

Estimating Productions

'How is the production process represented?'

Pick a functional form that represents the production process

1) → Can production be accomplished with only one input?

Produce: cheese

↳ Not very likely

Inputs: Milk
Labor
Time
Machine

} multiple inputs

2) → Does production require at least some of every input?

↳ More likely

↳ For, cheese, yes.

So if yes to #1

Linear function may make sense

$$Q = a + b_1 M + b_2 \text{Labor} + b_3 K$$

If yes to #2

Cobb-Douglas function is commonly used

$$Q = a M^{b_1} L^{b_2} K^{b_3}$$

⇒ That some milk, labor, capital, and any other inputs are required to produce the good.

↳ the marginal product of each input depends on the other inputs

Characteristics of Cobb-Douglas Production Function

Characteristics of Cobb-Douglas Production Function on the other inputs

→ Coefficients have similar intuition as w/ demand function

$b_2 \Rightarrow$ 'labor elasticity of production'

$b_3 \Rightarrow$ 'capital elasticity of production'

→ Returns to Scale

- If the sum of the exponents $> 1 \Rightarrow$ IRS
($b_1 + b_2 + b_3$)
- If the sum of the exponents $= 1 \Rightarrow$ CRS
- If the sum of " " " $< 1 \Rightarrow$ DRS

Estimating Short Cost Functions

- When written as a function of quantity produced

$$C = f(Q)$$

$$(C = 20000 + 200Q + .5Q^2)$$

it is assumed that the input prices and other conditions are held constant

- When using historical data to estimate a cost function, other components besides quantity of output must be considered, because of their ability to influence costs

→ Estimated cost function is comprised of two-parts

$$C = f(Q, x_1, x_2, \dots, x_n)$$

Relationship
between
 $C \neq Q$

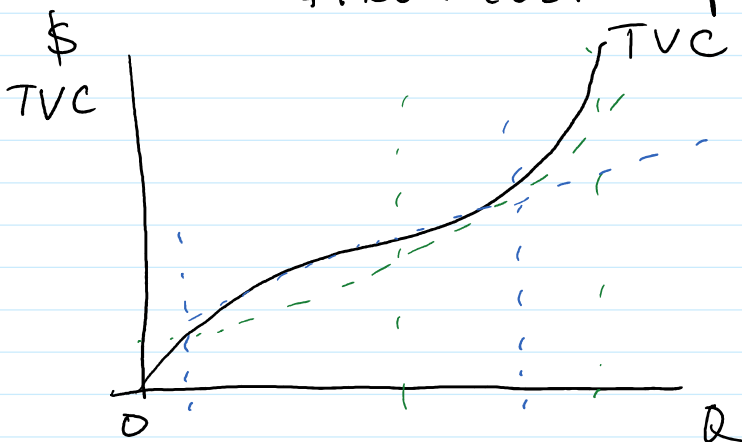
Effects of
other indep. variables

Data Considerations for Estimating SR Cost Fns.

- Including opportunity costs
- Depreciation of fixed assets
- Allocate the costs to the period production occurred
- length of time
- costs are corrected for inflation

Function Form SR Cost Functions

- Total Variable Cost is often used because of difficulty allocating fixed cost to production periods



- often TVC represented w/ 'S' shape (cubic function)

- linear function
 $TVC = a + b_1Q$

- Quadratic function
 $TVC = a + b_1Q + b_2Q^2$

this functional form would look like:

→ $TVC = a + b_1Q + b_2Q^2 + b_3Q^3$

$$AVC \left(\frac{TVC}{Q} \right) = b_1 + b_2 Q + b_3 Q^2 + \frac{a}{Q}$$

$$MC \left(\frac{\partial TVC}{\partial Q} \right) = b_1 + 2b_2 Q + 3b_3 Q^2$$

the estimated function may look like

$$TVC = \hat{a} + \hat{b}_1 Q + \hat{b}_2 Q^2 + \hat{b}_3 Q^3 + b_4 X_2 + b_5 X_3 + \dots + \varepsilon$$

Functional
Relationship
between Q & TVC

controlling for the
effects of other
ind. vars.

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#2 Log-linear (Log-log) Model

$$Y_i = a X_{1i}^{\hat{b}_1} X_{2i}^{\hat{b}_2} X_{3i}^{\hat{b}_3} X_{4i}^{\hat{b}_4} X_{5i}^{\hat{b}_5} e^{u_i}$$

Y_i = Total Expenditures for each observation (i)

$X_{1i} \rightarrow X_{5i}$: Age, family size, years of education, income, # chronic problems, for each observation

Take natural log:

$$\ln Y_i = \ln \hat{a} + \hat{b}_1 \ln X_{1i} + \hat{b}_2 \ln X_{2i} + \hat{b}_3 \ln X_{3i} + \hat{b}_4 \ln X_{4i} + \hat{b}_5 \ln X_{5i} + u_i$$

Data Issues

→ Look for patterns in residuals

- Functional form
- autocorrelation
- omitted variables

→ Would we expect autocorrelation?

→ Multicollinearity

→ check correlation matrix

5 Dummy Variables & their Coefficients

Categorical Variables

- quantitative variables represent w/ number (whose scale doesn't matter)

- If use binary 0 & 1

(or any two numbers)
then we're talking about

dummy variables

Note: To avoid perfect collinearity use 1 less variable than categories

Male or Female → use 1 variable

0 - Male
1 - Female

Quarters → use 3 variables

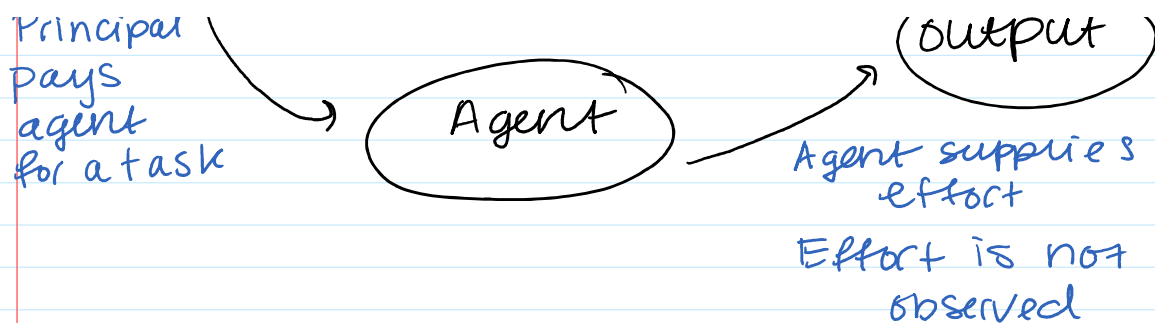
0 - No (Not Q1)
1 - Yes (is Q1)

Coefficient on Dummy variable

→ Tells us how much the intercept varies when not looking at the base case (D=1 and 0)

The Principal-Agent Problem & Managers





The principal agent problem occurs when the interests of the agent and the principal diverge

↳ Use incentives to align the interests

Methods of Compensation to align interests

Risk Premiums

- Profit Sharing
 - Compensation[^] tied to firm's profits
- Revenue Sharing
 - Compensation tied to firm's revenues
 - useful when employees actions are not related to costs
- Piece Rates
 - Paid per unit of output
- Salary & Risk Premium
 - ↳ Base salary to alleviate some 'risk'