

ONLINE APPENDIX (NOT INTENDED FOR PUBLICATION):
DECOMPOSING THE EFFECTS OF MONETARY POLICY USING AN EXTERNAL
INSTRUMENTS SVAR

Aeimit Lakdawala*
Michigan State University

July 2017

This appendix contains the following supplemental tables and figures:

Figures:

- Figure 1: Path factor constructed controlling for private info
- Figure 2: Impulse responses with instruments using 30 min window
- Figure 3: Impulse responses with instruments using 2 day change
- Figure 4: Impulse responses for sample: July 1979 to November 2015
- Figure 5: Impulse responses for sample: July 1979 to December 2008
- Figure 6: Impulse responses for sample: July 1984 to December 2011
- Figure 7: Impulse responses using Identification Strategy II
- Figure 8: Impulse responses using the 2 year rate
- Figure 9: Impulse responses using post 1994 futures data
- Figure 10: Impulse responses using alternative aggregation strategy
- Figure 11: Impulse response for specification with commodity prices
- Figure 12: Impulse responses with only scheduled FOMC meetings

Tables:

- Table 1: List of FOMC meeting dates
- Table 2: First stage regressions with instruments using 30 min. window and 2 day change
- Table 3: First stage regressions for sample: July 1979 to November 2015
- Table 4: First stage regressions for sample: July 1979 to December 2008
- Table 5: First stage regressions for sample: July 1984 to December 2011
- Table 6: First stage regressions for specification with excess bond premium
- Table 7: First stage regressions for specification with commodity prices
- Table 8: First stage regressions for specification with unemployment
- Table 9: First stage regressions without non-statement FOMC meetings
- Table 10: First stage regressions using post 1994 futures data
- Table 11: First stage regression using alternative aggregation strategy
- Table 12: First stage regressions with only one policy tool
- Table 13: First stage regressions with cleansed path factor
- Table 14: First stage regressions with only scheduled FOMC meetings
- Table 15: Private info regressions with unemployment forecasts
- Table 16: Weak IV testing using Stock & Yogo (2005) and Sanderson & Windmeijer (2016)

*aeimit@msu.edu

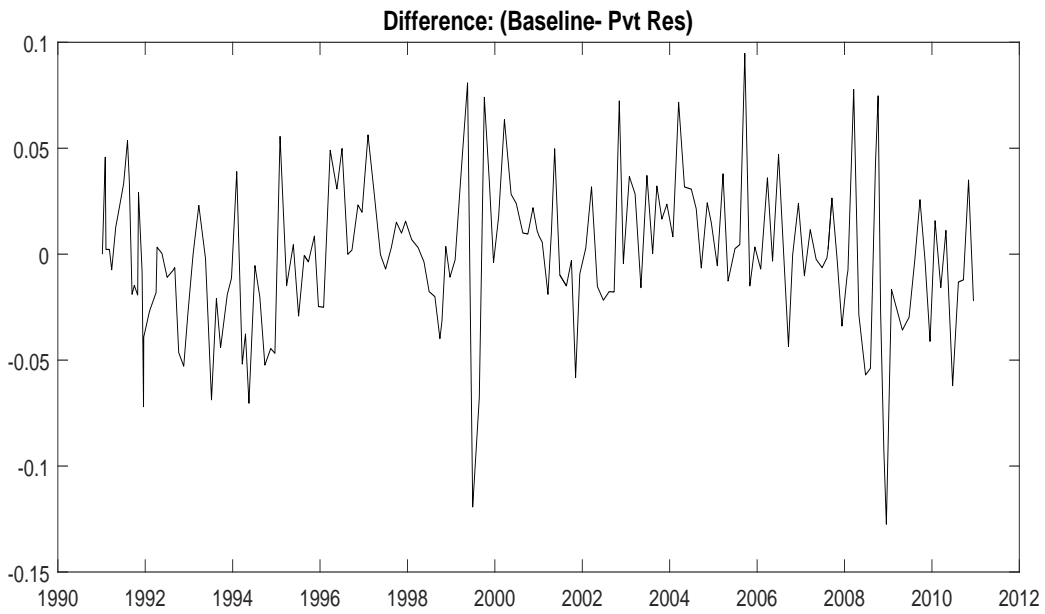
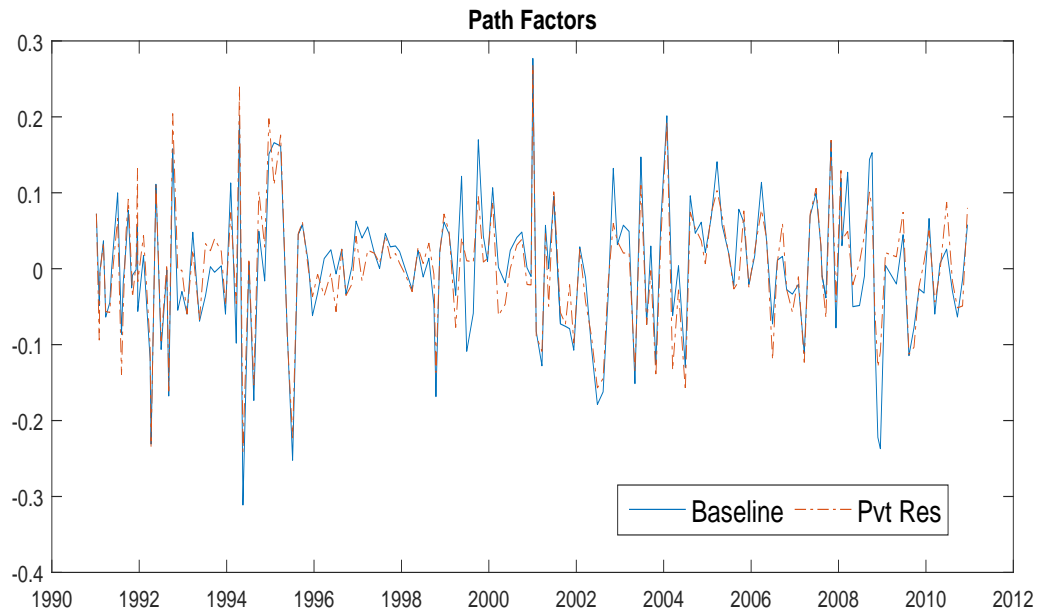


