Population projection of Mirsharai Upazila

Linear method and Cohort method

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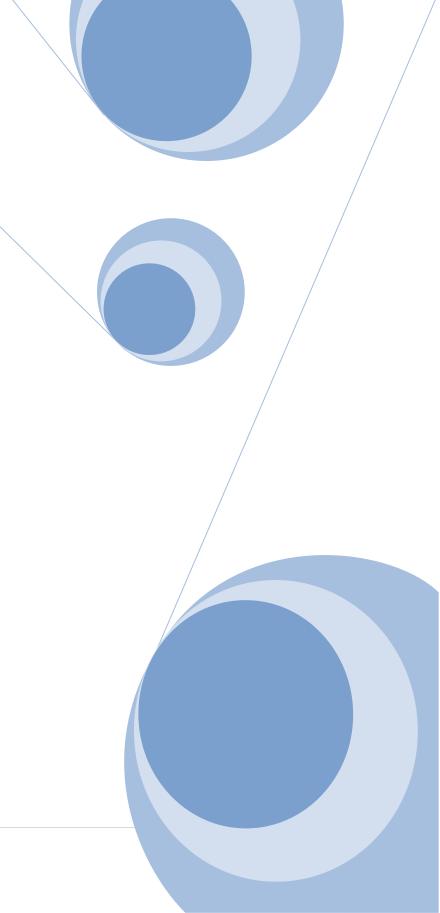Jahangirnagar University, savar, Dhaka.

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1.1.Introduction:

1.1.1. Linear Method:

The linear method assumes that population growth is growing at absolute equal increments per year, decade, or other unit of time. It also assumes that growth will follow a similar pattern in future years.

1.1.2. Cohort Method:

The "cohort component population projection" method follows the process of demographic change and is viewed as a more reliable projection then those that primarily rely on census data or information that reflects population changes. It also provides the type of information that needed to plan for services to meet the future demands of different segments of the population.

1.2. Population Projection of Mirsharai Upazila:

1.2.1. Linear Method formula: [7]

$$P_{t+n} = P_t (1+r)^n$$

Here,

P_{t+n} = Projected population

P_t = Current year population

r = growth rate

n = year interval

The formula of growth rate "r" is

$$r = \sqrt[n]{\frac{P_{t+n}}{P_t}} - 1,$$

Here,

P_{t+n} = Current year population.

P_t = Last year population.

n = Time interval

Growth rate of 2011:

Here,

$P_{1991}=325712$ [1]

$P_{2011}=398716$ [1]

Growth Rate $r = \sqrt[n]{\dfrac{P_{t+n}}{P_t}} - 1$

$= \sqrt[20]{\dfrac{P_{2011}}{P_{1991}}} - 1$

$= \sqrt[20]{\dfrac{398716}{325712}} - 1$

$= 0.01$

1.2.1.1. Population Projection of 2016:

Projected population of 2016 $= P_{t+n}(1+r)^n$

$= 398716(1+0.01)^5$

$= 419054$

1.2.1.2. Population Projection of 2021:

Projected population of 2021 $= P_{t+n}(1+r)^n$

$= 419054(1+0.01)^5$

$= 440429$

1.2.1.3. Population Projection of 2026:

Projected population of 2026 $= P_{t+n}(1+r)^n$

$= 440429(1+0.01)^5$

$= 462895$

1.2.1.4. Population Projection of 2031:

Projected Population 2031 = $P_{t+n}(1+r)^n$

$$= 462895 (1+.01)^5$$

$$= 486507$$

1.2.1.5. Population Projection of 2036:

Projected Population 2036= $P_{t+n}(1+r)^n$

$$= 486507 (1+.01)^5$$

$$= 511323$$

1.2.1.6. Population Projection of 2041:

Projected Population 2041 = $P_{t+n}(1+r)^n$

$$= 511323 (1+.01)^5$$

$$= 537405$$

There is used High Growth Rate for population projection.

1.2.2. Population Projection by different growth rate: (Mirsharai Upazila)

Year	High 1991-2011 Population : (325712-398716) Growth rate: .01	Medium 2001-2011 Population : (368950-398716) Growth rate: .007	Low Assumed growth rate; base year 2011 Growth rate .005
2016	419054	412867	408784
2021	440429	427521	419106
2026	462895	442695	429688
2031	486507	458687	440538
2036	511323	474967	451662
2041	537405	491825	463067

Table 01: Population Projection by different growth rate (High, Medium, and Low).

(Source: Population of 1991, 2001 and 2011 from census)

- In High growth rate 20 years interval is used.
- In Medium growth rate 10 years interval is used.
- In Low growth rate it is assumed from Medium growth rate.

