EC 831: Empirical Methods in Macroeconomics

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Benati & Surico (2009) AER

VAR Analysis and the Great Moderation

Overview

1) Suppose that the Great Moderation in the United States has been exclusively due to improved monetary policy, with a passive monetary policy regime in place before October 1979, and an active regime in place thereafter.

2) Would structural VAR techniques be capable of uncovering the authentic causes of the changes in the data-generation process?

The Model

$$R_t = \rho R_{t-1} + (1-\rho)[\phi_\pi \pi_t + \phi_y y_t] + \varepsilon_{R,t}$$

$$\pi_t = \frac{\beta}{1+\alpha\beta}\pi_{t+1|t} + \frac{\alpha}{1+\alpha\beta}\pi_{t-1} + \kappa y_t + \varepsilon_{\pi,t}$$

$$y_t = \gamma y_{t+1|t} + (1-\gamma)y_{t-1} - \sigma^{-1}(R_t - \pi_{t+1|t}) + \varepsilon_{y,t}$$

Shocks follow an AR(1) process with Normal errors.

Treat DSGE model as DGP

- No changes in the volatilities of the structural shocks
- No structural change in the nonpolicy parameters, $\alpha, \gamma, \kappa, \sigma$
- Impose indeterminacy for the pre-October 1979 period and determinacy for the period following the end of the Volcker stabilization, by allowing for different values of ρ, ϕ_π, ϕ_y across periods

TABLE 1—BAYESIAN ESTIMATES OF THE STRUCTURAL PARAMETERS

Parameter	Domain	Density	Prior distribution: Mode	Prior distribution: Standard deviation	Posterior distribution: Median and 90 percent coverage percentiles: Before October 1979	Posterior distribution: Median and 90 percent coverage percentiles: After the Volcker stabilization
σ_R^2	$\mathbb{R}^+$	Inverse Gamma	0.25	0.25	0.492 [0.413; 0.592]	
σ_π^2	$\mathbb{R}^+$	Inverse Gamma	0.50	0.50	0.391 [0.272; 0.562]	
σ_y^2	$\mathbb{R}^+$	Inverse Gamma	0.10	0.25	0.055 [0.039; 0.078]	
σ_s^2	$\mathbb{R}^+$	Inverse Gamma	0.25	0.25	0.193 [0.108; 0.406]	—
κ	$\mathbb{R}^+$	Gamma	0.05	0.01	0.044 [0.035; 0.056]	
σ	$\mathbb{R}^+$	Gamma	2.00	1.00	8.062 [6.352; 10.434]	
α	[0, 1]	Beta	0.75	0.20	0.059 [0.030; 0.099]	
γ	[0, 1]	Beta	0.25	0.20	0.744 [0.688; 0.822]	
ρ	[0, 1)	Beta	0.75	0.20	0.595 [0.515; 0.670]	0.834 [0.779; 0.877]
φ_π	$\mathbb{R}^+$	Gamma	1.00	0.50	0.821 [0.701; 0.893]	1.749 [1.107; 2.568]
φ_y	$\mathbb{R}^+$	Gamma	0.15	0.25	0.527 [0.383; 0.672]	1.146 [0.744; 1.610]
ρ_R	[0, 1)	Beta	0.25	0.20	0.404 [0.289; 0.518]	
ρ_π	[0, 1)	Beta	0.25	0.20	0.418 [0.302; 0.521]	
ρ_y	[0, 1)	Beta	0.25	0.20	0.796 [0.738; 0.843]	
Fraction of accepted draws					0.246	

DSGE model:under indeterminacy can be mapped into VARMA(2)

- Variance of endogenous variables

$$\mathrm{Var}(\mathbf{Y}_t) = \begin{bmatrix} 19.43 & 18.09 & 6.81 \\ 18.09 & 19.19 & 6.16 \\ 6.81 & 6.16 & 6.14 \end{bmatrix}$$

- Variance of shocks

$$\mathrm{Var}(\mathbf{v}_t) = \begin{bmatrix} 0.64 & 0.56 & 0.10 \\ 0.56 & 1.63 & 0.30 \\ 0.10 & 0.30 & 1.19 \end{bmatrix},$$

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DSGE model:under determinacy can be mapped into VAR(2)

- Variance of endogenous variables

$$\mathrm{Var}(\mathbf{Y}_t) = \begin{bmatrix} 2.95 & 0.45 & -0.27 \\ 0.45 & 1.51 & 0.21 \\ -0.27 & 0.21 & 3.55 \end{bmatrix}$$

- Variance of shocks

$$\mathrm{Var}(\mathbf{v}_t) = \begin{bmatrix} 0.44 & 0.26 & -0.17 \\ 0.26 & 1.18 & 0.04 \\ -0.17 & 0.04 & 1.02 \end{bmatrix}$$

Can Structural VAR Methods Uncover the Data-Generation Process?

