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

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 γ (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 (W_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 ;

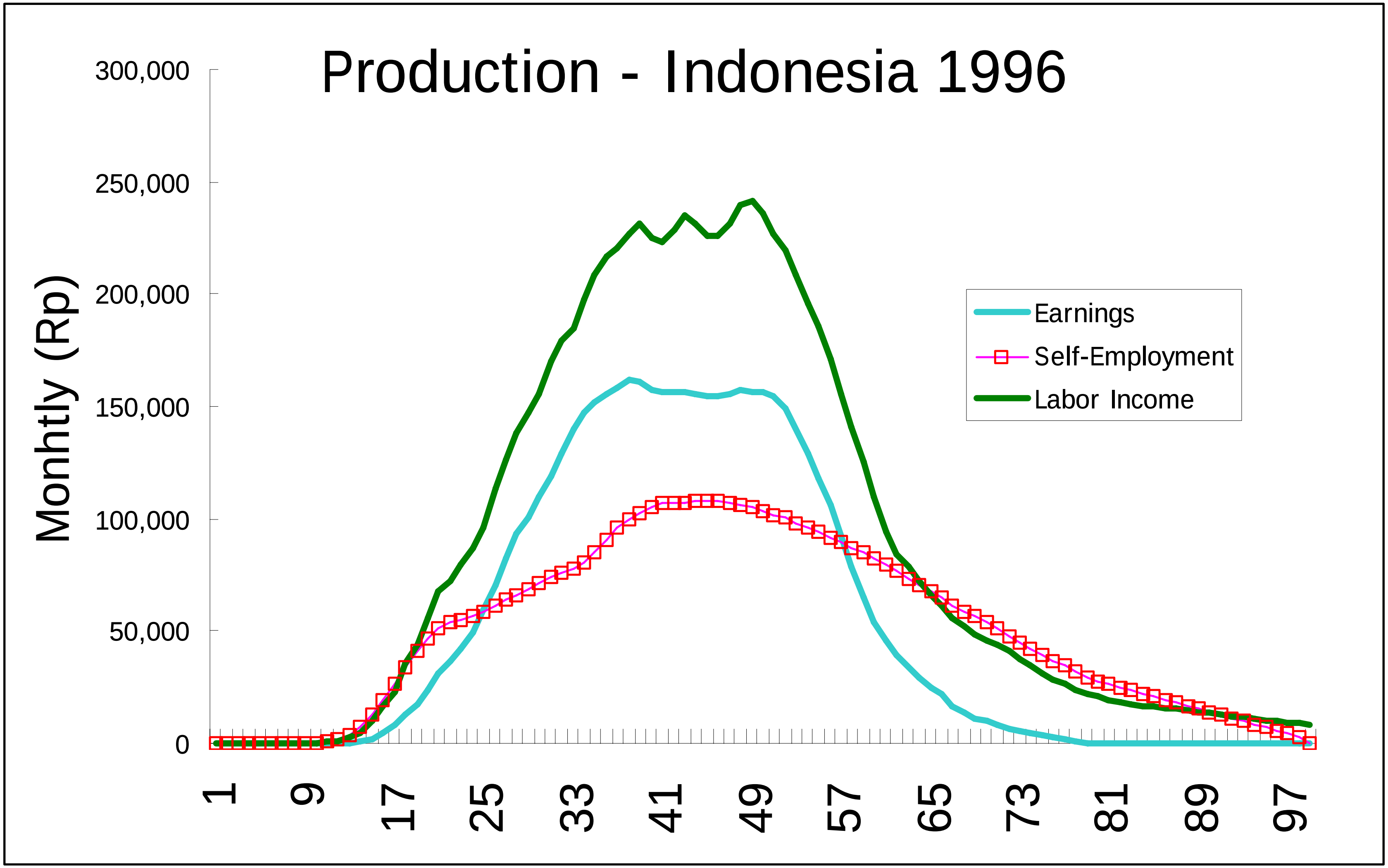
$$W_j = \sum_f W_{fj}$$

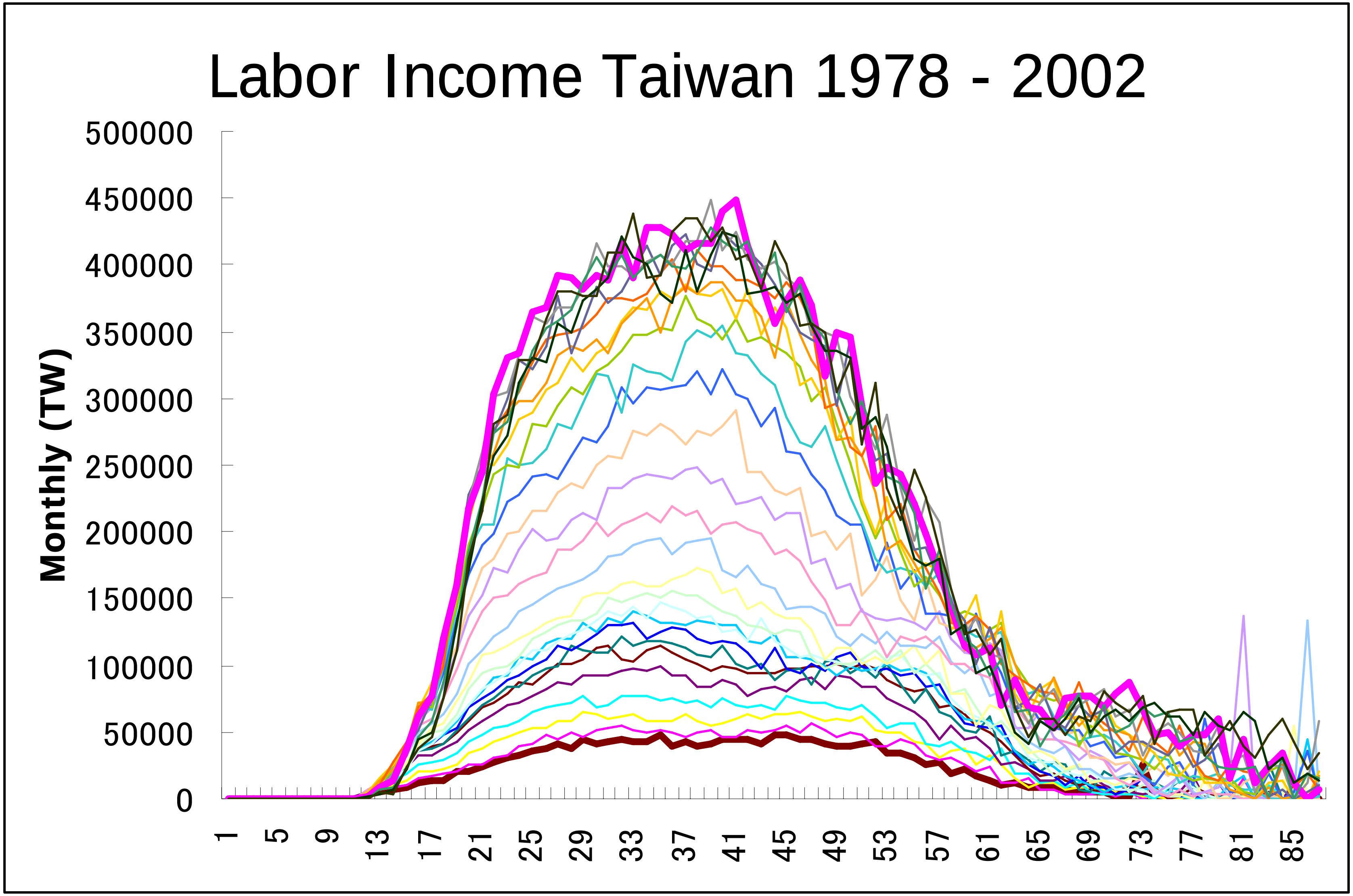
Estimation of Entrepreneurial Income (cont ..)

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

$$\overline{\overline{SE}}_{ij} = SE_j \frac{\beta_{fi} W_{fij}}{\sum_f \beta_f W_{fj}}$$

W_{fij} Dummy variable, working = 1, zero otherwise


Production - Indonesia 1996
Monhtly (Rp)
300,000
250,000
200,000
150,000
100,000
50,000
0
1
9
17
25
33
41
49
57
65
73
81
89
97
Earnings
Self-Employment
Labor Income



