A Unified Measure of Fed Monetary Policy Shocks

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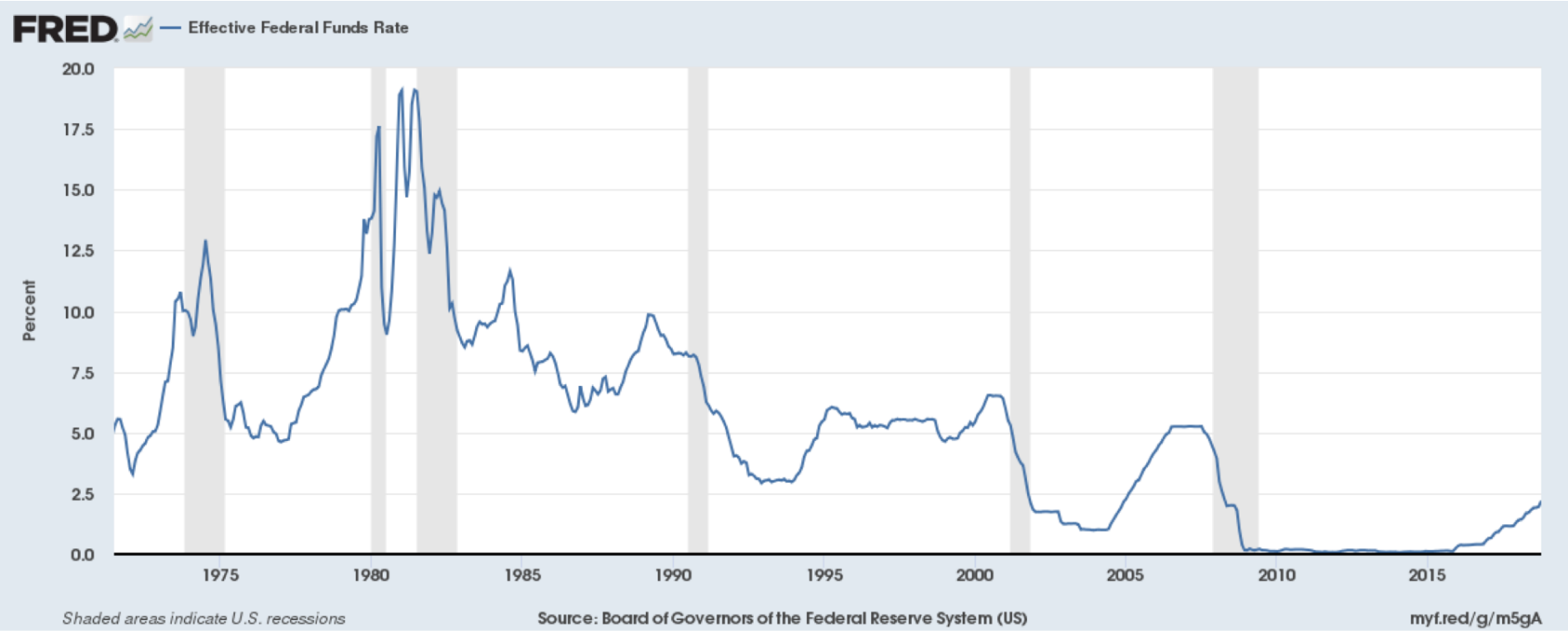
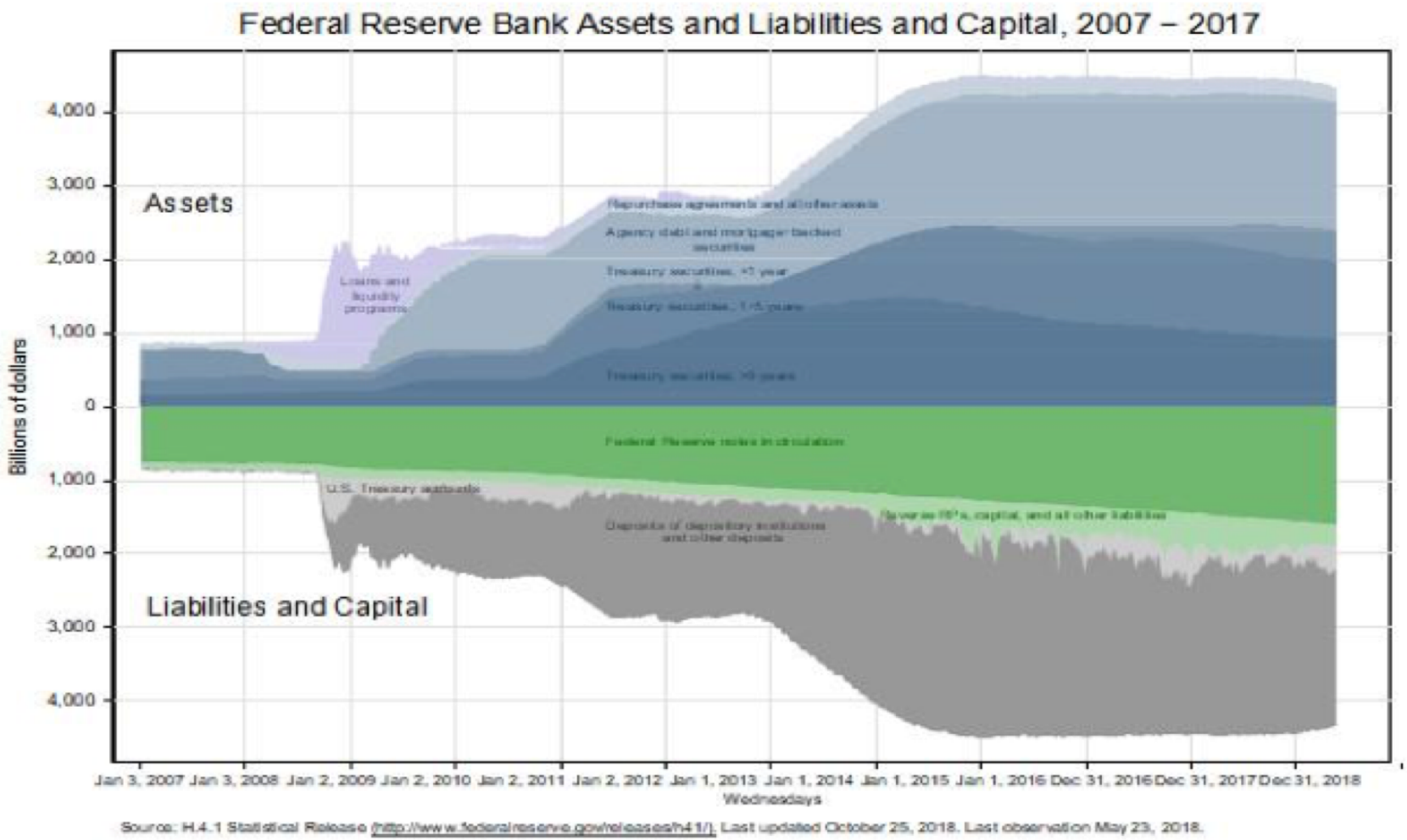
Fed Policy Regimes: Effective Federal Funds Rate



Federal Reserve Balance Sheet



Alternative Measures of Monetary Policy Shocks

- 1990s VAR shock
  - Residual from monthly VAR
- Romer and Romer (monthly)
  - Use Greenbook data
- Kuttner (daily)
  - Unexpected changes in Federal funds futures rate
- Nakumura and Steinsson (intradaily)
  - Policy factor shock, PC from futures data up to 2 years
- Swanson and Rogers-Scotti-Wright (intradaily)
  - Short window around FOMC announcements
- How to unify measurement across regimes without Fed information effects?

This Paper (1) Unified Measure across Regimes

- Technique: Fama-Macbeth meets Rigobon-Sack
- Our new measure
  - Moderately highly correlated with NS shock and Swanson FG shock but has crucially important differences
- Advantages of our method
  - Simplicity: estimation is straightforward, data requirements minimal
  - Broad applicability: use for countries with limited futures market data
  - Bridges periods of conventional and unconventional policy regime

This Paper (2) Analysis of Fed Information Effect

- Direct and indirect tests (NS, JK)
  - Confirm presence of information effect in existing measures
  - Find essentially no evidence of it in our measure

- Why this difference?
  - estimation technique: ours better filters out noise
  - use of long term interest rates: Fed info effect dissipates at long end

This Paper (3) Transmission of Shocks to our Measure

- SVAR and Local Projections on full sample and post-ZLB, on JK info and non-info days
- IRFs significant and with conventional signs
- Different results with alternative shocks. Perversely signed IRFs from shocks to NS or Swanson measures during ZLB. And Perversely signed IRFs for FF3 (used by JK) on information days.

Identification: Fama-Macbeth meets Rigobon-Sack

- Two-step procedure to identify unobserved monetary policy shock.
  - $\Delta R_{5,t} = \alpha_0 + e_t + \eta_t$ (normalization)
    - e_t is the true monetary policy shock (unobserved)
    - $\Delta R_{5,t}$ is is the change in 5 yr interest rate around FOMC announcement dates
  - $\Delta R_{i,t} = \alpha_i + \beta_i\ e_t + \epsilon_{i,t},$ for i = 1, 2, ... 30 (Step 1)
    - $\Delta R_{i,t}$ is the change in i-th year interest rate around FOMC announcement dates
    - β_i cannot be directly estimated using OLS because e_t is unobserved
    - Background noise $\epsilon_{i,t}$ is greater for larger i (Nakamura and Steinsson)

Identification: Fama-Macbeth meets Rigobon-Sack

- Rewrite Step 1 equation as,

$$\Delta R_{i,t} = \theta_i + \beta_i \Delta R_{5,t} + \xi_{i,t} \quad \text{for i} = 1, 2...30$$

where $\xi_{i,t} = -\beta_i \eta_t + \epsilon_{i,t}$

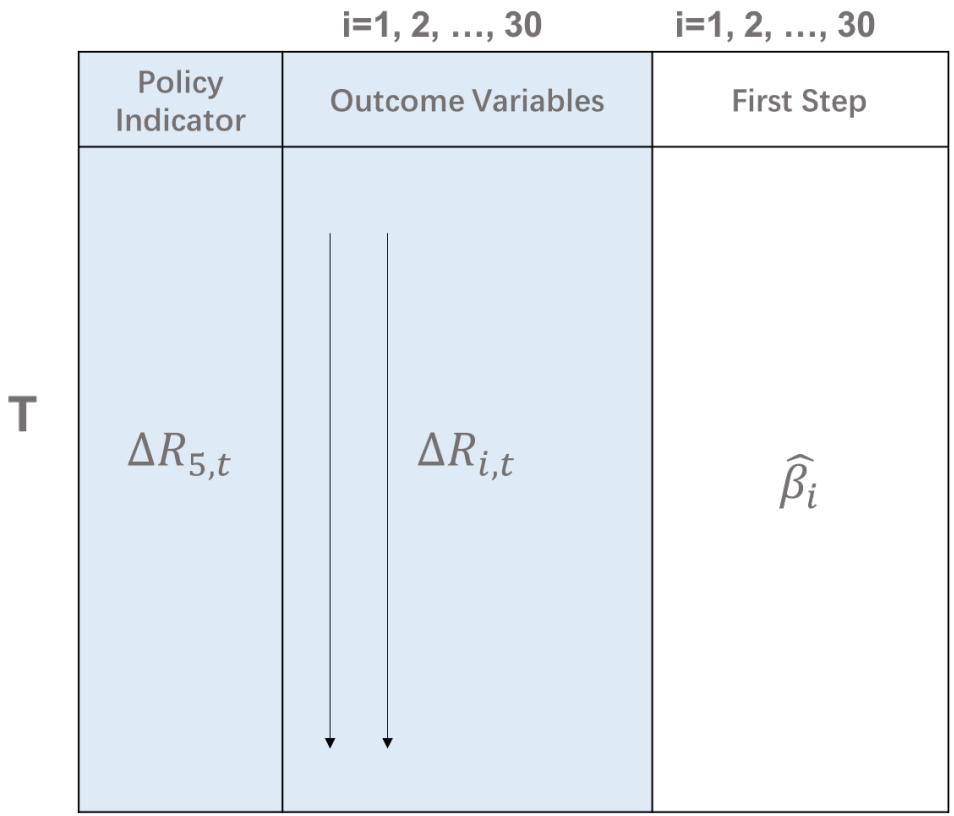
  - Could use OLS but regressor correlated with error term due to $-\beta_i \eta_t$
  - Use IDH to identify β_i (Rigobon 2003)
  - Assumption: on FOMC announcement days, volatility of e_t higher, while volatility of background noise unchanged
  - Fama-Macbeth uses OLS; IDH better minimizes background noise

- $\Delta R_{i,t} = \alpha_i + e_t^{aligned} \hat{\beta}_i + \nu_{i,t}$ (Step 2)
  - cross-section regression for each t = 1...T to get the estimated shock series e_t, of length T

