The Systematic Origins of Monetary Policy Shocks

Lukas Hack, Klodiana Istrefi and Matthias Meier

Discussion by Tatevik Sekhposyan, Texas A&M University
SF Fed Macroeconomics and Monetary Policy Conference, 2025

Characterization of the Problem

- Identification of causal effects in macroeconomic data is difficult since it is hard to pinpoint to exogeneous variation in macroeconomic variables.
  - For instance, most of the interest rate, oil price, etc. fluctuations are endogeneous to the state of the economy.
- More formally, as in Christiano and Eichenbaum (Handbook of Macro, Chapter 2, 1999)

$$S_t = f(\Omega_t) + \sigma_s \epsilon_t^s$$

  - S_t is the policy instrument, $f(.)$ is a (linear) function that relates S_t to the information set Ω_t, $\sigma_s \epsilon_t^s$ is the monetary policy shock (r.v.), with ϵ_t^s having a unit variance.
- How should an econometrician think of $f(.)$ and Ω_t to ensure that a monetary policy shock is identified?

Specification Choices for the Taylor Rule

What does Ω_t include? Is the central bank reacting to

→ inflation? (Galí & Monacelli, 2005)

$$\begin{aligned} i_t &= \alpha + \phi_\pi \pi_{H,t} + \sigma_s \epsilon_t^s \quad \text{domestic inflation-based} \\ i_t &= \alpha + \phi_\pi \pi_t + \sigma_s \epsilon_t^s \quad \text{CPI-based} \end{aligned}$$

→ inflation and output, while ensuring stability of the financial markets? (Clarida, Galí and Gertler, 1999)

$$i_t = (1-\rho)[\alpha + \beta \pi_t + \gamma x_t] + \rho i_{t-1} + \sigma_s \epsilon_t^s$$

→ expectations?

→ Commodity prices proxy expectations (Hanson, 2004)

→ Romer & Romer (2004), Miranda-Agrippino & Ricco (2021)

$$S_\tau = \alpha + \sum_{h=-1}^{3} \theta' F_\tau^{GB}(x_{q+h}) + \sum_{h=-1}^{2} \delta' \left[F_\tau^{GB}(x_{q+h}) - F_{\tau-1}^{GB}(x_{q+h}) \right] + \sigma_s \epsilon_\tau^s$$

Specification Choices for the Taylor Rule

Is $f(.)$ a linear function? The paper says NO!

Considers two forms of non-linearity

→ In the theoretical/expositional part

$$i_t = \alpha + (\phi + \underbrace{\widetilde{\phi}_t}_{\text{random}})\pi_t + \underbrace{m_t}_{\text{m.p. shock}}$$

$$\widetilde{\phi}_t = \rho_\phi \widetilde{\phi}_{t-1} + \psi^d \underbrace{d_t}_{\text{demand shock}} + \psi^a \underbrace{a_t}_{\text{supply shock}} + \underbrace{q_t}_{\text{syst. m.p. shock}}$$

