Economics 125 – Demographic Analysis and Forecasting, Spring 2022

Location/Time	Ridge Walk Academic Complex, Room 0121 2:00 - 3:20 pm T/TH
Instructor	Jeff Tayman Email: jtayman@ucsd.edu
Office Hours	Econ 110C Office Hours: 12:30 –1:45 pm T/TH
Class Web Site	Canvas.ucsd.edu
Graduate Assistant	Amanda Bauer agbauer@ucsd.edu Remote using Zoom https://ucsd.zoom.us/j/93109234904 Office Hours: 11:00 – 1:00 pm Wednesday

Objectives

This course is designed to teach you the foundations of demographic analysis and forecasting. You will learn: (1) the terminology, methods, and practical guidance needed to create, evaluate, interpret, and use forecasts; (2) fundamental demographic concepts including population size, composition, and change; (3) the measurement, and interpretation of trends and patterns in fertility, mortality, and migration; (4) key relationships between economic and demographic process; and (5) the implications of demographic changes for the social security system.

Required Readings

1. Stanley K. Smith, Jeff Tayman, & David A. Swanson (2013). *A Practitioner's Guide to State and Local Population Projections*. Dordrecht, Springer (available in hardcover or eBook). **The eBook is free for students to access through a network with a UCSD IP address (computer on campus, UCSD-PROTECTED wireless, VPN, or proxy from off-campus).**

2. Articles on the Internet and course website (See page 6 of the syllabus).

Academic Integrity

Students found to have violated the Policy on Integrity of Scholarship will face administrative sanctions imposed by their college Dean of Student Affairs and academic sanctions imposed by me. Administrative sanctions can range from disciplinary probation to suspension and dismissal from the university; those are not at my discretion. Academic sanctions can range from 0 points on an assignment/test to an F in the class.

If you have any questions about the academic integrity policy, call (858)-822-2163 or visit the Website (http://www.ucsd.edu/current-students/_organizations/academic-integrity-office/).

Course Assessment

Problem Sets— There are 6 problem sets. All assignments should be done with an electronic spreadsheet. Inputs to the assignments are on the class Website in the Folder labeled **Assignment Inputs.** (The URL https://www.youtube.com/watch?v=7RCdzTpKO0A contains a 30-minute Excel tutorial). **Problem sets are to be submitted through Canvas.**

Research Paper— A research paper is required (Details on pages 7-8 of the syllabus). **Paper is to be submitted through Canvas.**

Exams— There is one mid-term exam and a final exam. The final exam is not cumulative**.** If you miss the mid-term because of a compelling medical excuse or family emergency, your final exam will count for 49% of your grade instead of 33%. Missing the midterm for any other reason will result in zero points. **There will be no alternate date/time for the mid-term or final exam**. A make-up final exam will be given in case of a fully documented medical excuse or family emergency. **Exams will be conducted using Canvas**.

Grading—You can earn a maximum of 305 points as follows: Assignments (85 points, 28%), mid-term exam (50 points, 16%), final exam (100 points, 33%), and research paper (70 points, 23%). **Any disputes about points earned must be resolved within one week after the assignment, exam, or paper has been graded.**

You will receive no lower than: an (A-) with 274 points; a (B-) with 244 points; a (C-) with 213 points; and a (D) with 183 points. Depending on the distribution of the total points, the above breakpoints may be lowered.

Assessment Expectations

Assignments are due at the start of class; **assignments submitted through Canvas later than the class start time or by email will receive a score of zero.**

You have two choices for doing the problem sets and research paper: 1) do them independently; or 2) do them as a group no larger than **6** people. Each member of the group will receive the same score. To facilitate grading in Canvas, each member of the group must turn in an assignment or paper that must include all names in the group.

It is expected that the problem sets/research paper be completed on your own or as a group and in your own or the group's computations, graphs, tables, and words. You must not use the answers or spreadsheets developed by another person/group, including assignments from previous Econ 125 classes; or copy the work completed by others, including the Economics Tutor; or write the research paper with another person unless he/she is part of your group.

