Computing Assignment VIII

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March 15, 2018

Wald Test

- Our distance metric will be $\frac{\hat{\beta}_1}{\hat{\beta}_2} - \frac{.3}{1.1}$
- using the delta method, this is asymptotically distributed as follows:

$$N(0, R' n \hat{V}_{\hat{\theta}}^{-1} R))$$

$$R' = (0, \frac{1}{\beta_2}, -\frac{\beta_1}{\beta_2^2})$$

$$\hat{\theta} = \frac{\hat{\beta}_1}{\hat{\beta}_2}$$

Simulations

Our exact variance of the ratio is: 0.029

Our asymptotic variance is: 0.026

Our bootstrapped variance is: 0.278

Based on these, we expect to reject the null hypothesis too often with the bootstrap Wald test.

Actual wald distributions with entire sample: W_test = 1.258

Boostrap Wald statistics

- Bootstrap centered on the correct null hypothesis (95th percentile of bootstrap values, percent reject using the correct distribution)
- wtest_reject = 0.2
- wtest2_cval = 3.544676
- Bootstrap centered on the sample mean null hypothesis (95th percentile of bootstrap values, percent reject using the correct distribution)
- wtest2_reject = 0.04725
- waldq4 = 0.0033518

We reject the null too often with bootstrap methods.

First and second bootsrap tests

Question 4: Modified Wald test with bootstrap variance estimator (boot_var $= 0.0342643$)

Question 5: Since the 95th percentile of the bootstrap Wald is so far out, we naturally fail to reject the null.

The data frame, “crossval” (400×8)

- id: (100×1) identifies observation chosen for out-sample
- train/test: (100×99)/(100×1) randomly selects in-samples (99 obs) and out-samples (1 obs)
- model: (200×1) identifies the regression model (short or long)
- reg: (200 rows, number of columns undefined) contains regression results from the short and long regressions
- mse_in/mse_out: (200×1)/(200×1) calculates mean square error from in-sample and out-sample residuals (stacked into (400×1) by “gather” function)

Mean squared errors

- in-sample MSE is lower for the long regression since adding regressors decreses MSE
- out-sample MSE is lower for long regression, though not by much
- DGP is $y = 1.2 + 0.3X_1 + e$ so X_2 doesn't add much explanatory power (overfitting the data)
- in-sample MSE is lower for both models because it takes average of 99 squared residuals rather than just 1
- the out-sample MSE is the same for the full data as in the simulation
- $\frac{1}{n}\sum_{i=1}^{n} \tilde{e}_i^{\,2}$ (3.46) exactly describes the process in the simulation

reg1.in	reg2.in	reg1.out	reg2.out	reg1.out.all	reg2.out.all
1.198	1.164	1.25	1.241	1.25	1.241