→ In the empirics

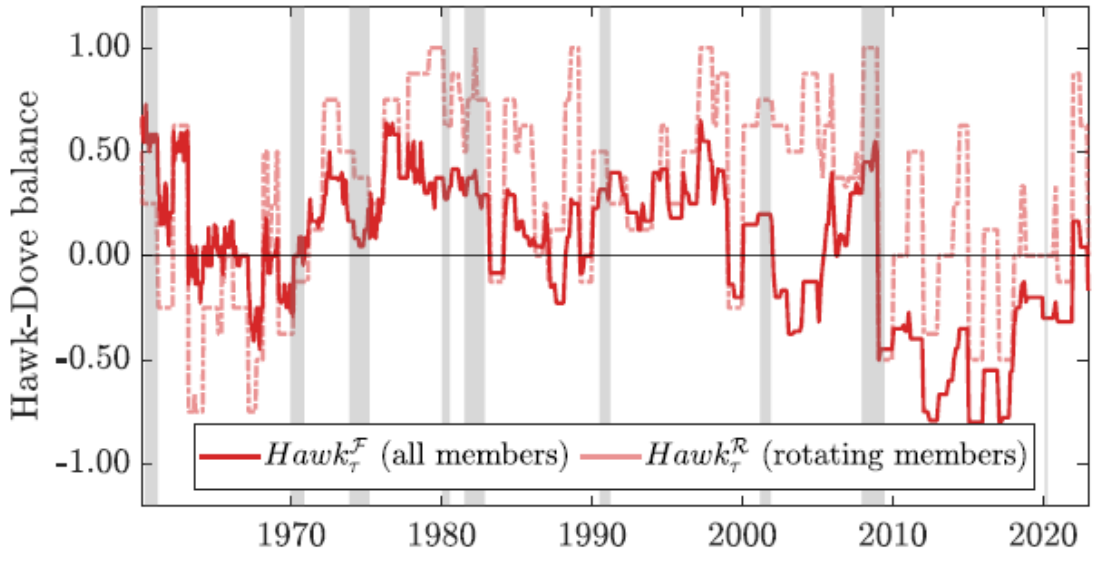
$$S_\tau = \alpha + \sum_{h=-1}^{3} (\theta' + \widetilde{\theta}' Hawk_{\tau-1}) F_\tau^{GB}(x_{\tau+h})$$

$$+ \sum_{h=-1}^{2} (\delta' + \widetilde{\delta}' Hawk_{\tau-1}) \left[F_\tau^{GB}(x_{\tau+h}) - F_{\tau-1}^{GB}(x_{\tau+h})\right] + \sigma_s \epsilon_\tau^s$$

Proposed Non-linearity in the Taylor Rule

$$S_\tau = \alpha \quad + \quad \sum_{h=-1}^{3} (\theta' + \widetilde{\theta}' \, Hawk_{\tau-1}) F_\tau^{GB}(x_{\tau+h})$$

$$+ \quad \sum_{h=-1}^{2} (\delta' + \widetilde{\delta}' \, Hawk_{\tau-1}) \left[F_\tau^{GB}(x_{\tau+h}) - F_{\tau-1}^{GB}(x_{\tau+h}) \right] + \sigma_s \epsilon_\tau^s$$



Misspecification and Identification

$$\begin{aligned} i_t &= f(\Omega_t) + \sigma_s \epsilon_t^s \quad \text{True Model} \\ i_t &= g(\mathcal{I}_t) + \sigma \epsilon_t \quad \text{Empirical Model} \end{aligned}$$

The identified monetary policy shock, even in population, is

$$\sigma \epsilon_t = \underbrace{[f(\Omega_t) - g(\mathcal{I}_t)]}_{\text{misspecification}} + \sigma_s \epsilon_t^s$$

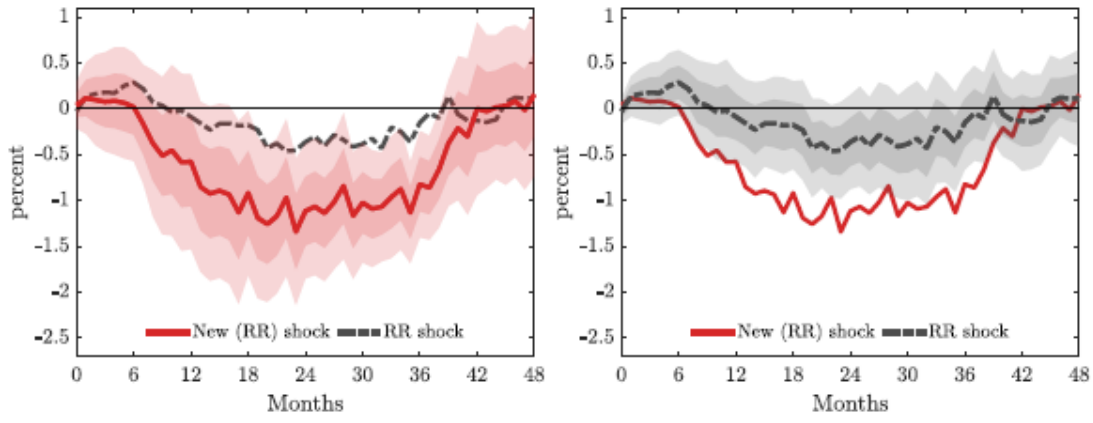
- → Is misspecification an issue? Depends...
- → We could think of $\sigma \epsilon_t$ as a noisy measure of $\sigma_s \epsilon_t^s$.
- → Basis of "method of external instruments"/proxy VARs.
- → Valid instrument Z_t, $E(Z_t \epsilon^{s'}) \neq 0$, $E(Z_t \epsilon^{q'}) = 0$, $\epsilon^{q'}$ being the nuisance shocks

