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Fertility, Parity Progression Ratio and Population Growth of Assam: A Statistical Analysis

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Abstract—The study of fertility provides important information about women reproductive behavior and attitudes. The study of religious differentials in fertility is all the more important and intriguing in the case of Assam because of its religious heterogeneity. In this paper, an attempt is made to examine the effect of religion on fertility of two communities especially Hindu and Muslim in Assam. In Assam an attention is drawn by Parity Progression Ratio for each district of Assam based on 2011 census data. The study also investigates the close relationship between Total Fertility Rate and Parity Progression Ratio and Complete Fertility Rate. Also, it is observed that there is an inter district disparities in the growth of population in Assam. Based on statistical data, it is also observed that the population structure is changing very fast.
Keywords—Fertility, Demographic Structure.

I. INTRODUCTION

Fertility is a key driver of the size and composition of the population. Fertility may be defined as the number of live births that a woman produces during her reproductive span; otherwise, it is the child-bearing activity of a population. Fertility refers to the actual production of children. Only a particular section of the females has the capacity to bear children viz. females belonging to the age group 15 to 49. Further, it is to be noted that only live births are to be taken into account while measuring fertility as it is only a live birth which accounts for increase in population. Fertility is the single most important determinant of population dynamics and growth. Fertility control is the most important way to check high population growth. Fertility is directly influence by a set of sociology and biological factors. The factors such as women's age, education level, age at marriage, economic status and religious attitudes etc., are often called intermediate fertility variable. Women's age is directly related to fertility. The age at marriage has been observed as an important factor associated with high fertility. Early marriage increases her reproductive span. The term religion plays an important role in determining the attitude of the people in limiting the fertility. Religion disparities play an important role in declining or increasing fertility. The terms Total Fertility Rate (TFR), Complete Fertility Rate (CFR), Parity Progression Ratio (PPR) are also the important factors to determine fertility.

The term Parity Progression Ratio is the probability of having another child given that mother has reached certain parity i.e. have had a certain number of children. Parity Progression Ratio be based on birth statistics or census data on fertility, and on birth cohorts, marriage cohorts and married population without birth cohorts or the corresponding period data. In this paper the birth cohort of (1961-1965) women is computed by PPR for rural and urban each district of Assam. Since, the PPR was introduced by Henry (1953) as a useful measure of fertility. The fertility behavior of population can be explained if we specify the processes: first, how females space their children and second, how many females of a given parity proceed to the next.These processes taken together specify the pattern and level of fertility of the given population.

The Complete Fertility Rate for the birth cohort of women is computed by PPR for each district of Assam. For that, the women are tabulated by parity. The CFR of a cohort, can be expressed as an arithmetic series of products of Parity Progression Ratios PPRs.

II. DISTRIBUTION OF POPULATION BY RELIGIOUS GROUPS AND THEIR SEX RATIO

It is found from the first Census (in 1872) that religious profile of population is an important demographic feature. It reports that in 2001 census India's Hindu population was 80.5 percent and Muslim population was 13.4 percent. Demographers generally use Sex-ratio **t**o depict the proportionate share of female in the population sample The sex ratio of a country or community is an important indicator for measuring their socio-economic condition as well as the extent of prevailing equality between males and females at a given point of time. Declining sex ratio is one of the serious problems. The population as well as sex ratio is depicted in table-1.

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TABLE- 1

Population Growth, Crude Birth and Death Rate and Sex Ratio India 1901-2011.

Year	Population (in million)	Percentage Decadal Variation	Annual average growth rate(percent)	Crude Birth Rate	Crude Death Rate	Sex Ratio(female per 1000 male)
1	2	3	4	5	6	7
1901	238.4	-	-	45.8	44.4	972
1911	252.1	5.75	0.56	49.2	42.6	964
1921	251.3	-0.31	0.03	48.1	47.2	955
1931	279.0	11.00	1.04	46.4	36.3	950
1941	318.7	14.22	1.33	45.2	31.2	945
1951	361.1	13.31	1.25	39.9	27.4	946
1961	439.2	21.51	1.95	41.7	22.8	941
1971	548.2	24.80	2.2	41.2	19.0	930
1981	683.3	24.66	2.22	37.2	15.0	934
1991	846.4	23.87	2.14	32.5	11.4	927
2001	1028.7	21.54	1.97	24.8	8.9	933
2011	1210.2	17.64	1.64	21.8	7.1	940

Source: Census and SRS reports of India.

