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Population Growth In Districts of India 1951-2011

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Abstract

This paper analysis population growth trend in 640 districts of India as they existed at the 2011 population census, during the 70 years between 1951-2011 based on the population of the district enumerated at different population censuses beginning 1951 through 2011. The paper follows a modelling approach in which population growth in the districts is modelled by fitting the simple logistic growth model. The paper reveals that the simple logistic growth model provides very good fit to population growth during 1951-2011 in all but a few districts of the country. The paper employs estimate of the district population for different years derived from the fitted logistic growth model to analyse the trend in population growth in each of the 640 districts of the country during the period 1951-2011. The analysis reveals that the trend in population growth in the districts has changed at least five times during this period and growth of population in different temporal segments has been different within the district and across districts. The analysis reveals that the average annual per cent change in population during the 70 years under reference has been more than 2 per cent in almost two-third of districts of the country and there are at least 11 districts where annual per cent change in population has always been more than 2 per cent.

Introduction

A district is the third tier of the population and development administration system in India. Population and development policies and programmes in India are conceptualised and programmed at the national level, customised at state/Union Territory level but implemented at the district level. The district ls also the lowest administrative unit for monitoring the implementation of different population and development programmes and interventions. The progress of population and development programmes and interventions at the state/Union Territory level and at the national level is simply an aggregation of the progress at the district level. The Constitution of India mandates formation of District Planning Committee in each district to prepare the development plan for the district in recognition of considerable inter-district diversity in all aspects of population and social and economic development. Since population transition and social and economic development processes are inter-dependent, there

has also been emphasis on the integration of population factors in social and economic development planning process in the country. However, integration of population factors with the social and economic development planning at the district level in India is hampered by the non-availability of necessary data. The only source of data about population at the district level in the country is the decennial population census. India had an enviable record of unbroken decennial population census since 1881 up to 2011. This continuity has now broken as the 2021 decennial population census in the country could not be conducted because of the COVID-19 pandemic.

Population and development planning may be defined as the planned allocation of resources to meet the development and welfare needs of the people. An understanding of the pattern of population growth and the factors that contribute to population growth is, therefore, an important component of social and economic development planning and programming process at the district level. There has, however, rarely been any attempt to analyse the pattern of population growth in the districts of the country. A major hindering factor is the change in the number of districts at every decennial population census. At the 1951 population census, the first population census after the independence, there were only 316 districts in the country. This number increased to 339 at the 1961 population census; 356 at the 1971 population census; 412 at the 1981 population census; 466 at the 1991 population census; 593 at the 2001 population census; and 640 at the 2011 population census. Although, there was no population census in the country after 2011 but the number of districts in the country increased to 751 in 2021 and now there are 785 districts in the country (Government of India, 2024) and this number continues to increase. The increase in the number of districts has resulted in frequent changes in the administrative boundaries of many districts which makes it difficult to analyse and explore how the population of many districts has evolved over time, especially, after the independence. The Government of India has now made available the population enumerated by sex at different decennial population censuses since 1901 in each of the 640 districts of the country as they existed at the time of the 2011 decennial population census. This database made available by the Government of India for the first time makes it possible, for the first time, to analyse the pattern of population growth in 640 districts of the country as they existed in 2011. This chapter uses the dataset made available by the Government of India to analyse the pattern of population growth in 640 districts of the country since the independence or more specifically, during the period 1951-2011.

The chapter is organised as follows. The next section of the chapter describes the data used for analysing the pattern of population growth in the districts. The analysis is based on the population enumerated at different decennial population censuses beginning 1951 through 2011 in 640 districts as they existed at the 2011 population census. The third section describes the approach adopted for analysing the pattern of population growth in the district. Since the enumerated population in the district is available at an interval of 10 years only, a modelling approach has been adopted to model the pattern of population growth in the district. It has been found that the simple logistic growth model provides very good fit to population growth during 1951-2011 in all but a few districts of the country. The simple logistic growth model has, therefore, been fitted to the population of each of the 640 districts enumerated at different decennial population censuses after the independence and the results of the modelling exercise are presented and discussed in section four of the paper. Section five of the chapter characterises the pattern of population growth in 640 districts of the country in terms of the parameters of the logistic growth model. The modelling of district population growth reveals the diversity in the pattern of population growth across the districts during the period 1951-2011 which has implications for district level social and economic development planning and programming and for the future growth of population in the district. The variation in the pattern of population growth across the districts also justifies the need of integrating district specific population factors in the district level social and economic development planning and programming directed towards improving the quality of life of the people of the district.

The Data

The analysis is based on the population enumerated in the 640 districts of the country, as they existed at the time of the 2011 population census, at different decennial population censuses in India beginning 1951 through 2011. These data have been made available by the Registrar General and Census Commissioner of India. There are, however, 42 districts for which the population enumerated at the 1951 population census is not available whereas in 10 districts, population enumerated at the 1951 and 1961 population censuses is not available. The population enumerated at the 1981 population census is also not available for all districts of Assam as the 1981 population census could not be conducted in the state. The analysis of population growth in 32 districts, therefore, been carried out based on the population enumerated at different population censuses since 1961 through 2011 population census whereas, in 10 districts, the analysis has been carried out based on the population enumerated at different population censuses since 1971 through 2011 population census. On the other hand, we have estimated population of the districts of Assam in 1981 as the average of the population enumerated at the 1971 population census and the population enumerated at the 1991 population census.

The population enumerated at the population census is known to be associated with several errors including errors of omission and duplication. The Registrar General and Census Commissioner of India undertakes post-enumeration survey after every decennial population census to estimate errors of omission and duplication in the population enumeration. The post enumeration survey conducted after the 2011 population census has revealed that there was a net omission of around 23 persons for every 1000 persons at the 2011 population census (Government of India, 2014). There was an estimated undercount of 23.08 persons for every 1000 persons counted which was offset by an estimated duplication of 0.10 persons for every 1000 persons counted. The post enumeration survey has also revealed that the net omission rate was markedly higher in the urban (29 persons per 1000 persons enumerated) as compared to the rural areas of the country (20 persons per 1000 persons enumerated). A comparison of the net omission rate at the 2011 population census with the net omission rate at the 2001 population census, however, suggests that there has been little change in the net omission rate in the two population censuses. The Registrar General and Census Commissioner of India, however, makes no adjustment in the enumerated population to consider the net omission rate in enumerating the population.

Estimates of the net omission rate at different population censuses are not available for the states/Union Territories and districts of the country. The Registrar General and Census Commissioner of India has, however, estimated the net omission rate in the census count at the 2011 population census in different zones of the country which reveals that the net omission rate varies across different zones of the country. The net omission rate is estimated to be the lowest in the eastern zone of the country but the highest in the central zone (Government of India, 2014). Although, estimates of the net omission rate are not available for the districts of the country, it may be argued that the net omission rate varies across the districts of the country as well as in different population censuses since 1951 and, in the absence of any information about the net omission rate in census count and other errors associated with population enumeration, it is not possible to make any adjustment in the population enumerated in the districts of the country at different population census. The present analysis has, therefore, been carried out without making any adjustment in the enumerated population in the 640 districts, as they existed at the 2011 population census, at 10 years interval beginning 1951 through 2011 as made available by the Registrar General and Census Commissioner of India. We use population enumerated at 1951 through 2011 population censuses for analysing population growth in 598 districts and enumerated population at 1961 through 2011 population census for analysing population growth in 32 districts of the country. For the remaining 10 districts, we use the population enumerated at 1971 through 2011 population censuses for analysing population growth as enumerated population at the 1951 and 1961 population census is not available in these districts.

Methodology

The database made available by the Registrar General and Census Commissioner of India gives the population enumerated at 10 years interval beginning 1901 in each of the 640 districts of the country, as they existed at the 2011 population census. Using these data, population growth is usually analysed in terms of average annual growth rate during the 10 years interval assuming that population grows exponentially within the interval. This approach also assumes that the trend in population growth changes only in that year when the population census is conducted and the time of change in the trend is the same for all districts. It is, however, not necessary that population grows exponentially between two population censuses. Similarly, it is not necessary that population growth trend changes in the census year only and the time of change is same for all districts. A more appropriate approach is to first model population growth and then use model estimates to analyse population growth trend. The modelling of population growth is motivated by the demographic transition theory which classifies the growth of the population in three distinct phases – initial slow growth phase, middle rapid growth phase, and final phase in which population growth slows down to reach an upper limit. The demographic transition theory implies that the population growth rate follows a reverse V-shape growth trajectory. The population growth rate first increases, reaches a maximum, and then decreases. The reverse V-shape trajectory of population growth rate means that population cannot continue increasing indefinitely. Instead, growth of the population follows an *S*-shaped growth trajectory.

Different models have been proposed to model the S-shaped growth trajectory. These include, among others, the logistic growth model, the Gompertz model, the modified exponential model, and the generalised logistic growth model. The logistic growth model is the simplest description of the *S*-shaped growth trajectory. It was first developed by Verhulst in 1838 (Verhlust, 1838) and later re-invented independently by Pearl and Reed (Pearl and Reed, 1920). The logistic growth model assumes exponential growth of the population under the constraint of an upper limit (Lotka, 1956). Application of the logistic growth model to describe and forecast population growth has a long history. It was a popular method of describing and forecasting population growth in the past. Several studies have shown that the application of the logistic growth model can provide reasonably accurate description and forecast of population growth (Dorn, 1950; Leach, 1981). In recent years, there is a renewed interest in the logistic growth model to describe and forecast population growth (Hrytsiuk et al, 2023; Burg and Ausubel, 2023; Mondol et al, 2018; Shariff Ullah et al, 2019). Bhat (1999) has used the logistic growth model to forecast the population of Delhi, the capital city of India when the data required for the application of the cohort-component method of population projection are not available.

If P denotes the population, U denotes the upper limit of population growth and r is the population growth rate, then the logistic growth model is defined by the differential equation:

$$\frac{dP}{dt} = rP\left(1 - \frac{P}{U}\right) \quad (1)$$

The cumulative function associated with equation (1) may be written as:

$$P_t = \frac{U-L}{1+e^{-r(t-t_m)}} + L \quad (2)$$

where

P_t = the population at time t,
L = lower asymptote of the model
U = upper asymptote of the model
r = intrinsic growth rate of the model
t_m = the time of inflexion of the growth rate. In case of the logistic growth model, this time is also the time when the population reaches half of the upper asymptote of the model as the logistic growth model is symmetric about t_m.

The intrinsic growth rate *r* reflects the "steepness" of the growth trajectory – the higher the *r* the steeper the growth trajectory. One approach frequently used to calculate *r* is based on the time required for the population to grow from 10 per cent to 90 per cent of the upper asymptote of the logistic growth model. This period is termed as the characteristic duration of growth and is denoted by Δt. If P_1 is 10 per cent of *U* at time t_1, then, we can write,

$$0.1 = \frac{P_1}{U} = \frac{1}{1+e^{-r(t_1-t_m)}} \; or \; 9 = \frac{1}{e^{-r(t_1-t_m)}} \tag{3}$$

Similarly, if P_2 is 90 per cent of *U* at time t_2, then, we can write,

$$0.9 = \frac{P_2}{U} = \frac{1}{1+e^{-r(t_2-t_m)}} \; or \; 9 = e^{-r(t_2-t_m)} \tag{4}$$

Combining equations (2) and (3), we get

$$9 \times 9 = 81 = \frac{e^{-r(t_2-t_m)}}{e^{-r(t_1-t_m)}} = e^{r(t_2-t_1)} = e^{r\times\Delta t} \tag{5}$$

so that

$$r = \frac{\ln(81)}{\Delta t} \tag{6}$$

We have used the open source Loglet software package (Yung et al, 1999) to fit the logistic growth model to population growth during 1951-2011 in 640 districts of India as they existed at the 2011 population census. The software provides estimates of the lower asymptote *d*, upper asymptote *K*, the characteristics duration of population growth Δt, and the time of inflexion of the rate of population growth, t_m. The software also provides goodness-of-fit statistics including mean absolute percentage error (MPAE), residual sum of squares (RSS), residual mean sum of squares (RMS) and R^2 which allow to test appropriateness of the logistic growth model to describe the pattern of district population growth. It may be pointed out that although, R^2 is not regarded as an appropriate measure for ascertaining the goodness of fit in case of nonlinear models as is the case with the logistic growth model (Spiess and Neumeyer, 2010), yet R^2 can be used for testing the goodness-of-fit of the logistic growth model as the model can be transformed into a linear growth model through the Fisher-Pry transformation (Fisher and Pry, 1971). We have used MAPE and R^2 to test the goodness-of-fit of the logistic growth model in describing district population growth. The model is termed as highly accurate in describing the district population growth, if the MAPE is less than 10 per cent; good if MAPE is 10 per cent and more but less than 20 per cent; reasonable if the MAPE ranges from 20-50 per cent. If the MAPE is 50 per cent and more than the model is termed as inaccurate in describing district population growth (Lewis, 1982). On the other hand, the model is termed as appropriate for describing district population growth if the model explains at least 80 per cent of the variation in the original data and the higher this proportion the better the appropriateness of the model in describing population growth.

The next step in analysing district population growth involves constructing time series of annual estimates of population for each of the 640 districts based on the parameters of the logistic growth model and using the constructed time series to analyse population growth trend in each district. We have followed the joinpoint regression approach for analysing the trend in population growth as the trend in population growth does not remain the same throughout the trend period (Kim et al, 2000). There are three steps in the joinpoint regression analysis. The first is to test whether the trend has changed during the period under reference or not and if the trend has changed, then how many times. If there is no change in the trend, then the trend analysis can be carried out by simply fitting a straight line (on a log scale) to the observed time series and the annual per cent change can be estimated from the slope of the regression line. If the trend is found to have changed, then the second step involves identifying joinpoint(s) or the time(s) or year(s) when the trend has changed. Once the number of joinpoint(s) is identified, the last step in the joinpoint regression analysis involves estimating the

regression function with identified joinpoint(s). If there are k joinpoints, then the entire trend period is divided into $k + 1$ temporal segments with different trends in population growth in different temporal segments. The population growth in different temporal segments may be measured in terms of the annual per cent change (APC) which provides complete characterisation of population growth in the temporal segment.

The number of times the trend in the growth of the population of a district has changed can be set in advance or can be determined statistically from the data. When the number of times the trend has changed is set in advance, the trend analysis can be carried out using piecewise or segmented regression modelling approach (Chaurasia, 2020). On the other hand, there are different methods that have been proposed to determine, statistically, the number of times the trend in population growth has changed during the period under reference. These include permutation procedure (Kim et al, 2000); Bayesian Information Criterion (BIC) (Kim et al, 2009); Bayesian Information Method with a harsher penalty (BIC3) (Kim and Kim, 2016); and the modified BIC method (Zhang and Siegmund, 2007). A data driven approach has also been proposed to identify the number of times the trend has changed in the time series (Kim et al, 2023). Identification of the number of times the trend has changed using the statistical, data driven approach is preferred over arbitrarily setting the number of times the trend has changed in advance because statistical identification of the number of times the trend has changed is based on the real time data and, therefore, is free from the selection bias.

Let P_i denotes the population in the year y_i such that $y_1 < y_2 < \ldots.. < y_n$ and $k_1 < k_2 < \ldots. < k_j$ are the years when the trend in population growth has changed or joinpoints. Then the joinpoint regression model is defined as:

$$\ln(P_t) = \alpha + \beta_1 * y_1 + \delta_1 * u_1 + \delta_2 * u_2 + \cdots + \delta_j * u_j + \varepsilon_i \quad (7)$$

where,

$$u_j = \begin{cases} (y_j - y_k), \ if \ y_j > k_j \\ 0, \text{otherwise} \end{cases} \quad (8)$$

When there is no change in the trend, the joinpoint regression analysis is the same as the linear regression analysis on a Log scale.

If P_0 is the population at the beginning and P_t is the population at the end a temporal segment of length t years, then the annual per cent change (APC), p, in the temporal segment is calculated as

$$p = \frac{P_t - P_0}{P_0 \times t} \quad (9)$$

On the other hand, the annual population growth rate (AGR), r, in the temporal segment is calculated as

$$r = \frac{1}{t} \times ln\left(\frac{P_t}{P_0}\right) \quad (10)$$

or

$$P_t = P_0 \times e^{(t \times r)} \quad (11)$$

Substituting from (9) into (7), we get

$$p = \frac{(P_0 \times e^{(t \times r)}) - P_0}{P_0 \times t} \quad (12)$$

Which gives

$$r = \frac{1}{t} \times \ln(1 + (t \times p)) \quad (13)$$

The AGR in different temporal segments can be compared to examine the acceleration or deceleration in population growth. Moreover, the weighted average of AGR in different temporal segments with weights proportional to the length of the temporal segment gives the average annual growth rate (AAGR) of the population for the entire trend period. Thus, the AAGR for the entire trend period (0,N) can be calculated as

$$AAGR = \sum_{i=1}^{N} w_i \times r_i, \;\; w_i = \frac{t}{N} \tag{14}$$

The AAGR is argued to be a better approach to describe the long-term trend in population growth in situations when the trend changes over time than the commonly used approach in which a single regression line (on a log scale) is fitted for the entire trend period and the average annual growth rate of the population is calculated from the slope of the regression equation (Clegg et al., 2009). The AAGR best summarises the trend in population growth that varies over time (Marrot, 2010).

Following Kitagawa (1955), the difference in AAGR between two districts *A* and *B* can be decomposed as

$$\Delta r = r^A - r^B = \sum w_i^A \times r_i^A - \sum w_i^B \times r_i^B \tag{15}$$

$$\Delta r = \sum \left(w_i^A - w_i^B\right) \times \left(\frac{\left(r_i^A + r_i^B\right)}{2}\right) + \sum \left(r_i^A - r_i^B\right) \times \left(\frac{\left(w_i^A + w_i^B\right)}{2}\right) \tag{16}$$

Equation (16) suggests that the difference in AAGR between two districts is the sum of the difference in the length of different temporal segments and the difference in the rate of growth in different temporal segments. Equation (16) provides a deeper understanding of the difference in the rate of growth of population between two districts as compared to the conventional approach which assumes that the rate of growth in population is linear throughout the trend period and there has been no change in the trend during the entire period.

We have used the Joinpoint Regression Program (National Institute of Health, 2020) for analysing the trend in population growth in the districts during 1951-2011. The software requires, in advance, specification of maximum (>0) number of joinpoints. The Program starts with the minimum number of joinpoints (0), and tests whether more joinpoints are statistically significant and need to be added to the model. The grid search method is used to identify the joinpoints (Lerman, 1980). The grid search method allows a joinpoint to occur at the exact time *t*. A grid is created for all possible positions of joinpoint(s) or combination of joinpoint(s), the model is fitted for each position separately and that position is selected which minimises the sum of squared error (SSE). It may be pointed out that even if the final model has *k* joinpoint(s), slope of all regression functions of $k+1$ temporal segments may not be statistically significantly different from 0. Identification of *k* joinpoints means that the model with these joinpoint(s) provides the best fit to the observed data relative to all other models. If the slope of a regression function in a time segment is statistically insignificant then this means that there has been no change in the trend in the time segment. We have set the maximum number of joinpoints to 5 and the data driven approach has been used to identify the joinpoints.

Joinpoint trend analysis has been used in analysing the trend in mortality and morbidity (Akinyede and Soyemi, 2016; Chatenoud et al, 2015; Doucet et al, 2016; John and Hanke, 2015; Mogos et al, 2016; Missikpode et al, 2015; Puzo et al, 2016; Qiu et al, 2008; Rea et al, 2017; Tyczynski and Berkel, 2005). It has also been used to estimate population parameters under changing population structure (Gillis and Edwards, 2019). This method is also recommended for analysing the trend in health-related measures when the trend changes over time (Ingram et al, 2018). It has also been used to analyse long-term trend in infant mortality rate (Chaurasia, 2020) and transition in mortality (Chaurasia, 2023). This method provides an easily interpretable characterisation of the non-linear trend.

Modelling Population Growth

We have fitted equation (2) to male and female population growth in 640 districts during 1951-2011 as revealed through the population enumerated at different population censuses since 1951 and added the estimates of the male and female population to estimate the population of the district. The MAPE and R^2 of the fitted model for each district is given in the table appended to the paper while inter-district variation in MAPE and R^2 is summarised in table 1. The modelling exercise suggests that model (2) has provided very good fit to population growth in all but a few districts. In all but 9 districts, the MAPE is estimated to be less than 10 per cent and there is only one district – district Kiphire in Nagaland – where MAPE is estimated to be more than 20 per cent. In this district, the population enumerated at the 1961 population census was only around 15.6 thousand which increased to more than 51.8 thousand at the 1991 population census. However, the population of the district nearly doubled between 1991 and 2001 population census to more than 106 thousand, but district decreased sharply to around 74 thousand at the 2011 population census. Model (2) did not provide good fit to population growth in New Delhi and Central districts of the National Capital Territory of Delhi. The enumerated population of these districts at the 2011 population census decreased, instead increased, relative to 1961 population censuses. On the other hand, model (2) explained at least 95 per cent of the variation in population growth during 1951-2011 in 536 districts and between 90-95 per cent in 78 districts. There are only 22 districts where model (2) explained less than 90 per cent of the variation in population growth during 1951-2011, and only one district where it explained less than 80 per cent of the variation.