Course Schedule

Date	Topics	Readings
Mar. 29	Overview and Introduction	Chapter 1
Mar. 31	Fundamentals of Population Analysis	Chapter 2
Apr. 5	Mortality	Chapter 4; Population Reference Bureau (2006); Dong, Milholland, and Vijg (2016)
Apr. 7	Fertility	Chapter 5; Blake (1968); Easterlin (1978); Lutz (2007)
Apr. 12	Finish Fertility	
Apr. 14	Migration	Chapter 6 **Assignment 1 due**
Apr. 19	Finish Migration	
Apr. 21	Exam review	
Apr. 26	**EXAM**	
Apr. 28	Demographic Change and Social Security	Research Paper Readings **Assignment 2 due**
May 3	Cohort-Component Method	Chapters 3 and 7; Isserman (1993)
May 5	Cohort-Component Method	
May 10	Trend Extrapolation	Chapter 8 **Assignment 3 due**
May 12	Trend Extrapolation	
May 17	Economic-Demographic Models	Chapter 9; Hunt (1993) **Assignment 4 due**
May 19	Economic-Demographic Models	**Paper Due**
May 24	Forecast Error	**Assignment 5 due** Chapter 13; Swanson and Tayman (1995)
May 26	Forecast Error	
May 31	Evaluating Projections	**Assignment 6 due** Chapter 12
June 2	Final Exam Review	
June 7	**Final Exam**	

Problem Sets

Assignment 1 (10 pts.)

1. Compute the doubling time using the exact method and approximation rule for selected counties in North Carolina using the 2010-2020 base period. (2 pts.)
2. Compute the projected 2050 total fertility rate for South Dakota using the synthetic method based on the total fertility rate for the U.S. (1 pt.)
3. Compute the projected 2050 total fertility rate for South Dakota using the targeting method for two alternatives:
    a. Assume an 85% convergence by the year 2065 (1 pt.)
    b. Assume a 55% convergence by the year 2065 (1 pt.)
4. Interpret the exact formula for doubling time for Watauga and Washington Counties (2 pts.)
5. Explain why the synthetic and targeting methods yield different total fertility rate projections in 2050 for South Dakota. (3 pts.)

Assignment 2 (7 pts.)

1. Compute the 2015-2020 net migration number and rate by 5-yr. age groups for Polk County, Iowa females. (5 pts.)
2. What at-risk population did you use to compute the net migration rates and why did you choose it? (2 pts.)

Assignment 3 (18 pts.)

1. Compute the 2025 projected population for Polk County, Iowa females using a net migration cohort-component model. (8 pts.)
2. Compute the 2020 to 2025 components of population change for Polk County females (2 pts.)
3. Calculate age-specific cohort change ratios between 2015 and 2020 and child-woman ratio for ages 0-4 in 2020 for Polk County females. (2 pts.)
4. Create a 2025 population projection by age for Polk County females using the Hamilton-Perry (HP) method. (3 pts.)
5. What is the difference in the 2025 total female population between the HP and CCM methods? What might explain the difference or lack thereof between these two projection methods? (1 pt.)
6. Explain results from Question 2. What are the factors contributing to the change in the female population of Polk County from 2020 to 2025? (2 pts.)

Problem Sets (Cont.)

Assignment 4 (20 pts.)

1. Using 2000 to 2021 as the base period, create 2060 total population projections for Ferndale, Washington using two complex extrapolation methods: 1) Linear model and 2) Exponential model. Use the recode value for time, include the CALIB term, and ignore the smearing correction in the Exponential model (some) (6 pts.) (Regression in Excel: http://www.wikihow.com/Run-Regression-Analysis-in-Microsoft-Excel)
2. Using 2000 to 2021 as the base period, create 2060 population projections for selected counties and balance of the State in California using five trend extrapolation methods: 1) Linear (LINE); 2) Exponential (EXPO); 3) Shift-Share (SHIFT); 4) Share of Growth (SHARE); and Constant Share (CONSTANT). (4 pts.)
3. Create a 2060 population projection for California for LINE and EXPO using the bottom-up method. (1 pt.)
4. Interpret the regression slopes from the Complex Linear and Exponential models. (2 pts.)
5. What are the key assumptions that underlie the Linear and Exponential models? (2 pts.)
6. Why was it necessary to have an independent projection for California for the SHIFT, SHARE, and CONSTANT methods? (1 pt.)
7. Describe why the 2060 projections in Question 2 vary for the California counties. Where appropriate, note specific geographic areas in the answer. (4 pts.)

Assignment 5 (10 pts.)