III. LITERACY RATE

Literacy Rate plays a key role in the social development approach. The literacy rate female education forms an important demographic element and is a vital measure of human progress towards modernization. For the underdeveloped countries, the level of education is considered to be a depression of fertility. Education enhances the quality of human capital and is indispensable for modernization. The literacy rate of male and female is plotted in Fig-1 and Fig-2. It has been observed that literacy rate of male is linear after 1970year's. Moreover the literacy rate of female is larger as compared to that of national level.

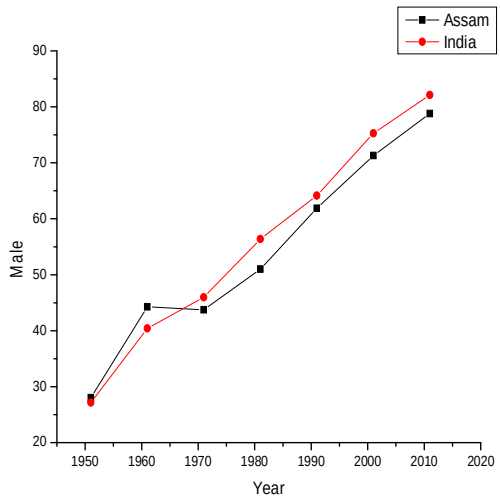

Fig. 1 Literacy Rate for male

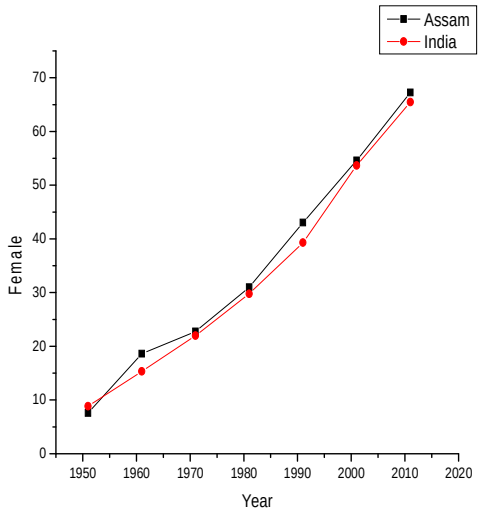

Fig. 2 Literacy Rate for Female.

POPULATION GROWTH DIFFERENTIALS IN ASSAM

The components of population growth, viz., fertility, mortality, migration. Religion has been an important factor in the causation of fertility differentials.

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According to census 2011, in Assam out of 27 districts the 14 districts i.e.Dhubri, Morigaon, Goalpara, Darrang, Nagaon, Karimganj, Hailakandi, Barpeta, Bongaigaon, Cachar ,Dhemaji, Kamrup(M), Karbi Anglong and Lakhimpur have recorded population growth rate above State Growth Rate. The fig-III shows the religion wise population of Assam. .

