Monetary Policy Shocks: Data or Methods?

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Intro

Identifying monetary policy is difficult!

- It is endogenous: both responds to and affects the economy

High-frequency changes in asset prices proxy exogenous variation in monetary policy since Kuttner (2001)

- isolate monetary news by comparing asset prices shortly before and after FOMC announcements
- many possible data and methods $\rightarrow$ many different monetary policy shocks available
    - Eurodollar and federal funds futures, Treasuries
    - first differences, principal component analysis, Fama-MacBeth regression

Stating the Problem

Problem: the sizes/signs of monetary shock series can vary across data/methods

- correlation as low as 0.3, same sign about 1/2 of the time
- differences starkest at the ELB

How do these differences affect estimates of monetary transmission?

What We Do

Compare data/methods of Kuttner (2001), Gertler & Karadi (2015), Nakamura & Steinsson (2018)/Gürkaynak et al. (2005), Bu et al. (2021)

1. shock construction
2. monetary policy transmission

We compare shocks that are

- **high-frequency**, for VAR or narrative comparisons see: Rudebusch (1998), Ettmeier and Kriwoluzky (2019)
- **single series**, for multiple dimensions see: Gürkaynak et al. (2005), Lewis (2023), Swanson (2021, 2023), Acosta (2023), Jarocinski (2023)
- **w/out add-ons**: Miranda-Agrippino and Ricco (2021), Bauer and Swanson (2023, 2022), Jarocinski and Karadi (2020), Nunes et al. (2023), Zhu (2023)

What We Find

Monetary transmission:

- IRFs of LPs and VARs more similar across shock series than forecast revisions
- swapping data/methods $\rightarrow$ qualitative differences: inference not robust to construction

Bu et al. (2021) shock series:

- unpredictable by economic news
- similar in ELB and non-ELB periods
- mitigates an adversely-signed response in the specifications we study

Attribute to data on long-term rates *and* a method that extract their differential responsiveness relative to short-term rates

- high-frequency shocks pioneered when the FFR was the key policy instrument (and no ELB...); now there is a portfolio of tools

Shock Construction

1. Data Only: MP1 and FF4

MP1: Kuttner (2001)

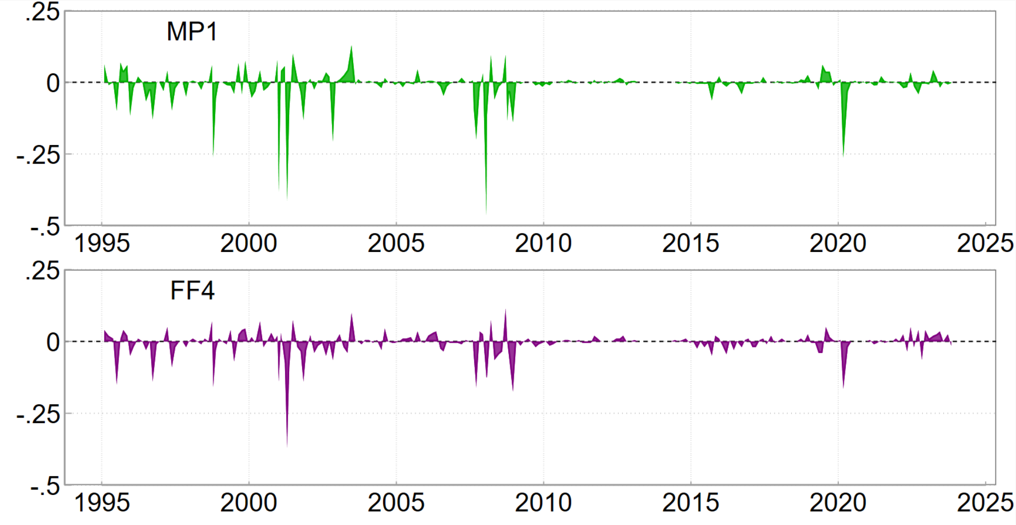
$$MP1_s = \begin{cases} \dfrac{D^s}{D^s - d^s}\left(ff^1_{s,t} - ff^1_{s,t-\Delta t}\right) & \text{if} \quad D^s - d^s > 7 \\ ff^2_{s,t} - ff^2_{s,t-\Delta t} & \text{otherwise} \end{cases}$$

FF4: Gertler & Karadi (2015), Jarocinski & Karadi (2021) ▸ next announcement

$$\Delta ff^4_s = \left(ff^4_{s,t} - ff^4_{s,t-\Delta t}\right)$$

Data Only: MP1 and FF4

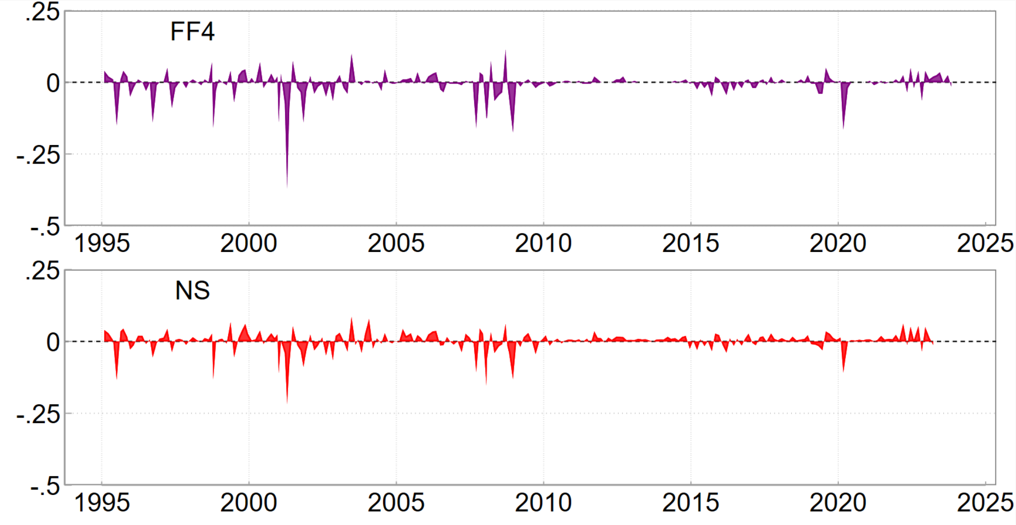
histograms



correlation=0.8 , same-sign=59%

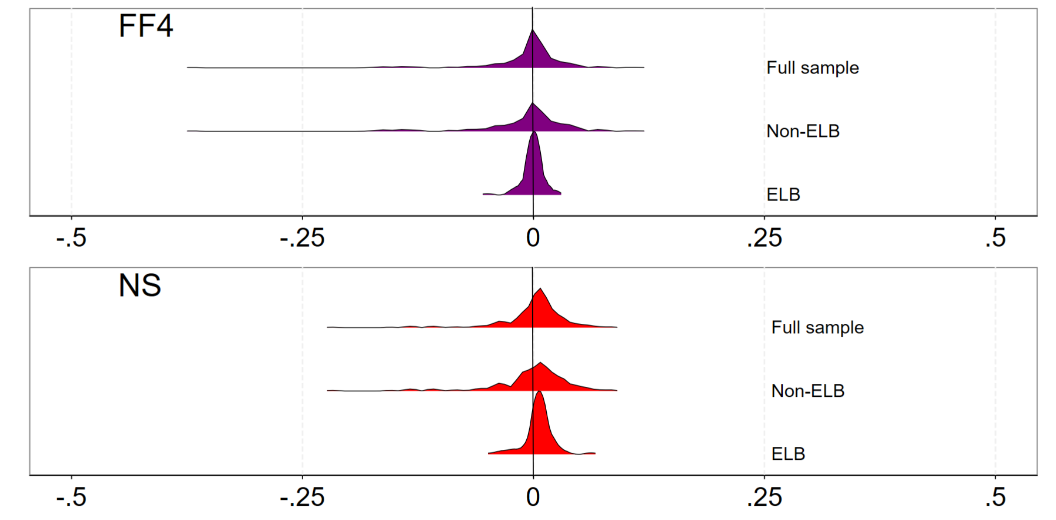
Data & Methods: Nakamura and Steinsson (NS)

▸ NS Construction



correlation=0.92 , same-sign=66%

Data & Methods: Nakamura and Steinsson (NS)



Data and Methods: Bu et al. (2021)

- Fama and MacBeth (1973) regression on Treasury yield curve
- One day window surrounding FOMC announcement s