Table 1: Results of fitting of the logistic growth model to population growth in districts, 1951-2011. Variation in MAPE and R^2 across districts.

MAPE			R^2		
Range	Males	Females	Range	Males	Females
<0.02	206	202	>=0.95	558	520
0.02-0.04	315	305	0.90-0.95	62	91
0.04-0.06	80	94	0.85-0.90	10	19
0.06-0.08	21	22	0.80-0.85	5	4
0.08-0.10	8	7	<0.80	3	4
>= 0.10	10	8			
No data	2	2	No data	2	2
Total	640	640	Total	640	640

Source: Author

Results of the population growth modelling exercise thus suggest that in all but a few districts of the country, population growth during the post-independence period may be characterised by an S-shaped growth trajectory which can be very satisfactorily modelled by the simple logistic growth model. This implies that the variation in the pattern of population growth during 1951-2011 across the districts can be explained in terms of the variation across districts in the parameters of the simple logistic growth model. The table appended to the paper presents estimates of three parameters of the simple logistic growth model for each district: 1) characteristic duration of population growth; 2) the intrinsic population growth rate; and 3) the time of inflexion of the population growth rate. The variation in the three parameters of the simple logistic growth model across the districts is summarised in table 2. In all but a few districts, the characteristic duration of population growth or the duration during which the population of the district increases from 10 per cent to 9 per cent of the upper asymptote of the model varies between 56-60 years, but the range is very wide, from around 10 years in district Kiphire in Nagaland to around 107 years in district Karim Nagar and district Medak in Andhra Pradesh. In 112 districts of the country, the characteristic duration of population growth is less than 56 years whereas in 23 districts, it is more than 60 years. In all districts of Sikkim, Arunachal Pradesh, Nagaland, and Mizoram, the characteristics duration of population growth is less than 52 years.

Similarly, in most of the districts of the country, the intrinsic growth rate, *r*, varies between 5-10 per cent. There are only 33 districts where the intrinsic growth rate has been 10 per cent and more. The intrinsic growth rate is inversely related to the characteristic duration of population growth – the higher the intrinsic growth rate, the steeper the population growth trajectory and the shorter the characteristic duration of population growth and vice versa. The intrinsic growth rate has been the most rapid in district Kiphire of Nagaland so that the characteristics duration of population growth or the time during which the population of the district increases from 10 per cent to 90 per cent of the upper asymptote of the logistic growth model is estimated to be only around 10 years, the shortest among all districts of the country. On the other hand, there are 14 districts where the intrinsic growth rate is estimated to be less than 0.050 so that the characteristic duration of population growth in these districts is very long. The population of these districts is likely to take a very long time to increase from 10 per cent to 90 per cent of the upper asymptote of the simple logistic growth model. The intrinsic population growth rate is found to be the lowest in district Karim Nagar and district Medak of Andhra Pradesh. The very low intrinsic population growth rate means that the characteristics duration of population growth or the time taken by the population to increase from 10 per cent to 90 per cent of the upper asymptote of the logistic growth model is the longest amongst the districts of the country. The population of these two districts is likely to increase from 10 per cent to 90 per cent of the upper asymptote of the logistic growth model or the upper limit of population growth in a period of around 107 years.

Table 2: Inter-district variation in the parameters of the logistic growth model.

Characteristic growth period		Intrinsic growth rate		Year of inflexion of the growth trajectory	
Number of years	Districts	Rate	Districts	Year	Districts
< 52	70	<0.050	14	Before 1980	52
52-54	10	0.050-0.075	253	1980-1990	236
54-56	32	0.075-0.100	338	1990-2000	292
56-58	140	0.100-0.150	25	2000-2010	50
58-60	363	0.150-0.200	6	2010-2020	3
≥60	23	≥0.200	2	2020 and after	5
No data	2	No data	2	No data	2
Total	640		640		640

Source: Author

The modelling exercise also suggests that in most of the districts, population growth is now flattening as the time of inflexion in the population growth rate trajectory has already been crossed. There are only four districts where the population growth rate still appears to be accelerating even in 2011. In 538 of the 640 districts of the country, the inflexion point in the population growth rate trajectory was reached sometimes during the period 1980-2000. In 52 districts, the inflexion point in the population growth rate trajectory was reached before 1980 whereas in 53 districts, the inflexion point in the population growth rate trajectory was reached sometimes after 2000 but before 2020. In one district, the inflexion point in the population growth rate trajectory was reached in 2020. The four districts, where the inflexion point in the population growth rate trajectory is yet to reach the inflexion point are district Kurung Kumey in Assam, district Rangareddy in Andhra Pradesh, district Yanam in Puducherry and district Daman in Daman and Diu. In district Kurung Kumey of Assam, the inflexion point in the population growth rate trajectory is expected to be reached by the year 2047 according to the logistic growth model. In the Rangareddy district of Andhra Pradesh, the inflexion point in the population growth rate trajectory is expected to be reached only by the year 2043. In district Yanam, of Puducherry, the inflexion point in the population growth rate trajectory is the most likely to be reached by the year 2037. Lastly, in district Daman, in Daman and Diu, the inflexion point in the population growth rate trajectory is expected to be reached by the year 2028. The variation in the inflexion point in the population growth rate trajectory across the districts is expected as different districts of the country are at different stage of population transition.

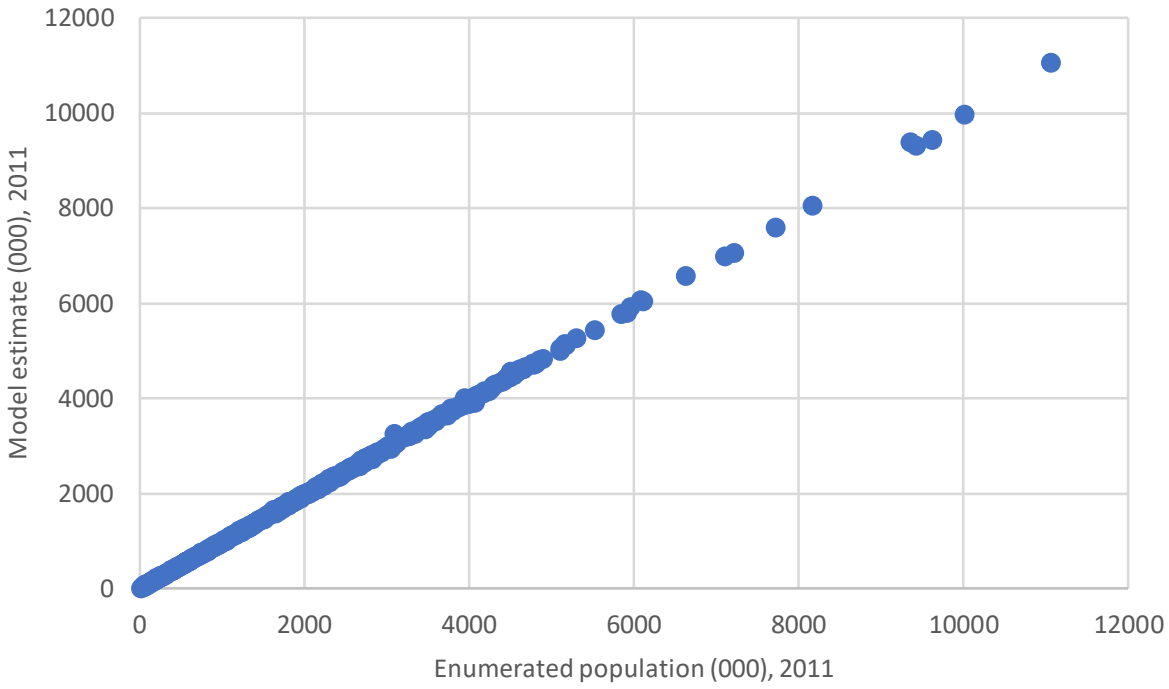


Figure 1: Population (000) enumerated at the 2011 population census and population (000) estimated from the model in districts of India, 2011.
Source: Author

Figure 1 compares the population enumerated at the 2011 population census in 640 districts with the population estimated in the year 2011 based on the logistic growth model. The figure confirms that the logistic growth model provides very good fit to population growth in the districts of the country during the period 1951-2011. The sum of the population estimates of 640 districts for the year 2011 derived from the logistic growth model gives an estimate of 1193 million of the population of the country in 2011 which is very close to 1206 million enumerated at the 2011 population census with an error of just around 1 per cent. This means that the annual estimates of the population of each of the 640 districts of the country for the year 1951-2011 may be derived from the fitted logistic growth model for the district based on the population of the district enumerated at different decennial population census in the country beginning 1951. We have used the annual estimates of the population of a district derived from the logistic growth model to characterise the population growth trend in each of the 640 districts of the country through the application of the joinpoint regression model. We have assumed that the tend in population growth in each district has changed at the most 5 times during the 60 years period between 1951 through 2011. This means that the period 1951 through 2011 can be divided into 6 time-segments and the population growth in each time segment may be different. The year(s) when the trend in population growth has changed have been determined through the data driven approach and has not been identified in advance which means that the length of the 6 time-segments may not be the same in the same district and across districts. This also means that the years when the trend in population growth has changed in a district may not be the same as the years of the enumeration of the population in the district. In other words, the analysis of the trend in population growth in the districts of the country assumes that in each district, the rate of population growth is different in different time-segments and the length of different time-segments is not the same. The growth of population in a district during 1951-2011 depends upon both the population growth rate in different time-segments and the length of different time-segments which is different in different.

Trend in District Population Growth

Results of the population growth trend analysis during 1951-2011 in each of the 640 districts are presented in the appendix table which gives length of each of the 6 time-segments, annual population growth rate (AGR) in each time segment and average annual growth rate (AAGR) during the period 1951-2011. The districts vary in terms of the length of the time-segments, in terms of the AGR in each time segment and hence in terms of AAGR during the period 1951-2011. Among the 640 districts of the country, the average annual population growth rate (AAGR) has been the slowest during the 60 years period 1951-2011 in district Satara of Maharashtra (0.392 per cent per year) but the highest in district East in the National Capital Territory of Delhi (8.025 per cent per year). There are 18 districts where the AAGR has been less than 1.0 per cent per year during 1951-2011. On the other hand, there are 37 districts where population increased, on average, at a rate of at least 2.5 per cent per year during this period (Figure 2). In majority of the districts of the country, the population increased during 1951-2011 at an average annual rate of 1.5-2.0 per cent per year. There are 145 districts where population increased at an average annual rate of 1.0-1.5 per cent per year whereas, in 91 districts population increased at an average annual rate of 2.0-2.5 per cent per year. There are, however, only 5 districts where the annual population growth (AGR) has been more than 2 per cent per year in all the 6 time-segments identified through the joinpoint regression analysis. These districts are Faridabad in Haryana, West Kameng in Arunachal Pradesh, Zunheboto in Nagaland, South Garo Hilla in Meghalaya and South Andaman in Andaman and Nicobar Islands. Three of these five districts are located in the north-eastern part of the country whereas district Faridabad is adjacent to the National Capital Territory of Delhi. In these districts, population growth has been rapid throughout the 60 years between 1951 and 2011.

On the other hand, there are 241 districts in the country where the annual population growth rate (AGR) has been less than 2.0 per cent per year in all the 6 time-segments or during the entire 60 years period between 1951-2011. This means that population growth, in these districts, has never been rapid during the entire 60 years period between 1951 and 2011. There are only 67 districts where AGR has been more than 2.0 per cent per year in only 1 of the 6 time-segments which means that population growth has not been rapid during most of the 60 years period in these districts. Similarly, the annual growth rate (AGR) has been more than 2.0 per cent per year in 2 of the 6 time-segments in 74 districts; in 3 of the 6 time-segments in 182 districts; in 4 of the 6 time-segments in 50 districts, the AGR has been more than 2.0 per cent per year in 4 of the 6 time-segments; and, in 5 of the 6 time-dements in 21 districts of the country, the AGR has been more than 2.0 per cent per year in 5 of the 6 time-segments identified through the joinpoint regression analysis. Since the length of a time-segment is different for different districts, the contribution of the AGR in a time-segment to the average annual growth rate (AAGR) during the period 1951-2011 has been different in different districts.

Table 3: Distribution of districts by population growth rate and the length of time-segment in different time-segments of the period 1951-2011.

Time segment	Population growth rate (per cent year)				Length of time-segment (years)			
	Range		Average	SD	Range		Average	SD
	Minimum	Maximum			Minimum	Maximum		
1	0.041	84.656	1.419	3.369	2	26	8.4	2.6
2	0.245	34.080	1.827	1.455	3	23	8.7	3.4
3	0.458	31.026	2.149	1.348	3	22	12.7	6.3
4	0.352	19.196	2.097	0.987	3	23	13.1	6.5
5	0.240	5.990	1.724	0.655	4	23	8.6	3.1
6	0.028	5.107	1.195	0.578	5	44	8.6	2.7
All	0.392	8.025	1.773	0.546				

Source: Author

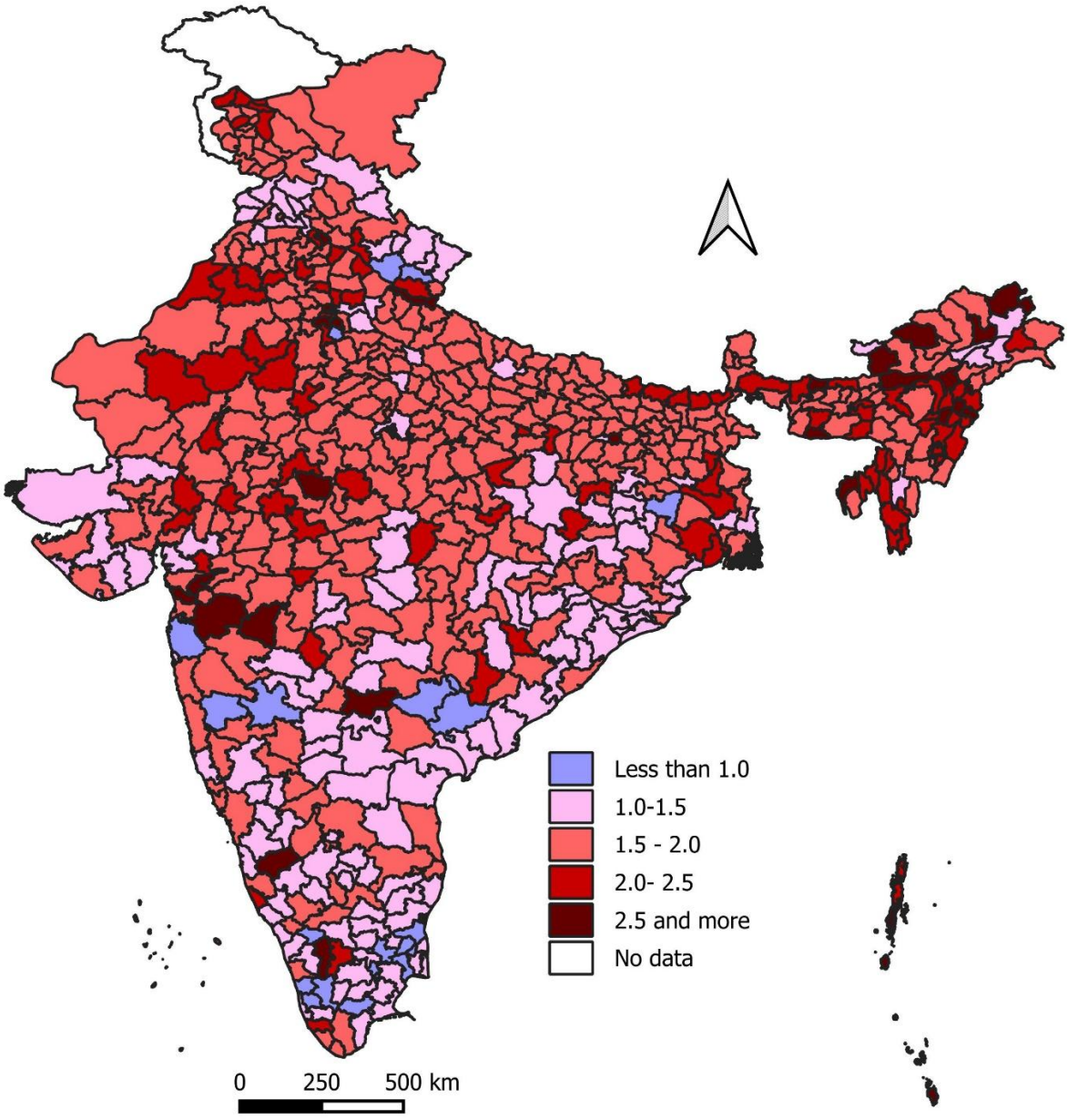
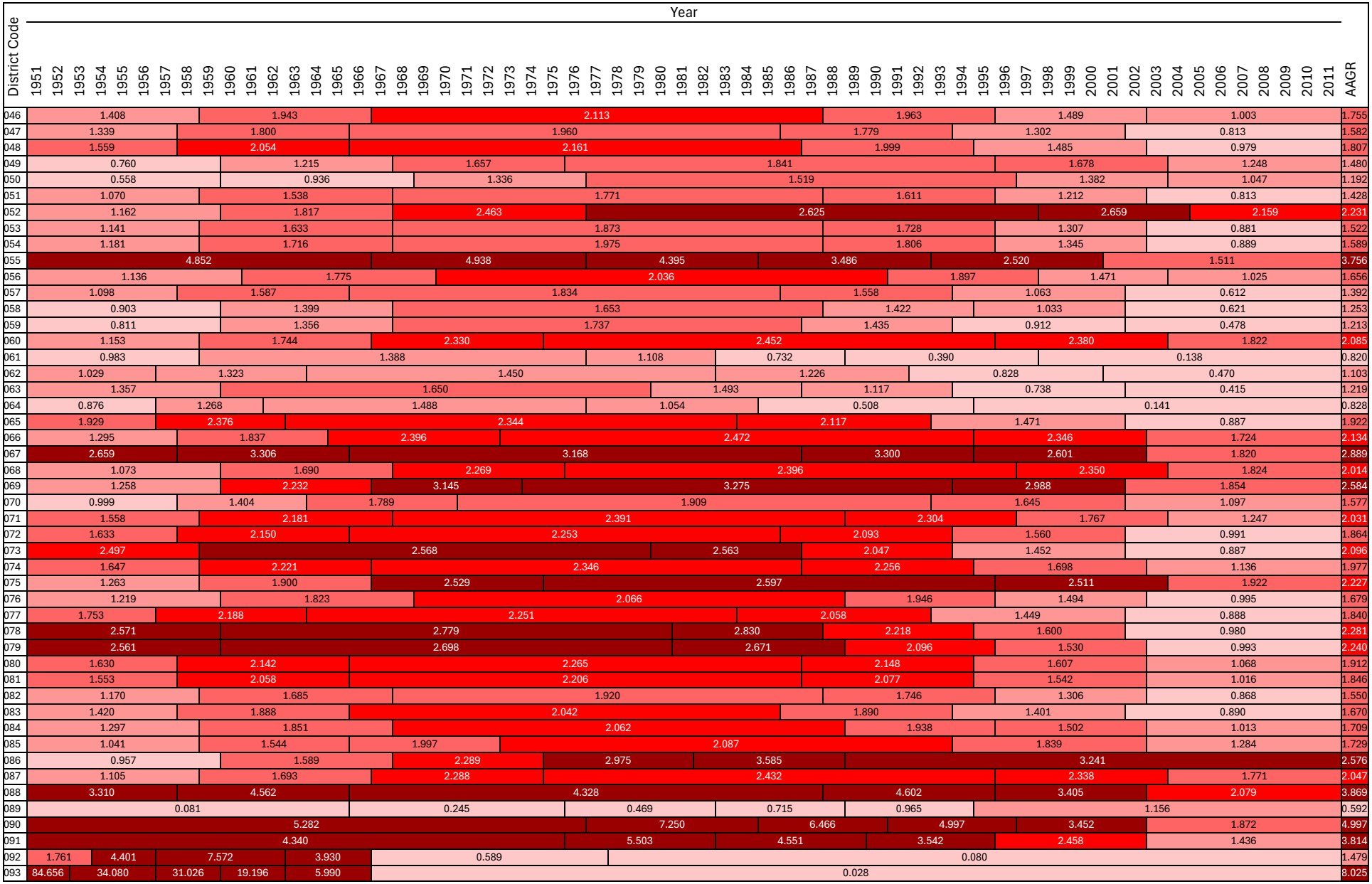


Figure 2: Average annual population growth rate during 1951-2011 in 640 districts of India.
Source: Author

Table 3 summarises the distribution of districts in each of the 6 temporal segments in terms of annual population growth rate (AGR) and average annual population growth rate (AAGR). The mean AGR across 640 districts increased from 1.419±3.369 per cent in the first temporal segment to 2.149±1.348 per cent during the third temporal segment and then decreased to 1.195±0.578 per cent during the sixth temporal segment. The range of AGR across districts, however, decreased rapidly from temporal segment 1 to temporal segment 6 indicating convergence of AGR across districts. The mean length of the temporal segment, however, increased from 8.4±2.6 years in the first temporal segment to 13.1±6.5 years in the fourth temporal segment and then decreased to 8.6±2.7 years in the sixth temporal segment. The range of the length of the temporal segment remained almost the same in second, third, fourth and fifth temporal segments but increased rapidly in the sixth temporal segment.

