

SOC6708H Advanced Data Analysis: Age-Period Cohort Models (Winter 2020)

Instructor: Prof. Ethan Fosse

Class Hours and Location: Mondays 5pm-7pm, Room 240 (725 Spadina)

Office Hours and Location: By appointment, Room 348 (725 Spadina)

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1 Course Description & Goals

Over the past two decades there has been an enormous increase in the number of studies using age-period-cohort (APC) models to understand social change. No discipline in the social sciences has been unaffected by this revolution. However, confusion abounds on the appropriate application, interpretation, and scope of APC models. This course provides an overview of how applied researchers can conduct theoretically-motivated APC analyses while avoiding common mistakes. Topics covered include visualization techniques, multilevel/hierarchical models, Moore-Penrose estimators, bounding/sensitivity analyses, and mechanism-based causal models. Some familiarity with multiple linear regression is helpful, but not required. Examples will be shown using the R programming language but general principles will be given for other statistical software.

2 Course Resources

Quercus Website: The course website will have additional information on the course mechanics, lecture materials, and readings. Note that all assignments will be submitted entirely through course website, which will be updated as the course begins. The course website may be accessed via the University of Toronto's [Quercus platform](#).

Weekly Readings: This course includes required and supplementary weekly readings. Only those weekly readings listed in this syllabus as “required readings” are, in fact, required. The supplementary weekly readings are not necessary for succeeding in this course and are offered only to give you deeper insight on particular topics and techniques. All readings will be posted on the course website.

Statistical Software: This course is focused primarily on helping you learn the basic concepts and principles underlying APC modeling. Accordingly, **you are not required to learn any statistical software**. Moreover, to the extent you conduct any empirical analyses, **you may use any statistical software of your choice**, including but not limited to Excel, Python, SAS, SPSS, and Stata. However, learning statistical concepts is generally aided by analyzing data using statistical software. Because of its popularity and applicability, to the extent any examples are presented in this course will focus on using R with RStudio. R is the underlying programming language, while RStudio is a graphical user interface that makes working with R much easier. Both are free, open-source, and used widely by statisticians. In this course, when we refer to R this should

be viewed as shorthand for using R with RStudio. To install R with RStudio, go to the [this link](#) and click on the installer for your computer's operational system.

3 Evaluation Components

Fall students, your grade will be based on the following:

1. **Class Participation:** You must not only attend but actively participate in class discussions throughout course. Class participation is worth 20% of your overall grade.
2. **Critical Review Essay:** You must submit a short paper (between 3 to 7 pages) critically analyzing a published paper using at least one temporal variable (i.e., age, period, or cohort). Details will be given at the beginning of the course. The due date for this assignment is **March 3, 2020 by 11:59pm Eastern Standard Time (EST)**. The critical review essay is worth 30% of your overall grade.
3. **Research Paper:** You must submit a longer, final research paper (between 15-25 pages) related to the course topics, typically either an empirical analysis or a theoretical piece. Details will be given at the beginning of the course. The due date for this assignment is **April 17, 2020 by 11:59pm Eastern Standard Time (EST)**. The research paper is worth 50% of your overall grade.

Instructions on Submitting Papers: All papers must be submitted via the course website. **Only Adobe pdf documents will be allowed.** Papers should be written using standard 12 point font, double spacing, and without a separate title page. All works should be referenced using American Sociological Association (ASA) style.

Late Penalty: Unless there is a documented reason beyond one's control (e.g., an illness or emergency), there will be a 5% deduction for each day the assignment is late.

4 Tentative Session Topics & Readings

Part I: Foundations

Week 1: Theoretical Foundations (January 6)

Required Readings

Alwin, Duane F. and Ryan J. McCammon. 2003. "Generations, Cohorts, and Social Change." Pp. 23–49 in *Handbook of the Life Course*, edited by J. T. Mortimer and M. J. Shanahan. New York, NY: Springer.

Mannheim, Karl. 1952 [1928]. "The Problem of Generations." Pp. 276-322 in *Essays on the Sociology of Knowledge: Collected Works, Volume 5*, edited by Paul Kecskemeti. New York: Routledge.

