

Very Tentative Introductory Syllabus

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This is a very tentative reading list. I hope to modify it in response to your suggestions and as you help me with topic selection. You also will note that I emphasize my own work in the “required reading” section, not because I think it is the best, but rather because the treatment is much simpler than available elsewhere. In most cases, if you have the aptitude, there is much more sophisticated discussions available and you may prefer those, although I will expect to be familiar with those aspects I discuss.

Books

There are no required books for this class.

These days there is so much information on the web, that for some of you books may be superfluous. I frequently find that *Wikipedia* is often a good place to go for reference purposes. I am aware (and somewhat amused) by the fact that it has never taken my more than a few seconds of DuckDuckGo to find a pdf of any econometrics textbook, including my own!

I would also recommend the “WhINE” (What is new in econometrics) at the NBER website – <http://www.nber.org/minicourse3.html>.

Imbens, G. and Wooldridge, J. (2007a). What’s new in econometrics? <http://www.nber.org/minicourse3.html>

To be honest, my smarter friends find these notes extremely valuable. I honestly find them frequently very confusing, but I leave that up to you.

Also please be warned that you should not expect to read all (or even most) of what is below. I will announce what readings are required ahead of time.

“Required Readings” will have an asterisk *.

Below is a list of books I found most useful as reference, while preparing this class. *Caveat Emptor*. I would definitely check out the books first, especially if you are on a tight budget.

- Cameron, A. and Trivedi, P. K. (2005). *Microeconometrics: Methods and Applications*. Cambridge University Press
This book may be helpful to some, although much of the material is covered in the STATA manuals.
- Davidson, R. and MacKinnon, J. G. (2004). *Econometric Theory and Methods*. Oxford University Press
- Wooldridge, J. M. (2002). *Econometric Analysis of Cross Section and Panel Data*. The MIT Press, Cambridge, Massachusetts
- Johnston, J. and DiNardo, J. (2013). *Econometric Methods*. John DiNardo, Ann Arbor, MI, 4.01th edition

I will provide an on-line copy of the book on coursetools so you don’t have to buy it. (Just don’t share it with tons of people, I still have fantasies about finishing the next edition.) The mathematical level of the book is much lower than other graduate textbooks, and it is not as encyclopedic as other textbooks. I also wince a bit at my discussion of non-parametric regression; my views on the subject have evolved since I wrote that material.

1 Introductory Stuff

1.1 Problem Set: The Role of the DGP, and an RCT

1.2 A tiny bit of “philosophy.”

I find that a *little bit* of philosophy helps me out a lot. While we won’t do much with Bayes, I think it is helpful to understand the logic of Non-Bayesian Inference.

1. Imbens, G. and Wooldridge, J. (2007a). What’s new in econometrics? <http://www.nber.org/minicourse3.html>[Lecture 7, Bayesian Methods] I read this and can’t understand why anyone is interested, but I am a really bad judge of what others find interesting. One thing I do agree with, however, is that if one is going to do complicated structural models, Bayesian methods can help a lot.
2. *DiNardo, J. (2010). Introductory remarks on metastatistics for the practically minded nonbayesian regression runner. In T. C. Mills and K. Patterson, editors, *Palgrave Handbook of Applied Econometrics*, volume 2. Palgrave Macmilan.

This has discussion of frequentist versus Bayesian inference.¹ Key points to think about:

- (a) What is the key difference between Bayesians and non-Bayesians about what “probability” is.
- (b) Why does pre-specified research design matter to a non-Bayesian?
- (c) From a severe testing point of view, why are “double-blind” trials desirable?

Things you can safely ignore if you wish. The first, because it is merely an illustration of how bad research can be. The second, because it discusses how “severity” can be used in the context of Bayesian estimation, which we will not discuss:

- (a) Case Study 1. The example of “Medication Overuse Headache”
- (b) Section 8.1 Bayesian doesn’t have to mean “not severe”

3. Gelman, A. and Robert, C. P. (2012). Not only defended but also applied:the perceived absurdity of bayesian inference. *American Statistician*, page (to appear).

This paper could be viewed as a “response” to the above article (although obviously it was not intended to be so.) Can be skipped if you have no interest in Bayesian inference. Optional.