▸ IV Implementation of IDH

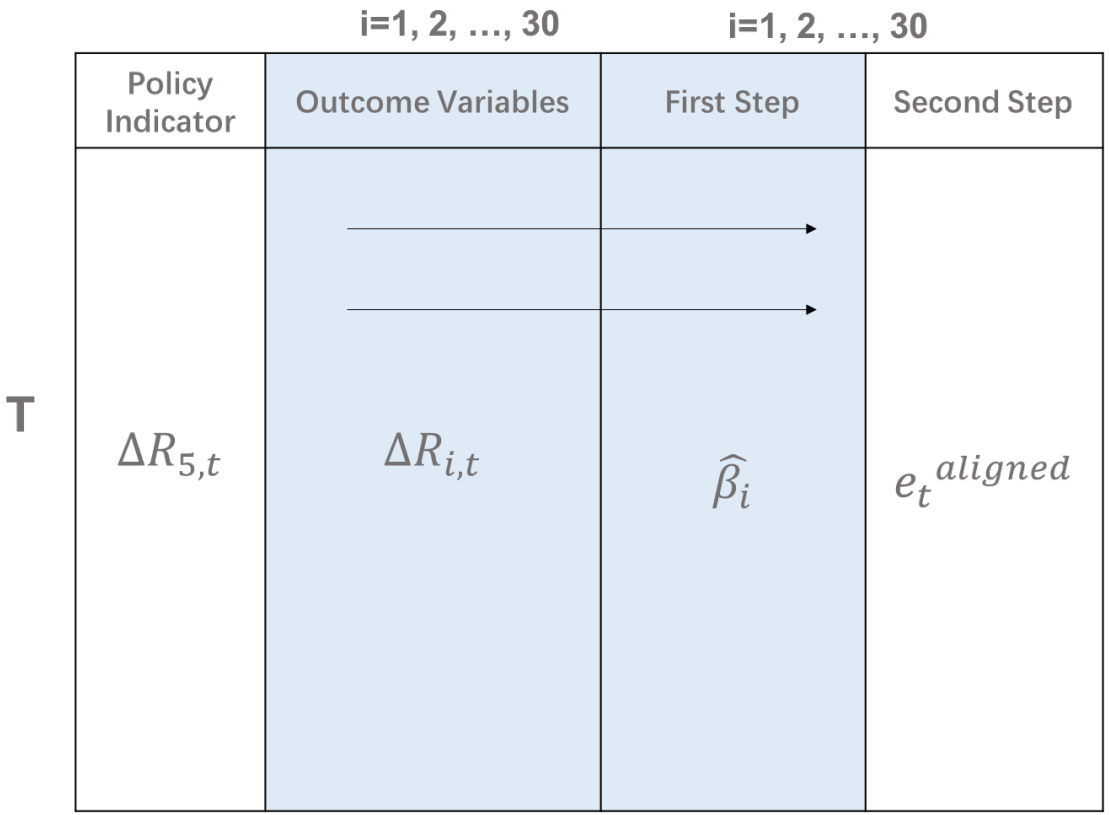
First Step: Time Series Regression

- $\Delta R_{i,t} = \alpha_i + \beta_i \; e_t + \xi_{i,t}$



Second Step: Cross Section Regression

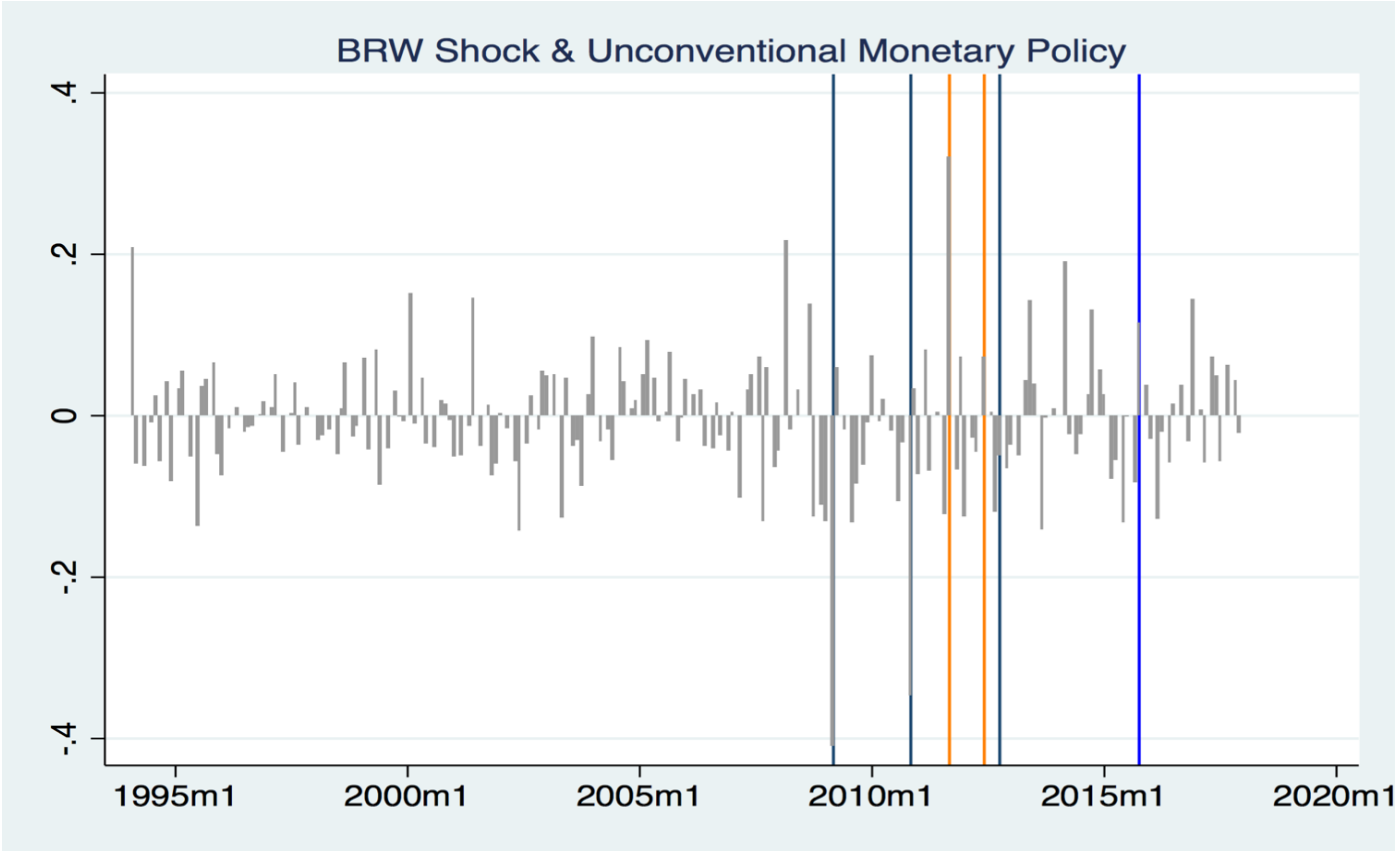
- $\Delta R_{i,t} = \alpha_i + e_t^{aligned} \ \hat{\beta}_i + \nu_{i,t}$
  - Delivers the (unobserved) monetary policy shock e_t.



Data

- 2-, 5-, and 10-year Treasury rates from FRB
- 1- to 30-year zero-coupon yield estimated by Gurkaynak, Sack, and Swanson (2005)
- Macroeconomic variables from St. Louis FED:
  Industrial production, CPI
- Commodity price index from Thompson Reuters
- Excess bond premium (EBP) from Gilchrist and Zakrajek (2012)
- Estimated term premia from Adrian, Crump, and Moench (2013)

BRW (us!) Shock Series 1994-2017



Note: navy vertical line denotes LSAP; blue vertical line denotes Forward Guidance; orange vertical line donotes Operation Twist.

Correlations with Shocks in the Literature

	Full Sample	Pre-ZLB	ZLB
NS Shock	0.512	0.653	0.494
SS shock	0.625	0.684	0.532
R&R Shock		0.131	
Kuttner Shock		0.308	
SS_FFR		0.373	
SS_FG	0.492	0.605	0.575
SS_LSAP			0.365
FF3	0.395	0.593	0.336

Robustness: Alternative BRW Construction Exercises

- Normalization: 2yr, 10yr Treasury Rate
- Extend back to 1969
- Outcome variables: only 1,2,5,10,30-year zero coupon yields
- Omit QE1
- Include unscheduled FOMC meetings
- 1 day window to 2 day window
- Alternative IV (*one-day* before FOMC meeting)

Fed Information Effect

- Direct test: NS expectations-based test
  - regress next quarter private sector output forecast change on FOMC announcement day surprises
  - regress current month FOMC announcement day surprises on the Fed private information (the gap between the Greenbook output forecast and the blue chip output forecast)
- Indirect test: Jarocinski and Karadi (2018)
  - classify FOMC announcement days in which stock market goes in same direction as interest rate surprise as information effect days
  - estimated IRFs different on info and non-info days

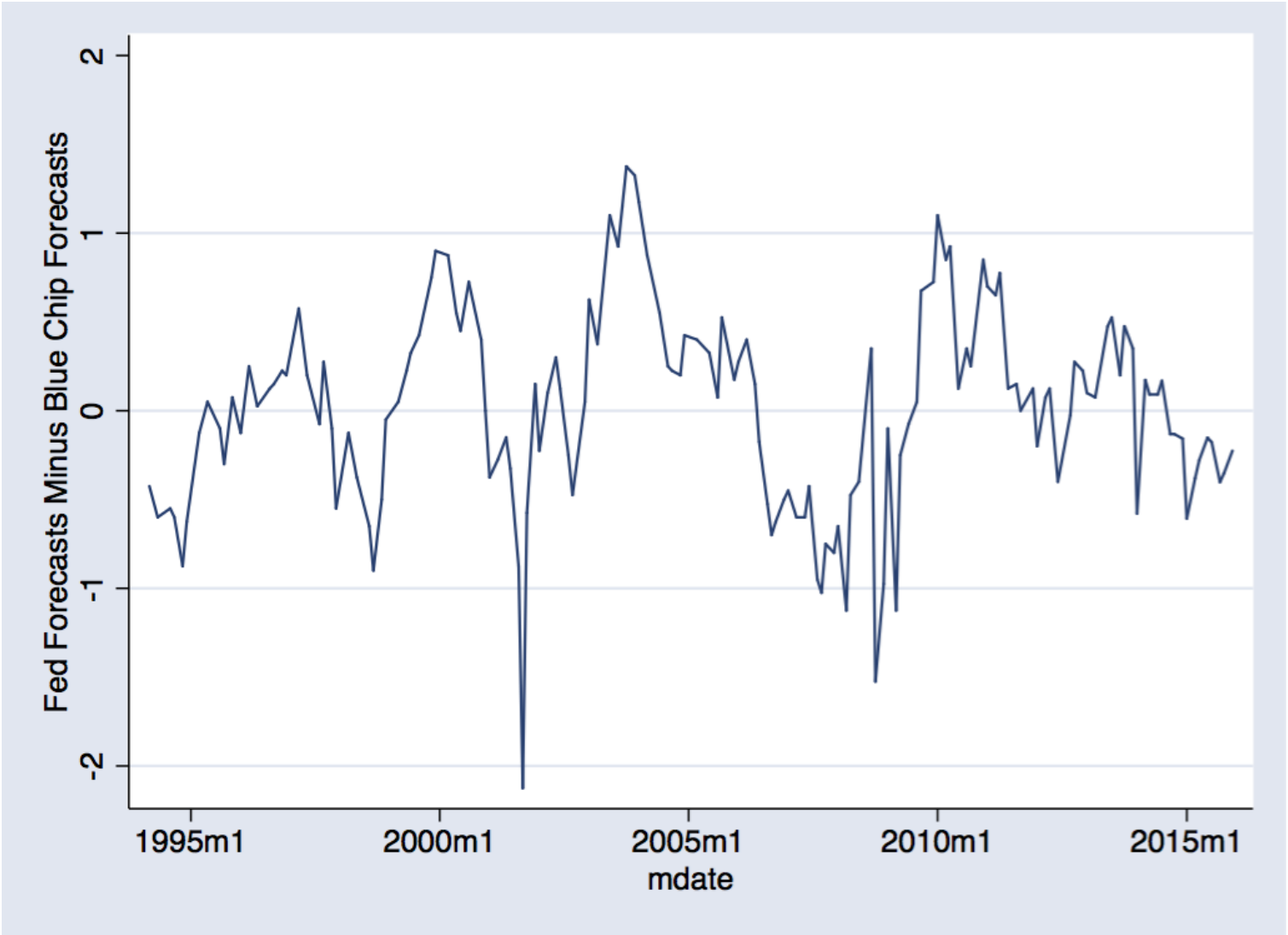
NS Fed Information Effect Regression

	1995-2014	2000-2014	2000-2007	1995-1999
BRW Shock	0.09 (0.20)	0.10 (0.20)	0.33 (0.31)	0.08 (0.49)
SS Shock	1.94** (0.79)	1.81* (0.99)	2.38*** (0.84)	2.63*** (0.81)
N&S Shock	0.81*** (0.24)	0.82*** (0.29)	0.81*** (0.27)	0.83** (0.33)
Observations	121	89	52	32

Empirically Account for Fed Private Information

- Create a central bank information proxy
- Purge raw surprises series of this proxy;
  re-estimate the VARs with purged series

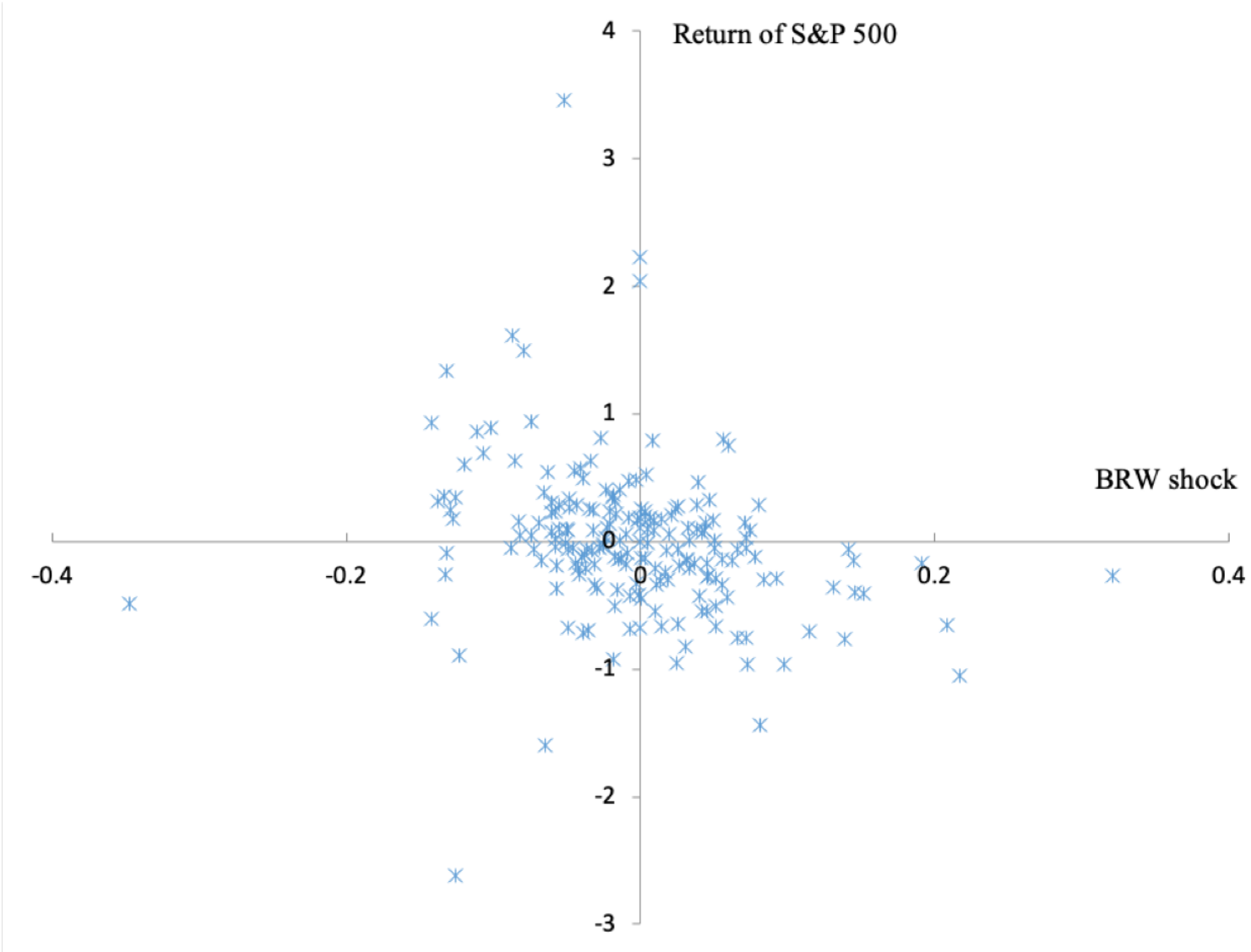
GDP Growth Forecasts, Fed Minus Blue Chip



Shock Regressed on GDP Growth Forecast Difference

	N&S Shock	Updated N&S Shock	BRW Shock	Swanson' s Shock
Fed - BC	2.00** (0.77)	1.93*** (0.70)	1.95 (1.53)	0.67** (0.31)
Constant	0.22 (0.34)	0.24 (0.29)	-0.72 (0.65)	0.07 (0.11)
Observations	130	150	150	149
R-squared	0.09	0.08	0.02	0.07