Appendix Table 2: Average annual per cent change (AAPC) and annual per cent change (APC) in different temporal segments of the period 1951-2011 in the districts of India.

District Code	Year (1951–2011)						AAGR
001	0.891	1.467	2.060	2.655	2.666	2.472	2.159
002	1.126	1.690	2.252	2.360	2.256	1.725	2.004
003	0.795	1.443	2.131	2.350	2.058	1.368	1.784
004	0.673	1.354	2.056	2.403	2.180	1.513	1.770
005	0.700	1.169	1.678	2.143	2.203	2.021	1.747
006	0.827	1.285	1.788	2.294	2.293	2.026	1.881
007	1.130	1.603	2.068	2.132	1.896	1.292	1.784
008	1.150	1.690	2.198	2.320	2.197	1.615	1.964
009	1.134	1.766	2.344	2.470	2.483	1.946	2.100
010	1.012	1.548	2.095	2.237	2.097	1.578	1.867
011	0.896	1.418	2.003	2.514	2.488	2.297	2.051
012	0.916	1.472	2.007	2.210	2.162	1.658	1.821
013	0.965	1.515	2.075	2.269	2.217	1.781	1.889
014	0.784	1.312	1.881	2.426	2.515	2.474	2.004
015	0.877	1.565	2.326	2.639	2.152	1.143	1.920
016	0.991	1.550	2.115	2.297	2.242	1.750	1.904
017	0.891	1.513	2.144	2.371	2.356	1.898	1.913
018	1.004	1.514	2.031	2.152	2.004	1.473	1.787
019	1.146	1.694	2.220	2.327	2.160	1.570	1.958
020	1.052	1.612	2.184	2.302	2.144	1.560	1.908
021	1.367	2.072	2.371	2.314	1.751	1.196	1.959
022	1.642	2.175	2.331	2.237	1.666	1.102	1.965
023	1.130	1.674	1.915	1.810	1.399	0.943	1.559
024	1.127	1.568	1.765	1.616	1.179	0.764	1.422
025	3.998	3.152	2.140	1.161	0.454	0.087	1.156
026	0.937	1.397	1.853	2.015	1.835	1.322	1.661
027	1.612	2.046	2.126	1.867	1.278	0.728	1.666
028	1.125	1.472	1.582	1.386	1.017	0.638	1.273
029	0.759	1.143	1.536	1.715	1.514	1.075	1.385
030	1.409	1.846	1.960	1.727	1.225	0.759	1.569
031	0.944	1.482	2.057	2.207	1.975	1.380	1.781
032	1.160	1.715	1.966	1.868	1.484	1.068	1.643
033	1.128	1.607	1.843	1.703	1.294	0.877	1.501
034	1.239	1.608	1.736	1.463	0.969	0.534	1.315
035	1.145	1.617	1.823	1.654	1.190	0.759	1.456
036	1.335	1.770	1.904	1.703	1.233	0.731	1.510
037	0.981	1.451	1.695	1.594	1.230	0.863	1.388
038	0.973	1.357	1.532	1.363	0.992	0.640	1.221
039	0.733	1.242	1.549	1.293	0.859	0.443	1.080
040	1.459	1.895	1.985	1.755	1.256	0.786	1.602
041	1.358	2.066	2.367	2.309	1.748	1.192	1.955
042	1.099	1.552	1.747	1.545	1.144	0.753	1.405
043	1.036	1.452	1.849	1.947	1.665	1.109	1.612
044	1.209	1.721	1.931	1.801	1.396	0.943	1.594
045	1.379	1.905	2.064	1.902	1.393	0.904	1.686


Year
District Code
1951 1952 1953 1954 1955 1956 1957 1958 1959 1960 1961 1962 1963 1964 1965 1966 1967 1968 1969 1970 1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982 1983 1984 1985 1986 1987 1988 1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011
AAGR
046 1.408 1.943 2.113 1.963 1.489 1.003 1.755
047 1.339 1.800 1.960 1.779 1.302 0.813 1.582
048 1.559 2.054 2.161 1.999 1.485 0.979 1.807
049 0.760 1.215 1.657 1.841 1.678 1.248 1.480
050 0.558 0.936 1.336 1.519 1.382 1.047 1.192
051 1.070 1.538 1.771 1.611 1.212 0.813 1.428
052 1.162 1.817 2.463 2.625 2.659 2.159 2.231
053 1.141 1.633 1.873 1.728 1.307 0.881 1.522
054 1.181 1.716 1.975 1.806 1.345 0.889 1.589
055 4.852 4.938 4.395 3.486 2.520 1.511 3.756
056 1.136 1.775 2.036 1.897 1.471 1.025 1.656
057 1.098 1.587 1.834 1.558 1.063 0.612 1.392
058 0.903 1.399 1.653 1.422 1.033 0.621 1.253
059 0.811 1.356 1.737 1.435 0.912 0.478 1.213
060 1.153 1.744 2.330 2.452 2.380 1.822 2.085
061 0.983 1.388 1.108 0.732 0.390 0.138 0.820
062 1.029 1.323 1.450 1.226 0.828 0.470 1.103
063 1.357 1.650 1.493 1.117 0.738 0.415 1.219
064 0.876 1.268 1.488 1.054 0.508 0.141 0.828
065 1.929 2.376 2.344 2.117 1.471 0.887 1.922
066 1.295 1.837 2.396 2.472 2.346 1.724 2.134
067 2.659 3.306 3.168 3.300 2.601 1.820 2.889
068 1.073 1.690 2.269 2.396 2.350 1.824 2.014
069 1.258 2.232 3.145 3.275 2.988 1.854 2.584
070 0.999 1.404 1.789 1.909 1.645 1.097 1.577
071 1.558 2.181 2.391 2.304 1.767 1.247 2.031
072 1.633 2.150 2.253 2.093 1.560 0.991 1.864
073 2.497 2.568 2.563 2.047 1.452 0.887 2.096
074 1.647 2.221 2.346 2.256 1.698 1.136 1.977
075 1.263 1.900 2.529 2.597 2.511 1.922 2.227
076 1.219 1.823 2.066 1.946 1.494 0.995 1.679
077 1.753 2.188 2.251 2.058 1.449 0.888 1.840
078 2.571 2.779 2.830 2.218 1.600 0.980 2.281
079 2.561 2.698 2.671 2.096 1.530 0.993 2.240
080 1.630 2.142 2.265 2.148 1.607 1.068 1.912
081 1.553 2.058 2.206 2.077 1.542 1.016 1.846
082 1.170 1.685 1.920 1.746 1.306 0.868 1.550
083 1.420 1.888 2.042 1.890 1.401 0.890 1.670
084 1.297 1.851 2.062 1.938 1.502 1.013 1.709
085 1.041 1.544 1.997 2.087 1.839 1.284 1.729
086 0.957 1.589 2.289 2.975 3.585 3.241 2.576
087 1.105 1.693 2.288 2.432 2.338 1.771 2.047
088 3.310 4.562 4.328 4.602 3.405 2.079 3.869
089 0.081 0.245 0.469 0.715 0.965 1.156 0.592
090 5.282 7.250 6.466 4.997 3.452 1.872 4.997
091 4.340 5.503 4.551 3.542 2.458 1.436 3.814
092 1.761 4.401 7.572 3.930 0.589 0.080 1.479
093 84.656 34.080 31.026 19.196 5.990 0.028 8.025

District Code	Year						AAGR
094	1951–1957: 2.827	1958–1965: 3.861	1966–1985: 3.833	1986–1993: 3.871	1994–2001: 2.772	2002–2011: 1.618	3.251
095	1951–1958: 1.662	1959–1965: 2.619	1966–1973: 3.535	1974–1994: 3.511	1995–2002: 3.443	2003–2011: 2.415	3.008
096	1951–1958: 2.363	1959–1967: 3.502	1968–1987: 3.696	1988–1995: 3.719	1996–2002: 2.757	2003–2011: 1.740	3.122
097	1951–1959: 2.356	1960–1982: 2.575	1983–1989: 2.659	1990–1995: 2.169	1996–2002: 1.620	2003–2011: 1.060	2.198
098	1951–1957: 3.116	1958–1978: 2.971	1979–1986: 3.016	1987–1993: 2.429	1994–2001: 1.752	2002–2011: 1.085	2.485
099	1951–1957: 1.718	1958–1963: 2.315	1964–1970: 2.810	1971–1993: 2.709	1994–2002: 2.591	2003–2011: 1.901	2.440
100	1951–1958: 1.536	1959–1967: 2.147	1968–1989: 2.344	1990–1996: 2.307	1997–2003: 1.809	2004–2011: 1.284	2.017
101	1951–1957: 1.535	1958–1965: 2.066	1966–1986: 2.246	1987–1994: 2.103	1995–2002: 1.537	2003–2011: 0.993	1.858
102	1951–1958: 1.152	1959–1965: 1.686	1966–1973: 2.183	1974–1994: 2.317	1995–2002: 2.225	2003–2011: 1.647	1.968
103	1951–1957: 1.252	1958–1964: 1.758	1965–1971: 2.246	1972–1992: 2.281	1993–2001: 2.078	2002–2011: 1.441	1.939
104	1951–1959: 1.048	1960–1967: 1.641	1968–1975: 2.195	1976–1995: 2.316	1996–2003: 2.183	2004–2011: 1.654	1.925
105	1951–1958: 1.124	1959–1965: 1.644	1966–1973: 2.131	1974–1994: 2.266	1995–2002: 2.163	2003–2011: 1.599	1.921
106	1951–1957: 1.207	1958–1964: 1.704	1965–1971: 2.183	1972–1992: 2.245	1993–2001: 2.047	2002–2011: 1.416	1.900
107	1951–1959: 1.052	1960–1967: 1.649	1968–1975: 2.208	1976–1996: 2.336	1997–2003: 2.281	2004–2011: 1.770	1.962
108	1951–1957: 1.477	1958–1964: 2.070	1965–1972: 2.655	1973–1993: 2.696	1994–2002: 2.570	2003–2011: 1.878	2.347
109	1951–1959: 1.436	1960–1968: 2.075	1969–1989: 2.303	1990–1996: 2.296	1997–2003: 1.803	2004–2011: 1.288	1.961
110	1951–1957: 1.343	1958–1963: 1.858	1964–1970: 2.319	1971–1992: 2.360	1993–2001: 2.139	2002–2011: 1.462	2.018
111	1951–1957: 1.377	1958–1964: 1.956	1965–1972: 2.538	1973–1993: 2.628	1994–2002: 2.491	2003–2011: 1.799	2.261
112	1951–1959: 1.333	1960–1967: 2.052	1968–1976: 2.726	1977–1997: 2.845	1998–2004: 2.980	2005–2011: 2.458	2.471
113	1951–1959: 1.217	1960–1967: 1.887	1968–1975: 2.497	1976–1997: 2.578	1998–2004: 2.594	2005–2011: 2.098	2.225
114	1951–1958: 1.147	1959–1965: 1.678	1966–1973: 2.174	1974–1994: 2.305	1995–2002: 2.206	2003–2011: 1.632	1.957
115	1951–1959: 0.943	1960–1967: 1.477	1968–1975: 1.983	1976–1996: 2.118	1997–2003: 2.016	2004–2011: 1.559	1.761
116	1951–1958: 1.180	1959–1967: 1.718	1968–1988: 1.957	1989–1995: 1.802	1996–2002: 1.377	2003–2011: 0.909	1.592
117	1951–1958: 0.846	1959–1966: 1.305	1967–1974: 1.784	1975–1995: 1.958	1996–2003: 1.790	2004–2011: 1.332	1.604
118	1951–1957: 1.113	1958–1964: 1.568	1965–1971: 2.012	1972–1992: 2.072	1993–2001: 1.843	2002–2011: 1.267	1.739
119	1951–1958: 1.449	1959–1967: 2.034	1968–1988: 2.238	1989–1996: 2.117	1997–2003: 1.621	2004–2011: 1.141	1.886
120	1951–1958: 0.879	1959–1966: 1.358	1967–1974: 1.859	1975–1995: 2.012	1996–2003: 1.821	2004–2011: 1.351	1.651
121	1951–1958: 0.905	1959–1965: 1.338	1966–1972: 1.735	1973–1993: 1.833	1994–2002: 1.573	2003–2011: 1.091	1.502
122	1951–1957: 1.195	1958–1964: 1.707	1965–1972: 2.240	1973–1993: 2.357	1994–2002: 2.155	2003–2011: 1.530	1.989
123	1951–1957: 1.434	1958–1964: 2.016	1965–1971: 2.574	1972–1992: 2.555	1993–2001: 2.354	2002–2011: 1.627	2.194
124	1951–1958: 1.241	1959–1967: 1.760	1968–1988: 2.006	1989–1995: 1.937	1996–2002: 1.514	2003–2011: 1.037	1.672
125	1951–1958: 1.984	1959–1966: 2.641	1967–1988: 2.695	1989–1996: 2.703	1997–2003: 2.124	2004–2011: 1.532	2.392
126	1951–1958: 1.078	1959–1965: 1.607	1966–1972: 2.082	1973–1993: 2.186	1994–2002: 1.961	2003–2011: 1.371	1.816
127	1951–1957: 1.063	1958–1964: 1.520	1965–1971: 1.971	1972–1992: 2.068	1993–2001: 1.839	2002–2011: 1.246	1.718
128	1951–1957: 1.218	1958–1964: 1.721	1965–1971: 2.204	1972–1993: 2.268	1994–2002: 2.075	2003–2011: 1.479	1.940
129	1951–1959: 1.485	1960–1968: 2.141	1969–1990: 2.365	1991–1997: 2.379	1998–2003: 1.932	2004–2011: 1.420	2.047
130	1951–1957: 1.125	1958–1964: 1.596	1965–1971: 2.054	1972–1993: 2.141	1994–2002: 1.935	2003–2011: 1.374	1.816
131	1951–1957: 1.057	1958–1964: 1.521	1965–1971: 1.978	1972–1992: 2.097	1993–2001: 1.884	2002–2011: 1.279	1.740
132	1951–1957: 1.185	1958–1964: 1.674	1965–1971: 2.146	1972–1992: 2.212	1993–2001: 2.016	2002–2011: 1.396	1.870
133	1951–1959: 1.021	1960–1967: 1.610	1968–1975: 2.164	1976–1996: 2.303	1997–2003: 2.243	2004–2011: 1.738	1.927
134	1951–1957: 1.232	1958–1964: 1.733	1965–1971: 2.212	1972–1993: 2.261	1994–2002: 2.071	2003–2011: 1.486	1.942
135	1951–1958: 1.113	1959–1966: 1.662	1967–1974: 2.210	1975–1995: 2.294	1996–2003: 2.160	2004–2011: 1.652	1.948
136	1951–1957: 1.105	1958–1964: 1.579	1965–1971: 2.053	1972–1992: 2.102	1993–2001: 1.820	2002–2011: 1.223	1.745
137	1951–1958: 0.977	1959–1967: 1.421	1968–1988: 1.665	1989–1995: 1.527	1996–2002: 1.173	2003–2011: 0.786	1.346
138	1951–1958: 1.148	1959–1965: 1.746	1966–1972: 2.359	1973–1980: 2.966	1981–2002: 2.881	2003–2011: 2.855	2.464
139	1951–1960: 0.929	1961–1969: 1.614	1970–1977: 2.368	1978–1985: 3.023	1986–2004: 3.044	2005–2011: 3.325	2.412
140	1951–1957: 0.877	1958–1964: 1.278	1965–1971: 1.684	1972–1992: 1.826	1993–2001: 1.586	2002–2011: 1.058	1.484
141	1951–1959: 0.883	1960–1967: 1.394	1968–1975: 1.882	1976–1996: 2.050	1997–2003: 1.963	2004–2011: 1.516	1.693