4. Poirier, D. J. (1995). *Intermediate Statistics and Econometrics: A Comparative Approach*. MIT Press, Cambridge, MA Not the latest book on Bayesian Econometrics, but a useful place to start (if you have lived your life as a frequentist.) Don’t let the word “Intermediate” in the title fool you. It was, for me, a bit of work. It also nicely compares and contrasts the Bayesian and Classical approaches (although he comes down firmly on the Bayesian side.) Optional.

5. Freedman, D. A. (1995). Some issues in the foundation of statistics. *Foundations of Science*, 1(1), 19–39. Accessed October 12, 2012 at http://mangellabs.soe.ucsc.edu/sites/default/files/16/freedman_antibayes.pdf

An interesting discussion from an “apostate”-Bayesian. Optional.

6. DiNardo, J. and Lee, D. S. (2010). Program evaluation and research designs. Working Paper 16016, National Bureau of Economic Research

This has a discussion of various research designs and some discussion of the difference between “structural” versus “ex post evaluation” or “non-structural” evaluation.

¹In the interest of full disclosure, at least one “real” Bayesian has skimmed the paper and provided a vehement criticism of my discussion. See http://andrewgelman.com/2010/06/hey_dude_ya_don/ but don’t miss his postscript.

1.3 Off the Beaten Path – Very Optional

These should be ignored unless you are really interested and have a high threshold for pain.

- Bottke, W. F., Vokrouhlický, D., and Nesvorný, D. (2007). An asteroid breakup 160 million years ago as the probable source of the K/T impactor. *Nature*, **449**(6), 48–53 This is the article that combines a non-frequentist use of probability produced with a decidedly frequentist approach. Optional.
- Peirce, C. S. (1958). Collected papers. In A. Burks, editor, *Collected Papers*, volume 7–8. Harvard University Press, Cambridge, MA [7.182 and 7.231] According to Stephen Stigler (the son of the economist Stigler) Charles Saunders Peirce was the first to do a blinded, randomized controlled experiment. His reward in life was to die penniless using his library to provide fuel for heat in the winter ☹. Optional.
- Mayo, D. G. (1996). *Error and the Growth of Experimental Knowledge*. Science and Its Conceptual Foundations. University of Chicago Press, Chicago Optional.
- Mayo, D. G. (2003). Severe testing as a guide for inductive reasoning. In H. E. Kyburg, Jr and M. Thalos, editors, *Probability Is the Very Guide of Life: The Philosophical Uses of Chance*, pages 89–117, Chicago and LaSalle, Illinois Optional.

Perhaps more than you ever want to know about the philosophical debate on “severe testing.”

2 Simulation (with the delta method as an example)

One of the things I will do in this class, is give a variety of assignments using Monte Carlo methods. As I will use STATA, you will need to learn to use the `simulate` command. Because this command is a bit obscure, I will also provide a podcast with a discussion of how to use it.

2.1 Problem Set: Intro to Monte Carlo

2.2 Readings

- Cameron, A. and Trivedi, P. K. (2005). *Microeconometrics: Methods and Applications*. Cambridge University Press[page 231-232] Delta Method
- Cameron, A. and Trivedi, P. K. (2005). *Microeconometrics: Methods and Applications*. Cambridge University Press[page 410-416,957-959] Pseudo–random number generators
- Cameron, A. and Trivedi, P. K. (2005). *Microeconometrics: Methods and Applications*. Cambridge University Press[Chapter 12]

This discussion is far more comprehensive than anything I will try, but it is also a well written discussion.

- *Johnston, J. and DiNardo, J. (2013). *Econometric Methods*. John DiNardo, Ann Arbor, MI, 4.01th edition[Chapter 12] Simulation I have made this a “required” reading, but if you have more sophisticated treatments you prefer they will cover more than all of the points I cover here.
- Smart, F. (2012). Econometrics by simulation. <http://www.econometricsbysimulation.com/p/stata.html> Accessed on 20 October 2012

I haven’t gone through this in detail, but it has a discussion of various aspects of STATA that are helpful for simulation including some discussion of MATA (which, unfortunately, is execrably documented.)

