TA Structural Empirical Methods for Labour Economics

Tutorial 1: Introduction & Chapter 1

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Slides based on those from Katherina Tomas (Phd Student at IDEA)

Preliminaries

- Format TA: guideline for problem sets (by presentation/code)
- Grading: 5 problem sets (TA) + research proposal
- Form groups of 2 (not mandatory)
- Contact: sergiquintanagarcia@gmail.com
- Office hours: Upon schedule. Email me at any time!

Problem Set Deadlines

	Sent	Deadline	Time
PS1	January 21st	January 27th	1 week
PS2	January 28th	February 3rd	1 week
PS3	February 4th	February 14th	10 days
PS4	February 16th	February 26th	10 days
PS5	February 25th	March 4th	1 week

- Important! Remember the Research Proposal! Joan will be more helpful if you ask him questions at the beginning of the course, rather than at the end.
- We will recover the lost TA Session on Wednesday February 16th .

Problem Set Hand Out

- Groups of 2 people
- STATA/Matlab code + PDF file with answers/results for each exercise
- Easy replication and understandable code by comments is key here!
- The solutions should be send in a zipped file named `SM_PS1_Surame1_Surname2` with the surnames in alphabetical order

Firm-Level Estimation

Cobb-Douglas production framework

Simple framework: two inputs into production, capital k and labour l, ζ_{it} as the firm's total factor productivity

$$y_{it} = \zeta_{it} k_{it}^{\alpha} l_{it}^{\beta}$$

Taking logs leads to a linear regression equation:

$$ln y_{it} = \alpha ln k_{it} + \beta ln l_{it} + \nu_{it} + \epsilon_{it},$$

with $\nu_{it} = ln\zeta_{it}$ being unobserved by the econometrician.

Potential biases

Simultaneity bias: firm knows ν_{it} when deciding on quantities of inputs k_{it} and l_{it} and decides simultaneous on inputs.

Further issues: measurement error in inputs, selection bias (only more productive firms survive)

Fixes:

- Instrumental variables (e.g. input prices)
- Dynamic panel data approaches
- Control function approaches

Olley and Pakes (1996)

Method: look for observable variables that can control for unobserved total factor productivity

Modifications: Introduce investments $i_{it} = F_K(k_{it}, l_{it-1}, \nu_{it}, \mathbf{r_{it}})$ and $l_{it} = F_L(k_{it}, l_{it-1}, \nu_{it}, \mathbf{r_{it}})$, where $\mathbf{r_{it}}$ are factor prices.

Important: i_{it} is not productive until $t+1$ where $k_{t+1} = (1-\delta)k_{it} + i_{it}$

Estimation procedure

1. Estimate:
   $lny_{it} = \beta lnl_{it} + \phi_t(l_{it-1}, k_{it}, i_{it}) + \epsilon_{it}$,
   where $\phi_t(l_{it-1}, k_{it}, i_{it}) \equiv \alpha lnk_{it} + F_K^{-1}(l_{it-1}, k_{it}, i_{it}, \mathbf{r_{it}})$
   ($F_K^{-1}(.)$ can be approximated by polynomial series approximations)

2. Use:
   $\hat{\phi}_{it} = \alpha lnk_{it} + h(\hat{\phi}_{it-1} - \alpha lnk_{it-1}) + \xi_{it}$
   with $\hat{\phi}_{it} \equiv lny_{it} - \hat{\beta} lnl_{it}$
   to get updated guess of α
   (Again,$h(.)$ can be approximated by polynomial series)

Estimation procedure (continued)

$\hat{\phi}_{it} = \alpha lnk_{it} + h(\hat{\phi}_{it-1} - \alpha lnk_{it-1}) + \xi_{it}$ with $\hat{\phi}_{it} \equiv lny_{it} - \hat{\beta} lnl_{it}$

Issue: h(.) is not observable $\rightarrow$ recursive semiparametric method

$\rightarrow$ Assume an initial value for α

$\rightarrow$ Compute: $\hat{\phi}_{it-1} - \alpha lnk_{it-1}$

$\rightarrow$ Obtain next guess for α by estimating: $\hat{\phi}_{it} = \alpha lnk_{it} + h(\hat{\phi}_{it-1} - \alpha lnk_{it-1}) + \xi_{it}$

$\rightarrow$ repeat until convergence.