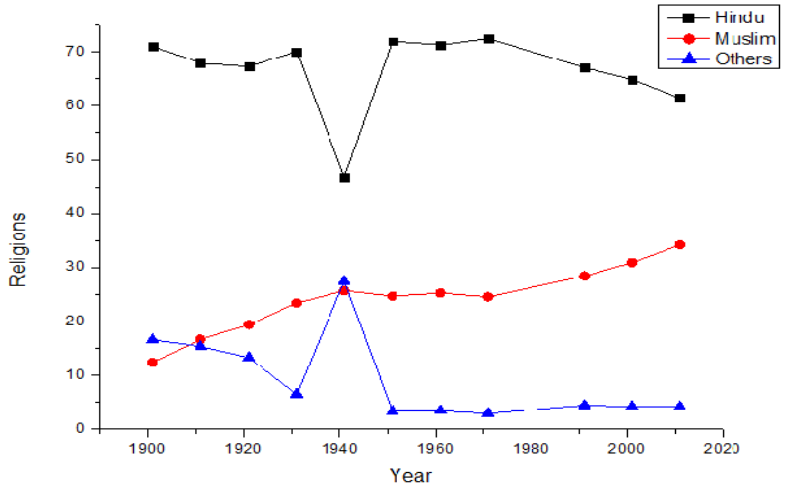

Fig. 3 Religion-Wise Population of Assam since 1901 to 2011.
Source: Census Data.

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, Muslim population increased consistently till it reached 34.22 % in 2011. Further between 1941 and 1951, the Muslim population had dropped marginally in percentage terms from 25.72% to 24.68% in Assam.

IV. METHODS AND ANALYSIS

Assam, being a Hindu majority state, fears that it will become Muslim-dominated state. The demography as a whole in the world is concerned with understanding the fertility behavior and the term fertility is related to the population projection. Female education could be an important influencing variable in fertility transition among the Muslims. There is an indication that several districts of Assam have shown a very low rate of growth, while Muslim dominant districts like Dhubri, Goalpara, Barpeta, Nagaon and Marigaon in lower Assam, and also Hailakandi in Cachar, have grown at a much higher rate than the average of the state. The process of demographic change and of the marginalization of Hindus in Assam has not yet abated. According to population census 2001, religion wise percentage distribution of population, reveals that out of total population in the state Hindu was 64.89 percentage and 30.92 percent were Muslims. The sex ratio, i.e. number of female per 1000 males in the state shows an improvement. During 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 other 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 are inordinately high in Assam during 1971-2001. In 1901 in Assam, out of total population in the state Hindus were 69.22 percentage and only 9.5 percent were Muslims. According to Census 2011, Hindus slide from 80.5 % to 79.8 %; Muslims climb from 13.4 % to 14.2 %. That is, it is seen that the share of Muslims has increased in the overall population. The table-II shows it clearly.

TABLE- II
New Growth Rates of Two Religions Communities in Assam from 1971-2011

Year	% of Hindu Population	% of Muslim Population
1971-1901	3.29	15.06
1991-1971	-5.38	3.87
2001-1991	-2.24	2.49
2011-2001	-3.43	3.3

Source: Compiled from various Census Reports.

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The percentage of Muslim population increases in all the decades. But, for Hindu community it increases in the decade 1971-1901, after that it has a negative growth rate.

V. SLOW AND STEADY FERTILITY DECLINE IN ASSAM

TFR is a summary measure of fertility based on age-specific fertility rate (ASFR). ASFR are obtained by mathematically by summing up of the ASFRs and multiplying by age interval gives the measure of TFR . Usually, fertility is measured as the total fertility rate (TFR), which equals the average number of births a woman would have if she were to bear children in each year of her life at the same rate.

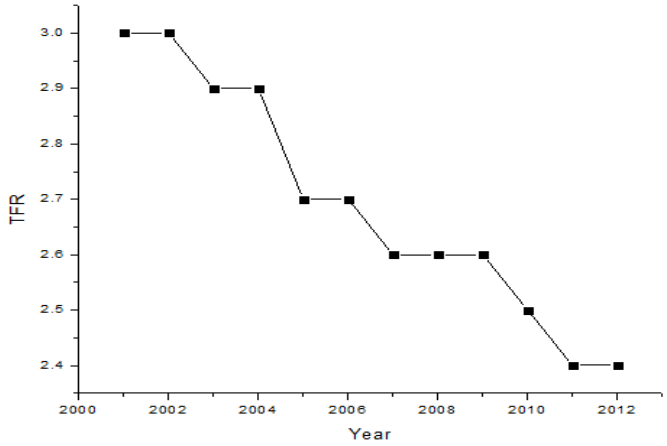

Fig. 4 TFR of Assam from 2001-2012.