Misspecification and Identification

→ Is misspecification an issue?

→ The answer could be in the results since the responses are different, which implies at least one (or both) are biased.

(b) Real GDP



→ It would still be useful to think in terms of validity of the instruments as opposed direct measurement of the shock.

Discussion Items

→ Is Taylor rule non-linear? If the aim is to get to a direct measurement of the shock, the form of the non-linearity is relevant.

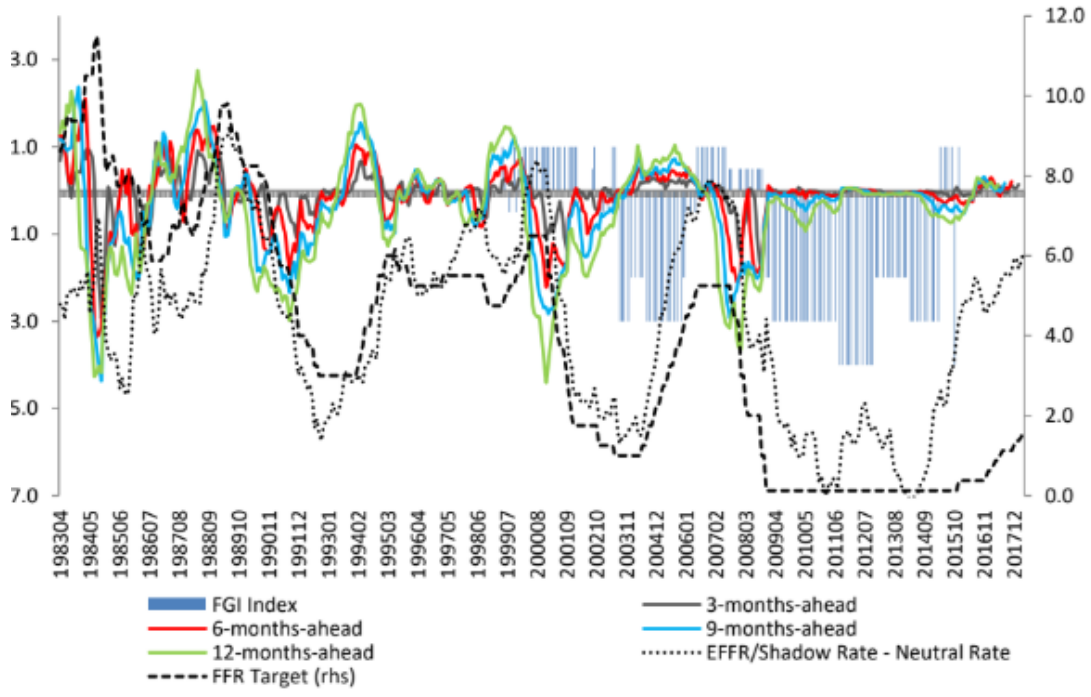
→ Should we see the non-linearity in other places outside of the Romer & Romer (2004) type cleaning regressions?

→ Are we explicitly interested in characterizing the non-linearities?

