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Increasing Urban-Rural Ratios of Women in the Reproductive Age Group and the Impact on Fertility Transition: A District-Wise Analysis

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Abstract

The present paper attempts to study the contribution of female urbanisation to fertility decline, trends, and patterns of total fertility rate, as well as to understand the regional effect of urbanisation on total fertility rate by spatial analysis at the district level. Data from secondary sources was used, and changes and trends were analysed using scatter plots, choropleth maps, decomposition analysis, and spatial analysis. The analysis revealed that female urbanisation is increasing in India and playing an important role in fertility decline, although it is not universal. It also shows that female urbanisation does not contribute much to fertility decline at the country level. The choropleth maps show a clear north-south divide, showing rapid urbanisation and a decline in fertility in southern districts. The significance maps show that the effect of urbanisation on fertility has increased over 20 years.

Keywords: decomposition, spatial analysis, female urbanisation, fertility, transition

Introduction

Urbanisation is the most significant phenomenon of the 20th century, and India's urban population constitutes a sizeable proportion of the world's urban population (Jayaswal, 2015). Urbanisation refers to the gradual increase in the proportion of people living in urban areas (United Nations, 2009). According to the Census of India 2011, the state government grants municipal status – corporation, municipal council, notified town area committee or Nagar Panchayat, etc. to a settlement. In the census definition of urban areas, such settlements are statutory or municipal towns. Secondly, if a settlement does not have an urban civic status but satisfies demographic and economic criteria, which are:

i. A minimum population of 5000.

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ii. At least 75 per cent of the male main working population engaged in non-agricultural activities.
iii. A population density of at least 400 persons per square km.

Managing urbanisation is important to nurturing growth; neglecting cities—even in countries with low urbanisation levels—can impose high costs. In India, the percentage of urban population to the total population in Census 2011 was 31.16 per cent.

The three major components of population change are fertility, mortality, and migration, of which fertility plays a significant role. There was a decline in the Total Fertility Rate (TFR) in India from 2005-06 to 2015-16, i.e., from 2.7 to 2.2, respectively (International Institute for Population Sciences [IIPS] and Macro International, 2008; IIPS, 2018). Libenstein, in his cost-benefit analysis of children, proposed that the fertility decision of a couple is based on the balance between the utility and disutility of an additional child. Becker emphasised the demand and supply concept of children based on economic conditions. In urban areas, the cost of raising a child is much more than raising a child in a rural area; hence, urban fertility is lesser than rural fertility. Jaffe stated that fertility rates are generally higher in rural areas than in cities.

The impact of urbanisation on the fertility of India in the 1960s had been framed by a narrative about the facilities, i.e. a shift in occupational structure by increasing non - non-agricultural occupations, increases the rates of literacy, and rural-urban migration and effects improvements in the level of living, which further lowers fertility (Paulus, 1966). The researchers show considerable diversity across countries regarding urban-rural differences in age-specific fertility rates and the pace and character of fertility change by taking urban and rural areas as separate entities (Shapiro & Tambashe, 2001).

In a special research paper on 'Urbanisation and the fertility transition in Ghana', the researcher found that cumulative lifetime fertility declines with urban experiences. Each 10-year increase in age is associated with an additional 1.5 children. Urban ward migration may lower fertility. Adaptation to and socialisation in an urban environment significantly correlates with fertility decline (White et al., 2005). Similarly, in the 2008 paper, 'Urbanisation and fertility: An event-history analysis of coastal Ghana', he explained that the effect of urbanisation is strong and consistent with the adaptation mechanism (White et al., 2008).

In his paper, the researcher shows that urban residents have lower fertility odds than rural residents. Rural to urban migrants have lower odds of giving birth than rural stayers. Women with three children are predicted to have a probability of mobility that is 33 per cent lower than women with no children and 20 per cent below those with one child. It is revealed that secondary education reduces fertility

in rural areas more so than in urban areas; therefore, the most "fertility-effective" education strategy would be to target secondary education investments towards rural areas. Facilitating more rapid urbanisation could reduce fertility, especially migration from isolated areas where infrastructure investments are less cost-effective (Tadesse & Headey, 2010). Guo showed that rural fertility behaviour accounted for 72 per cent of the decline in national TFR due to the one-child policy compared to the modest contribution of urbanisation (22%) to the decline of China's TFR between 1982 and 2008 by doing the decomposition analysis. Urbanisation will be the main factor in fertility decline from 2010 to 2030. The trends of national, urban, and rural fertility may not be in the same direction when we consider the role of urbanisation (Guo, 2012). One of the studies indicates a clear and significant decline in fertility with migration to urban areas. Urban norms, opportunity costs, access to family planning services, higher education, and broad social changes reflected in the cohort's clear impact on fertility all support lower fertility in urban areas (Tadesse & Headey, 2010).

