

# A New Measure of Monetary Shocks: Derivation and Implications

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# Motivation

- What is the impact of monetary policy on economic activity?
  - Conventional measures of monetary policy have obvious flaws;
    - Endogenous movements (e.g.: money supply, or federal funds rate);
    - Anticipation (e.g.: targets).
- ⇒ Derive a new measure based on information about meetings of the Federal Open Market Committee (FOMC).

## Empirical Strategy

1. Derivation of the New Measure of Monetary Shocks;
2. Implication on economic measures using simple OLS regressions:
  - Output; and
  - Inflation.
3. Vector Autorregressive Regressions (VARs) to account for multiple causality<sup>1</sup>.

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<sup>1</sup>They only provide a descriptive description of the model and which variables are included.

## Deriving the new measure

$$(1) \quad \Delta ff_m = \alpha + \beta ffb_m + \sum_{i=-1}^2 \gamma_i \widetilde{\Delta y}_{mi}$$
$$+ \sum_{i=-1}^2 \lambda_i (\widetilde{\Delta y}_{mi} - \widetilde{\Delta y}_{m-1,i}) + \sum_{i=-1}^2 \varphi_i \tilde{\pi}_{mi}$$
$$+ \sum_{i=-1}^2 \theta_i (\tilde{\pi}_{mi} - \tilde{\pi}_{m-1,i}) + \rho \tilde{u}_{m0} + \epsilon_m.$$

where:

- $\Delta ff_m$ : change in intended funds rate at meeting  $m$ ;
  - $ffb_m$ : levels *before* the meeting;
  - $\tilde{X} = \{\tilde{\Delta y}, \tilde{\pi}, \tilde{u}\}$ : forecasts of output (growth), inflation and unemployment respectively;
  - $i$ : quarter  $\implies$  they account for forecasts prior and after the meetings;
- $\implies \epsilon_m$ : the new measure of monetary shocks.

# Figure 1: Measures of Monetary Policy



Table 1: Determinants of the Change in the Intended Funds Rate

	Coefficient	(Standard Errors)
Old Target	-0.021*	(0.012)
Forecasted Output Growth (-1)	0.007	(0.010)
Forecasted Output Growth (0)	0.003	(0.019)
Forecasted Output Growth (+1)	0.010	(0.032)
Forecasted Output Growth (+2)	0.022	(0.032)
Change in Forecast Output (-1)	0.050*	(0.030)
Change in Forecast Output (0)	0.152***	(0.030)
Change in Forecast Output (+1)	0.021	(0.046)
Change in Forecast Output (+2)	0.021	(0.051)
Forecasted Inflation (-1)	0.021	(0.024)
Forecasted Inflation (0)	-0.044	(0.029)
Forecasted Inflation (+1)	0.010	(0.044)
Forecasted Inflation (+2)	0.052	(0.047)
Change in Forecasted Inflation (-1)	0.057	(0.045)
Change in Forecasted Inflation (0)	0.003	(0.048)
Change in Forecasted Inflation (+1)	0.031	(0.074)
Change in Forecasted Inflation (+2)	-0.062	(0.081)
Forecasted Unemployment Rate (0)	-0.048**	(0.021)
Constant	0.171	(0.141)
Observations	263	
R <sup>2</sup>	0.282	

Note: \* p<0.1; \*\* p<0.05; \*\*\* p<0.01. R<sup>2</sup> = 0.28; D.W. = 1.84; s.e.e. = 0.39; N = 263. The sample is FOMC meetings over the period 1969:3–1996:12.