1. estimate $\{\hat{\beta}_j\}_{j=1}^{30}$ via separate regressions

$$\Delta R_s^1 = \alpha_1 + \beta_1 \Delta i_s + \epsilon_s^1$$
$$\vdots$$
$$\Delta R_s^{30} = \alpha_{30} + \beta_{30} \Delta i_s + \epsilon_s^{30}$$

   assume Δi_s is one-to-one with 2-year yield ΔR_s^2, so $\Delta i = \Delta R_s^2 - \varepsilon_s^2$. Then,

$$\Delta R_s^j = \theta_j + \beta_j \Delta R_s^2 + \underbrace{\epsilon_s^j - \beta_j \epsilon_s^2}_{\xi_s^j}$$

   endogeneity of $corr(\Delta R_s^j, \xi_s^j) > 0$ reconciled w/ IV or Rigobon (2003) estimator

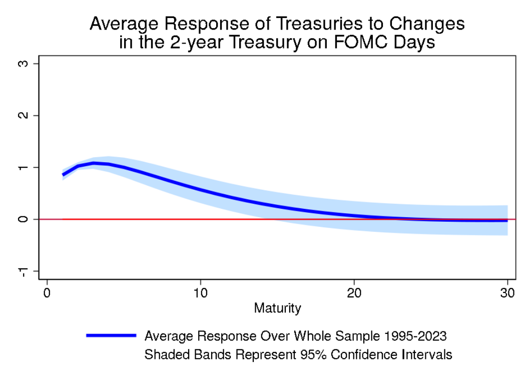
2. estimate shocks $\widehat{\Delta i_s}$ from $s = 1, ..., T$ cross-sectional reg. of ΔR_s^j on $\{\hat{\beta}_j\}_{j=1}^{30}$

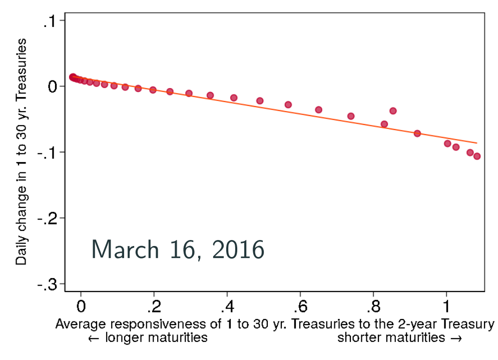
$$\Delta R_s^j = \alpha_j + \Delta i_s \hat{\beta}_j + v_s^j, \quad s = 1, ..., T \text{ announcements}$$

3. Re-scale shocks series to ΔR_s^2

Data and Methods: Bu et al. (2021)

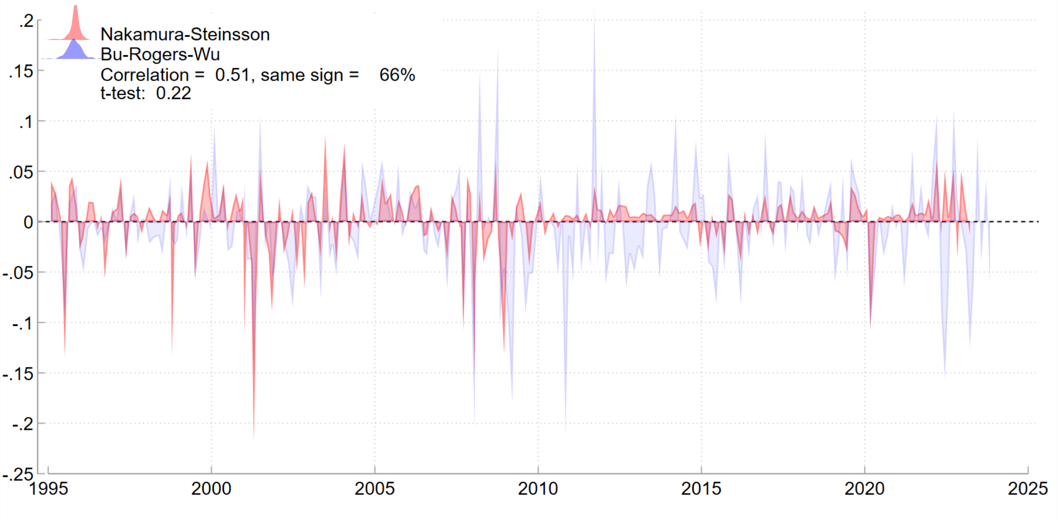
▸ ELB Comparison





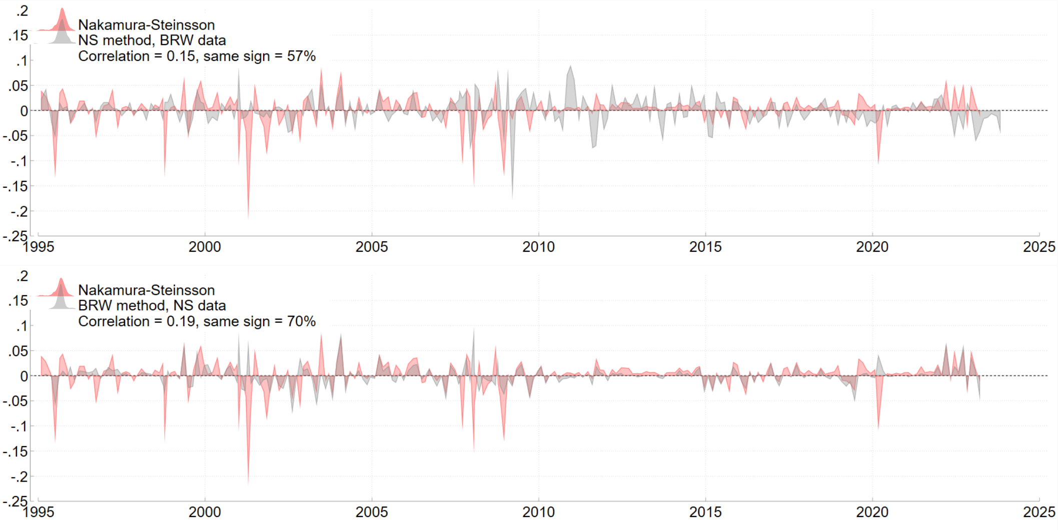
Why the difference?

histograms



3. Swapped shocks: differences due to methods or data?

BRW compare



Estimating Monetary Transmission

Estimating Monetary Transmission

▸ Predictability

Monthly revisions to Blue-chip forecasts à la Nakamura and Steinsson (2018), Campbell et al. (2012)

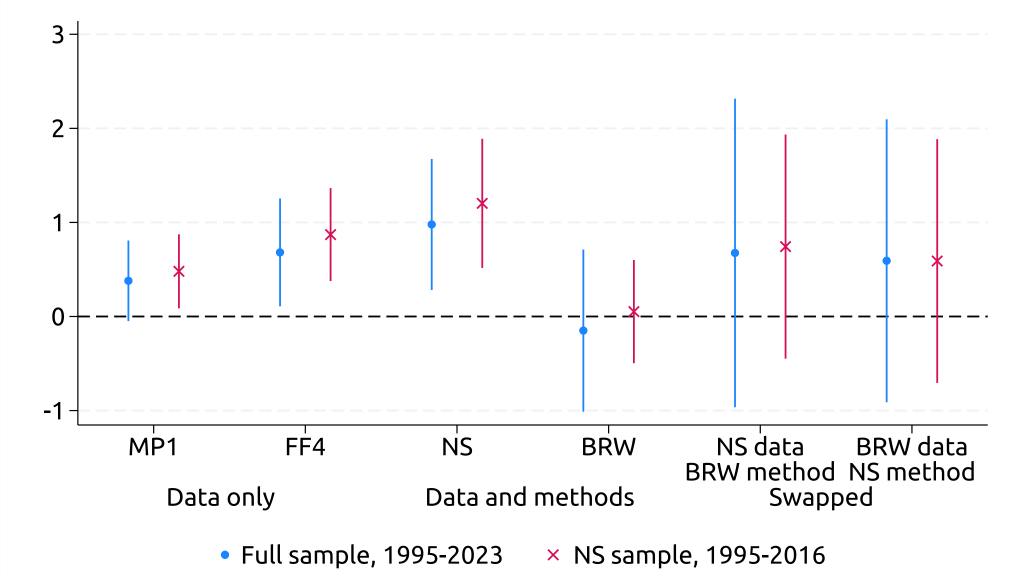
$$\text{Blue Chip GDP Revisions}_T = \beta \varepsilon_t^i + e_T$$

