Labor Income Estimation & Smoothing Method

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NTA Workshop I
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Organization

- Labor Income Allocation
- Smoothing Method: Lowess
- Intra-household Transfers (next week)
Labor Income Estimation
Labor Income Definition

All compensation that is return to work effort

- Labor earnings
- Employer-provided benefits
- Taxes paid to the government on behalf of the employees
- Part of entrepreneurial income (return to labor)
Labor Income Definition

\[ YL_i = YLE_i + YLF_i + YLX_i + YLS_i \]

- \( YL_i \)  labor income of individual \( i \)
- \( YLE_i \)  sum of earnings
- \( YLF_i \)  fringe benefits
- \( YLX_i \)  other labor income
- \( YLS_i \)  share of entrepreneurial income
If entrepreneurial income is available for individual \(i\), its share to individual`s labor is calculated as:

\[
YLS_i = \gamma SE_i
\]

where return to labor for individual is \(\gamma\) (estimated to be 2/3)

\(SE_i\)  self-employment income

\(YLS_i\)  return to labor income
Entrepreneurial Income – Household Level

If return to self-employment reported on a household, return to labor of individual $i$ in the household $j$ has to be estimated.

Regress household entrepreneurial income on the total number of self-employed individual in the household ($N_j$).
Estimation of Entrepreneurial Income

\[ SE_j = \alpha W_j + \sum \beta_f \frac{W_{fj}}{W_j} \]

\( W_{fj} \) number of self-employed individuals in the household \( j \)
in age group \( f \) (starting from 10)
and;

\[ W_j = \sum_f W_{fj} \]
Estimation of Entrepreneurial Income
(cont ..)

Individual coefficients are summed by household; Share of this household sum is calculated for each individual

\[ \bar{SE}_{ij} = SE_j \frac{\beta_{fi}W_{fij}}{\sum_f \beta_f W_{fj}} \]

\[ W_{fij} \quad \text{Dummy variable, working = 1, zero otherwise} \]
Labor Income Taiwan 1978 - 2002

Monthly (TW)

Source: Comfort Sumida
Adjust to National Level

1. Estimate the age profile

\[ YL_f = \zeta \bar{Y}L_f N_f \]

2. Multiply by the population

3. Adjust to National Income And Product Account (NIPA) total

\[ \zeta = \frac{Y_{NIPA}}{\sum_f \bar{Y}L_f N_f} \]
Adjusted Labor Income

Relative to Max

Taiwan

Indonesia
Intra-household Transfers
List of NTA Table

- T1. Flow Account
  - T1.1 Lifecycle Deficit
  - T1.2 Asset Reallocation
  - T1.3 Public Transfers
  - T1.4 Private Transfers
- T2. Wealth Account
Table 1.4 Private Transfers

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Assumptions

- Deficit of household members are financed by taxing members` surplus including the household head
- Consumption of housing and durable assets are financed by intra-household transfers from head to household members
Define Disposable Income

Individual $i$ disposable income

$$Y_d(i, j) = Y_l(i, j) + \tau^g_{\text{cash}}(i, j) + \tau^f_x(i, j)$$

Household $j$ disposable income

$$Y_d(j) = \sum_i Y_d(i, j)$$

$Y_l(i, j)$ \hspace{1cm} Labor income

$\tau^g_{\text{cash}}(i, j)$ \hspace{1cm} Public transfers

$\tau^f_x(i, j)$ \hspace{1cm} Inter-household transfers
Define Surplus

Surplus if

\[ Y_d(i, j) > c_{\text{current}}^f(i, j) \]

\[ \Delta^+(i, j) = [Y_d(i, j) - c_{\text{current}}^f(i, j)]D_{Y_d(i, j) > c_{\text{current}}^f(i, j)} \]

\[ D_{Y_d(i, j) > c_{\text{current}}^f(i, j)} = 1 \text{ if the condition in the subscript is met and zero otherwise} \]
Define Deficit

- Deficit if

\[ Y_d(i, j) < c^f_{\text{current}}(i, j) \]

\[ \Delta^-(i, j) = [c^f_{\text{current}}(i, j) - Y_d(i, j)] D_{Y_d(i, j) < c^f_{\text{current}}(i, j)} \]
Calculate the Inflow

Intra-household transfers inflow to individual \( i \) is to current deficit plus the value of asset consumption for non-heads.

\[
\tau^{fr+} (i, j) = \Delta^{-} (i, j) + c_{asset} (i, j) D_{i \neq 1}
\]

for household \( j \)

\[
\tau^{fr+} (j) = \sum_{i} \tau^{fr+} (i, j)
\]
Calculate the Tax

Tax rate assessed on each individual's surplus

\[
tax(j) = \min\left(1, \frac{\tau^{fr^+}(j)}{\Delta^+(j)}\right)
\]
Calculate Intra-household Transfers

Outflow

Non-head

\[ \tau^{fr^-}(i, j) = -tax(j) \Delta^+(i, j) D_{i \neq 1} \]

Head

\[ \tau^{fr^-}(1, j) = -\left[ tax(j) \Delta^+(i, j) + c_{asset, \sim h}(j) \right. \\
\left. + \left( \Delta^-(j) - \Delta^+(j) \right) D_{\Delta^-(i, j) > \Delta^+(i, j)} \right] D_{i = 1} \]
Calculate Intra-household Sector Inflow

Current consumption

\[ \tau^{fr+}(i, j, x) = \frac{c_{current}(i, j, x)}{c_{current}(i, j)} \Delta^-(i, j) \]

Asset consumption

\[ \tau^{fr+}(i, j, x) = c(i, j, x) D_{i \neq 1} \]
Calculate Intra-household Sector Outflow

Current consumption

$$\tau_{fr^-}^{(i, j, x)} = \frac{\tau_{fr+}^{current}(j, x)}{\tau_{fr+}^{current}(j)} \tau_{fr^-}^{current}(i, j)$$

Asset consumption

$$\tau_{fr^-}^{(i, j, x)} = \left(c(j, x) - c(1, j, x)\right) D_{i=1}$$
Intra-Household Transfers Inflow

Monthly

- education
- health
- other consumption
- Assets
LOWESS
Smoothing: Lowess

- Lowess: *locally weighted scatter plot smooth*
- Each smoothed value is determined by neighboring data points defined within the span
- Command in STATA
  - `Lowess yvar xvar, bwidth(#) gen(newvary) nograph`
Lowess Procedure (cont ..)

- Define span
  - A window of neighboring points to include in the smoothing calculation for each data point
  - This window moves across the data set as the smoothed response value is calculated for each predictor value
  - A large span increases the smoothness but increases the resolution of the smoothed data set
Compute the regression weights for each point in the span

\[ w_i = \left(1 - \left| \frac{x - x_i}{d(x)} \right|^3 \right)^3 \]

- \( x \) predictor value associated with the response value to be smoothed
- \( x_i \) the nearest neighbors of \( x \) as defined by the span
- \( d(x) \) distance along the abscissa from \( x \) to the most distant predictor value within the span

The data point to be smoothed has the largest weight and the most influence on the fit
Data point outside the span have zero weight and no influence on the fit.
Lowess Procedure (cont .. )

- A weighted linear least squares regression is performed
- Lowess uses a first degree polynomial
- The smoothed value is given by the weighted regression at the predictor value of interest
1. Span does not change
2. Regression weight function might not be symmetric about the data point to be smoothed
3. Regression weight is depending on the nearest neighbors

a/b using asymmetric function
c/d using symmetric function
系列2