Consider the VAR representation of DSGE models

Write both determinate and indeterminate cases as VAR(100)

$$\mathbf{A}_{0,IND}^{-1}\,\mathbf{Y}_t = \tilde{\mathbf{B}}_1^{IND}\,\mathbf{Y}_{t-1} \ldots + \tilde{\mathbf{B}}_{100}^{IND}\,\mathbf{Y}_{t-100} + \varepsilon_t, \tag{10}$$

$$\mathbf{A}_{0,DET}^{-1}\,\mathbf{Y}_t = \tilde{\mathbf{B}}_1^{DET}\,\mathbf{Y}_{t-1} \ldots + \tilde{\mathbf{B}}_{100}^{DET}\,\mathbf{Y}_{t-100} + \varepsilon_t, \tag{11}$$

Can Structural VAR Methods Uncover the Data-Generation Process?

From the VAR representation of DSGE model consider

1) sum of the coefficients on the lagged interest rate

2) the long-run coefficient on inflation

3) the long run coefficient on output gap

Under indeterminacy

- 1) 0.76, 2) 0.85, 3)0.43

Under determinacy

- 1) 0.9, 2) 1.75, 3)1.15

Counterfactual

1) Write down both determinacy and indeterminacy as VAR(100)

2) Switch monetary policy rules

3) Convert the counterfactual structural VARs into corresponding counterfactual reduced-form VARs

Under determinacy the true theoretical standard deviations are equal to

- R_t: 1.72
- π_t: 1.23
- y_t: 1.88

Counterfactual 1:impose the structural monetary rule corresponding to the indeterminacy regime onto the structural VAR for the determinacy regime

- R_t: 1.21
- π_t: 1.22
- y_t: 1.92

"bring Arthur Burns into the post-Volcker stabilization era"

Under indeterminacy the true theoretical standard deviations are equal to

- R_t: 16.84
- π_t: 9.47
- y_t: 2.12

Counterfactual 2:"bring Paul Volcker/Alan Greenspan back in time"

- R_t: 1.65
- π_t: 1.32
- y_t: 2.11

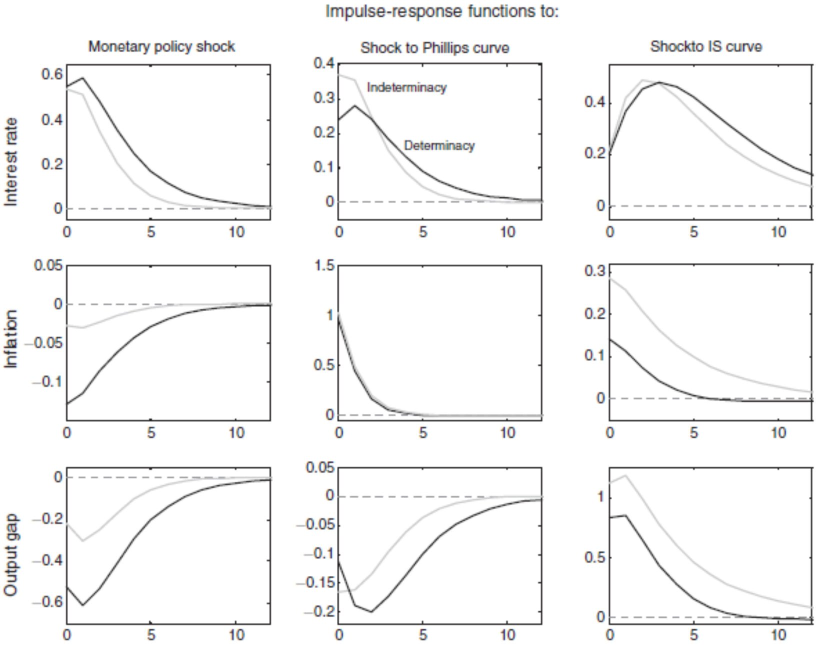

FIGURE 4. THEORETICAL IMPULSE-RESPONSE FUNCTIONS UNDER THE TWO REGIMES

Conclusion

" Changes in the coefficients of the monetary policy rule of the DSGE model exert their impact on both

- the coefficients of the VAR representation of the model and
- the elements of the VAR covariance matrix of reduced-form innovations

" Existing VAR evidence is difficult to interpret, and is in principle compatible with the good policy explanation of the Great Moderation"