Estimation procedure **Hints**

- **Polynomial Series Approximation:**

  An example can be

  $F_K^{-1}(l_{it-1}, k_{it}, i_{it}, \mathbf{r_{it}}) = l_{it-1} + l_{it-1}^2 + l_{it-1}^3 + k_{it} + k_{it}^2 + k_{it}^3 + i_{it} + i_{it}^2 + i_{it}^3$

  We could also include cross terms of the elements and square of cross prodcts...

- Also remember we do not need to include factor prices in $F_K(.)$ as a necessary control.
- Notice i_{it} is not observed but can be recovered from the data.

Aggregate Production Functions

Nested CES

- To estimate elasticities of substitution across inputs
- Advantage 1: exhibit a log-linear relation between relative prices and relative inputs
- Advantage 2: elasticity of substitution between two inputs inside one nest can be estimated without information on the inputs or parameters in the nests that lie above the nest of interest $\rightarrow$ easier procedure

Example: Borjas (2003)

- To estimate the labour market impact of immigrants
- Exploits variation in supply shifts across education-experience groups to see effect on (native) wages
- Different composition of influx of immigrants (schooling, age/experience)
- Their additional labour supply affects different subgroups of native workers/wages

Model

$$Y_t = A_t K_t^{\alpha} L_t^{1-\alpha}, \quad L_t \equiv [\sum_i \theta_{it} L_{it}^{\rho}]^{\frac{1}{\rho}},$$

$$L_{it} \equiv [\sum_j \gamma_{ij} L_{ijt}^{\eta}]^{\frac{1}{\eta}}, \quad L_{ijt} \equiv [\lambda L_{ijNt}^{\phi} + (1-\lambda) L_{ijMt}^{\phi}]^{\frac{1}{\phi}}$$

- i as index for education groups
- j for experience groups
- M for immigrants and N for natives respectively
- mostly α is assumed to be e.g. 0.3 with few periods

Estimation procedure (1)

Relative wages of natives and immigrants expressed as:

$$ln\frac{w_{ijMt}}{w_{ijNt}} = ln(\frac{1-\lambda}{\lambda}) + (\phi - 1)ln\frac{L_{ijMt}}{L_{ijNt}}$$

$\rightarrow$ used to identify λ and ϕ

$\rightarrow$ use to construct L_{ijt}

Estimation procedure (2)

Use:

$$lnw_{ijt} = \kappa_t + \pi_{it} + ln\gamma_{ij} + (\eta - 1)lnL_{ijt}$$

To get η and γ_{ij} and consequently construct L_{it}

Keep in mind: $ln\gamma_{ij}$ is estimated as fixed effects coefficient (normalized)

$$\hat{\gamma}_{ij} = \frac{exp(ln\hat{\gamma}_{ij})}{\sum_j exp(ln\hat{\gamma}_{ij})}$$

with: $\sum_j \gamma_{ij} = 1$ for every education group i

Estimation procedure (3)

Use:

$$lnw_{it} = \kappa_t + ln\theta_{it} + (\rho - 1)lnL_{it}$$

To get θ_{it} and ρ

θ_{it} also estimated as fixed effect coefficient

Estimation procedure **Hints**

- Notice that the *hoursworked* variable is at a weekly basis, while all the other variables are at yearly. To transform hours worked into yearly simply multiply by 52.
- To compute w_{ijt} you should do it as a weighted average of the wages by group, using as weights the share of hours worked by each group.

Interpreting the parameters

- **Elasticity of substitution:** elasticity of the ratio of two inputs to a production function with respect to the ratio of their marginal products. In a competitive market, it measures the percentage change in the two inputs used in response to a percentage change in their prices. How to compute it?

$$Y = A[\alpha K^{\rho} + (1-\alpha)L^{\rho}]^{1/\rho}$$

- ρ is the substitution parameter and $\sigma = \frac{1}{1-\rho}$ is the elasticity of substitution parameter.