Researchers showed in his paper that education and income variables explain 26 per cent of variations in the rural-urban differential in fertility (Tumbe, 2016). A cohort study by Lerch showed that average fertility dropped to near replacement levels only 40 years after the national transition onset in the three continents (Lerch, 2017). The contribution of migration is dominant at early stages but declines in importance as the transitions proceed. In contrast, the contribution of natural increase grows at first and declines at later stages, and the contribution of reclassification rises throughout the transitions (Jiang & Neill, 2018). Post-transitional regional fertility in Romania suggested that for the regions with the highest degree of urbanisation and lowest fertility rates, a slight increase in the fertility rate is observed (Jemna & David, 2018). Another paper on fertility decline in urban and rural areas of developing countries supports the hypothesis of an inverted U-shaped trend in the fertility ratio by residence. The results reveal a fast and continuous decline in urban fertility once it starts in all developing regions. This confirms the importance of the universal process of fast structural and ideational change in societies to transform reproductive behaviours. (Lerch, 2018; Lerch, 2019)).

The available evidence shows an association between increasing urbanisation and declining fertility. Therefore, it is important to study fertility changes in the context of changing urbanisation patterns in India. Urbanisation promotes women's empowerment regarding the choice of contraception and the reduction of fertility in urban areas. The cost of an additional child increases in urban areas due to the cost of childbearing and rearing. Very few studies focused on the

contribution of urbanisation to fertility transition, and no study has used recent data, especially in India. This paper is an attempt to understand the regional variation and changes of urbanisation affecting fertility with the following research objectives:

1. To estimate the contribution of urbanisation in the TFR decline of India from 1971 to 2011.
2. To analyse the trends and patterns of TFR and urbanisation at the district level from 1991 to 2011.
3. To understand the regional effect of urbanisation on TFR by spatial analysis at the district level from 1991 to 2011.

Materials and Methods

The data for the country-level proportion of urban females of reproductive ages were taken from the 1971 Census, 1981 Census, 1991 Census, 2001 Census, and 2011 Census. The country-level TFR was taken from the SRS compendium for the respective years. The level of urbanisation was calculated at the district level from the 1991 Census and 2011 Census. The district-level TFR estimate is obtained from the research paper "Fertility Transition in the Districts of India, 1991-2011" (Mohanty et al., 2019), which uses the Reverse Survival Method of fertility estimation.

The following dependent and independent variables were used to analyse the trends, patterns, and distribution of TFR and urbanisation at the district level from 1991 to 2011.

Dependent variable: The study focuses on fertility transition, and the dependent variable is the Total Fertility Rate (TFR).

Independent variable: The level of the ratio of the female urban population is considered as the independent variable in all the objectives. In the first objective, the ratio of female urban population was calculated from Census data from 1991 and 2011.

Using GeoDa, scatter plots were generated for the district level, the independent variable being the percentage of the ratio of female urban population and the dependent variable being the TFR for the respective districts. Separate scatter plots were generated for 1991 and 2011.

Using ArcGIS, separate choropleth maps were created for district-level TFR for both 1991 and 2011. Similarly, separate choropleth maps were created for a district-level percentage of urbanisation for both 1991 and 2011. The percentage of urbanisation was calculated by taking urban females of the 15-49 age group and the total females of the 15-49 age group of the respective districts. Due to the division of several districts after 1991, the same estimated value is used for the divided districts (equal to the estimated value for the parent district).

The following choropleth maps were generated:

i. District-level percentage of the ratio of the female urban population in India, 1991

ii. District-level percentage of the ratio of female urban population in India, 2011
iii. District-level Total Fertility Rate in India, 1991
iv. District-level Total Fertility Rate in India, 2011

1. The following dependent and independent variables were used in the analysis to estimate the contribution of urbanisation in the TFR decline of India from 1971 to 2011

Dependent variable: The second objective's dependent variable is the Total Fertility Rate (TFR). The country-level TFR estimates are taken from the SRS compendium.