## Table 2: New Measure of Monetary Policy (% points)

	year	jan	fev	mar	abr	mai	jun	jul	ago	set	out	nov	dez
1	1969	0	0	-0.245	0.405	0.204	-0.02	0.181	0.309	0.029	0.088	-0.005	0.065
2	1970	-0.16	-0.36	-0.14	-0.145	0.3	-0.18	-0.243	-0.483	-0.272	-0.009	-0.346	-0.229
3	1971	-0.682	-0.025	-0.065	0.461	0.003	0.343	-0.117	0	0	-0.322	-0.342	-0.92
4	1972	-0.234	-0.086	0.252	-0.104	-0.115	-0.05	0	0	0	0	0.036	-0.027
5	1973	0.279	0.225	0.064	-0.063	0.317	0.409	0.115	0.318	-0.571	-0.848	-0.095	-0.165
6	1974	-0.206	0.201	0.733	0.387	0.392	0.28	-0.091	-0.022	-0.43	-0.284	0.336	-0.229
7	1975	-0.354	0.243	-0.499	-0.637	0.136	0.17	0.07	-0.136	-0.114	-0.2	-0.281	0.28
8	1976	-0.091	-0.469	-0.239	0.139	-0.298	-0.038	-0.139	-0.044	0.019	-0.041	0.03	-0.131
9	1977	-0.097	-0.085	-0.228	-0.049	-0.051	-0.146	-0.24	0.03	0.073	-0.026	-0.048	-0.122
10	1978	-0.205	0.106	0.042	-0.069	-0.216	0.243	-0.142	-0.064	-0.156	0.133	0.168	-0.042
11	1979	0	-0.152	0.133	-0.064	0.105	0	0.761	0.322	-0.224	0	0.045	0
12	1980	-0.011	0.197	1.422	-3.221	-0.764	0	0.403	-0.198	0.771	1.218	1.871	-0.634
13	1981	0	-0.783	0.307	0	1.515	0	-0.611	-0.041	0	-0.574	-0.356	0.1
14	1982	0	1.021	-0.435	0	-0.056	0	-0.196	-0.211	0	-0.242	0.125	0.651
15	1983	0	0.185	0.145	0	-0.019	0	-0.008	-0.234	0	0.282	-0.172	0.217
16	1984	0.257	0	-0.101	0	0.173	0	0.327	-0.061	0	0.035	-0.546	-0.144
17	1985	0	-0.158	0.201	0	-0.104	0	0.06	0.186	0	0.104	0.021	-0.069
18	1986	0	-0.11	0	0.207	0.076	0	-0.168	-0.234	0.001	0	0.021	-0.082
19	1987	0	0.176	0.191	0	0.238	0	-0.041	-0.021	-0.147	0	-0.085	-0.18
20	1988	0	-0.224	0.018	0	0.188	0.308	0	-0.182	-0.067	0	-0.009	0.446
21	1989	0	0.297	0.061	0	0.153	0	0.075	-0.139	0	-0.087	0.108	-0.067
22	1990	0	0.313	-0.094	0	0.044	0	-0.066	0.15	0	-0.119	-0.018	-0.159
23	1991	0	-0.251	0.227	0	0.262	0	-0.077	0.14	0	-0.035	-0.121	0.113
24	1992	0	-0.004	-0.126	0	0.148	0	-0.088	-0.003	0	-0.175	-0.029	-0.237
25	1993	0	0.094	-0.063	0	0.335	0	0.009	0.044	0.159	0	-0.087	-0.163
26	1994	0	0.224	0.313	0	0.287	0	0.07	0.417	0.041	0	0.549	-0.248
27	1995	0	0.501	0.241	0	0.209	0	-0.006	-0.091	0.025	0	0.052	-0.171
28	1996	0.073	0	0.056	0	-0.027	0	-0.04	-0.065	-0.042	0	0.048	-0.029

## Implications of the new measure: Output

$$(2) \quad \Delta y_t = a_0 + \sum_{k=1}^{11} a_k D_{kt} + \sum_{i=1}^{24} b_i \Delta y_{t-i} \\ + \sum_{j=1}^{36} c_j S_{t-j} + e_t,$$

where:

- $\Delta y_t$ : output growth in month  $t$  proxied by industrial production;
- $D_{kt}$ : month dummies (seasonality) for each month  $k$ ;
- $S_t$ : new measure of monetary shock.

Table 3: The Impact of Monetary Policy Shocks On Industrial Production

Monetary policy shock			Change in industrial production		
Lag	Coefficient	Standard error	Lag	Coefficient	Standard error
1	0.0038	0.0018	1	0.0627	0.0637
2	0.0026	0.0018	2	-0.0128	0.0633
3	-0.0038	0.0018	3	0.1072	0.0628
4	-0.0012	0.0018	4	0.0484	0.0630
5	-0.0039	0.0018	5	0.0284	0.0629
6	-0.0001	0.0018	6	-0.0054	0.0628
7	-0.0008	0.0019	7	0.0179	0.0627
8	-0.0029	0.0019	8	0.0075	0.0626
9	-0.0021	0.0019	9	0.0396	0.0622
10	-0.0047	0.0018	10	-0.0426	0.0609
11	-0.0025	0.0019	11	0.0709	0.0593
12	-0.0035	0.0019	12	0.2867	0.0602
13	-0.0021	0.0019	13	0.0227	0.0608
14	-0.0007	0.0018	14	-0.1964	0.0604
15	-0.0003	0.0019	15	-0.1511	0.0610
16	0.0019	0.0018	16	-0.1282	0.0623
17	-0.0009	0.0018	17	0.0777	0.0635
18	-0.0024	0.0018	18	0.0853	0.0632
19	-0.0023	0.0019	19	0.0557	0.0632
20	-0.0007	0.0019	20	0.0805	0.0629
21	-0.0011	0.0019	21	-0.0604	0.0631
22	-0.0032	0.0018	22	-0.0171	0.0630
23	0.0015	0.0019	23	-0.0675	0.0630
24	0	0.0019	24	0.0863	0.0631
25	-0.0001	0.0019			
26	0	0.0019			
27	-0.0007	0.0019			
28	0.0038	0.0019			
29	0.0013	0.0019			
30	0.0035	0.0019			
31	0.0018	0.0019			
32	0.0009	0.0018			
33	0.0014	0.0018			
34	0.0047	0.0018			
35	0.0011	0.0018			
36	0.0024	0.0018			

Notes:  $R^2 = 0.86$ ; D.W. = 2.01; s.e.e. = 0.009; N = 324. The sample period is 1970:1-1996:12. Coefficients and standard errors for the constant term and monthly dummies are not reported.

