ANALYSIS OF PANEL DATA

Fixed-Effect and Random-Effect Models

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Fixed-Effect Model

An Introduction to Fixed-Effect Models

Fixed-Effect Transformation

- Recall from the last lecture that we consider the following models:

$$y_{it} = \beta_0 + \beta_1 x_{it} + a_i + \epsilon_{it}$$

where $i = 1, 2, \ldots, n$ and $t = 1, 2, \ldots, T$

- An alternative way to eliminate the time-invariant unobserved variable is the **fixed effect transformation**.

- Fixed effect transformation uses the average of individual over time and the "**average equation**" from the original equation. Averaging individuals over time, we get

$$\bar{y}_i = \beta_0 + \beta_1 \bar{x}_i + \bar{a}_i + \bar{\epsilon}_i$$

- Fixed effect transformation uses the average of individual over time and the "**average equation**" from the original equation. Averaging individuals over time, we get

$$\bar{y}_i = \beta_0 + \beta_1 \bar{x}_i + \boxed{\bar{a}_i} + \bar{\epsilon}_i$$

Substracting it from the original model, we obtain

$$\left(y_{it} - \bar{y}_i\right) = \beta_1 \left(x_{it} - \bar{x}_i\right) + \left(\epsilon_{it} - \bar{\epsilon}_i\right)$$

where $\bar{y}_i = \frac{1}{n}\sum_{t=1}^{T} y_{it}$ and $\bar{x}_i$ is defined similarly. The model can be expressed more compactly in the **time-demeaned** form:

$$\boxed{\left(y_{it} - \bar{y}_i\right) = \beta_1 \left(x_{it} - \bar{x}_i\right) + \left(\epsilon_{it} - \bar{\epsilon}_i\right)}$$

where $y_{it} - \bar{y}_i$ is the time demeanded dependent (or response) variable.

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