Fall 2017

Final Project Guidelines and Due Dates

**Introduction:** The goal of this course is to both learn and apply data analysis methods in R. To that end each student will, over the course of the semester, complete an econometric analysis project. You will be responsible for formulating an econometric question of interest, identifying appropriate data sources, cleaning, processing, and analyzing data to answer your research question. This work will be completed over the course of the semester using the R methods learned in lecture and homework. You will also be partnered with a Federal Reserve Board staff economist to help guide and assist you with your economic analysis.

**To ensure that progress is being made on the project throughout the semester students will have interim due date for project milestones.** There are two major milestones. The first is the project check in which is due Friday, October 20th. At this point you will have formulated a question, found appropriate data and begun extracting useful analysis. You will not be presenting your own work, instead you will provide a write up to one of your classmates who will use it to make a short (10min) presentation of your material. This method of presenting a colleague’s work will help you to better understand how to write technical papers and code that other people can follow, a key component of the peer-reviewed research process. (This is also the format used at several economic conferences, including those hosted by the National Bureau of Economic Research).

At the end of the semester each student will give a longer presentation of their own work and turn in a written report. The deadlines throughout the semester will help you build up each section of the final report so that hopefully at the end you can compile everything with minimal additional work.

**Goals:** The goals of this project are two-fold.

* Students will carry out econometric analysis from start to finish including: data cleaning, validation, plotting, analysis, modelling, and presentation
* Students will create a high quality presentation and codebook which can be used for future graduate study or professional applications

**Rubric:** The final write-up will include the following sections:

1. **Introduction**
   1. State the economic question you intend to investigate.
   2. Discuss why this question is economically significant by providing some background to your research.
   3. Explicitly lay out what hypothesis/hypotheses will be tested in your project.
   4. Provide a brief summary of at least one other economic paper on your research topic. You are not expected to understand everything in the paper, but you should be able to summarize what question the authors were trying to answer and what data they used in the process. (When looking through papers, focus especially on the abstract, introduction, data sources, and conclusion).
   5. Write out the regression specification you intend to use.
2. **Data Description**
   1. Describe your data. You will want to answer the following questions:
      1. What data source(s) are you using?
      2. Who publishes them?
      3. What does the data cover?
      4. Why is this data appropriate for answering your economic question?
      5. Does the data have a cross-sectional, time series, or panel structure?
      6. What is the unit of observation in each dataset?
      7. What is the time period covered by the data?
      8. (if applicable) What variables did you use as a basis for merging data sources?
   2. Describe the key economic variables:
      1. What are the dependent variable(s) you are using?
      2. What are the independent variables that allow you to test your hypothesis? Explain why these variables allow you to do test your hypothesis.
      3. Explain any independent control variables you use and why they are necessary.
   3. Include a brief description of any data cleaning issues you encountered.
      1. How did you deal with missing observations? Does this introduce any bias into your analysis?
      2. Did you encounter any outliers? Did you remove them or keep them in your sample?
      3. Did you encounter any issues while merging?
   4. Show some summary statistics for your data
      1. How many observations are there?
      2. What is the range/mean/median for some of your most significant variables?
3. **Analysis**
   1. This section will include derived tables, plots, and models with explanation and commentary on the relevance and significance of the results.
   2. You should create at least three plots to illuminate relationships that you find in your data.
      1. Each plot should have appropriate axis labels and titles.
      2. Each plot should be accompanied by text that walks the reader through what the chart shows and what you learn from the chart.
   3. You should create at least two tables that show some illuminating conditional statistics for your data.
   4. You should restate you regression equations, explicitly mentioning all the variables in your data.
   5. You should have a well formatted and self-contained table of regression results for each regression run.
4. **Conclusion**
   1. A description of the major takeaways of the analysis you performed (i.e. the answer to your economic question).
   2. A brief discussion of some further analysis you could do to further strengthen your results.
5. **References**
   1. You need to cite any economic papers that you reference as well as any R packages that you use.

The final project will be worth a total of 100 points. The following metrics will be used to determine your grade. Late work will not be accepted. The more work you put into the project along the way the easier the semester will be.

* Sep. 15th, Project proposal – 5 points
* Sep. 29rd, Code for loading/cleaning/validation – 10 points
* Oct. 13th, Plots and Summary Statistics – 10 points
* Oct. 20th, Check-in Presentation materials due
  + Write-up – 15 points
* Oct. 27st, Check-in Presentations delivered in class
  + Presentation – 5 points
* Nov. 17th, Regression – 5 points
* Nov. 28th, Final Project Submission
  + Write-up + code – 30 points
  + Presentation – 20 points