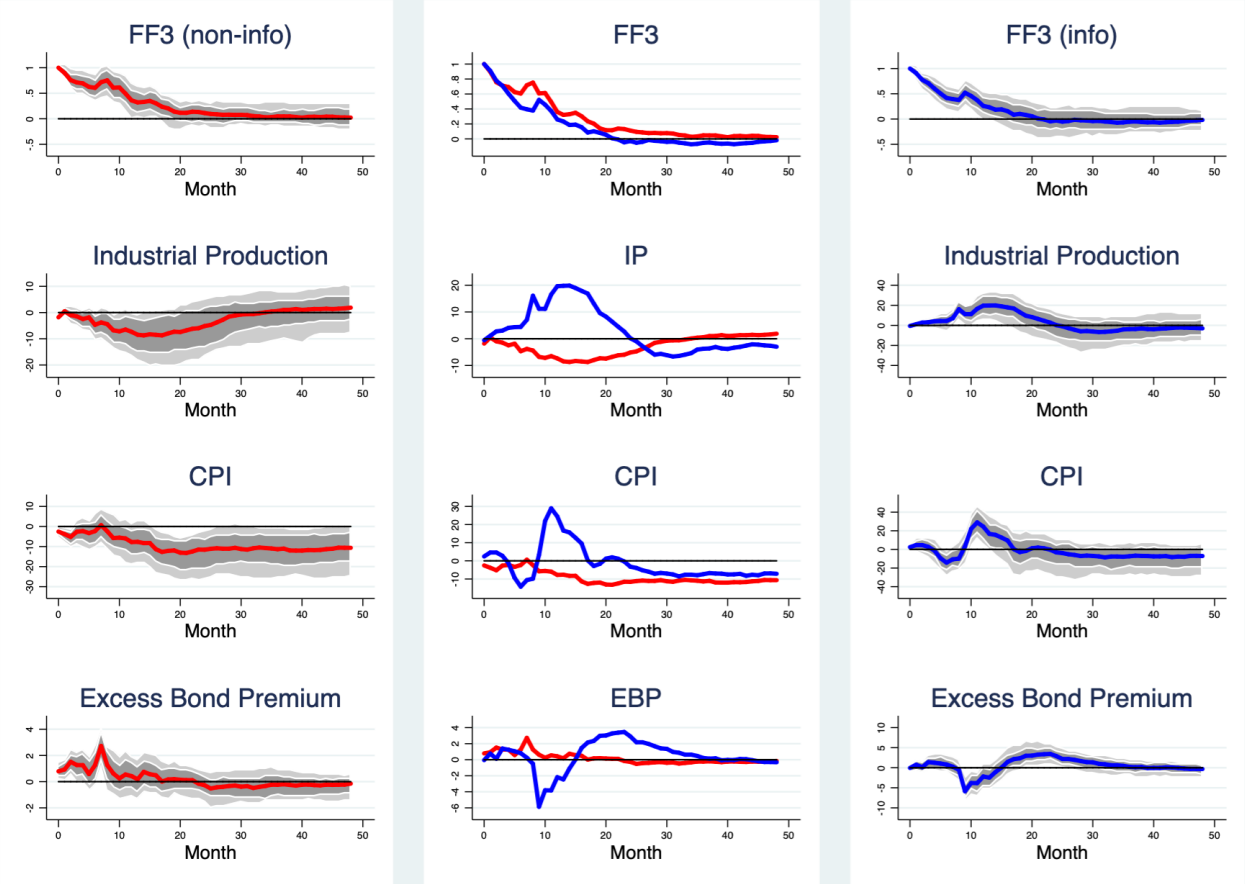
Jarocinski and Karadi (2018) Information Effect



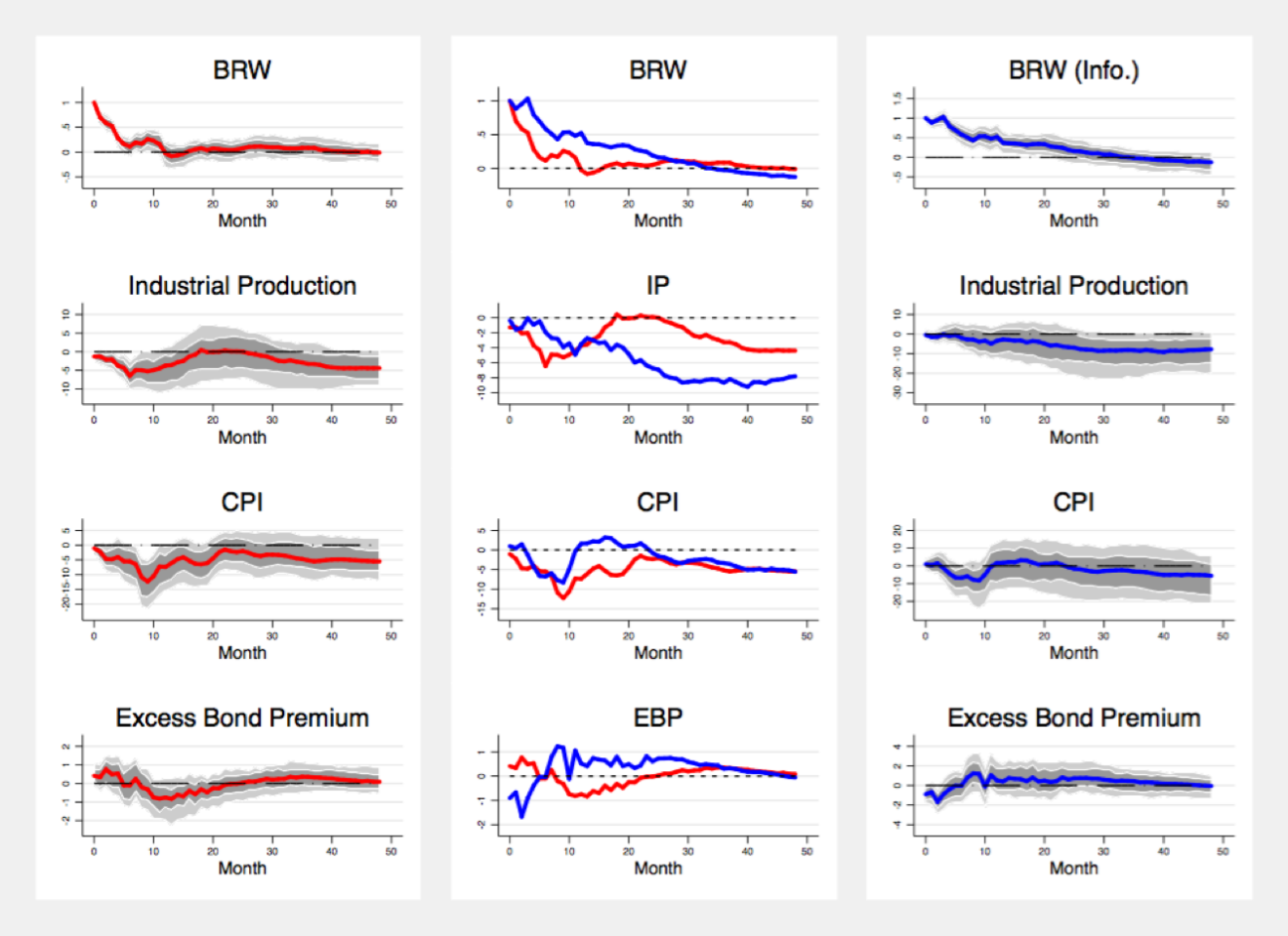
NS Fed Information Effect Regression On JK info days

	1995-2014	2000-2014	2000-2007
BRW(JK Info days)	0.69	0.89	-0.39
	(0.78)	(0.81)	(0.92)
BRW(JK non-info days)	0.00	-0.02	0.71
	(0.36)	(0.35)	(0.59)
FF3(JK Info days)	1.028***	0.871***	4.874***
	(0.25)	(0.23)	(0.98)
FF3(JK non-info days)	0.25	0.217	0.416**
	(0.20)	(0.23)	(0.15)

Replicating JK: SVAR on JK monetary policy and information shocks



SVAR on BRW monetary policy and information shocks



Why Less Info Effect in BRW Shock? I. Data Matters

	Kuttner	6-month	2-yr.	5-yr.	10-yr.	30-yr.
Coef.	0.296***	0.389*	0.368**	0.277	0.308	0.214
	(0.11)	(0.22)	(0.17)	(0.18)	(0.22)	(0.30)
Observations	144	144	144	144	144	144
R-squared	0.04	0.024	0.034	0.017	0.012	0.004

Why Less Info Effect? II. Econometric Procedure

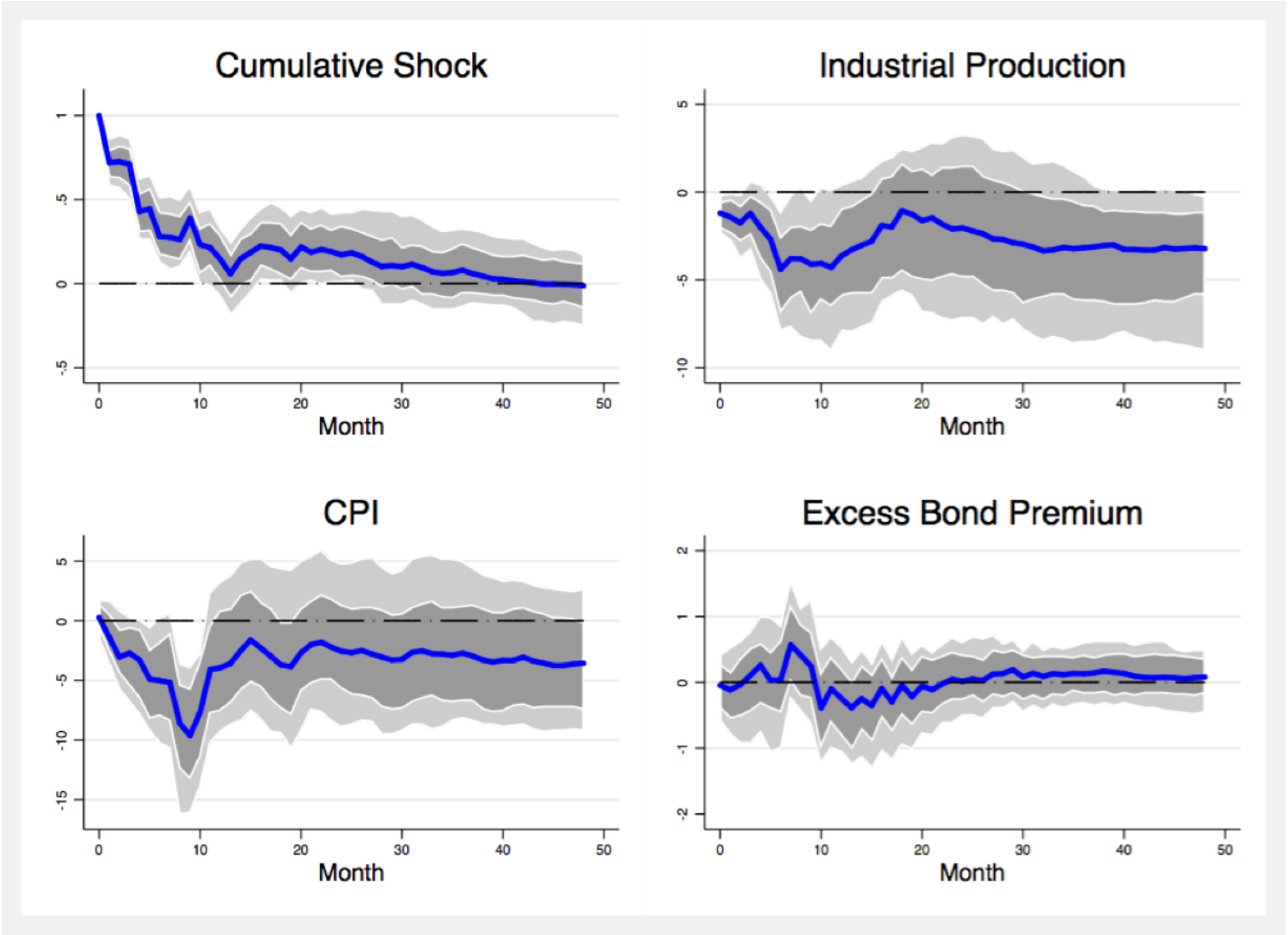
- Use BRW data with NS PCA method, obtain "PCA shock"
  - Corr(PCA, BRW) $= 0.25$
  - VAR results using this PCA shock: very noisy
  - Role of IDH vs. PLS? PLS more important
- PLS vs. PCA
  - PCA maximizes the ability of factors to explain variation in all variables; likely picks up a lot of noise (Kelly and Pruitt 2013)
  - PLS instead maximizes factors' ability to capture variation in the policy indicator. Saw that there is less of an info effect in longer rates

Why Less Info Effect? III. Encompassing

- Saw above that BRW data in NS regression does not diminish evidence of information effect
- Use NS data in Fama-Macbeth regression: "tight window" shock
  - Much less evidence of "perverse" IRFs compared to using NS shock
  - Data and the econometric procedure both matter