for i= data, data and methods, swapped

- $\hat{\beta}$ often the opposite sign of theoretical predictions

Blue Chip Regression Coefficients, 95% CI

Other samples ELB



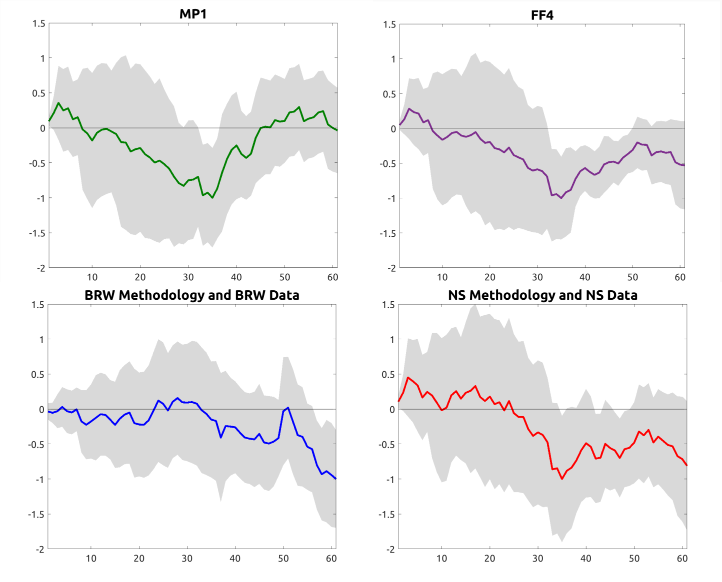
Estimating Monetary Transmission

Billion Prices Project's daily CPI in a local projection for day $t + h$.

$$\pi_{t+h} = \alpha_{(h)} + \beta_{(h)} \varepsilon_t^i + \Gamma_h z_t + e_t^h$$

- LHS and RHS both high-frequency
- Jacobson et. al (2023): high-frequency LHS mitigates temporal aggregation bias

2. Local Projections 2008-2015, 90% CI



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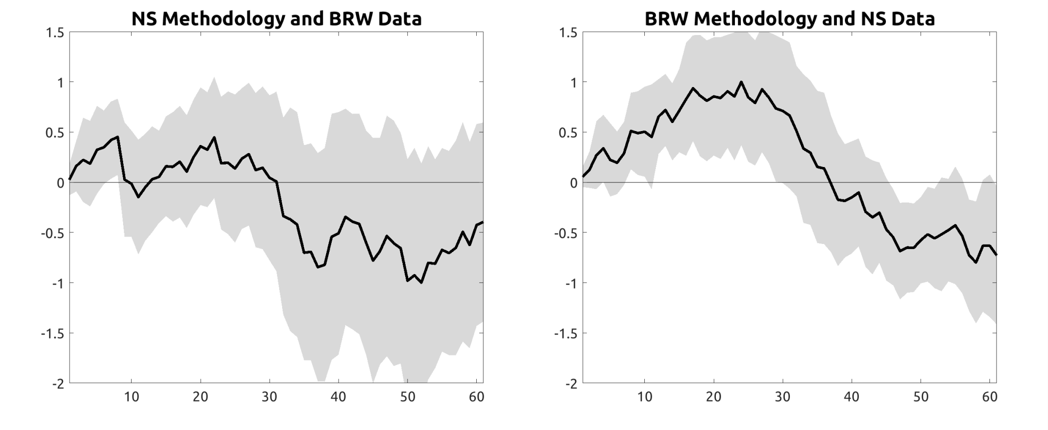


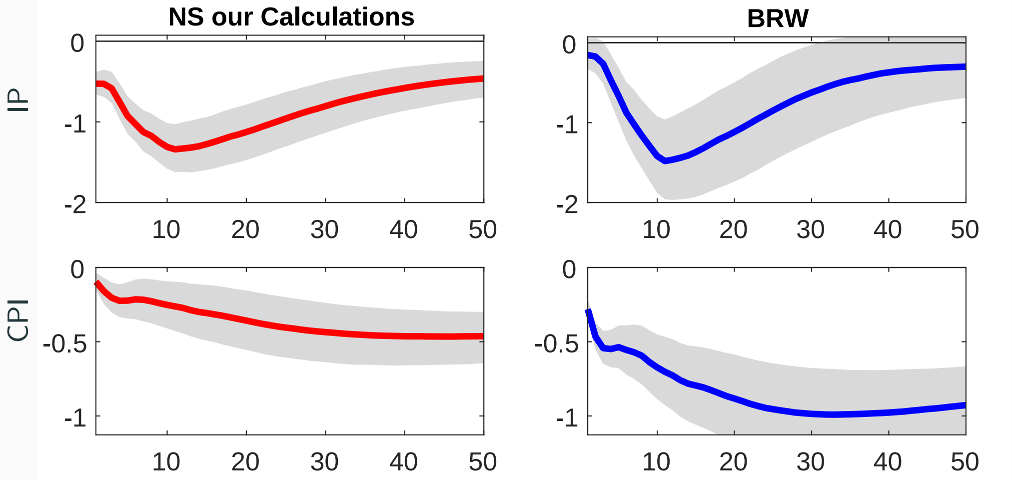
Estimating Monetary Transmission

Gertler and Karadi (2015) VAR with the monetary shock as an external instrument à la Bauer and Swanson (2022)

- 8 lags, 4 variables: IP, CPI, excess bond premium, 2-year Treasury
- VAR: 1973 to Feb. 2020
- External instrument: 1995 to 2019
- Canova & Ferroni Toolbox

VAR IRFs, 25 bps Monetary Shock

▸ detailed comparison ▸ financial variables



VAR IRFs, 25 bps Monetary Shock

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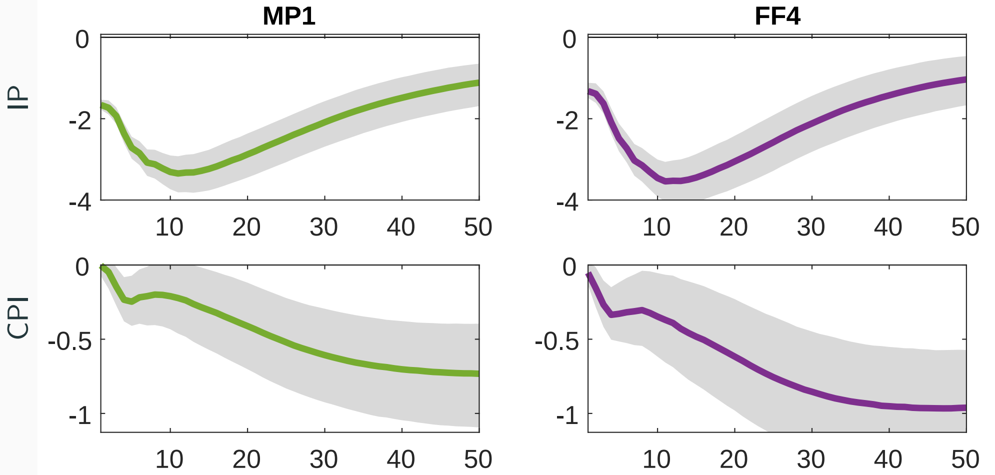
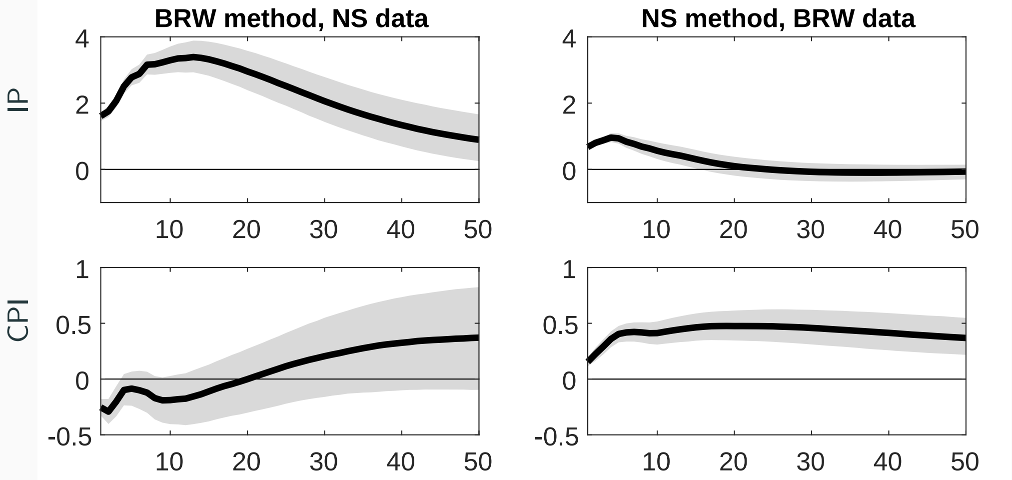