Source: Comfort Sumida

Adjust to National Level

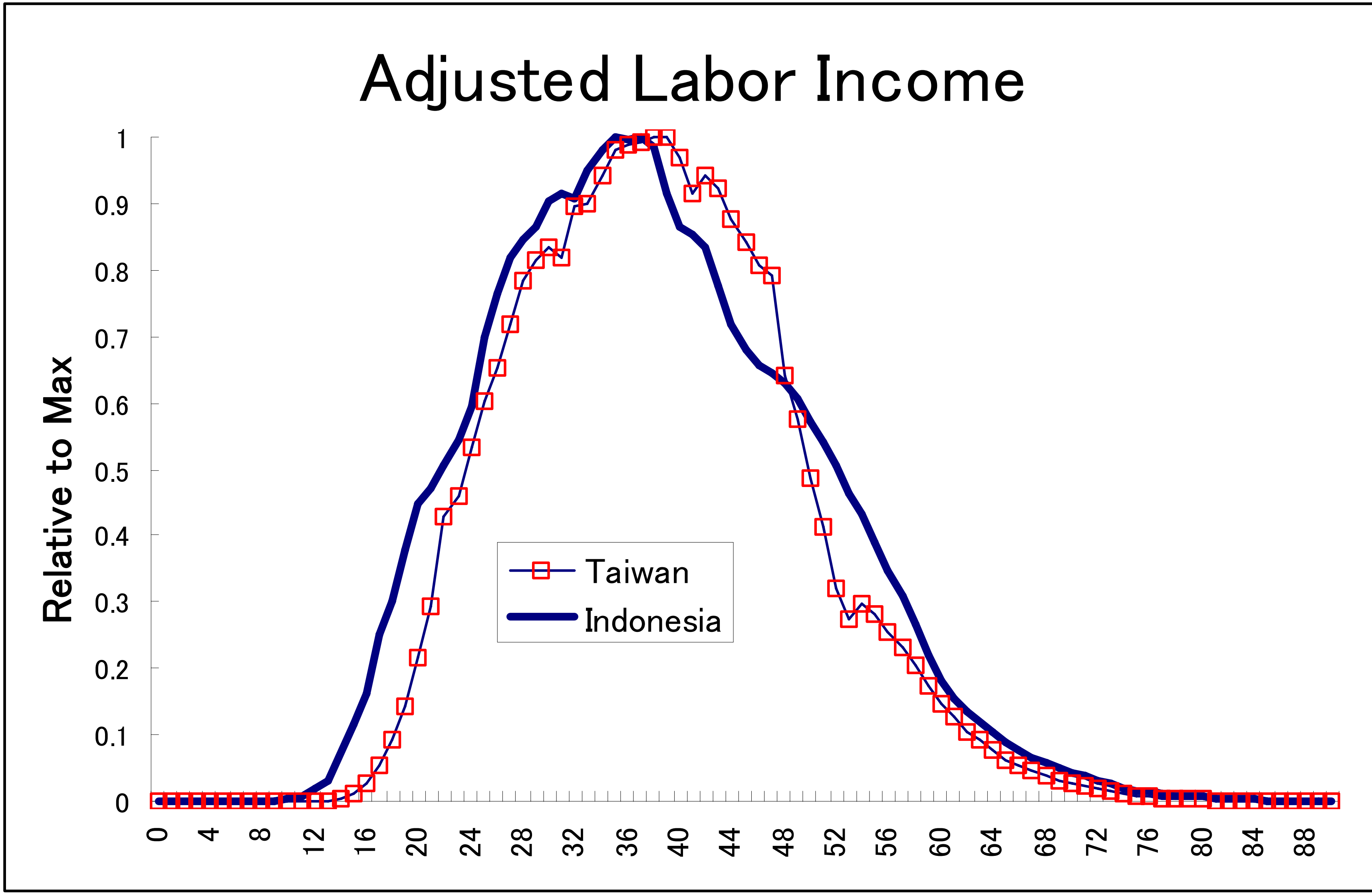
1. Estimate the age profile

2. Multiply by the population

$$YL_f = \zeta \overline{YL}_f N_f$$

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

$$\zeta = Y_{NIPA} \Big/ \sum_f \overline{YL}_f N_f$$



Adjusted Labor Income
Relative to Max
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0
4
8
12
16
20
24
28
32
36
40
44
48
52
56
60
64
68
72
76
80
84
88
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

	Total	Domestic by Age			Foreign
		0-4	**...**	**90+**	
Inter-vivos Transfers					
Inter-household transfers					
Inflows					
Outflows					
Intra-household Transfers					
Education					
Inflows					
Outflows					
Health					
Inflows					
Outflows					
Other Consumption					
Inflows					
Outflows					

Transfers Outflow

- 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

$$Y_d(i, j) = Y_l(i, j) + \tau_{cash}^{g}(i, j) + \tau_x^{f}(i, j)$$

Household *j* disposable income

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

$Y_l(i, j)$	Labor income
$\tau_{cash}^{g}(i, j)$	Public transfers
$\tau_x^{f}(i, j)$	Inter-household transfers

Define Surplus

- Surplus if

$$Y_d(i,j) > c^f_{current}(i,j)$$