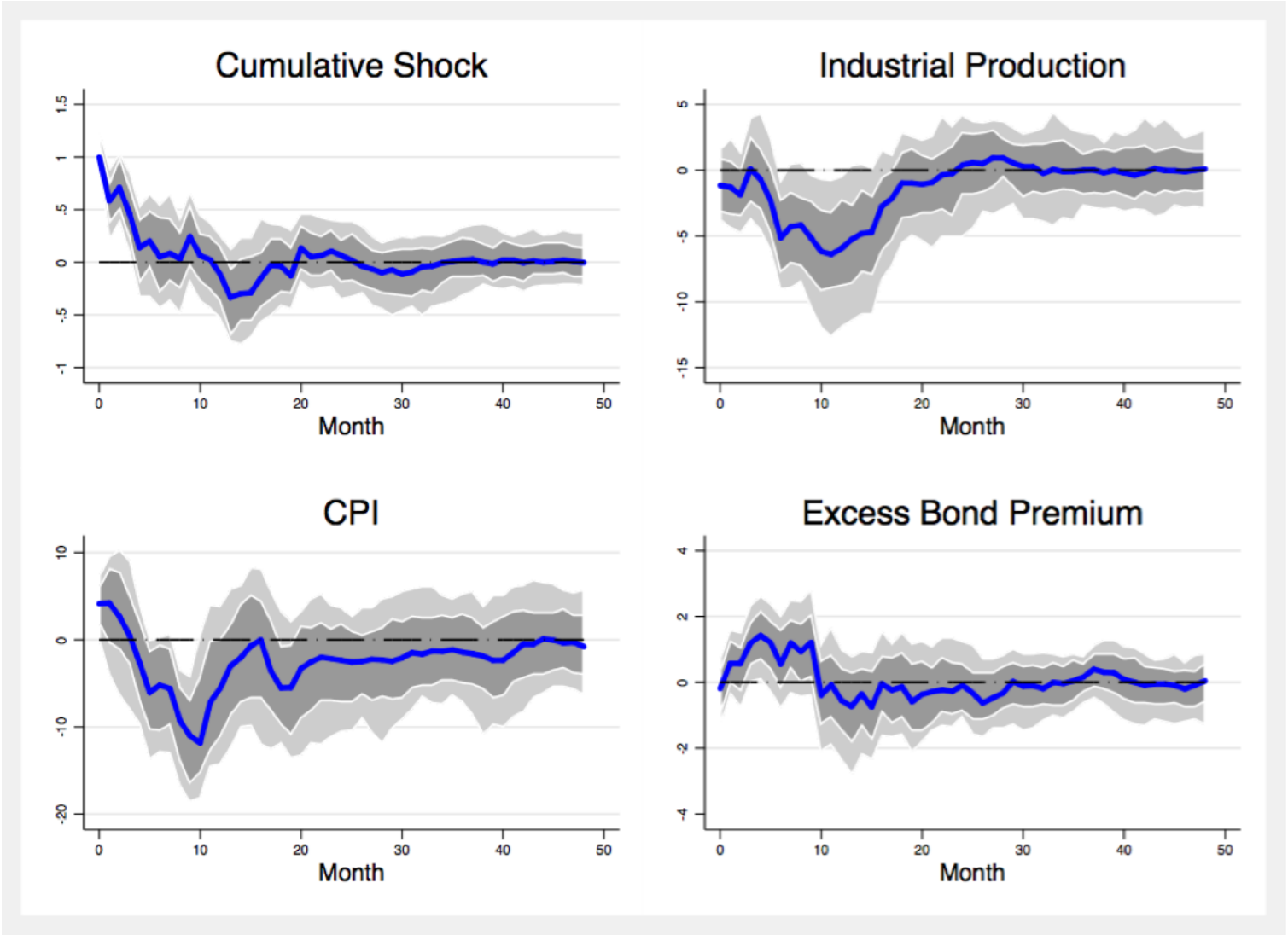
Transmission effects of monetary policy

BRW Shock IRFs: SVAR over 1994-2017



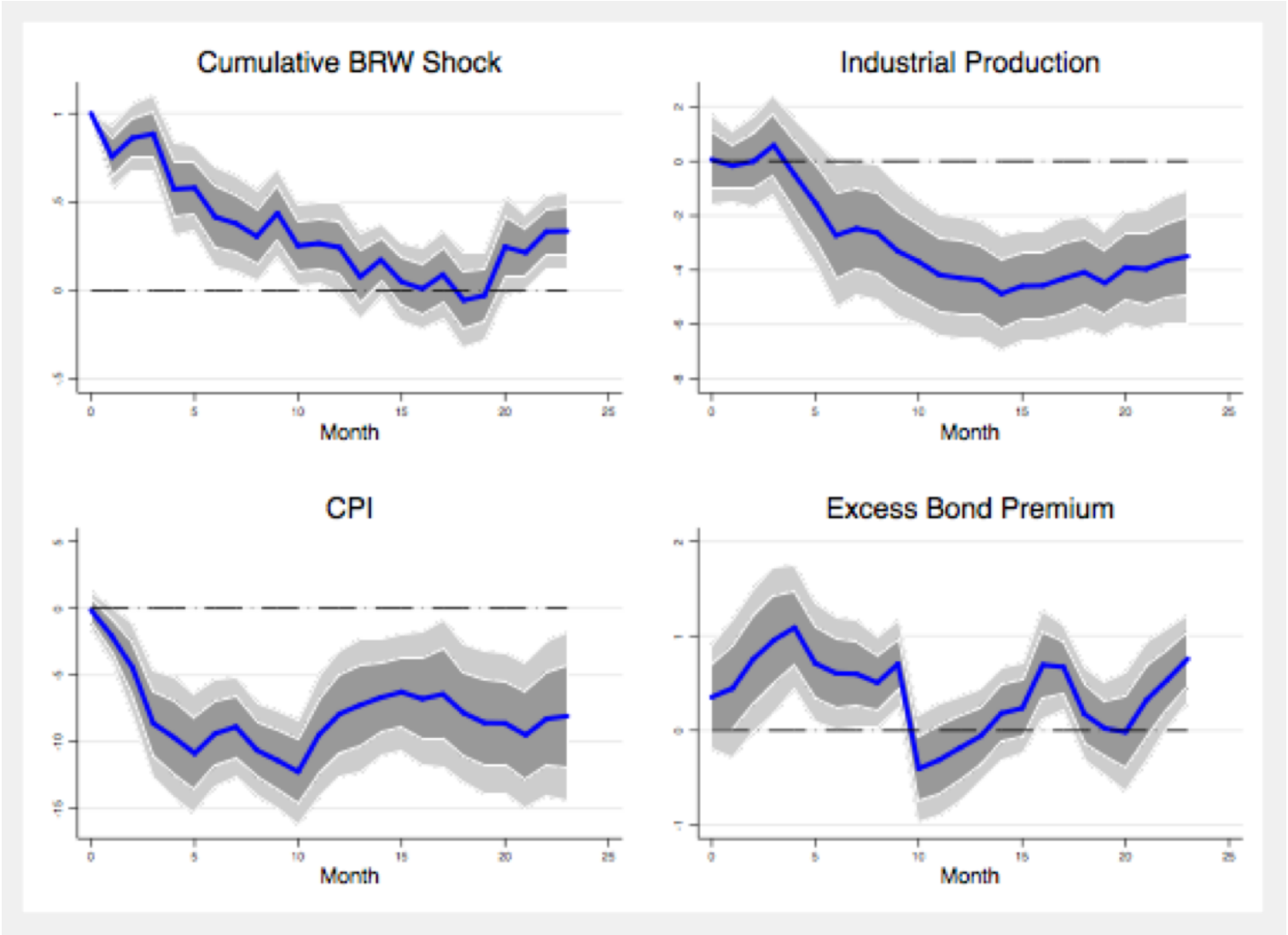
Note: 5-variable structural VAR model with monthly data during 1994-2017. Variables ordered

BRW Shock IRFs: SVAR over 2008-2017



Note: 5-variable structural VAR model with monthly data during 1994-2017. Variables ordered

Robustness: Jorda (2005) local projections 2008-2017



Note: Deep and shallow gray shaded areas are 68% and 90% confidence intervals produced by

Robustness:

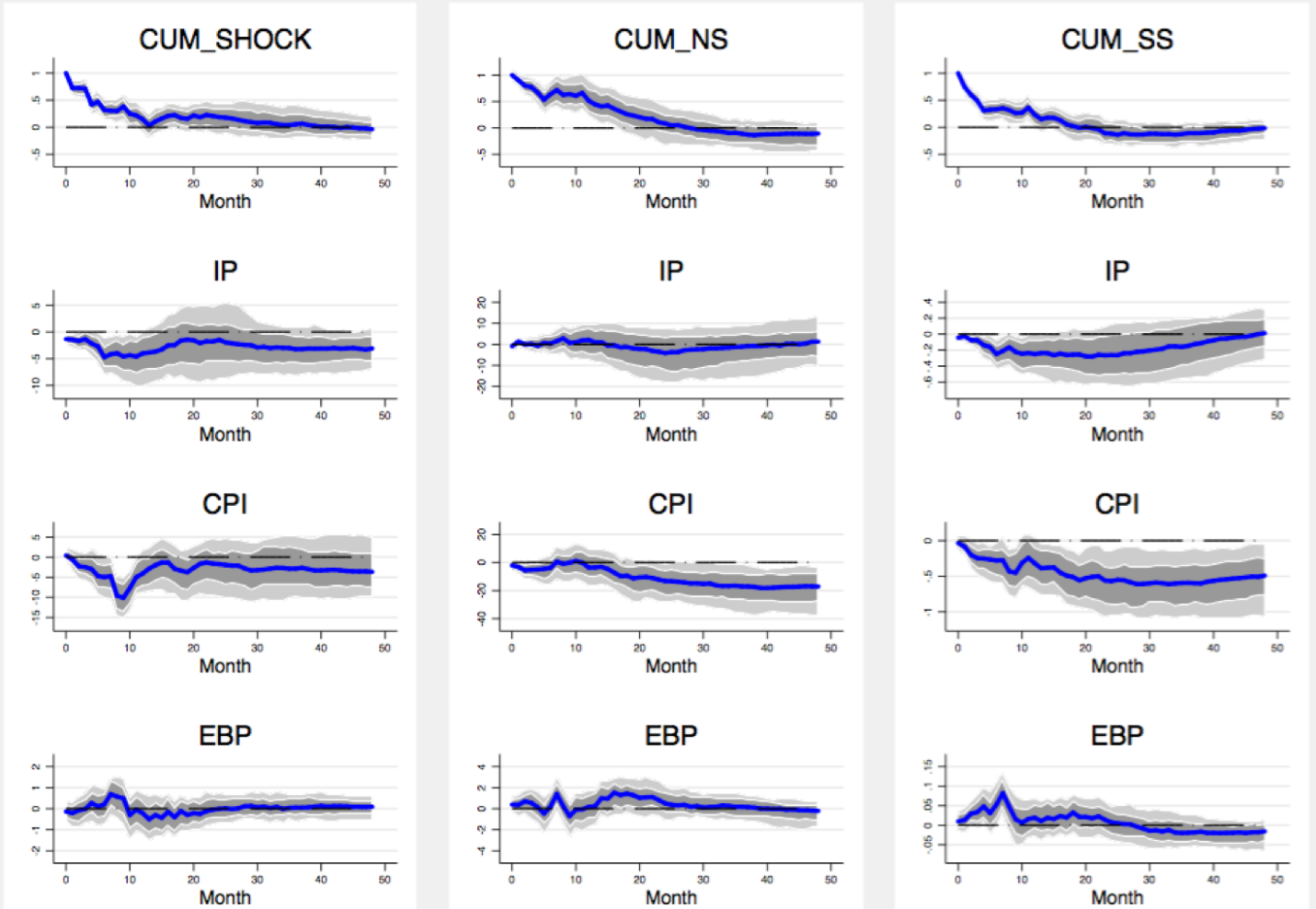
- Accounting for term premium
- Use 2-, 10-y Treasury Rates as benchmark
- Use alternative IV
- Include all unscheduled FOMC meetings
- Use only 1, 2, 5, 10, 30-y Treasury Rates
- Use tight window (intraday shocks)
- Extending back to 1969

VAR estimates with alternative monetary policy shocks

- Updated NS shocks
- Swanson shocks, sum (results robust using components)

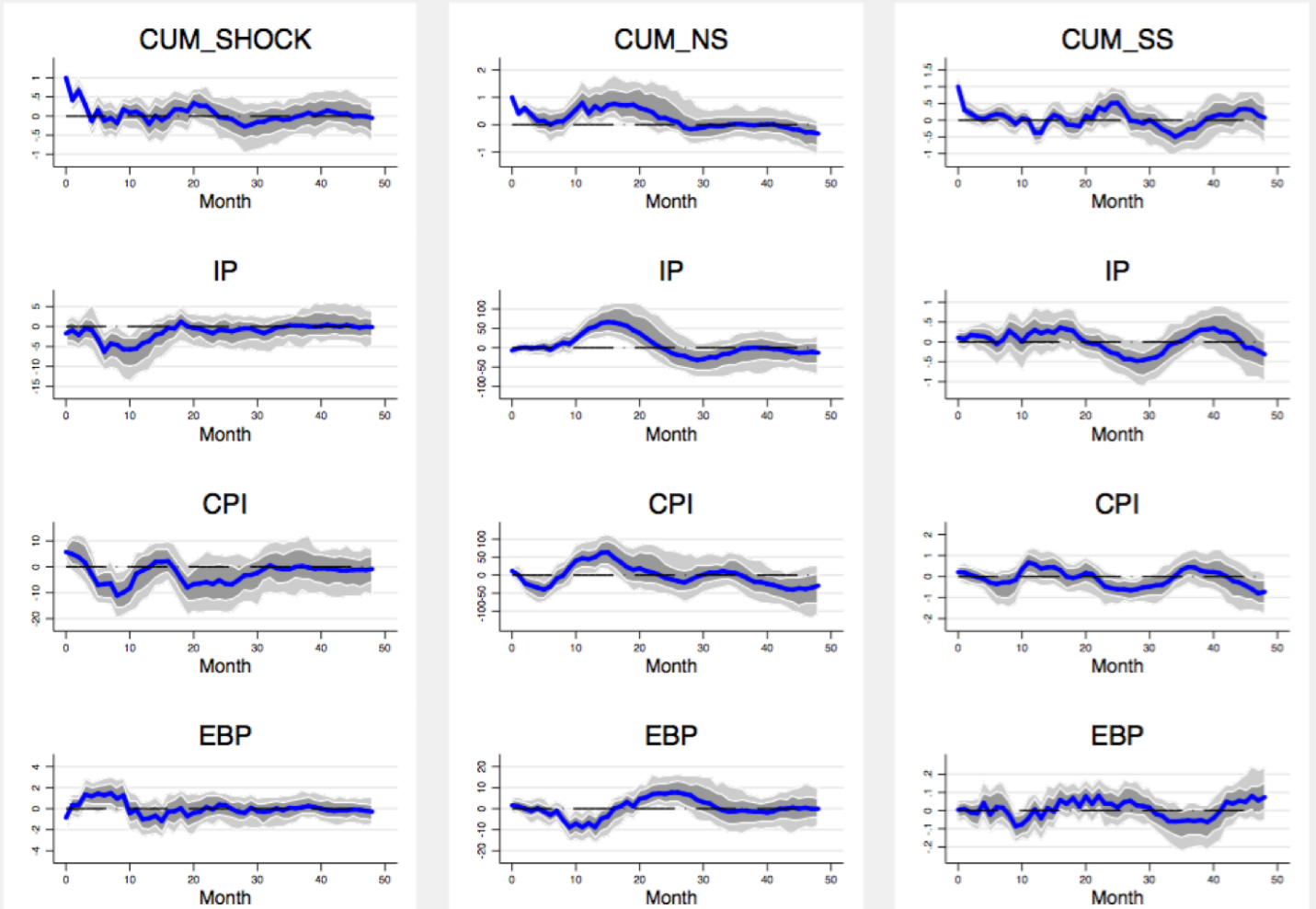
VARs with alternative monetary policy shocks (1994-2015)