1. Determined the 2030 labor supply for Thurston County, WA (3 pts.)
2. Determine the 2030 labor demand for Thurston County using the Shift-Share method (3 pts.)
3. Determine the 2020-2030 net employment-related migration in Thurston County (1 pt.)
4. Determine the 2020-2030 net employment-related migration in Thurston County, assuming the U.S. adds on average 70,000 jobs per month from 2020 and 2039 (2 pts.)
5. What other migration components would need to be forecast to determine the 2020-2030 total net migration for Thurston County? (1 pt.)

Assignment 6 (20 pts.)

1. Using 10-year horizon 2020 population forecasts based on extrapolation methods and cohort-component model for 36 counties within Oregon, calculate algebraic and absolute percentage errors for each county. (4 pts.)
2. Calculate the following summary measures of error: MALPE, MAPE, MEDAPE, and PRE for the MAPE and MALPE using the naïve forecast. (4 pts.)
3. Evaluate the precision, bias, shape of the error distribution, and utility of the forecasts based on extrapolation methods and cohort-component model. Which method or model does the best and worst? (8 pts.)
4. What would the MAPE value be for a 15-year forecast based on extrapolation method for counties in Oregon? (2 pts.)
5. What would the MALPE value be for a 15-year forecast based on the extrapolation method for counties in Oregon? (2 pts.)

Internet Links and Articles on Class Web Site

Fundamentals	ACS.pdf (**On class website)**
Mortality	Population Reference Bureau. 2006. The Future of Human Life Expectancy (**On class website**) X. Dong, B. Milholland, & J. Vijg. 2016. Evidence for a limit to human life span. *Nature*, 538-257-259. (**On class website**)
Fertility	J. Blake. 1968. Are babies consumer durables?: A critique of the economic theory of reproductive motivation. *Population Studies*, 22: 5-25. **(On class website)** R. Easterlin. 1978. What will 1984 be like? Socioeconomic implications of recent twists in age structure. *Demography*, 15: 397-432. **(On class website)** W. Lutz. 2007**.** The Future of Human Reproduction: Will Birth Rates Recover or Continue to Fall? *Ageing Horizons, 7*:15-21 **(On class website)**
Cohort-Component Method	A. Isserman. 1993. The right people, the right rates: Making population estimates and forecasts with an interregional cohort-component model. *Journal of the American Planning Association,* 59: 45-64. **(On class website)**
Economic-Demographic Models	G. Hunt. 1993. Equilibrium and disequilibrium in migration modeling. *Regional Studies*, 27: 341-49. **(On class website)**
Forecast Error	D. Swanson and J. Tayman. 1995. Between a rock and a hard place: the evaluation of demographic forecasts. *Population Research and Policy Review*, 14:233-249. **(On Class Website))**
Research Paper	Examples of data representation using tables, graphs, and charts https://faculty.up.edu/lulay/MEStudentPage/graphexamples-how-to-do.pdf AARP. 2022. 9 Ways to Strengthen Social Security B. Bergmann. 2005. Could social security go broke? The Economist Voice, 2(1): Article 10. **(On class website**) M. Bosin. 2005. Straight talk on social security. The Economist Voice, 2(1): Article 11. **(On class website**) P. Diamond and P. Orszag. 2005. Social security: The Diamond-Orszag plan. The Economist Voice, 2(1): Article 8. **(On class website**) J. Gruber. 2010. Social Security (PowerPoint Lecture) **(On class website**) R. Lee, M. Andersen, and S. Tuljapurkar. 2003. Stochastic forecasts of the social security trust fund. **(On Class Website)** D. Myers. 2007. Testimony before the House Committee on the Judiciary Ellis Island New York and New Jersey. **(On class website**) J. Siegel. 2002. Demographic aspects of selected public policy issues, pp 595-605 in *Applied Demography: Applications to Business Government, Law, and Public Policy*. Academic Press, San Diego, CA **(On class website)** Social Security Administration (SSA). 2020. OASDI Trustees Report (Sections I, II, and V.A, V.B, and VI.E). https://www.ssa.gov/OACT/TR/2020 U.S. News. 2014. 5 Potential social security fixes. money.usnews.com/money/blogs/planning-to-retire/2014/11/14/5-potential-social-security-fixes R. Weaver. 2008. Bridging the Social Security Divide: Lessons from Abroad. Brooking Policy Brief # 166 https://www.brookings.edu/research/bridging-the-social-security-divide-lessons-from-abroad/ S. Williams. 2018. What is means-testing, and how could it affect social security? https://www.fool.com/retirement/2018/08/16/what-is-means-testing-and-how-could-it-affect-soci.aspx

Research Paper: Topic, Questions, and Scoring

This research paper will analyze and evaluate population projections and the impact that fertility and migration assumptions can have on the future size of a population and its age composition. The topic of the paper is *U.S. Demographics to the Year 2069 and the Outlook for Social Security*. I hope this will be a challenging and rewarding exercise.

