Discussion of
“Principled Identification of Structural Dynamic Models”
Francis, Hansen and Tong (2026)

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Identification Problem

Take a standard SVAR:

$$y_t = \Phi_1 y_{t-1} + \cdots + \Phi_p y_{t-p} + \epsilon_t, \quad \epsilon_t \sim N(0, \Sigma).$$
$$u_t = A' \epsilon_t, \quad \mathrm{Var}(u_t) = \mathrm{I}_n.$$

- Identification problem: $\Phi_1, \ldots, \Phi_p$ identified, but not A.
  - Important: linear and Gaussian.
- Standard solutions:
  - Based on economic theory (exclusion restrictions, sign restrictions, ...)
  - Based on statistical theory (independence and non-Gaussianity, heteroskedasticity, ..., this paper)

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Main Contributions

1. Novel Paradigm: How to pick from $\{A \in \mathbb{R}^{n \times n} : A' \Sigma A = \mathrm{I}_n\}$.
    - Reframes standard identification practice as sequential optimization problem.
    - Illustrates very specific correlation patterns between u and ϵ.
2. Agnosticism: Maximize the weighted-correlation criterion $\rho_w(A) = \sum_{i=1}^{n} w_i \mathrm{corr}(u_i, \epsilon_i)$.
    - The maximizer is unique and order- and scale-invariant (OASIS).
    - Found via SVD of correlation matrix.
3. Demystify Cholesky robustness: Variable ordering has no effect on average correlation.
    - Average correlation from OASIS is half as far from unity than in Cholesky.

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1. Role of Measurement Error and Noise

- Are reduced-form residuals good proxies for the structural forces?
- Some macroeconomic variables are notoriously noisy.
  - If a variable's innovation is largely measurement error, forcing a structural shock to be highly correlated with it will simply result in identifying a noise shock.
- Authors propose weighted OASIS.
  - May downweight noisy dimensions...
  - But introduces exactly the kind of researcher discretion that OASIS was meant to eliminate.
- Is there a notion of optimal weighting?

2. Prior Beliefs on Structural Shocks

- In a Bayesian VAR, lack of identification results in a flat likelihood over the rotation matrix.
  - $\Sigma = \Sigma_{Ch}\Sigma'_{Ch}$, hence any valid $A = \Sigma_{Ch}^{-1'} R$ for some rotation R.
- Researchers overcome this by imposing a prior over the orthogonal rotations.
  - E.g., Cholesky assumes with certainty that $R = \mathrm{I}_n$.
  - Careful: priors may not get updated by the data. (Baumeister and Hamilton, 2015)
- OASIS can be understood as a dogmatic prior that places probability mass 1 on the rotation that maximizes the correlation trace.
- Is there a way to relax the dogmatic prior and acknowledge more uncertainty?

3. The Economic Meaning of “Structural”

- The paper does not find a better way to identify standard structural shocks; it creates a new way to identify different shocks.
  - Motivation: a shock is “naturally associated” with a particular variable.
  - Problem: modern macroeconomics frequently features shocks with muted effects on impact.
- A “structural shock” is a primitive economic force.
  - E.g., a shift in consumer preferences or a technology breakthrough.
  - The authors replace an economic definition with a purely statistical one.
- If the resulting shocks cannot be mapped to a specific economic agent’s behavior, in what sense are they structural?

4. Dynamic (In)Consistencies

- OASIS optimization problem only involves the contemporaneous impact matrix A.
  - SVAR literature frequently uses long-run or dynamic sign restrictions to ensure that IRFs make economic sense at horizons $h > 0$.
  - OASIS forces contemporaneous alignment and leaves the future IRFs to fall wherever the reduced-form VAR coefficients dictate.
- Are the implied IRFs always consistent with economic theory over time?