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<tr><th rowspan="2">District Code</th><th colspan="61">Year</th><th rowspan="2">AAGR</th></tr>
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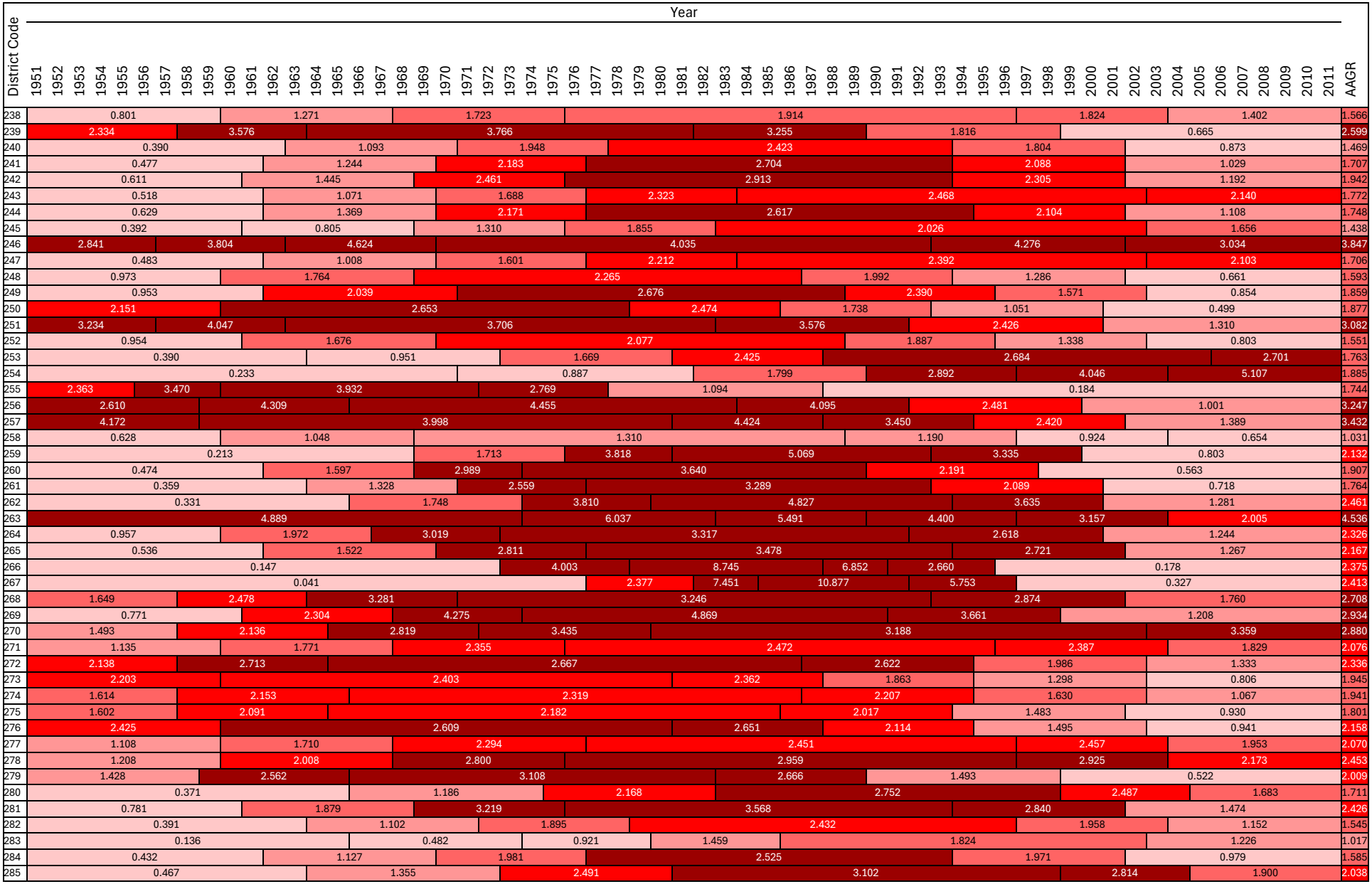
<tr><td>143</td><td colspan="9">0.803</td><td colspan="8">1.286</td><td colspan="9">1.799</td><td colspan="21">2.030</td><td colspan="7">1.938</td><td colspan="7">1.538</td><td>1.652</td></tr>
<tr><td>144</td><td colspan="9">0.917</td><td colspan="8">1.444</td><td colspan="8">1.941</td><td colspan="21">2.116</td><td colspan="7">2.061</td><td colspan="8">1.599</td><td>1.756</td></tr>
<tr><td>145</td><td colspan="8">0.972</td><td colspan="8">1.485</td><td colspan="8">2.008</td><td colspan="21">2.166</td><td colspan="8">2.039</td><td colspan="8">1.540</td><td>1.805</td></tr>
<tr><td>146</td><td colspan="8">0.916</td><td colspan="7">1.357</td><td colspan="8">1.790</td><td colspan="20">1.930</td><td colspan="9">1.694</td><td colspan="9">1.187</td><td>1.575</td></tr>
<tr><td>147</td><td colspan="9">0.694</td><td colspan="9">1.166</td><td colspan="9">1.697</td><td colspan="20">1.949</td><td colspan="7">1.877</td><td colspan="7">1.489</td><td>1.551</td></tr>
<tr><td>148</td><td colspan="9">0.898</td><td colspan="8">1.432</td><td colspan="8">1.941</td><td colspan="21">2.136</td><td colspan="7">2.086</td><td colspan="8">1.612</td><td>1.764</td></tr>
<tr><td>149</td><td colspan="7">1.177</td><td colspan="7">1.666</td><td colspan="7">2.139</td><td colspan="22">2.201</td><td colspan="9">1.986</td><td colspan="9">1.409</td><td>1.874</td></tr>
<tr><td>150</td><td colspan="10">0.737</td><td colspan="9">1.264</td><td colspan="9">1.818</td><td colspan="20">2.035</td><td colspan="6">1.985</td><td colspan="7">1.608</td><td>1.623</td></tr>
<tr><td>151</td><td colspan="9">0.860</td><td colspan="9">1.418</td><td colspan="9">2.031</td><td colspan="21">2.251</td><td colspan="6">2.261</td><td colspan="7">1.840</td><td>1.844</td></tr>
<tr><td>152</td><td colspan="9">0.758</td><td colspan="9">1.258</td><td colspan="9">1.811</td><td colspan="20">2.063</td><td colspan="7">2.016</td><td colspan="7">1.606</td><td>1.657</td></tr>
<tr><td>153</td><td colspan="9">0.788</td><td colspan="8">1.256</td><td colspan="8">1.707</td><td colspan="21">1.904</td><td colspan="7">1.821</td><td colspan="8">1.403</td><td>1.556</td></tr>
<tr><td>154</td><td colspan="8">0.880</td><td colspan="7">1.329</td><td colspan="7">1.743</td><td colspan="21">1.883</td><td colspan="9">1.626</td><td colspan="9">1.112</td><td>1.527</td></tr>
<tr><td>155</td><td colspan="9">0.969</td><td colspan="8">1.542</td><td colspan="9">2.130</td><td colspan="21">2.362</td><td colspan="7">2.354</td><td colspan="7">1.887</td><td>1.960</td></tr>
<tr><td>156</td><td colspan="9">0.770</td><td colspan="8">1.231</td><td colspan="9">1.725</td><td colspan="20">1.943</td><td colspan="7">1.827</td><td colspan="8">1.400</td><td>1.562</td></tr>
<tr><td>157</td><td colspan="8">0.844</td><td colspan="8">1.313</td><td colspan="8">1.805</td><td colspan="21">1.975</td><td colspan="8">1.791</td><td colspan="8">1.332</td><td>1.614</td></tr>
<tr><td>158</td><td colspan="7">1.044</td><td colspan="7">1.491</td><td colspan="7">1.930</td><td colspan="21">2.036</td><td colspan="9">1.822</td><td colspan="10">1.244</td><td>1.693</td></tr>
<tr><td>159</td><td colspan="7">0.896</td><td colspan="7">1.301</td><td colspan="7">1.710</td><td colspan="21">1.841</td><td colspan="9">1.597</td><td colspan="10">1.066</td><td>1.500</td></tr>
<tr><td>160</td><td colspan="9">1.056</td><td colspan="9">1.613</td><td colspan="22">1.911</td><td colspan="7">1.790</td><td colspan="6">1.394</td><td colspan="8">0.983</td><td>1.564</td></tr>
<tr><td>161</td><td colspan="7">0.937</td><td colspan="6">1.326</td><td colspan="7">1.704</td><td colspan="22">1.827</td><td colspan="9">1.537</td><td colspan="10">1.009</td><td>1.492</td></tr>
<tr><td>162</td><td colspan="8">1.308</td><td colspan="9">1.877</td><td colspan="21">2.111</td><td colspan="7">2.003</td><td colspan="7">1.547</td><td colspan="9">1.038</td><td>1.747</td></tr>
<tr><td>163</td><td colspan="7">1.033</td><td colspan="6">1.422</td><td colspan="7">1.782</td><td colspan="22">1.868</td><td colspan="9">1.625</td><td colspan="10">1.110</td><td>1.566</td></tr>
<tr><td>164</td><td colspan="8">1.340</td><td colspan="9">1.903</td><td colspan="21">2.130</td><td colspan="8">1.992</td><td colspan="7">1.509</td><td colspan="8">1.053</td><td>1.774</td></tr>
<tr><td>165</td><td colspan="9">0.979</td><td colspan="8">1.542</td><td colspan="9">2.114</td><td colspan="20">2.315</td><td colspan="7">2.283</td><td colspan="8">1.788</td><td>1.916</td></tr>
<tr><td>166</td><td colspan="8">1.134</td><td colspan="9">1.633</td><td colspan="20">1.859</td><td colspan="8">1.682</td><td colspan="7">1.261</td><td colspan="9">0.838</td><td>1.499</td></tr>
<tr><td>167</td><td colspan="7">1.032</td><td colspan="6">1.446</td><td colspan="7">1.840</td><td colspan="22">1.938</td><td colspan="9">1.664</td><td colspan="10">1.117</td><td>1.608</td></tr>
<tr><td>168</td><td colspan="7">1.143</td><td colspan="6">1.576</td><td colspan="7">1.977</td><td colspan="22">2.029</td><td colspan="9">1.760</td><td colspan="10">1.196</td><td>1.709</td></tr>
<tr><td>169</td><td colspan="9">0.916</td><td colspan="8">1.467</td><td colspan="8">2.004</td><td colspan="21">2.171</td><td colspan="7">2.065</td><td colspan="8">1.578</td><td>1.785</td></tr>
<tr><td>170</td><td colspan="7">0.913</td><td colspan="7">1.326</td><td colspan="7">1.747</td><td colspan="21">1.866</td><td colspan="9">1.604</td><td colspan="10">1.066</td><td>1.519</td></tr>
<tr><td>171</td><td colspan="9">0.813</td><td colspan="8">1.292</td><td colspan="8">1.753</td><td colspan="20">1.922</td><td colspan="8">1.760</td><td colspan="8">1.315</td><td>1.557</td></tr>
<tr><td>172</td><td colspan="9">0.773</td><td colspan="9">1.302</td><td colspan="9">1.897</td><td colspan="20">2.133</td><td colspan="7">2.035</td><td colspan="7">1.602</td><td>1.704</td></tr>
<tr><td>173</td><td colspan="8">1.093</td><td colspan="7">1.613</td><td colspan="8">2.114</td><td colspan="21">2.234</td><td colspan="8">2.073</td><td colspan="9">1.514</td><td>1.876</td></tr>
<tr><td>174</td><td colspan="10">0.673</td><td colspan="9">1.173</td><td colspan="9">1.709</td><td colspan="20">1.978</td><td colspan="6">1.961</td><td colspan="7">1.581</td><td>1.558</td></tr>
<tr><td>175</td><td colspan="10">0.711</td><td colspan="8">1.218</td><td colspan="8">1.698</td><td colspan="20">1.936</td><td colspan="7">1.818</td><td colspan="8">1.356</td><td>1.523</td></tr>
<tr><td>176</td><td colspan="8">0.849</td><td colspan="8">1.320</td><td colspan="8">1.814</td><td colspan="21">1.996</td><td colspan="8">1.830</td><td colspan="8">1.359</td><td>1.632</td></tr>
<tr><td>177</td><td colspan="9">0.779</td><td colspan="8">1.250</td><td colspan="9">1.756</td><td colspan="20">1.974</td><td colspan="7">1.861</td><td colspan="8">1.429</td><td>1.589</td></tr>
<tr><td>178</td><td colspan="9">0.771</td><td colspan="7">1.235</td><td colspan="7">1.703</td><td colspan="7">2.173</td><td colspan="21">2.217</td><td colspan="10">1.991</td><td>1.786</td></tr>
<tr><td>179</td><td colspan="10">0.546</td><td colspan="9">0.992</td><td colspan="8">1.521</td><td colspan="8">2.030</td><td colspan="19">2.160</td><td colspan="7">2.121</td><td>1.609</td></tr>
<tr><td>180</td><td colspan="9">0.598</td><td colspan="8">1.010</td><td colspan="7">1.462</td><td colspan="8">1.911</td><td colspan="20">2.039</td><td colspan="9">1.855</td><td>1.577</td></tr>
<tr><td>181</td><td colspan="9">0.597</td><td colspan="8">1.014</td><td colspan="7">1.477</td><td colspan="7">1.912</td><td colspan="21">2.008</td><td colspan="9">1.796</td><td>1.562</td></tr>
<tr><td>182</td><td colspan="10">0.537</td><td colspan="8">0.941</td><td colspan="8">1.399</td><td colspan="8">1.885</td><td colspan="19">2.031</td><td colspan="8">1.917</td><td>1.520</td></tr>
<tr><td>183</td><td colspan="9">0.720</td><td colspan="8">1.163</td><td colspan="9">1.642</td><td colspan="20">1.876</td><td colspan="7">1.767</td><td colspan="8">1.353</td><td>1.499</td></tr>
<tr><td>184</td><td colspan="11">0.608</td><td colspan="9">1.140</td><td colspan="9">1.709</td><td colspan="19">1.986</td><td colspan="6">1.901</td><td colspan="7">1.500</td><td>1.508</td></tr>
<tr><td>185</td><td colspan="9">0.839</td><td colspan="9">1.373</td><td colspan="9">1.953</td><td colspan="20">2.172</td><td colspan="7">2.129</td><td colspan="7">1.711</td><td>1.768</td></tr>
<tr><td>186</td><td colspan="8">0.843</td><td colspan="8">1.301</td><td colspan="8">1.780</td><td colspan="21">1.941</td><td colspan="8">1.755</td><td colspan="8">1.304</td><td>1.589</td></tr>
<tr><td>187</td><td colspan="9">0.816</td><td colspan="9">1.353</td><td colspan="9">1.943</td><td colspan="20">2.180</td><td colspan="7">2.131</td><td colspan="7">1.699</td><td>1.762</td></tr>
<tr><td>188</td><td colspan="8">0.883</td><td colspan="7">1.322</td><td colspan="8">1.760</td><td colspan="21">1.927</td><td colspan="8">1.734</td><td colspan="9">1.243</td><td>1.578</td></tr>
<tr><td>189</td><td colspan="8">0.882</td><td colspan="8">1.349</td><td colspan="8">1.832</td><td colspan="21">1.995</td><td colspan="8">1.838</td><td colspan="8">1.377</td><td>1.646</td></tr>
</table>

District Code	Year						AAGR
190	1951–1959: 0.915	1960–1967: 1.441	1968–1975: 1.938	1976–1995: 2.106	1996–2003: 1.984	2004–2011: 1.500	1.729
191	1951–1958: 0.793	1959–1966: 1.225	1967–1974: 1.680	1975–1995: 1.849	1996–2003: 1.662	2004–2011: 1.231	1.505
192	1951–1958: 0.939	1959–1965: 1.398	1966–1972: 1.813	1973–1993: 1.943	1994–2002: 1.717	2003–2011: 1.196	1.597
193	1951–1959: 0.815	1960–1967: 1.332	1968–1975: 1.847	1976–1995: 2.053	1996–2003: 1.875	2004–2011: 1.373	1.641
194	1951–1958: 0.998	1959–1966: 1.513	1967–1974: 2.040	1975–1995: 2.150	1996–2003: 1.972	2004–2011: 1.484	1.795
195	1951–1957: 1.111	1958–1964: 1.574	1965–1971: 2.023	1972–1993: 2.111	1994–2002: 1.903	2003–2011: 1.352	1.789
196	1951–1957: 1.153	1958–1964: 1.757	1965–1971: 2.401	1972–1991: 2.510	1992–2000: 2.170	2001–2011: 1.342	2.005
197	1951–1958: 1.022	1959–1966: 1.557	1967–1974: 2.100	1975–1994: 2.239	1995–2002: 2.110	2003–2011: 1.551	1.858
198	1951–1957: 1.532	1958–1964: 2.121	1965–1971: 2.667	1972–1993: 2.617	1994–2002: 2.484	2003–2011: 1.822	2.312
199	1951–1958: 0.821	1959–1966: 1.261	1967–1974: 1.717	1975–1994: 1.881	1995–2002: 1.729	2003–2011: 1.260	1.532
200	1951–1958: 0.768	1959–1966: 1.190	1967–1974: 1.631	1975–1995: 1.819	1996–2003: 1.662	2004–2011: 1.242	1.482
201	1951–1960: 0.824	1961–1969: 1.397	1970–1978: 1.986	1979–1998: 2.205	1999–2004: 2.212	2005–2011: 1.806	1.782
202	1951–1959: 0.698	1960–1967: 1.170	1968–1974: 1.686	1975–1981: 2.164	1982–2002: 2.205	2003–2011: 1.989	1.747
203	1951–1960: 0.587	1961–1968: 1.030	1969–1976: 1.537	1977–1984: 2.074	1985–2004: 2.227	2005–2011: 2.205	1.679
204	1951–1959: 0.635	1960–1967: 1.086	1968–1974: 1.588	1975–1982: 2.092	1983–2002: 2.234	2003–2011: 2.057	1.723
205	1951–1960: 0.755	1961–1969: 1.287	1970–1978: 1.842	1979–1998: 2.070	1999–2004: 2.051	2005–2011: 1.668	1.657
206	1951–1957: 1.413	1958–1964: 1.952	1965–1971: 2.461	1972–1992: 2.426	1993–2001: 2.226	2002–2011: 1.562	2.097
207	1951–1958: 1.295	1959–1965: 1.895	1966–1973: 2.452	1974–1994: 2.531	1995–2002: 2.422	2003–2011: 1.786	2.168
208	1951–1958: 1.270	1959–1965: 1.846	1966–1973: 2.376	1974–1994: 2.454	1995–2002: 2.346	2003–2011: 1.740	2.105
209	1951–1958: 1.173	1959–1966: 1.778	1967–1974: 2.391	1975–1995: 2.464	1996–2003: 2.315	2004–2011: 1.748	2.087
210	1951–1959: 1.077	1960–1967: 1.690	1968–1975: 2.257	1976–1995: 2.399	1996–2003: 2.311	2004–2011: 1.763	2.001
211	1951–1960: 0.814	1961–1969: 1.407	1970–1978: 2.031	1979–1998: 2.281	1999–2004: 2.306	2005–2011: 1.870	1.829
212	1951–1959: 0.872	1960–1968: 1.440	1969–1977: 2.057	1978–1997: 2.297	1998–2004: 2.285	2005–2011: 1.832	1.871
213	1951–1959: 0.912	1960–1967: 1.435	1968–1975: 1.931	1976–1996: 2.109	1997–2003: 2.055	2004–2011: 1.593	1.749
214	1951–1960: 0.788	1961–1969: 1.348	1970–1978: 1.931	1979–1998: 2.173	1999–2004: 2.189	2005–2011: 1.782	1.745
215	1951–1959: 0.833	1960–1967: 1.330	1968–1975: 1.810	1976–1996: 1.994	1997–2003: 1.898	2004–2011: 1.459	1.633
216	1951–1959: 0.737	1960–1968: 1.230	1969–1977: 1.783	1978–1997: 2.011	1998–2004: 1.909	2005–2011: 1.509	1.606
217	1951–1959: 0.759	1960–1967: 1.230	1968–1976: 1.741	1977–1997: 2.002	1998–2004: 1.910	2005–2011: 1.501	1.613
218	1951–1960: 0.837	1961–1969: 1.418	1970–1978: 2.013	1979–1998: 2.227	1999–2004: 2.232	2005–2011: 1.822	1.802
219	1951–1959: 0.754	1960–1968: 1.278	1969–1977: 1.870	1978–1997: 2.139	1998–2004: 2.075	2005–2011: 1.634	1.704
220	1951–1959: 0.873	1960–1968: 1.431	1969–1977: 2.037	1978–1997: 2.238	1998–2004: 2.174	2005–2011: 1.738	1.825
221	1951–1958: 0.794	1959–1965: 1.230	1966–1972: 1.709	1973–1979: 2.189	1980–2001: 2.214	2002–2011: 1.962	1.810
222	1951–1959: 0.884	1960–1967: 1.418	1968–1975: 1.935	1976–1996: 2.121	1997–2003: 2.029	2004–2011: 1.550	1.739
223	1951–1959: 0.845	1960–1967: 1.342	1968–1976: 1.863	1977–1997: 2.095	1998–2004: 2.031	2005–2011: 1.618	1.717
224	1951–1958: 0.803	1959–1966: 1.239	1967–1974: 1.695	1975–1994: 1.855	1995–2002: 1.678	2003–2011: 1.210	1.502
225	1951–1959: 0.755	1960–1967: 1.225	1968–1976: 1.737	1977–1997: 1.990	1998–2004: 1.881	2005–2011: 1.475	1.600
226	1951–1959: 0.749	1960–1967: 1.200	1968–1976: 1.683	1977–1997: 1.904	1998–2004: 1.780	2005–2011: 1.405	1.539
227	1951–1958: 0.912	1959–1965: 1.355	1966–1973: 1.788	1974–1993: 1.951	1994–2002: 1.735	2003–2011: 1.220	1.591
228	1951–1959: 0.945	1960–1967: 1.490	1968–1975: 2.004	1976–1996: 2.174	1997–2003: 2.124	2004–2011: 1.646	1.808
229	1951–1959: 0.772	1960–1967: 1.241	1968–1976: 1.745	1977–1996: 1.981	1997–2003: 1.881	2004–2011: 1.441	1.591
230	1951–1959: 0.770	1960–1967: 1.239	1968–1976: 1.745	1977–1997: 1.986	1998–2004: 1.888	2005–2011: 1.492	1.607
231	1951–1958: 0.800	1959–1965: 1.233	1966–1972: 1.700	1973–1979: 2.170	1980–2001: 2.170	2002–2011: 1.894	1.782
232	1951–1958: 0.990	1959–1965: 1.468	1966–1973: 1.932	1974–1994: 2.090	1995–2002: 1.939	2003–2011: 1.410	1.739
233	1951–1960: 0.839	1961–1969: 1.412	1970–1978: 1.996	1979–1998: 2.208	1999–2004: 2.225	2005–2011: 1.824	1.792
234	1951–1959: 0.832	1960–1968: 1.388	1969–1977: 2.003	1978–1997: 2.245	1998–2004: 2.194	2005–2011: 1.745	1.812
235	1951–1959: 0.852	1960–1968: 1.393	1969–1977: 1.983	1978–1997: 2.189	1998–2004: 2.126	2005–2011: 1.701	1.782
236	1951–1960: 0.859	1961–1969: 1.441	1970–1978: 2.032	1979–1998: 2.222	1999–2004: 2.215	2005–2011: 1.815	1.808
237	1951–1960: 0.760	1961–1969: 1.285	1970–1978: 1.823	1979–1997: 2.046	1998–2004: 1.984	2005–2011: 1.592	1.631