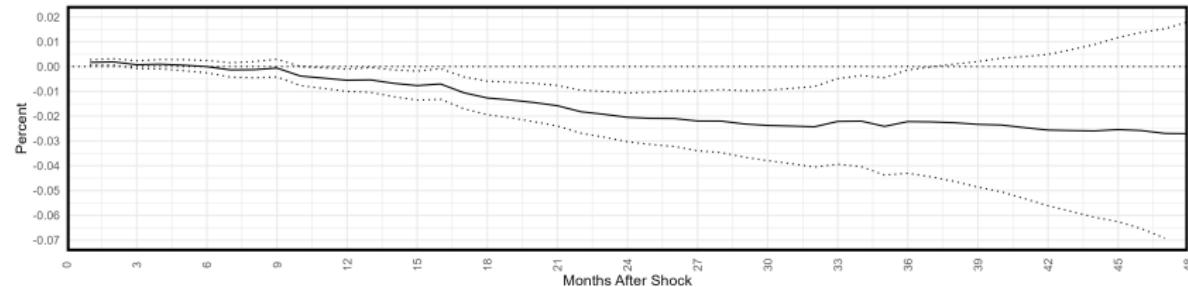
## Figure 2: The Effect of Monetary Policy Shocks On Industrial Production



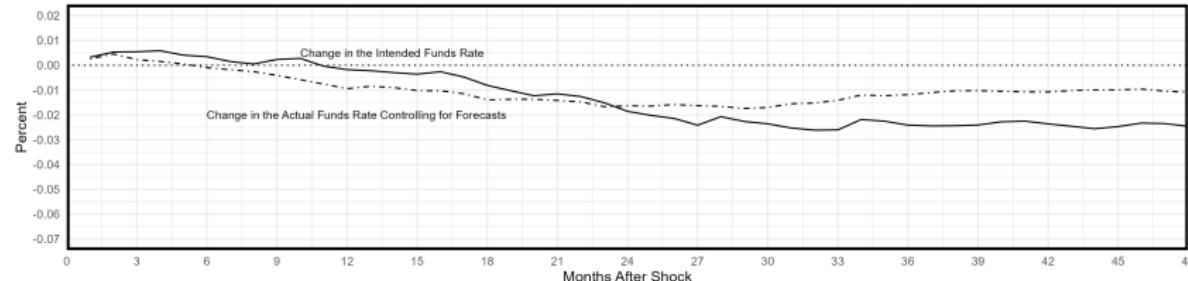
# Figure 3: The Impact of Broader Measures of Monetary Policy On Output

FIGURE 3. THE EFFECT OF BROADER MEASURES OF MONETARY POLICY ON OUTPUT

a. Using the Change in the Actual Federal Funds Rate



b. Using the Intermediate Broader Measures



## Implications of the new measure: Inflation

$$(3) \quad \Delta p_t = a_0 + \sum_{k=1}^{11} a_k D_{kt} + \sum_{i=1}^{24} b_i \Delta p_{t-i} \\ + \sum_{j=1}^{48} c_j S_{t-j} + e_t,$$

as before, but now...

...  $\Delta p_t$ : inflation.

obs.: Also some more lags to  $S$ .