VAR IRFs, 25 bps Monetary Shock

▸ detailed comparison ▸ financial variables



Conclusion

Document differences in sizes/signs of high-frequency monetary shocks

- starkest at the ELB

Attribute differences to both data and methods

- shift away from a single instrument to a portfolio of tools
- exploiting additional information from long-term rates depends on the method

Consequences for inference depends on the specification

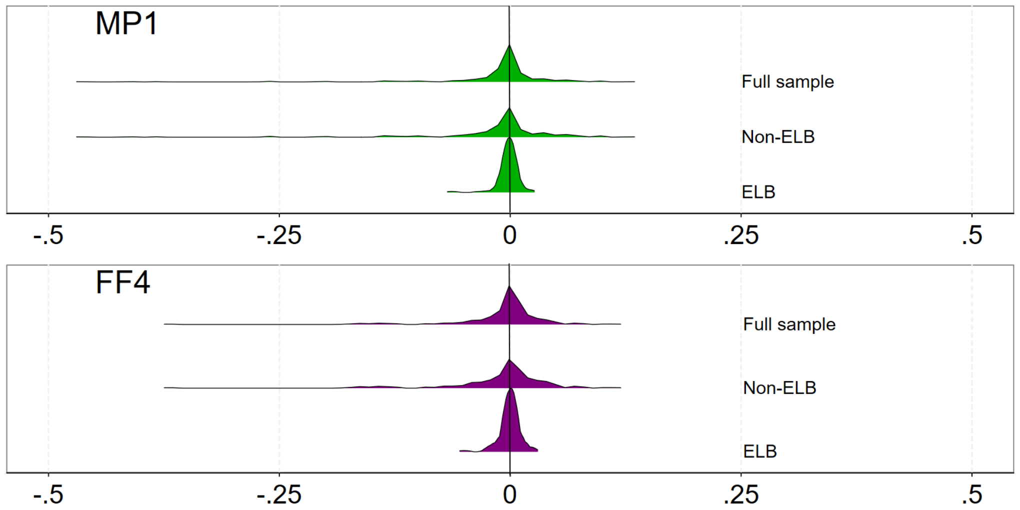
- qualitatively similar in some LPs and VARs
- qualitatively different when swapping data/methods, inference may not be robust to all constructions

Appendix

Months Ahead of the Next Scheduled FOMC Announcement

Future		Percent	Number
$FF1$	in current month	2.05%	5
$FF2$	1-month ahead	50.41%	123
$FF3$	2-months ahead	47.13%	115
$FF4$	3-months ahead	0.41%	1
Total			244

1. Data only: High Frequency Monetary Policy Shocks



Data & Methods: Nakamura and Steinsson (2018)

- First principal component of intraday changes in five futures
- Fed funds futures liquid for ≈ 3 months ahead, eurodollars 4 to 12 months ahead

  eurodollars: dollar-denominated deposits at foreign banks

- 30-minute window surrounding FOMC announcement in month s

$MP1_s$ as previously shown

$$MP2_s = \begin{cases} \frac{D^{s'}}{D^{s'} - d^{s'}} \left[(ff^{j}_{s',t} - ff^{j}_{s',t-\Delta t}) - \frac{d^{s'}}{D^{s'}} MP1_s \right] & \text{if} \quad D^{s'} - d^{s'} > 7, \quad j \approx 2, 3 \\ ff^{j+1}_{s',t} - ff^{j+1}_{s',t-\Delta t} & \text{otherwise} \end{cases}$$

details

$$edk_q = edk_{q,t} - edk_{q,t-\Delta t}, \quad k = 2, 3, 4 \quad \text{quarters ahead}$$

Construction of Nakamura and Steinsson (2018) Shocks

1. expected ffr (r_0) for the month of the FOMC announcement, adjusted elapsed days of the month (d^s) out of total days (D^s)

$$\underbrace{f^1_{t-\Delta t}}_{\substack{\text{current month's ffr future} \\ \text{prior to FOMC}}} = \underbrace{\frac{d^s}{D^s} r_{-1}}_{\substack{\text{current month's ffr} \\ \text{prior to FOMC}}} + \underbrace{\frac{D^s - d^s}{D^s} \mathbb{E}_{t-\Delta t} r_0}_{\substack{\text{current month's ffr future} \\ \text{prior to FOMC}}}$$

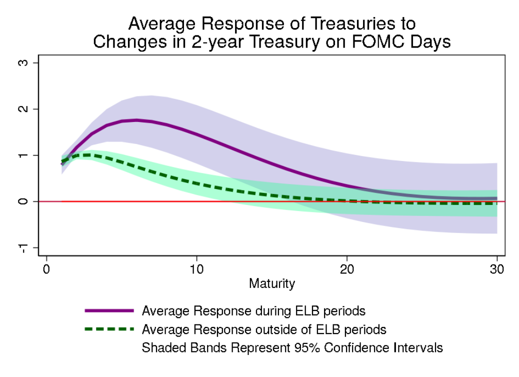
$$\underbrace{f^1_{t}}_{\substack{\text{current month's ffr future} \\ \text{after FOMC}}} = \underbrace{\frac{d^s}{D^s} r_{-1}}_{\substack{\text{current month's ffr} \\ \text{prior to FOMC}}} + \underbrace{\frac{D^s - d^s}{D^s} \mathbb{E}_{t} r_0}_{\substack{\text{current month's ffr future} \\ \text{after FOMC}}}$$

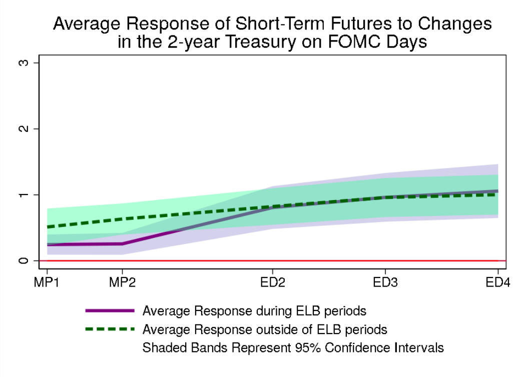
Combining and re-arranging: $$\underbrace{\mathbb{E}_t r_0 - \mathbb{E}_{t-\Delta t} r_0}_{\text{expected } \Delta \text{ in current month's ffr}} = \frac{D^s}{D^s - d^s} \left(f^1_t - f^1_{t-\Delta t} \right)$$

2. expected ffr r_1 for the remainder of the month of the next scheduled FOMC announcement

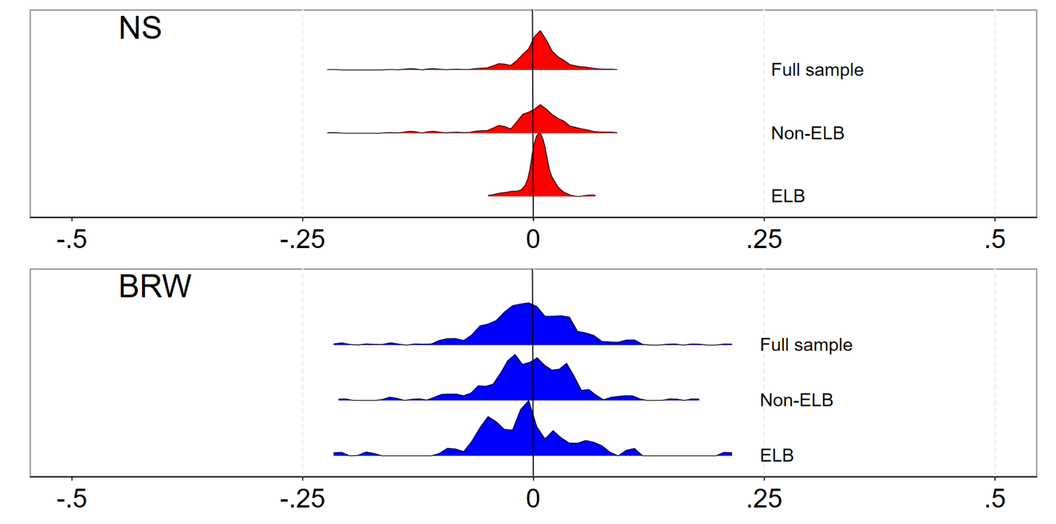
$$\underbrace{\mathbb{E}_t r_1 - \mathbb{E}_{t-\Delta t} r_1}_{\substack{\text{expected } \Delta \text{ in ffr} \\ \text{in month of next FOMC}}} = \frac{d^{s'}}{D^{s'} - d^s} \left[\underbrace{\left(f^n_t - f^n_{t-\Delta t} \right)}_{\substack{\Delta \text{ in ffr future} \\ \text{for next FOMC}}} - \underbrace{\frac{d^{s'}}{D^{s'}} \left(\mathbb{E}_t r_0 - \mathbb{E}_{t-\Delta t} r_0 \right)}_{\text{scaled expected } \Delta \text{ in current month}} \right]$$