District Code
Year
1951 1952 1953 1954 1955 1956 1957 1958 1959 1960 1961 1962 1963 1964 1965 1966 1967 1968 1969 1970 1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982 1983 1984 1985 1986 1987 1988 1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011
AAGR
238 0.801 1.271 1.723 1.914 1.824 1.402 1.566
239 2.334 3.576 3.766 3.255 1.816 0.665 2.599
240 0.390 1.093 1.948 2.423 1.804 0.873 1.469
241 0.477 1.244 2.183 2.704 2.088 1.029 1.707
242 0.611 1.445 2.461 2.913 2.305 1.192 1.942
243 0.518 1.071 1.688 2.323 2.468 2.140 1.772
244 0.629 1.369 2.171 2.617 2.104 1.108 1.748
245 0.392 0.805 1.310 1.855 2.026 1.656 1.438
246 2.841 3.804 4.624 4.035 4.276 3.034 3.847
247 0.483 1.008 1.601 2.212 2.392 2.103 1.706
248 0.973 1.764 2.265 1.992 1.286 0.661 1.593
249 0.953 2.039 2.676 2.390 1.571 0.854 1.859
250 2.151 2.653 2.474 1.738 1.051 0.499 1.877
251 3.234 4.047 3.706 3.576 2.426 1.310 3.082
252 0.954 1.676 2.077 1.887 1.338 0.803 1.551
253 0.390 0.951 1.669 2.425 2.684 2.701 1.763
254 0.233 0.887 1.799 2.892 4.046 5.107 1.885
255 2.363 3.470 3.932 2.769 1.094 0.184 1.744
256 2.610 4.309 4.455 4.095 2.481 1.001 3.247
257 4.172 3.998 4.424 3.450 2.420 1.389 3.432
258 0.628 1.048 1.310 1.190 0.924 0.654 1.031
259 0.213 1.713 3.818 5.069 3.335 0.803 2.132
260 0.474 1.597 2.989 3.640 2.191 0.563 1.907
261 0.359 1.328 2.559 3.289 2.089 0.718 1.764
262 0.331 1.748 3.810 4.827 3.635 1.281 2.461
263 4.889 6.037 5.491 4.400 3.157 2.005 4.536
264 0.957 1.972 3.019 3.317 2.618 1.244 2.326
265 0.536 1.522 2.811 3.478 2.721 1.267 2.167
266 0.147 4.003 8.745 6.852 2.660 0.178 2.375
267 0.041 2.377 7.451 10.877 5.753 0.327 2.413
268 1.649 2.478 3.281 3.246 2.874 1.760 2.708
269 0.771 2.304 4.275 4.869 3.661 1.208 2.934
270 1.493 2.136 2.819 3.435 3.188 3.359 2.880
271 1.135 1.771 2.355 2.472 2.387 1.829 2.076
272 2.138 2.713 2.667 2.622 1.986 1.333 2.336
273 2.203 2.403 2.362 1.863 1.298 0.806 1.945
274 1.614 2.153 2.319 2.207 1.630 1.067 1.941
275 1.602 2.091 2.182 2.017 1.483 0.930 1.801
276 2.425 2.609 2.651 2.114 1.495 0.941 2.158
277 1.108 1.710 2.294 2.451 2.457 1.953 2.070
278 1.208 2.008 2.800 2.959 2.925 2.173 2.453
279 1.428 2.562 3.108 2.666 1.493 0.522 2.009
280 0.371 1.186 2.168 2.752 2.487 1.683 1.711
281 0.781 1.879 3.219 3.568 2.840 1.474 2.426
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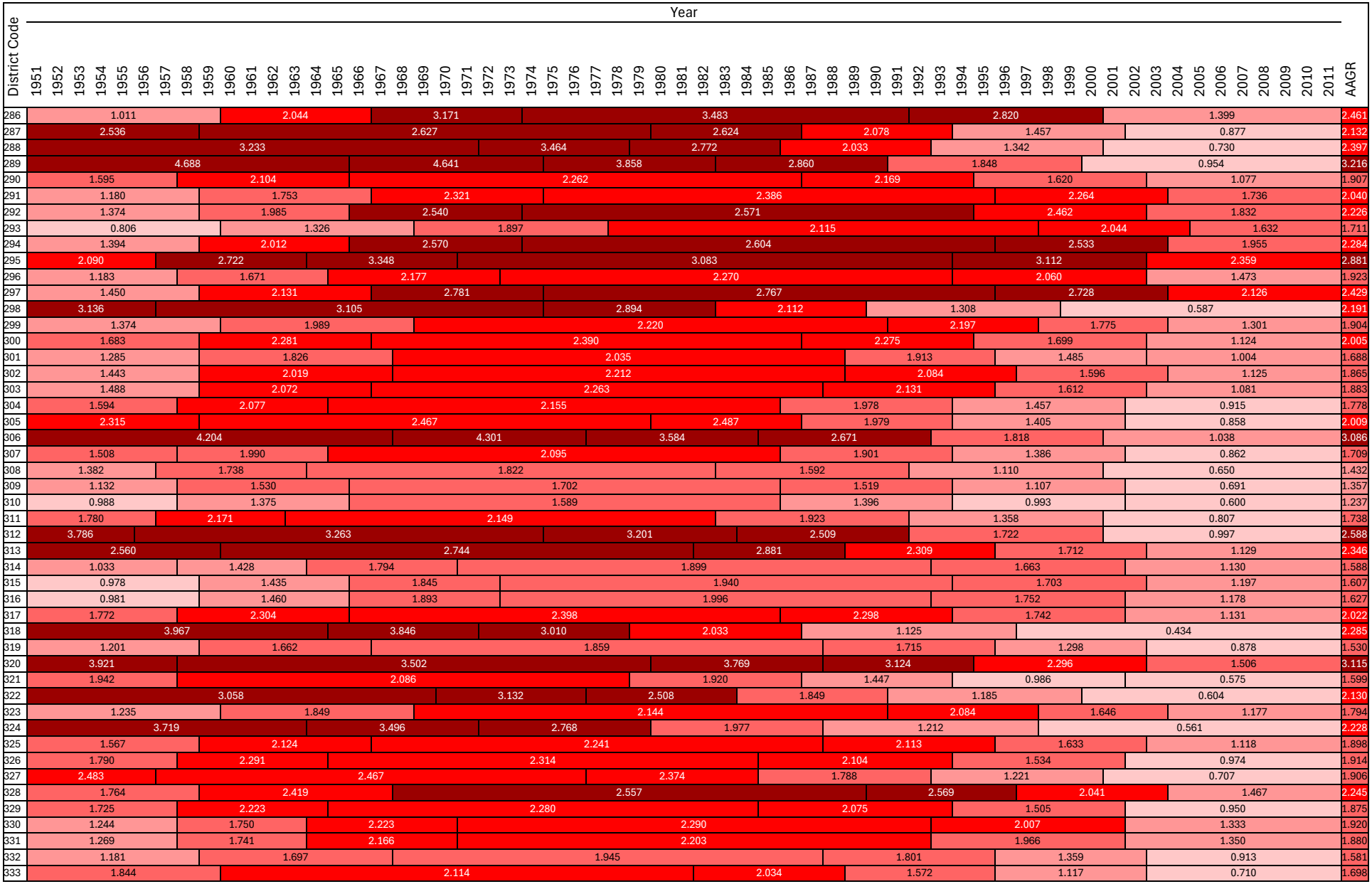
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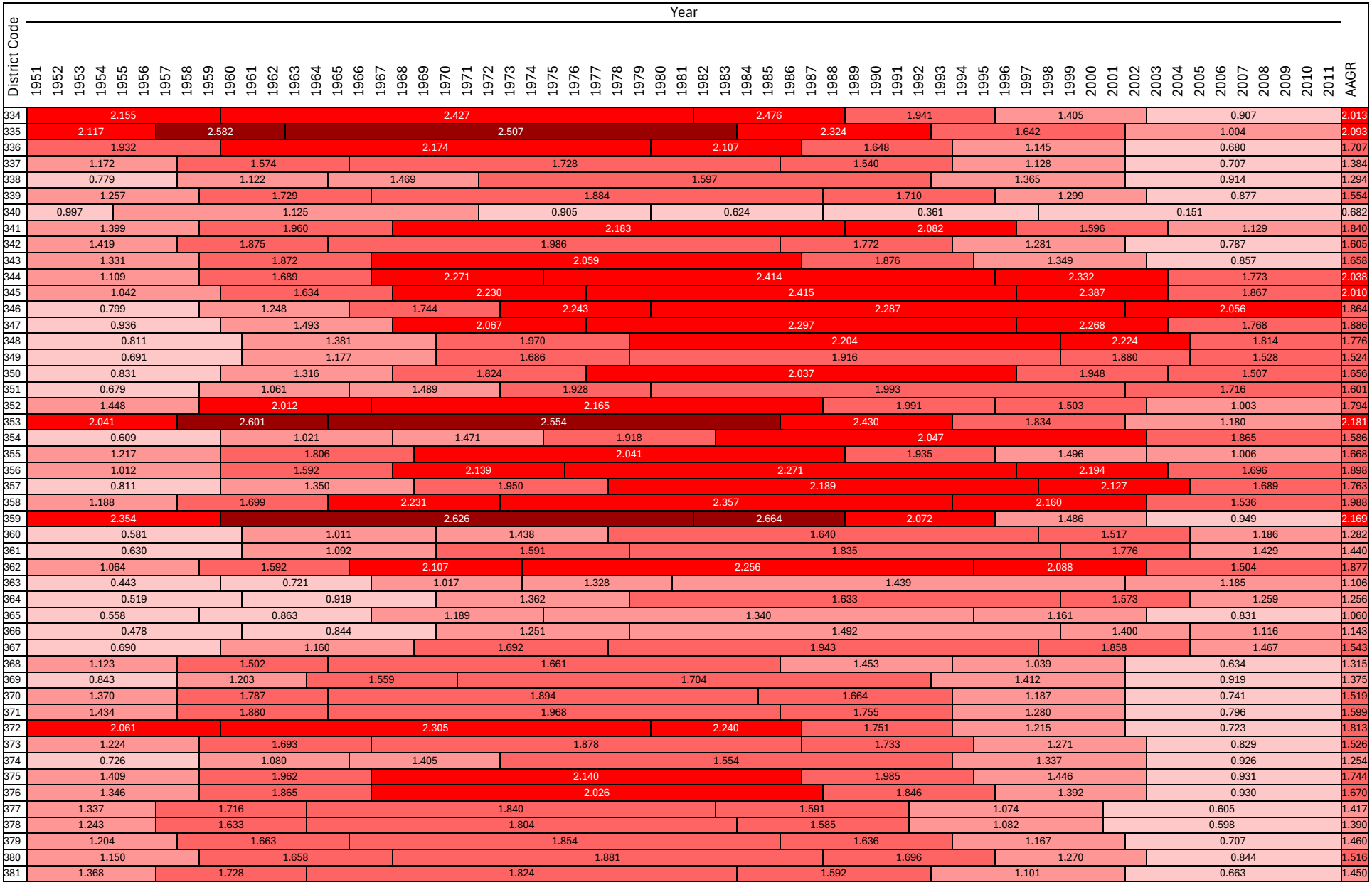
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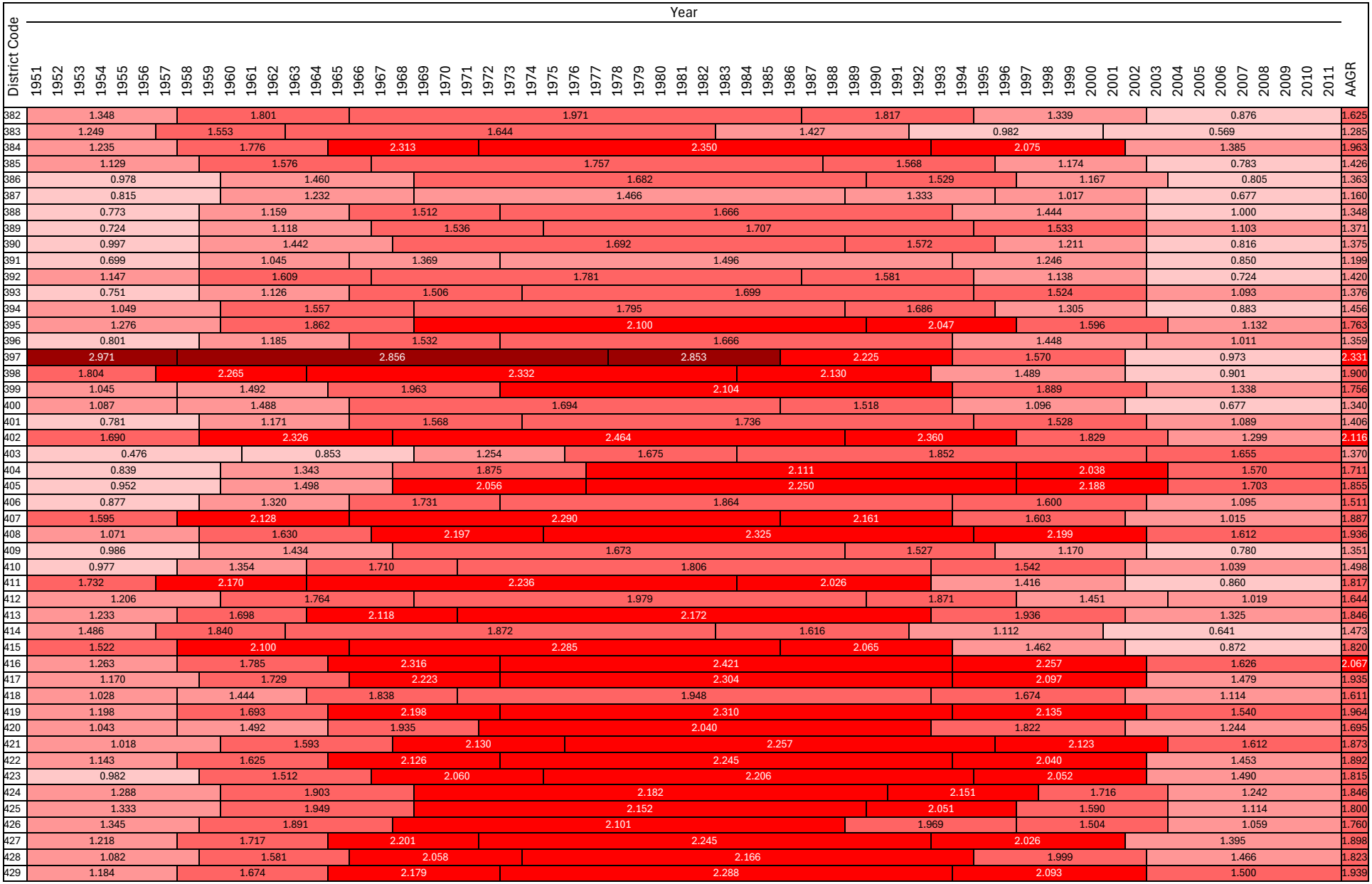
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<tr><td>469</td><td colspan="6">1.463</td><td colspan="6">1.807</td><td colspan="20">1.836</td><td colspan="9">1.581</td><td colspan="9">1.090</td><td colspan="11">0.632</td><td>1.445</td></tr>
<tr><td>470</td><td colspan="7">1.536</td><td colspan="7">1.986</td><td colspan="21">2.049</td><td colspan="8">1.865</td><td colspan="8">1.383</td><td colspan="10">0.877</td><td>1.692</td></tr>
<tr><td>471</td><td colspan="7">1.558</td><td colspan="8">2.066</td><td colspan="20">2.187</td><td colspan="8">2.018</td><td colspan="8">1.494</td><td colspan="10">0.943</td><td>1.796</td></tr>
<tr><td>472</td><td colspan="9">1.566</td><td colspan="9">2.242</td><td colspan="21">2.419</td><td colspan="7">2.400</td><td colspan="7">1.890</td><td colspan="8">1.351</td><td>2.076</td></tr>
<tr><td>473</td><td colspan="9">1.203</td><td colspan="9">1.763</td><td colspan="21">1.996</td><td colspan="7">1.913</td><td colspan="7">1.483</td><td colspan="8">1.045</td><td>1.662</td></tr>
<tr><td>474</td><td colspan="9">1.406</td><td colspan="9">2.022</td><td colspan="21">2.218</td><td colspan="7">2.164</td><td colspan="7">1.700</td><td colspan="8">1.212</td><td>1.883</td></tr>
<tr><td>475</td><td colspan="6">1.646</td><td colspan="6">2.050</td><td colspan="21">2.086</td><td colspan="8">1.889</td><td colspan="9">1.334</td><td colspan="11">0.772</td><td>1.680</td></tr>
<tr><td>476</td><td colspan="7">1.734</td><td colspan="20">1.884</td><td colspan="8">1.715</td><td colspan="7">1.294</td><td colspan="8">0.889</td><td colspan="11">0.503</td><td>1.412</td></tr>
<tr><td>477</td><td colspan="9">1.844</td><td colspan="21">2.106</td><td colspan="7">2.044</td><td colspan="7">1.587</td><td colspan="7">1.142</td><td colspan="10">0.706</td><td>1.676</td></tr>
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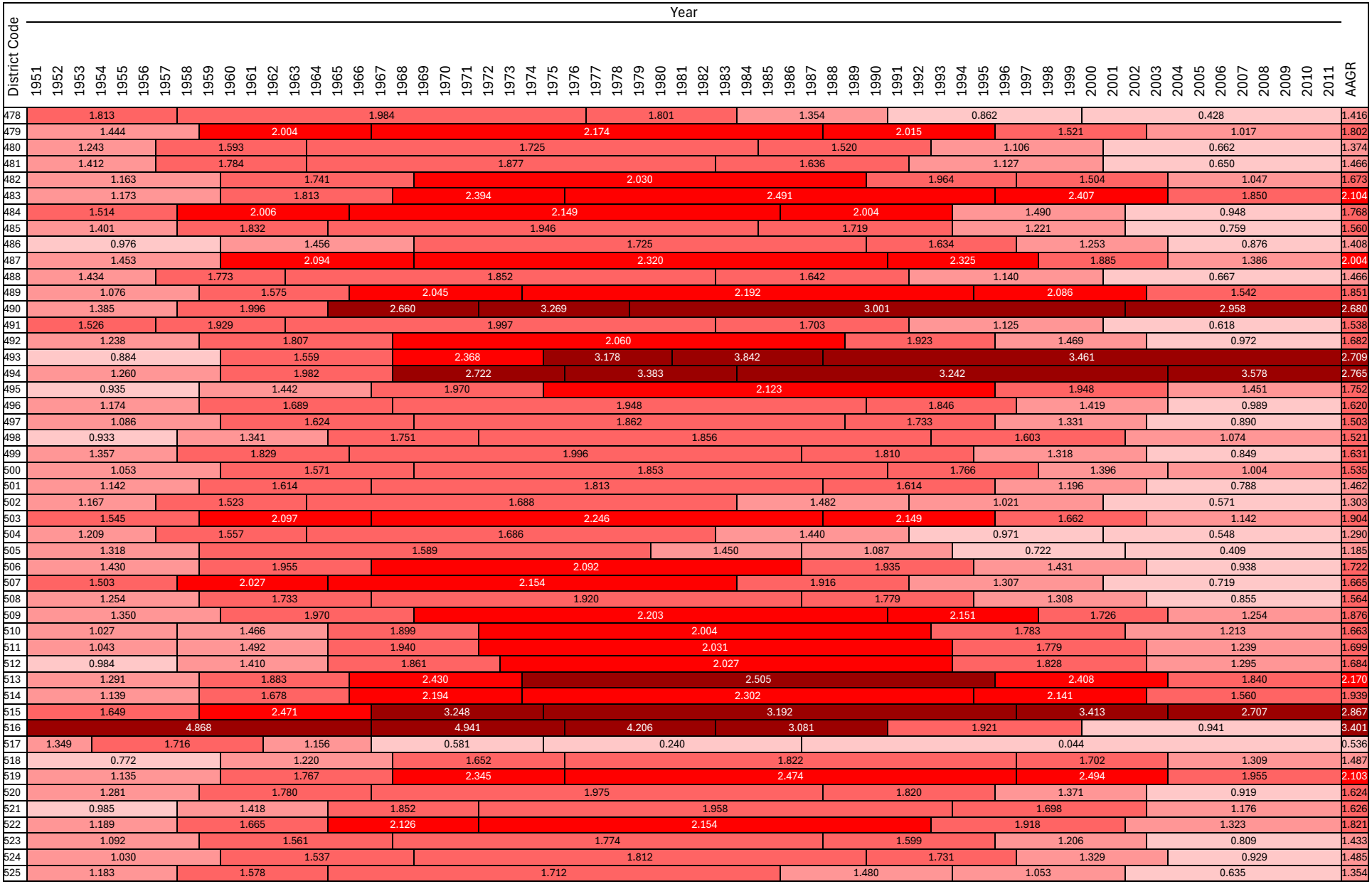
Year
District Code
1951 1952 1953 1954 1955 1956 1957 1958 1959 1960 1961 1962 1963 1964 1965 1966 1967 1968 1969 1970 1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982 1983 1984 1985 1986 1987 1988 1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011
AAGR
478 1.813 1.984 1.801 1.354 0.862 0.428 1.416
479 1.444 2.004 2.174 2.015 1.521 1.017 1.802
480 1.243 1.593 1.725 1.520 1.106 0.662 1.374
481 1.412 1.784 1.877 1.636 1.127 0.650 1.466
482 1.163 1.741 2.030 1.964 1.504 1.047 1.673
483 1.173 1.813 2.394 2.491 2.407 1.850 2.104
484 1.514 2.006 2.149 2.004 1.490 0.948 1.768
485 1.401 1.832 1.946 1.719 1.221 0.759 1.560
486 0.976 1.456 1.725 1.634 1.253 0.876 1.408
487 1.453 2.094 2.320 2.325 1.885 1.386 2.004
488 1.434 1.773 1.852 1.642 1.140 0.667 1.466
489 1.076 1.575 2.045 2.192 2.086 1.542 1.851
490 1.385 1.996 2.660 3.269 3.001 2.958 2.680
491 1.526 1.929 1.997 1.703 1.125 0.618 1.538
492 1.238 1.807 2.060 1.923 1.469 0.972 1.682
493 0.884 1.559 2.368 3.178 3.842 3.461 2.709
494 1.260 1.982 2.722 3.383 3.242 3.578 2.765
495 0.935 1.442 1.970 2.123 1.948 1.451 1.752
496 1.174 1.689 1.948 1.846 1.419 0.989 1.620
497 1.086 1.624 1.862 1.733 1.331 0.890 1.503
498 0.933 1.341 1.751 1.856 1.603 1.074 1.521
499 1.357 1.829 1.996 1.810 1.318 0.849 1.631
500 1.053 1.571 1.853 1.766 1.396 1.004 1.535
501 1.142 1.614 1.813 1.614 1.196 0.788 1.462
502 1.167 1.523 1.688 1.482 1.021 0.571 1.303
503 1.545 2.097 2.246 2.149 1.662 1.142 1.904
504 1.209 1.557 1.686 1.440 0.971 0.548 1.290
505 1.318 1.589 1.450 1.087 0.722 0.409 1.185
506 1.430 1.955 2.092 1.935 1.431 0.938 1.722
507 1.503 2.027 2.154 1.916 1.307 0.719 1.665
508 1.254 1.733 1.920 1.779 1.308 0.855 1.564
509 1.350 1.970 2.203 2.151 1.726 1.254 1.876
510 1.027 1.466 1.899 2.004 1.783 1.213 1.663
511 1.043 1.492 1.940 2.031 1.779 1.239 1.699
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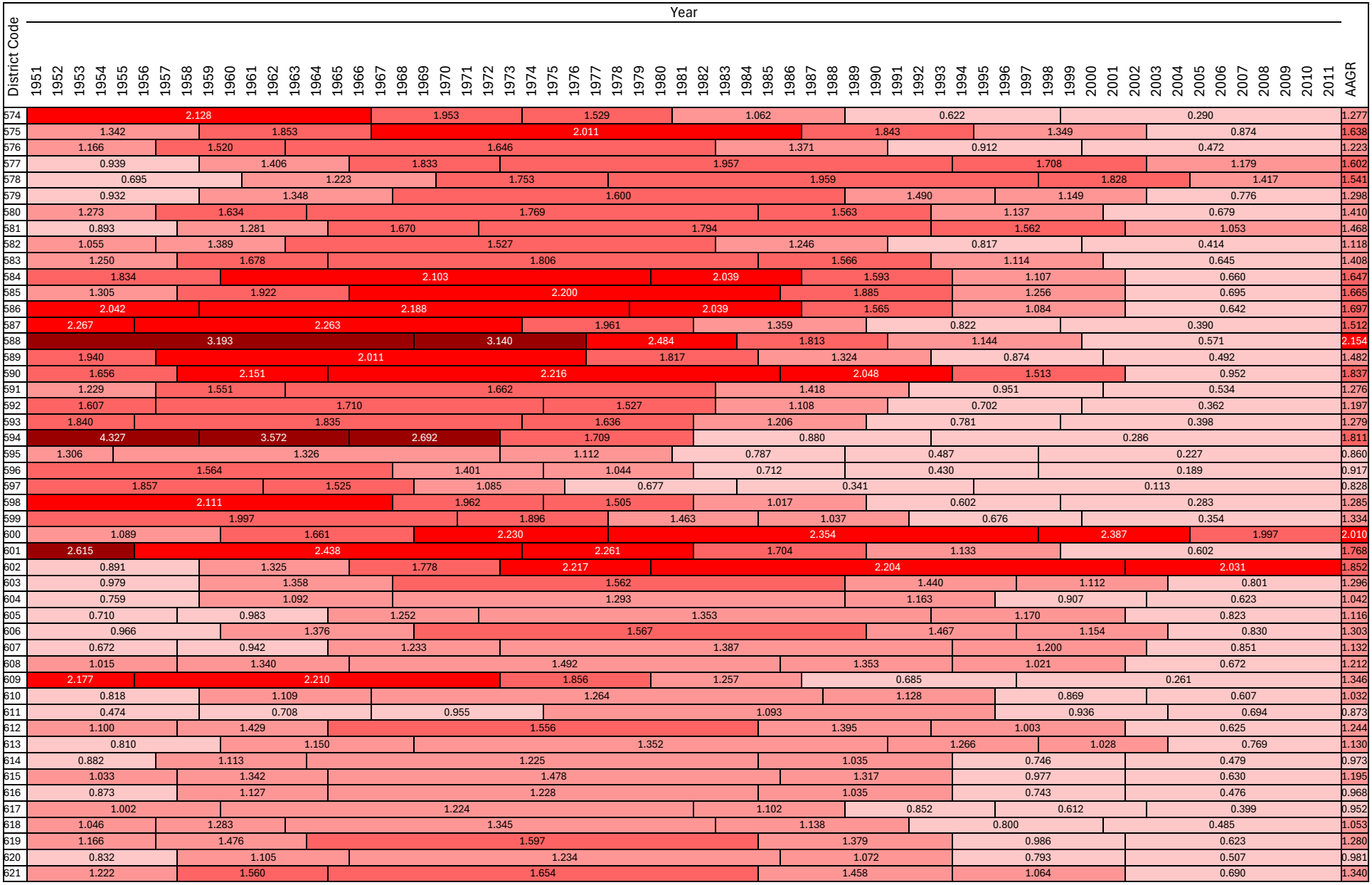
514 1.139 1.678 2.194 2.302 2.141 1.560 1.939
515 1.649 2.471 3.248 3.192 3.413 2.707 2.867
516 4.868 4.941 4.206 3.081 1.921 0.941 3.401
517 1.349 1.716 1.156 0.581 0.240 0.044 0.536
518 0.772 1.220 1.652 1.822 1.702 1.309 1.487
519 1.135 1.767 2.345 2.474 2.494 1.955 2.103
520 1.281 1.780 1.975 1.820 1.371 0.919 1.624
521 0.985 1.418 1.852 1.958 1.698 1.176 1.626
522 1.189 1.665 2.126 2.154 1.918 1.323 1.821
523 1.092 1.561 1.774 1.599 1.206 0.809 1.433
524 1.030 1.537 1.812 1.731 1.329 0.929 1.485
525 1.183 1.578 1.712 1.480 1.053 0.635 1.354

