Macroeconometrics

Lecture 6 Macroeconometrics research themes

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Forecasting with Bayesian VARs

Assessing policy effects with Structural VARs

Trend and cycle analysis with Unobserved Component models

Forecasting with Bayesian VARs

Forecasting with Bayesian VARs

Baseline model: Vector Autoregression

$$y_t = A_1 y_{t-1} + \cdots + A_p y_{t-p} + \mu_0 + \epsilon_t$$

$$\epsilon_t | Y_{t-1} \sim iid\left(\mathbf{0}_N, \Sigma\right)$$

System modelling – all variables are endogenous

Dynamics – captures system dynamics of the variables

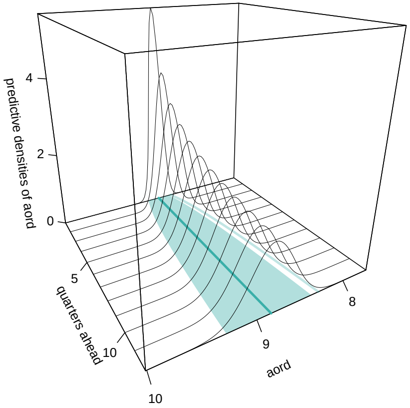
Forecasting – a go to model for predictive applications

Extensions capturing important data features improve forecasting precision

Forecasting with Bayesian VARs

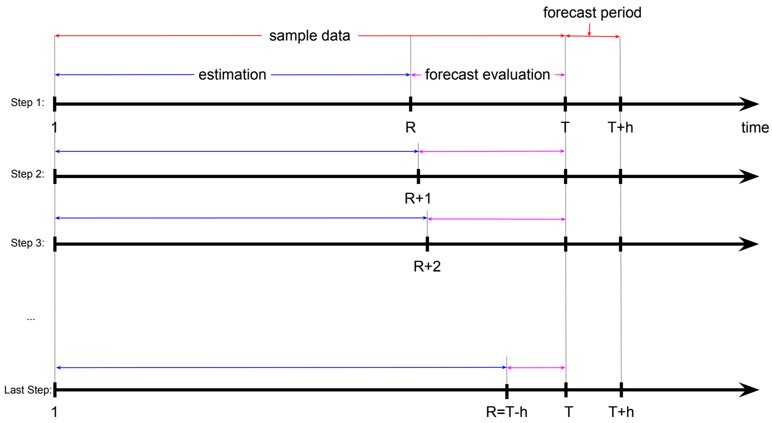
Objective: Density forecasting performance evaluation

$$p(y_{T+h} \mid Y_T)$$



Forecasting with Bayesian VARs

Method: Recursive forecasting exercise



Forecasting with Bayesian VARs

Data set examples.

Fat data of 117 quarterly macro variables for Australia

Bond yield curve modelling using daily/monthly interest rates

Small-open economy forecasting with a foreign sector

Forecasting with Bayesian VARs

Examples of possible model extensions.

Common heteroskedasticity for all variables

Non-normal error term via gamma-scale mixtures

Estimated prior shrinkage of the Minnesota prior

Regime change to capture time-variation in parameters

Assessing policy effects with Structural VARs

Assessing policy effects with Structural VARs

Structural Vector Autoregressions.

$$
\begin{aligned}
y_t &= A_1 y_{t-1} + \cdots + A_p y_{t-p} + \mu_0 + \epsilon_t \\
B\epsilon_t &= u_t \\
u_t | Y_{t-1} &\sim iid\left(\mathbf{0}_N, I_N\right)
\end{aligned}
$$

Structural relationships are explicitly modelled

Economic theory informs identification of structural shocks

Dynamic causal effects can be estimated and interpreted

Policy decision-making is based on evidence provided by SVARs

Assessing policy effects with Structural VARs

Objective: identification of a structural shock and its effects

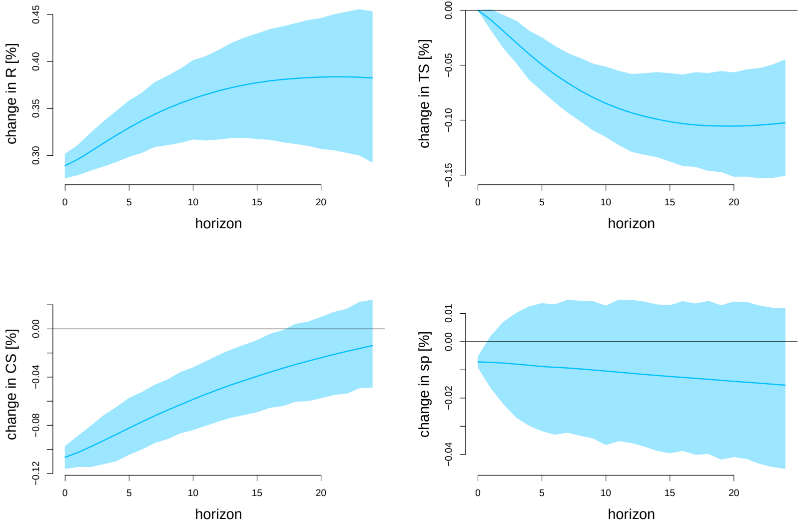
Identification via restrictions leading to fast estimation