Independent variable: The level of the female urban population ratio is considered the independent variable. Rural and urban females of age groups 15-49 were taken from Census 1971 to 2011 and used to estimate the decomposition of fertility.

2. A decomposition approach was used to determine urbanisation's effect on fertility change. (Guo, Z. et al.; 2012). The analysis decomposes $TFR_{15\text{-}49}$ into three components, i.e., the effect of changes in urban fertility: It denotes the contribution of female urbanisation on TFR from changes in age-specific urban fertility.

i. Effect of changes in rural fertility: It denotes the contribution of the ratio of female urban population on TFR from changes in age-specific rural fertility.
ii. Effect of changes in the ratio of female urban population on TFR: It denotes the contribution of the ratio of female urban population on TFR from changes in the age-specific proportion of urban females within the total female population at reproductive age.

The decomposition is based on the following assumption:

i. Rural fertility is always higher than urban fertility in any age group.
ii. All components have no changes during the period taken.

3. The following dependent and independent variables were used in the analysis to understand the regional effect of urbanisation on TFR by spatial analysis at the district level from 1991 to 2011

Dependent variable: The study focuses on fertility transition, and the dependent variable is the Total Fertility Rate (TFR).

Independent variable: The level of the female urban population ratio is considered the independent variable in all the objectives. In the first objective, the ratio of the female urban population was calculated using census data from 1991 and 2011.

GeoDa software was used to generate bivariate LISA cluster maps, showing the regression between the level of urbanisation and TFR on a regional basis. LISA cluster maps were generated for:

i. Effect of urbanisation on TFR for 1991

ii. Effect of urbanisation on TFR for 2011

Discussion and Results

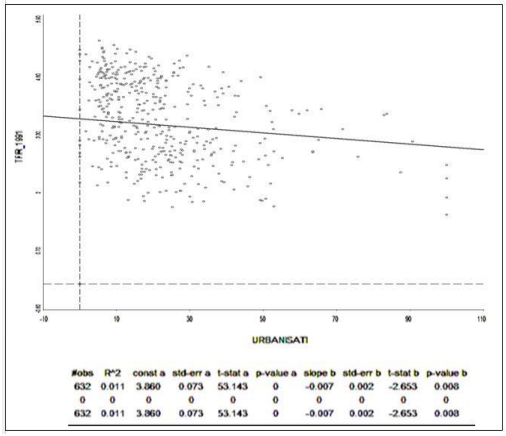
Distribution of Total Fertility Rate According to the Ratio of Female Urban Population in India

The scatter plot for the percentage of the ratio of female urban population and total fertility rate in India for the year 1991 is presented in Graph 1. Each dot represents a district. Each point's horizontal position indicates the level of the ratio of the female urban population (in percentage), and the vertical position indicates the total fertility rate (TFR) of the district. From the plot, a moderate negative correlation can be seen between the percentage of the ratio of the female urban population and TFR. As the percentage of the ratio of female urban population increases, TFR decreases. The plot does not have any outliers. The trend line shows the mathematically best fit of the data.

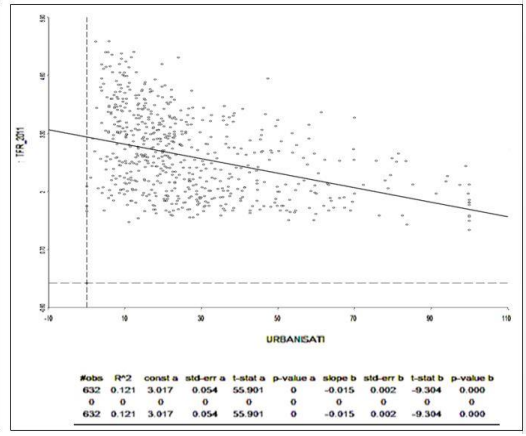
Graphs 1 and 2

Scatter Plot for the Percentage Ratio of Female Urban Population to Total Fertility Rate in India, 1991 and 2011

Graph 1: 1991



Graph 2: 2011



Graph 2 depicts the scatter plot for the percentage ratio of the female urban population to TFR in India for 2011. A moderate negative correlation can be seen between the percentage ratio of the female urban population and TFR. As the percentage ratio of the female urban population decreases, TFR decreases. The correlation between the two variables seems stronger than that of 1991.