Year

1951 1952 1953 1954 1955 1956 1957 1958 1959 1960 1961 1962 1963 1964 1965 1966 1967 1968 1969 1970 1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982 1983 1984 1985 1986 1987 1988 1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011

District Code	Year						AAGR
526	0.446	0.777	1.047	0.792	0.485	0.209	0.677
527	0.478	0.536	0.458	0.352	0.244	0.147	0.393
528	1.440	1.875	1.987	1.773	1.268	0.795	1.603
529	1.293	1.694	1.822	1.644	1.204	0.756	1.479
530	1.500	1.987	2.128	1.981	1.474	0.938	1.751
531	1.658	2.055	2.071	1.814	1.248	0.719	1.641
532	1.077	1.595	1.858	1.610	1.142	0.717	1.450
533	0.880	1.287	1.703	1.837	1.573	1.036	1.486
534	1.102	2.144	2.786	2.304	1.413	0.633	1.873
535	1.295	1.955	2.622	3.242	3.011	3.043	2.645
536	1.090	1.622	1.878	1.779	1.366	0.952	1.542
537	1.120	1.653	1.920	1.702	1.173	0.684	1.464
538	1.152	1.648	1.835	1.603	1.129	0.698	1.442
539	1.776	2.220	2.239	1.976	1.344	0.761	1.771
540	0.690	1.043	1.277	1.102	0.822	0.532	0.991
541	0.608	1.029	1.292	1.042	0.682	0.354	0.903
542	1.139	1.735	1.988	1.833	1.390	0.912	1.591
543	0.915	1.428	1.731	1.409	0.883	0.438	1.215
544	1.008	1.531	1.849	1.519	0.905	0.399	1.262
545	1.245	1.654	1.790	1.583	1.146	0.679	1.412
546	1.295	1.625	1.727	1.496	1.016	0.579	1.341
547	0.923	1.345	1.575	1.397	1.038	0.689	1.249
548	1.004	1.420	1.626	1.435	1.061	0.698	1.300
549	0.990	1.431	1.663	1.497	1.121	0.749	1.331
550	1.167	1.715	1.925	1.795	1.385	0.965	1.590
551	1.096	1.576	1.792	1.645	1.267	0.850	1.463
552	0.988	1.439	1.682	1.542	1.184	0.792	1.360
553	1.120	1.615	1.849	1.716	1.323	0.888	1.512
554	1.063	1.568	1.812	1.701	1.351	0.975	1.506
555	0.783	1.217	1.677	1.850	1.668	1.195	1.488
556	1.151	1.693	1.937	1.852	1.434	1.009	1.605
557	1.318	1.941	2.203	2.168	1.681	1.185	1.847
558	1.105	1.559	1.999	2.078	1.870	1.289	1.745
559	1.091	1.453	1.606	1.404	1.008	0.619	1.274
560	1.513	1.974	2.066	1.885	1.388	0.873	1.697
561	1.963	2.027	1.828	1.331	0.839	0.446	1.460
562	1.143	1.614	1.789	1.576	1.128	0.712	1.419
563	1.179	1.670	2.149	2.199	1.966	1.344	1.849
564	1.289	1.711	1.836	1.614	1.162	0.714	1.470
565	1.853	2.178	2.078	1.618	1.157	0.689	1.719
566	2.780	2.568	2.329	1.671	1.038	0.475	1.748
567	1.207	1.554	1.385	0.993	0.628	0.322	1.088
568	2.276	2.151	1.661	1.177	0.734	0.351	1.445
569	1.289	1.626	1.703	1.434	0.960	0.518	1.285
570	1.475	2.191	2.907	2.974	3.157	2.608	2.645
571	1.920	2.086	1.864	1.301	0.760	0.340	1.391
572	1.784	1.932	1.737	1.252	0.780	0.407	1.371
573	1.426	1.776	1.862	1.636	1.122	0.646	1.462


District Code
Year
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AAGR
574 2.128 1.953 1.529 1.062 0.622 0.290 1.277
575 1.342 1.853 2.011 1.843 1.349 0.874 1.638
576 1.166 1.520 1.646 1.371 0.912 0.472 1.223
577 0.939 1.406 1.833 1.957 1.708 1.179 1.602
578 0.695 1.223 1.753 1.959 1.828 1.417 1.541
579 0.932 1.348 1.600 1.490 1.149 0.776 1.298
580 1.273 1.634 1.769 1.563 1.137 0.679 1.410
581 0.893 1.281 1.670 1.794 1.562 1.053 1.468
582 1.055 1.389 1.527 1.246 0.817 0.414 1.118
583 1.250 1.678 1.806 1.566 1.114 0.645 1.408
584 1.834 2.103 2.039 1.593 1.107 0.660 1.647
585 1.305 1.922 2.200 1.885 1.256 0.695 1.665
586 2.042 2.188 2.039 1.565 1.084 0.642 1.697
587 2.267 2.263 1.961 1.359 0.822 0.390 1.512
588 3.193 3.140 2.484 1.813 1.144 0.571 2.154
589 1.940 2.011 1.817 1.324 0.874 0.492 1.482
590 1.656 2.151 2.216 2.048 1.513 0.952 1.837
591 1.229 1.551 1.662 1.418 0.951 0.534 1.276
592 1.607 1.710 1.527 1.108 0.702 0.362 1.197
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594 4.327 3.572 2.692 1.709 0.880 0.286 1.811
595 1.306 1.326 1.112 0.787 0.487 0.227 0.860
596 1.564 1.401 1.044 0.712 0.430 0.189 0.917
597 1.857 1.525 1.085 0.677 0.341 0.113 0.828
598 2.111 1.962 1.505 1.017 0.602 0.283 1.285
599 1.997 1.896 1.463 1.037 0.676 0.354 1.334
600 1.089 1.661 2.230 2.354 2.387 1.997 2.010
601 2.615 2.438 2.261 1.704 1.133 0.602 1.768
602 0.891 1.325 1.778 2.217 2.204 2.031 1.852
603 0.979 1.358 1.562 1.440 1.112 0.801 1.296
604 0.759 1.092 1.293 1.163 0.907 0.623 1.042
605 0.710 0.983 1.252 1.353 1.170 0.823 1.116
606 0.966 1.376 1.567 1.467 1.154 0.830 1.303
607 0.672 0.942 1.233 1.387 1.200 0.851 1.132
608 1.015 1.340 1.492 1.353 1.021 0.672 1.212
609 2.177 2.210 1.856 1.257 0.685 0.261 1.346
610 0.818 1.109 1.264 1.128 0.869 0.607 1.032
611 0.474 0.708 0.955 1.093 0.936 0.694 0.873
612 1.100 1.429 1.556 1.395 1.003 0.625 1.244
613 0.810 1.150 1.352 1.266 1.028 0.769 1.130
614 0.882 1.113 1.225 1.035 0.746 0.479 0.973
615 1.033 1.342 1.478 1.317 0.977 0.630 1.195
616 0.873 1.127 1.228 1.035 0.743 0.476 0.968
617 1.002 1.224 1.102 0.852 0.612 0.399 0.952
618 1.046 1.283 1.345 1.138 0.800 0.485 1.053
619 1.166 1.476 1.597 1.379 0.986 0.623 1.280
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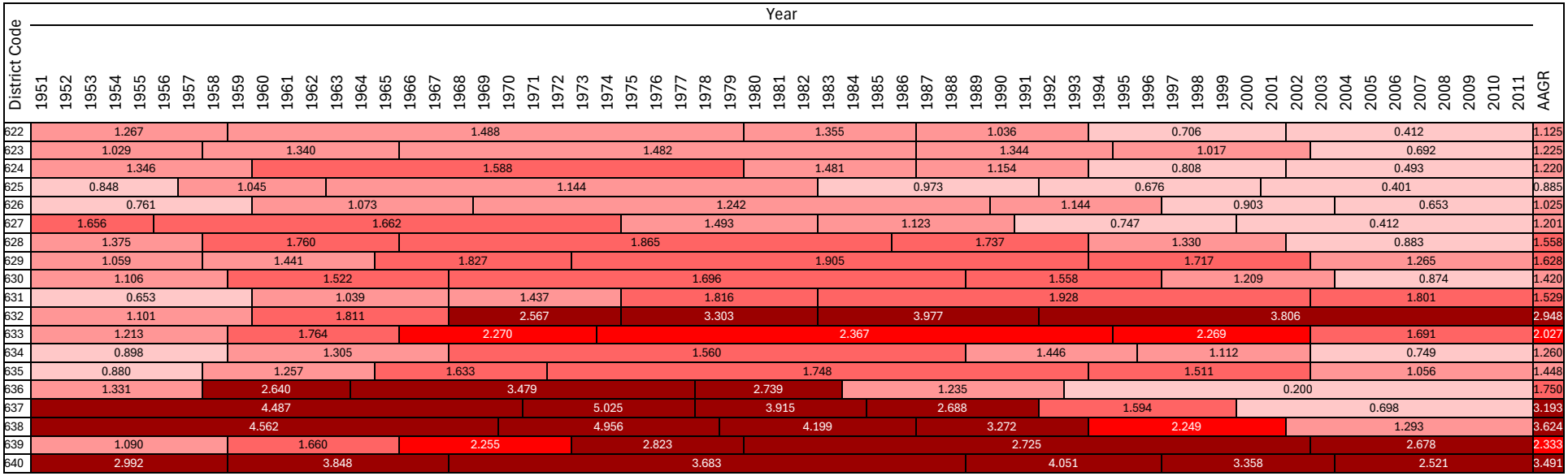

Source: Author

Discussions and Conclusions

The present paper analyses, for the first time, population growth across the 640 districts of India as they existed at the time of the 2011 population census, during the post-independence period (1951-2011). The analysis could be possible because the Registrar General and Census Commissioner of India has made available the population enumerated at different population censuses beginning 1901 through 2011 in the 640 districts of the country. The analysis has followed the modelling approach as the enumerated population of the districts is available at an interval of 10 years only. We found that population growth during 1951-2011 in all, but a few districts can be modelled through the simple logistic growth model which means that population growth in districts of India has followed an S-shaped population growth trajectory during the post-independence period. This observation implies that the assumption that population between two successive population censuses is linear or the population changes at a constant rate between two successive population censuses is not the right approach to analyse the trend in population growth and for interpolating the population of districts for years between successive population censuses. We have used the annual estimates of population of districts derived by fitting the simple logistic growth model for analysing population growth trend in each district.

The present analysis reveals that population growth trend in the 640 districts of the country during the post-independence period has varied widely. This is expected as population transition and social and economic development has varied widely across the districts of the country. The diversity in population growth trend across the districts may be judged from the observation that the time taken by the population of a district to increase from 10 per cent to 90 per cent of the upper limit of the population of the district varies from just around 10 years to more than 100 years, and the shorter this time the rapid the population growth. The analysis also reveals that in all but a few districts of the country, population growth rate trajectory has crossed the inflexion point which implies that population growth rate is now slowing down in all, but a few districts of the country and population growth is flattening. This suggests that projecting or forecasting district population beyond 2011, the year when the last population census was conducted in India, should not be based on the constant rate of growth estimated as the annual population growth rate between 2001 and 2011 population censuses but should be based on the simple logistic growth model derived from population growth during the period 1951-2011. The simple logistic growth model may also serve as the basis for forecasting population of districts beyond 2011 and the forecasted district population may be added to obtain population forecast for the country to constitute the bottom-up approach of population forecasting.

The balancing equation of population growth (Preston et al, 2001) informs us that the change in population in a time interval is the result of the four and only four factors – number of births during the time interval which is determined by the level of fertility in the population; number of deaths during the time interval which is determined by the level of mortality in the population; the number of in-migrants during the time interval; and the number of out-migrants during the time interval. Estimates of fertility and mortality, and information about the number of in-migrants and the number of out-migrants is not available at the district level in India. It is, therefore, not possible to analyse the contribution of the change in fertility and mortality, and net migration to the population growth in the districts of the country. At the national and state/Union Territory levels, population growth is primarily be attributed to the change in the difference between the birth rate and the death rate or to the change in the natural population growth. Net migration constitutes a small proportion of population growth at country and state/Union Territory levels. However, at the district level, migration, in and out of the district may often be the dominant factor in deciding population growth in the district.

The decadal annual population growth rate estimated from the population enumerated at different population censuses depicts a discontinuous trajectory of population growth at either the district or the country and state/Union Territory levels. The decadal annual growth rate means that the population increases linearly or at a constant rate of growth throughout the 10 years interval between

two successive population censuses and this constant rate of increase is different for different ten years intervals. The decadal annual population growth rate based on successive population censuses ten years apart masks the variation in the growth of population within the ten years interval. This paper follows the modelling approach to address the issue of discontinuity in the population growth trajectory based on the data 10 years apart available from decennial population census. Using the annual estimates of the population of the district derived from the population growth model, it is straightforward to obtain annual estimates of the population of the country and the states/Union Territories of the country. An advantage of the modelling approach adopted in this paper is that the district population growth model may be used to forecast district population at least in the near future and district population forecast may be used to forecast population of the country. This is important as the 2021 population census in India has been deferred and projecting district population using the conventional cohort-component projection method is not possible because of the non-availability of the data necessary for the application of the cohort-component method of population projection at the district level. Modelling district population growth also leads to the bottom-up approach of forecasting the population of the country.

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Appendix Table 1: Parameters of the simple logistic model of population growth in districts of India.