Ryder, Norman B. 1965. "The Cohort as a Concept in the Study of Social Change." *American Sociological Review* 30(6):843.

Supplementary Readings

Duncan, Otis Dudley. 1974. "Developing Social Indicators." *Proceedings of the National Academy of Sciences* 71(12):5096–5102.

Giele, Janet Z. and Glen H. Elder. 1998. "Life Course Research: Development of a Field." Pp. 5–27 in *Methods of Life Course Research: Qualitative and Quantitative Approaches*. Thousand Oaks, CA: Sage Publications.

Rosow, Irving. 1978. "What Is a Cohort and Why?" *Human Development* 21(2):65–75.

Week 2: Overview of APC Analysis (January 13)

Required Readings

Fosse, Ethan and Christopher Winship. 2019 "Analyzing Age-Period-Cohort Data: Critiques and New Directions." *Annual Review of Sociology* 45: 467-492.

Fosse, Ethan, Christopher Winship, and Adel Daoud. 2020. "Learning from Age-Period-Cohort Data: Bounds, Mechanisms, and 2D-APC Graphs." In *Age, Period, and Cohort Effects: The Identification Problem and Beyond*, edited by Andrew Bell. London: Routledge.

Supplementary Readings

Altman, Douglas G. and J. Patrick Royston. 1988. "The Hidden Effect of Time." *Statistics in Medicine* 7(6):629–37.

O'Brien, Robert. 2015. Pp. 1-20 in *Age-Period-Cohort Models: Approaches and Analyses with Aggregate Data*. Boca Raton, FL: CRC Press.

Mason, William and N. H. Wolfinger. 2001. "Cohort Analysis." Pp. 2189–94 in *International Encyclopedia of the Social & Behavioral Sciences*, edited by N. J. Smelser and P. B. Baltes. Oxford, UK: Pergamon Press.

Week 3: The APC Identification Problem (January 20)

Required Readings

Holford, Theodore R. 1983. "The Estimation of Age, Period and Cohort Effects for Vital Rates." *Biometrics* 39(2):311.

Kuang, D., B. Nielsen, and J. P. Nielsen. 2008. "Identification of the Age-Period-Cohort Model and the Extended Chain-Ladder Model." *Biometrika* 95(4):979–86.

Supplementary Readings

Moore, Will H. and David A. Siegel. Pp. 275-303 and 327-339 in *A Mathematics Course for Political & Social Research*. Princeton, NJ: Princeton University Press.

Rodgers, Willard L. 1982. "Estimable Functions of Age, Period, and Cohort Effects." *American Sociological Review* 47(6):774–87.

Week 4: Splines & Generalized Additive Models (January 27)

Required Readings

Carstensen, Bendix. 2007. "Age-Period-Cohort Models for the Lexis Diagram." *Statistics in Medicine* 26(15):3018-45.

Jiang, Bei and Keumhee C. Carriere. 2014. "Age-Period-Cohort Models Using Smoothing Splines: A Generalized Additive Model Approach." *Statistics in Medicine* 33(4):595-606.

Supplementary Readings

James, Gareth, Daniela Witten, Trevor Hastie, and Robert Tibshirani. 2017. Pp. 265-296 in *An Introduction to Statistical Learning: With Applications in R*. New York, NY: Springer.

Heuer, Carsten. 1997. "Modeling of Time Trends and Interactions in Vital Rates Using Restricted Regression Splines." *Biometrics* 53(1):161.

Perperoglou, Aris, Willi Sauerbrei, Michal Abrahamowicz, and Matthias Schmid. 2019. "A Review of Spline Function Procedures in R." *BMC Medical Research Methodology* 19:46.

Week 5: Equality Constraints & Proxy Variables (February 3)

Required Readings

Farkas, George. 1977. "Cohort, Age, and Period Effects upon the Employment of White Females: Evidence for 1957-1968." *Demography* 14(1):33.

Glenn, Norval. 2005. Pp. 11-17 in *Cohort Analysis, Second Edition*. Thousand Oaks, CA: Sage Publications.

Mason, K. O., W. M. Mason, H. H. Winsborough, and W. Kenneth Poole. 1973. "Some Methodological Issues in Cohort Analysis of Archival Data." *American Sociological Review* 38(2): 242-258.