BRW, NS and Swanson Shocks



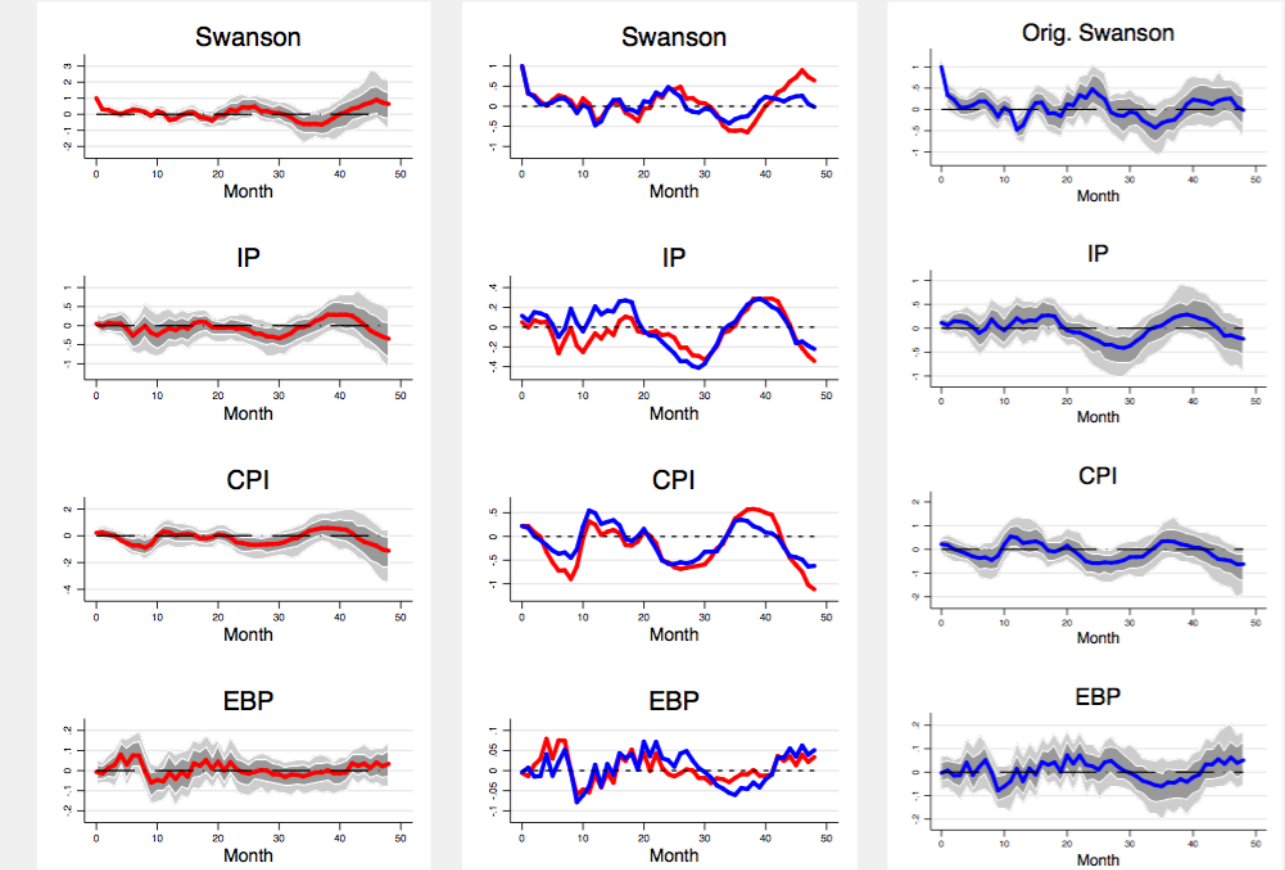
VARs with alternative monetary policy shocks (2008-15)

BRW, NS and Swanson Shocks



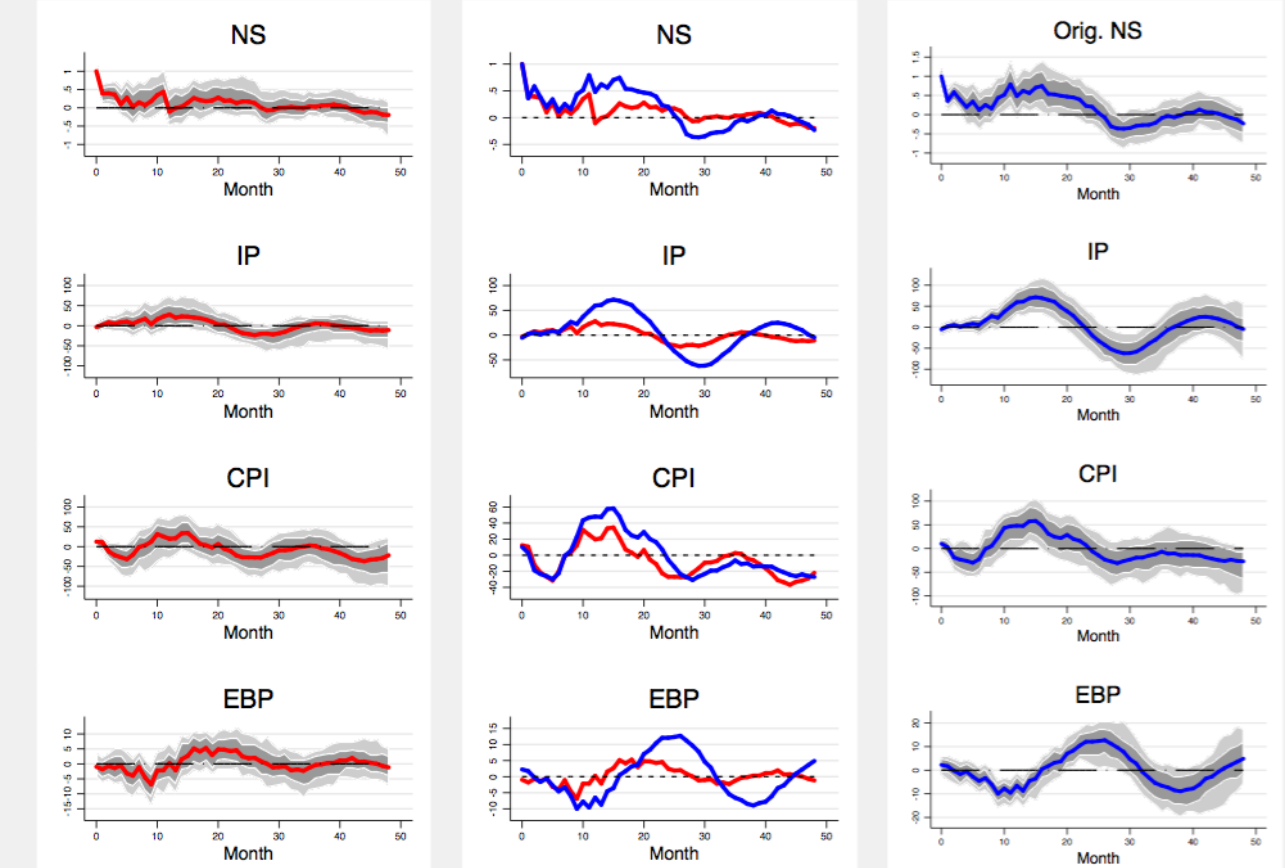
SVARs using Purged Shock Series

a. Swanson Shock: Original (blue) versus Purged (red) Series (2009:1 - 2015:12)



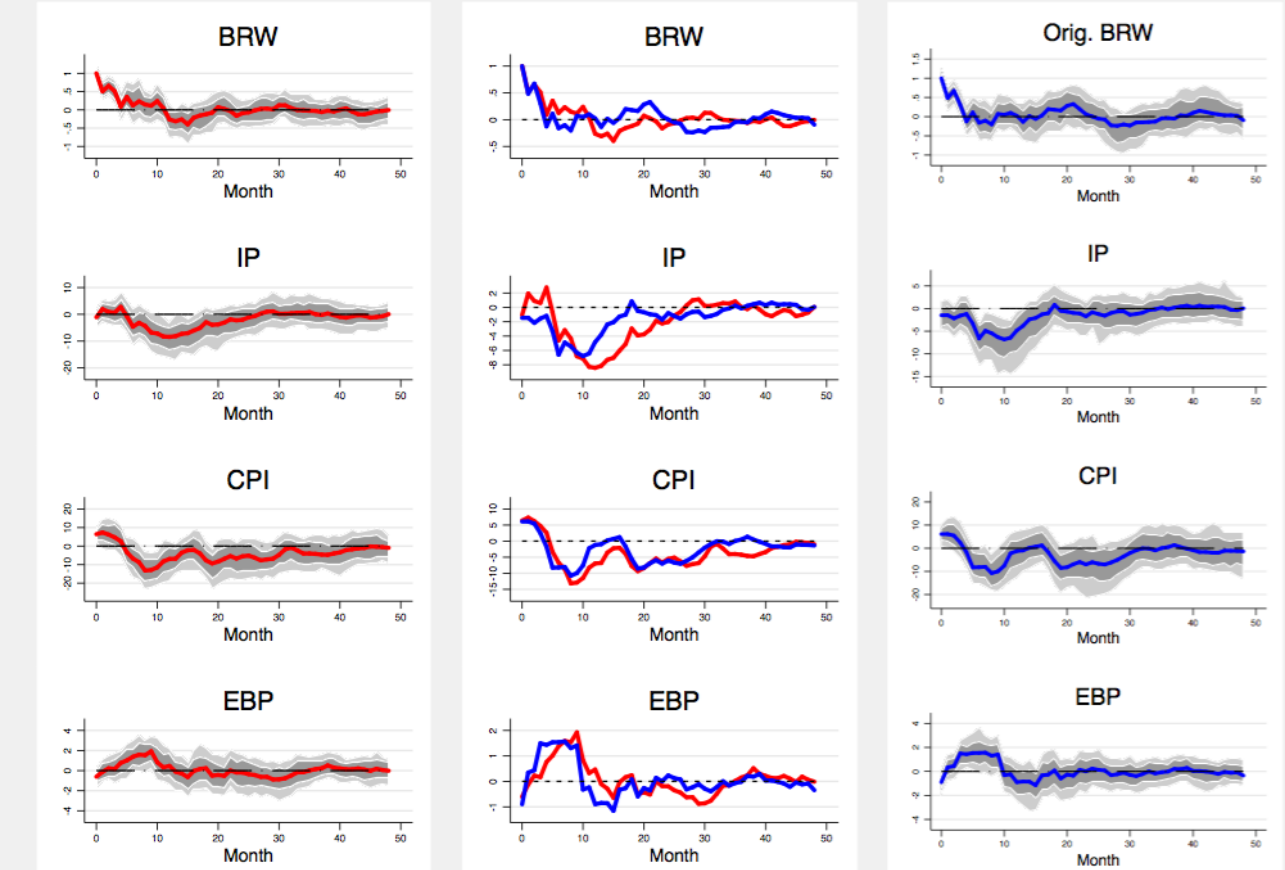
SVARs using Purged Shock Series

b. NS Shock: Original (blue) versus Purged (red) Series (2009:1 - 2015:12)



SVARs using Purged Shock Series

c. BRW Shock: Original (blue) versus Purged (red) Series (2009:1 - 2015:12)



Conclusions

- New measure of US monetary policy shock
  - easy to implement, minimal data requirements
  - bridges periods of conventional and unconventional policymaking
  - similarities with NS and Swanson shocks, but important differences
- Fed information effect essentially non-existent in our series
  - Direct NS test and indirect JK test
  - why no Fed information effect in BRW series?
    - less information effect in long term interest rates
    - estimation technique matters
- Transmission
  - SVAR and Local Projections on full sample and post-ZLB
  - BRW shocks produce IRFs with conventional signs
  - alternative shocks: perversely signed IRFs, especially during ZLB.

IV implementation of IDH

- We prove that β_i can be estimated using an IV approach,

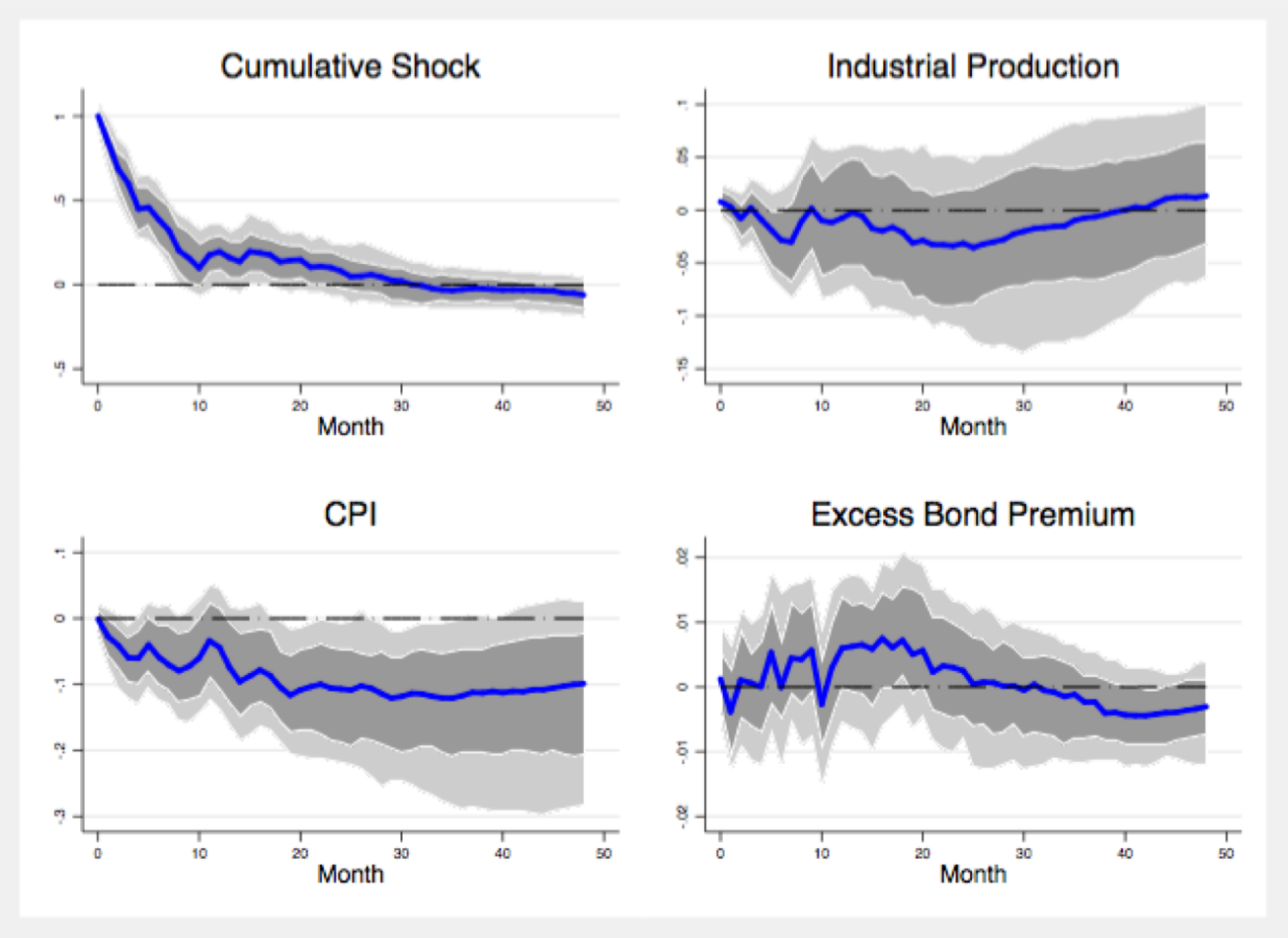
$$[\Delta R_{i,t}] = \alpha_i + \beta_i [\Delta R_{5,t}] + \mu_{i,t} \quad i = 1, 2, \cdots, 30$$

  $[\Delta R_{5,t}] = (\Delta R_{5,t}, \Delta R^*_{5,t})'$, $\Delta R_{5,t}$ is 1-day movement in policy indicator around the FOMC announcement, and $\Delta R^*_{5,t}$ is the change one week before.

- β_i can be estimated using an instrumental variable $\Delta R^{IV}_t = (\Delta R_{5,t}, -\Delta R^*_{5,t})'$ for the independent variable.
- Assumption: on days of FOMC meetings, variance of the true monetary policy shock increases while that of background noise is unchanged.
- Straightforward to prove that the instrument is correlated with the independent variable, but not correlated with the error term.