1.2.3. Cohort component method:

Cohort Component Summary Equation:

$$\mathbf{P_{t+n} = \text{Survived population} + \text{Births} + \text{Net migrants}}\ [5]$$

Here,

Survived population = The number of persons alive at the beginning of the age interval.

Birth = Number of births taking place during the projection interval.

Net migrants = Movement of people across political boundaries that are semi-permanent or permanent in nature.

Residual method of migration:

$$\mathbf{\text{Net migrants} = (\text{Population}_{t+n} - \text{Population}_{t}) - (\text{Births} - \text{Deaths})}\ [5]$$

Population $_{t+n}$ = Current population

Population $_{t}$ = Last census

1.2.3.1. Population projection of Mirsharai Upazila:

Age group	L_x (Population Mirsharai upazila,year 2011) [1]	$_n d_x$ (Number of death of Chittagong District, year 2016) [8]	$L_x = l_x - {}_n d_x$ (Existing population) [6]	Survived population $= L_x$ *survival rate [6]
0-4	40391	250	40141	40141
5-9	47617	50	47567	47567
10-14	48789	50	48739	48739
15-19	42898	30	42868	42868
20-24	37402	70	37332	37332
25-29	33436	100	33336	33336
30-34	25549	150	25399	25399
35-39	23471	200	23271	23271
40-44	21223	250	20973	20973
45-49	16806	300	16506	16506
50-54	15575	440	15135	15135
55-59	10335	510	9825	9825
60-64	12470	750	11720	11720
65-69	6606	830	5776	5776
70	7376	900	6476	6476
Total	389944	4900	385064	385064

Table: 02: Abridged Life Table For Both Sexes Combined.

(Source: Census 2011, SVRS 2016)

l_x: The number of persons alive at the beginning of the age interval

L_x: The total number of person-years in the stationary population for each age interval. It can be viewed as the average population size between birthdays, taking into account the distribution of deaths throughout the year.

$_n d_x$: The number of persons dying during the age interval.

Age specific number of birth, death and migration is constant for each year population projection.

Formula:

$$\text{Survival Rate} = \frac{5Lx+5}{5Lx}$$

$$= \frac{(5*385064) + 5}{5*385064}$$

$$= 1.00$$

Net Migrants = (Population $_{t+n}$ – Population $_t$) - (Births - Deaths)

$= (398716\,_{2011} - 368950\,_{2001}) - (13830 - 32600)$

$= 48536$

> **N.B.** 13830 is total number of birth from year 2011(census) - 2016(SVRS) and 32600 is the total number of death from year 2011(SVRS) - 2016(SVRS). Birth and death number of the year 2012-2015 is assumed.

1.2.3.2. Projected population of 2016:

Population$_{2016}$ = Survived population + Births + Net migrants

$= 385064 + 13830 + 48536$

$= 447430$

1.2.3.3. Projected population of 2021:

Population$_{2021}$ = Survived population + Births + Net migrants

$= 447430 + 13830 \text{ (constant)} + 48536 \text{ (constant)}$

$= 509796$

1.2.3.4. Projected population of 2026:

Population$_{2026}$ = Survived population + Births + Net migrants

$= 509796 + 13830 + 48536$

$= 572162$

1.2.3.5. Projected population of 2031:

Population₂₀₃₁ = Survived population + Births + Net migrants

$$= 572162 + 13830 + 48536$$

$$= 634528$$

1.2.3.6. Projected population of 2036:

Population₂₀₃₆ = Survived population + Births + Net migrants

$$= 634528 + 13830 + 48536$$

$$= 696894$$

1.2.3.7. Projected population of 2041:

Population₂₀₄₁ = Survived population + Births + Net migrants

$$= 696894 + 13830 + 48536$$

$$= 759260$$

1.3. Process of cohort component method that used for the calculation:

➢ Age specific population is collected from census 2011 of Mirsharai Upazila and age specific number of death collected from Census of 2011of Chittagong district.

➢ Survived population (L_x) calculated by subtracting $_n d_x$ from l_x.

➢ Survival rate is calculated by this formula $=\frac{5Lx+5}{5Lx}$, survived population calculated by this formula = (L_x * survival rate), net migrants calculated by this formula = (population $_{t+n}$ − population $_t$) - (Births - Deaths), projected population calculated by this formula = Survived population + Births + Net migrants.