**Due Dates:**

* **September 15, 2017** – Submit a detailed project proposal. This should include:
  + A one page discussion of the background for your economic question. You should briefly discuss the analysis of at least one other paper that is related to your project.
  + Your economic question should be stated clearly and succinctly. It should also be stated in a way that makes clear what variables you will be trying to use. For example: *In my project I will explore whether the great recession led to an increase or decrease in divorce rates controlling for income, race, education, and location. It is unclear what effect I would see. I might expect an increase in divorce rates since the recession was a great stress on many marriages but at the same time getting a divorce is expensive and so I might see no effect or a delayed effect.*
  + Provide some overview of the econometric methodology you intend to use in your project.
  + You should briefly discuss what data you intend to use.
* **September 29, 2017** – Submit code used for data loading, cleaning, and validation. Your code should:
  + Load in your data from a file/multiple files.
  + Deal with missing observations and variable recoding.
  + Merge any data sets that need merging
  + Produce summary statistics
  + Be easy to read - follow good style guidelines and include appropriate comments
  + Be able to be run by someone else
  + Datasets you are using must be explicitly defined and url location of downloaded data from the internet must be given in the comments.
* **October 13, 2017** - Plots and Summary Statistics. Submit four plots and/or tables, (at least one of each), that show substantive information about the data set that will help you address your economic question.
* **October 20, 2017** – Submit check-in presentation materials.
  + Your check-in materials should cover parts 1 and 2 of the rubric above (Introduction and Data Description)
  + You are expected to submit a short technical write-up that explains the central question your final paper will answer and how your dataset will help you answer that question. At a minimum it should include:
    - Your question and why it is an important question to answer
    - The data set you are using and the datasets you used to build it
    - Where you sourced your data from
    - Why this data will help you answer your question
    - Key summary statistics
    - Graphs/Tables as appropriate to help elaborate on the above
  + You will also submit **all code that you used to prepare the data**, including (but not limited to) any merges, reshapes, summarizations, etc that you performed to make your data ready for presentation. It is expected that if we download your data untouched, run it through your R code, and only your R code, the end result will be your final dataset. The person presenting your data will use this code to explain how you cleaned your data in R, so you will need to follow good coding standards and style including indenting your code and commenting your code.
  + Your write-up for this due date must be in the form of an Rmarkdown .Rmd file, and the corresponding pdf file generated from the Rmarkdown.
    - This .Rmd document must contain all the code needed to take your analysis from raw data to the generation of plots and summary statistics that will be shown when your project is presented.
    - You do not need to show all of your code in the pdf document, since it will be visible in the .Rmd file
    - Your code will be graded on the following criteria:
      * Reproducibility, if we give your code the raw data you were given by your economist, do we get the same results?
      * Code formatting and readability. Can people read your code and easily understand what you are doing? Is your code concise? How clear and useful are your comments?
      * Be sure to test your code to ensure that it runs correctly as we will be working with your economist to ensure that your .Rmd file, when pointed to the raw data provided to you, creates the same output
    - The write-up portion of your pdf will be graded on the following:
      * Formatting –Did you include graphs and R output where necessary/appropriate? Do the graphs, code, and output included in the document add to the message and understanding or are they an unnecessary distraction?
      * Content – Does your content flow logically from topic to topic, does this paper do an effective job in setting the stage for the final project by providing us with background on your question, relevant data, etc. Do you include all of the topics discussed above?
      * Validity and Readability – Does the project make sense, does your dataset make sense to use in answering your question? Do your cleaning methods make sense?
* **October 27, 2017** – Check-in presentations
  + You will be given the pdf and .Rmd from another student of our choosing. Using these files, you will prepare a PowerPoint presentation, no more than 10 minutes, which covers at least the following topics:
    - What the central question is
    - Where the data came from
    - Relevant summary statistics
    - How R was used to prepare the data set, including specific data manipulation packages and functions used
  + As above, you are not expected to provide any results from analysis. This is an overview of the central question and data used to answer that question, along with specifics on how R is being used to prepare the data.
  + As noted above, any graphs and/or tables you use in your presentation must be pulled straight out of the Word document that you are given. You cannot create any visual aids independently to explain the data. The only “original” material that will be in your PowerPoint presentation will be the bullet points on the slides.
  + The presentation is expected to cover the data/central question and the R code in equal amounts (ie, dedicate about 5 minutes to data presentation, and 5 to the R code used).
  + For your presentation, you will be graded based on how you present the information you are given (i.e. you will not lose points if you are assigned a paper that included no graphs, or incomplete code). The grade for your presentation will be made up of two categories:
    - Oral Delivery
      * Do you know the presentation and understand the material?
      * Are you able to answer basic questions from audience?
    - Written PowerPoint
      * Does your presentation flow from topic to topic?
      * Does your presentation cover all the aspects of the project covered in the write-up?
      * Does the presentation make sense?
* **November 17, 2017** – Regressions. Submit the results of at least one regression relevant to your analysis with an accompanying paragraph explaining the significance and meaning of the regression and its results.
* **November 28, 2017 (note this is a Tuesday)** – Submit final project. This will include:
  + A write up of your work. The write-up must be completed in Rmarkdown and the .Rmd file as well as the knit pdf document is required for submission.
    - Your write-up should include all sections, 1-5 of the above rubric
    - You will be graded on reproducibility, readability, and flow, similarly to the check-in assignment
  + A slide presentation of your results to give to the class. These slides should be in the form of a Beamer presentation (created via Rmarkdown). You must also provide the .Rmd file for your slides.
    - Your slide presentation should document your entire project and should be a summary of the longer pdf document you are handing in as well
    - Note that your presentation should focus more on the regressions and results as the data cleaning aspect of your project was already covered in the project check-in assignment
    - Be sure to include at least 2 plots in your presentation
  + You will be given 12 minutes to present your materials to the class after which the audience will have the opportunity to ask questions
    - The presentation is your chance to show off your research to everyone else in the course, be sure to come prepared!