→ Perhaps it is sufficient to robustify to non-linearities (along the lines of Kolesár & Plagborg-Møller, 2025).

Non-linearities in Taylor Rule

→ Blue Chip Financial Forecasts, errors: realization minus forecasts

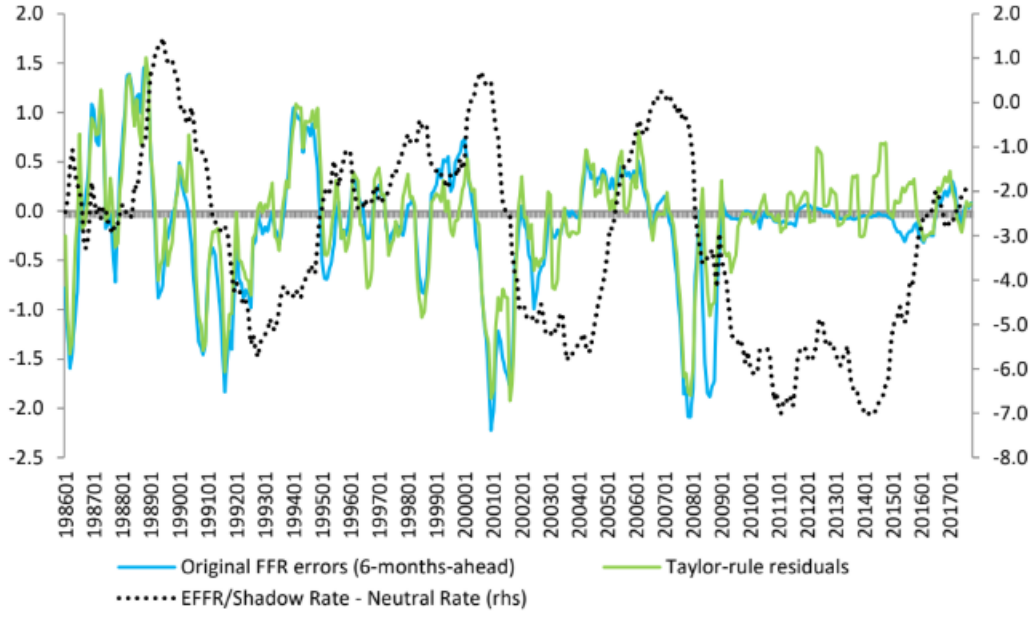


Source: Dahlhaus & Sekhposyan (2025)

→ Is policy implemented differently in easing/tightening?

Non-linearities in Taylor Rule

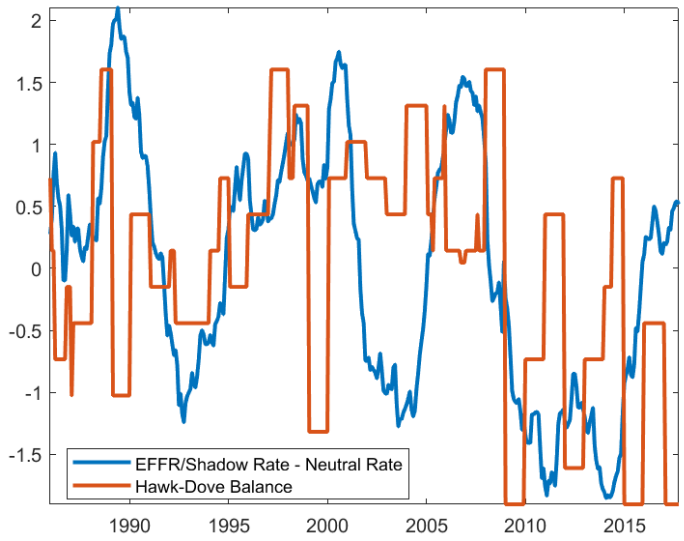
→ Taylor rule residuals from a projection of interest rate forecasts on output growth and inflation forecasts



Source: Dahlhaus & Sekhposyan (2025)

Non-linearities in Taylor Rule

→ Comparing the interest rate gap and hawk-dove balance index, both measures are standardized.