$$\Delta^+(i,j) = [Y_d(i,j) - c^f_{current}(i,j)]D_{Y_d(i,j)>c^f_{current}(i,j)}$$

$D_{Y_d(i,j)>c^f_{current}(i,j)}$ = 1 if the condition in the subscript is met and zero otherwise

Define Deficit

- Deficit if

$$Y_d(i,j) < c_{current}^f(i,j)$$

$$\Delta^-(i,j) = [c_{current}^f(i,j) - Y_d(i,j)]D_{Y_d(i,j)<c_{current}^f(i,j)}$$

Calculate the Inflow

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

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

for household *j*

$$\tau^{fr+}\left(j\right)=\sum_{i}\tau^{fr+}\left(i,j\right)$$

Calculate the Tax

Tax rate assessed on each individual`s surplus

$$tax(j) = \min\left(1, \tau^{fr+}(j) \big/ \Delta^{+}(j)\right)$$

Calculate Intra-household Transfers Outflow

Non-head

$$\tau^{fr-}\left(i,j\right)=-tax\left(j\right)\Delta^{+}\left(i,j\right)D_{i\neq 1}$$

Head

$$\tau^{fr-}\left(1,j\right)=-\begin{bmatrix} tax\left(j\right)\Delta^{+}\left(i,j\right)+c_{asset,\sim h}(j) \\ +\left(\Delta^{-}\left(j\right)-\Delta^{+}\left(j\right)\right)D_{\Delta^{-}(i,j)>\Delta^{+}(i,j)} \end{bmatrix}D_{i=1}$$

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

$$\tau^{fr+}(i,j,x) = c(i,j,x) D_{i \neq 1}$$

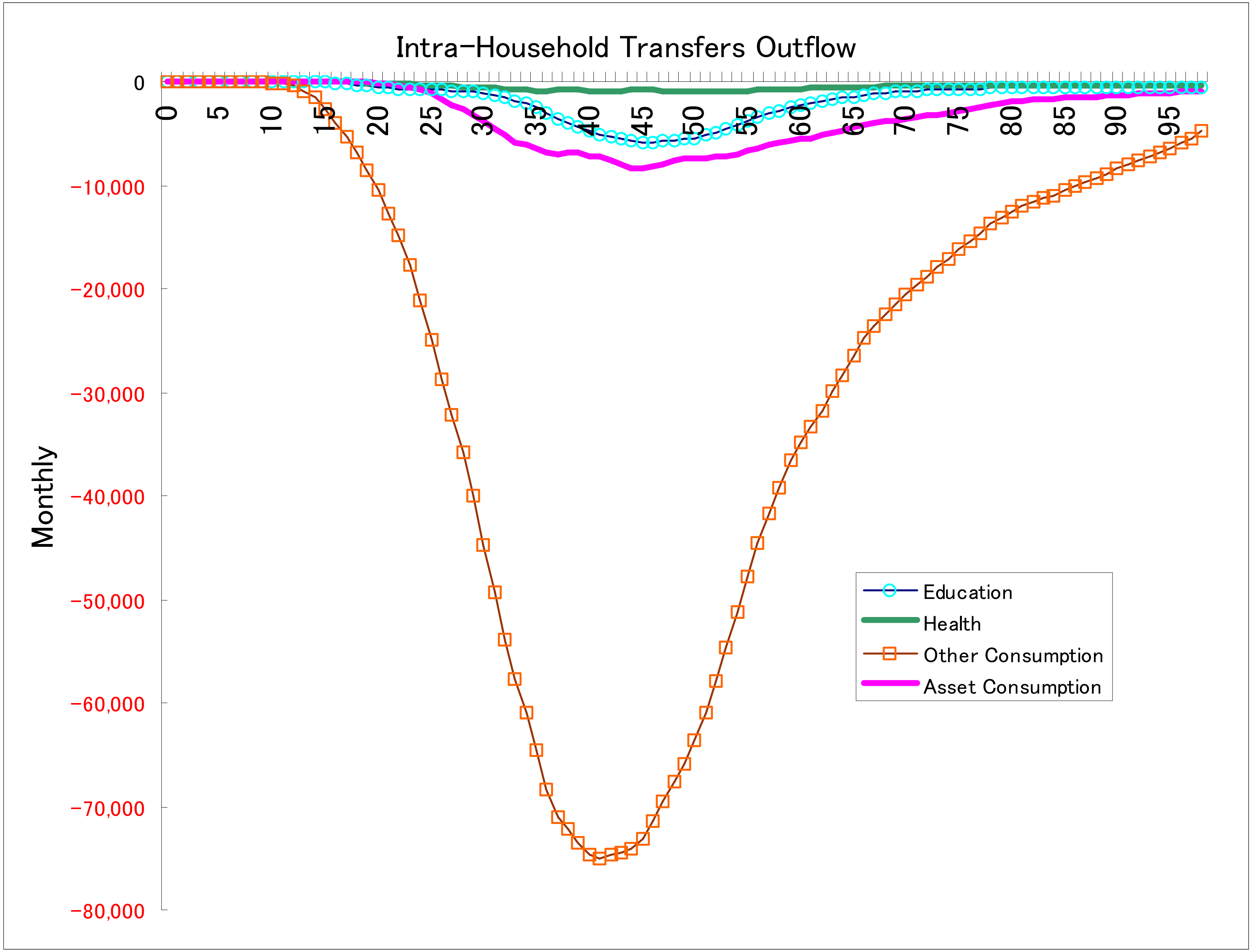
Calculate Intra-household Sector Outflow

