average. According to Census Report 2011, the proportion of Muslims has significantly increased by 0.8 percentage points, particularly in Assam. The percentage of Muslim population grew from 15% in 1901 to 25% in 1951. The growth rate Muslims constituted 30.9 % of the state's population in 2001 and it has increased to 34.26% in 2011. This higher growth rate has been attributed to higher fertility among Muslims. During the period 1971-91 and 1991-2001, the average annual growth of Muslim in Assam was 38.7 and 29.3 respectively. But, during this period the growth of another religion was 21.8 and 13.9 only and also corresponding estimated average natural growth rate of Assam was only 19.6 and 18.7. Therefore, it is seen that the growth of Muslim population is inordinately high in Assam during 1971-2001. So, female education could be an important influencing variable in fertility transition among the Muslims. The growth rate of population in some of the minority dominated districts of Assam like Dhubri, Goalpara, Barpeta, Nagaon, Marigaon, Hailakandi, etc., are comparatively much higher than the state growth rate. The Figure 1 shows the religion wise population of Assam.



Source: Census Reports

Figure 1: Religion-Wise Population of Assam Since 1901 To 2011

Religion has been quite an important factor in the causation of fertility differentials. From the figure, it is clearly seen that the Muslim population of Assam had almost doubled from 12.40% in 1901 to 25.72 % in 1941. Since then, no doubt, the Muslim population has increased consistently. Further, between 1941 and 1951, the Muslim population had dropped marginally in percentage terms from 25.72% to 24.68% in Assam.

OBJECTIVES

The main objective of this work is to study the district wise demographic disparities of two major communities of Assam and classify the districts, according to different demographic indicators by computing an index using Principal Component Analysis approach.

MATERIALS AND METHODS

The district wise demographic disparities of Assam are 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 version 16.0) to measure districts wise development, differential at various principal component levels as well as the aggregate level of development. Principal Component Analysis is a multivariate statistical technique to find a few interrelated linear combinations of original variables, which can be used to summarize the data, loosing as little information as possible. In mathematical terms, from an initial set of n correlated variables. Here, say from a set of variables X_1 through to X_n

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

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

Where a_{mm} represents the weight for the mth principle components and the nth variable

PCA 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 the eigenvectors of the correlation matrix. The variance λ for each principal component is given by the eigenvalue of the corresponding eigenvectors. 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 less variation than the first component, subject to the same constraint. Here, analysis is to reduce the number of variables into a few ones that can explain most of the variance of the original data set. Also, the index value is used for demographic disparities and for classification of districts.

Some other demographic indicators of two communities and its mean, standard deviation, range, maximum and minimum values are presented in Table 1. It is seen that there is wide variation in the selected indicators.

Table 1: Indicators and Demographic Variables

Sl. No	Indicators	Variables	Mean	σ	Range	Maximum	Minimum
1	Hindu Population (HPOP)	X_1	63.89	21.97	75.55	95.47	19.92
2	Muslim Population (MPOP)	X_2	30.51	24.69	77.71	79.67	1.96
3	Hindu Sex (HSEX)	X_3	957.97	14.55	66.25	985.86	919.62
4	Muslim Sex (MSEX)	X_4	944.56	31.93	66.88	971.44	804.55
5	Crude Birth Rate for Hindu (HCBR)	X_5	15.38	1.36	5.30	17.93	12.63
6	Crude Birth Rate for Muslim (MCBR)	X_6	21.22	4.38	13.93	27.94	14.01
7	Total Fertility Rate for Hindu (HTFR)	X_7	1.73	0.244	1.00	2.20	1.20
8	Total Fertility Rate for Muslim (MTFR)	X_8	2.74	0.688	2.20	3.70	1.50
9	Hindu Male Literacy (HML)	X_9	55.15	1.100	3.52	57.10	53.58
10	Hindu Female Literacy(HFL)	X_{10}	44.85	1.100	3.52	46.42	42.90
11	Muslim Male Literacy(MML)	X_{11}	55.56	1.69	7.38	60.23	52.85
12	Muslim Female Literacy (MFL)	X_{12}	44.43	1.69	7.38	47.15	39.77
13	Hindu Child Women Ratio (HCWR)	X_{13}	151.17	23.34	86.55	193.80	107.25
14	Muslim Child Women Ratio (MCWR)	X_{14}	245.43	61.81	186.49	312.53	126.03

