Dissertation Research

- **Dissertation Title: Impact of Great Recession on State Tax Revenues**

  My dissertation examines the question “How did the Great Recession affect state tax revenue collections in Virginia, in particular, and in the U.S. states in general?” It is widely known that the Great Recession was the severest downturn since the Great Depression. In my dissertation, I employ statistical and analytical tools to study trends in state tax revenues from the onset of the Great Recession in fiscal year 2008 until the end of fiscal year 2014.

  In essay #1, I examine whether Virginia and other states could have better planned for the extreme revenue shortfalls in the Great Recession and the anemic economic recovery that followed by employing Bayesian vector autoregression (BVAR) in their revenue forecasting. To establish a baseline, I perform vector autoregression (VAR) and vector error correction (VEC) modeling of Virginia state revenue data in accordance with frequentist statistical inference. I pivot to Bayesian statistical inference in making the case for estimating a BVAR model. Finally, I perform revenue forecasting based on the VAR and the BVAR with the prior knowledge that the BVAR produces better forecasts as demonstrated by Krol (2010) using California revenue data.

  In essay #2, I employ a form of event history analysis (also known as survival analysis) to study how states coped with tax revenue shortfalls in selecting and timing which taxes and/or fees to increase or decrease. I use multi-state Markov modeling that is used with panel data allowing for differentiation between states raising minor taxes first rather than raising major tax revenue categories, for example. I use data on net revenue actions from the National Association of State Budget Officers (NASBO). This essay finds that the Great Recession had a large impact on how U.S. states approached improving their fiscal conditions via change to net revenue actions. I establish that many states decided to instigate both minor and major net tax revenue actions early in the downturn rather than make incremental adjustments to tax revenue.

  In essay #3, I explore the uniqueness of the Great Recession and its aftermath, i.e., whether the revenue fluctuations during this time frame are indeed different from revenue fluctuations in previous business cycles. To do so, I employ the threshold autoregressive conditional heteroscedasticity model (TGARCH). TGARCH recognizes that revenue volatility declines when the economy is expanding and revenue volatility rises when the economy is contracting. Furthermore, a positive shock will have a smaller effect on volatility than a negative shock of the same magnitude. In addition, I will explore what characteristics states with relatively more volatile revenue streams possess: These characteristics cover political attributes of states and features of the various taxes concerned.

Other Research Projects

I have initially undertaken the first two projects as term paper assignments for econometrics classes and the third project is borne of my immense curiosity for the unlimited possibilities that data science has to offer in solving public policy problems.

- **Financial Access of the Low Income: Characteristics of the Unbanked in the Survey of Financial Activities and Attitudes**

  This paper examines data from the Survey of Financial Activities (Survey) to establish a profile of the unbanked in the United States. The unbanked are people who do not possess a savings or checking account. The Survey was conducted in 1998 to 1999 by the Office of the Comptroller of
the Currency, the federal regulator of national banks, to better understand why millions of people in the United States rarely or never conduct financial activities through banks. The survey generated new data on financial activities of the unbanked, the costs they incur, their attitudes towards banks, and any prior experiences with banks. With a multinomial logit model, I model the decision to be unbanked, have a checking account, have a savings account, and have both types of accounts. I find statistically significant evidence that blacks are 16.9% less likely than whites to hold just a checking account. Using a bivariate probit model, I find that older people, high income earners, and females are less likely to be unemployed, while those with poor English ability, the unemployed, and those on welfare are more likely to be unemployed. The paper originated from a paper written for an applied microeconometrics course I took at GWU.

- **Energy and Public Policy: Natural Gas Industry in Texas**

  Natural gas, unlike coal or gasoline, is a clean-burning fossil fuel. In the era of volatile oil prices and concern for the environment, natural gas is touted as the alternative fuel. The purpose of this project is to study the interaction between industrial natural gas prices, natural gas consumption, and industrial sector activity in Texas. The project can be broken down into four parts. One, I will examine the time series properties of individual data series. Then, I will find patterns and trends in the data and test for stationarity and order of integration. Two, I will model monthly industrial natural gas consumption in Texas from 1989 to 2015 using a vector autoregression (VAR) framework. I will perform a test for appropriate lag length of system as well as residual diagnostic tests and tests for model/system stability. Three, I will examine the system for potential cointegration relationships. Four, I will interpret cointegrating relations and test for weak exogeneity. This research project emanated from research done for an applied time series course I took at GWU.

- **Data Science and Public Policy: Linking credit histories with health data**

  It is well-known in the banking industry and its regulators that a primary reason for a loan credit application rejection is bad credit history stemming from delinquent medical bills. With the use of credit histories on over 180 million adult Americans, one can perform a large-scale event history analysis to study how credit deterioration is linked with poor health. The data can be obtained from large financial institutions who have access to credit histories to virtually all adult Americans with formal means of credit. Empirical findings can be used to help bridge the gap between business practice and social well-being: perhaps there are ways in which financial institutions can still profit while sick individuals can better manage their finances with dignity.

**Possible Future Directions in Research**

I see several possible extensions to the finished dissertation. In the immediate future, one could extend the BVAR analysis in Essay #1 to other U.S. states. It is perhaps a tedious exercise, but it would be interesting to see if patterns across time and states do emerge. For future research originating from Essay #2, I could find data of higher frequency and run similar models. I could also extend the study by lengthening span of years studied as time goes by. With tools of Big Data, finer geographic units as well as higher frequency data can be used to extend Essay #2. Sometime in the future, Essay #3 could be extended to account for significant measures to modernize state tax systems have been put in place.