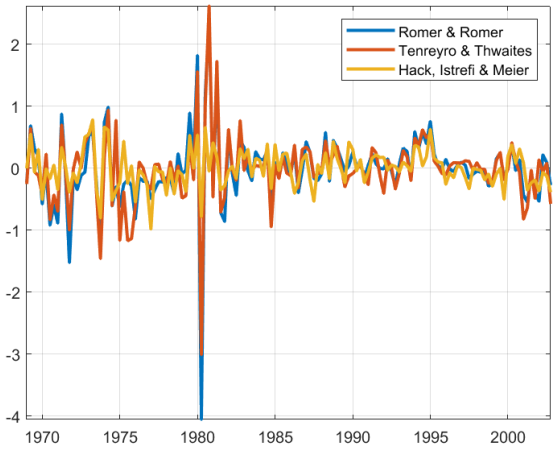


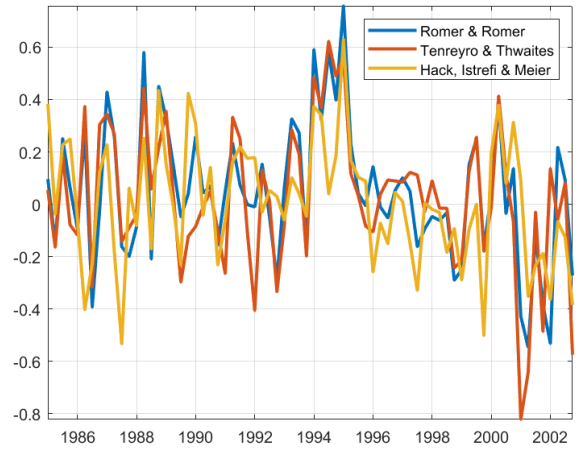
→ Contemporaneous correlation of the raw series is 0.2 (0.5 with the all member index).

→ Difficult to pin down the source of the non-linearity.

Comparison with Non-linearly Identified Shocks

- → Tenreyro & Thwaites (2016) consider a Romer and Romer-type regression, allowing parameters to change with the business cycle in a smooth manner.
- → Cont. correlations of RR and TT is 0.9, while RR and HIM is 0.6. Meanwhile, between TT and HIM is 0.55.