It has been observed that the mean of Crude Birth Rate (CBR) of Hindus is 15.38 and of Muslims are 21.22, i.e. the CBR of Muslim is greater than that of Hindus. In the observations of CBR data of different districts, it is 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 result is drawn for TFR and Child Women Ratio. From these observations, we may summaries that in the said area, the fertility rate for Muslim is higher than the Hindu community.

Table 2: 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}
X1	1													
X2	-.964	1												
X3	-.218	.312	1											
X4	-.181	.354	.558	1										
X5	.107	-.145	-.333	-.276	1									
X6	-.794	.700	.266	.105	-.118	1								
X7	.011	.007	-.181	-.095	-.088	-.039	1							
X8	-.130	.042	-.017	-.139	-.235	.024	.003	1						
X9	.426	-.569	-.329	-.425	-.011	-.134	-.104	.110	1					
X10	-.426	.569	.329	.425	0.11	.134	-.104	-.110	-1	1				
X11	-.017	-.127	-.388	-.728	.106	.138	.314	-.028	.484	-.484	1			
X12	.017	.127	.388	.728	-.106	-.138	-.314	.028	-.484	.484	-1	1		
X13	.261	-.377	-.196	-.305	.247	-.036	-.019	.205	.566	-.566	.327	-.327	1	
X14	-.734	.670	.321	.240	-.225	.923	.043	.088	-.073	.073	.131	-131	.085	1

The eigen values and the percentage of variance explained by the principal components derived from the correlation matrix R are represented Table 3.

Table 3: Eigen Values and Percentage of Variations

Variance Components	Initial Eigen Values		
	Total	% of Variation	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 components corresponding to the eigenvalue greater than 1 is due to the fact that they are together explaining 85 percent variation of the data. The first, second, third, fourth and fifth components, respectively explains 34.6%, 57.0%, 68.6%, 77.2% and 84.6% of the total variation in the data.

The weight of the principle component corresponding to the first five eigen values, computing by using the correlation matrix is presented in Table 4.

Table 4: Weight of Principal Component Matrix

Variables	Components				
	d_1	d_2	d_3	d_4	d_5
HPOP	-.671	-.664	.125	-.070	.164
MPOP	.793	.512	-.159	.003	-.093
HSEX	.599	-.067	.422	-.031	.279
MSEX	.712	-.331	.337	.044	.292
HCBR	-.253	-.076	-.529	.660	.005
MCBR	.481	.781	.120	.196	.115
HTFR	-.181	.238	-.200	-.686	.124
MTFR	-.034	.146	.431	-.130	-.852
HML	-.799	.210	.455	.019	.159
HFL	.799	-.210	-.455	-.019	-.159
MML	-.616	.668	-.253	-.133	.079
MFL	.616	-.668	.253	.133	-.079
HCWR	-.562	.218	.382	.431	-.049
MCWR	.465	.774	.284	.115	.151

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

$D=W^T * Z$

Where, D is a 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 6 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. Hence, they are transformed to standard normal to make them free of the units of measurement. Table 5 shows the value of Principal Component of 27 districts.