Supplementary Readings

Knoke, David and Michael Hout. 1974. "Social and Demographic Factors in American Political Party Affiliations, 1952-72." *American Sociological Review* 39(5):700.

O'Brien, Robert. 2015. Pp. 21-58 in *Age-Period-Cohort Models: Approaches and Analyses with Aggregate Data*. Boca Raton, FL: CRC Press.

O'Brien, Robert. 1989. "Relative Cohort Size and Age-Specific Crime Rates: An Age-Period-Relative-Cohort-Size Model." *Criminology* 27(1):57-78.

Week 6: Hierarchical Models & Moore-Penrose Estimators (February 10)

Required Readings

Fosse, Ethan and Christopher Winship. 2018. "Moore-Penrose Estimators of Age-Period-Cohort Effects: Their Interrelationship and Properties." *Sociological Science* 5: 304-34.

Bell, Andrew and Kelvyn Jones. 2014. "Don't Birth Cohorts Matter? A Commentary and Simulation Exercise on Reither, Hauser, and Yang's (2009) Age-Period-Cohort Study of Obesity." *Social Science & Medicine* 101:176-80.

Reither, Eric N., Robert M. Hauser, and Yang Yang. 2009. "Do Birth Cohorts Matter? Age-Period-Cohort Analyses of the Obesity Epidemic in the United States." *Social Science & Medicine* 69(10):1439-48.

Supplementary Readings

Bell, Andrew and Kelvyn Jones. 2018. "The Hierarchical Age-Period-Cohort Model: Why Does It Find the Results That It Finds?" *Quality & Quantity* 52(2):783-99.

Yang, Yang and Kenneth C. Land. 2006. "A Mixed Models Approach to the Age-Period-Cohort Analysis of Repeated Cross-Section Surveys, with an Application to Data on Trends in Verbal Test Scores." *Sociological Methodology* 36:75-97.

Yang, Yang, Sam Schulhofer-Wohl, Wenjiang J. Fu, and Kenneth C. Land. 2008. "The Intrinsic Estimator for Age-Period-Cohort Analysis: What It Is and How to Use It." *American Journal of Sociology* 113(6):1697-1736.

Week 7: No Class (February 17)

Week 8: Trend Analysis with APC Models (February 24)

Required Readings

Fosse, Ethan. 2019. "Seeing vs. Doing: On the Hard Problem of Age-Period-Cohort Analysis." Working Paper, University of Toronto.

Riley, Matilda White. 1973. "Aging and Cohort Succession: Interpretations and Misinterpretations." *Public Opinion Quarterly* 37(1):35.

Robinson, Robert V. and Elton F. Jackson. 2001. "Is Trust in Others Declining in America? An Age-Period-Cohort Analysis." *Social Science Research* 30(1):117-45.

Supplementary Readings

Firebaugh, Glenn. 1989. "Methods for Estimating Cohort Replacement Effects." *Sociological Methodology* 19:243.

Rodgers, Willard L. 1990. "Interpreting the Components of Time Trends." *Sociological Methodology* 20:421.

Xie, Yu. 2007. "Otis Dudley Duncan's Legacy: The Demographic Approach to Quantitative Reasoning in Social Science." *Research in Social Stratification and Mobility* 25(2):141–56.

Week 9: Bounding Analyses of Temporal Effects (March 2)

Required Readings

Fosse, Ethan and Christopher Winship. 2019. "Bounding Analyses of Age-Period-Cohort Effects." *Demography*.

Manski, Charles F. 2003. "Identification Problems in the Social Sciences and Everyday Life." *Southern Economic Journal* 70(1):11-21.

Supplementary Readings

O'Brien, Robert. 2015. Pp. 59-92 in *Age-Period-Cohort Models: Approaches and Analyses with Aggregate Data*. Boca Raton, FL: CRC Press.

Morgan, Stephen L. and Christopher Winship. 2014. "Chapter 12: Distributional Assumptions, Set Identification, and Sensitivity Analysis." Pp. 419-434 in *Counterfactuals and Causal Inference: Methods and Principles for Social Research (2nd Edition)*. Cambridge, UK: Cambridge University Press.

