Economics 125 Fall 2009
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**Problem Set #2**

**I. Cobb-Douglass Production Function**

To illustrate the estimation of the Cobb-Douglass production function, we use data on inputs and output for the U.S. from 1948 to 2008 provided in **cdpf.dta**[1] in the course folder. Assume that the production function takes the form

$$Q = AK^{\alpha}L^{\beta}e^{\varepsilon}$$

where Q is output, A is some constant, K is the capital stock and L is the employment. $\alpha$ and $\beta$ can be estimated by taking logs of both sides.

a. Estimate the Cobb-Douglass production function and report the summary statistics.

b. Use the F-test to test at the 5% significance level the hypothesis that $\alpha = \beta = 0$.

c. Use the F-test to test at the 5% significance level the hypothesis that the Cobb-Douglass production function exhibits constant returns to scale (i.e, $\alpha + \beta = 1$). Report the relevant equation and summary statistics.

d. Use the F-test to test at the 10% significance level the hypothesis that the capital elasticity $\alpha$ is equal to the labor elasticity $\beta$. Report the relevant equation and summary statistics.

e. Calculate the beta coefficients to determine whether capital stock or labor force is more important in causing variations in output. Use the command

**summ loutput llabor lcapital**

to find the standard deviations of all the variables.

**II. Money**

Back in the 1950s Baumol and Tobin developed the famous square-root formula for money demand.

$$M^* = \sqrt{\frac{Y \cdot tc}{2i}}$$

Transactions demand for money increases with the cost of transactions *tc* and with the level of income *Y*, but decreases when the interest rate *i* rises. Taking logs we have,

$$\ln M^* = \frac{1}{2}\ln tc - \frac{1}{2}\ln 2 + \frac{1}{2}\ln Y - \frac{1}{2}\ln i$$

Assuming a partial adjustment model where

$$\ln M_t = \ln M_{t-1} + \lambda(\ln M_t^* - \ln M_{t-1})$$

gives us the following regression equation

$$\ln M_t = \alpha + \beta \ln M_{t-1} + \gamma \ln Y_t + \delta \ln i_t + \varepsilon_t$$

Data for this exercise is available in **money.dta**[2]. All the variables (except the interest rate) are in real per capita terms.

a. According to the Baumol-Tobin square root rule of money demand, what is the theoretical elasticity of money demand with respect to the interest rate? with respect to income?

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[1] The file contains annual data from 1948 to 2008 on four variables: YEAR, OUTPUT(real GDP), LABOR (employment) and CAPITAL (capital stock).

[2] The file contains quarterly data from 1959:1 to 2009:2 on six variables: YEAR (year of observation), QTR (quarter of the observation), GDP (real per capita GDP), M2 (real M2 per capita), M1 (real M1 per capita), and INT (3-month treasury bill interest rate, secondary market).

b. Estimate the above money demand equation and report the summary statistics. You can use M1 or M2. What is the estimated elasticity of money demand with respect to the interest rate. What is the estimated elasticity of money demand with respect to income? (You need to do a little algebra here).
c. The Monetary Decontrol Act of 1980 probably changed the fundamental money demand relationship. Test the hypothesis of no structural change in the demand for money occurring after 1980 using an F-test. You will have to run a regression with pre-1980 data and with post-1980 data. Assume that the variance of the errors does not change.

**III. Current Population Survey**

We can examine the effect of gender and marital status on labor market earnings by examining current population survey data in **cpsmar09.dta**[3]. This contains data from March 2009 on a subsample of 7431 individuals.
a. Begin by estimating the following model which allows for no differences by gender or marital status.

$$LNWAGE = \alpha + \beta_1 ED + \beta_2 EX + \beta_3 EXSQ + \varepsilon$$

Are your estimate plausible? Why?
b. Now allow the intercepts to vary by gender. FE is a dummy variable which is 1 if the individual is female and 0 if the individual is male.

$$LNWAGE = \alpha + \alpha_F FE + \beta_1 ED + \beta_2 EX + \beta_3 EXSQ + \varepsilon$$

Using a reasonable level of significance, formulate and test the null hypothesis that there are no differences in the intercept terms for males and females.
c. Now allow the slope on education to vary by gender. Create a new variable which is the product of FE and ED and run the following regression.

$$LNWAGE = \alpha + \beta_1 ED + \gamma(FE \cdot ED) + \beta_2 EX + \beta_3 EXSQ + \varepsilon$$

Using a reasonable level of significance, formulate and test the null hypothesis that there are no differences in return to education for males and females.
d. Next examine whether marital status affects the statistical earnings function in a linear manner. The dummy variable MARR equals 1 if the individual is married with spouse present and is 0 otherwise.

$$LNWAGE = \alpha + \alpha_F FE + \alpha_M MARR + \beta_1 ED + \beta_2 EX + \beta_3 EXSQ + \varepsilon$$

Interpret estimates of $\alpha$, $\alpha_F$ and $\alpha_M$. Show that the effect of marital status on LNWAGE in this specification, given ED, EX and EXSQ, is the same for males and females. Within this specification, formulate and then test the null hypothesis that marital status has no effect on LNWAGE.
e. Now construct a new variable INFMAR = FE*MARR and run the following regression.

$$LNWAGE = \alpha + \alpha_F FE + \alpha_M MARR + \alpha_{FM} INFMAR + \beta_1 ED + \beta_2 EX + \beta_3 EXSQ + \varepsilon$$

Interpret the parameter estimates of $\alpha$, $\alpha_F$, $\alpha_M$ and $\alpha_{FM}$. Formulate and test the null hypothesis that the effect of marital status does not depend on gender. How do you interpret this finding? Does it seem plausible?

[3] The file contains 7431 observations on six variables: ED (years of education), FE (dummy variable equal to 1 if female, 0 if male), MARR (dummy variable equal to 1 if married, 0 if not married), EX (years of experience), EXSQ (years of experience squared), and LNWAGE (log of weekly earnings).