ANALYSIS OF PANEL DATA

Fixed-Effect and Random-Effect Models

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Fixed-Effect Model

Remarks on Fixed-Effect Models

Deterministic Time-Varying and Time-Invariant Variables

- The fixed effect estimator allows for correlation between a_i and the explanatory variables in any time period, as in the case in first-differencing.

- A side-effect is that all of the time-invariant variables are eliminated alongisde with the unobserved fixed effect. As such, variables such as gender, credit score at loan origination, a biometric measure at the beginning of using a wearable, the distance between the center of a city to the nearest port, etc., will all be swept away by the fixed effect transformation. As such, the effect of time-invariant variables cannot be estimated

- That said, the effect of interactions with time-invariant variables can be estimated (e.g. the interaction of education with time dummies)

- If a full set of time dummies are included, the effect of deterministic time-varying variables (e.g. experience) cannot be estimated because they cannot be distinguished from the aggregate time effect.

Assumptions Required for valid OLS Estimation

- Under a $ assumption on the explanatory variables, the fixed effect estimator is unbiased: the error term ϵ_{it} is uncorrelated with all of the explanatory variables across all time period:

$$E(\epsilon_{it}|X_i, a_i) = 0 \forall t$$

- Other assumptions require that the error term be homoskedastic and serially uncorrelated across t.