3 The Randomized Controlled Trial – An Introduction

- ***Fisher, S. R. A. (1935).** *Design of Experiments*. Oliver and Boyd, Edinburgh, London[page 1 - 26] A must read for its concise and practical philosophical ideas and for the classic example of the “Lady Tasting Tea.” Other parts of the book (for example, where he excoriates statisticians for emphasizing the “advanced” aspects of the permutation first introduced by Fisher himself in this book). Available at CTools.
- ***Johnston, J. and DiNardo, J. (2013).** *Econometric Methods*. John DiNardo, Ann Arbor, MI, 4.01th edition[Chapter 3, A Special Two Variable Relationship] A discussion of randomized controlled trials and the permutation test. If you are curious, you might compare this discussion to Chapter 2, which is ostensibly on the same topic, but very different.
- ***Hopper, P. A. and Hopper, D. A. (1997).** Principals of design. In R. Langhans and T. Tibbitts, editors, *Plant Growth Chamber Handbook*, north central regional research publication no. 340, iowa agriculture and home economics experiment station special report no. 99 13. http://www.controlledenvironments.org/Growth_Chamber_Handbook/Plant_Growth_Chamber_Handbook.htm[Pages 179–183] This is a book discussing randomized control trials in the setting of “growth chambers”. Although I am not interested in growth chambers, I think it is useful to see how randomization and treatment effect heterogeneity is thought about in “the real world.” This will be available on CTools if you do not DuckDuckGo it yourself.
- ***DiNardo, J. and Lee, D. S. (2010).** Program evaluation and research designs. Working Paper 16016, National Bureau of Economic Research Although I will not yet discuss the comparisons of the RCT to other research designs, nor discuss “structural modeling”, I will talk about the first part of the chapter, namely why we like randomized controlled trials, and types of evaluation exercises. Different parts of this paper will be covered at different times during the semester.
- ***Kent, D. M., Rothwell, P. M., Ioannidis, J. P. A., Altman, D. G., and Hayward, R. A. (2010).** Assessing and reporting heterogeneity in treatment effects in clinical trials: a proposal. *Trials*, **11**, 85 This will have a lot of medical buzzwords, but it is still a valuable read. In particular, compare their handling of treatment effect heterogeneity (which they call TEH) to the way economists do. For policy purposes, which approaches make more sense.

4 Regression Discontinuity and Nonparametrica

I hope to have a couple of class discussions and a problem set on these two papers

- ***Card, D. and Giuliano, L. (2013).** Does gifted education work? for whom? Unpublished working paper, University of California, Berkeley and University of Miami. A wonderful example of combining the RD with other contrasts. Available at CTools.
- ***Card, D. E., Dobkin, C., and Maestas, N. (2004).** The impact of nearly universal insurance coverage on health care utilization and health: Evidence from medicare. NBER Working Paper 10365, National Bureau of Economic Research A nice example of a paper I would have loved to have written.

4.1 A brief review of RD

- Lee, D. S. (2008). Randomized experiments from non-random selection in u.s. house elections. *Journal of Econometrics*

The paper that started it all, and observed and formalized the link between regression discontinuity and randomized controlled trials.

- *Lee, D. S. and Lemieux, T. (2009). Regression discontinuity designs in economics. Working Paper 14723, National Bureau of Economic Research

See also:

- Lee, D. S. and Lemieux, T. (2010). Regression discontinuity designs in economics. *Journal of Economic Literature*, **48**(2), 281–355. Also available as NBER working paper 14723 at <http://www.nber.org/papers/w14723.pdf>

An extremely nice review of regression discontinuity designs and nonparametric issues of estimation. A must read if you are trying to evaluate a Regression Discontinuity Design.

4.2 “Nonparametrica”

- *Lee, D. S. and Lemieux, T. (2010). Regression discontinuity designs in economics. *Journal of Economic Literature*, **48**(2), 281–355. Also available as NBER working paper 14723 at <http://www.nber.org/papers/w14723.pdf>

In my opinion, one of the most sensible and practical discussions of nonparametric estimation (in the regression discontinuity context)

5 Blinder–Oaxaca decompositions

I must confess that for years, I found this a rather “boring” topic. However, the strengths and limitations of the current focus on Treatment Effect Heterogeneity are much easier to understand in this context.