Go back

SVAR Impulse Responses with PCA Shock (1994-2017)



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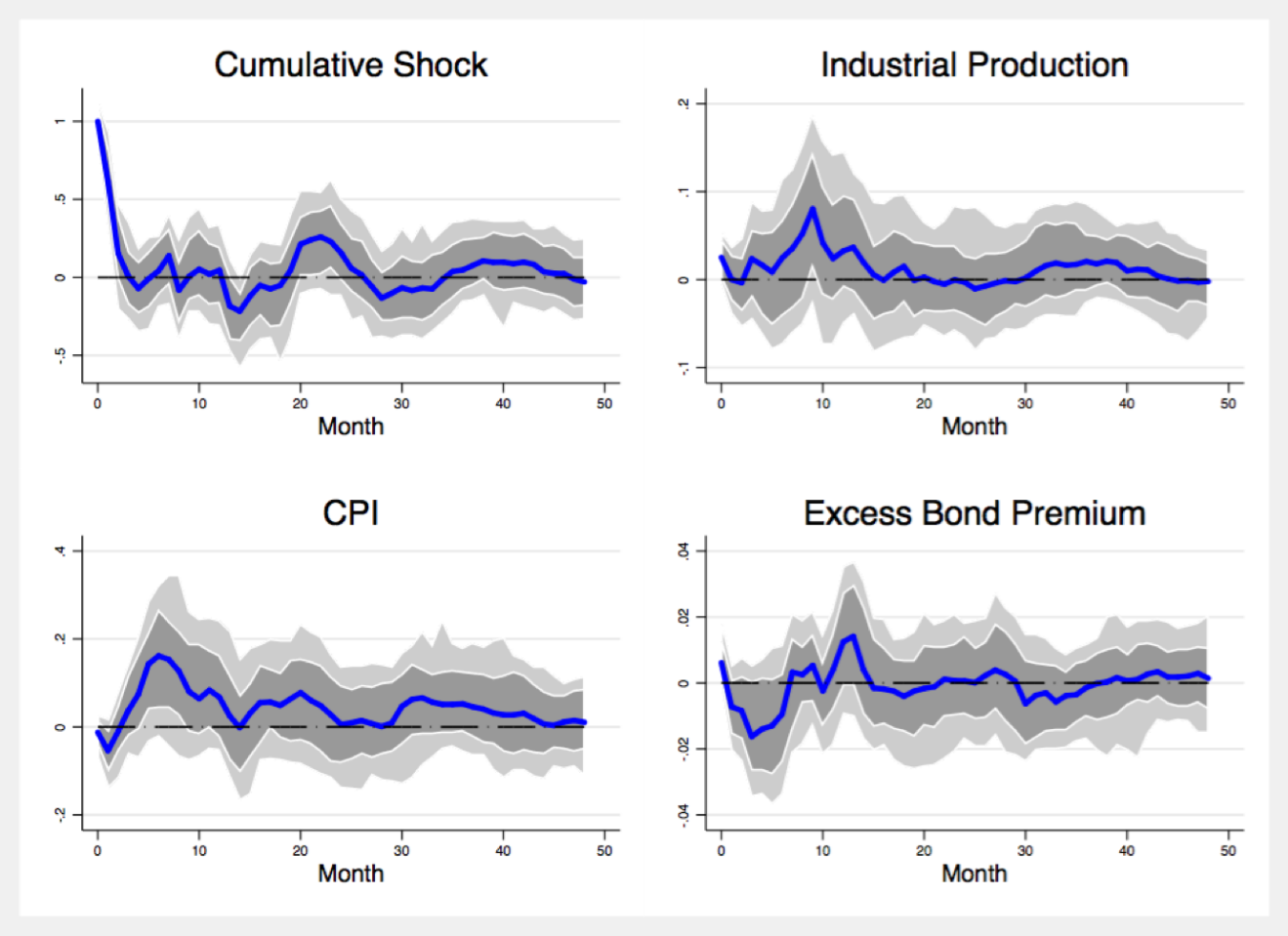
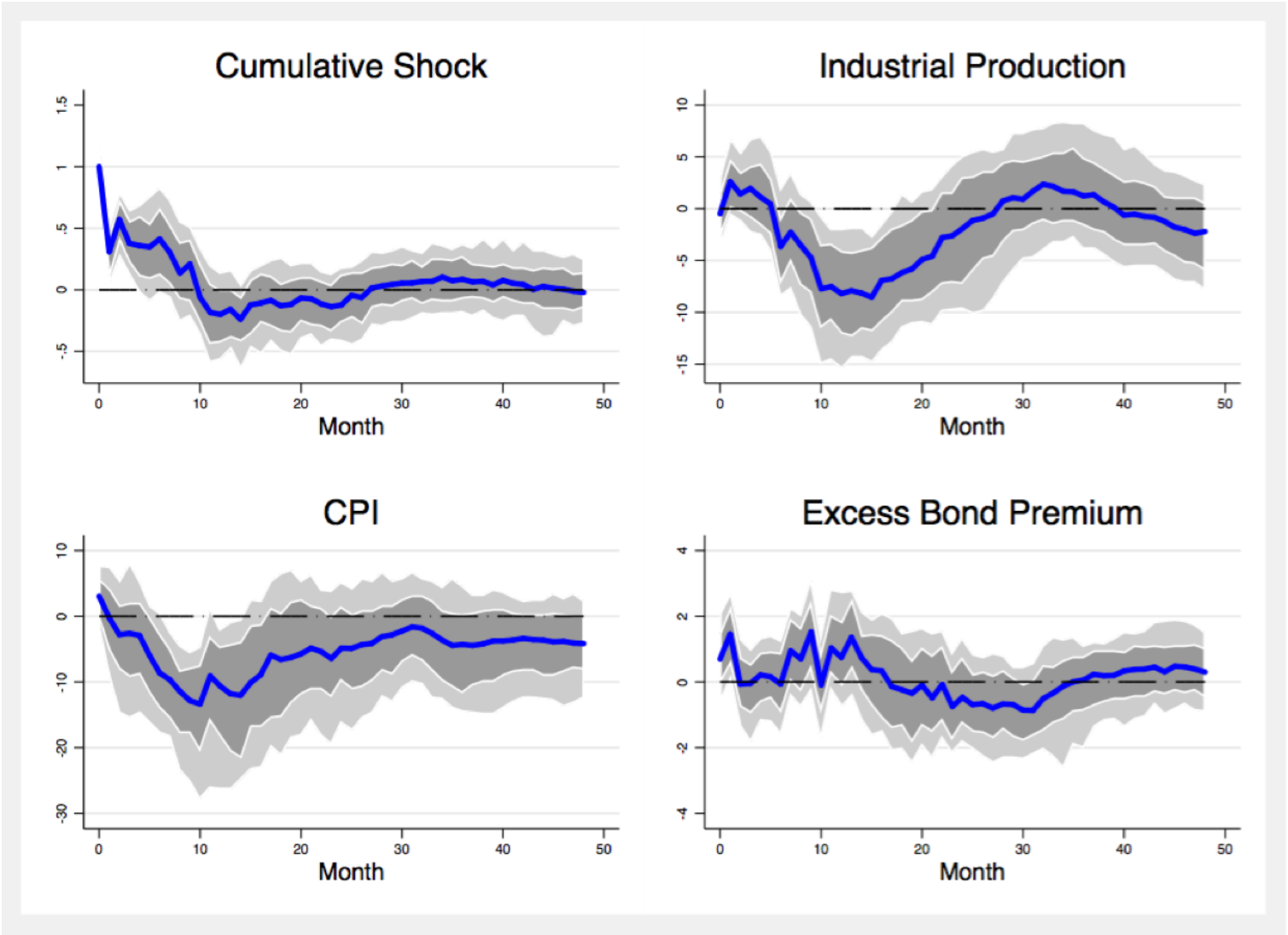
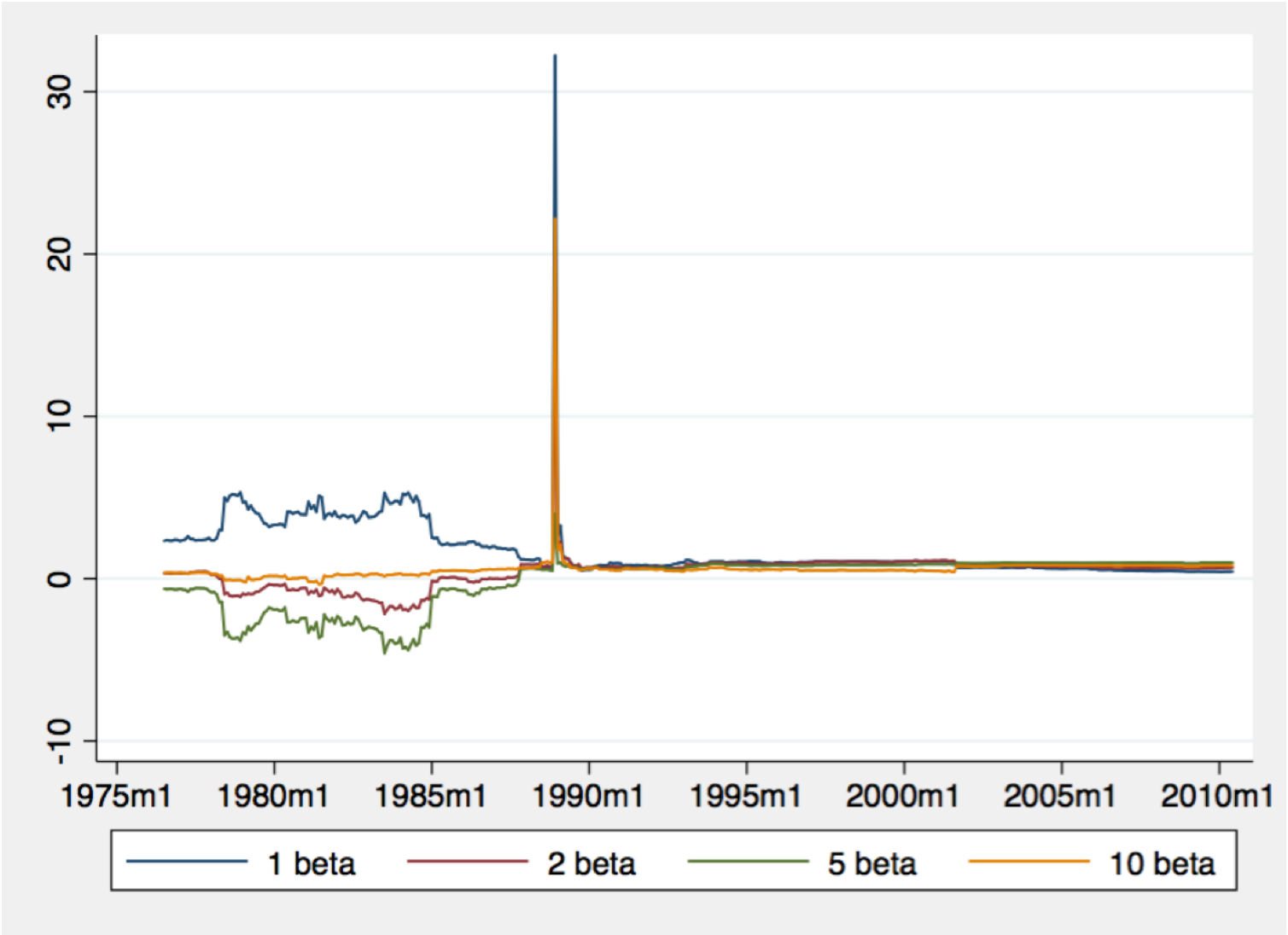


Robustness: Accounting for Term Premium (2008-2017)

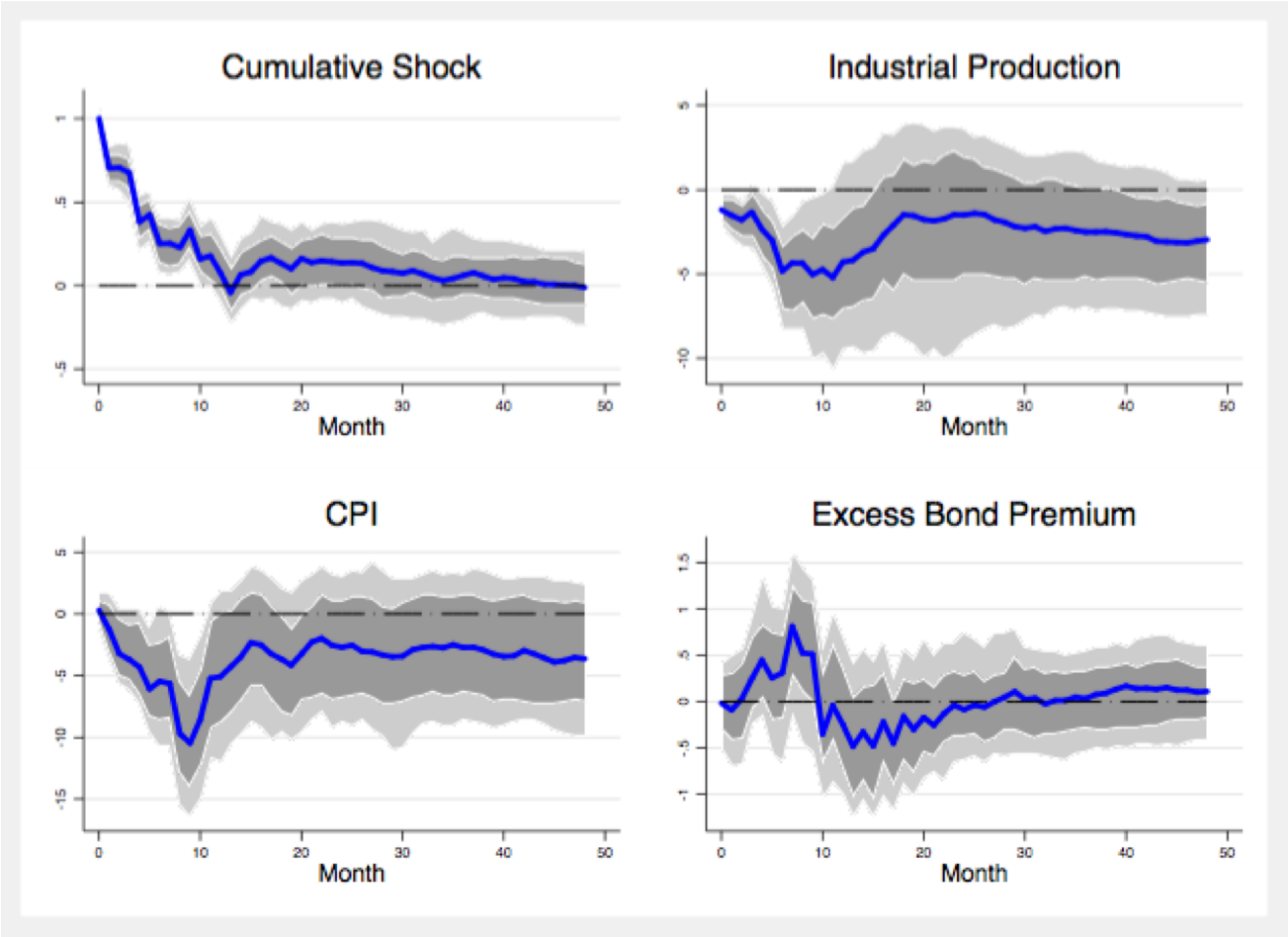


Note: Deep and shallow gray shaded areas are 68% and 90% confidence intervals produced by

Appendix 1: Rolling Sample



Appendix 2: SVAR Impulse Responses with alternative IV (1994-2017)