According to Sample Registration System (SRS) 2001-2012, TFR of Assam has dropped consistently from 3.0 to 2.4. Similarly, Register General Of India (RGI) Population Projection 2006 reported that, Assam is likely to achieve replacement-level of fertility (i.e. 2.1) by 2019.

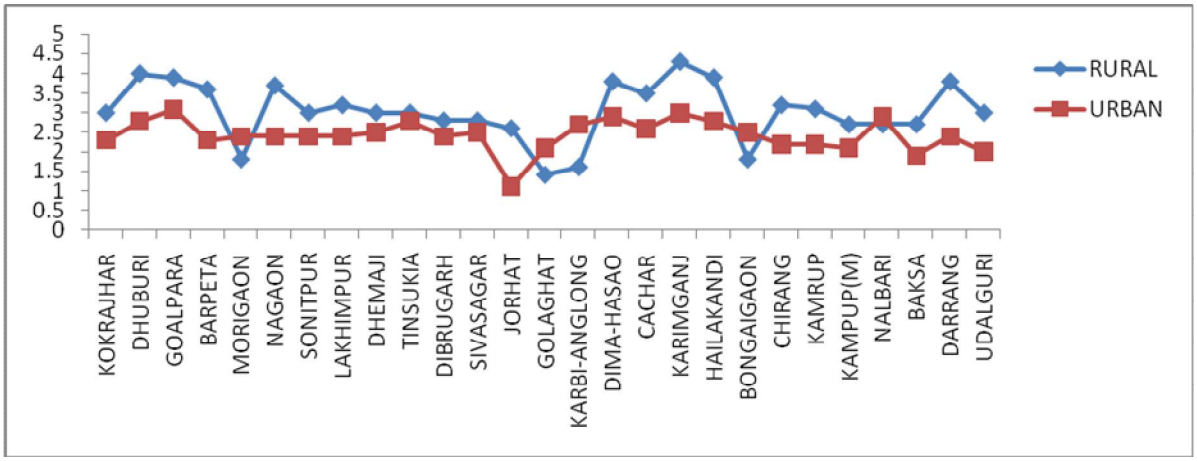

Fig. 5 District Wise Estimation of Total Fertility Rate.

From that it is clear the Total Fertility Rate for Urban is less than Rural areas. The figure shows that, TFR is height in all the districts for Muslim community except Tinsukia, Dibrugarh, Sivasagar and Jorhat. The TFR is height in Dhuburi (rural) and lowest in Jorhat (urban).From the figure-V it is clear that the upper Assam districts always have a lower fertility level than that of the lower Assam districts. Hence, we can also conclude that the TFR is always height in lower Assam districts than others.

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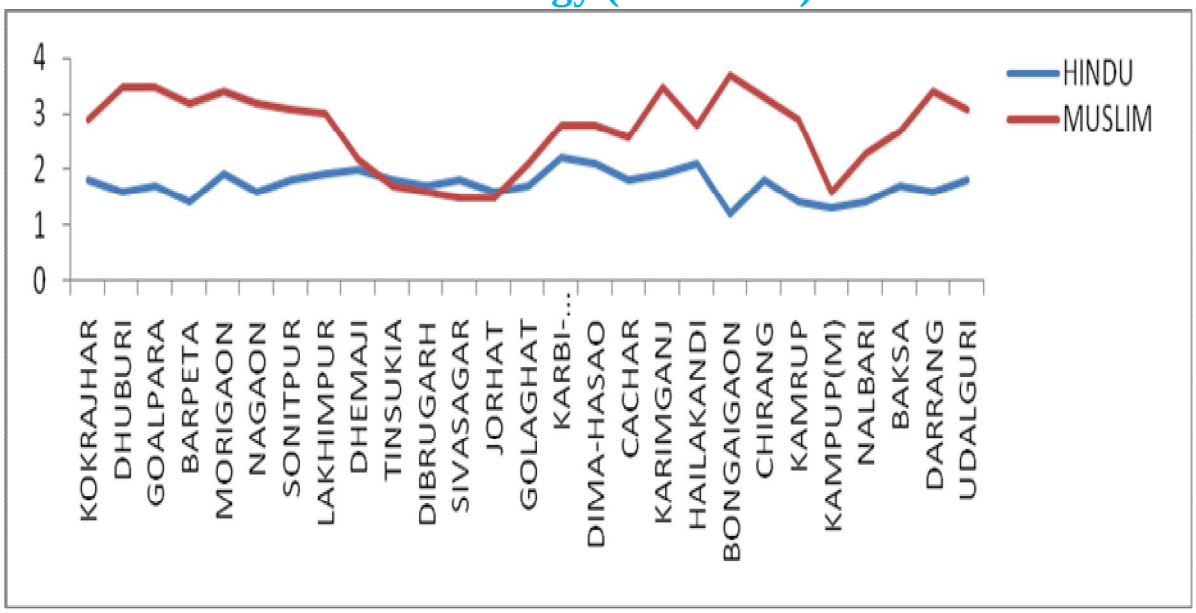