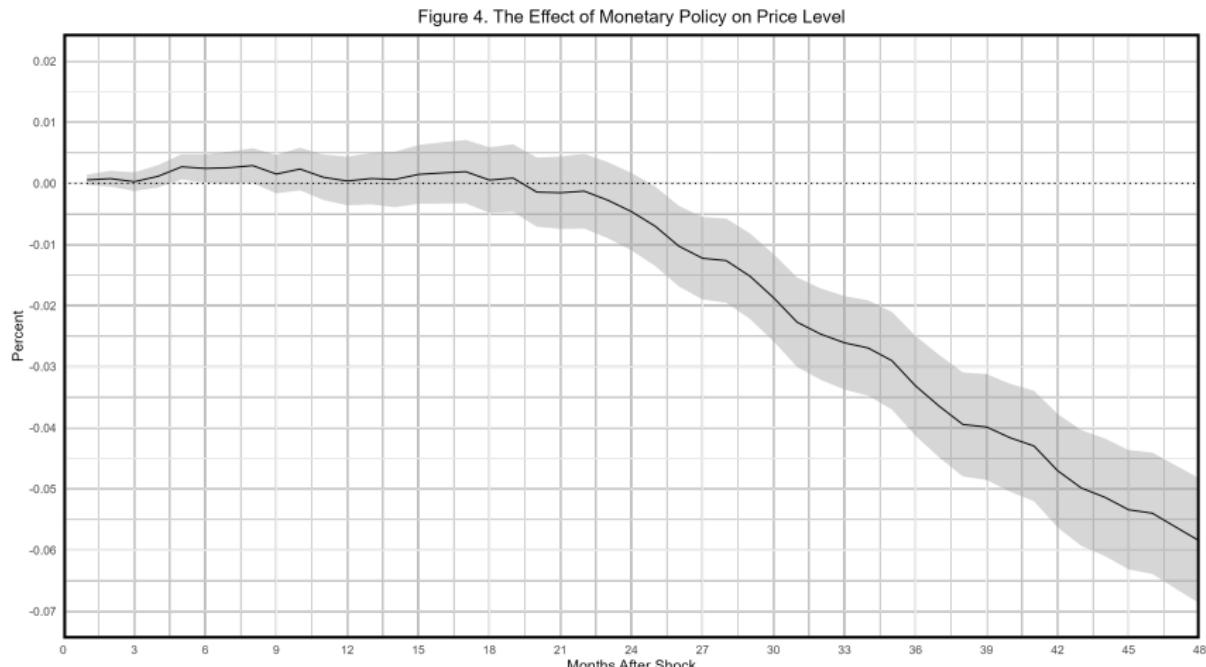
Table 4: The Impact of Monetary Policy Shocks On Prices

Monetary policy shock			Change on Producer Prices		
Lag	Coefficient	Standard error	Lag	Coefficient	Standard error
1	0.0006	0.0009	1	0.1916	0.0645
2	0.0001	0.0009	2	0.0024	0.0652
3	-0.0005	0.0009	3	-0.0378	0.0655
4	0.0010	0.0009	4	-0.0984	0.0655
5	0.0014	0.0009	5	0.0089	0.0656
6	-0.0006	0.0009	6	0.1073	0.0654
7	0.0001	0.0009	7	-0.0563	0.0653
8	0.0005	0.0009	8	0.0499	0.0652
9	-0.0013	0.0009	9	0.0743	0.0654
10	0.0009	0.0009	10	-0.0494	0.0653
11	-0.0016	0.0009	11	0.0873	0.0653
12	-0.0003	0.0009	12	0.1268	0.0653
13	0.0001	0.0009	13	-0.0707	0.0646
14	-0.0002	0.0009	14	-0.0201	0.0642
15	0.0010	0.0009	15	-0.0185	0.0639
16	-0.0004	0.0009	16	-0.0176	0.0634
17	0.0003	0.0009	17	0.0562	0.0632
18	-0.0012	0.0009	18	0.0287	0.0633
19	0.0005	0.0009	19	0.0091	0.0623
20	-0.0020	0.0009	20	0.0928	0.0625
21	0.0002	0.0009	21	0.0042	0.0627
22	-0.0001	0.0009	22	-0.0037	0.0626
23	-0.0013	0.0009	23	-0.0572	0.0622
24	-0.0019	0.0009	24	0.0451	0.0610
25	-0.0024	0.0009			
26	-0.0025	0.0010			
27	-0.0017	0.0010			
28	-0.0002	0.0010			
29	-0.0022	0.0010			
30	-0.0033	0.0010			
31	-0.0031	0.0010			
32	-0.0006	0.0010			
33	-0.0013	0.0010			
34	-0.0010	0.0010			
35	-0.0015	0.0010			
36	-0.0033	0.0010			
37	-0.0019	0.0010			
38	-0.0016	0.0010			
39	0.0001	0.0010			
40	-0.0017	0.0010			
41	-0.0007	0.0010			
42	-0.0029	0.0010			
43	-0.0013	0.0010			
44	-0.0003	0.0009			
45	-0.0015	0.0009			
46	0.0001	0.0009			
47	-0.0015	0.0009			
48	-0.0008	0.0009			

