Dynamic Factor Models

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Last Time: Classical Factor Analysis Model

$$\underset{(N\times 1)}{X_t} = \underset{(N\times 1)}{\mu} + \underset{(N\times k)}{\Lambda}\underset{(k\times 1)}{Z_t} + \underset{(N\times 1)}{\epsilon_t}$$

$$\begin{bmatrix} Z_t \\ \epsilon_t \end{bmatrix} \overset{iid}{\sim} \mathcal{N}\left(\begin{bmatrix} 0_k \\ 0_N \end{bmatrix}, \begin{bmatrix} I_k & 0 \\ 0 & I_N \end{bmatrix}\right)$$

What Can We Do with Factors?

There are just a few possibilities:

1. Use them as Instumental Variables
2. Use them to construct Forecasts
3. Use them to "Augment" a VAR

"IV Estimation in a Data Rich Environment" (Bai & Ng, 2010)

Endogenous Regressors x_t

$$y_t = x_t'\beta + \epsilon_t \qquad E[x_t\epsilon_t] \neq 0$$

Unobserved Variables F_t are Strong IVs

$$\underset{(k\times 1)}{x_t} = \underset{(k\times r)}{\Psi'}\underset{(r\times 1)}{F_t} + \underset{(k\times 1)}{u_t} \qquad E[F_t\epsilon_t] = 0$$

Observe Large Panel $z_{1t}, \ldots, z_{Nt}$

$$z_{it} = \lambda_i' F_t + e_{it}$$