New Residence Adjustment and Unemployment Calculations for PI+ v1.5 Models

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Residence Adjustment is the net inflow of the earnings of interarea commuters. Personal income in a region is based on the residence of the income recipients. However, the source data for most of the components of wage and salary disbursements, supplements to wages and salaries, and contributions for government social insurance are on a place-of-work basis. Consequently, a residence adjustment is made to convert these sources of data to a place-of-residence basis.

The Residence Adjustment (RA) is calculated by subtracting the gross outflow of income (GO) from the gross inflow of income (GI), and therefore represents a region's net transfer of income. In models prior to v1.5, the earnings shares (*rs* and *nrs*) are fixed at their calculated last history year values (determined by Journey to Work and Residence Adjustment data from the Census and BEA).

Residence Adjustment:

$$RA_t^k = GI_t^k - GO_t^k$$

Gross Inflows:

$$GI_t^k = \sum_{k \neq l}^{n} rs^{l,k} * \left(COMPT_t^l - COMP_t^{nFM,l} - TWPER_t^l - EGSI_t^l \right)$$

GI_t^k = The income of employees who live in the local region *k* and work in another (gross inflow of commuter dollars for residents of region *k* who work in all other areas) in time period *t*.

$COMPT_t^l$ = Total compensation in region *l* and time period *t*.

$COMP_t^{nFM,l}$ = Federal military compensation in region *l* and time period *t*.

$TWPER_t^l$ Employee and self-employed contributions for government social insurance in region *l* and time period *t*.

$EGSI_t^l$ = Employer contributions for government social insurance in region *l* and time period *t*.

$rs^{l,k}$ = The share of earnings in l that is earned by residents of k who work outside of k (fixed for the forecast period based on the last history year share).

Gross Outflows:

$$GO_t^k = \sum_{k \neq l}^{n} nrs^{k,l} * \left(COMPT_t^k - COMP_t^{nFM,k} - TWPER_t^k - EGSI_t^k \right)$$

GO_t^k = The income of employees who work in the local region k and live in another (gross outflow of commuter dollars for employees of region k who live in all other areas) in time period t.

$nrs^{k,l}$ = Share of earnings in region k going to residents of region l (fixed for the forecast period based on the last history year share).

New Methodology

A new commuter flow equation has been implemented that takes into account the spatial distance and relative cost of living between places of residence and places of work, allowing the earnings shares to endogenously shift in the forecast in response to both direct and indirect policy variable changes.

Commuter Flow Shares:

$$rs_t^{k,l} = \frac{LF_t^l * (P_t^l)^{(1-\sigma)} * \left(D^{k,l}\right)^{-\beta}}{\sum_{k \neq l}^{n} LF_t^j * (P_t^j)^{(1-\sigma)} * \left(D^{j,k}\right)^{-\beta}}$$

$rs_t^{k,l}$ = the share of commuters who live in region l and work in region k in time period t.

LF_t^l = labor force in region l in time period t.

P_t^l = the consumer price index including housing price in region l in time period t.

$D^{k,l}$ = the commute distance from region l to region k.

σ = Sigma value, the estimated parameter for consumer price.

β = Beta value, the estimated parameter for distance decay.

Commuter Income:

Commuter income is then calculated as the share times the region's income:

$$CI_t^{k,l} = \sum_{k \neq l}^{n} rs_t^{k,l} * \left(COMPT_t^k - COMP_t^{nFM,k} - TWPER_t^k - EGSI_t^k \right)$$

$CI_t^{k,l}$ = the commuter income flow from commuters who live in region *l* and work in region *k* in time period *t*.

Gross Inflows and Outflows:

Summing commuter income flows yields the relative gross inflow and gross outflow for a region:

$$GI_t^k = \sum_{k \neq l}^{n} CI_t^{l,k}$$

$$GO_t^k = \sum_{k \neq l}^{n} CI_t^{k,l}$$

Residence Adjustment:

The net residence adjustment is calculated the same as before:

$$RA_t^k = GI_t^k - GO_t^k$$

Residence Adjusted Employment:

Residence adjusted employment (*RAE*) is calculated by scaling the total number of non-military jobs by the share of residence adjustment to total labor and proprietor's income (YLPT):

$$RAE_t^k = (1. + (RA_t^k / YLPT_t^k)) * (EMPT_t^k - EMP_t^{nFM,k})$$

Residence adjusted employment is a key variable in the model's migration equation.

Unemployment Rate:

The unemployment rate (*UR*) for the region is predicted as a function of the previous year's rate, the current year's national rate, the change in the national rate from the previous year, the growth rate of per capita real personal income, and growth rate of residence adjusted employment (*RAE*), and the growth

rate of national employed (*RAED*) to national residence adjusted employment (*RAEU*) relative to the target year of natural unemployment:

$$
\begin{aligned}
UR_t^k &= \beta_1 * UR_{t-1}^k \\
&+ \beta_2 * UR_t^u + \beta_3 * (UR_t^u - UR_{t-1}^u) \\
&+ \beta_4 * (((RYP_t^k / POP_t^k) - (RYP_{t-1}^k / POP_{t-1}^k)) / (RYP_{t-1}^k / POP_{t-1}^k)) \\
&+ \beta_5 * ((RAE_t^k - RAE_{t-1}^k) / RAE_{t-1}^k) \\
&+ const
\end{aligned}
$$

UR_t^k = The unemployment rate for the local region *k* in time period *t*.

UR_{t-1}^k = The unemployment rate for the local region *k* in time period *t-1*.

UR_t^u = The unemployment rate for the nation in time period *t*.

UR_{t-1}^u = The unemployment rate for the nation in time period *t-1*.

RYP_t^k = Total real personal income in the local region *k* from time period *t*.

RYP_{t-1}^k = Total real personal income in the local region *k* from time period *t-1*.

POP_t^k = Total population in the local region *k* from time period *t*.

POP_{t-1}^k = Total population in the local region *k* from time period *t-1*.

RAE_t^k = Total residence adjusted employment (jobs) in the local region *k* from time period *t*.

RAE_{t-1}^k = Total residence adjusted employment (jobs) in the local region *k* from time period *t-1*.

β_1 = estimated coefficient using generalized methods of moments (GMM) estimated method.
β_2 = estimated coefficient using generalized methods of moments (GMM) estimated method.
β_3 = estimated coefficient using generalized methods of moments (GMM) estimated method.
β_4 = estimated coefficient using generalized methods of moments (GMM) estimated method.
β_5 = estimated coefficient using generalized methods of moments (GMM) estimated method.
const = The constant from the regression model.

Employed:

An estimate of the number of people employed (*RAED*) is made based on the labor force and the unemployment rate:

$$RAED_t^k = (1 - (UR_t^k / 100)) * LF_t^k$$

LF_t^k = The labor force in the local region *k* and time period *t*.