

Econometrics - Advanced Methods

1. Mata introduction

- A. Read the Mata introduction slides; play around with the Mata introduction do-file to get familiar with Mata.
- B. Use the automobile dataset to calculate the OLS point estimates, its covariance matrix, p-values, confidence intervals and all the results shown in the header of Stata's regress output. See bottom of the Mata introduction do-file for more information.
- C. Compare your estimates with Stata's `regress` command.

2. Illustration of LLN and CLT

- A. Replicate the left part of the figure on lecture slide 1-36 to illustrate convergence in distribution. (Hint: use loops - see Intro to Mata)
- B. How could you illustrate convergence in probability? You only need to change your statistic slightly. What do you observe as n gets large?
- C. Finally, let X be standard normally or uniformly distributed and illustrate convergence in distribution.

3. Linear regression model (OLS and FWL)

- A. Use the dataset "ols.dta" and consider the following population model

$$y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + u$$

with $cov(x_1, u) = 0$ and $cov(x_2, u) = 0$.

- 1. Use the Frisch-Waugh-Lovell theorem to estimate β_1 and compare your result with the $\hat{\beta}_1$ that you get from a multiple regression of y on x_1 and x_2 .
 - 2. Are the effects of x_1 and x_2 comparable? If not, can you make them comparable?
- B. Transfer "ols.dta" to Mata (`. putmata y x1 x2`). Use the projection matrix and the residual maker to estimate β_1 . If you think two regressors are too boring, you can generate as many additional variables as you like (of course, for all of them we know the true $\beta = 0$).

Hint:

```
: mata Xnew=rnormal(rows(x1),5,0,1)
: mata X=(x2,Xnew,J(rows(x1),1,1))

. getmata xnew*=Xnew
. regress y x1 x2 xnew1 xnew2 xnew3 xnew4 xnew5
```

- The first line generates five new variables (independent standard normals). The second line puts them together with the already existing variable x_2 from “ols.dta” and a constant in the matrix X . Now, you can use X to construct P_X and M_X , and to factor/partial out x_2 , our new variables and a constant.
- The next-to-last line (a Stata command - period instead of colon!) sends the new variables, generated in Mata, to Stata.
- You can use the last line to compare your Mata results with Stata.