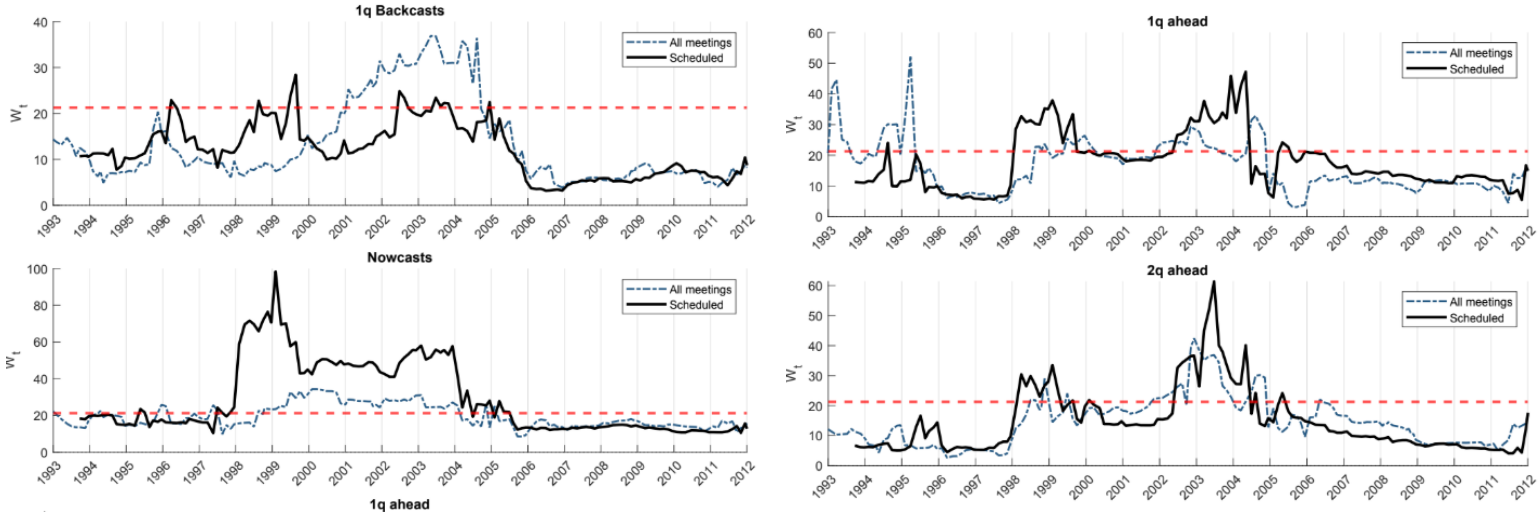


Detecting Non-linearities in Taylor rule

→ Take a more agnostic approach robust to smooth changes

$$S_\tau = \alpha_t + \sum_{h=-1}^{3} \theta_t' F_\tau^{GB}(x_{q+h}) + \sum_{h=-1}^{2} \delta_t' \left[F_\tau^{GB}(x_{q+h}) - F_{\tau-1}^{GB}(x_{q+h}) \right] + \sigma_{st} \epsilon_\tau^s$$

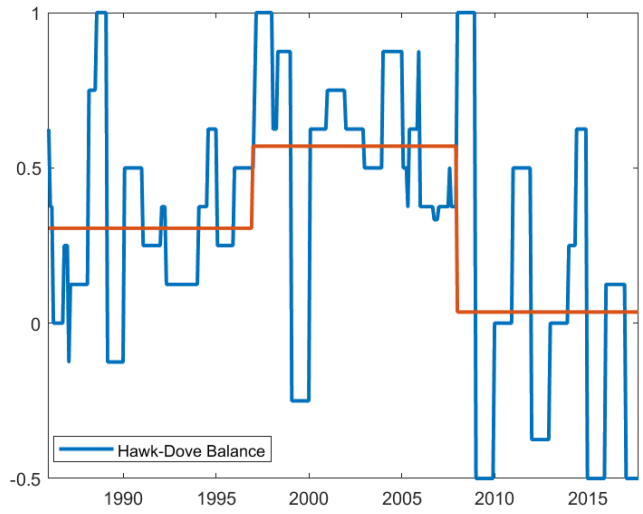
→ Information content of market-based (3-month-ahead FFR futures-based) surprises



Source: Hoesch, Rossi & Sekhposyan (2023)

Detecting Non-linearities in Taylor rule

→ Is the agnostic method picking up the Hawk-Dove balance?



Non-linearities & Hawk-Dove Balance

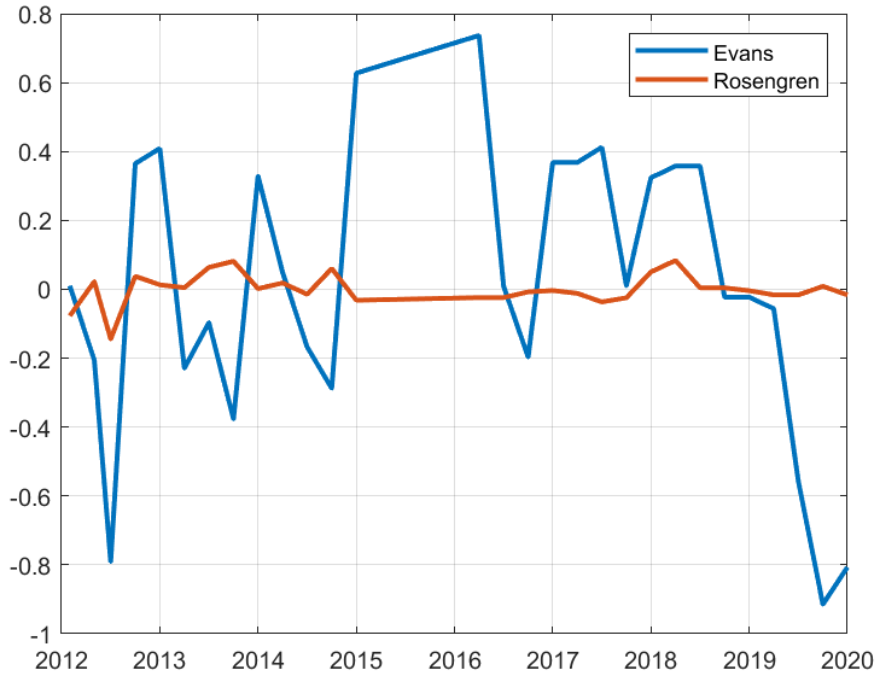
→ Hawk-dove balance captures issues related to cross sectional aggregation across FOMC members.