Week 10: Mechanism-Based Models of APC Effects (March 9)

Required Readings

Bijlsma, Maarten J., Rhian M. Daniel, Fanny Janssen, and Bianca L. De Stavola. 2017. "An Assessment and Extension of the Mechanism-Based Approach to the Identification of Age-Period-Cohort Models." *Demography* 54(2):721–43.

Duncan, Otis Dudley. 1985. "Generations, Cohorts, and Conformity." Pp. 289–321 in *Cohort Analysis in Social Research*, edited by William Mason and Stephen Fienberg. New York, NY: Springer.

Winship, Christopher and David J. Harding. 2008. "A Mechanism-Based Approach to the Identification of Age-Period-Cohort Models." *Sociological Methods & Research* 36(3):362–401.

Supplementary Readings

Elwert, Felix. 2013. "Graphical Causal Models." Pp. 245-273 in *Handbook of Causal Analysis for Social Research*, edited by Stephen L. Morgan. Dordrecht, Netherlands: Springer.

Jackson, John W. and Tyler J. VanderWeele. 2018. "Decomposition Analysis to Identify Intervention Targets for Reducing Disparities." *Epidemiology* 29(6):825–35.

Morgan, Stephen L. and Christopher Winship. 2014. "Chapter 10: Mechanisms and Causal Explanation." Pp. 325-353 in *Counterfactuals and Causal Inference: Methods and Principles for Social Research (2nd Edition)*. Cambridge, UK: Cambridge University Press.

Week 11: Bayesian APC Models (March 16)

Required Readings

Fosse, Ethan. 2020. “Bayesian Analyses of Age-Period-Cohort Effects.” In *Age, Period, and Cohort Effects: The Identification Problem and Beyond*, edited by Andrew Bell. London: Routledge Press.

Sasaki, Masamichi and Tatsuzo Suzuki. 1987. “Changes in Religious Commitment in the United States, Holland, and Japan.” *American Journal of Sociology* 92(5):1055-76.

Glenn, Norval D. 1989. “A Caution About Mechanical Solutions to the Identification Problem in Cohort Analysis: Comment on Sasaki and Suzuki.” *American Journal of Sociology* 95(3):754-61.

Supplementary Readings

Berzuini, C., D. Clayton, and L. Bernardinelli. 1993. “Bayesian Inference on the Lexis Diagram.” *Bulletin of the International Statistical Institute* 50: 149-64.

Fukuda, Kosei. 2006. “Age-Period-Cohort Decomposition of Aggregate Data: An Application to US and Japanese Household Saving Rates.” *Journal of Applied Econometrics* 21(7):981-98.

Knorr-Held, Leonhard and Evi Rainer. 2001. “Projections of Lung Cancer Mortality in West Germany: A Case Study in Bayesian Prediction.” *Biostatistics* 2(1):109-29.

Schmid, Volker J. and Leonhard Held. 2007. “Bayesian Age-Period-Cohort Modeling and Prediction – BAMP.” *Journal of Statistical Software* 21(8).

Week 12: APC Analysis with Comparison Groups (March 23)

Required Readings

Dinas, Elias and Laura Stoker. 2014. “Age-Period-Cohort Analysis: A Design-Based Approach.” *Electoral Studies* 33:28-40.

Firebaugh, Glenn and Kevin Chen. 1995. “Vote Turnout of Nineteenth Amendment Women: The Enduring Effect of Disenfranchisement.” *American Journal of Sociology* 100(4):972-996.

Wilson, James A., Christine Zozula, and Walter R. Gove. 2011. “Age, Period, Cohort and Educational Attainment: The Importance of Considering Gender.” *Social Science Research* 40(1):136-49.

Supplementary Readings

Riebler, Andrea and Leonhard Held. 2010. “The Analysis of Heterogeneous Time Trends in Multivariate Age-Period-Cohort Models.” *Biostatistics* 11(1):57-69.

Riebler, Andrea, Leonhard Held, Havard Rue, and Matthias Bopp. 2012. “Gender-Specific Differences and the Impact of Family Integration on Time Trends in Age-Stratified

Swiss Suicide Rates: Influence of Family Integration in Swiss Suicide Rates.” *Journal of the Royal Statistical Society: Series A (Statistics in Society)* 175(2):473–90.