The paper should not be based only on data/information from published sources that has already been analyzed. You must analyze original data**,** which are based on national population projections prepared by the U.S. Census Bureau and found in an Excel spreadsheet (US_Pop2019-2069.xls) on the class website. The **Projections Tab** contains population by selected age groups for the launch year 2019, five horizon years (2029-2069 in 10-year time increments), and three alternatives (low, middle, and high). The **Assumptions Tab** shows the fertility, mortality, and migration assumptions for each alternative. Articles on electronic reserve, the Internet, and the class website are available as resources.

The paper **must** address these questions (points are shown in parenthesis):

1. What two parts of the age distribution most influence the social security system? What measure, based solely on age groups, has been used to relate these segments? What are the strengths and weaknesses of this measure? What age groups are you using in this measure and why? (10 pts.)
2. Based on the measure defined in Question 1, how does the age distribution vary under the different projection alternatives and why? Which alternatives are the most and least favorable to the social security system and why (effects of fertility and migration)? (20 pts.)
3. Based on the measure defined in Question 1, how does the age distribution vary within the 50-year forecast horizon? What are the reasons for these trends? (5 pts.)
4. Which one of the three projection alternatives is most likely to occur (i.e., as a forecast) and why (i.e., by **numerically specifying and justifying** the total fertility rate, life expectancy, and immigration assumptions in 2069)? Instead of picking one alternative, you can create assumptions by combining elements from the alternates or specifying and justifying assumptions that are not in any alternative. (15 pts.)
5. Playing the role of president, what strategies would you implement to address the social security system problem? Why would these strategies be selected over the other strategies being considered? (10 pts.)
6. Overall Quality: organization; including an Introduction and Conclusion; spelling and grammar; professional-looking graphs/tables; proper citations and bibliography; well-articulated, concise, supported, and documented arguments (10 pts.)

The URL below links to a policymaking simulation on Social Security Reform that d lets you decide which reforms you want Congress to adopt. It is a fun exercise that you might find interesting and informative.

http://www.actuary.org/content/try-your-hand-social-security-reform

Research Paper: Guidelines

DO

- Include a cover page.
- An analysis of the provided U.S. population projections.
- Include an Introduction to provide background information and motivation for the topic (answer the "why we should care" question) and a Conclusion summarizing the implications of your findings.
- Proofread the paper carefully. Make sure the paper is well-organized (do an outline before writing word one), has proper grammar and spelling, and effectively communicates your ideas.
- Think about the reader when making tables and graphs. Are they easy to read? Is there a better, cleaner way to display the same information? Does the information help support or clarify the analysis and conclusions? Learning to do this well is an invaluable skill.
- Label and number tables and graphs properly (*see Examples of data representation using tables, graphs, and charts* .pdf file); Include a proper source at the bottom, telling where the data came from. All tables and figures should be cited in the text (e.g., see Figure 1). Do not split tables and figures across pages.
- Cite all data and references completely (for Websites, this means the complete URL, the date, the organization publishing it). Consult a style manual for the proper way to cite a source.
- Do a "common-sense" test of the analysis. It is a way to catch computational mistakes that yield improbable results.
- Have a friend from outside of class read the paper.

DON'T

- Exceed more than five double-spaced typewritten pages, excluding references, figures, and tables.
- Rely exclusively on data analyzed by others. (Information can be cited from external sources, but the paper must include the analysis of the U.S. projection data).
- Include extraneous information (verbiage, tables, and charts) that do not help answer the questions, defend a position, or support a claim.
- Wait until the last minute to start your paper.
- Plagiarize. If the ideas, data, and findings, etc. come from other sources they must be cited and given appropriate credit.

ASK YOURSELF THESE QUESTIONS

- Is it clear from the Introduction what this paper is about?
- Does each paragraph pertain to the paper's topics?
- Do important ideas stand out clearly?
- Are more explanations, details, examples, anecdotes needed?
- Are their sweeping statements that require support?
- Do technical terms need an explanation?
- Is there unwarranted repetition?
- Is the tone consistent?
- Are any of the sentences too difficult to follow?