Econ 112: Macroeconomic Data Analysis
Final Paper

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Lecture Plan

1. Final Paper Assignment
2. analysis: "Structural VARs: An Application to U.S. Monetary Policy"

Lecture Plan

1. **Final Paper Assignment**
2. analysis: "Structural VARs: An Application to U.S. Monetary Policy"

Final Paper

An Empirical Investigation of the Impact of Monetary Policy on the Economic Activity of "Your Assigned State"

monetary policy: short-run interest rate (Federal Funds Rate)

economic activity: growth rate of real GDP, unemployment rate

question: does monetary policy affect real GDP growth and the unemployment rate for your assigned state?

note: States have been assigned randomly, you can see your assignment with a link to the data on Canvas

What is a Monetary Policy Shock?

from Ramey (2016), page 24:

"Because monetary policy is typically guided by a rule, most movements in monetary policy instruments are due to the systematic component of monetary policy rather than to deviations from that rule.

We do not have many good economic theories for what a structural monetary policy shock should be. Other than "random coin flipping," the most frequently discussed source of monetary policy shocks is shifts in central bank preferences, caused by changing weights on inflation vs. unemployment in the loss function or by a change in the political power of individuals on the FOMC.

A few papers explicitly link the empirically identified shocks to shifts in estimated central bank preferences [...], but most treat them as innovations to a Taylor rule, with no discussion of their economic meaning."

Grading Criteria

- numerical results (30 pts) - complete? correct?
- choice of what to report (30 pts) - useful? essential?
- clarity of exposition (40 pts) - clear? complete?

Effective Writing in Final Paper

- discuss justification of choices made
- precision and organization in reporting results
- beware of “chronological” writing

measuring structural parameters

- **structural model**

$$\begin{bmatrix} y_t \\ i_t \end{bmatrix} = \begin{bmatrix} 0 & \alpha_i \\ \alpha_y & 0 \end{bmatrix} \begin{bmatrix} y_t \\ i_t \end{bmatrix} + \begin{bmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{bmatrix} \begin{bmatrix} y_{t-1} \\ i_{t-1} \end{bmatrix} + \begin{bmatrix} \varepsilon_t^y \\ \varepsilon_t^i \end{bmatrix}$$

structural shocks $\begin{bmatrix} \varepsilon_t^y \\ \varepsilon_t^i \end{bmatrix} \sim iid\mathcal{N}\left(\begin{bmatrix} 0 \\ 0 \end{bmatrix}, \begin{bmatrix} \sigma_y^2 & 0 \\ 0 & \sigma_i^2 \end{bmatrix} \right)$

- **reduced-form model**

$$\begin{bmatrix} y_t \\ i_t \end{bmatrix} = \begin{bmatrix} A_{11} & A_{12} \\ A_{21} & A_{22} \end{bmatrix} \begin{bmatrix} y_{t-1} \\ i_{t-1} \end{bmatrix} + \begin{bmatrix} e_{1t} \\ e_{2t} \end{bmatrix}$$

VAR residuals (a.k.a. innovations) $\begin{bmatrix} e_{1t} \\ e_{2t} \end{bmatrix} \sim iid\mathcal{N}\left(\begin{bmatrix} 0 \\ 0 \end{bmatrix}, \begin{bmatrix} \sigma_1^2 & \sigma_{12} \\ \sigma_{21} & \sigma_2^2 \end{bmatrix} \right)$

- mapping between data and theory

$$\begin{bmatrix} e_{1t} \\ e_{2t} \end{bmatrix} = \underbrace{\begin{bmatrix} \frac{1}{1-\alpha_y\alpha_i} & \frac{\alpha_i}{1-\alpha_y\alpha_i} \\ \frac{\alpha_y}{1-\alpha_y\alpha_i} & \frac{1}{1-\alpha_y\alpha_i} \end{bmatrix}}_{S} \begin{bmatrix} \varepsilon_t^y \\ \varepsilon_t^u \end{bmatrix}$$

impulse response analysis

- infinite moving average representation of reduced-form VAR

$$\begin{bmatrix} y_t \\ i_t \end{bmatrix} = B(L) \begin{bmatrix} e_{1t} \\ e_{2t} \end{bmatrix}$$

- impulse response to e_{1t} and e_{2t} implemented by $\mathrm{ortho{=}FALSE}$
- under $\mathrm{ortho{=}FALSE}$ the size of the impulses are $e_{1t} = 1$ and $e_{2t} = 1$
- infinite moving average representation of structural VAR

$$\begin{bmatrix} y_t \\ i_t \end{bmatrix} = B(L)S \begin{bmatrix} \varepsilon_t^y \\ \varepsilon_t^i \end{bmatrix}$$

- impulse response to ε_t^y and ε_t^i under Sims (1980) solution obtained by setting $\mathrm{ortho{=}TRUE}$
- under $\mathrm{ortho{=}TRUE}$ the size of the impulses are $\varepsilon_t^y = \sigma_y$ and $\varepsilon_t^i = \sigma_i$