

# Economics 6352: Applied Econometrics

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Practice Midterm I – Answers

1. (a)  $\hat{\beta}_1 = \frac{\sum (x_{1t} - \bar{x}_1)(y_t - \bar{y})}{\sum (x_{1t} - \bar{x}_1)^2}$
  - (b) Yes it is biased. It is possible to discover the bias by replacing  $y$  with the true DGP. Doing this gives  $E(\hat{\beta}_1) = \beta_1 + \frac{\sum (x_{1t} - \bar{x}_1)(x_{2t} - \bar{x}_2)}{\sum (x_{1t} - \bar{x}_1)^2}$ , where the second term is the bias. Unless  $x_1$  and  $x_2$  are uncorrelated,  $\hat{\beta}_1$  will be biased.
  - (c) One way to check for functional form is to use Ramsey's RESET test. This test estimates in model under consideration, obtains the fitted values and uses higher order values of the fitted values in an expanded equation. In this situation one the expanded equation would be  $y = \beta_0 + \beta_1 x_1 + \delta_1 \hat{y}^2 + \delta_2 \hat{y}^3 + w$ . If  $\delta_1$  and  $\delta_2$  were found to be jointly significant, this would lead to a rejection of the null.
2. (a) Measurement error in the independent variable leads to consistent estimates of the parameters if the covariance between the observed exogenous variable and the measurement error is zero. This measurement error increases the variance. However, if the covariance between the observed unobserved exogenous variable and the measurement error is zero, OLS estimation will give biased and inconsistent estimates.
  - (b) Measurement error in the dependent variable leads to unbiased estimates if the measurement error has zero mean. Also, here the measurement error results in a larger error variance and thus larger variances of the OLS estimates.
3. (a) If there is no personal income tax exemption, we are not in World War II and if the birth control pill is not available, then we can expect that the general fertility rate would be 95.87 births per 1,000 women of childbearing age.
  - (b) For every average real dollar value increase in the personal tax exemption, we can expect that there will be an additional .083 births per 1,000 women. During WWII, the number of births per 1,000 was about 24 fewer than outside of the WWII period. The introduction of the birth control pill reduced the number of births per 1,000 women of childbearing age by 31.59, *ceteris paribus*.
4. (a) 0.073
  - (b)  $0.073 - 0.0058 + 0.034 \approx 0.101$
  - (c) The addition of two lags causes a cost in two degrees of freedom. This is because for 1913 we would need data from 1912 and 1911 which we do not have in this data set.

5. (a) Running a regression of one nonstationary variable on another can lead to a spurious regression.
- (b) The intercept suggests that change in the general fertility rate is negative, if the change in the average real dollar value of personal tax exemption is zero. Now, an increase in  $pe$  is estimated to lower  $gfr$  contemporaneously. This different result casts doubt on our earlier analysis.