Data and Methods: Bu et al. (2021) ELB Comparison

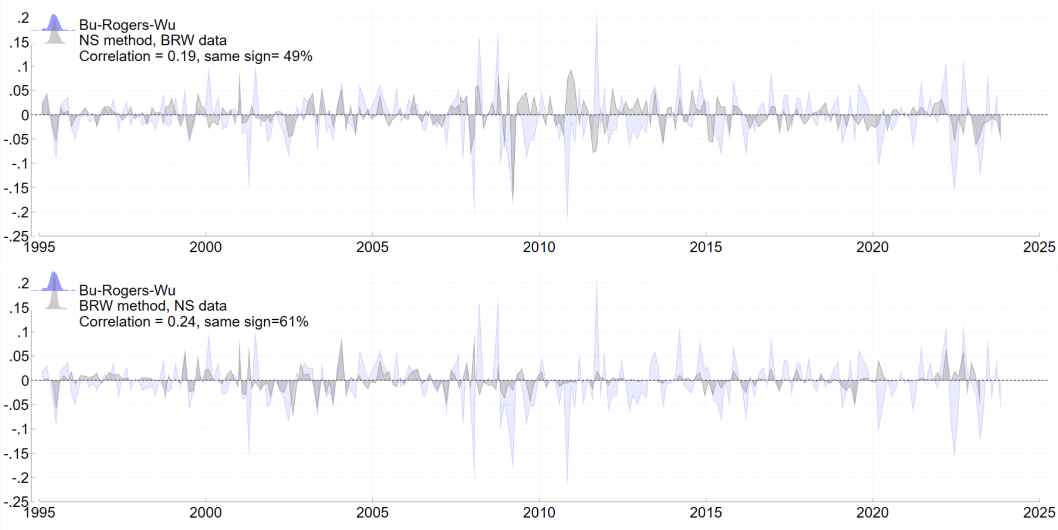




2. Why the difference?



3. Swapped shocks: differences due to methods or data?



Note: legend markers are data distributions.

Predictability

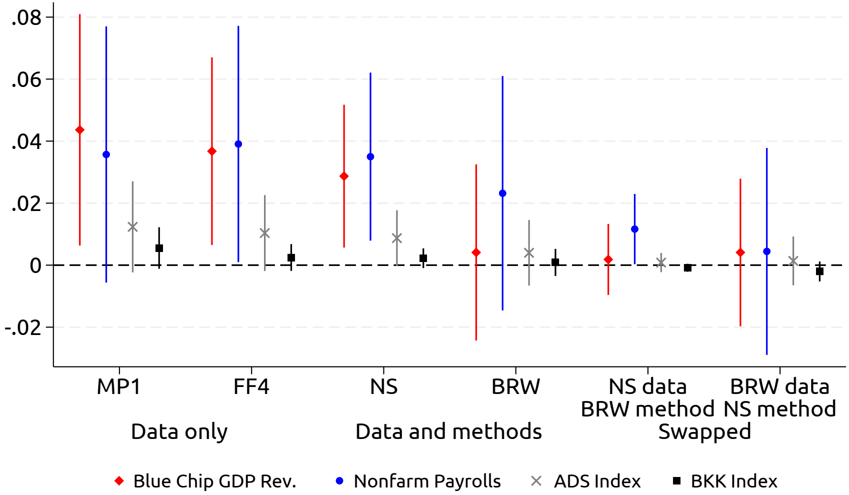
Karnaukh and Vokata (2022), Sastry (2021), and Bauer and Swanson (2023) show that monetary shocks ε_t^i can be predicted by economic news

$$\varepsilon_t^i = \alpha + \beta \, news_t^k + e_t$$

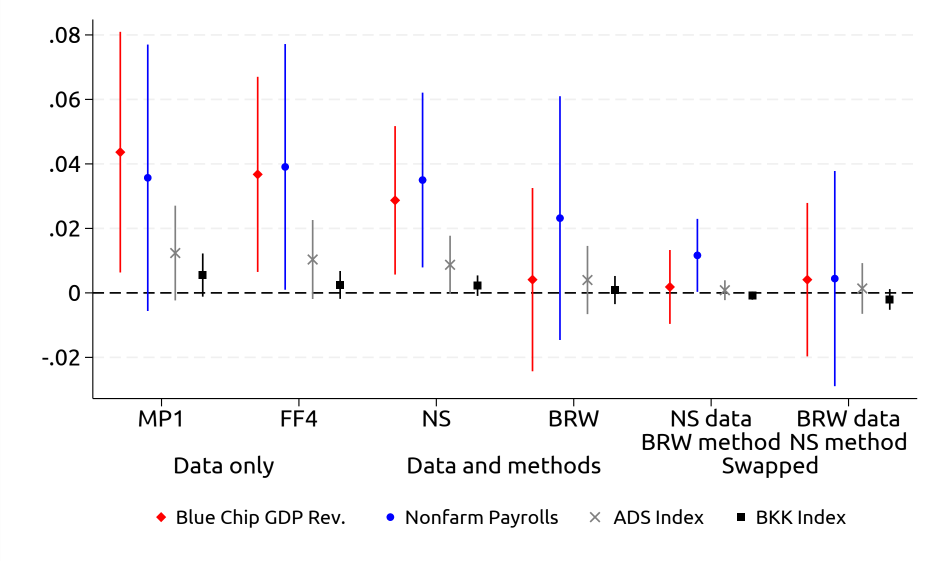
$$\text{news } k = \begin{cases} \text{Blue-Chip GDP revisions} \\ \text{Change in non-farm payrolls} \\ \text{Aruoba-Scotti-Diebold index} \\ \text{Brave et. al Index} \end{cases}$$

for $i=$ data, data & methods, swapped shocks

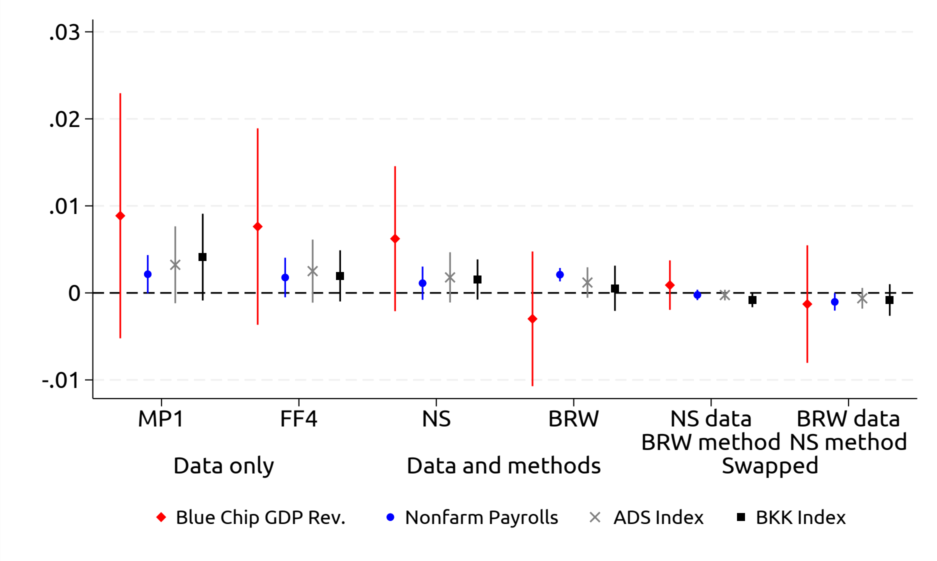
Predictability Coefficients from 1995 to 2023 (ex. Covid), 95% CI