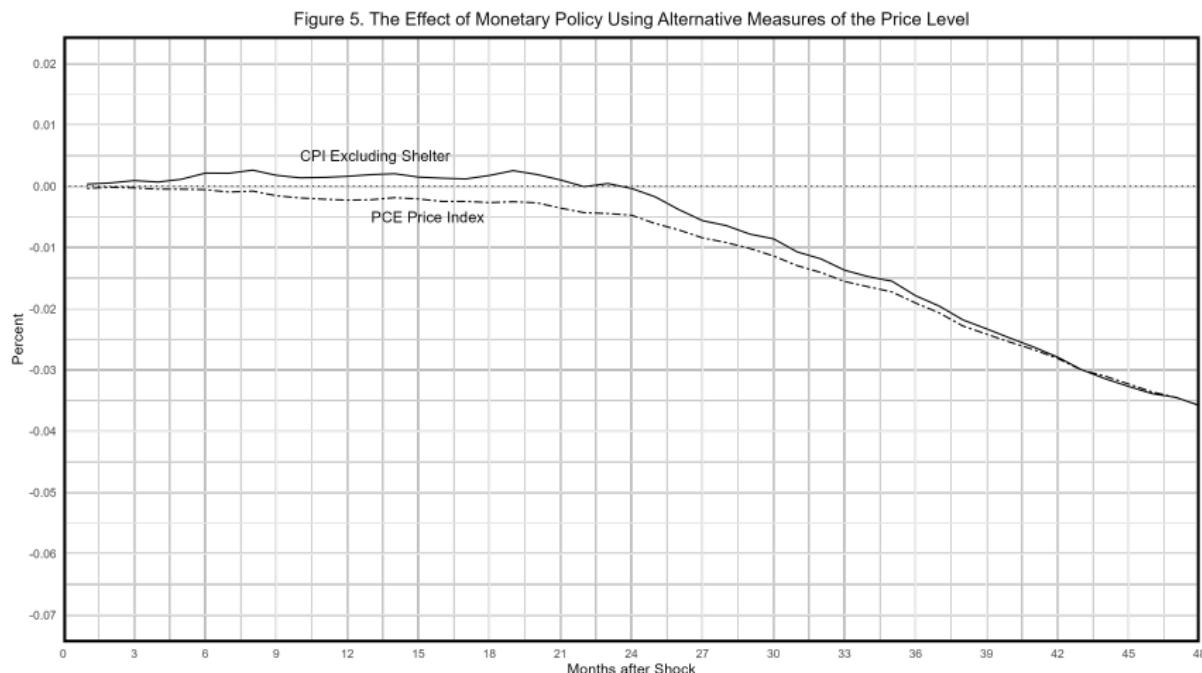
12/26

Notes: R<sup>2</sup> = 0.57; D.W. = 2.00; s.e.e. = 0.005; N = 324. The sample period is 1970:1-1996:12. Coefficients and standard errors for the constant term and monthly dummies are not reported.

## Figure 4: The Effect of Monetary Policy on Price Level



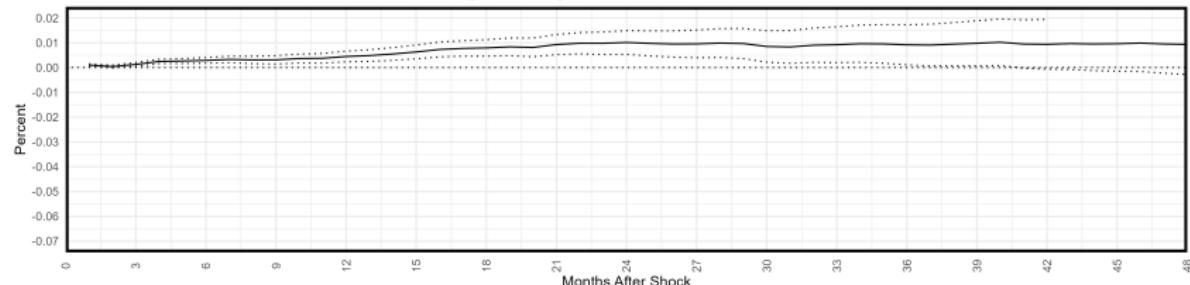
## Figure 5: The Effect of Monetary Policy Using Alternative Measures of The Price Level



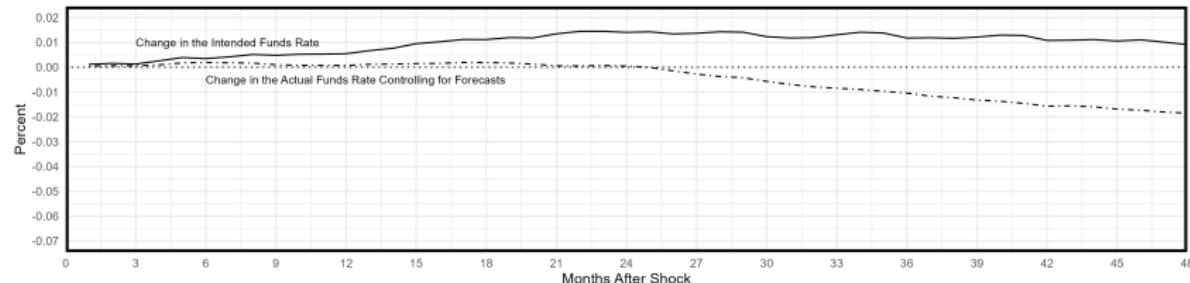
# Figure 6: The Effect of Broader Measures of Monetary Policy on the Price Level

