EC709 PS3. Quantile Methods

Iván Fernández-Val

Boston University

Due on October 17

Question 1: Returns to Schooling (Angrist, Chernozhukov and Fernandez-Val, 2004). In this question you are going to construct a confidence band for the conditional quantile effect of years of education using bootstrap using the dataset `census00.dta` from the U.S. 2000 census.

1. Run 19 quantile regressions of real log weekly wage (`logwk`) on years of schooling (`educ`), race (`race`), experience (`exper`) and experience squared (`exper2`) for the indexes $u \in \{0.05, 0.10, \ldots, 0.95\}$. Save the estimates of the coefficient of years of schooling, $\hat{\beta}(u)$, and the corresponding standard errors, $s(u)$.

2. Implement the following bootstrap algorithm:

   (a) Draw a bootstrap sample with replacement from the data.

   (b) Run 19 quantile regressions of real log weekly wage (`logwk`) on years of schooling (`educ`), race (`race`), experience (`exper`) and experience squared (`exper2`) for the indexes $u \in \{0.05, 0.10, \ldots, 0.95\}$ in the bootstrap sample.

   (c) Compute the bootstrap draw of the maximal t-statistic:

   $$t_{\max} = \max_{u \in \{0.05, 0.10, \ldots, 0.95\}} \frac{|\hat{\beta}^*(u) - \hat{\beta}(u)|}{s(u)},$$

   where $\hat{\beta}^*(u)$ is the estimate of the coefficient of years of schooling in the bootstrap sample.

   (d) Repeat steps (a)–(c) multiple times (200 or the number of times that your computer permits).

   (e) Estimate the 95% quantile of the maximal t-statistic, $c(0.95)$, as the 95% sample quantile of $t_{\max}$ across simulations.

   (f) Construct the 95% confidence band for the coefficient of years of schooling as

   $$CB_{0.95} = \hat{\beta}(u) \pm c(0.95)s(u).$$

3. Plot the estimate and confidence band for the coefficient of years of schooling. Give examples of hypotheses that you can test with the confidence band.

4. Repeat the analysis for 1980 and 1990 using the datasets `census80.dta` and `census90.dta` and produce a figure for the coefficients of years of schooling similar to the figure from the lecture notes.

[Hint: the package `boot` is very useful to implement the bootstrap. It has functionality for parallel computing.]

Question 2: Job Training Programs (Abadie, Angrist, and Imbens, 2002). In this question you are going to implement the quantile methods of Abadie, Angrist and Imbens (2002) and Chernozhukov and Hansen (2005) to carry out causal inference. In particular, you are going to estimate the quantile effects of the Job Training Partnership Act (JTPA) accounting for possible nonrandom selection into the program. The file `jtpa.dta` contains the data.[1] You should perform the analysis with the sample of men (`male = 1`) and report your quantile effects for the 9 indexes $u \in \{0.10, 0.20, \ldots, 0.90\}$.

1. Estimate the quantile effects of JTPA (`trained`) on earnings (`earnings`) by quantile regression without accounting for nonrandom selection into the program. Plot and compare estimates with and without controlling for other covariates.

2. Implement the IVQR estimator of Chernozhukov and Hansen (2005) to obtain the quantile effects of JTPA on earnings controlling for nonrandom selection into the program using the random offer of participation (`offer`) as an instrument. Plot and compare estimates with and without controlling for other covariates.

3. Obtain pointwise confidence intervals for the quantile effects of JTPA on earnings robust to weak instruments.

4. Implement the LQTE estimator of Abadie, Angrist and Imbens (2002) to obtain the local quantile effects of JTPA on earnings controlling for nonrandom selection into the program using the random offer of participation (`offer`) as an instrument. Plot the estimates without controlling for other covariates.

5. Compare and explain the differences between the estimates that you obtained in parts (1), (2) and (4).

[1] See Abadie, Angrist and Imbens (2002) for a description of the variables.