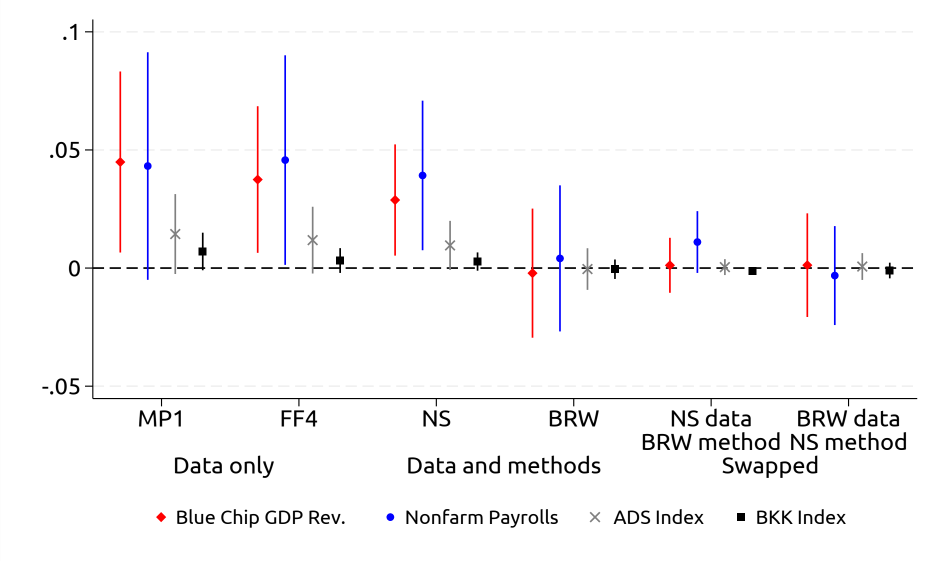
Predictability Coefficients from 1995 to 2023, 95% CI



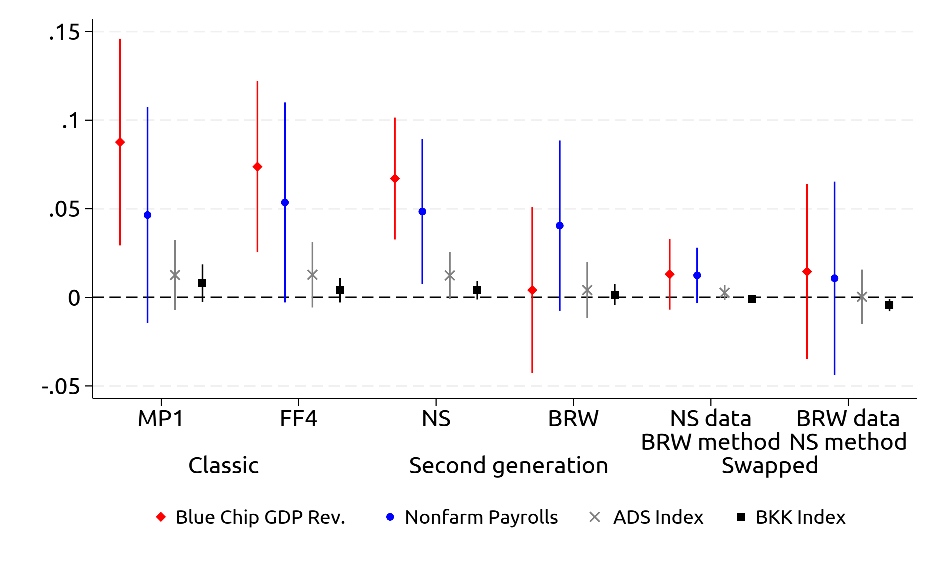
Predictability Coefficients from 1995 to 2023 (ex. crisis), 95% CI



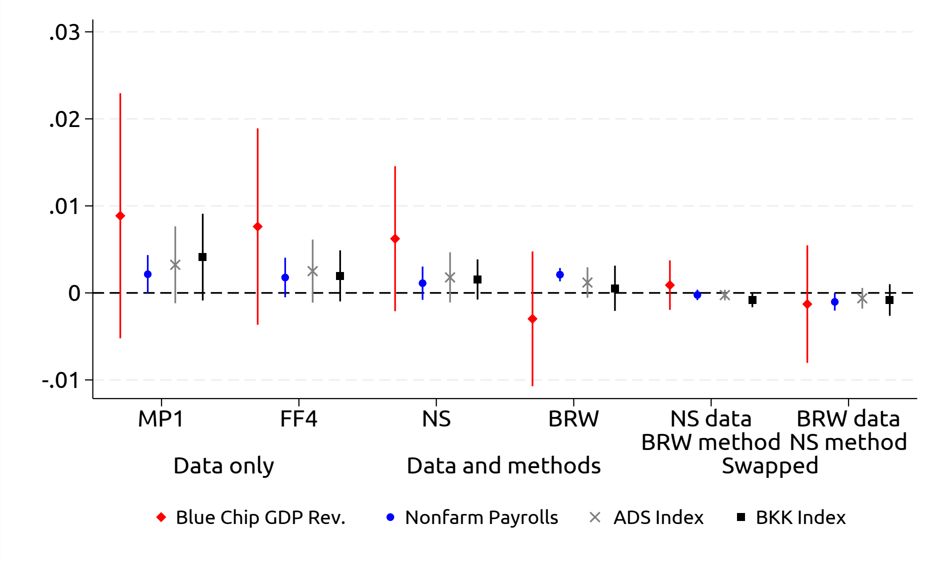
Predictability Coefficients from 1995 to 2023 (ex. crisis & Covid), 95% CI



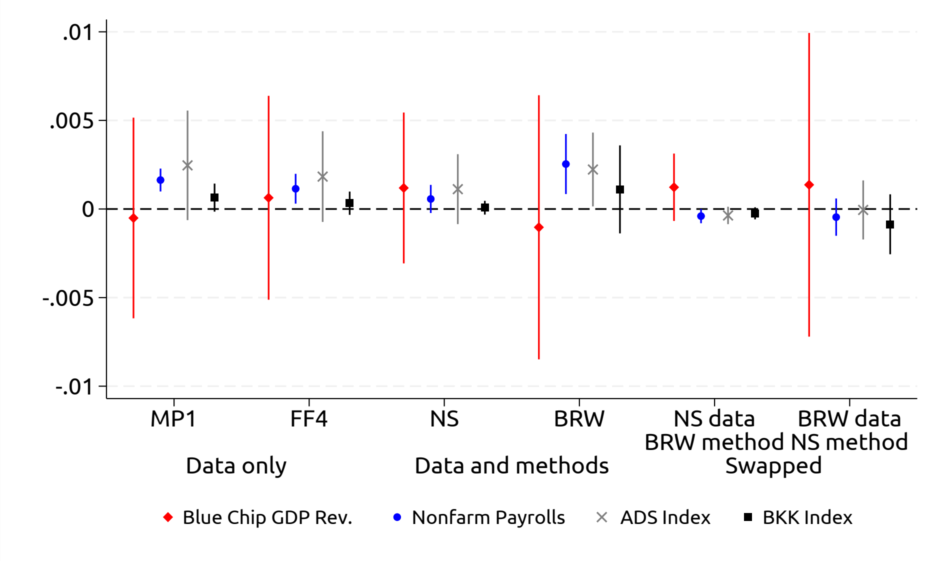
Predictability Coefficients from 1995 to 2016, 95% CI