- *Firpo, S., Forin, N., and Lemieux, T. (2010). Decomposition methods in economics. In O. Ashenfelter and D. E. Card, editors, *Handbook of Labor Economics*, volume 4. North Holland, Amsterdam. Also available as NBER working paper 16045 <http://www.nber.org/papers/w16045.pdf>

An amazingly detailed, comprehensive, and intelligent discussion of “decomposition methods.” If you understand all of this discussion, consider yourself an expert.

5.1 Problem Set: The Costs and (possibly small) Benefits of Heterogeneous Treatment Effects

5.2 DFL

- Horvitz, D. and Thompson, D. (1952). A generalization of sampling without replacement from a finite population. *Journal of the American Statistical Association*, **47**, 663–685

The original re-weighting paper.

- DiNardo, J., Fortin, N., and Lemieux, T. (1996). Labor market institutions and the distribution of wages, 1973–1993: A semi-parametric approach. *Econometrica*, **64**(5), 1001–1045

A lot harder to read than it should be.

- Gelbach, J. B. (2009). When do covariates matter? and which ones? and how much? Unpublished working paper, Department of Economics, University of Arizona, New Haven, CT. Available at http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1425737

This paper is one of the first papers to give standard errors for Blinder/Oaxaca decompositions!

- Firpo, S. (2007). Efficient semiparametric estimation of quantile treatment effects. *Econometrica*, **75**(1), 259 – 276

It took a long time, but some one smarter than I am proves that DFL works, gives standard errors of quantile estimates, etc.

- Johnston, J. and DiNardo, J. (1997). *Econometric Methods*. McGraw–Hill, Cambridge, MA, Fourth edition[Section 11.4]

A lot less sophisticated than anything else written on the subject, but may make things easier to understand if you are having trouble.

- *DiNardo, J. (2002). Propensity score reweighting and changes in wage distributions. Unpublished manuscript, University of Michigan. Available as <http://www-personal.umich.edu/~jdinardo/bztalk5.pdf>

A mind-blowingly unsophisticated “proof” that there is no magic in reweighting procedures versus regressions. Superseded by a more sophisticated demonstration by Pat Kline (Univ of Mich, Ph.D). Available at my web-site.

- Kline, P. (2011). Oaxaca-blinder as a reweighting estimator. *American Economic Review: Papers & Proceedings*, **101**(3), 532–537. Available at <http://pubs.aeaweb.org/doi/pdfplus/10.1257/aer.101.3.532>

The adult version of my short paper. Also points out the “doubly robust” properties of weighted Blinder Oaxaca regressions.

- Hirano, K., Imbens, G., and Ridder, G. (2003). Efficient estimation of average treatment effects using the estimated propensity score. *Econometrica*, **71**(4), 1161–1189

This paper demonstrates various properties of IPW estimators in the Average Treatment Effect context.

5.3 Influence Functions

- Essama-Nssah, B. and Lambert, P. J. (2011). Influence functions for distributional statistics. ECINEQ WP 2011–236, Society for the Study of Economic Inequality (ECINEQ), Palma de Mallorca, Spain and www.ecineq.org. Available at <http://www.ecineq.org/milano/WP/ECINEQ2011-236.pdf>

Works out the influence functions for most distributional statistics you can think of, and catalogs them nicely.

5.4 RIF-regression

- Firpo, S., Fortin, N. M., and Lemieux, T. (2009). Unconditional quantile regressions. *Econometrica*, **77**(3), 953–973. Also available as NBER Technical Working Paper 339, <http://www.nber.org/papers/t0339.pdf> The paper that invented it all.

6 Bootstrap Methods and Permutation Tests

- Cameron, A. and Trivedi, P. K. (2005). *Microeconometrics: Methods and Applications*. Cambridge University Press[Chapter 11] Bootstrap Methods
- *Johnston, J. and DiNardo, J. (1997). *Econometric Methods*. McGraw–Hill, Cambridge, MA, Fourth edition[Chapter 11] Bootstrap

The discussion in this chapter is extremely elementary.

7 Quantile Regression

I will cover this *very briefly* as most of you have probably seen more detailed expositions elsewhere.