FIGURE 6. THE EFFECT OF BROADER MEASURES OF MONETARY POLICY ON THE PRICE LEVEL

a. Using the Change in the Actual Federal Funds Rate



b. Using the Intermediate Broader Measures



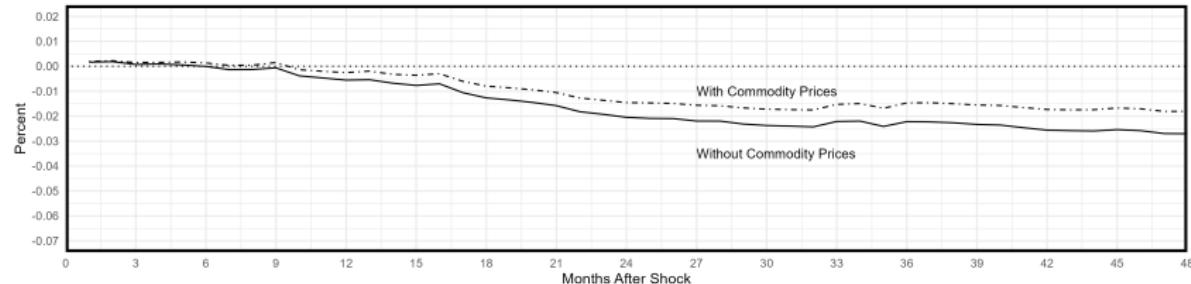
# Figure 7: The Effect of Monetary Policy on Output with and without Commodity Prices

Figure 7. The Effect of Monetary Policy on Output With and Without Commodity Prices

a. Using the New Measure of Monetary Policy Shocks



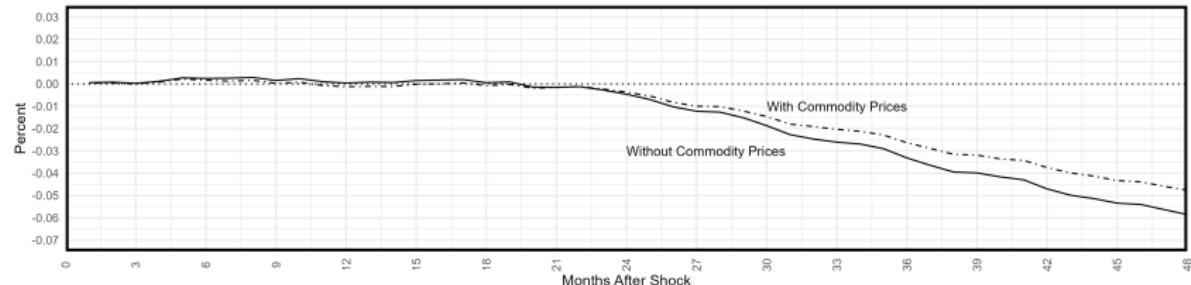
b. Using the Change in the Actual Federal Funds Rate



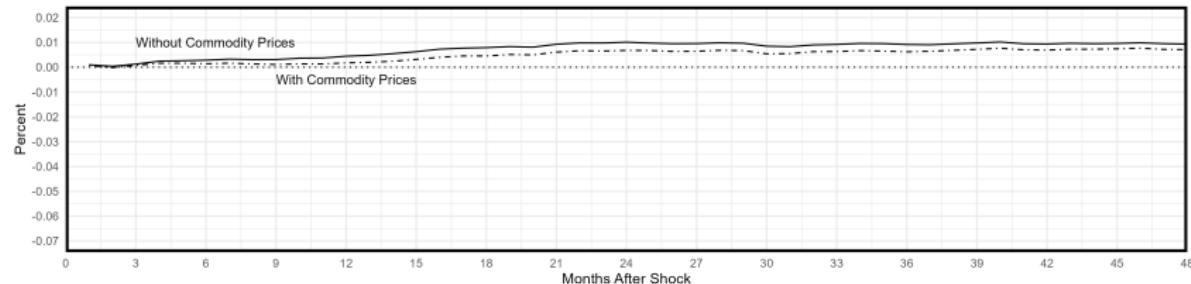
# Figure 8: The Effect of Monetary Policy on the Price Level with and without Commodity Prices

Figure 8. The Effect of Monetary Policy on The Price Level With and Without Commodity Prices

a. Using the New Measure of Monetary Policy Shocks



b. Using the Change in the Actual Federal Funds Rate



# VAR

- The basic VAR model includes three variables:
  - log of industrial production,
  - log of the Producer Price Index (PPI) for finished goods,
  - the new measure of monetary policy
- Unlike Christiano et al., who included only a year of lags in their VAR, this mode includes three years of lags, (why did they choose this value, only god knows)