- Suppose the true underlying economy is a recursive 2-variate SVAR:

$$\begin{pmatrix} \epsilon_1 \\ \epsilon_2 \end{pmatrix} = \begin{pmatrix} 1 & 0 \\ \rho & \sqrt{1-\rho^2} \end{pmatrix} \begin{pmatrix} u_1 \\ u_2 \end{pmatrix}.$$

  - $\text{corr}(u_1, \epsilon_1) = 1$ and $\text{corr}(u_2, \epsilon_2) = \sqrt{1-\rho^2}$.
  - Cholesky with y_1 ordered first recovers the true structural shocks u_1 and u_2.
  - Cholesky with y_2 ordered first keeps average correlation the same but identifies other shocks.
- What does OASIS do?
  - OASIS solution is $u^* = A_*' \epsilon$, where $A_* = \Lambda_\sigma^{-1} C^{-1/2} = \Sigma^{-1/2}$.
  - $\text{corr}(u_1^*, \epsilon_1) = \text{corr}(u_2^*, \epsilon_2) = \frac{\sqrt{1+\rho}+\sqrt{1-\rho}}{2}$.

5. The Averaging Bias in Recursive Economies

- OASIS structural shocks are a particular rotation of the true shocks:

$$\begin{pmatrix} u_1^* \\ u_2^* \end{pmatrix} = \begin{pmatrix} \cos(\theta^*) & -\sin(\theta^*) \\ \sin(\theta^*) & \cos(\theta^*) \end{pmatrix} \begin{pmatrix} u_1 \\ u_2 \end{pmatrix}, \quad \theta^* = -\frac{1}{2}\arcsin(\rho).$$

  - Mathematically, u^* are still structural in the sense that $\mathrm{Var}(u^*) = \mathrm{I}_2$.
  - Economically, the implications are very different.

	True		OASIS	
	Effect on y_1	Effect on y_2	Effect on y_1	Effect on y_2
Shock 1	1	ρ	$\cos(\theta^*)$	$-\sin(\theta^*)$
Shock 2	0	$\sqrt{1-\rho^2}$	$-\sin(\theta^*)$	$\cos(\theta^*)$

- OASIS actively confounds distinct structural economic forces.
  - OASIS shock 1 is actually the true economy being hit by $u_1 = \cos(\theta^*)$ and $u_2 = -\sin(\theta^*)$ *simultaneously*.

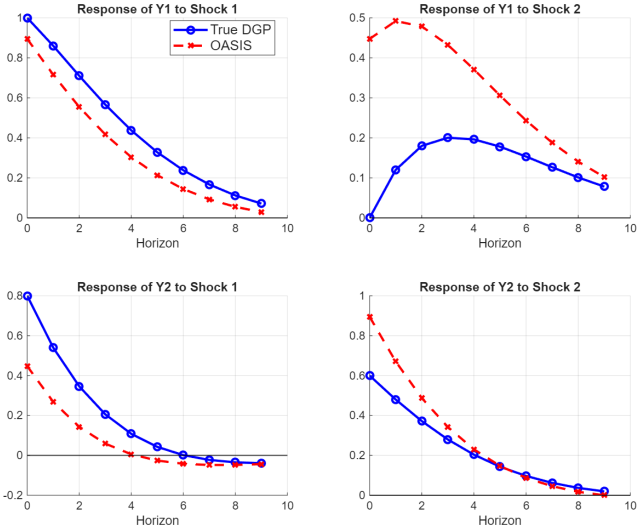

Figure: IRF Comparison: True DGP vs. OASIS ($u_1 = 1$, $u_2 = 0$)

5. The Averaging Bias in Recursive Economies

- Can weighted OASIS recover the true recursive DGP? No.
- The weighted OASIS solution is $A_* = \Lambda_\sigma^{-1}\Lambda_w(\Lambda_w C \Lambda_w)^{-1/2}$.
- This yields an impact matrix
$$B_* = A_*^{-1'} = (\Lambda_w C \Lambda_w)^{1/2}\Lambda_w^{-1}\Lambda_\sigma,$$
which can never be lower triangular when $\rho \neq 0$ and weights are positive.

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Concluding Remarks

- Thought-provoking paper that successfully shifts how we think about SVAR identification.
- OASIS is an excellent tool when researchers are genuinely agnostic and want a symmetric, invariant baseline.
- Extra care is needed to interpret maximum correlation in economic terms.

References I

Baumeister, C. and Hamilton, J. D. (2015), 'Sign restrictions, structural vector autoregressions, and useful prior information', *Econometrica* **83**(5), 1963–1999.