Identification via sign restrictions that are less controversial

Identification via heteroskedasticity using data properties

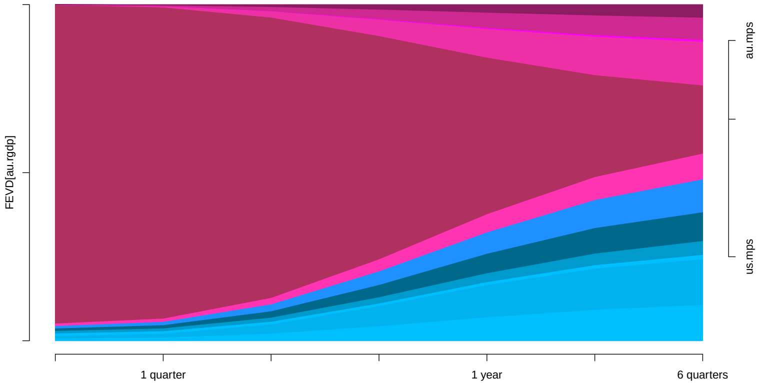
Assessing policy effects with Structural VARs

Method: impulse response analysis



Assessing policy effects with Structural VARs

Method: forecast error variance decomposition



Trend and cycle analysis with UC models

Trend and cycle analysis with UC models

Unobserved Component Models.

$$
\begin{aligned}
y_t &= \tau_t + \epsilon_t \\
\tau_t &= \mu + \tau_{t-1} + \eta_t \\
\epsilon_t &= \alpha_1 \epsilon_{t-1} + \cdots + \alpha_p \epsilon_{t-p} + e_t \\
\eta_t | Y_{t-1} &\sim iid\mathcal{N}\left(0, \sigma_\eta^2\right) \\
e_t | Y_{t-1} &\sim iid\mathcal{N}\left(0, \sigma_e^2\right)
\end{aligned}
$$

Trend and cycle decomposition of a variable

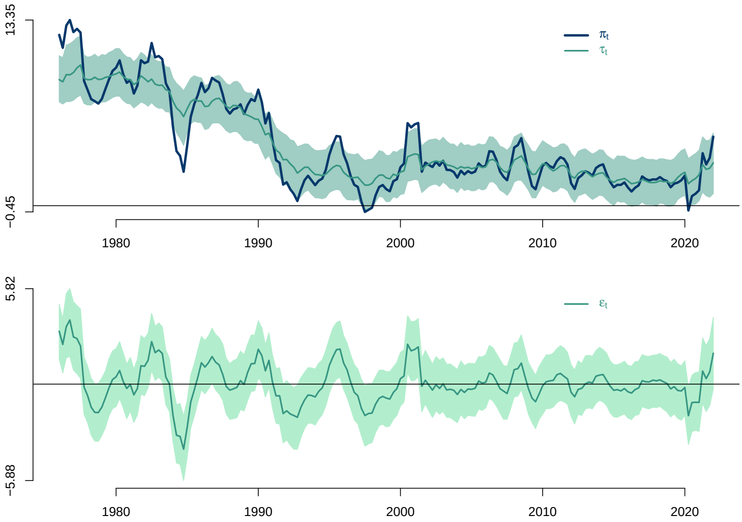
Long-run trend is highly-persistent

Oscillating cycle captures short-term dynamics

Inflation trend analysis and output gap estimation are the main applications

Trend and cycle analysis with UC models

Objective: inflation trend and cycle analysis.



Trend and cycle analysis with UC models

Heteroskedastic Model.

$$\begin{aligned} y_t &= \tau_t + \epsilon_t \\ \tau_t &= \mu + \tau_{t-1} + \eta_t \\ \epsilon_t &= \alpha_1 \epsilon_{t-1} + \cdots + \alpha_p \epsilon_{t-p} + e_t \\ \eta_t | Y_{t-1} &\sim iid\mathcal{N}\left(0, \sigma^2_{\eta.t}\right) \\ e_t | Y_{t-1} &\sim iid\mathcal{N}\left(0, \sigma^2_{e.t}\right) \end{aligned}$$

Trend and cycle analysis with UC models

Time-varying trend.

$$
\begin{aligned}
y_t &= \tau_t + \epsilon_t \\
\tau_t &= \mu_t + \tau_{t-1} + \eta_t \\
\mu_t &= \mu_{t-1} + m_t \\
\epsilon_t &= \alpha_1 \epsilon_{t-1} + \cdots + \alpha_p \epsilon_{t-p} + e_t \\
\eta_t | Y_{t-1} &\sim iid\mathcal{N}\left(0, \sigma_\eta^2\right) \\
e_t | Y_{t-1} &\sim iid\mathcal{N}\left(0, \sigma_e^2\right) \\
m_t | Y_{t-1} &\sim iid\mathcal{N}\left(0, \sigma_m^2\right)
\end{aligned}
$$

Trend and cycle analysis with UC models

Common factor.

$$y_{n.t} = \tau_t + \epsilon_{n.t}$$

$$n = 1, \ldots, N$$

$$\tau_t = \mu + \tau_{t-1} + \eta_t$$

$$\epsilon_t = \alpha_1 \epsilon_{t-1} + \cdots + \alpha_p \epsilon_{t-p} + e_t$$

$$\eta_t | Y_{t-1} \sim iid\mathcal{N}\left(0, \sigma_\eta^2\right)$$

$$e_t | Y_{t-1} \sim iid\mathcal{N}\left(0, \sigma_e^2\right)$$

The choice is yours!