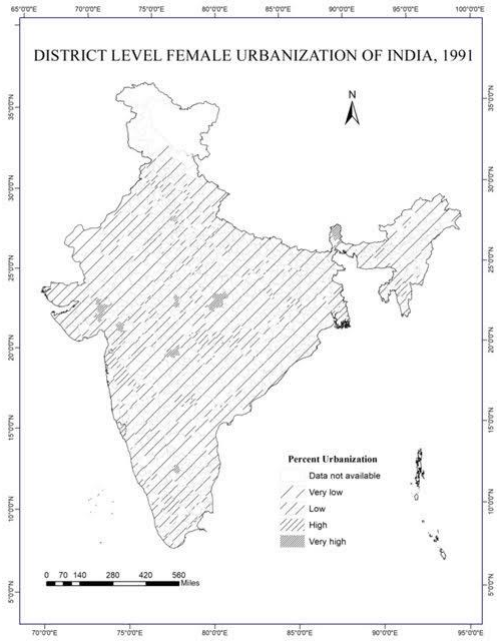
The plot does not have any outliers. The trend line shows the mathematically best fit of the data. It is more inclined in the 2011 graph than in 1991.

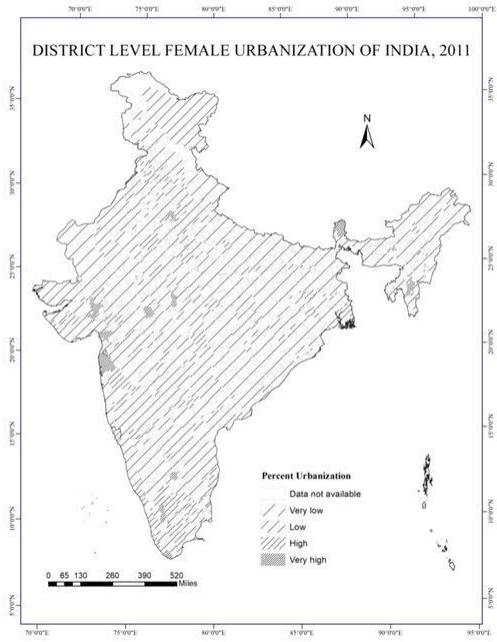
Trends and Patterns of District-Level Total Fertility Rate in India

Figures 1 and 2 show the trends and patterns of India's total fertility rate at the district level from 1991 to 2011.

In the maps, dark red denotes high TFR with the range 2.4 and above (Highest – Latehar and Purbi Singhbum districts with 5.69 TFR in 1991 and Khagaria with TFR 5 in 2011). Medium TFR is denoted by a dark pink colour with a range of 1.8 to 2.4 TFR. The light pink colour represents low TFR with a range of less than 1.8 TFR (Lowest –Kolkata with 1.62 TFR in 1991 and 1.1 TFR in 2011). The white colour shows the unavailability of data (Jammu and Kashmir, Assam and UTs in 1991). By comparing both maps, it is seen that, in 20 years, the TFR has declined largely in South India.

Figures 1 and 2
Total fertility rate by districts in India, 1991 and 2011





It has declined moderately in some parts of Central India. TFR is still very high in North India. The 2011 map shows a clear north-south divide.

Trends and Patterns of the Ratio of Female Urban Population in the Districts of India

The trends and patterns of the female urban population ratio in India's districts from 1991 to 2011 are shown in Figures 3 and 4. The percentage of the ratio of female urban population in the maps has been denoted in four categories with the following range:

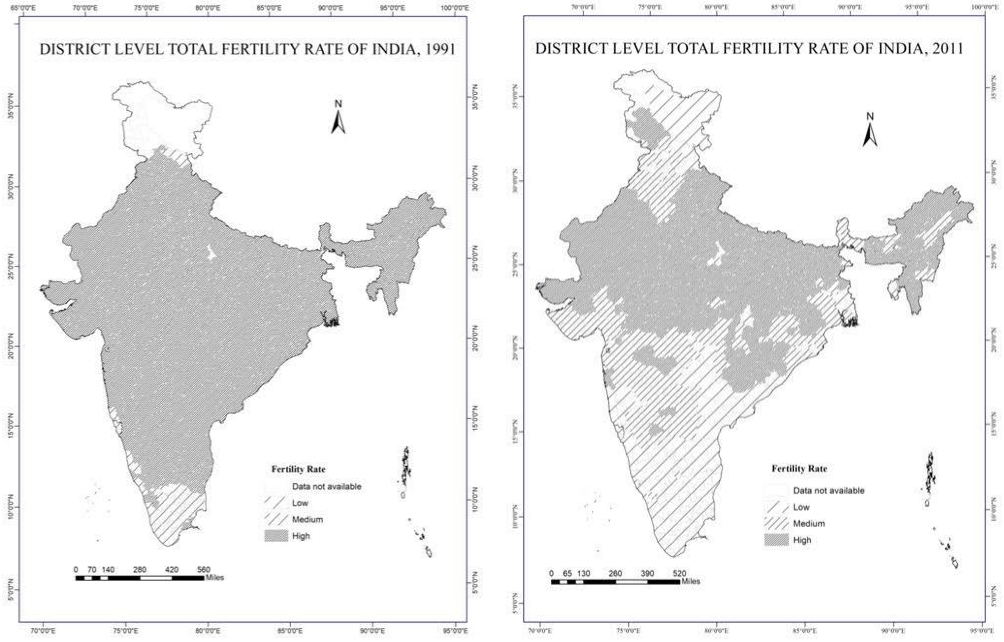
i. Very Low: 0 to 25 per cent (Lowest – West Sikkim with 1.75 per cent in 1991 and Baksa with 1 per cent in 2011)
ii. Low: 25 to 50 percent
iii. High: 50 to 75 percent
iv. Very High: 75 to 100 per cent (Highest – Hyderabad, Mumbai City, Suburban Mumbai, Washim, Chennai and Kolkata with 100 per

cent in 1991 and 2011 along with Central and East Delhi, Mahe, and Yanam in 2011)

The white colour shows the unavailability of data. Comparing both maps reveals that urbanisation has increased largely in 20 years. Western India has experienced more urbanisation than Eastern India. The rural population still dominates the Northeastern states. A clear north-south divide is visible on the 2011 map, where North India has a low urban population compared to South India.

Figures 3 and 4

The Ratio of Female Urban Population in the Districts of India, 1991 and 2011



The Contribution of the Ratio of Female Urban Population on the Total Fertility Rate in India

The decomposition of the changes in TFR in India from 1971 to 2011 is given in Table 1. The results show a 2.8-point decline in India's TFR between 1971 and 2011. The change in rural fertility behaviour contributed to 2.7 points of this decline. The change in urban fertility behaviour contributed to 2.2 points of this decrease. The change in urbanisation resulted in a 0.13-point increase in national TFR, which accounted for 4.71 per cent of the total increase in TFR from 1971 to 2011. The change in rural fertility behaviour accounted for the largest amount, 96.42 per cent, of the decline in TFR during this period. From 1971 to 1981, 1981 to 1991, and 2001 to 2011, the changes in rural and urban fertility behaviour led to a reduction in national TFR. Changes in rural fertility behaviour, urban

fertility behaviour, and urbanisation levels contributed to the reduction in national TFR from 3.6 in 1991 to 3.1 in 2001. From 1971 to 2011, the TFR has declined from 5.2 to 3.1. It is evident from the decomposition analysis that urbanisation does not contribute little to fertility at the country level. Apart from 1991-2001, all other decades saw an increase in fertility due to increased urbanisation. Other factors are more prominent in lowering fertility.

Table 1

Decomposition of the Changes in TFR in India, 1971 to 2011

Period	TFR per 1000 women			Absolute change per 1000			
	Start	End	Change	Rural	Urban	Urbanisation	Other
1971-1981	5200	4500	-700	-600	-800	43	-657
1981-1991	4500	3600	-900	-900	-600	24	-576
1991-2001	3600	3100	-500	-500	-400	-171	-571
2001-2011	3100	2400	-700	-700	-400	236	-164
1971-2011	5200	2400	-2800	-2700	-2200	132	-2068

Cluster Effect of the Ratio of Female Urban Population on Total Fertility Rate in the Districts of India

Figures 5 and 6 show the cluster effect of the ratio of female urban population on the total fertility rate in the districts of India for 1991 and 2011. The 1991 map also shows that 369 districts of India are insignificant, i.e., urbanisation does not affect TFR. In the cluster map 1991, 45 districts of India have a high-high relation, denoted in red. This means that TFR is high even with high urbanisation. Light blue denotes a Low-High relation, which means the TFR is high, and there is a low level of urbanisation. One hundred eighteen districts are in this category, all in North India. The pink colour denotes the High-Low relation, which means the TFR is low and urbanisation is high. There are 30 districts in the category, of which most are concentrated in the southern extreme of India.