Fig. 6 Estimation Total Fertility Rate for Hindu and Muslim.

Since, TFR is related to the Parity Progression Ratio.Parity Progression Ratio (PPR) is obtained with the following procedure:

Tabulate the women by parity.
Obtain the number of women who have reached parity by cumulating the figure from bottom up.
Divide adjacent figure to obtain the probability.

Note: a_0 is the probability of women in the cohort who become mother.
In their form, PPR may be computed as ratios of the number of births of adjusted orders in a current year.
The formulae may then be given as follows:

$$a_{i} = B_{i+1} / B_i$$

Where, B_i represent birth of a given order in some year and B_{i+1} are birth of the next higher order in the same year.

In a more refined form, PPR may be computed for birth cohorts and may make allowances for marriage and the different intervals between the births of different parities. In another form, the rates are based on the proportions of married women who have had children of a particular order and above.

The PPR a_i would then be defined as follows:

$$a_o = m_{1+} \quad \text{……..……(1)}$$
$$a_1 = m_{2+} / m_{1+} \quad \text{……..(2)}$$
$$a_i = m_{i+1} / m_{i+} \quad \text{……..(3)}$$

where $m_{1+}, m_{2+}, \ldots, m_{i+}$ are the percent of married women in a given year who have had 1 or more, 2 or more, …, i+1 or more children and where a_0, a1, …, a_i are the "probabilities d'agrandissement " of the families with 0 (without children), 1 child, …, i children, or, in general, the probabilities that a family will enlarged by an additional child each year. The probabilities are calculated only for cohorts of women who have reached the end of the child bearing period.

VI. COMPLETE FERTILITY RATE (CFR)

The average number of children ever born to women in a birth cohort may be expressed as:

CFR= a(0)+ a(0)a(1) + a(0)a(1)a(2) + a(0)a(1)a(2)a(3)+. . . +a(0)a(1)…a(n)

Where, a (0) is just the proportion of women in the cohort who become mothers.

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Table-III
Complete Fertility Rate for Rural and Urban.

Districts	CFR Rural	CFR Urban
Kokrajhar	2.288	1.697
Dhuburi	2.723	2.043
Goalpara	2.571	2.162
Barpeta	2.594	1.92
Morigaon	2.541	2.005
Nagaon	2.567	1.907
Sonitpur	2.291	1.761
Lakhimpur	2.413	1.886
Dhemaji	2.417	1.966
Tinsukia	2.326	1.881
Dibrugarh	2.107	1.714
Sivasagar	2.007	1.692
Jorhat	1.992	1.666
Golaghat	2.149	1.678
Karbi-Anglong	2.656	2.093
Dima-Hasao	2.666	2.064
Cachar	2.415	1.865
Karimganj	2.735	2.057
Hailakandi	2.709	1.882
Bongaigaon	2.878	1.752
Chirang	2.387	1.978
Kamrup	2.292	1.955
Kamrup Metro	2.081	1.607
Nalbari	2.24	1.838
Baksa	2.189	1.935
Darrang	2.547	1.8
Udalguri	2.293	1.866

The following figures show the Parity Progression Ratio of Rural-Urban separately for all districts of Assam.