1.4. Comparison between linear and cohort component method projected population:

Year	Projected Population in Linear Method	Projected Population in Cohort Method
2016	419054	447430
2021	440429	509796
2026	462895	572162
2031	486507	634528
2036	511323	696894
2041	537405	759260

Table 03: Comparison between linear and cohort method projected population.

1.5. Comparison between linear projection and cohort component method:

➤ Cohort component method is used as a projection tool, it assumes the components of demographic change, mortality, fertility, and migration, **will remain constant throughout the projection period** (**Source:**"Lesson 8: The Cohort Component Population Projection Method").On the other hand in linear projection method only population and growth rate is used as a component.

➤ In case of projection result, the number of population of cohort component method is bigger than the number of population in linear projection method. As an example, the projected population of 2031 is 447264 in linear method and 634508 in cohort component method.

➤ As migrations, births, deaths are used in cohort component method so the projected population number is more accurate than linear projection method. Because in linear projection method only population and growth rate is used for projection.

➤ Cohort calculation is difficult than linear projection method.

1.6.1. Limitation of cohort component projection method:

➢ First, it is highly dependent on reliable birth, death and migration data. Thus, it may be difficult to collect the information to apply this tool.

➢ Second, it assumes that survival and birth rates and estimates of net migration will remain the same throughout the projection period.

➢ Third, it does not consider the non-demographic factors that influence population growth or decline.

1.6.2. Limitation of linear method:

➢ In 10 year linear projection first ten year population projection is approximately correct, but next ten year population is comparatively less than before.

➢ Because only growth rate is taken for projection, the value is not accurate.

1.6.3. Limitation:

➢ Do not have age specific data of birth, death, migration number from 1998-2015.

➢ Do not have each year mortality rate of Mirsharai.

➢ Age specific fertility rate also is not available of Mirsharai.

➢ Projection of male population of Mirsharai is not possible for the lacking of gender specific fertility and mortality rate.

➢ Birth and death number from 2012-2015 is assumed because lacking of data.

1.7. Conclusion:

Cohort component method used in this projection because the number of population in this case is more accurate than linear projection method. When making a 10-year projection, it is best to perform two separate projections: *a projection for the first 5 years and then a projection for the next 5 years.* The result of the first projection is used to perform the second round of the projection. In linear projection method, it is not possible to establish separate projection but is possible in cohort component method. So cohort component method is selected to make accurate projection of future population.

Reference:

- Bangladesh Census Bureau. "Bangladesh Census 2011", "Bangladesh Census 1991", Bangladesh Bureau of Statistics, 4 December, 2017. [1]
- Bangladesh Census Bureau. "Chittagong Division Census 2011", Bangladesh Bureau of Statistics, 4 December, 2017. [2]
- Bangladesh Census Bureau. "Chittagong Community Series 2016", Bangladesh Bureau of Statistics, 4 December, 2017. [3]
- Bangladesh Census Bureau. "Fertility Differentials in Bangladesh: Trends and Determinates: Population Monograph: Volume- 14", Bangladesh Bureau of Statistics, 4 December, 2017. [4]
- "Lesson 8: The Cohort Component Population Projection Method." *Lesson 8: The Cohort Component Population Projection Method — MEASURE Evaluation*. N.p., n.d. Web. 9 Dec. 2017. <https://www.measureevaluation.org/resources/training/online-courses-and-resources/non-certificate-courses-and-mini-tutorials/population-analysis-for-planners/lesson-8>. [5]
- "Lesson 7: Overview of life tables and survival rates." *Lesson 7: Overview of life table and survival rates Method — MEASURE Evaluation*. N.p., n.d. Web. 9 Dec. 2017. <https://www.measureevaluation.org/resources/training/online-courses-and-resources/non-certificate-courses-and-mini-tutorials/population-analysis-for-planners/lesson-7>. [6]
- "Lesson 6:" *Lesson 6: Method — MEASURE Evaluation*. N.p., n.d. Web. 9 Dec. 2017. <https://www.measureevaluation.org/resources/training/online-courses-and-resources/non-certificate-courses-and-mini-tutorials/population-analysis-for-planners/lesson-6>. [7]
- National Institution of Population Research and Training(Bangladesh), Bangladesh Sample Vital Statistics 2016 (May 2017), Bangladesh Demographic and Health Survey, Dhaka, Maryland, NIPORT. [8]

Appendix:

- Appendix-I: Population census of Mirsharai Upazila census 2011 from census 2011.

- Appendix-II: Death number of Chittagong zila from SVRS, 2016.

- Appendix- III: Total number of Mirsharai Upazila 2001 and 2011 from census.

- Appendix- IV: Birth number of Chittagong from SVRS, 2016 and census, 2011.