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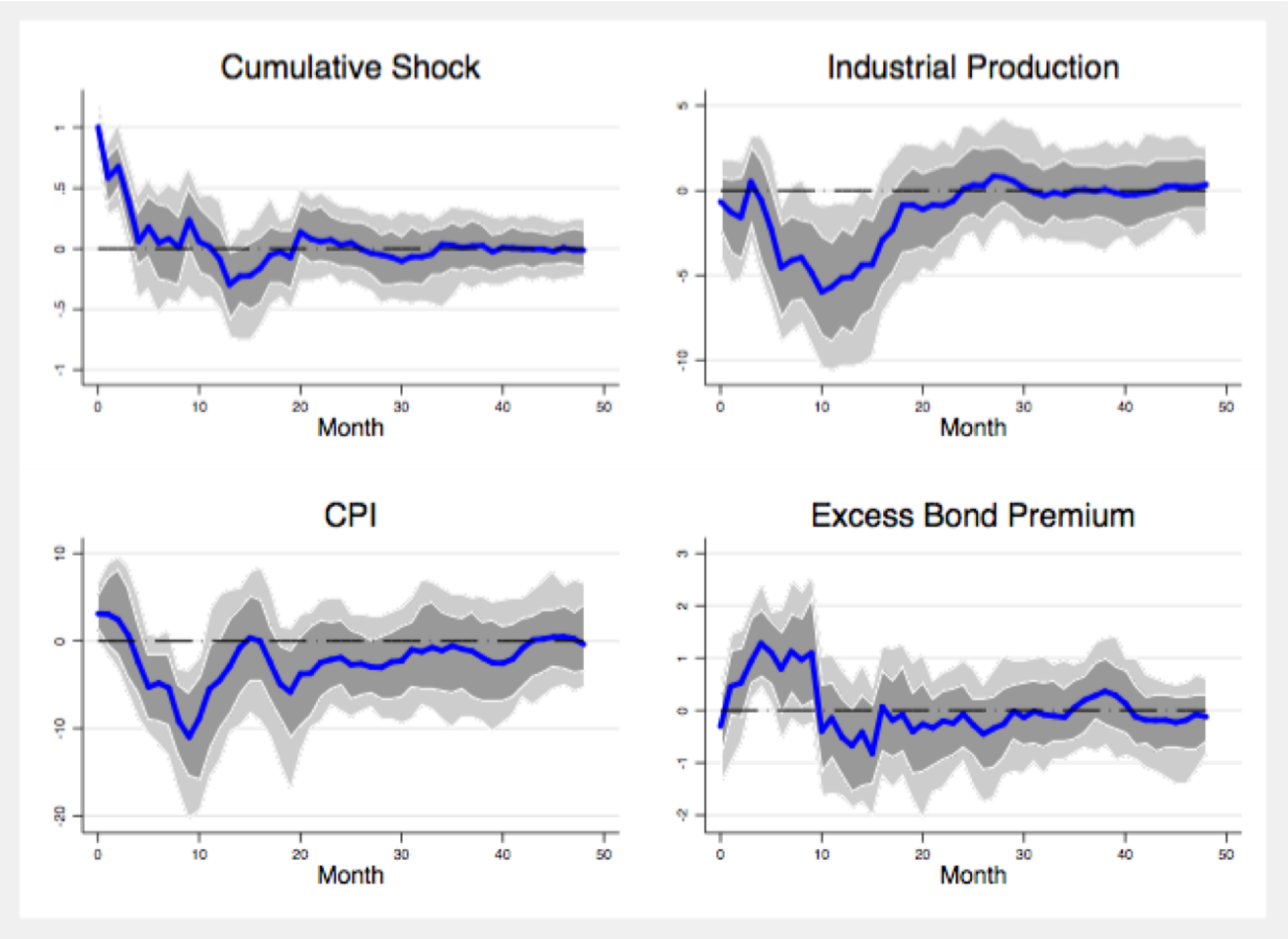
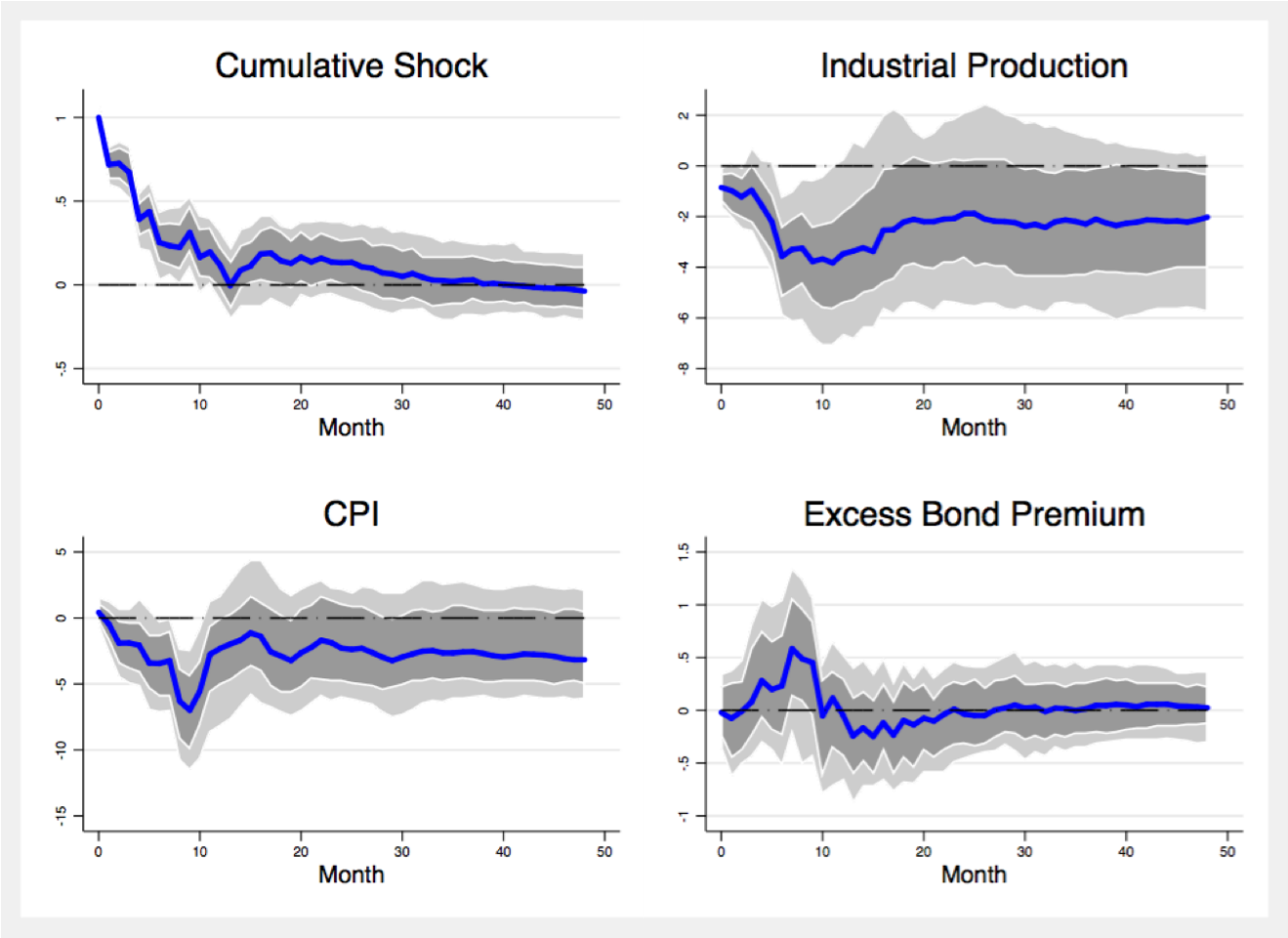


Appendix 3: SVAR Impulse Responses with Simple Fama-Macbeth Shock(1994-2017)



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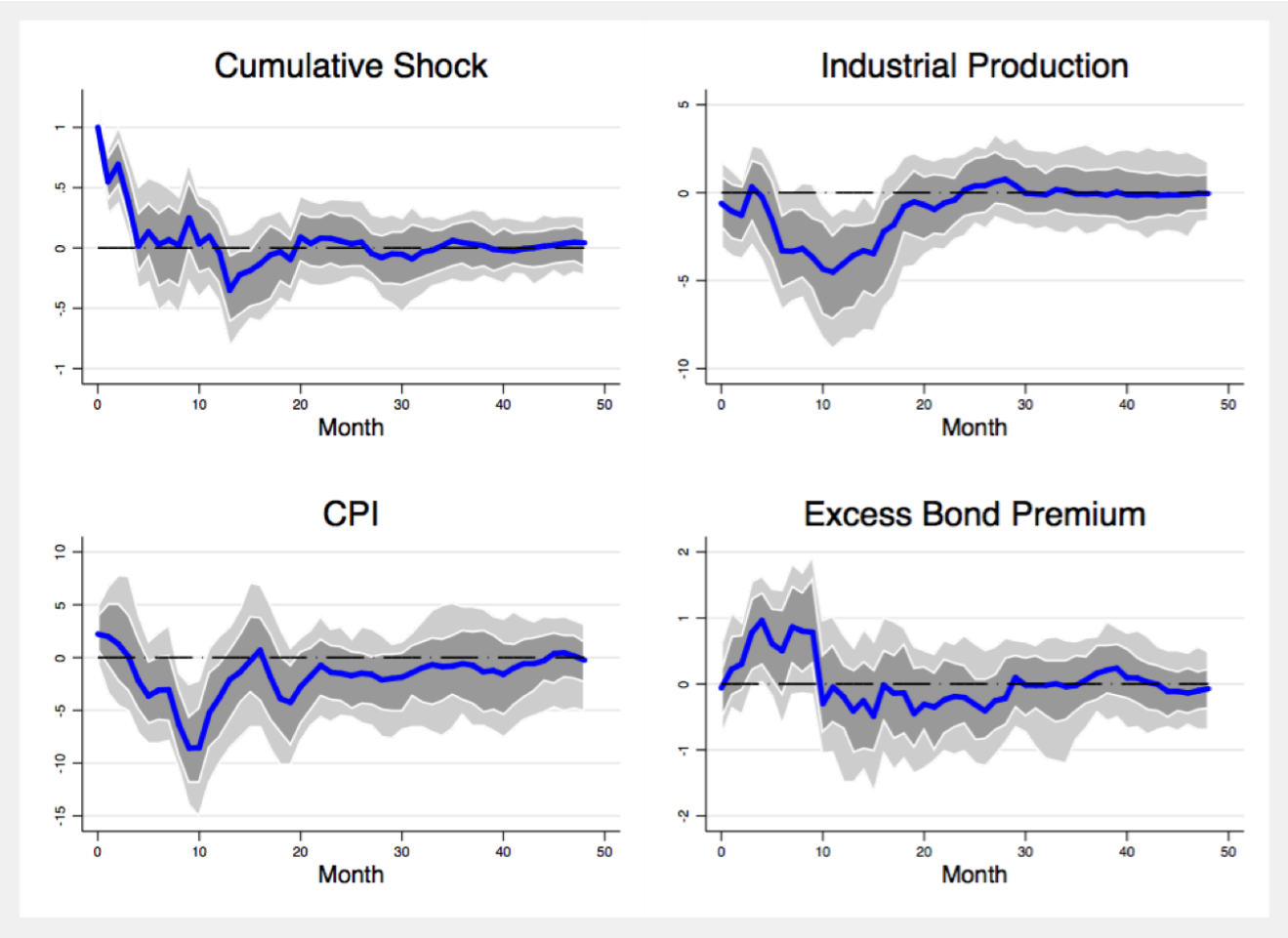
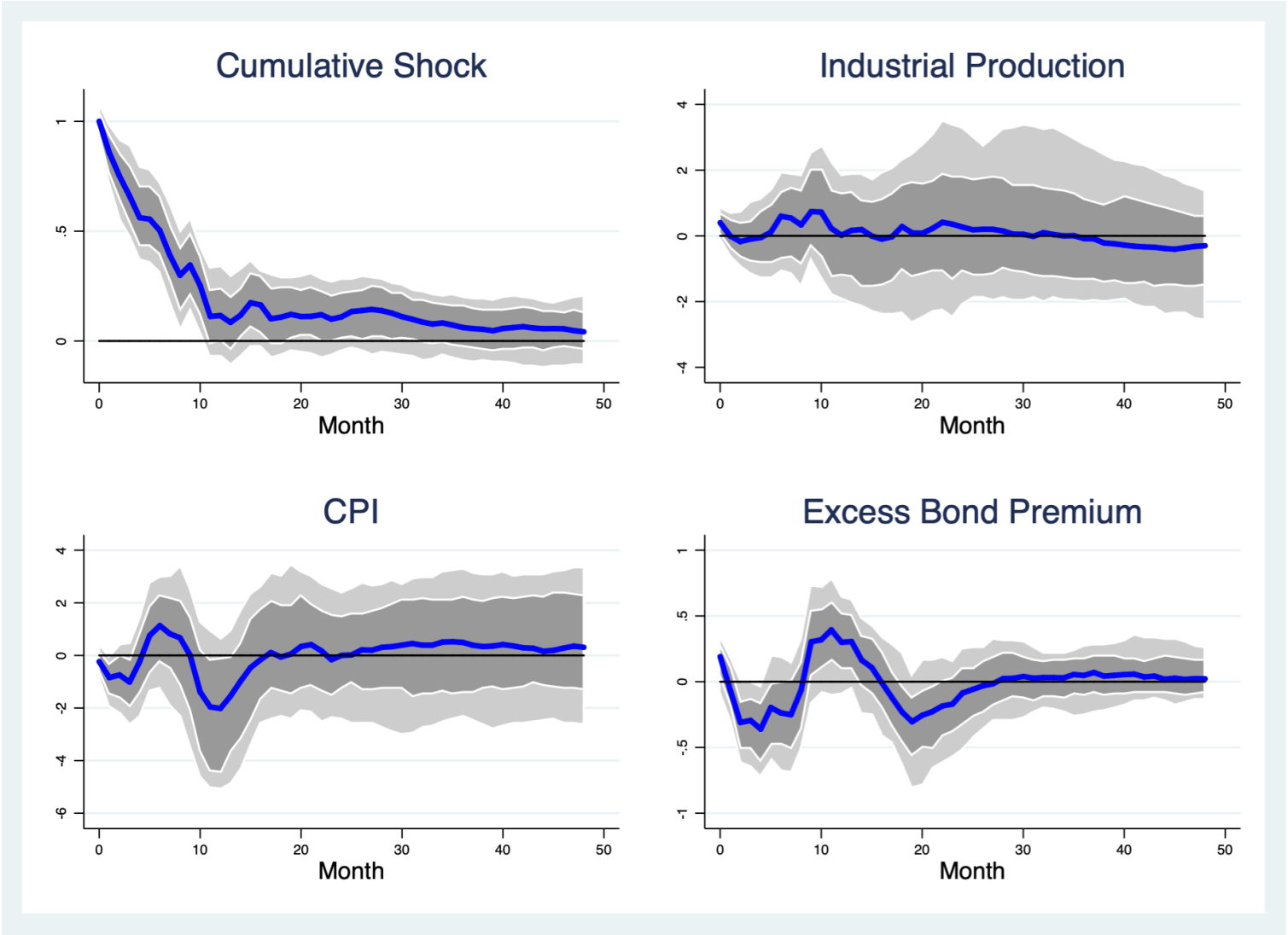