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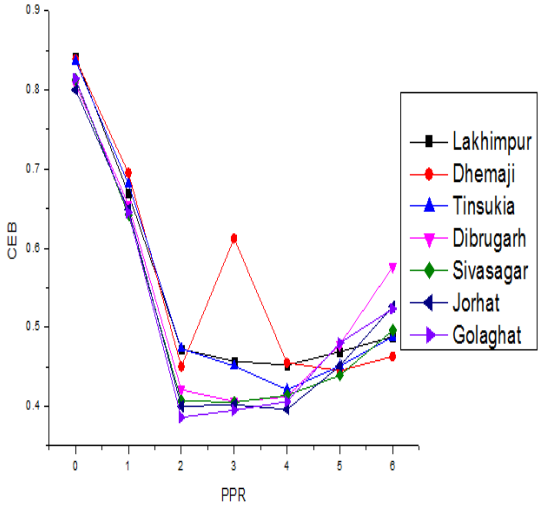

Fig.7(a) PPR for Urban district wise of Assam (upper)

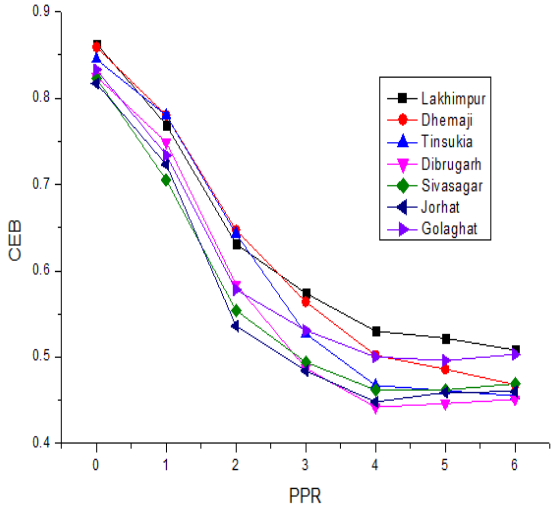

Fig.7(b): PPR for Rural district wise of Assam(upper)

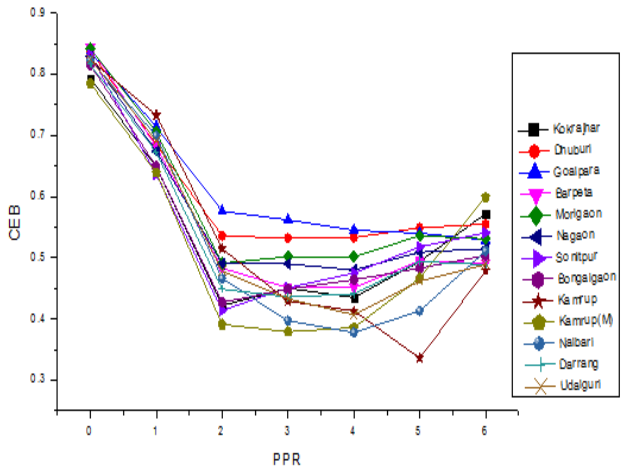

Fig.7(c) PPR for Urban district wise of Assam(lower)

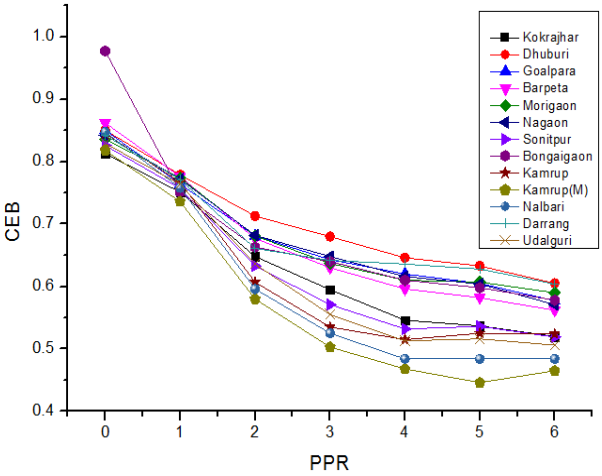

Fig.7(d) PPR for Rural district wise of Assam(lower)