Current consumption

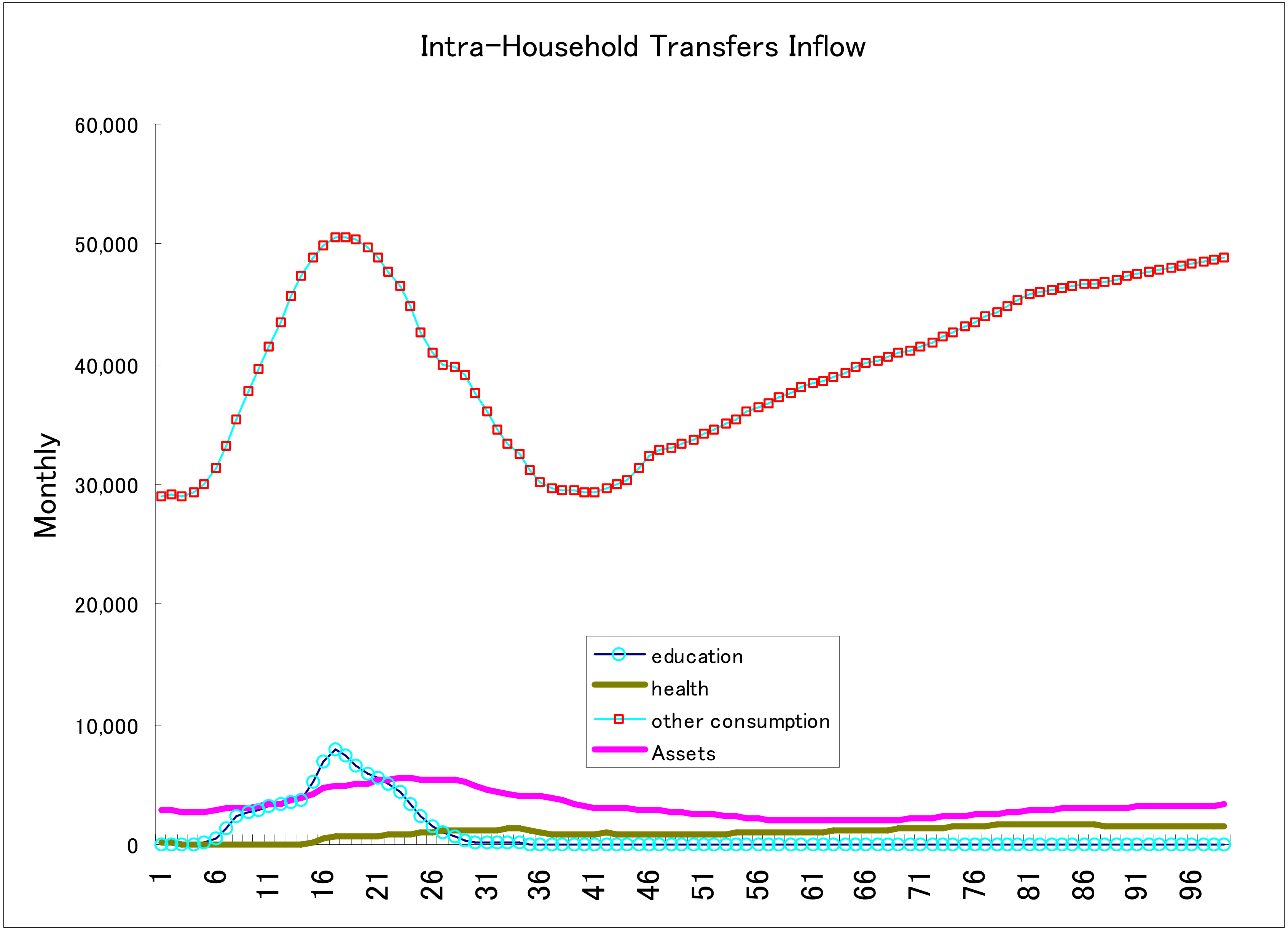
$$\tau^{fr-}(i,j,x) = \frac{\tau_{current}^{fr+}(j,x)}{\tau_{current}^{fr+}(j)} \tau_{current}^{fr-}(i,j)$$