Appendix 4: Tight Window (NS) 1994-2017



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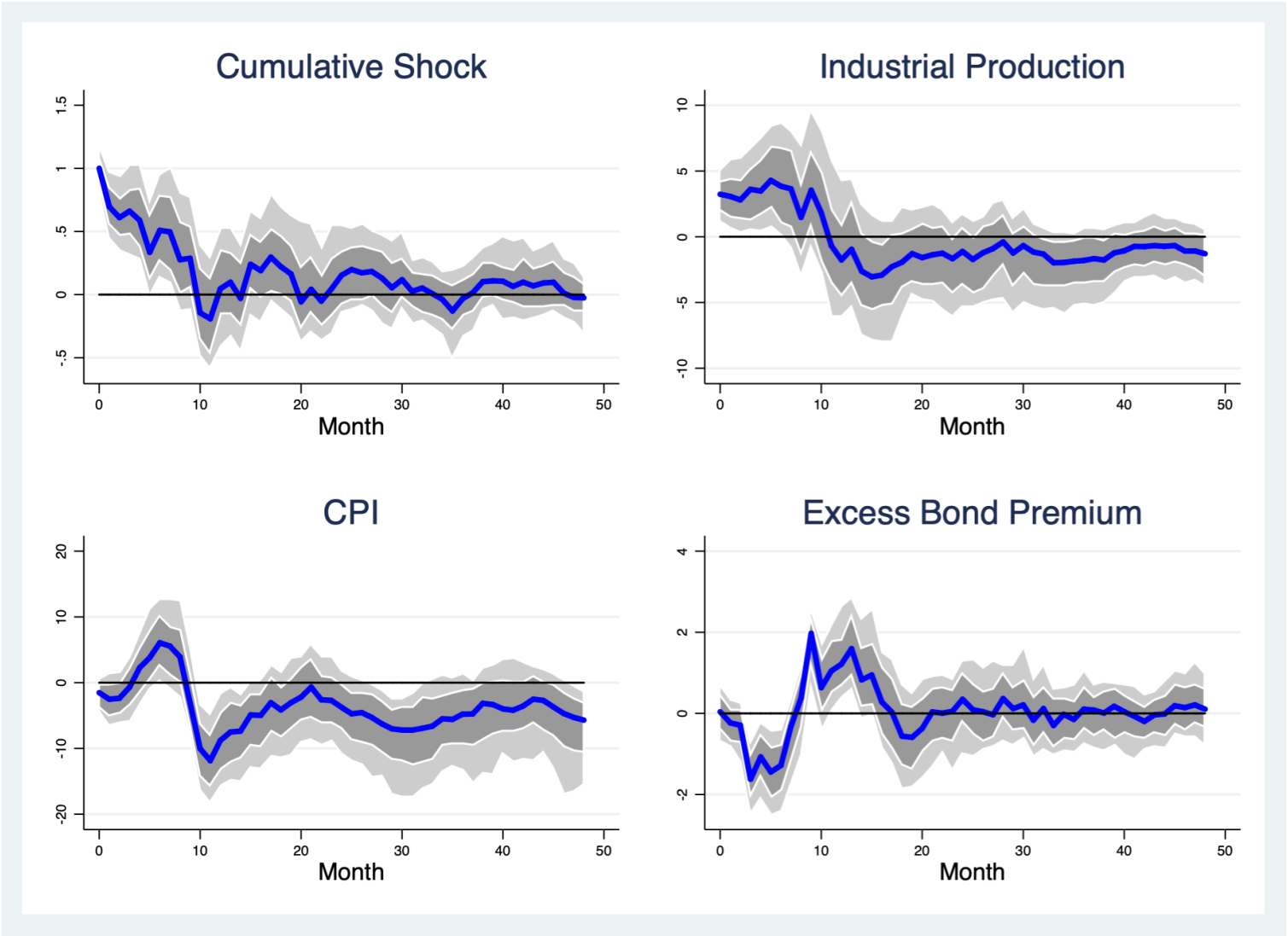
Appendix 4: Tight Window (NS) 2008-2017



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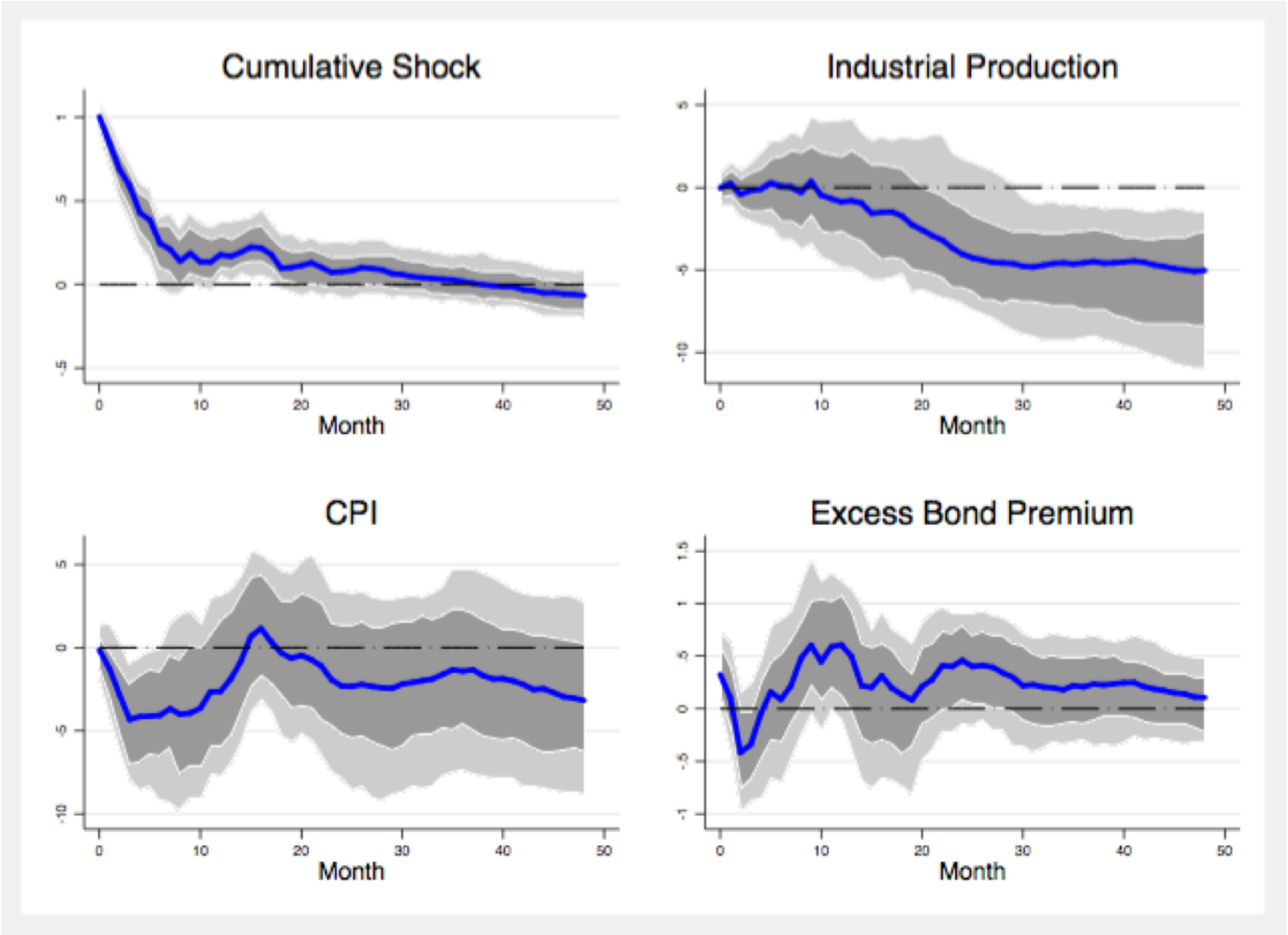
Appendix 5: Tight Window (Full) 1994-2017



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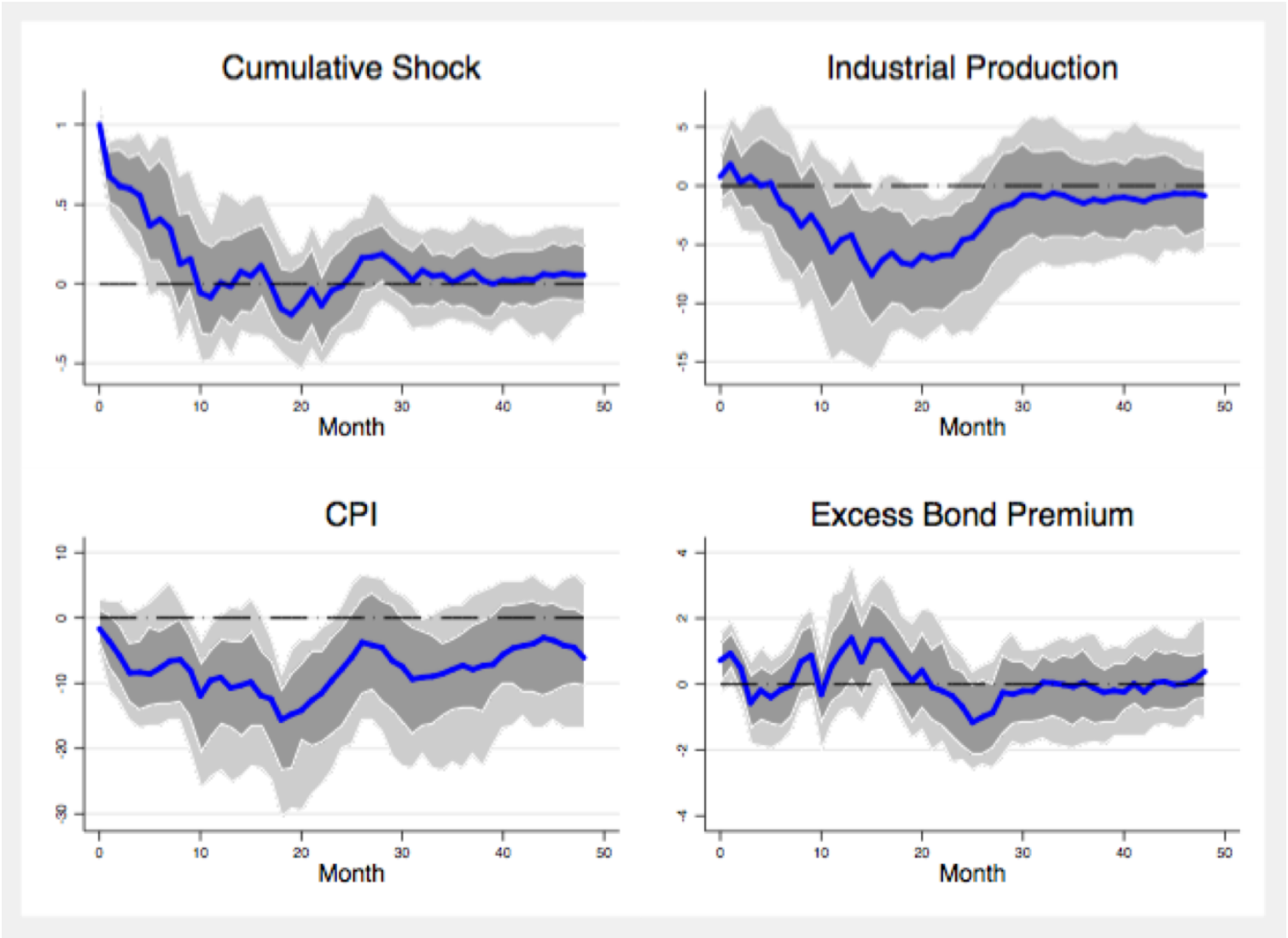
Appendix 5: Tight Window (Full) 2008-2017



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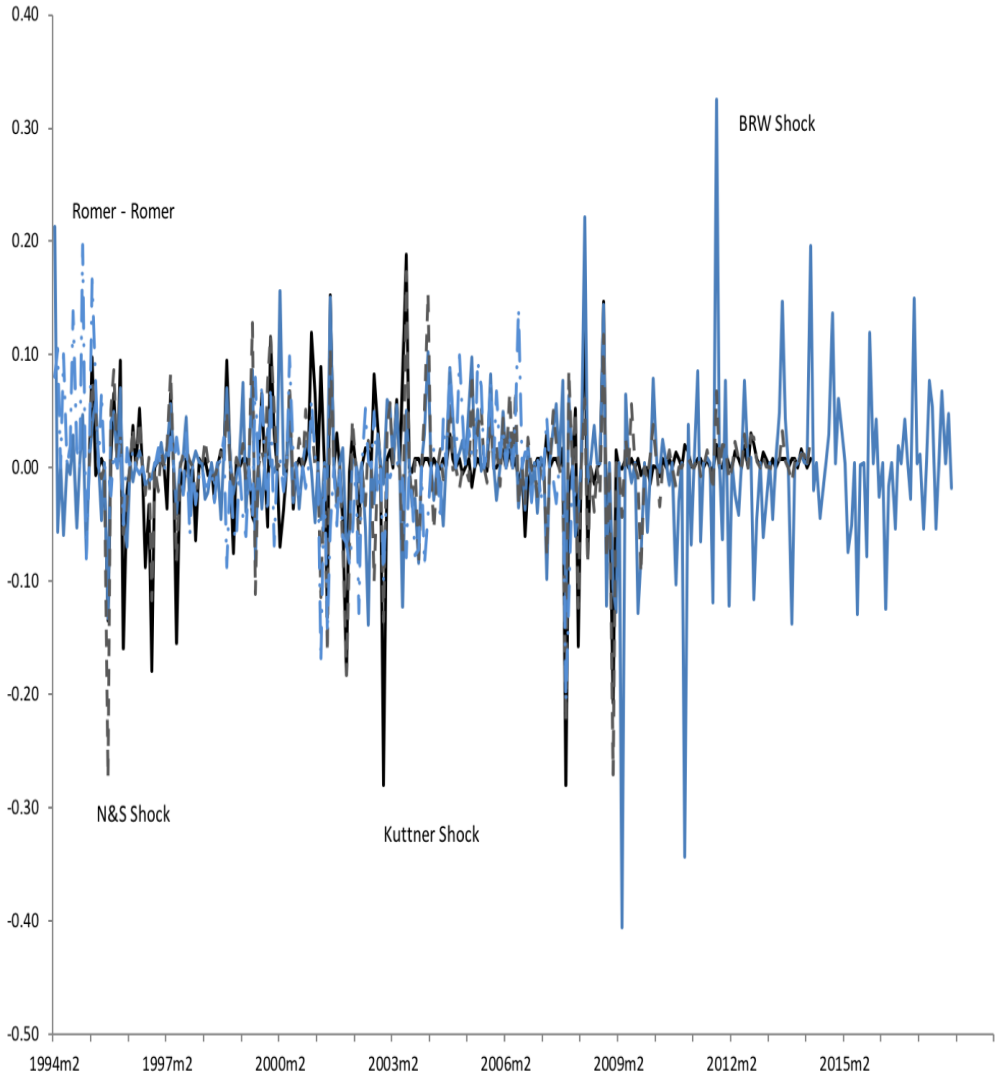
BRW, NS, RR, and Kuttner Shocks

- BRW shock, the solid blue line.
- Nakamura and Steinsson (2018) Shock, the black dotted line.
- Kuttner Shock (the 30-minute fed funds rate changes around FOMC announcement) , the solid black line.
- Romer and Romer (2004) Shock, the blue dashed line.



BRW and Alternative UMP Shocks (Swanson, 2018)

- Navy bars are BRW.
- Gray bars are: SS_FFR, SS_FG, SS_LSAP, and SS_Sum, shocks to the federal funds rate, forward guidance, large asset purchases, and the sum of the three shocks, all from Swanson (2018).