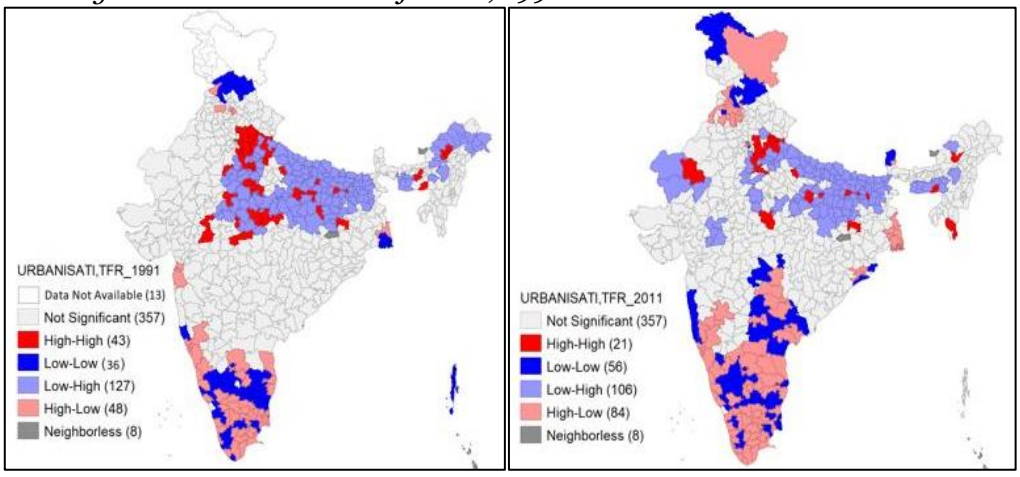
The map of 2011 shows that 353 districts of India are insignificant, i.e., urbanisation does not affect TFR. In the cluster map 2011, 20 districts of India have a high-high relation, denoted in red. This means TFR is in highly urbanised areas. Light blue denotes a low-high relation, which means the TFR is high and the level of urbanisation is low. One hundred nine districts are in this category, all in North India. The pink colour denotes the High-Low relation, which means the TFR is low and urbanisation is high. There are 83 districts in the category, of which the majority are concentrated in the southern extremities of India. The dark blue colour denotes a Low-Low

relation, which means the level of urbanisation and TFR are low. It includes 59 districts in India. A clear north and south divide shows urbanisation's impact on TFR. The cluster maps show that the red-coloured districts (High – High relation) are a matter of deep concern as the TFR is still high even after a high level of urbanisation. The blue-coloured districts (Low relation) are also a matter of concern as the female urban population and TFR ratio are low.

The ratio of female urban population increased in India during the study period, and the ratio plays an important role in fertility decline, although it is not universal. The available evidence shows an association between increasing urbanisation and declining fertility. The decomposition analysis shows that urbanisation only contributes a little to fertility at the country level. The choropleth maps indicate a clear north-south divide, showing rapid urbanisation and a decline in fertility in southern districts. The significance maps show that the effect of urbanisation on fertility has increased over the period.

Figures 5 and 6

Cluster Map of the Effect of the Ratio of Female Urban Population on Total Fertility Rate in the Districts of India, 1991 and 2011



Conclusion

More studies should focus on the contribution of urbanisation towards fertility decline. The limitation of the study is that the 1991 Census was not conducted in Jammu and Kashmir. Therefore, the value taken is zero. Due to the division of several districts after 1991, the estimated value is the same for both the divided districts (equal to the estimated value for the parent district). A primary survey is required for some particular districts to study human behaviour, which goes against demographic transition theory. Some primary studies may be undertaken in particular districts of high–high and low–low relations to

study the behaviour of people, which leads to the rejection of the Demographic Transition Theory.

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