

$$\begin{matrix} y_{i2} - y_{i1} \\ \parallel \\ \Delta y_{i2} \end{matrix}$$

$$\begin{matrix} IV(Lag 1) \\ y_{i1} \end{matrix}$$

$$\begin{matrix} IV(Lag 2) \\ \cancel{y_{i1}, y_{i0}} \end{matrix}$$

$$\begin{matrix} \Delta y_{i3} \\ \vdots \end{matrix}$$

$$\begin{matrix} y_{i2} \\ \vdots \end{matrix}$$

$$\begin{matrix} y_{i2}, y_{i1} \\ \vdots \end{matrix}$$

$$\Delta y_{iT-1}$$

$$y_{iT-2}$$

$$y_{iT-2}, y_{iT-3}$$

Lag 1

$$Z_i = \begin{bmatrix} 0 & 0 & \dots & 0 \\ y_{i1} & 0 & \dots & 0 \\ 0 & y_{i2} & \dots & 0 \\ \vdots & \vdots & \ddots & \vdots \\ 0 & 0 & & y_{iT-2} \end{bmatrix}$$

IV个数: T-2

Roodman (2009)

All Lag

$$Z'_i = \begin{bmatrix} 0 & \Delta y_{i2} & \Delta y_{i3} & \Delta y_{i4} & \dots & 0 \\ y_{i1} & 0 & 0 & 0 & \dots & 0 \\ 0 & y_{i2} & y_{i1} & 0 & \dots & 0 \\ 0 & 0 & 0 & y_{i3} & y_{i2} & y_{i1} \\ \vdots & \vdots & \vdots & \vdots & \vdots & \vdots \end{bmatrix}$$

IV个数:

$$\frac{(T-1)(T-2)}{2}$$

$$1+2+\dots+(T-2)$$

Moment Condition

$$\Delta y_{i2} E[y_{i1} \Delta \varepsilon_{i3}] = 0$$

$$\Delta y_{i3} \begin{cases} E[y_{i1} \Delta \varepsilon_{i4}] = 0 \\ E[y_{i2} \Delta \varepsilon_{i4}] = 0 \end{cases}$$

$$\Delta y_{iT-1} \begin{cases} E[y_{i1} \Delta \varepsilon_{iT}] = 0 \\ \vdots \\ E[y_{iT-2} \Delta \varepsilon_{iT}] = 0 \end{cases}$$