Table 5: Principal Component Values for 27 Districts of Assam

Districts	d_1	d_2	d_3	d_4	d_5	$\bar{d}$
Kokrajha	-1.727	1.652	2.146	0.392	-0.459	0.401
Dhuburi	3.084	4.020	-0.123	0.038	-0.462	1.311
Goalpara	7.461	1.242	1.589	0.823	-1.468	1.930
Barpeta	5.413	3.353	-1.131	-0.954	-0.661	1.204
Morigaon	6.776	0.044	2.609	-0.436	-0.935	1.612
Nagaon	5.990	-0.141	0.055	1.572	-1.022	1.291
Sonitpur	-1.013	0.400	1.779	0.039	0.500	0.341
Lakhimpu	0.350	-0.845	-0.084	2.571	0.472	0.493
Tinsukia	-7.716	-1.912	0.188	1.284	-0.396	-1.710
Dibrugar	-7.410	-2.420	-0.265	0.856	-0.414	-1.930

Table 5: Contd.,						
Districts	**d_1**	**d_2**	**d_3**	**d_4**	**d_5**	**$\bar{d}$**
Sivasaga	-0.608	-6.006	0.513	-0.134	-1.417	-1.530
Jorhat	-0.220	-6.300	-0.491	-0.530	-0.787	-1.666
Golaghat	-0.637	-5.003	0.536	-0.124	-0.475	-1.141
KarbiAnglong	-7.218	2.024	1.435	0.782	-0.223	-0.640
Dima Hasao	-13.278	5.824	-2.192	0.156	-1.714	-2.241
Cachar	1.167	-0.654	-1.417	0.284	-0.093	-0.142
Karimgan	4.202	2.283	-1.036	0.495	-0.052	1.178
Hailakan	1.656	2.160	-1.270	0.792	0.365	0.741
Bongaiga	5.301	1.520	-1.696	1.535	1.877	1.707
Chirang	-0.955	1.416	1.254	0.375	2.537	0.925
Kamrup	0.946	0.569	-2.145	-0.284	1.273	0.072
kamrup (M)	-0.110	-4.749	-3.756	-1.206	0.135	-1.937
Nalbari	0.530	0.446	-1.489	-2.457	-0.494	-0.693
Baksa	-1.915	0.134	1.934	-2.286	1.784	-0.070
Darrang	3.815	2.708	-0.803	-1.394	-0.067	0.852
Udalguri	-1.680	0.803	2.904	-1.010	0.172	0.238
Dhemaji	-7.954	0.858	0.266	-1.210	0.439	-1.520

Classification of Districts

Since some of the mean value of d' is negative, it will be proper to compute indices from the value of by using transformation, which makes them to lie between 0 and 100. That is, in the index table 6, for each district is given. The classification of districts of Assam is given in Table 7.

Table 6: Index Value

Districts	**$\bar{d}$**	**Index**
Dima Hasao	-2.241	0.000
Kamrup(M)	-1.937	7.287
Dibrugar	-1.930	7.446
Tinsukia	-1.710	12.724
Jorhat	-1.666	13.798
Sivasaga	-1.530	17.044
Dhemaji	-1.520	17.286
Golaghat	-1.141	26.384
Nalbari	-0.693	37.120
KarbiAnglong	-0.640	38.388
Cachar	-0.142	50.318
Baksa	-0.070	52.061
Kamrup	0.072	55.452
Udalguri	0.238	59.431
Sonitpur	0.341	61.903
Kokrajha	0.401	63.341
Lakhimpu	0.493	65.547
Hailakan	0.741	71.490
Darrang	0.852	74.154
Chirang	0.925	75.920
Karimgan	1.178	81.989
Barpeta	1.204	82.606
Nagaon	1.291	84.683

Table 6: Contd.,		
Districts	$\bar{d}$	**Index**
Dhuburi	1.311	85.174
Morigaon	1.612	92.375
Bongaiga	1.707	94.672
Goalpara	1.930	100.000

The classifications of the districts have been made based on calculated index values of the indicators shown in Table 7. The percentiles of Normal distribution are used to classify the districts of Assam. The value of have been categorized by the following.

