

**ECON 7010: Econometric Analysis
Fall 2013**

Assignment #2

Question 1:

You may want to use the results from our class overheads on “Partitioned and Partial Regression” to help you to answer this question.

Suppose that we have a linear multiple regression model,

$$\begin{aligned} y &= X\beta + \varepsilon \\ &= X_1\beta_1 + X_2\beta_2 + \varepsilon, \end{aligned}$$

where all of the usual assumptions are satisfied, except that $E(\varepsilon) = X_1\gamma$. That is, the mean vector for the disturbances is a linear combination of a subset of the regressors.

Let b_1 and b_2 be the OLS estimators of β_1 and β_2 . Obtain the expressions for $E(b_1)$ and $E(b_2)$, and interpret your results.

Question 2:

Consider the following simple linear regression model, with a single regressor, and *no intercept*:

$$y_i = \beta x_i + \varepsilon_i \quad ; \quad i = 1, 2, \dots, n.$$

Suppose that all of our usual six assumptions are satisfied. Now, consider the following three estimators for β :

$$\tilde{\beta} = \left[\frac{1}{n} \sum_{i=1}^n (y_i) \right] / \left[\frac{1}{n} \sum_{i=1}^n (x_i) \right]$$

$$\hat{\beta} = \frac{1}{n} \sum_{i=1}^n (y_i / x_i)$$

and
$$b = \left[\sum_{i=1}^n (y_i x_i) \right] / \left[\sum_{i=1}^n (x_i^2) \right].$$

- (a) By what name do you know the last of these estimators? Write down its variance (*i.e.*, the variance of its sampling distribution).
- (b) Are $\hat{\beta}$ and $\tilde{\beta}$ linear estimators? Are they unbiased?

- (c) Obtain the sampling distributions for $\hat{\beta}$ and $\tilde{\beta}$.
- (d) Which of these estimators produces a fitted line that passes through the sample mean of the data?
- (e) Calculate the variance of each of the other two estimators. Can you rank the three estimators in terms of their precision?

Question 3:

Suppose that the classical regression model applies but that the true value of the constant is zero. Compare the variance of the least squares slope estimator computed without a constant term with that of the estimator computed with an unnecessary constant term.