District code	State/Union Territory/District	Results of fitting of logistic model				
		MAPE	R^2	Δt	r	t_m
Jammu and Kashmir						
001	Kupwara	0.011	0.999	57.9	0.076	2005
002	Badgam	0.016	0.999	59.6	0.074	1997
003	Leh (Ladakh)	0.007	1.000	47.2	0.093	1992
004	Kargil	0.009	0.999	50.9	0.086	1996
005	Punch	0.018	0.993	57.8	0.076	2002
006	Rajouri	0.042	0.959	58.6	0.075	2002
007	Kathua	0.025	0.994	59.5	0.074	1992
008	Baramula	0.015	0.997	58.0	0.076	1996
009	Bandipore	0.020	0.997	55.8	0.079	1998
010	Srinagar	0.019	0.995	58.0	0.076	1996
011	Ganderbal	0.024	0.996	55.9	0.079	2002
012	Pulwama	0.027	0.993	59.5	0.074	1998
013	Shupiyan	0.020	0.996	58.7	0.075	1999
014	Anantnag	0.036	0.966	59.2	0.074	2007
015	Kulgam	0.029	0.992	44.6	0.099	1990
016	Doda	0.033	0.979	58.8	0.075	1999
017	Ramban	0.039	0.964	58.5	0.075	2001
018	Kishtwar	0.030	0.981	56.3	0.078	1995
019	Udhampur	0.016	0.997	58.7	0.075	1996
020	Reasi	0.032	0.993	57.3	0.077	1995
021	Jammu	0.023	0.995	56.7	0.078	1991
022	Samba	0.031	0.992	58.5	0.075	1988
Himachal Pradesh						
023	Chamba	0.016	0.991	59.6	0.074	1988
024	Kangra	0.012	0.996	58.8	0.075	1985
025	Lahul & Spiti	0.024	0.816	42.6	0.103	1953
026	Kullu	0.015	0.994	58.2	0.076	1994
027	Mandi	0.016	0.997	58.7	0.075	1982
028	Hamirpur	0.011	0.995	58.6	0.075	1982
029	Una	0.019	0.979	58.1	0.076	1992
030	Bilaspur	0.020	0.994	58.7	0.075	1984
031	Solan	0.016	0.996	57.4	0.077	1994
032	Sirmaur	0.018	0.994	58.4	0.075	1990
033	Shimla	0.019	0.992	57.5	0.076	1987
034	Kinnaur	0.011	0.997	55.5	0.079	1980
Punjab						
035	Gurdaspur	0.016	0.997	58.4	0.075	1985
036	Kapurthala	0.008	0.999	55.7	0.079	1983
037	Jalandhar	0.022	0.984	57.3	0.077	1988
038	Hoshiarpur	0.008	0.999	57.9	0.076	1983
039	Shahid	0.005	0.999	50.8	0.087	1981
040	Fatehgarh Sahib	0.026	0.991	58.5	0.075	1984
041	Ludhiana	0.017	0.996	57.5	0.076	1991
042	Moga	0.013	0.996	58.0	0.076	1985
043	Firozpur	0.026	0.978	59.2	0.074	1990
044	Muktsar	0.047	0.913	59.1	0.074	1988
045	Faridkot	0.031	0.972	56.6	0.078	1987
046	Bathinda	0.040	0.969	57.2	0.077	1987
047	Mansa	0.035	0.980	58.9	0.075	1985
048	Patiala	0.046	0.973	59.7	0.074	1987

District code	State/Union Territory/District	Results of fitting of logistic model				
		MAPE	R^2	Δt	r	t_m
049	Amritsar	0.025	0.965	57.9	0.076	1994
050	Tarn Taran	0.037	0.953	57.2	0.077	1993
051	Rupnagar	0.020	0.983	59.0	0.075	1986
052	Sahibzada Ajit Singh Nagar	0.028	0.960	59.2	0.074	2002
053	Sangrur	0.021	0.991	58.9	0.075	1987
054	Barnala	0.027	0.983	58.9	0.075	1987
Chandigarh						
055	Chandigarh	0.112	0.977	55.8	0.079	1989
Uttarakhand						
056	Uttarkashi	0.006	1.000	59.0	0.075	1990
057	Chamoli	0.012	0.996	52.4	0.084	1983
058	Rudraprayag	0.009	0.998	50.9	0.086	1983
059	Tehri Garhwal	0.014	0.991	47.3	0.093	1982
060	Dehradun	0.041	0.979	58.7	0.075	1999
061	Garhwal	0.008	0.923	41.7	0.105	1971
062	Pithoragarh	0.012	0.995	58.7	0.075	1979
063	Bageshwar	0.005	1.000	57.3	0.077	1977
064	Almora	0.010	0.965	38.5	0.114	1971
065	Champawat	0.029	0.993	59.5	0.074	1984
066	Nainital	0.040	0.929	58.7	0.075	1997
067	Udham Singh Nagar	0.101	0.873	59.1	0.074	1995
068	Hardwar	0.045	0.959	58.0	0.076	1999
Haryana						
069	Panchkula	0.039	0.966	45.4	0.097	1995
070	Ambala	0.026	0.976	58.4	0.075	1990
071	Yamunanagar	0.037	0.978	59.6	0.074	1991
072	Kurukshetra	0.068	0.927	59.5	0.074	1986
073	Kaithal	0.033	0.993	58.7	0.075	1983
074	Karnal	0.033	0.986	59.1	0.074	1989
075	Panipat	0.019	0.991	59.6	0.074	1999
076	Sonipat	0.023	0.988	59.4	0.074	1989
077	Jind	0.029	0.991	58.1	0.076	1985
078	Fatehabad	0.062	0.978	59.1	0.074	1985
079	Sirsa	0.051	0.984	59.4	0.074	1985
080	Hisar	0.036	0.983	58.7	0.075	1987
081	Bhiwani	0.026	0.993	59.2	0.074	1987
082	Rohtak	0.034	0.977	57.2	0.077	1986
083	Jhajjar	0.026	0.991	57.8	0.076	1985
084	Mahendragarh	0.014	0.997	59.3	0.074	1988
085	Rewari	0.023	0.983	59.1	0.074	1993
086	Gurgaon	0.086	0.988	59.2	0.074	2020
087	Mewat	0.047	0.879	59.1	0.074	2007
088	Faridabad	0.028	0.999	54.9	0.080	2000
089	Palwal	0.040	0.939	58.3	0.075	1998
National Capital Territory of Delhi						
090	Northwest	0.018	1.000	46.1	0.095	1996
091	North	0.016	0.936	48.4	0.091	2007
092	Northeast	0.075	0.998	37.7	0.116	1994
093	East	0.016	1.000	47.0	0.093	1990
094	New Delhi	0.665	NA	NA	NA	NA
095	Central	0.973	NA	NA	NA	NA
096	West	0.065	0.990	49.3	0.089	1992
097	Southwest	0.061	0.972	48.7	0.090	1999

District code	State/Union Territory/District	Results of fitting of logistic model				
		MAPE	R^2	Δt	r	t_m
098	South	0.042	0.996	49.2	0.089	1993
Rajasthan						
099	Ganganagar	0.045	0.986	58.7	0.075	1986
100	Hanumangarh	0.046	0.991	56.7	0.078	1985
101	Bikaner	0.012	0.998	59.2	0.074	1997
102	Churu	0.021	0.995	58.7	0.075	1991
103	Jhunjhunun	0.006	1.000	59.1	0.074	1987
104	Alwar	0.031	0.957	58.6	0.075	1996
105	Bharatpur	0.039	0.948	58.3	0.075	1993
106	Dhaulpur	0.025	0.976	59.1	0.074	1997
107	Karauli	0.022	0.989	57.3	0.077	1995
108	Sawai Madhopur	0.032	0.978	59.0	0.074	1993
109	Dausa	0.017	0.995	59.4	0.074	1998
110	Jaipur	0.020	0.994	58.6	0.075	1997
111	Sikar	0.009	0.999	58.0	0.076	1991
112	Nagaur	0.020	0.995	59.5	0.074	1994
113	Jodhpur	0.038	0.977	58.7	0.075	1997
114	Jaisalmer	0.024	0.988	58.1	0.076	2003
115	Barmer	0.049	0.948	58.4	0.075	2001
116	Jalor	0.039	0.940	57.8	0.076	1996
117	Sirohi	0.035	0.942	57.8	0.076	1997
118	Pali	0.022	0.992	57.6	0.076	1987
119	Ajmer	0.027	0.952	57.7	0.076	1995
120	Tonk	0.025	0.987	59.0	0.075	1992
121	Bundi	0.019	0.997	59.1	0.074	1990
122	Bhilwara	0.026	0.960	59.1	0.074	1995
123	Rajsamand	0.028	0.974	58.3	0.075	1992
124	Dungarpur	0.050	0.911	55.2	0.080	1994
125	Banswara	0.042	0.970	58.6	0.075	1995
126	Chittaurgarh	0.025	0.991	58.3	0.075	1989
127	Kota	0.027	0.996	57.7	0.076	1993
128	Baran	0.025	0.983	57.9	0.076	1994
129	Jhalawar	0.031	0.975	59.1	0.074	1993
130	Udaipur	0.036	0.977	58.5	0.075	1994
131	Pratapgarh	0.038	0.979	57.3	0.077	1993
Uttar Pradesh						
132	Saharanpur	0.020	0.991	59.8	0.074	1994
133	Muzaffarnagar	0.016	0.995	58.6	0.075	1992
134	Bijnor	0.018	0.994	58.8	0.075	1993
135	Moradabad	0.023	0.973	56.8	0.077	1997
136	Rampur	0.030	0.981	58.4	0.075	1994
137	Jyotiba Phule Nagar	0.020	0.988	59.5	0.074	1997
138	Meerut	0.014	0.995	59.4	0.074	1992
139	Baghpat	0.011	0.996	59.2	0.074	1986
140	Ghaziabad	0.025	0.981	58.1	0.076	2007
141	Gautam Buddha Nagar	0.021	0.999	58.8	0.075	2013
142	Bulandshahr	0.018	0.992	57.2	0.077	1990
143	Aligarh	0.016	0.991	59.1	0.074	1996
144	Mahamaya Nagar	0.017	0.990	58.5	0.075	1992
145	Mathura	0.027	0.960	59.2	0.074	1997
146	Agra	0.038	0.924	57.9	0.076	1997
147	Firozabad	0.036	0.933	58.8	0.075	1997
148	Mainpuri	0.023	0.978	59.0	0.075	1993

District code	State/Union Territory/District	Results of fitting of logistic model				
		MAPE	R^2	Δt	r	t_m
149	Budaun	0.014	0.984	59.5	0.074	1998
150	Bareilly	0.022	0.983	59.0	0.075	1997
151	Pilibhit	0.016	0.994	58.9	0.075	1993
152	Shahjahanpur	0.019	0.993	57.2	0.077	1998
153	Kheri	0.026	0.962	58.6	0.075	2000
154	Sitapur	0.029	0.982	56.9	0.077	1997
155	Hardoi	0.028	0.960	55.3	0.080	1995
156	Unnao	0.018	0.988	58.1	0.076	1992
157	Lucknow	0.019	0.991	57.7	0.076	1999
158	Rae Bareli	0.014	0.989	57.9	0.076	1996
159	Farrukhabad	0.021	0.977	59.6	0.074	1995
160	Kannauj	0.019	0.992	59.6	0.074	1992
161	Etawah	0.031	0.965	58.6	0.075	1991
162	Auraiya	0.028	0.976	58.6	0.075	1989
163	Kanpur Dehat	0.028	0.973	55.5	0.079	1989
164	Kanpur Nagar	0.026	0.991	57.7	0.076	1989
165	Jalaun	0.024	0.981	56.9	0.077	1990
166	Jhansi	0.018	0.994	59.4	0.074	1989
167	Lalitpur	0.018	0.983	57.5	0.076	1999
168	Hamirpur	0.019	0.992	57.7	0.076	1986
169	Mahoba	0.020	0.992	59.4	0.074	1991
170	Banda	0.029	0.987	59.6	0.074	1991
171	Chitrakoot	0.028	0.976	59.3	0.074	1997
172	Fatehpur	0.020	0.989	57.6	0.076	1990
173	Pratapgarh	0.012	0.996	59.0	0.075	1995
174	Kaushambi	0.021	0.974	58.9	0.075	1999
175	Allahabad	0.015	0.993	59.0	0.075	1995
176	Bara Banki	0.019	0.962	57.2	0.077	1999
177	Faizabad	0.008	0.997	57.9	0.076	1997
178	Ambedkar Nagar	0.011	0.997	58.6	0.075	1996
179	Sultanpur	0.006	0.999	57.8	0.076	1996
180	Bahraich	0.020	0.981	59.0	0.075	2003
181	Shrawasti	0.014	0.960	58.4	0.075	2006
182	Balrampur	0.018	0.984	58.4	0.075	2001
183	Gonda	0.011	0.997	59.1	0.074	2002
184	Siddharthnagar	0.011	0.995	58.8	0.075	2005
185	Basti	0.022	0.967	59.5	0.074	1996
186	Sant Kabir Nagar	0.009	0.995	59.0	0.075	1999
187	Mahrajganj	0.021	0.982	59.2	0.074	1999
188	Gorakhpur	0.012	0.994	58.4	0.075	1994
189	Kushinagar	0.013	0.994	58.3	0.075	1999
190	Deoria	0.007	0.999	58.6	0.075	1993
191	Azamgarh	0.010	0.996	57.4	0.077	1995
192	Mau	0.016	0.985	59.2	0.074	1997
193	Ballia	0.014	0.995	57.9	0.076	1994
194	Jaunpur	0.006	0.999	58.2	0.076	1992
195	Ghazipur	0.016	0.992	58.8	0.075	1996
196	Chandauli	0.020	0.982	57.8	0.076	1995
197	Varanasi	0.011	0.995	58.5	0.075	1993
198	Sant Ravidas Nagar (Bhadohi)	0.012	0.998	51.3	0.086	1991
199	Mirzapur	0.013	0.993	57.7	0.076	1996
200	Sonbhadra	0.024	0.988	59.2	0.074	1997
201	Etah	0.021	0.979	58.7	0.075	1994

District code	State/Union Territory/District	Results of fitting of logistic model				
		MAPE	R^2	Δt	r	t_m
202	Kanshiram Nagar	0.025	0.945	58.8	0.075	1995
Bihar						
203	Pashchim Champaran	0.052	0.930	59.3	0.074	2000
204	Purba Champaran	0.026	0.956	59.3	0.074	2003
205	Sheohar	0.023	0.970	56.6	0.078	2004
206	Sitamarhi	0.025	0.965	59.0	0.075	2003
207	Madhubani	0.032	0.917	58.3	0.075	1999
208	Supaul	0.082	0.872	59.1	0.074	1994
209	Araria	0.070	0.928	59.6	0.074	1998
210	Kishanganj	0.069	0.951	58.6	0.075	1996
211	Purnia	0.062	0.896	59.3	0.074	1999
212	Katihar	0.049	0.917	59.1	0.074	1999
213	Madhepura	0.043	0.902	59.6	0.074	2002
214	Saharsa	0.030	0.931	59.0	0.075	2000
215	Darbhanga	0.020	0.980	57.9	0.076	1997
216	Muzaffarpur	0.027	0.926	58.2	0.076	2001
217	Gopalganj	0.013	0.995	58.9	0.075	1996
218	Siwan	0.025	0.970	59.3	0.074	1998
219	Saran	0.023	0.974	57.8	0.076	1997
220	Vaishali	0.029	0.893	58.8	0.075	2001
221	Samastipur	0.022	0.958	58.5	0.075	1999
222	Begusarai	0.033	0.939	57.2	0.077	1998
223	Khagaria	0.036	0.888	58.3	0.075	2002
224	Bhagalpur	0.041	0.922	57.7	0.076	1997
225	Banka	0.032	0.891	57.4	0.077	1998
226	Munger	0.034	0.944	58.0	0.076	1994
227	Lakhisarai	0.034	0.970	58.3	0.075	1997
228	Sheikhpura	0.032	0.957	58.5	0.075	1997
229	Nalanda	0.026	0.980	58.8	0.075	1993
230	Patna	0.029	0.973	58.7	0.075	1998
231	Bhojpur	0.029	0.923	58.7	0.075	1997
232	Buxar	0.036	0.956	59.5	0.074	1998
233	Kaimur (Bhabua)	0.041	0.923	59.5	0.074	2001
234	Rohtas	0.036	0.963	59.4	0.074	1995
235	Aurangabad	0.034	0.940	58.4	0.075	1999
236	Gaya	0.032	0.936	59.5	0.074	2000
237	Nawada	0.031	0.924	58.7	0.075	1999
238	Jamui	0.046	0.965	56.5	0.078	1998
239	Jehanabad	0.032	0.867	58.4	0.075	1999
240	Arwal	0.029	0.957	59.2	0.074	1996
Sikkim						
241	North District	0.057	0.970	38.6	0.114	1981
242	West District	0.009	0.999	37.2	0.118	1990
243	South District	0.026	0.994	37.8	0.116	1991
244	East District	0.043	0.986	39.4	0.111	1991
Arunachal Pradesh						
245	Tawang	0.029	0.932	47.9	0.092	2001
246	West Kameng	0.011	0.998	41.5	0.106	1992
247	East Kameng	0.061	0.947	48.3	0.091	1996
248	Papum Pare	0.043	0.995	49.1	0.090	2002
249	Upper Subansiri	0.093	0.870	47.3	0.093	2001
250	West Siang	0.011	0.999	45.4	0.097	1984
251	East Siang	0.046	0.974	42.9	0.102	1988

District code	State/Union Territory/District	Results of fitting of logistic model				
		MAPE	R^2	Δt	*r*	t_m
252	Upper Siang	0.102	0.952	49.1	0.090	1978
253	Changlang	0.056	0.990	48.8	0.090	1988
254	Tirap	0.027	0.984	46.9	0.094	1987
255	Lower Subansiri	0.064	0.841	48.6	0.090	2008
256	Kurung Kumey	0.097	1.000	47.0	0.093	2047
257	Dibang Valley	0.007	0.995	31.7	0.139	1968
258	Lower Dibang Valley	0.065	0.991	38.1	0.115	1987
259	Lohit	0.037	0.998	49.1	0.090	1989
260	Anjaw	0.035	0.930	48.5	0.091	1988
Nagaland						
261	Mon	0.112	0.831	22.6	0.194	1991
262	Mokokchung	0.087	0.892	26.8	0.164	1986
263	Zunheboto	0.077	0.984	30.6	0.144	1989
264	Wokha	0.123	0.955	26.8	0.164	1993
265	Dimapur	0.080	0.995	45.9	0.096	1995
266	Phek	0.025	0.996	39.0	0.113	1990
267	Tuensang	0.062	0.949	33.6	0.131	1992
268	Longleng	0.059	1.000	13.7	0.320	1986
269	Kiphire	0.331	1.000	10.1	0.437	1991
270	Kohima	0.017	0.997	46.6	0.094	1994
271	Peren	0.046	0.990	29.0	0.152	1990
Manipur						
272	Senapati	0.113	0.909	59.0	0.075	2011
273	Tamenglong	0.010	1.000	58.9	0.075	1999
274	Churachandpur	0.048	0.981	58.2	0.076	1990
275	Bishnupur	0.023	0.995	58.2	0.076	1983
276	Thoubal	0.037	0.978	57.5	0.077	1988
277	Imphal West	0.024	0.993	59.4	0.074	1986
278	Imphal East	0.034	0.991	58.1	0.076	1985
279	Ukhrul	0.030	0.983	58.3	0.075	1999
280	Chandel	0.049	0.993	54.2	0.081	2000
Mizoram						
281	Mamit	0.080	0.804	36.6	0.120	1981
282	Kolasib	0.041	0.949	39.0	0.113	1998
283	Aizawl	0.027	0.996	38.1	0.115	1992
284	Champhai	0.015	0.996	38.4	0.115	1993
285	Serchhip	0.013	0.996	38.7	0.113	1998
286	Lunglei	0.035	0.979	36.8	0.119	1990
287	Lawngtlai	0.050	0.976	39.8	0.111	1998
288	Saiha	0.020	0.998	39.1	0.112	1991
Tripura						
289	West Tripura	0.054	0.980	58.1	0.076	1983
290	South Tripura	0.049	0.988	56.5	0.078	1979
291	Dhalai	0.054	0.984	54.9	0.080	1982
292	North Tripura	0.100	0.799	58.3	0.075	1988
Meghalaya						
293	West Garo Hills	0.045	0.927	59.3	0.074	1998
294	East Garo Hills	0.023	0.984	59.0	0.074	1998
295	South Garo Hills	0.049	0.891	58.3	0.075	1998
296	West Khasi Hills	0.024	0.992	59.3	0.074	1999
297	Ribhoi	0.053	0.995	59.7	0.074	2001
298	East Khasi Hills	0.042	0.925	54.3	0.081	1993
299	Jaintia Hills	0.032	0.983	58.8	0.075	2000

District code	State/Union Territory/District	Results of fitting of logistic model				
		MAPE	R^2	Δt	r	t_m
Assam						
300	Kokrajhar	0.007	0.999	50.6	0.087	1977
301	Dhubri	0.053	0.964	59.3	0.074	1992
302	Goalpara	0.056	0.969	59.6	0.074	1989
303	Barpeta	0.055	0.944	58.6	0.075	1988
304	Morigaon	0.060	0.961	57.5	0.076	1988
305	Nagaon	0.054	0.958	58.9	0.075	1989
306	Sonitpur	0.033	0.986	59.4	0.074	1986
307	Lakhimpur	0.048	0.980	58.4	0.075	1983
308	Dhemaji	0.043	0.994	59.1	0.074	1984
309	Tinsukia	0.044	0.973	57.1	0.077	1985
310	Dibrugarh	0.033	0.976	58.0	0.076	1981
311	Sivasagar	0.022	0.987	59.0	0.075	1984
312	Jorhat	0.029	0.968	54.6	0.081	1982
313	Golaghat	0.018	0.994	55.7	0.079	1983
314	Karbi Anglong	0.055	0.987	57.2	0.077	1983
315	Dima Hasao	0.011	1.000	56.8	0.077	1987
316	Cachar	0.042	0.972	53.0	0.083	1988
317	Karimganj	0.045	0.901	58.9	0.075	1993
318	Hailakandi	0.047	0.953	58.1	0.076	1991
319	Bongaigaon	0.058	0.962	59.6	0.074	1988
320	Chirang	0.032	0.960	50.4	0.087	1972
321	Kamrup	0.041	0.978	58.7	0.075	1986
322	Kamrup Metropolitan	0.059	0.990	58.3	0.075	1991
323	Nalbari	0.040	0.970	58.2	0.076	1978
324	Baksa	0.018	0.991	57.8	0.076	1975
325	Darrang	0.046	0.979	59.1	0.074	1988
326	Udalguri	0.021	0.992	59.0	0.075	1973
West Bengal						
327	Darjiling	0.030	0.982	57.6	0.076	1988
328	Jalpaiguri	0.043	0.975	58.5	0.075	1986
329	Koch Bihar	0.040	0.983	58.9	0.075	1979
330	Uttar Dinajpur	0.048	0.957	57.9	0.076	1993
331	Dakshin Dinajpur	0.016	0.998	59.0	0.075	1985
332	Maldah	0.034	0.976	59.8	0.074	1993
333	Murshidabad	0.040	0.952	58.7	0.075	1992
334	Birbhum	0.044	0.940	59.2	0.074	1987
335	Barddhaman	0.032	0.988	59.5	0.074	1982
336	Nadia	0.030	0.992	58.5	0.075	1984
337	North Twenty	0.031	0.992	59.2	0.074	1986
338	Hugli	0.028	0.992	58.5	0.075	1981
339	Bankura	0.032	0.975	57.0	0.077	1983
340	Puruliya	0.025	0.967	55.5	0.079	1989
341	Haora	0.023	0.989	59.5	0.074	1987
342	Kolkata	0.009	0.905	49.2	0.089	1968
343	South Twenty-Four Parganas	0.036	0.975	58.7	0.075	1990
344	Paschim Medinipur	0.031	0.985	57.7	0.076	1984
345	Purba Medinipur	0.025	0.989	59.5	0.074	1986
Jharkhand						
346	Garhwa	0.030	0.973	58.1	0.076	1998
347	Chatra	0.034	0.955	57.5	0.076	1999
348	Kodarma	0.034	0.914	58.8	0.075	2002
349	Giridih	0.038	0.946	55.8	0.079	1997