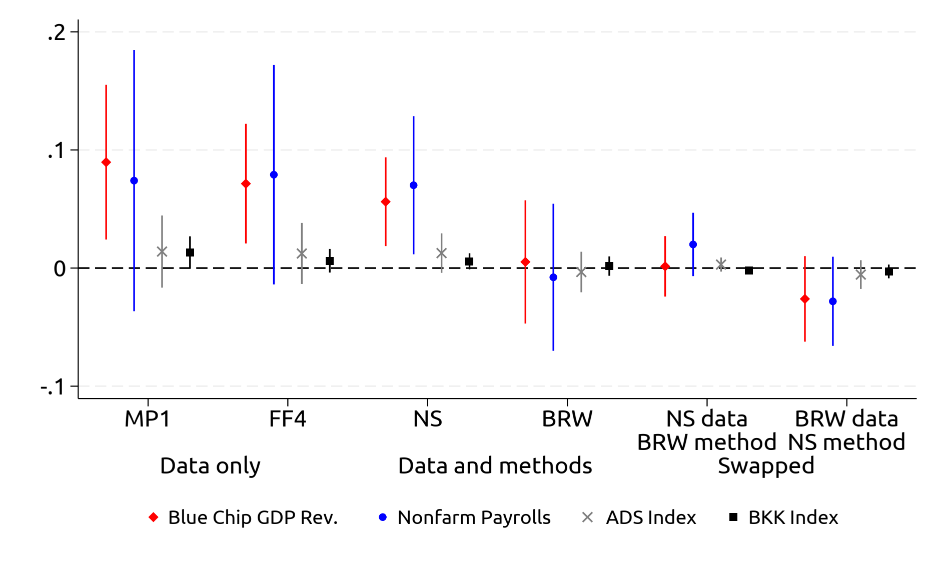
Predictability Coefficients from 1995 to 2016 (ex. crisis), 95% CI



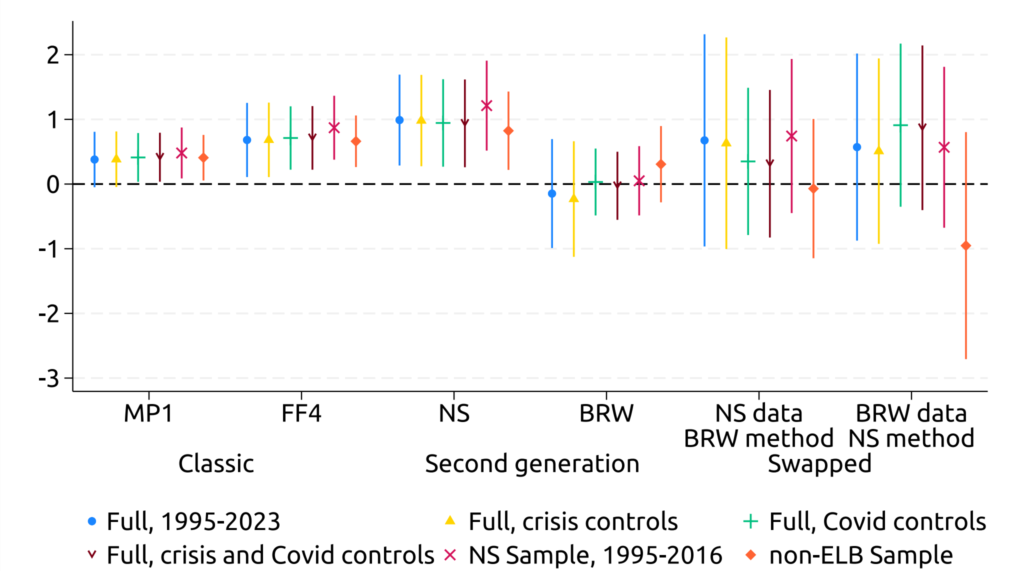
Predictability Coefficients ELB, 95% CI



Predictability Coefficients non-ELB, 95% CI



1. Blue Chip Regression Coefficients, 95% CI



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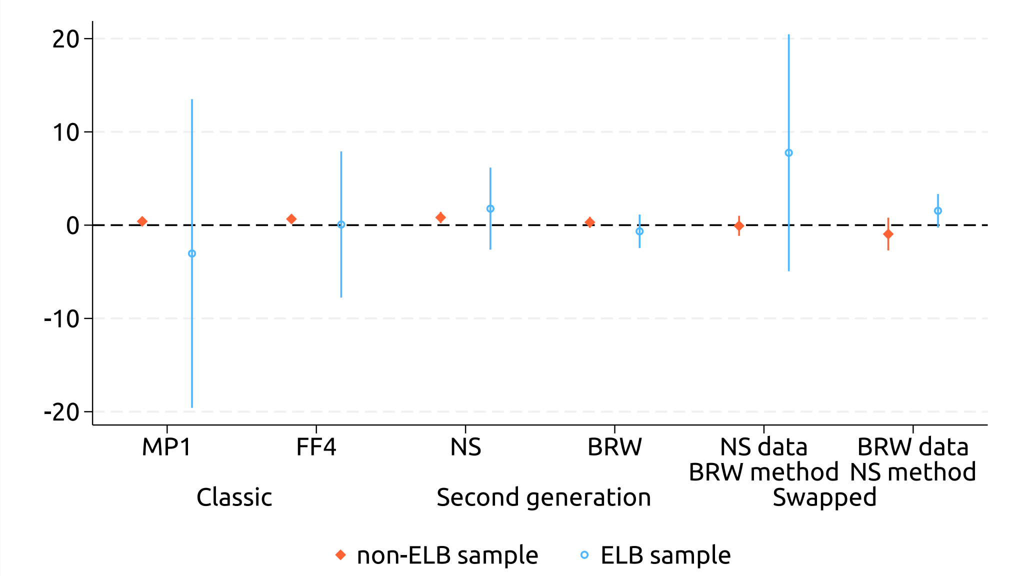
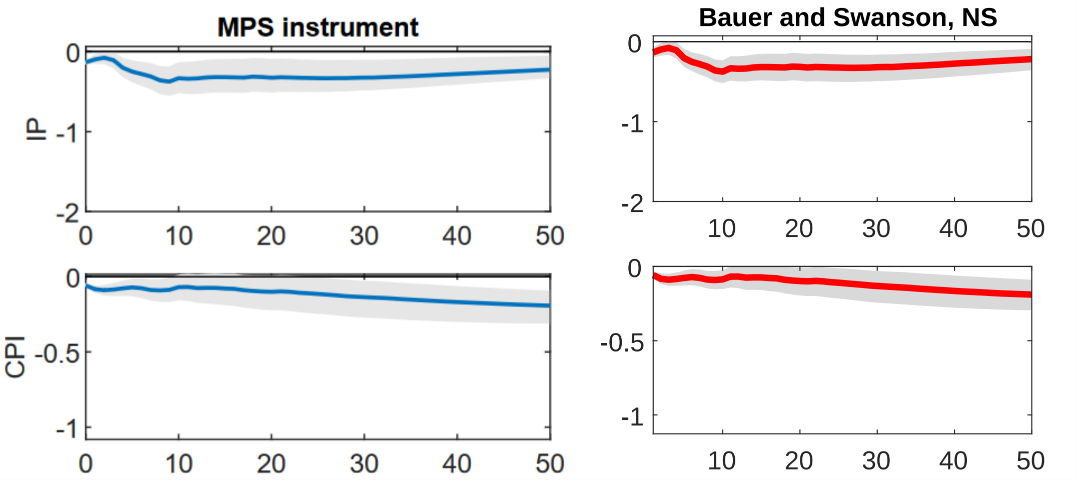
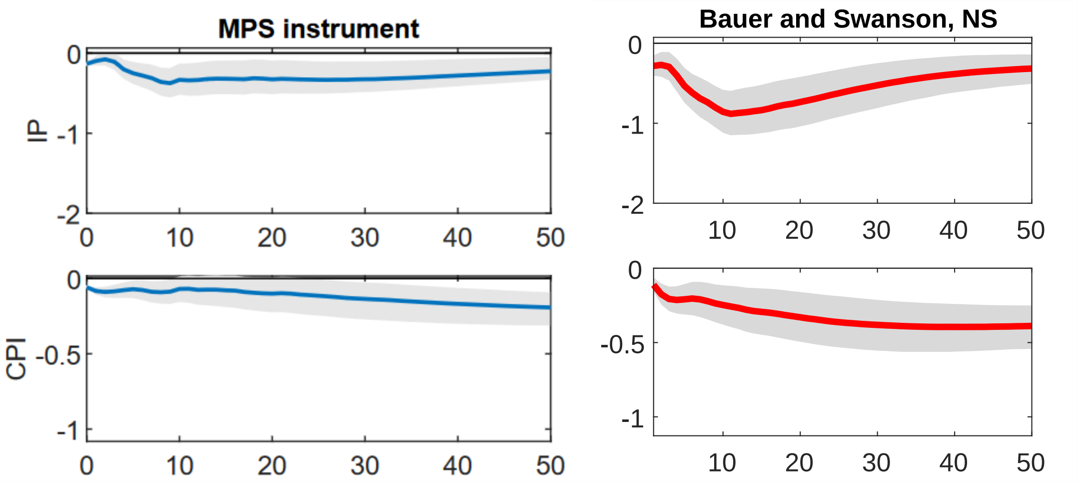


