Econometrics Tutorials

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MT 2019

Tutorials will take place on Thursdays from 3-6pm in the Lodge Seminar Room of Lady Margaret Hall. Work is due at noon on the day of the tutorial. Either submit a physical copy to my pigeonhole at Lady Margaret Hall, or email a digital copy to `francis.ditraglia@lmh.ox.ac.uk`. Please scan in black-and-white to cut down on file size and improve legibility.

Vacation Assignment

Assignment

1. Complete the problems in "`stats-review-questions.pdf`."
2. Complete the problem set for week zero: "`ps0.pdf`," which covers matrix algebra.

Hints/Suggestions

1. This assignment will not be marked, but try to solve as many problems as you can. Don't be discouraged if you find some of them difficult. I will provide full solutions to these exercises next week.
2. If you get stuck on the statistics problems, it may help to consult the following references:
   (a) `econ-103-slides.pdf`
   (b) `econ-103-lecture24.pdf`
   (c) `random-variables-handout.pdf`
3. If you get stuck on the matrix algebra questions, it may help to consult these references:
   (a) "`Greene - Appendix A (Matrix Algebra).pdf`"
   (b) "`Cameron - Matrix Algebra Review.pdf`"

Tutorial #1 – 17 October

Assignment

1. Look over the solutions to the matrix problems (PS #0) and the statistics review questions, flagging anything that you found confusing so we can discuss in the tutorial.

2. Submit solutions to PS #1 problems 1, 2, 3(c), and 3(d)(i).

3. Read the following documents and come prepared to discuss: "`Cameron & Trivedi.pdf`," "`Wooldridge.pdf`," and "`Koenker & Hallock.pdf`." I'll email you the pdfs.

Hints/Suggestions

1. I suggest solving 1(b) before 1(a). Then you can just plug in $x = 1$.

2. The wording of 1(c) is a little confusing. Here's a restatement of the question: "Let $Z = 1000X + 1000Y$. What is the conditional expectation of Z given that $X = 1$?"

3. The notation on the problem set is somewhat imprecise *vis-a-vis* random variables versus their realizations and conditional expectation as a *random variable* versus the *realization* that that random variable takes on. We'll discuss in the tutorial.

Tutorial #2 – 24 October

Assignment

1. Show that:

   (a) $\sum_{i=1}^{n}(x_i - \bar{x})^2 = \sum_{i=1}^{n}(x_i^2 - \bar{x}^2)$

   (b) $\sum_{i=1}^{n}(x_i - \bar{x})(y_i - \bar{y}) = \sum_{i=1}^{n}(x_i y_i - \bar{x}\bar{y})$

2. Complete PS #2 Problem 1(i) and 1(ii).

3. Using your solutions to the above, show that:

   (a) $\widehat{\beta}_1 = \beta_1 + \bar{u} - (\widehat{\beta}_2 - \beta_2)\bar{x}$

   (b) $\widehat{\beta}_2 = \beta_2 + \dfrac{\sum_{i=1}^{n}(x_i - \bar{x})u_i}{\sum_{i=1}^{n}(x_i - \bar{x})^2}$

4. Complete PS #2 Problem 1(iii) using the expressions for $\widehat{\beta}_1$ and $\widehat{\beta}_2$ from 3(a) and 3(b) above.

5. Complete PS #2 Problem 1(v).

6. Complete PS #2 Problem 2(a)–(e).

7. Complete PS #2 Problem 4.
8. Spend a few minutes thinking about the following hypothetical essay question:

   > *Discuss the relevance of heteroskedasticity and the Gauss-Markov Theorem for applied work in Economics.*

   You don't have to submit anything for this.

During the Tutorial We'll start by discussing the essay question on least squares, least absolute deviations, and quantile regression that we didn't have time for last time. I'll then leave some time for you to ask questions about the past week's lecture material and/or the problems I've assigned. After the break, my plan is for us to solve PS#2 Problems 1(iv), 2(f), and 3 together. Time permitting, we'll discuss problems 5 and 6 and the essay question I asked you to think about in advance. If we run out of time, we'll talk about these next time.

No Tutorial on 31 October: Happy Halloween!

Tutorial #3 – 7 November

Assignment

1. PS #3, problems 1, 2, 3, and the first half of 4: i.e. everything *except* the parts marked "(Weak Instrument)"
2. This is a review question on conditional expectation. Let $X \sim \texttt{Bernoulli}(1/2)$ and suppose that $Y|X$ follows a $\texttt{Bernoulli}(1/3)$ distribution if $X = 1$ and a $\texttt{Bernoulli}(2/3)$ distribution if $X = 0$.
   (a) Write out the joint distribution of (X, Y) in a 2×2 table. Are X and Y independent? How can you tell?
   (b) Using the preceding part, calculate the marginal distribution of Y.
   (c) Calculate $E[Y]$ two ways: first using the law of iterated expectations and second using your answer to the preceding part. Check that they agree.
   (d) What is the probability distribution of $E[Y|X]$?
3. Questions for Discussion (think about them, but don't submit anything)
   (a) Consider the regression results from Problem #1 of PS #3, in which the characteristics of a house are used to predict its price.
      i. The estimated slope for *bdrms* has a standard error of 9.01. In light of this, is reasonable to report the slope coefficient 13.85 to two decimal places? Why or why not?
      ii. Can you think of a way to alter the regression model to make better use of the number of bedrooms in a house to predict its price?
   (b) What is the meaning of u_i in the linear regression $y_i = \beta_1 + \beta_2 x_i + u_i$? How is it related to x_i?

Hints/Suggestions

1. Problem #2 on PS #3 leaves out an assumption that you will need to solve the problem: assume that the S non-overlapping groups are formed *completely at random*—i.e. independently of (y_i, x_i, u_i)—with the specified group sizes n_s. For example, if $S = 2$, $n_1 = 30$, and $n_2 = 70$ then we randomly partition the 100 total observations into groups of size 30 and 70.

2. Remember that $E[Y|X]$ is function of X *only* and hence a *random variable* in its own right. If you get confused, write $E[Y|X] = g(X)$. The problem statement tells you everything you need to know to figure out what g is.

Tutorial #4 – 14 November

TBA

Tutorial #5 – 21 November

TBA

Tutorial #6 – 28 November

TBA

Tutorial #7 – 5 December

TBA