Dynamic Factor Models

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Econ 722

Survey Articles on Dynamic Factor Models

Stock & Watson (2010)

Best general overview of dynamic factor models and applications.

Bai & Ng (2008)

Comprehensive review of large-sample results for high-dimensional factor models estimated via PCA.

Stock & Watson (2006)

Handbook chapter on forecasting with many predictors. One section is devoted to dynamic factor models.

Breitung & Eickmeyer (2006)

Brief overview with an application to Euro-area business cycles.

Why Factor Models?

1. Factors could be intrinsically interesting if they arise from a theoretical model (e.g. Financial Economics)
2. Many variables without running out of degrees of freedom
   - More information could improve forecasts/macro analysis
   - Mimic central banks "looking at everything"
3. Eliminate measurement error and idiosyncratic shocks to provide more reliable information for policy
4. "Remain Agnostic about the Structure of the Economy"
   - Advantages over SVARs: don't have to choose variables to control degrees of freedom, and can allow fewer underlying shocks than variables.

Last Time: Classical Factor Analysis Model

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

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

Adding Some Dynamics

Choosing the Number of Factors

Onatski paper: no one in the class listed it as a preference! Bai & Ng (2002).

What Can We Do with Factors?

Among other possibilities:

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

Factors as Instruments – 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 $z_{1t}, \ldots, z_{Nt}$

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