- Koenker, R. and Hallock, K. F. (2001). Quantile regression. *Journal of Economic Perspectives*, **15**(4), 143–156 A gentle introduction cowritten by the “creator” of the quantile regression, Roger Koenker (a nice guy and a UM Ph.D. grad)
- Cameron, A. and Trivedi, P. K. (2005). *Microeconometrics: Methods and Applications*. Cambridge University Press[Section 4.6 and 4.76]
- Johnston, J. and DiNardo, J. (1997). *Econometric Methods*. McGraw–Hill, Cambridge, MA, Fourth edition[Chapter 13.11.2] An extremely short discussion of CLAD (Censored Least Absolute Deviations). Probably not worth the bother.
- Powell, J. L. (1984). Least absolute deviations estimation for the censored regression model. *Journal of Econometrics*, **25**, 303–325 The original CLAD. Despite being in *Econometrica* the first bit is very clear and lucid.
- Chay, K. Y. and Powell, J. L. (2001). Semiparametric censored regression models. *The Journal of Economic Perspectives*, **15**(4), 29–42 A nice discussion and application in an appropriate context.
- Imbens, G. and Wooldridge, J. M. (2007b). What’s new in econometrics? lecture 14: Quantile methods. Technical report, National Bureau of Economic Research. Accessed 1 October 2012 http://www.nber.org/WNE/lect_14_quantile.pdf

8 Taking Heterogeneous Treatment Effects a bit more Seriously, Part I

8.1 APEs, ASF, etc

- Viet, C. N. (2008). A note on estimation of the average treatment effect and average partial effect in nonlinear models. *Economics Bulletin*, **15**(15), 1–13. Available at <http://www.accessecon.com/pubs/EB/2008/Volume15/EB-08010018A.pdf>
This paper presents a clear exposition of all the permutations of APES, ATETs, etc.
- Johnston, J. and DiNardo, J. (1997). *Econometric Methods*. McGraw–Hill, Cambridge, MA, Fourth edition[Chapter 13] Discrete and Limited Dependent Variable Models
Again an all too elementary discussion with a bit of discussion about “quasi–true” parameters and unobserved heterogeneity (aka heteroskedasticity) in simple binary dependent variable models
- Norton, E. C., Wang, H., and Ai, C. (2004). Computing interaction effects and standard errors in logit and probit models. *Stata Journal*, **4**(2), 154–167(14). Available at <http://www.stata-journal.com/sjpdf.html?articlenum=st0063>
A paper that may help you avoid making a mistake in interpreting probit and logit coefficients.
- Wooldridge, J. M. (2002). *Econometric Analysis of Cross Section and Panel Data*. The MIT Press, Cambridge, Massachusetts[Section 2.2.5] Average Partial Effects
- Wooldridge, J. M. (2002). *Econometric Analysis of Cross Section and Panel Data*. The MIT Press, Cambridge, Massachusetts[Section 15.7] Specification Issues in Binary Response Models
- Wooldridge, J. M. (2002). *Econometric Analysis of Cross Section and Panel Data*. The MIT Press, Cambridge, Massachusetts[Chapter 15] Average Partial Effects
- Wooldridge, J. M. (2004). Estimating average partial effects under conditional moment independence assumptions. Unpublished paper, Michigan State University, East Lansing, Michigan. Available at <http://www.cemmap.ac.uk/wps/cwp0403.pdf>
The discussions by Wooldridge are significantly deeper and more comprehensive.

- Busso, M., DiNardo, J., and McCrary, J. (2009). New evidence on the finite sample properties of propensity score matching and reweighting estimators. Working Paper 3998, Institute for the Study of Labor (IZA)

Useful as a summary of different types of reweighting and matching estimators and suggests that matching does not dominate IPW.

- Sekhon, J. S. (2008). The neyman-rubin model of causal inference and estimation via matching methods. In J. Box-Steffensmeier, H. Brady, and D. Collier, editors, *The Oxford Handbook of Political Methodology*, Oxford Handbooks of Political Science Series. Oxford University Press. Accessed October 12, 2012 <http://sekhon.berkeley.edu/papers/SekhonOxfordHandbook.pdf> Optional. A view of matching from a different perspective.

