Visualization, Identification, and Estimation in the Linear Panel Event-Study Design

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Identification with Proxies or Instrumental Variables

Confound

$$y_{it} = \alpha_i + \gamma_t + q'_{it}\psi + \sum_{m=-G}^{M} \beta_m z_{i,t-m} + C_{it} + \varepsilon_{it} \qquad \text{(linear panel model)}$$

- Parameters of interest not identified unless we can say something more about the confound C_{it}
- Appropriate identifying assumptions should be justified on economic grounds

- Previous video: Identification Strategies without Proxies or Instruments
- This video: Identification Strategies with Proxies or Instruments

Approaches to identification with proxies or instrumental variables

- Instrumental variable
- Two proxy variables
- One proxy with noise uncorrelated with the policy

Instrumental variable

- Traditional instrument for the policy that is unrelated to the confound
- Can estimate parameters via 2SLS

Two proxy variables

- If you have access to two proxies for the confound with measurement error uncorrelated across proxies, you can use one proxy to instrument for the other
- Related to measurement error models

One proxy with noise uncorrelated with the policy

Assumption

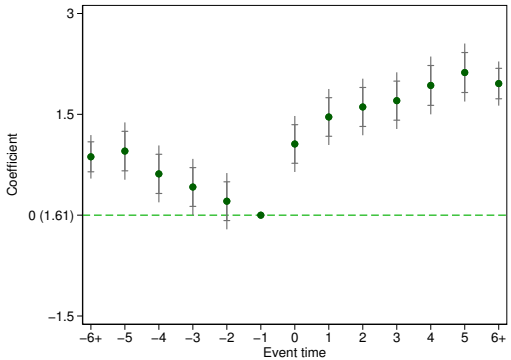
There is an observed proxy x_{it} that obeys

$$x_{it} = \alpha_i^x + \gamma_t^x + \psi^x q_{it} + \Xi^x C_{it} + u_{it}.$$

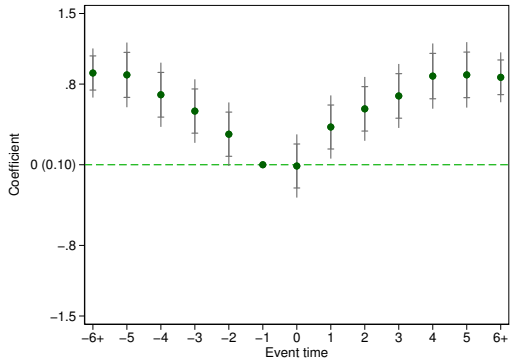
with

1. *Proxy related to the confound:* $\Xi^x \neq 0$
2. *Noise in the proxy not related to the policy:* $\mathbb{E}[u_{it}|z_i, \alpha^{x_i}, \gamma^x, q_i] = 0$
3. *The projection of C_{it} on $\{z_{i,t-m}\}_{m=-G-L_G}^{M+L_M}$, q_{it} and unit and time indicators has at least one non-zero coefficient on $z_{i,t+m}$ for $m > G$*

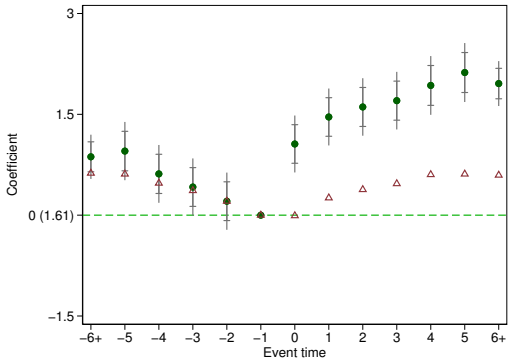
Event-study plot for outcome



Event-study plot for proxy



Align proxy to outcome



Subtract rescaled confound from outcome