

# Empirical Industrial Organization-Spring 2007

## Problem Set 2

### Cost/Production function estimation

**The due date for this assignment is March 22<sup>nd</sup>.**

#### 1. Deriving the Cobb Douglas cost function

Consider the following production function for a firm

$$q = zx_1^\alpha x_2^\beta$$

- i. State the cost minimization problem
- ii. Derive the conditional demand function
- iii. Derive the cost function

#### 2. Estimating a cost function (Nerlove)

Suppose that firm's technology is described by the following production function

$$q_i = z_i x_1^{\alpha_1} x_2^{\alpha_2} x_3^{\alpha_3}$$

where  $q_i$  is the quantity produced by firm  $i$ ,  $x_1$  is the labor used by the firm,  $x_2$  is the capital input, and  $x_3$  is the fuel consumption. The term  $z_i$  captures idiosyncratic differences in technology.

- i. Show that it is possible to write the cost function implied by this technology as

$$\log C_i = \nu_i + \frac{1}{r} \log q_i + \frac{\alpha_1}{r} \log p_{i1} + \frac{\alpha_2}{r} \log p_{i2} + \frac{\alpha_3}{r} \log p_{i3}$$

- ii. Read appendix B in Nerlove's paper and explain briefly the construction of the variables.

- ii. Estimate the unrestricted model using OLS. Explain why makes senses to use OLS in this case.

- iii. Consider again the unrestricted model

$$\log C_i = \beta_1 + \beta_2 \log q_i + \beta_3 \log p_{i1} + \beta_4 \log p_{i2} + \beta_5 \log p_{i3} + \varepsilon_i$$

Show that if impose the restriction  $\beta_3 + \beta_4 + \beta_5 = 1$  is equivalent to express the above cost function as

$$\log \frac{C_i}{p_{i3}} = \beta_1 + \beta_2 \log q_i + \beta_3 \log \frac{p_{i1}}{p_{i3}} + \beta_4 \log \frac{p_{i2}}{p_{i3}} + \varepsilon_i \quad (1)$$

- iv. Using the F-ratio test the homogeneity restriction
- v. Using equation (1) test the hypothesis of constant return to scale.

**3. Estimation of production function *a la* Olley and Pakes (mandatory for PhD student)**

- i. Read Trade Liberalization, Exit, and Productivity Improvements: Evidence from Chilean Plants by Nina Pavcnik.
- ii. Using data from the textiles and apparel sector from 1976 to 1986 (to be provided) replicate the results from Table 2 using first a balanced panel and then the full sample.
- iii. Using the productivity composition suggested in Olley and Pakes replicate the results in table 3.