- Neyman, J., Dabrowska, D. M., and Speed, T. P. (1923). On the application of probability theory to agricultural experiments. essay on principles. section 9. *Statistical Science*, **5**(4), 465–472. Translated and edited by D. M. Dabrowska and T. P. Speed from the Polish original, which appeared in *Roczniki Nauk Rolniczych Tom X (1923)* 1-51 (*Annals of Agricultural Sciences*) The translation appeared in *Statistical Science*, Volume 5, Number 4, 1990, pages 465–472. Neyman’s last name at this time was Splawa-Neyman

Of historical interest. The original statement of what would later be rediscovered by Rubin. To me, the basic model makes much more sense in Neyman’s very specialized context than it does in the “Rubin Causal Model” framework.

- Lehmann, E. L. and Hodges Jr., J. L. (1964). *Basic Concepts of Probability and Statistics*. Holden-Day, San Francisco. In the 1964 edition, see section 9.4 A short nice explanation of Neyman’s model (later to be re-christened the “Rubin Causal Model”) before its reinvention by Rubin.
- Rosenbaum, P. and Rubin, D. (1983). The central role of the propensity score in observational studies for causal effects. *Biometrika*, **70**(1), 41–55 The paper that (re) started it all. Optional, but it is a fun exercise to see their one sentence caveat about the “strong ignorability assumption” in their discussion of randomized experiments and non-randomized (observational) studies.

8.2 The Non-central Role of the Propensity Score in Observational Studies

- Wooldridge, J. M. (2011). Thoughts on heterogeneity in econometric models. Slides for Presidential Address of the Midwest Economics Association, accessed October 1, 2012 at http://web.grinnell.edu/MEA/Web2011/Wooldridge_mea_pres_lecture_final_r1.pdf (Note that there is an annoying space between “Web” and “2011” in the URL even if you can’t see it.)
- DiNardo, J. (2012a). Dimensions of treatment effect heterogeneity. With the help of Justin McCrary and Matias Busso. All errors are mine. Accessed 1 October, 2012 <http://www-personal.umich.edu/~jdnardo/chapterstuff.pdf>

A screed that has been eliminated from at least two different papers. ☺

- DiNardo, J. and Lee, D. S. (2010). Program evaluation and research designs. Working Paper 16016, National Bureau of Economic Research

Has a discussion of “included variable bias” and argument against using matching estimators, except in very rare circumstances, *inter alia*.

9 Taking Heterogeneous Treatment Effects a bit more Seriously, part 2

9.1 Problem Set: The Whitehall Study

9.2 ATE, LATE, and all that

- Imbens, G. and Angrist, J. (1994). Identification and estimation of local average treatment effects. *Econometrica*, **62**(2), 467–476
This paper defines the monotonicity assumption for LATE.
- Wooldridge, J. M. (1997). On two-stage least squares estimation of the average treatment effect in a random coefficient model. *Economics Letters*, **56**, 129–133
This paper discusses two stage least squares estimate of ATE (Average Treatment Effects) and such for the case of continuous or discrete covariates.
- Card, D. E. (2000). The causal effect of education on earnings. In O. Ashenfelter and D. E. Card, editors, *Handbook of Labour Economics*, chapter 30, pages 1001–1035. North Holland, Amsterdam
Appendix A has always struck me as the clearest exposition of how to interpret coefficients when one wants to treat them as random. The article itself, I think, puts random coefficients to the best use I have seen. Appendix B on measurement error is also useful.
- DiNardo, J. and Lee, D. S. (2010). Program evaluation and research designs. Working Paper 16016, National Bureau of Economic Research
Yup. This paper again. In one section we discusses how one gets from LATE to ATE. All of this section was done first by Heckman and if you want the originals (and there are many of them!) the references should be a good start.
- Heckman, J. J., Tobias, J. L., and Vytlacil, E. J. (2003). Simple estimators for treatment parameters in a latent variable framework. *Review of Economics and Statistics*, **85**(3), 748–755
- Heckman, J. J., Tobias, J. L., and Vytlacil, E. J. (2001). Four parameters of interest in the evaluation of social programs. *Southern Economic Journal*, **68**(2), 210–223
Two nice and clear papers about how one goes from LATE to ATE, etc. in the “normal” framework, and in a generalization using the Student-t distribution.
- Lee, L.-F. (1982). Some approaches to the correction of selectivity bias. *Review of Economic Studies*, **49**(3), 355–372
- Lee, L.-F. (1983). Generalized econometric models with selectivity. *Econometrica*, **51**(2), 507–512
Two papers on extending the “two-step” estimators using the student -t distribution with any of a possible large number of “degrees of freedom.”
- Heckman, J. J. (1990). Varieties of selection bias. *American Economic Review*, **80**, 313–318
A nice clear discussion of various “selectivity” corrections.
- Gronau, R. (1974). Wage comparisons – a selectivity bias. *Journal of Political Economy*, **82**(6), 1119–1143
- Heckman, J. J. (1976). The common structure of statistical models of truncation, sample selection, and limited dependent variables and a simple estimator for such models. *Annals of Economic and Social Measurement*, **5**, 475–492
- Amemiya, T. (1984). Tobit models: A survey. *Journal of Econometrics*, **24**(1-2), 3–61