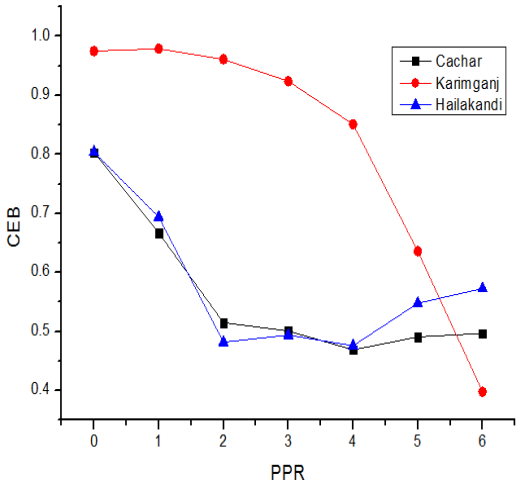

Fig.7 (e) PPR for Urban of Assam(Barak Valley)

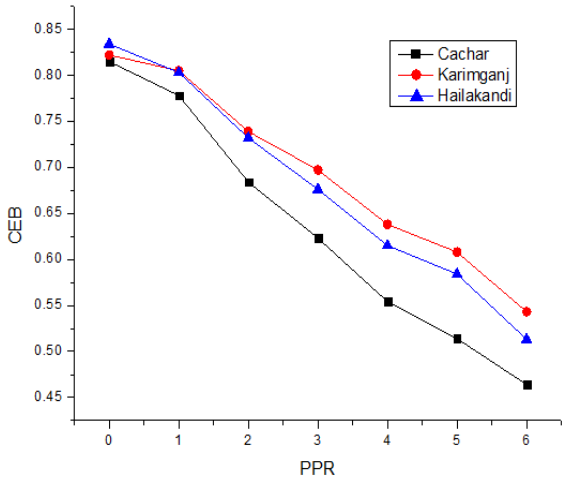

Fig.7 (f) PPR for Rural of Assam(Barak Valley)

In fig-7(a) and fig-7(b) PPR for urban-upper Assam the district Dhemaji has highest parity at 3. Similarly, for figure 7(e) it is seen that, though Karimganj urban parity is high, after that it is in decreasing.

VII.CONCLUSION

From the above analysis it is observed that Hindus are declining particularly in Assam very significantly, showing a dangerous signal for the future. Since despite a rise in the Hindu population, their percentage had gone down. Abnormal increase of Muslim's population observed to be a serious issue. One of the main reasons behind the abnormal growth of the Muslim population in Assam is early marriage i.e. legal age at marriage, higher birth rate, etc. TFR of Muslims are significantly higher than the Hindus.

Also, this paper has tried to evaluate the relationship between TFR, PPR and CFR . It is seen that, the CFR and TFR both are lower in Jorhat district. When TFR and CFR is low in that district Progression Ratio is low. It indicates that there is a close relationship among the variables. Again, if we compare the TFR, PPR and CFR for selected district like Nagaon then we see that TFR is high in that district. Similarly, the PPR and CFR is also high. Hence, it is clear that fertility is correlated with the factors like Total Fertility Rate , Parity Progression Ratio, Complete Fertility Rate. The estimated TFR for Jorhat, rural and urban is 2.6 &1.1 and for Dhemaji 3.0 &, 2.5 respectively. Similarly, PPR for urban Goalpara district is high and Bongaigaon district is low. Again, TFR for rural and urban of Goalpara district is 3.9, 3.1 and for Bongaigaon district 3.8 & 2.5.Again, it is seen that, estimated TFR for Dhuburi district rural -urban is 4 and 2.8 accordingly. It has been observed that the Parity Progression Ratio for rural is higher than the urban areas. Similarly, from the figure-v, it is observed that the total fertility rate is high in rural area. From that we may also conclude that in lower Assam districts in rural area the TFR is high.

