# ECON 5350 Final Exam

## Fall 2019

1. (120 pts) Consider the following Keynesian model of consumption for a representative agent:

$$C_t = \beta_1 + \beta_2(Y - T)_t + \beta_3 W_t + \varepsilon_t,$$

where $t = 1, \ldots, T$ indexes time in quarters of a year, $C_t$ is consumption in thousands of dollars, $(Y - T)_t$ is disposable income in thousands of dollars, and $W_t$ is wealth in thousands of dollars.

(a) (20 pts) Write the regression model in matrix form and derive the OLS estimator for the special (and unlikely) case where disposable income and wealth are uncorrelated.

(b) (20 pts) Describe two methods to jointly test that the marginal propensity to consume (MPC) is 0.75 and autonomous consumption is zero. What assumptions on the error terms are necessary for the tests to be valid?

(c) (20 pts) The consumption data are suspected of being seasonal. Develop a method using dummy variables to filter out and test for seasonality.

(d) (20 pts) Write down the spline version of the consumption function using one of the two explanatory variables above and explain why you chose that variable. Then describe how you estimate the spline regression and test whether the spline is appropriate.

(e) (20 pts) Next, assume you have either missing data or measurement error on individual wealth. Write a brief paragraph explaining, as the econometrician, how you would deal with the problem and the impact on your estimator. [NOTE: You can choose either data problem, but you are NOT allowed to choose the topic that you presented in class.]

(f) (20 pts) Now assume you have heteroscedasticity such that the first half of the sample has one error variance and the second half of the sample has a different (but constant) error variance. In addition, the errors are serially correlated according to a first-order moving average (MA) process: $\varepsilon_t = \mu_t + \theta\mu_{t-1}$, where $\mu_t \sim iidN(0, \sigma_\mu^2)$ with MA coefficient $\theta$. Derive the variance-covariance matrix of the errors and discuss two possible estimation strategies for the MPC.

2. (80 pts) Now consider an alternative Classical model of consumption behavior for an infinitely lived representative agent that chooses consumption and leisure each quarter. The intertemporal first-order conditions for these two choice variables with separable utility are:

$$C_t^{\gamma} = \beta E_t\left[C_{t+1}^{\gamma}(1 + r_{t+1})\right] \qquad \text{(consumption tradeoff)}$$

$$w_t = C_t^{\gamma} L_t^{\varphi}. \qquad \text{(labor-leisure tradeoff)}$$

There are two unknown parameters: the curvature parameter on consumption ($\gamma$) and the curvature parameter on leisure ($\varphi$) in the utility function. Assume the discount factor ($\beta$) is known. As the econometrician, you have time series data on consumption ($C_t$), interest rates ($r_t$), wage rates ($w_t$), and hours worked ($L_t$). If necessary, you can assume that expectations of consumption and the interest rate, $E_t C_{t+1}$ and $E_t r_{t+1}$, follow naïve expectations such that expectations of the future time periods can be replaced with past values (i.e., $C_{t-1}$ and $r_{t-1}$).

(a) (20 pts) Develop an estimation strategy for $\gamma$ and $\varphi$ using only the labor-leisure tradeoff and discuss the necessary assumptions.

(b) (20 pts) Develop an estimation strategy for $\gamma$ using only the intertemporal consumption tradeoff and the Gauss-Newton algorithm.

(c) (20 pts) Develop an estimation strategy for $\gamma$ using only the intertemporal consumption tradeoff and non-linear least squares (NLS).

(d) (20 pts) Describe how to use GMM to jointly estimate $\gamma$ and $\varphi$ using both first-order condtions.