- Johnston, J. and DiNardo, J. (1997). *Econometric Methods*. McGraw–Hill, Cambridge, MA, Fourth edition[Section 14.12]

Where it all got started. Gronau was the first to identify “selectivity bias” and proposed an intuitive way to handle it when one only has grouped data. Heckman took Gronau’s model to micro–data and extended things quite considerably. The section from my book is derivative of the above but it may have slightly fewer typos.

9.3 An Example, The Whitehall Experiments

This section is optional, but for the interested they explain the background for the problem set questions.

- Rose, G., Hamilton, P. J., Colwell, L., and Shipley, M. J. (1982). A randomised controlled trial of anti-smoking advice: 10-year results. *J Epidemiol Community Health*, **36**(2), 102–108

One interesting finding is that non–cancer causes of death were *higher* in the intervention group (i.e. who were more likely to quit smoking). See if you believe their explanation of the results (and contrast it to their discussion 10 years later.)

- Rose, G. and Colwell, L. (1992). Randomised controlled trial of anti-smoking advice: final (20 year) results. *Journal of Epidemiology and Community Health*, **46**(1), 75–77
- Rose, G., Tunstall-Pedoe, H. D., and Heller, R. F. (1983). Uk heart disease prevention project: incidence and mortality results. *Lancet*, **1**(8333), 1062–1066
- Rose, G. and Hamilton, P. J. (1978). A randomised controlled trial of the effect on middle-aged men of advice to stop smoking. *J Epidemiol Community Health*, **32**(4), 275–281

These papers describes the research design in some detail and some of the other results. Only for those with a high pain threshold.

10 Some Stuff about Standard Errors and Clustering

- Wooldridge, J. M. (2006). Cluster–sample methods in applied econometrics: An extended analysis. Unpublished paper, Michigan State University, East Lansing, Michigan. Available at <http://www-personal.umich.edu/~jdinardo/clusterextended.pdf> A comprehensive and sophisticated discussion. Available at C-Tools
- Moulton, B. (1990). An illustration of a pitfall in estimating the effects of aggregate variables on micro units. *Review of Economics and Statistics*, **57**, 334–338 A gentle introduction.
- Card, D. E. and Lee, D. S. (2004). Regression discontinuity estimation with random specification error. Working Paper 74, Center for Labor Economics, University of California – Berkeley
Although this focuses on the regression discontinuity case, it also has a nice discussion of the “cluster option” in STATA and what standard errors are discussed.
- Kloek, T. (1981). Ols estimation in a model where a microvariable is explained by aggregates and contemporaneous disturbances are equicorrelated. *Econometrica*, **49**(1), 205–207 A special case of the “clustering” problem, but a more straightforward application.
- DiNardo, J. (2012b). Some thoughts on the moulton problem. Accessed 1 October, 2012 http://www-personal.umich.edu/~jdinardo/general_moulton.pdf

My understanding of the issue circa 1996. It is a different (and not too popular) way to think about and “test” for problems for the standard error. I wouldn’t take the argument for the two–step approach described here as seriously as I did then. but this exposition is simple and has always helped me.

11 A light smattering of “Structural” Models

References

- Amemiya, T. (1984). Tobit models: A survey. *Journal of Econometrics*, **24**(1-2), 3–61.
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