District code	State/Union Territory/District	Results of fitting of logistic model				
		MAPE	R^2	Δt	r	t_m
350	Deoghar	0.028	0.967	56.1	0.078	2000
351	Godda	0.028	0.986	57.9	0.076	1997
352	Sahibganj	0.038	0.920	59.6	0.074	1998
353	Pakur	0.054	0.896	58.5	0.075	2000
354	Dhanbad	0.026	0.993	58.2	0.076	1987
355	Bokaro	0.011	0.999	58.0	0.076	1988
356	Lohardaga	0.025	0.927	59.2	0.074	2002
357	Purbi Singhbhum	0.037	0.976	57.7	0.076	1988
358	Palamu	0.032	0.955	59.4	0.074	1999
359	Latehar	0.038	0.933	58.2	0.076	1998
360	Hazaribagh	0.032	0.982	59.6	0.074	1995
361	Ramgarh	0.012	0.999	56.2	0.078	1985
362	Dumka	0.027	0.961	57.8	0.076	1995
363	Jamtara	0.018	0.981	58.5	0.075	1997
364	Ranchi	0.040	0.960	58.6	0.075	1996
365	Khunti	0.031	0.841	59.1	0.074	1998
366	Gumla	0.042	0.932	56.0	0.079	1995
367	Simdega	0.038	0.937	58.0	0.076	1990
368	Pashchimi Singhbhum	0.040	0.883	56.7	0.078	1995
369	Saraikela-Kharsawan	0.031	0.940	58.4	0.075	1998
Odisha						
370	Bargarh	0.010	0.996	56.3	0.078	1982
371	Jharsuguda	0.013	0.996	53.2	0.083	1988
372	Sambalpur	0.021	0.993	59.5	0.074	1983
373	Debagarh	0.029	0.988	58.5	0.075	1984
374	Sundargarh	0.032	0.986	59.4	0.074	1981
375	Kendujhar	0.036	0.973	58.8	0.075	1986
376	Mayurbhanj	0.030	0.974	57.4	0.077	1989
377	Baleshwar	0.027	0.988	57.1	0.077	1987
378	Bhadrak	0.030	0.981	57.6	0.076	1987
379	Kendrapara	0.022	0.990	58.3	0.075	1981
380	Jagatsinghapur	0.006	0.999	57.7	0.076	1981
381	Cuttack	0.017	0.994	59.6	0.074	1983
382	Jajapur	0.022	0.989	58.2	0.076	1986
383	Dhenkanal	0.024	0.985	54.7	0.080	1982
384	Anugul	0.018	0.994	57.3	0.077	1986
385	Nayagarh	0.020	0.978	58.1	0.076	1979
386	Khordha	0.014	0.998	59.0	0.075	1993
387	Puri	0.020	0.992	57.3	0.077	1985
388	Ganjam	0.018	0.992	59.5	0.074	1987
389	Gajapati	0.023	0.990	55.8	0.079	1985
390	Kandhamal	0.017	0.983	56.5	0.078	1991
391	Baudh	0.027	0.972	56.4	0.078	1992
392	Subarnapur	0.009	0.998	58.7	0.075	1987
393	Balangir	0.042	0.938	59.0	0.075	1990
394	Nuapada	0.029	0.982	58.8	0.075	1984
395	Kalahandi	0.029	0.943	57.8	0.076	1992
396	Rayagada	0.033	0.977	56.8	0.077	1987
397	Nabarangapur	0.035	0.976	59.1	0.074	1990
398	Koraput	0.018	0.995	58.6	0.075	1991
399	Malkangiri	0.067	0.978	58.8	0.075	1984
Chhattisgarh						
400	Koriya	0.020	0.996	58.9	0.075	1985

District code	State/Union Territory/District	Results of fitting of logistic model				
		MAPE	R^2	Δt	r	t_m
401	Surguja	0.033	0.956	56.0	0.078	1992
402	Jashpur	0.037	0.970	59.2	0.074	1984
403	Raigarh	0.033	0.890	59.6	0.074	1993
404	Korba	0.012	0.999	58.7	0.075	1991
405	Janjgir-Champa	0.018	0.987	57.1	0.077	2002
406	Bilaspur	0.051	0.945	58.2	0.076	1997
407	Kabeerdham	0.055	0.973	59.3	0.074	1997
408	Rajnandgaon	0.033	0.952	58.1	0.076	1991
409	Durg	0.034	0.986	58.7	0.075	1987
410	Raipur	0.057	0.904	57.4	0.077	1997
411	Mahasamund	0.029	0.975	59.2	0.074	1986
412	Dhamtari	0.024	0.983	58.4	0.075	1989
413	Uttar Bastar Kanker	0.039	0.983	56.5	0.078	1984
414	Bastar	0.031	0.978	57.0	0.077	1989
415	Narayanpur	0.025	0.988	59.1	0.074	1992
416	Dakshin Bastar Dantewada	0.039	0.975	58.7	0.075	1980
417	Bijapur	0.018	0.996	55.3	0.080	1985
Madhya Pradesh						
418	Sheopur	0.025	0.985	59.1	0.074	1996
419	Morena	0.023	0.989	59.0	0.075	1995
420	Bhind	0.026	0.982	59.0	0.074	1991
421	Gwalior	0.032	0.980	59.1	0.074	1995
422	Datia	0.028	0.975	57.6	0.076	1992
423	Shivpuri	0.015	0.993	59.2	0.074	1997
424	Tikamgarh	0.025	0.983	59.4	0.074	1994
425	Chhatarpur	0.023	0.969	56.0	0.078	1994
426	Panna	0.036	0.947	54.8	0.080	1991
427	Sagar	0.031	0.983	58.4	0.075	1990
428	Damoh	0.023	0.992	59.3	0.074	1989
429	Satna	0.032	0.975	57.5	0.077	1993
430	Rewa	0.025	0.976	58.6	0.075	1994
431	Umaria	0.036	0.963	59.8	0.074	1995
432	Neemuch	0.016	0.998	59.1	0.074	1987
433	Mandsaur	0.019	0.995	58.9	0.075	1988
434	Ratlam	0.036	0.966	58.7	0.075	1992
435	Ujjain	0.022	0.995	59.1	0.074	1990
436	Shajapur	0.028	0.980	59.0	0.075	1992
437	Dewas	0.027	0.990	58.7	0.075	1992
438	Dhar	0.040	0.937	58.6	0.075	1996
439	Indore	0.047	0.950	58.4	0.075	2000
440	Khargone (West Nimar)	0.052	0.923	59.7	0.074	1994
441	Barwani	0.038	0.928	59.6	0.074	1999
442	Rajgarh	0.035	0.956	57.9	0.076	1996
443	Vidisha	0.043	0.919	58.0	0.076	1992
444	Bhopal	0.034	0.993	57.3	0.077	1996
445	Sehore	0.041	0.963	59.6	0.074	1993
446	Raisen	0.037	0.981	59.5	0.074	1991
447	Betul	0.017	0.996	56.9	0.077	1986
448	Harda	0.037	0.952	56.0	0.079	1992
449	Hoshangabad	0.019	0.996	58.3	0.075	1989
450	Katni	0.030	0.977	56.9	0.077	1992
451	Jabalpur	0.028	0.995	59.2	0.074	1986
452	Narsimhapur	0.024	0.991	58.4	0.075	1988

District code	State/Union Territory/District	Results of fitting of logistic model				
		MAPE	R^2	Δt	r	t_m
453	Dindori	0.046	0.963	59.1	0.074	1987
454	Mandla	0.029	0.978	57.7	0.076	1989
455	Chhindwara	0.013	0.997	59.4	0.074	1987
456	Seoni	0.028	0.983	57.7	0.076	1989
457	Balaghat	0.017	0.988	58.8	0.075	1984
458	Guna	0.028	0.987	58.8	0.075	1998
459	Ashoknagar	0.041	0.923	57.0	0.077	1993
460	Shahdol	0.026	0.989	59.4	0.074	1988
461	Anuppur	0.008	0.999	53.8	0.082	1987
462	Sidhi	0.031	0.959	59.3	0.074	1996
463	Singrauli	0.016	0.997	58.7	0.075	1999
464	Jhabua	0.057	0.923	59.2	0.074	1997
465	Alirajpur	0.037	0.969	58.2	0.076	1993
466	Khandwa (East Nimar)	0.041	0.961	57.4	0.077	1991
467	Burhanpur	0.032	0.989	58.6	0.075	1988
Gujarat						
468	Kachchh	0.053	0.946	59.1	0.074	1999
469	Banas Kantha	0.032	0.977	59.8	0.074	1995
470	Patan	0.031	0.977	59.6	0.074	1981
471	Mahesana	0.016	0.993	57.4	0.077	1980
472	Sabar Kantha	0.042	0.978	58.4	0.075	1984
473	Gandhinagar	0.020	0.997	57.6	0.076	1986
474	Ahmadabad	0.044	0.969	57.8	0.076	1992
475	Surendranagar	0.045	0.939	59.5	0.074	1990
476	Rajkot	0.043	0.971	59.5	0.074	1991
477	Jamnagar	0.044	0.980	58.9	0.075	1982
478	Porbandar	0.024	0.973	57.6	0.076	1976
479	Junagadh	0.025	0.991	57.9	0.076	1981
480	Amreli	0.009	0.987	56.1	0.078	1975
481	Bhavnagar	0.021	0.995	59.5	0.074	1988
482	Anand	0.023	0.985	58.8	0.075	1982
483	Kheda	0.032	0.963	52.1	0.084	1981
484	Panch Mahals	0.036	0.961	58.0	0.076	1990
485	Dohad	0.042	0.929	59.0	0.075	1998
486	Vadodara	0.023	0.994	58.9	0.075	1986
487	Narmada	0.033	0.981	59.1	0.074	1984
488	Bharuch	0.032	0.960	58.0	0.076	1988
489	The Dangs	0.067	0.904	59.6	0.074	1993
490	Navsari	0.004	1.000	58.9	0.075	1981
491	Valsad	0.033	0.961	59.4	0.074	1996
492	Surat	0.032	0.980	58.7	0.075	2008
493	Tapi	0.035	0.980	55.7	0.079	1981
Daman and Diu						
494	Diu	0.093	0.680	58.1	0.076	1988
495	Daman	0.080	0.977	59.2	0.074	2028
Dadra and Nagar Haveli						
496	Dadra & Nagar Haveli	0.070	0.996	59.0	0.074	2015
Maharashtra						
497	Nandurbar	0.043	0.964	57.8	0.076	1995
498	Dhule	0.039	0.961	57.9	0.076	1989
499	Jalgaon	0.020	0.990	58.5	0.075	1988
500	Buldana	0.023	0.979	59.3	0.074	1991
501	Akola	0.024	0.990	58.9	0.075	1986

District code	State/Union Territory/District	Results of fitting of logistic model				
		MAPE	R^2	Δt	r	t_m
502	Washim	0.031	0.984	58.2	0.075	1987
503	Amravati	0.019	0.994	58.4	0.075	1985
504	Wardha	0.013	0.997	57.9	0.076	1981
505	Nagpur	0.013	0.998	58.9	0.075	1989
506	Bhandara	0.012	0.997	54.9	0.080	1980
507	Gondiya	0.025	0.930	54.8	0.080	1977
508	Gadchiroli	0.022	0.995	57.1	0.077	1987
509	Chandrapur	0.009	0.999	54.0	0.081	1983
510	Yavatmal	0.022	0.994	57.3	0.077	1986
511	Nanded	0.017	0.995	59.1	0.074	1991
512	Hingoli	0.026	0.977	59.0	0.075	1992
513	Parbhani	0.020	0.993	58.0	0.076	1992
514	Jalna	0.041	0.904	58.3	0.075	1994
515	Aurangabad	0.033	0.959	59.5	0.074	1998
516	Nashik	0.039	0.969	58.1	0.076	1994
517	Thane	0.015	0.998	57.2	0.077	2004
518	Mumbai Suburban	0.028	0.999	51.0	0.086	1982
519	Mumbai	0.010	0.999	25.8	0.171	1958
520	Raigarh	0.025	0.976	58.7	0.075	1994
521	Pune	0.037	0.950	58.2	0.076	1999
522	Ahmadnagar	0.026	0.988	59.5	0.074	1987
523	Bid	0.031	0.967	58.2	0.076	1992
524	Latur	0.023	0.981	58.8	0.075	1992
525	Osmanabad	0.029	0.984	59.5	0.074	1986
526	Solapur	0.027	0.976	58.7	0.075	1988
527	Satara	0.017	0.995	58.5	0.075	1982
528	Ratnagiri	0.019	0.963	41.5	0.106	1978
529	Sindhudurg	0.012	0.971	55.3	0.080	1971
530	Kolhapur	0.016	0.996	58.1	0.076	1984
531	Sangli	0.020	0.994	58.8	0.075	1983
Andhra Pradesh						
532	Adilabad	0.051	0.885	95.9	0.046	1995
533	Nizamabad	0.020	0.973	75.3	0.058	1983
534	Karimnagar	0.046	0.905	107.0	0.041	1994
535	Medak	0.075	0.890	107.0	0.041	1995
536	Hyderabad	0.061	0.989	68.9	0.064	1984
537	Rangareddy	0.042	0.992	91.9	0.048	2043
538	Mahbubnagar	0.037	0.954	105.0	0.042	2002
539	Nalgonda	0.034	0.906	87.5	0.050	1986
540	Warangal	0.033	0.938	99.9	0.044	1988
541	Khammam	0.030	0.986	85.9	0.051	1985
542	Srikakulam	0.014	0.994	98.9	0.044	1987
543	Vizianagaram	0.019	0.989	94.2	0.047	1980
544	Visakhapatnam	0.024	0.993	79.1	0.056	1990
545	East Godavari	0.027	0.985	91.3	0.048	1980
546	West Godavari	0.030	0.959	87.1	0.051	1977
547	Krishna	0.017	0.990	96.5	0.046	1983
548	Guntur	0.023	0.957	92.5	0.048	1982
549	Prakasam	0.017	0.984	101.0	0.043	1991
550	Sri Potti Sriramulu Nellore	0.011	0.995	82.9	0.053	1987
551	Y. S. R.	0.009	0.992	79.8	0.055	1987
552	Kurnool	0.021	0.979	89.3	0.049	1996
553	Anantapur	0.014	0.989	84.0	0.052	1989

District code	State/Union Territory/District	Results of fitting of logistic model				
		MAPE	R^2	Δt	r	t_m
554	Chittoor	0.009	0.998	94.0	0.047	1991
Karnataka						
555	Belgaum	0.022	0.990	57.7	0.076	1987
556	Bagalkot	0.016	0.996	58.4	0.075	1988
557	Bijapur	0.032	0.957	58.0	0.076	1992
558	Bidar	0.017	0.993	59.5	0.074	1989
559	Raichur	0.008	0.998	59.3	0.074	1991
560	Koppal	0.017	0.997	58.3	0.075	1992
561	Gadag	0.017	0.991	59.0	0.075	1982
562	Dharwad	0.024	0.993	58.4	0.075	1985
563	Uttara Kannada	0.016	0.996	57.3	0.077	1975
564	Haveri	0.018	0.988	56.8	0.077	1984
565	Bellary	0.019	0.995	59.0	0.075	1993
566	Chitradurga	0.020	0.992	58.4	0.075	1983
567	Davanagere	0.004	1.000	57.8	0.076	1981
568	Shimoga	0.027	0.989	59.1	0.074	1973
569	Udupi	0.010	0.972	49.2	0.089	1975
570	Chikmagalur	0.021	0.975	56.3	0.078	1969
571	Tumkur	0.008	0.998	55.6	0.079	1979
572	Bangalore	0.061	0.981	59.0	0.075	2005
573	Mandya	0.005	0.998	52.4	0.084	1972
574	Hassan	0.006	0.998	56.7	0.078	1974
575	Dakshina Kannada	0.019	0.994	57.8	0.076	1982
576	Kodagu	0.027	0.979	57.1	0.077	1967
577	Mysore	0.012	0.998	58.5	0.075	1986
578	Chamarajanagar	0.011	0.998	54.3	0.081	1978
579	Gulbarga	0.027	0.975	59.2	0.074	1993
580	Yadgir	0.021	0.994	59.2	0.074	1997
581	Kolar	0.011	0.998	57.1	0.077	1986
582	Chikkaballapura	0.011	0.998	58.5	0.075	1982
583	Bangalore Rural	0.018	0.994	59.0	0.075	1991
584	Ramanagara	0.009	0.998	53.5	0.082	1977
Goa						
585	North Goa	0.019	0.993	56.0	0.078	1982
586	South Goa	0.027	0.993	56.1	0.078	1981
Lakshadweep						
587	Lakshadweep	0.011	0.999	49.8	0.088	1983
Kerala						
588	Kasaragod	0.007	0.999	57.9	0.076	1980
589	Kannur	0.003	1.000	55.9	0.079	1972
590	Wayanad	0.018	0.998	55.4	0.079	1975
591	Kozhikode	0.009	0.996	56.5	0.078	1976
592	Malappuram	0.011	0.999	57.6	0.076	1986
593	Palakkad	0.006	0.998	55.4	0.079	1980
594	Thrissur	0.013	0.986	55.1	0.080	1973
595	Ernakulam	0.012	0.988	57.5	0.076	1972
596	Idukki	0.019	0.941	52.1	0.084	1963
597	Kottayam	0.009	0.992	54.2	0.081	1969
598	Alappuzha	0.005	0.994	56.5	0.078	1965
599	Pathanamthitta	0.009	0.935	49.5	0.089	1960
600	Kollam	0.005	0.998	57.7	0.076	1967
601	Thiruvananthapuram	0.012	0.996	58.8	0.075	1970

District code	State/Union Territory/District	Results of fitting of logistic model				
		MAPE	R^2	Δt	r	t_m
Tamil Nadu						
602	Thiruvallur	0.046	0.981	58.9	0.075	2001
603	Chennai	0.019	0.997	58.4	0.075	1976
604	Kancheepuram	0.051	0.965	59.6	0.074	2001
605	Vellore	0.022	0.993	58.3	0.075	1988
606	Tiruvannamalai	0.012	0.987	59.1	0.074	1984
607	Viluppuram	0.021	0.986	58.8	0.075	1988
608	Salem	0.035	0.966	58.8	0.075	1990
609	Namakkal	0.019	0.987	57.4	0.077	1993
610	Erode	0.019	0.989	57.8	0.076	1983
611	The Nilgiris	0.023	0.864	42.1	0.104	1972
612	Dindigul	0.021	0.984	58.1	0.076	1985
613	Karur	0.014	0.957	56.2	0.078	1994
614	Tiruchirappalli	0.021	0.983	57.3	0.077	1982
615	Perambalur	0.018	0.990	59.0	0.075	1988
616	Ariyalur	0.016	0.979	56.6	0.078	1980
617	Cuddalore	0.018	0.981	57.6	0.076	1983
618	Nagapattinam	0.012	0.991	57.0	0.077	1982
619	Thiruvarur	0.009	0.988	58.3	0.075	1979
620	Thanjavur	0.016	0.970	53.2	0.083	1979
621	Pudukkottai	0.021	0.986	56.9	0.077	1981
622	Sivaganga	0.027	0.905	57.0	0.077	1981
623	Madurai	0.026	0.974	57.5	0.076	1984
624	Theni	0.022	0.914	57.4	0.077	1978
625	Virudhunagar	0.012	0.994	58.7	0.075	1984
626	Ramanathapuram	0.028	0.916	58.6	0.075	1977
627	Thoothukkudi	0.022	0.913	53.0	0.083	1980
628	Tirunelveli	0.023	0.980	57.9	0.076	1986
629	Kanniyakumari	0.019	0.931	58.5	0.075	1975
630	Dharmapuri	0.033	0.980	59.1	0.074	1986
631	Krishnagiri	0.030	0.966	59.6	0.074	1992
632	Coimbatore	0.043	0.957	59.2	0.074	1989
633	Tiruppur	0.034	0.961	58.9	0.075	2004
Puducherry						
634	Yanam	0.033	0.997	58.7	0.075	2027
635	Puducherry	0.032	0.993	58.7	0.075	1996
636	Mahe	0.015	0.993	58.4	0.075	1986
637	Karaikal	0.026	0.972	58.5	0.075	1991
Andaman and Nicobar Islands						
638	Nicobars	0.036	0.984	27.7	0.159	1976
639	North & Middle Andaman	0.058	0.978	44.2	0.099	1980
640	South Andaman	0.041	0.998	51.9	0.085	1987

Source: Author