University of Illinois at Chicago
Urban Planning and Policy

UPP502
Planning Skills
Fall2013

Homework Assignment: 4   **Population Projection**

Date Assigned: Wednesday, 09.18.13, 2:45pm (Week 4)

Date Due: Wednesday, 09.25.13, 12:00pm (Week 5)

Weighted Value: 15 points

Estimated Workload: 8 - 10 hours

OVERVIEW

Projecting population is a skill central to planning. Comprehensive plans rely on population projections for forecasting land use, housing, and transportation trends. Local governments use projections for sizing and scheduling major public facilities and infrastructure, such as water and wastewater treatment plants, water and sewer lines, and designing new roads (Steiner and Butler, 2007). Plan elements depend on the assessment of existing and changing population characteristics and the needs of future populations (Daniels et al., 2007).

LEARNING OBJECTIVES

- Demonstrate knowledge about population characteristics, analysis and projection methods.

- Demonstrate proficiency with population projection analysis using cohort survival and trendline extrapolation methods, based on U.S. Census data for your community selected for Community Profile.

- Be able to graphically represent population projection data with population pyramids and trendline charts using MS Excel.

- Be able to provide and communicate critical analysis in the form of a letter report.

ASSIGNMENT

Complete a population projection analysis for your selected community using **cohort survival** and **trendline extrapolation** methods. Describe the methodologies, findings, analysis and conclusions, along with supporting data graphics, in a summary report.

COHORT SURVIVAL METHOD

For the cohort survival method, you are to create a population pyramid (comparative histogram) comprised of 5-year age cohorts for the baseline year 2010, and another one for the projection year 2020.

1. To project population from 2010 to 2020, follow the step-by-step instructions provided by 'Chapter 7: Population Estimates for the Miniplan' (pp.57-64) of *The Small Town Planning Handbook* (Daniels et al., **1995**), posted on Bb via Assignments > Reading Assignments.

    a. *Note:* this is an older (second) edition of the current (third) edition of the same book (Daniels et al., **2007**) providing this week's assigned reading ('Chapter 7: Population Characteristics and Projections'). The current edition no longer includes these step-by-step instructions, which is the reason for reverting to the second edition.

    b. *Note:* the step-by-step instructions contain several typos. For this reason, I have included corrections and clarification notes (yellow) on the pdf

document. Handwritten notes and underlining are from a previous UPP 502 course instructor, and not intended for this course section.

    c.   Age cohort survival rates are provided by 'Table 7-3: Assignment of survival rates for females', and 'Table 7-4: Assignment of survival rates for males' (Daniels, et al, 1995, p. 58).

    d.   Age cohort fertility rates are provided by 'Table 7-6: Application of fertility rates' (Daniels, et al, 1995, p. 60).

2.   Population data for the various age cohorts may be obtained from 'Table QT-P1: Age Groups and Sex: 2010' for your selected community, provided from the U.S. Census Bureau's 2010 Census Summary File 1 data set. This table may be accessed via various paths, such as; U.S. Census Bureau > American FactFinder > Advanced Search, entering search terms 'QT-P1' (topic or table name) and your community (place).

    a.   *Note:* 2010 Decennial Census data (rather than '2007-2011 ACS 5-Year Estimates') is being used so as to be consistent with the decennial timeline being used by the trendline extrapolation method portion of this assignment. It is also being used so students gain familiarity with using Decennial Census data.

3.   To graphically represent your population projection data with a population pyramid (comparative histogram), refer to the step-by-step instructions provided by the excerpt "Creating a Comparative Histogram" from *Excel 2007 Charts* by John Walkenbach (2007), or "Comparative Histogram in Excel 2010" from the tech blog *AddictiveTips.*

    a.   *Note:* the histogram's back-to-back horizontal bars for gender are to be aligned with each other for each 5-year age cohort, not offset.

    b.   *Note:* the assigned readings from both editions of *The Small Town Planning Handbook* provide examples of population pyramids.

4.   Copy your MS Excel population pyramid charts into your letter report as Figures, with appropriate title and source information. Try using MS Word > Reference > Insert Caption.

TRENDLINE EXTRAPOLATION METHOD

Trendline analysis, also named regression analysis, is used to extrapolate from a known data set to construct a future trend with new data points. Graphically, trendlines are used to display trends in data and to help analyze problems of prediction.

For the trendline extrapolation method, you are to create a table using historical population data for your selected community from the Decennial Census years 1960-2010, and then plot the population trend to the projection year 2020 using a trendline chart. There are various ways to accomplish this, with the following steps being one such way.

1.   Create a data set with MS Excel for total population data from the decennial census years 1960-2010 and the projection year 2020. Input your total population data for each decennial year, leaving 2020 blank. Population data may be found as follows;

    a.   Decennial Census years 2000 and 2010 may be found at U.S. Census Bureau > 2000 Census, and 2010 Census.

    b.   Decennial Census years 1960, 1970, 1980 and 1990 may be found at U.S. Census Bureau > Census of Population and Housing. The path to your community population will be slightly different for each Decennial Census, so here are a few tips;

        ▪   When applicable, be sure to use *Advance Reports: Series PC(V1). Final Population Counts*, as they supersede the *Preliminary Reports: Series PC(P3). Population Summaries.*

        ▪   The Table of Contents may be hyperlinked to particular states, and from there one can seek out their community (which is categorized

as a County Subdivision). The communities are then listed under their respective township (TWP).