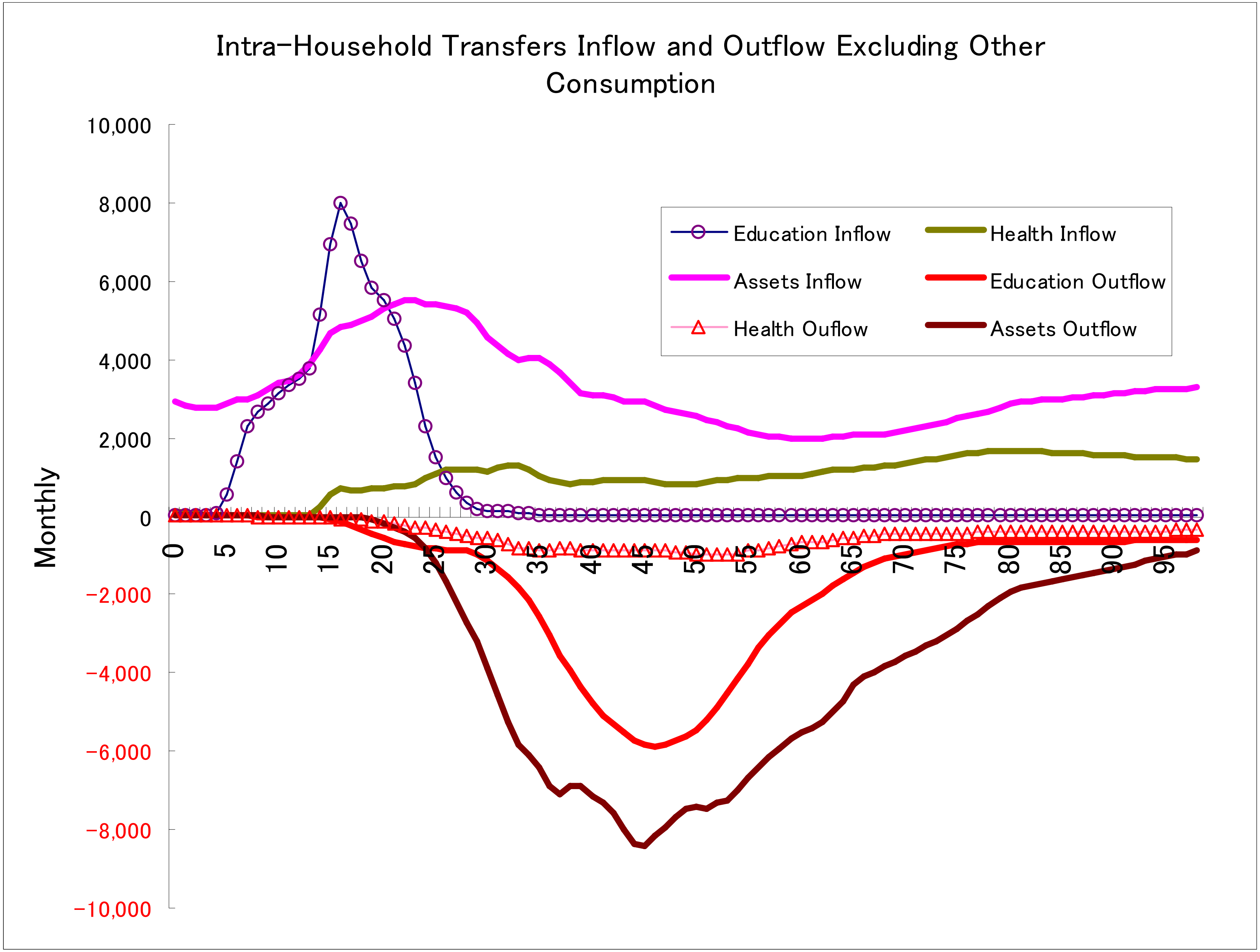
Asset consumption

$$\tau^{fr-}(i,j,x) = \left(c(j,x) - c(1,j,x)\right) D_{i=1}$$



Intra-Household Transfers Outflow
0
−10,000
−20,000
−30,000
−40,000
−50,000
−60,000
−70,000
−80,000
Monthly
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95
Education
Health
Other Consumption
Asset Consumption


Intra-Household Transfers Inflow
Monthly
60,000
50,000
40,000
30,000
20,000
10,000
0
1
6
11
16
21
26
31
36
41
46
51
56
61
66
71
76
81
86
91
96
education
health
other consumption
Assets


Intra-Household Transfers Inflow and Outflow Excluding Other Consumption
10,000
8,000
6,000
4,000
2,000
0
-2,000
-4,000
-6,000
-8,000
-10,000
Monthly
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95
Education Inflow
Health Inflow
Assets Inflow
Education Outflow
Health Ouflow
Assets Outflow

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

Lowess Procedure (cont ..)