So in conclusion it can be said that, the demographic imbalance of Assam has not only challenged its identity, but has also posed a threat to its existence.

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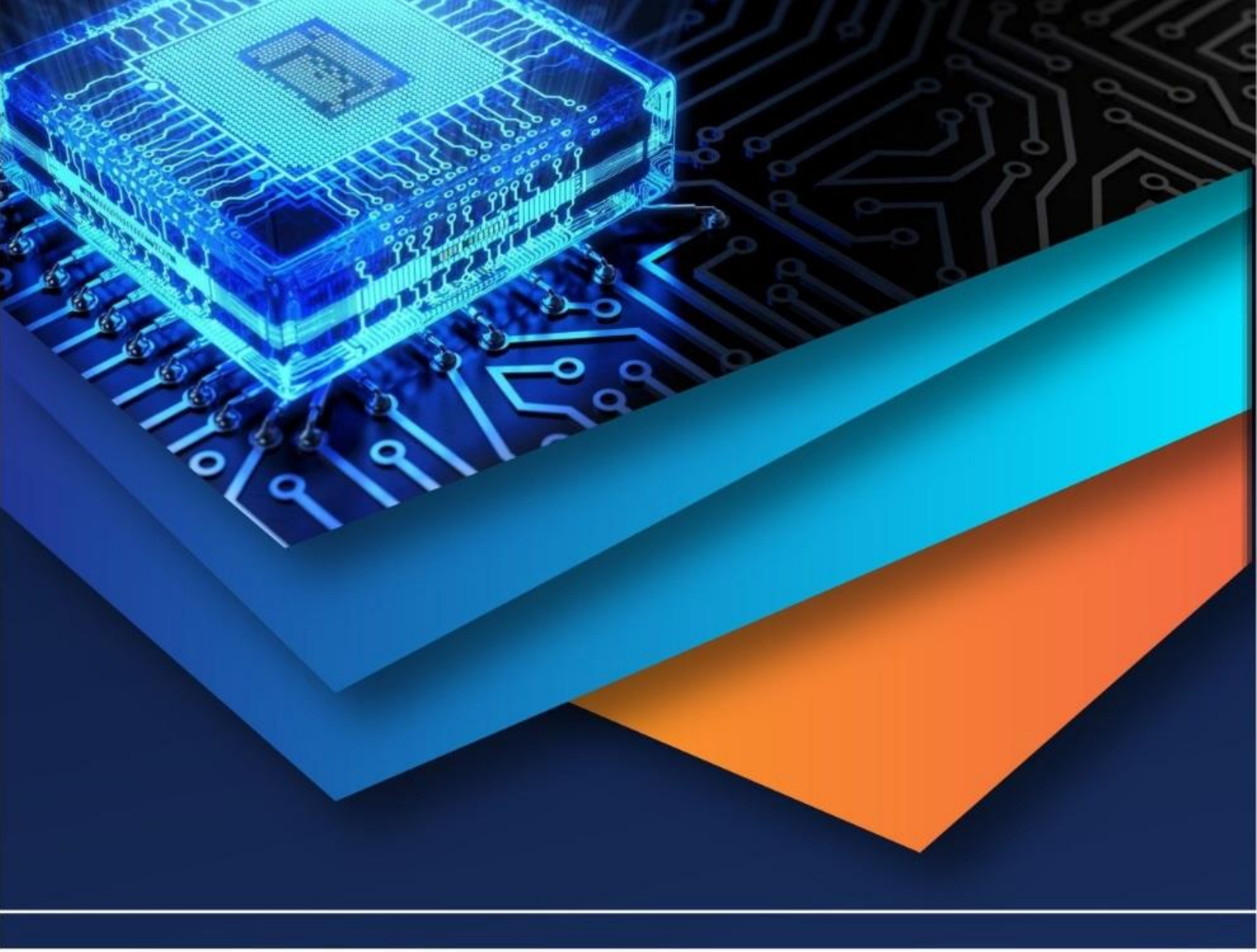

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