→ Aggregation implied endogeneity is easy to see under the assumptions of similar information set and/or preferences.

→ Would be interesting to have examples of aggregation to see what are other sources of misspecification that can arise (Bobrov, Kamdar & Ulate, forthcoming, Coibion & Goldstein, 2012).

Non-linearities & Hawk-Dove Balance

→ Heterogeneous residual behavior from projecting long-run interest rate expectations on output growth and inflation expectations.



Non-linearities Elsewhere

→ In a New-Keynesian example, the approximate equilibrium dynamics of z_t, which includes inflation and output growth is given by

$$z_t = \alpha_z + \delta_z^d d_t + \delta_z^a a_t + \delta_z^m m_t + \gamma_z^d d_t \tilde{\phi}_t + \gamma_z^a a_t \tilde{\phi}_t + \gamma_z^m m_t \tilde{\phi}_t + \delta_z^\phi \tilde{\phi}_t.$$

→ Should we see a similar type of time-variation in the propagation of other shocks?

→ At least from the survey expectations point of view output growth and inflation expectations have a different dynamics than those of the interest rates.

Non-linearities Elsewhere

→ In addition, the "cleaning" regression is non-linear, proxied by the interaction of the hawk-dove balance and fundamentals.

→ The causal effects are estimated with a time-invariant local projections.

$$\begin{aligned} y_t &= \rho y_{t-1} + \beta x_t + u_t \\ x_t &= \phi_t y_t + \epsilon_t \end{aligned}$$

The solution would be

$$y_t = \frac{\rho}{1-\beta\phi_t} y_{t-1} + \frac{\beta}{1-\beta\phi_t}\epsilon_t + \frac{1}{1-\beta\phi_t} u_t$$

→ Time-invariant local projection will still uncover causal effects, but it would be averaging out the randomness in ϕ_t.

Non-linearities & Local Projections

- → Kolesár & Plagborg-Møller (2025) argue that when we observe the shock of interest (or have a valid proxy), then regular linear LP provides a meaningful causal summary regardless of how non-linear the DGP is.
- → In contrast the non-linear extensions of the LP and VARs do not do that.
- → In "cleaning" regressions we do not observe the shock, instead we are in the case of identification with control variables and the results are more fragile.

"We recommend that researchers do careful sensitivity checks with respect to both the set of controls and the functional form for the controls, say, by including interactions and polynomials."

Identification with Control

→ If we go through identification with controls route, then we can estimate the LP in one step:

$$Y = X\beta + \gamma(W) + residual$$

→ Will help characterize the uncertainty in a more comprehensive way
"... effects are more precisely estimated when using the new shock"

Summary

- → It context of non-linearities, the identification with controls could be somewhat sensitive to specification choices, so
  - → robustify the specification choices
  - → take a stronger stance on the non-linearity
- → The paper pushes forward our understanding of shock-identification in the context of macro and was a pleasure to read and discuss!