Master of Science in Applied Economics – University of North Dakota

August 2016 – May 2019

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| Predictive Model Regressions Studied (and Acronym Glossary) | Explanation of econometric tests studied |
| OLS: Ordinary least squares regression model GLS: Generalized east squares regression model AR: Autoregressive model VAR: Vector autoregressive model MA: Moving average model ARMA: Autoregressive moving average model ADL: Autoregressive distributed lag model ARCH: Autoregressive distributed conditional heteroskedasticity model GARCH: Generalized autoregressive distributed conditional heteroskedasticity model 2SLS: Two stage least squared model GMM: Generalized method of moments SEM: Structural Equation Modeling for cross-sectional variation IV: Instrumental variables Step ahead forecast: MLE: Maximum likelihood estimation Anderson-Hsiao estimators Arellano-Bond difference GMM estimator CAPM: Capital asset pricing model DID & Anderson-Hsiao: Difference in difference model in lieu of experiment Probit, Logit, and Togit models for categorical variables. Fixed effects and random effects models for panel data | t test for hypothesis testing  Chi2 test for hypothesis testing  White test: for heteroskedasticity Breusch-Pagan test for heteroskedasticity Cook-Weisbert test for heteroskedasticity Durban Watson test for autocorrelation(serial correlation) in residuals Breush-Godfrey test for autocorrelation(serial correlation) in residuals Granger causality tests which time series predicts the other Chow test for structural break in time series Quandt likelihood ratio test for break in time series when not known Hausman test for endogeneity, when one predictor predicts another F test for Instrument Variable relevance Instrument exogeneity-overidentification test |