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

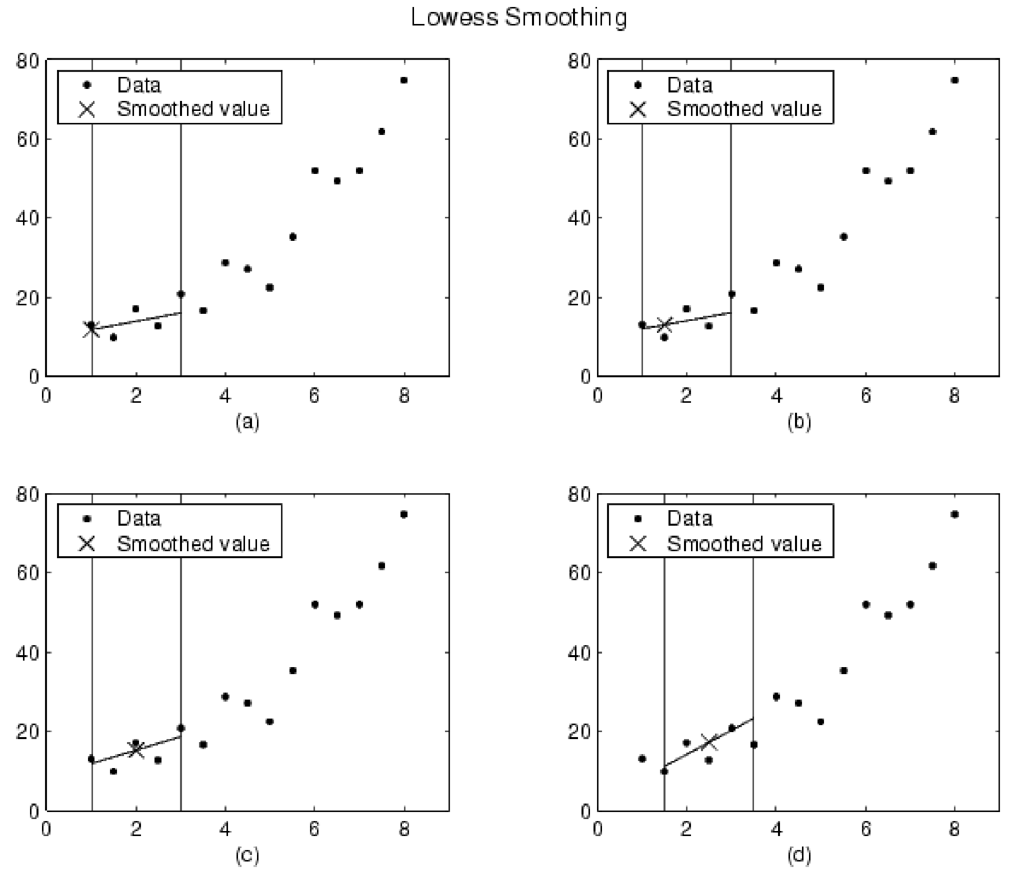
The data point to be smoothed has the largest weight and the most influence on the fit
Data point outside the span have zero weight and no influence on the fit

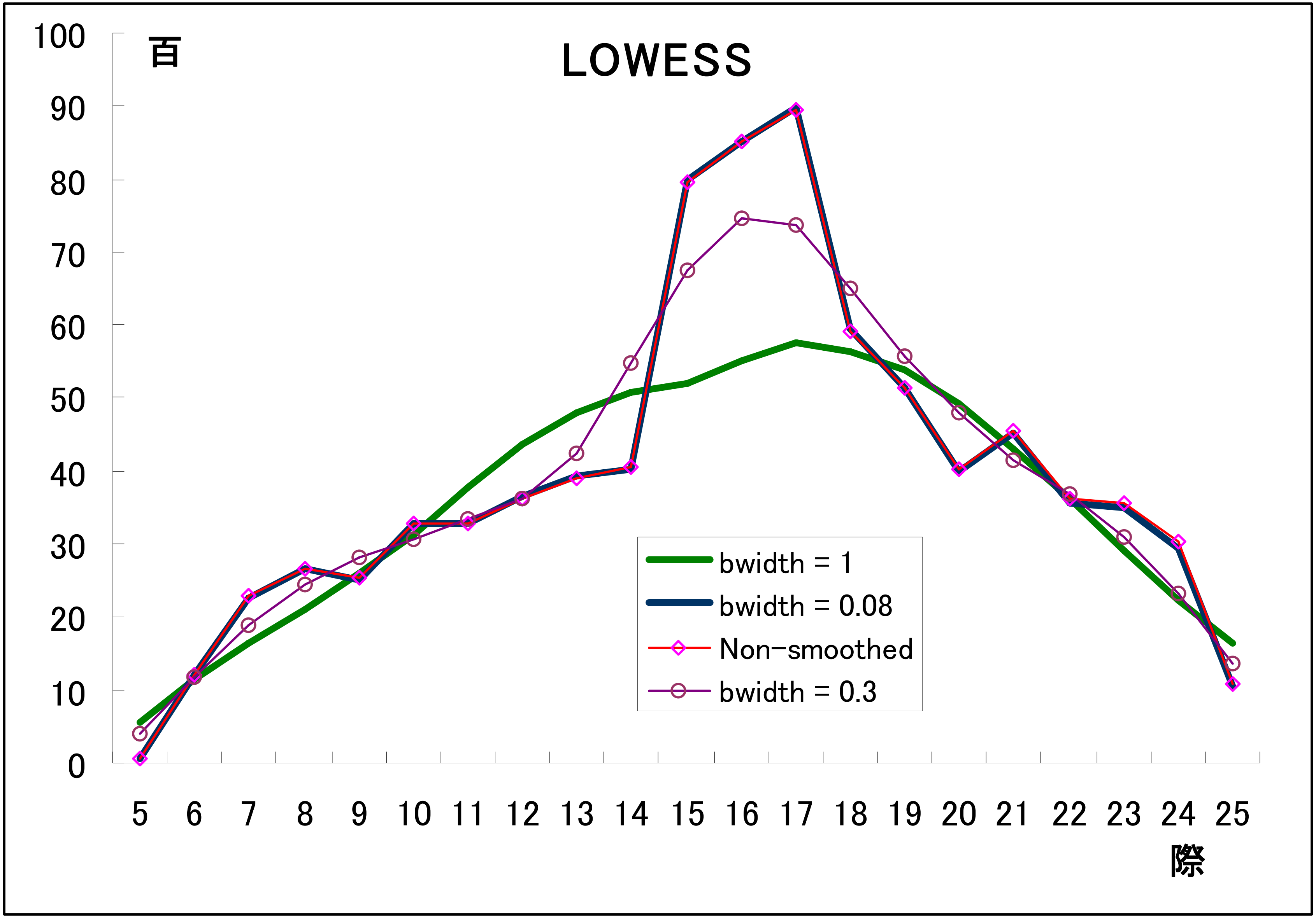
Lowess Procedure (cont ..)