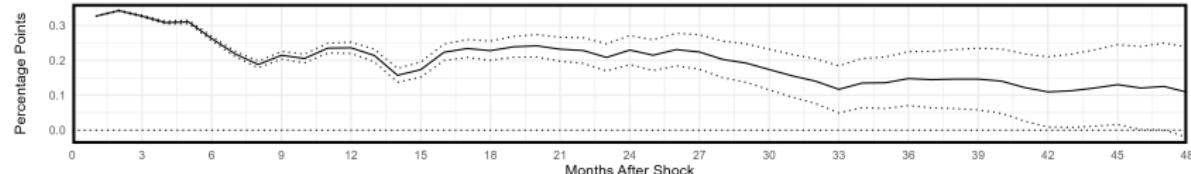
## VAR

- The findings, illustrated in Figure 9, show the response of cumulated shock, output, and the price level to a one-percentage-point innovation in the monetary policy shock.
- The cumulated shock decreases to about half its initial level after a year, indicating a less persistent change compared to a permanent, one-time shock.
- Output initially rises slightly for the first two months, then significantly drops until month 23 before returning to its initial level, with the peak effect being smaller compared to single-equation regression results.
- The price level shows a small and irregular response for the first eight months, followed by a negative response, with the monetary policy innovation lowering the price level significantly after 18, 30, and 48 months.

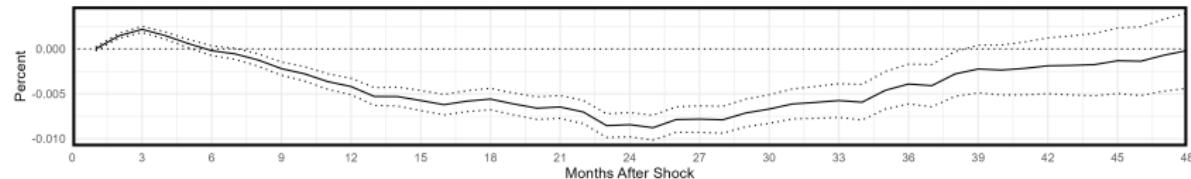
# Figure 9: The Effect of Monetary Policy in a VAR Using the New Measure of Monetary Policy Shocks

FIGURE 9. THE EFFECT OF MONETARY POLICY IN A VAR USING THE NEW MEASURE OF MONETARY POLICY

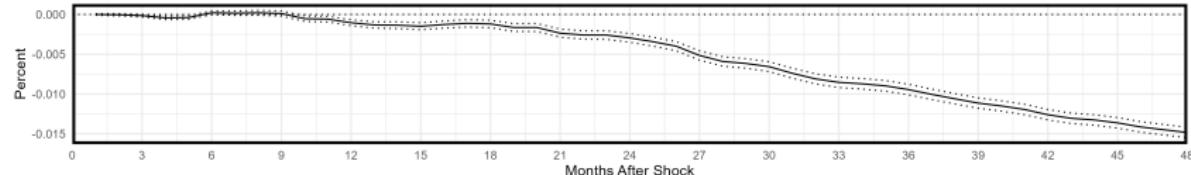
a. Effect on the Cumulated Shock



b. Effect on Output



c. Effect on the Price Level



# Extended Results

## Where the Data comes from?

- The data has been collected in the Handbook of Macroeconomics, 2016. More specifically, from “Macroeconomic Shocks and Their Propagation” section.
- We were not able to identify some of the specific original variables, for example the intention to change of the federal fund rate.
- Nevertheless, the VAR, table 3, and figures 2 and 3 were replicated, with the same original conclusions holding for them.