Strumpf, Erin, Sam Harper, and Kaufman Jay S. 2017. “Chapter 14: Fixed Effects and Difference-in-Differences.” Pp. 341–68 in *Methods in Social Epidemiology (2nd Edition)*, edited by Jay S. Kaufman.

Week 13: Using Qualitative & Subjective Data (March 30)

Required Readings

Timonen, Virpi and Catherine Conlon. 2015. “Beyond Mannheim: Conceptualising How People ‘Talk’ and ‘Do’ Generations in Contemporary Society.” *Advances in Life Course Research* 24:1–9.

Hart-Brinson, Peter. 2014. “Discourse of Generations: The Influence of Cohort, Period and Ideology in Americans’ Talk about Same-Sex Marriage.” *American Journal of Cultural Sociology* 2(2):221–52.

Schuman, Howard and Willard L. Rodgers. 2004. “Cohorts, Chronology, and Collective Memories.” *Public Opinion Quarterly* 68(2):217–54.

Supplementary Readings

Dinas, Elias. 2013. “Opening ‘Openness to Change’: Political Events and the Increased Sensitivity of Young Adults.” *Political Research Quarterly* 66(4):868–82.

Griffin, Larry J. 2004. “ ‘Generations and Collective Memory’ Revisited: Race, Region, and Memory of Civil Rights.” *American Sociological Review* 69(4):544–57.

Schuman, H. and A. Corning. 2012. “Generational Memory and the Critical Period: Evidence for National and World Events.” *Public Opinion Quarterly* 76(1):1–31.

5 Academic Integrity

Copying, plagiarizing, falsifying medical certificates, or other forms of academic misconduct will not be tolerated. Any student caught engaging in such activities will be referred to the Dean’s office for adjudication. Any student abetting or otherwise assisting in such misconduct will also be subject to academic penalties. Students are expected to cite sources in all written work and presentations. See this [link](#) for tips for how to use sources effectively.

According to Section B.I.1.(e) of the Code of Behaviour on Academic Matters it is an offense “to submit, without the knowledge and approval of the instructor to whom it is submitted, any academic work for which credit has previously been obtained or is being sought in another course or program of study in the University or elsewhere.” By enrolling in this course, you agree to abide by the university’s rules regarding academic conduct. You are expected to be familiar with the [Code of Behaviour on Academic Matters](#) and [Code of Student Conduct](#), which spell out your rights and provide all relevant details on academic responsibilities at the University of Toronto.

6 Accessibility Services

It is the University of Toronto's stated goal to create a community that is inclusive of all persons and treats all members of the community in an equitable manner. In creating such a community, the University aims to foster a climate of understanding and mutual respect for the dignity and worth of all persons. Please see the University of Toronto Governing Council's Statement of Commitment Regarding Persons with Disabilities. In working toward this goal, the University has committed to supporting and facilitating the accommodation of individuals with disabilities so that all may share the same level of access to opportunities, participate in the full range of activities that the University offers, and achieve their full potential as members of the community.

Students seeking support must have an interview with a disability adviser to discuss their individual needs. In many instances it is easier to arrange certain accommodations with advance notice, so you are strongly encouraged to act as quickly as possible. To schedule a registration appointment with a disability adviser, please visit Accessibility Services or call 416-978-8060. The office is located at 455 Spadina Avenue, 4th Floor, Suite 400. Additional student resources for distressed or emergency situations can be found here. You may also contact the Health & Wellness Centre at 416-978-8030 or Student Crisis Response at 416-946-7111.

7 Equity and Diversity

The University of Toronto has a public commitment to equity and respect for diversity. All members of the learning environment in this course should strive to create an atmosphere of mutual respect. As the course instructor, I will neither condone nor tolerate behavior that undermines the dignity or self-esteem of any individual in this course and wish to be alerted to any attempt to create an intimidating or hostile environment. It is our collective responsibility to create a space that is inclusive and welcomes discussion. Discrimination, harassment, and hate speech of any kind will not be tolerated. Additional information on Equity and Diversity at the University of Toronto is available here.