2. From your spreadsheet data input, create a Scatter (XY) chart in Excel[*], via; Insert > Charts / Scatter > Scatter with only Markers. The x-axis is for the Decennial Census years, the y-axis for total population.

3. Add a trendline to the Scatter (XY) chart in Excel, via; Chart Tools (will display upon clicking on your scatter chart) > Layout > Analysis / Trendline > More Trendline Options.

   There are six different trendline (or regression) types: exponential, linear, logarithmic, polynomial, power, or moving average. The type of data that you have determines the type of trendline that should be used.

   When you fit a trendline to your data, Excel automatically calculates its R-squared value (toggle on 'Display R-squared value on chart'). A trendline's calibration accuracy with data is measured by its R-squared value, which is a number within the range 0-1, with the best fit indicated by being nearest to 1.

   Fit all six trendline types to your total population data for the Decennial Census years 1960-2010, and choose the one that best fits your data. Refer to Excel > Help > 'Add, change, or remove a trendline in a chart' for additional information.

4. Using the trendline with the best fit for the data, project and plot the population trend to the projection year 2020; via; More Trendline Options > Forecast > Forward: 10 periods (years). Toggle on 'Display R-squared value on chart'.

5. Determine, label and report the 2020 projected total population.

   One may calculate the projected population manually, via; Chart Tools > Layout > Trendline > Trendline Options. Select your best-fit trendline, and toggle on 'Display Equation on chart'. Use this equation to manually calculate (or insert equation as a function into Excel) your 2020 projected population, where x = projected year (value = 2020) and resulting y = projected 2020 population. You will then have to manually add the 2020 projected population to your chart as a data label. Even though Excel provides a graphic representation of the projected data point for 2020, to my knowledge, it does not automatically provide the numerical equivalent.

6. Format your trendline chart as appropriate, using Chart Tools > Design / Layout / Format. Include the R-squared value on your chart, as well as data labels for the population of each Decennial Census year data point, including 2020.

7. Copy your Excel trendline chart into your letter report as a data graphic (Figure), with appropriate title and source information (see 'Chart Example' posted on Bb). Try using MS Word > Reference > Insert Caption.

ITEMS OF CONSIDERATION

▪ *Format*: Structure your summary as a letter report to include; heading, introduction, methods (include assumptions and limitations), findings, analysis, conclusions and closing.

▪ *Trendline Extrapolation Method:* in the use of logarithmic and power trendlines, the values assigned to the x-axis makes a difference in the trendline and R-squared value, depending on whether one uses values for decennial years (1960, 1970, 1980, etc.) or other proxy values (1, 2. 3, etc.). In this case, it would appear using the proxy values (1, 2, 3, etc.) instead of years (1960, 1970, 1980, etc.) is more appropriate. By projecting forward an additional increment of 1 (or to 7), Excel will extend the trendline and provide the equation to calculate projected population. One will need to find a way to clarify/revise the x-axis values on the chart, such as by using a legend (i.e., 1 = 1960), or cut and paste values along the x-axis in MS Word.

---

[*] Paths throughout these instructions are based on Excel 2007, and may be slightly different for other Excel versions.

- *Trendline Extrapolation Method:* In some population data sets, it would be appropriate to consider certain year(s) as an anomaly when significantly out of alignment with other years. If so, the anomaly years would be excluded in the projected population data set. As with all data analysis, this is a judgment call by the data analyst / urban planner. In doing so, remember to include this decision in the report, and explain the rationale. One may also compare their findings between including and excluding the data point(s), so as provide full disclosure to their client.

- *Final Project: Community Profile:* Students will be required to provide a population projection for their selected community for the years 2020 and 2030. For this reason, it is recommended to save all work from this assignment, or project to the year 2030 while completing this assignment, for future use.

DELIVERABLES

Students are to submit **two** print copies of their summary report to the instructor at the start of class on assignment's due date, one of which will be returned with grade and review comments.

- *Format:* **letter report (long version)**, refer to Purdue OWL > Subject Specific Writing > Writing in Engineering > Handbook on Report Formats > The Report Body, and 'Letter Report (long version)' example' posted on Bb.

  Address the report to your client, which in this case is the appropriate staff member (for example, the village / city planner) of your selected community.

- *Particulars:* 8.5" x 11", 2-3 pages, pdf document.

EVALUATION CRITERIA

- *Methods:* student demonstrated ability to perform population projection analysis, using cohort survival and trendline extrapolation methods.

- *Skills:* student demonstrated visualization skill of graphically representing population projection data with population pyramids and trendline charts using MS Excel.

- *Communication:* student demonstrated ability to provide and communicate critical analysis in the form of a summary letter report.

- *Completeness:* deliverables submitted in a complete and orderly manner.

- *Timeliness:* deliverables were submitted by due date.