IRFs, 25 bps Monetary Shock

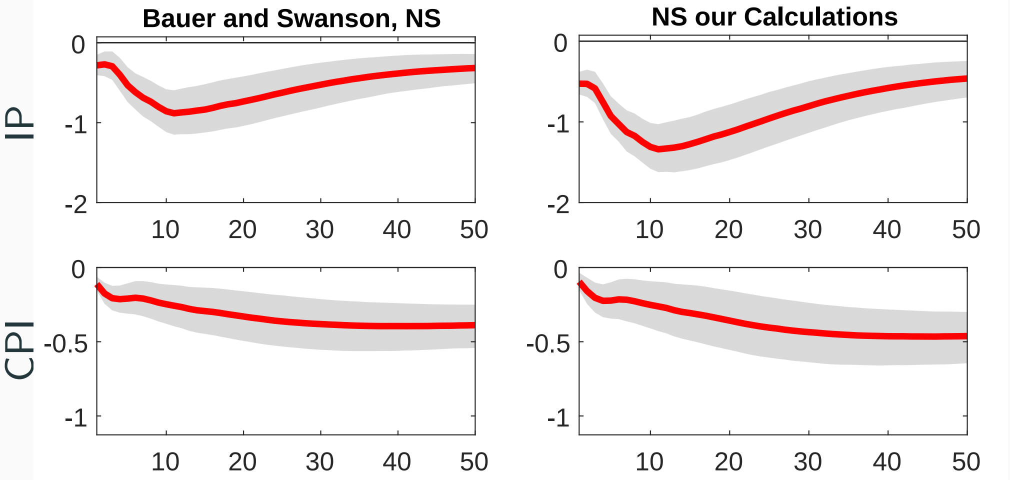
fin. vars
orthogonalized NS



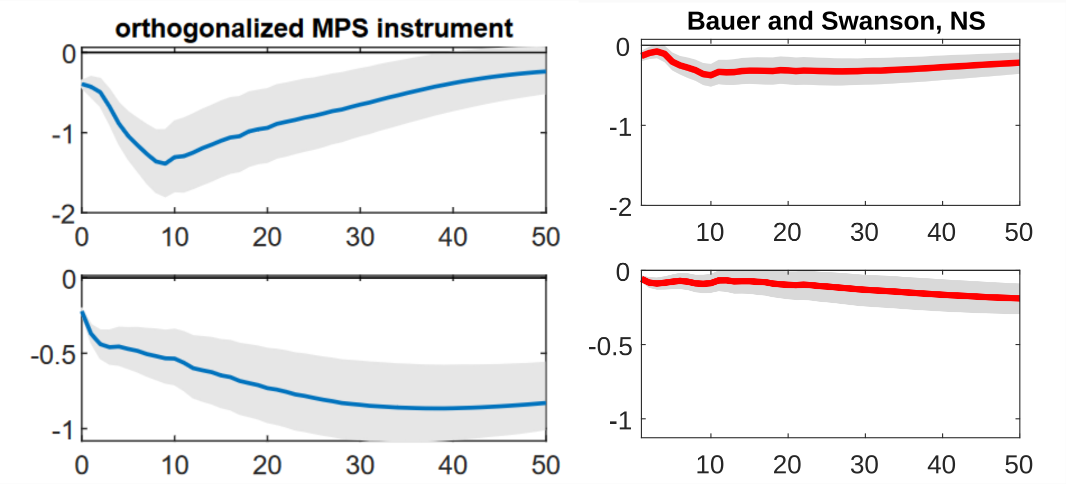

MPS instrument
Bauer and Swanson, NS
IP
CPI
0
-1
-2
-0.5
0
10
20
30
40
50

IRFs, 25 bps Monetary Shock, 1995 start, 8 lags

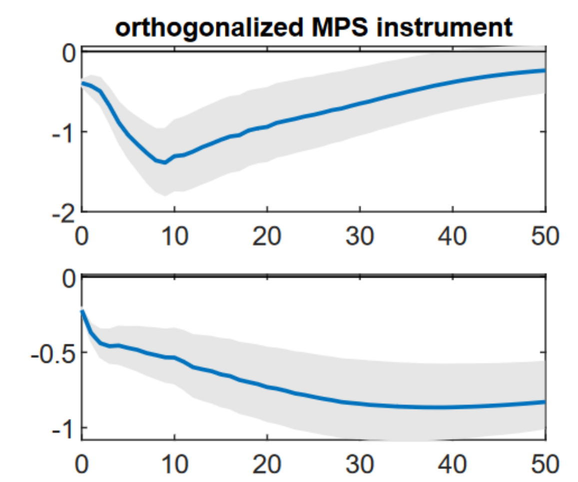
fin. vars
orthogonalized NS

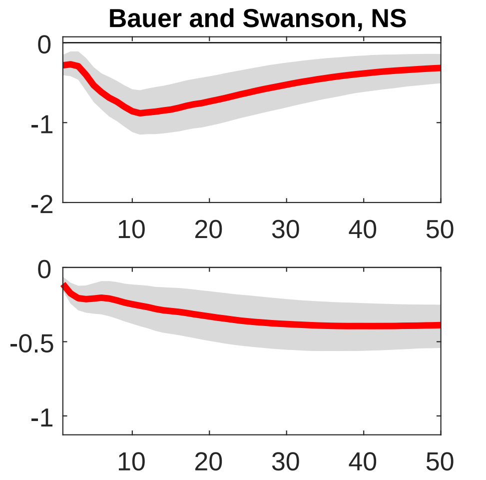


Bauer & Swanson IRFs, 25 bps Monetary Shock

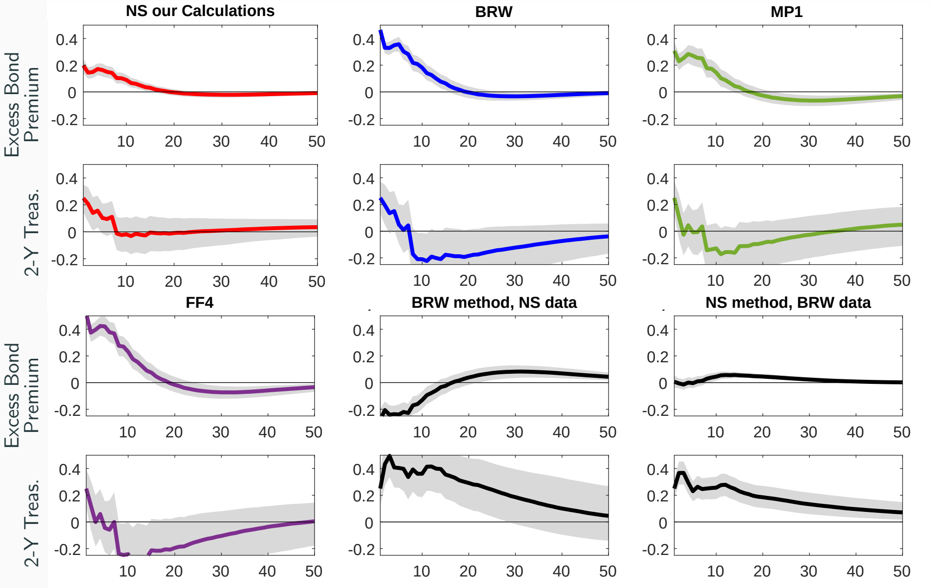


Bauer & Swanson IRFs, 25 bps Monetary Shock, 1995 start, 8 lags





VAR IRFs, 25 bps Monetary Shock



Recursive vs. Full Sample

	NS Shock	NS Shock (Recursive)	BRW Shock	BRW Shock (Recursive)
Mean	-0.004	-0.002	-0.004	-0.005
Median	0.002	0.003	-0.005	-0.006
SD	0.037	0.034	0.054	0.0678

Corr[NS Shock, NS Shock (Recursive)] $= 0.9946$

Corr[BRW Shock, BRW Shock (Recursive)] $= 0.9874$