- 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





LOWESS
百
100
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6
7
8
9
10
11
12
13
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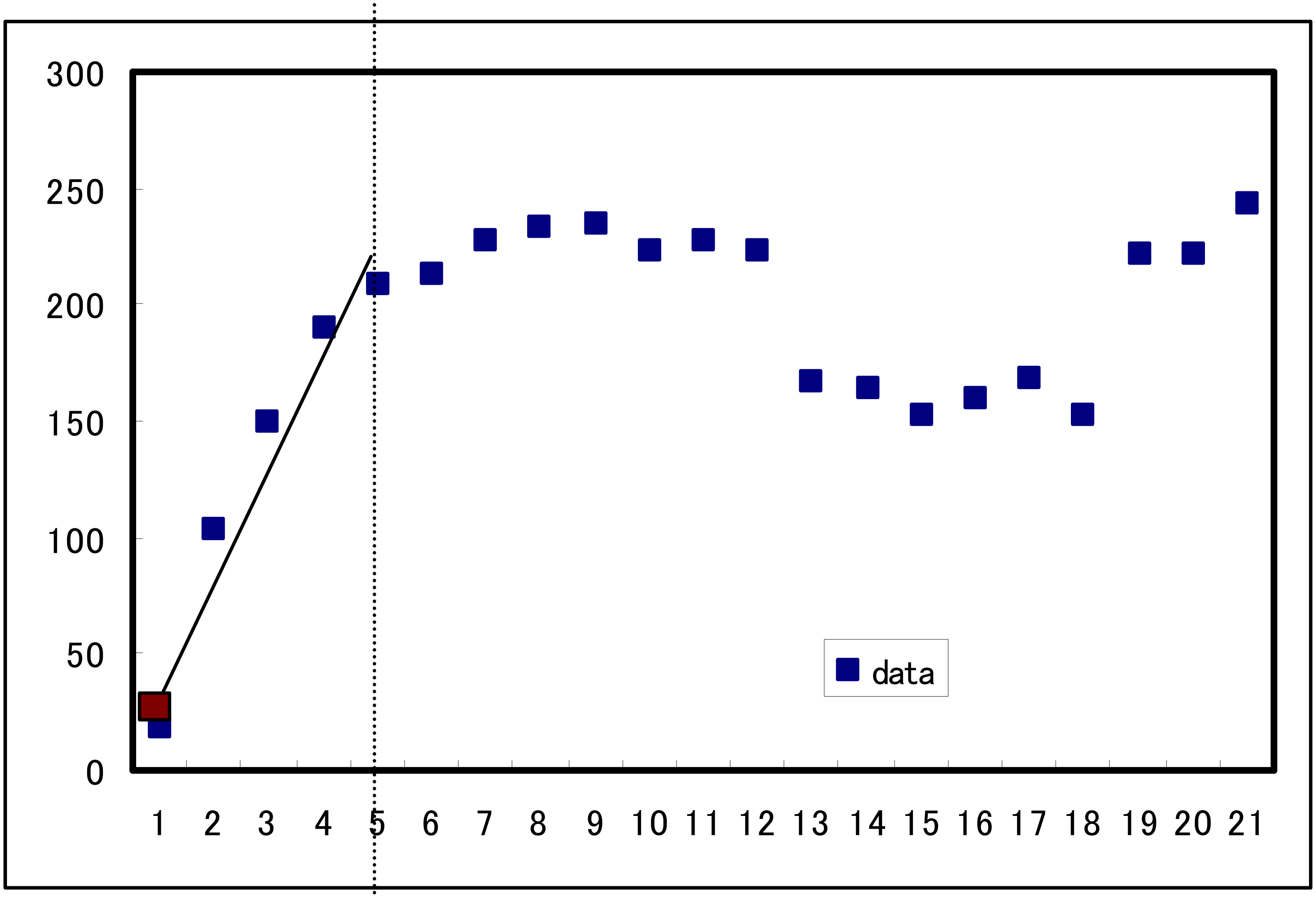
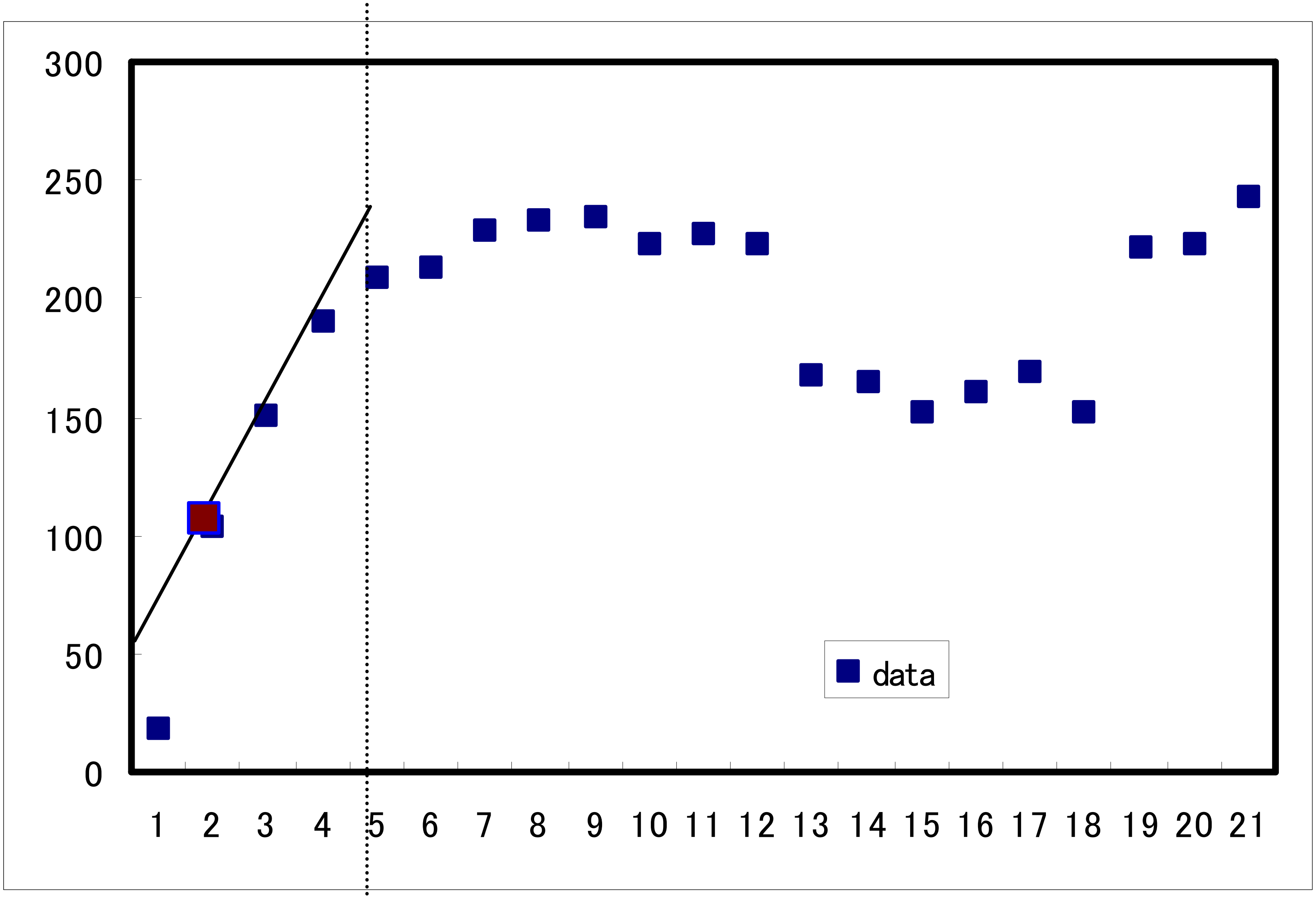
25
際
bwidth = 1
bwidth = 0.08
Non-smoothed
bwidth = 0.3