| Class | Description | Date |
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| Publication / Capstone Project | Did banking deregulation improve or worsen minority access to capital?  <https://www.linkedin.com/posts/jgfcpa_deregulation-and-minority-access-to-mortgage-ugcPost-6675029994177224704-VdSV> | December 2018 |
| Applied Public Economics – Econ 545 | Randomized experiments and the "Gold Standard" internal and external validity, the conditional expectation function (CEF) and the regression model. Best predictor, linear projection model and the best linear predictor and counterfactuals and the "fundamental problem of causal inference". Studied identification of causal effects under strong ignorability and the conditional independence or unconfoundedness assumption. Discussion of causal estimands (ATE, ATET, LATE). Studied model identification problems via over identification test of a model, introduced the Neyman-Rubin Potential Outcomes Framework. Studied endogeneity and Instrumental Variables (IV's), static panel data models, estimation and inference, the overlap assumption, regression adjustment, propensity score methods, matching methods, and identification of causal effects when strong ignorability does not hold. Studied methods of searching for causality by a more detailed discussion of identifying assumptions, SUTVA, exogeneity issues, Instrumental variables (IV) methods, control function approaches, difference-in-differences, regression discontinuity design: both "Sharp" and "Fuzzy", and various applications and discussion of falsification checks.  **TEXT: Mostly Harmless Econometrics. Angrist and Piskhke** | Spring 2019 |
| Demographic methods for economists – Econ 565 | Surveyed data sources. Used STATA to graph population structures. Studied life tables, standardizing population data for comparisons, the three fundamental demographic processes (fertility, mortality, and migration), growth rates, population projection methods, developing social science questions and relationship to economic analysis, and policy effects of demographic processes,  **Text: Newell, Colin, Methods & Models in Demography, First Edition, The Guilford Press (1990). ISBN: 9780898624519** | Summer 2018 |
| Topics in applied econometrics - Econ 510 | Time series models in financial markets were primary focus. Studied regressions using OLS, MLE, IV, GMM, AR, MA, ARMA, ARCH, GARCH, and Fama-French model. Studied problems of stationarity, random walk, breaks in time series, unit root, autocorrelation and partial autocorrelation. Studied movements of asset prices, market efficiency, model selection, distributed lag model, and analyzed with granger causality test, F-test, cross-sectional tests, Freson Harvey model for calculating alphas by industry, risk factors in security market, and the effect of investor sentiment on security prices, benchmark asset pricing models, Sharpe ratio, statistical properties of asset returns and the efficient markets hypothesis, empirical tests of asset pricing models (CAPM, APT, Intertemporal CAPM, Consumption CAPM), tests of conditional asset pricing models, value-at-risk models, models of time-varying expected returns and then consider models of time-varying risk, model returns and risk of multiple assets. Studied the matrix algebra behind Beta.  **Text: Financial Econometric Modelling by Stan Horn, Vance Martin, Peter Phillips and Jun Yu (Nov, 2015)**  **(2) Empirical Asset Pricing by Turin Bali, Robert Engle, and Scott Murray.**  **Publisher: Wiley; 1st edition (April, 2016, ISBN-13: 978-1118095041)** | Spring 2018 |
| Applied Economic Analysis – Econ 534 | Study of cross sectional, time series, and panel data. Interpreting coefficients of OLS, GLS, limited dependent variable models logit and probit, pooled OLS estimator, tobit, Heckman sample section models, one and two way fixed effects models, random effects models, IV models for panel data, difference in difference estimation, general IV regression model, and 2SLS estimation using goodness of fit, marginal effects, fixed versus random effects test, and causality test. Search for best model using all subset regression, stepwise regression, and Bayesian model averaging. Compared models using Bayes factors, Hausman test, instrument relevance test, instrument exogeneity-overidentification test. Studied bias in OLS, order condition with time series, SEM with time series and panel data, Anderson-Hsiao estimators, GMM, Arellano-Bond difference GMM estimator, diagnostic test for autocorrelation, collinearity, and overidentification, interaction variables, heteroskedasticity, omitted variable bias problem, latent variables, significance interpretations, and predictions. Used STATA to perform regressions and tests.  **Text: Berndt, E. R., 1991. The Practice of Econometrics: Classic and Contemporary, New York: Addison Wesley. ISBN 0‐201‐17628‐9**  **Text: Stock, J.H., and M. W. Watson. 2003. Introduction to Econometrics, New York: Addison Wesley. ISBN 0‐201‐71595‐3.**  **Text: Wooldridge, J. M. 2006. Introductory Econometrics, Mason, OH: Thompson South‐Western. ISBN 0‐324‐28978‐2** | Fall 2017 |
| Advanced Price Theory – Econ 504 | Theory of the consumer and producer, some basic welfare economics, externalities and monopoly, competitive markets, and other forms of imperfect competition. Preferences and marginal utility, production function, long run cost function, factors of production, diminishing return of a single production factor. Decisions under uncertainty, partial equilibrium analysis, income and substitution effects, demand relationship among goods, optimization problems, Lagrange method, constrained maximization. Elasticity, Euler’s Theorem, preferences and utility, diminishing MRS and diminishing marginal utility, indirect utility function.  **Text: Microeconomic Theory Basic Principles and Extensions, 12th Edition by Walter Nicholson & Christopher Snyder** | Fall 2017 |
| Forecasting – Econ 411 | Time series analysis, forecasting methods, forecast evaluation, model selection. AR, MA, ARMA, ADL, VAR, ARCH, and GARCH models. Optimal, plug-in, iterated forecasts for AR(1) models. Forecasting with lagging and leading indicators, step ahead forecasts. AIC, BIC, analyzing error terms for white noise, orthogonalizing errors. Trends, cycles, seasonality, causality, Granger causality tests, term structure theory, volatility, standard deviations, variance, autocorrelations and their graphs, Durban Watson test, Breush-Godfrey test, residual autocorrelations. Testing for breaks in time series with Chow test or Quandt likelihood ratio. Prediction commands in STATA, using dummy variables to handle seasonality, transforming time series from exponential to linear using natural logs, multiple regression comparisons using STATA graphics, importing data into STATA. Matrix equation of Beta and expected value of loss function.  **Text: Forecasting in Economics, Business, Finance and Beyond by Francis X Diebold.** | Spring 2017 |
| Advanced Macroeconomics – Econ 505 | Neoclassical growth regression model, deriving fundamental equation of the Solow growth model, concept of steady state, Harrod-Domar growth model, Easterly's Ghost, Solow's fundamental equation, stylized facts of growth. Intergenerational mobility economics, IS-LM framework, Phillips curve, production function, institutions effect on growth models. Read 43 papers and analyzed. Presented analysis of Solow growth model and other referee reports.  **Text: David Romer, Advanced Macroeconomics, MacGraw-Hill, fourth edition, 2011.**  **Text: Morris Davis. Macroeconomics for MBAs and Masters of Finance. Cambridge University Press, 2009.** | Spring 2017 |
| Econometrics – Econ 506 | Transforming data to get normal distribution. Summary statistics, expected value, variance, standard deviation, kurtosis, skewness, and elasticity. Heteroskedasticity and White & Breusch-Pagan & Cook-Weisbert tests and multicollinearity. Hypothesis tests, omitted variable bias, ANOVA, covariance, correlation, t-tests, goodness of fit R-squared and adjusted R-squared, sum of squares standard error of regression(SER). OLS, simple and multiple regressions, time series and dummy variables, non-linear regressions, first differences. Market alpha and beta. Used STATA for these regressions and tests.  **Text: Introduction to Econometrics, by James H. Stock and Mark W. Watson Publication Date: December 13, 2010** | Fall 2016 |
| Math for economists – Econ 416 | Matrix notation formula for beta, matrix algebra, expected value, and variance, college algebra, linear algebra, differential calculus, exponential, logarithmic, and exponential functions. Optimization problems with constraints. Utility theory and problems. Elasticity, Cobb-Douglas production function. LaGrange function, and Euler's equation.  **Text: Michael W. Klein, Mathematical Methods for Economics, 2nd edition. Addison Wesley, 2002.** | Fall 2016 |

MATHEMATICS

| Class | Credits | Date |
| --- | --- | --- |
| Probability and Statistics 1320 – UMSL | 3 | Spring 2016 |
| Elementary Linear Algebra 2450 – UMSL | 3 | Fall 2015 |
| Differential equations – STLCC | 3 | Fall 2014 |
| Calculus III – STLCC | 5 | Spring 2014 |
| Calculus II – STLCC | 5 | Fall 2014 |
| Calculus I – STLCC | 5 | Spring 2013 |
| Trigonometry – STLCC | 3 | Spring 2012 |
| College algebra – STLCC | 4 | Spring 2011 |