1. Low Fertility = [Less than -0.903]
2. Middle Fertility = [-0.903 t0 0]
3. High Fertility = [0 to 0.835]
4. Very High Fertility = [More than 0.835]

Table 7: Classification of Districts of Assam Based on Fertility Indicators

Low	Middle	High	Very High
Tinsukia	Karbi_Anglong	Kokrajhar	Dhuburi
Dibrugarh	Cachar	Sonitpur	Goalpara
Sivasagar	Nalbari	Lakhimpur	Barpeta
Jorhat	Baksa	Hailakandi	Morigaon
Dima-Hasao		Kamrup	Nagaon
Kamrup(M)		Udalguri	Karimganj
Golaghat			Bongaigaon
Dhemaji			Chirang
			Darrang

The computed index value of demographic development of two communities of Assam district shows that Dima-Hasao has the lowest index while Goalpara stands height index. From that, we may say that the districts like Goalpara, Bongaigain, Dhuburi, Barpeta, Nagaon, Morigaon, Karinjang, Darrang have higher TFR, CBR, CWR for Muslim community than Hindu. Similarly, the upper Assam Districts i.e. Jorhat, Dibrugarh, Sivasagar, Tinsukia, Golaghat has the lowest Total Fertility Rate (TFR) and Crude Birth Rate (CBR) for the Hindu community. In Chirang district, Muslim TFR is high. So, an analysis has been made for classifying all districts of Assam, according to demographic indicators. Districts have been divided into four classes based upon the values of the principal components, calculated from 14 indicators considered in the study. The classification of the districts of Assam is on the basis of **Error! Bookmark not defined.**calculating from the indicators in the study.

It is observed from the Figures 2 and it may be concluded that, the state Assam has a wide range of disparity in respect of demographic indicators among the districts. From the above study, it is also seen that the Total Fertility Rate (TFR), Crude Birth Rate (CBR), Child Women Ratio (CWR) is higher in the eight districts of Assam, particularly Dhuburi, Barpeta, Marigaon, Karimganj, Hailakadi, Bongaigaon and Nagaon.

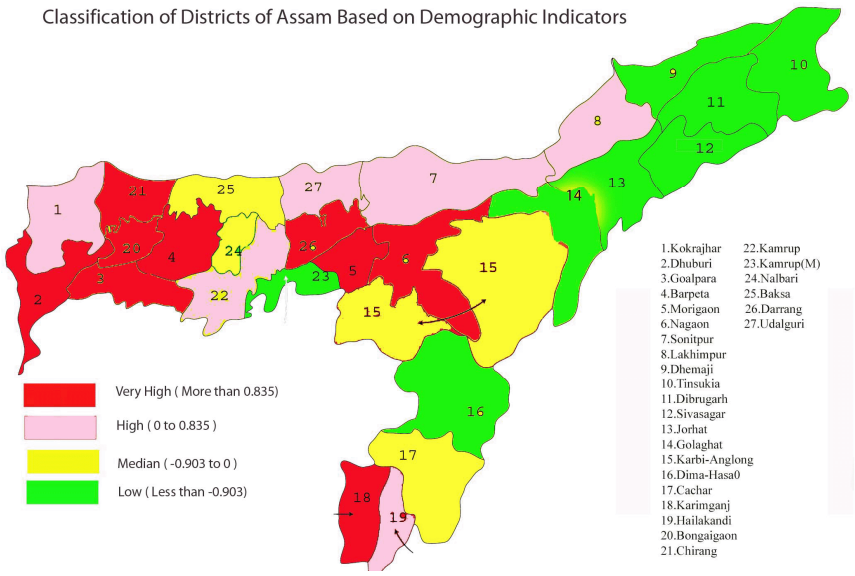


Figure 2: Classification of Districts based on Demographic Indicators

CONCLUSIONS

From what has been found from the above observation, we have come into conclusion that Assam as a whole has fairly large fertility differentials. Hindus are declining significantly and Muslim population increases abnormally. Higher crude birth rate of Muslim communities in the districts of lower Assam has also been observed, which may be the significant parameter for the growth of population. One of the main reasons behind the abnormal growth of the Muslim population in Assam is due to below the higher birth rate, illiteracy and alarmingly higher fertility rate, religious conversion and aggressive behavior of a particular community. To find the root cause we need more analysis of the complex interaction between religions, reproduction, and fertility differentials in Assam. So, widespread opportunities are there in the field for future research, which may cover more and more indicators.

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