300
250
200
150
100
50
0
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21
data



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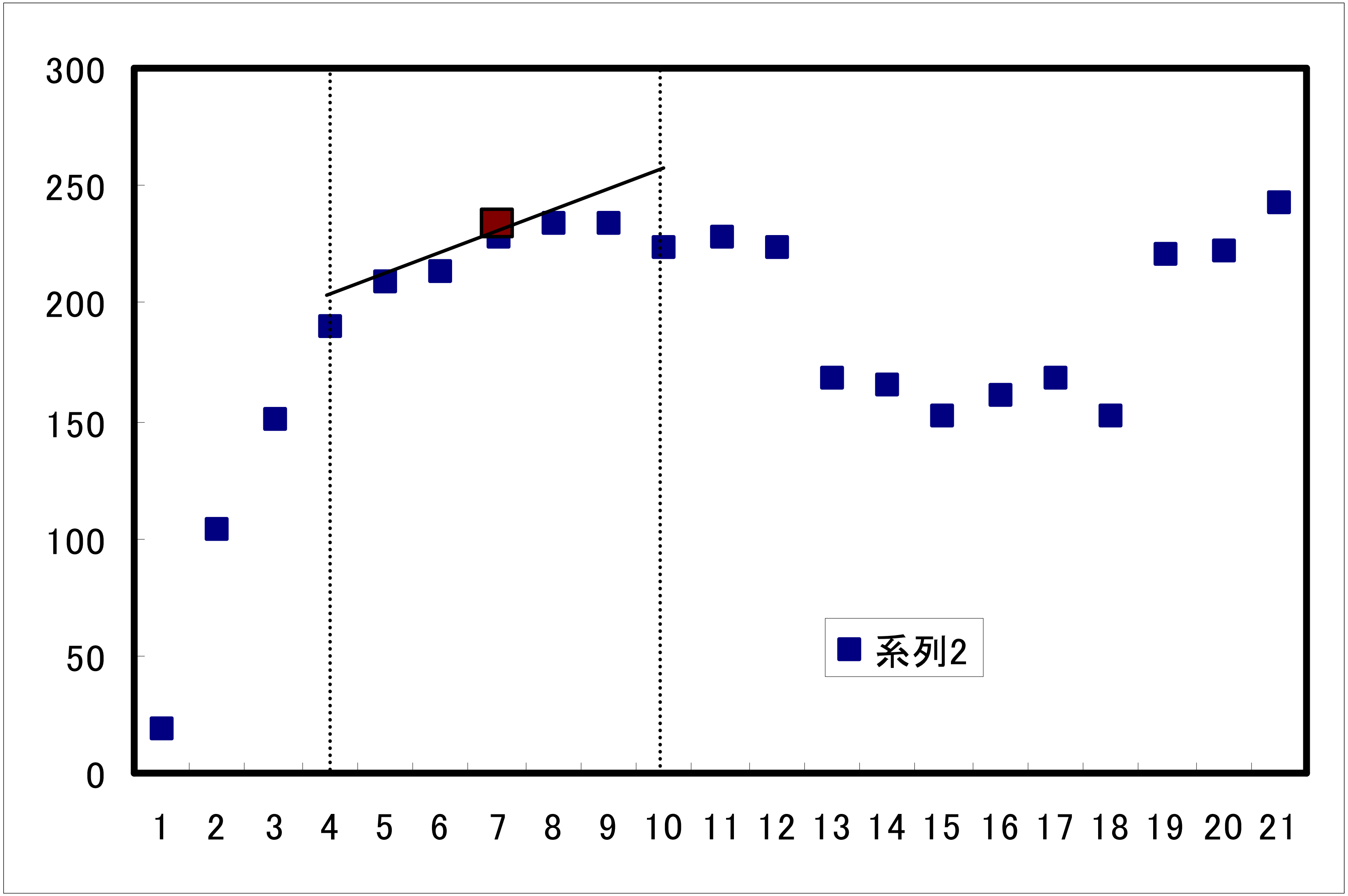
data



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100
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1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21
系列2