# Implications of the New Measure on Output

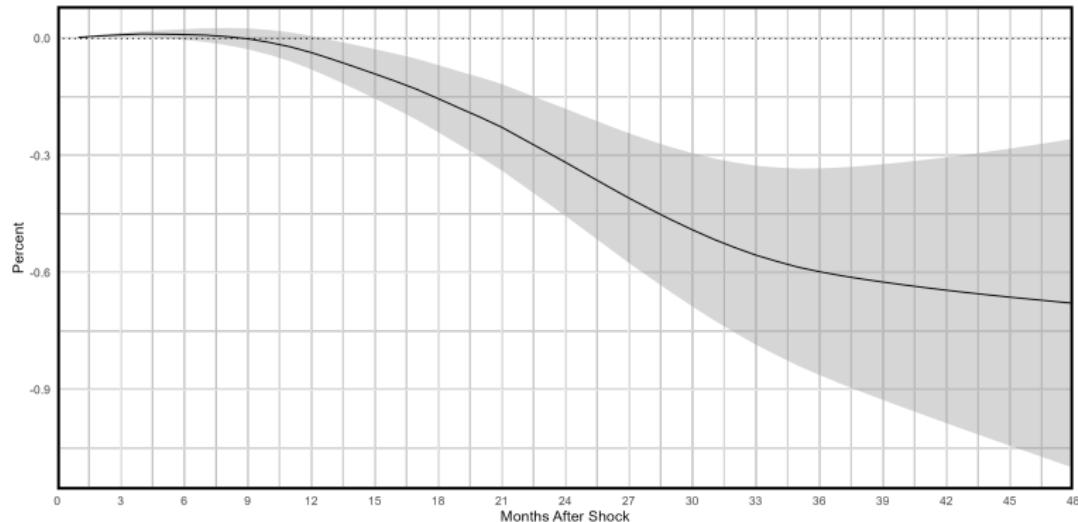
Monetary policy shock			Change in industrial production		
Lag	Coefficient	Standard error	Lag	Coefficient	Standard error
1	0.0025	0.0011	1	1.1960	0.0515
2	0.0010	0.0012	2	-0.0777	0.0801
3	-0.0018	0.0012	3	0.0029	0.0801
4	-0.0008	0.0012	4	-0.0698	0.0800
5	-0.0029	0.0012	5	-0.0856	0.0797
6	0.0004	0.0012	6	0.0262	0.0792
7	0.0003	0.0012	7	-0.0635	0.0792
8	-0.0017	0.0012	8	0.1151	0.0789
9	-0.0013	0.0012	9	0.0704	0.0793
10	-0.0033	0.0012	10	-0.0648	0.0792
11	-0.0013	0.0012	11	-0.0170	0.0795
12	-0.0025	0.0012	12	-0.0418	0.0797
13	-0.0009	0.0012	13	-0.0244	0.0799
14	0.0008	0.0012	14	-0.0584	0.0799
15	0.0006	0.0012	15	0.0565	0.0793
16	0.0004	0.0012	16	0.0135	0.0793
17	-0.0009	0.0012	17	0.0325	0.0787
18	-0.0025	0.0012	18	0.1164	0.0788
19	-0.0003	0.0012	19	-0.1904	0.0788
20	0.0015	0.0012	20	0.1424	0.0790
21	-0.0008	0.0012	21	-0.1432	0.0790
22	-0.0037	0.0012	22	0.0506	0.0793
23	0.0014	0.0012	23	0.0459	0.0792
24	0	0.0012	24	-0.0318	0.0503
25	-0.0009	0.0012			
26	0.0007	0.0012			
27	0.0005	0.0012			
28	0.0022	0.0012			
29	0.0003	0.0012			
30	0.0020	0.0012			
31	0.0013	0.0012			
32	0.0018	0.0012			
33	0.0012	0.0012			
34	0.0024	0.0012			
35	0.0002	0.0012			
36	0.0022	0.0012			

23/26

Notes: The sample period is 1970:1-2007:12. Coefficients and standard errors for the constant term and monthly dummies are not reported.

# Implications of the New Measure on Output

Figure 2. The Effect of Monetary Policy on Output



# Implications of the New an Alternative Measure on Output

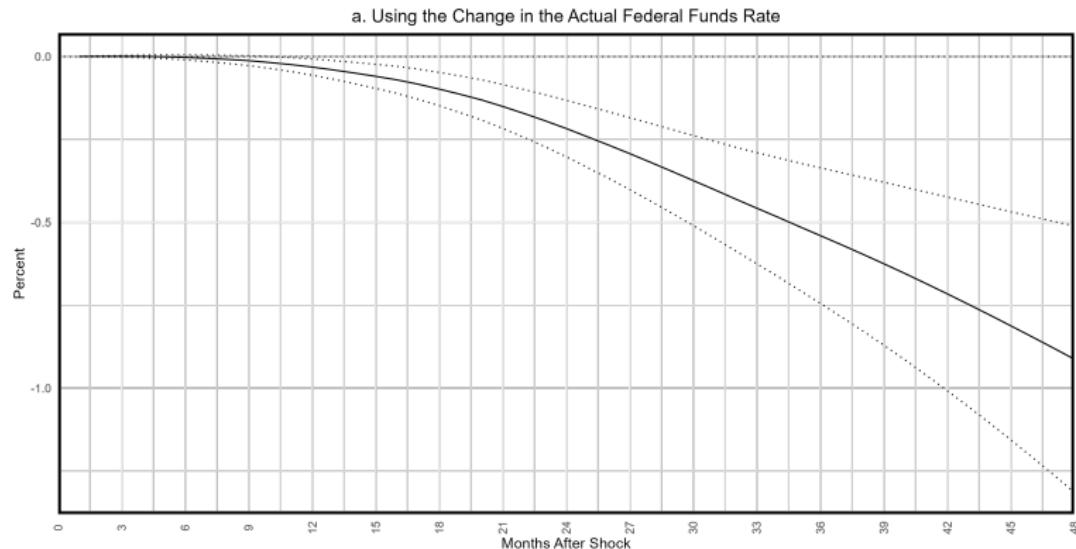


FIGURE 9e. THE EFFECT OF MONETARY POLICY IN A VAR USING THE NEW MEASURE OF MONETARY POLICY