Figure 1: The top panel shows the path factors from the baseline specification (solid blue line) and the residual after controlling for Fed private info (dashed red line). The bottom panel shows the difference between the two series.

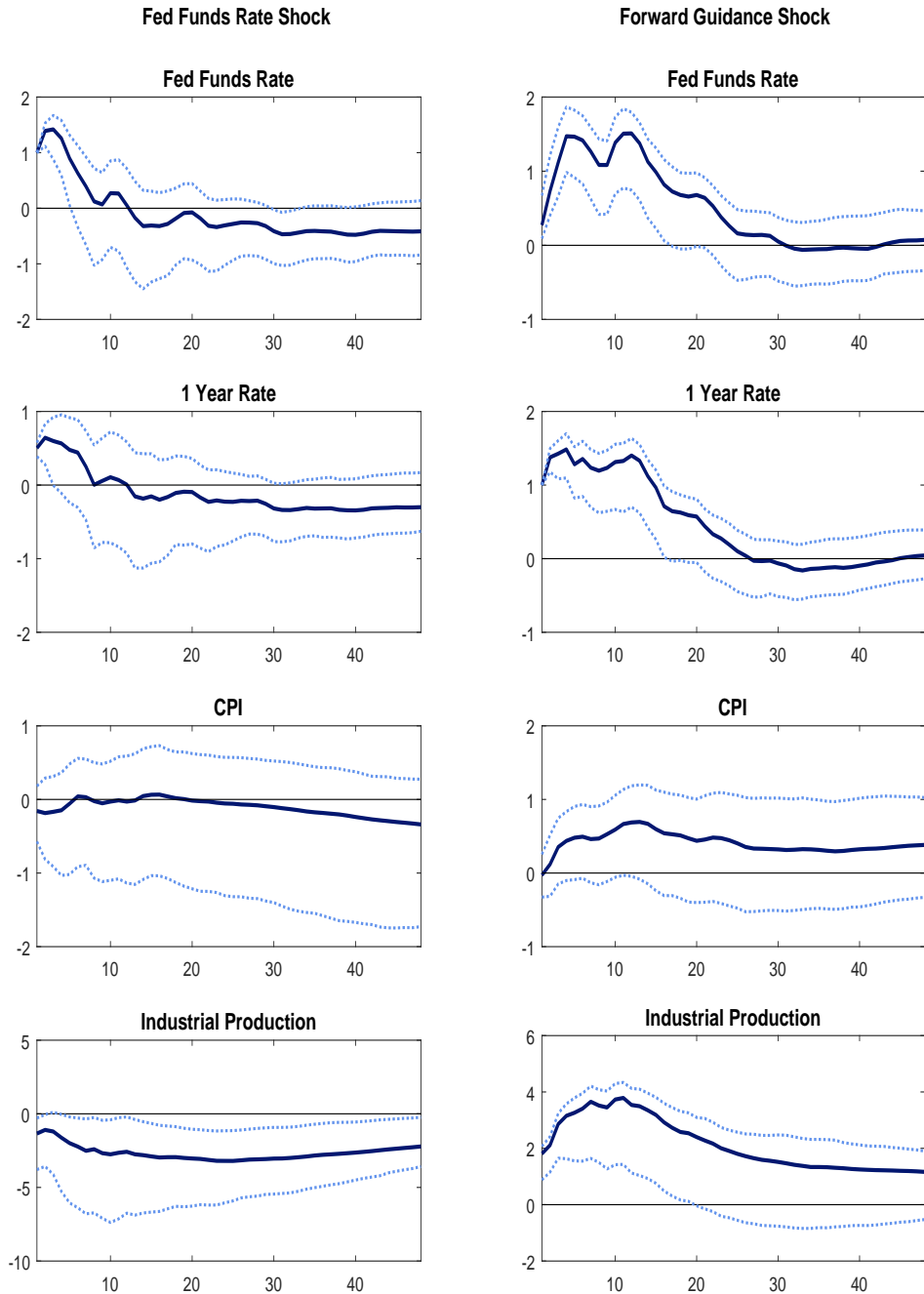


Figure 2: **Tight 30 minute window.** The impulse responses to a unit monetary policy shock identified using the external instruments identification strategy I outlined in the text, with 90% confidence intervals. The monetary surprises are constructed using a 30 minute window around FOMC announcements. The first column shows the response to a conventional monetary policy shock (i.e shock to the federal funds rate equation), while the second column shows the response to a forward guidance shock (i.e. shock to the 1 year rate equation)

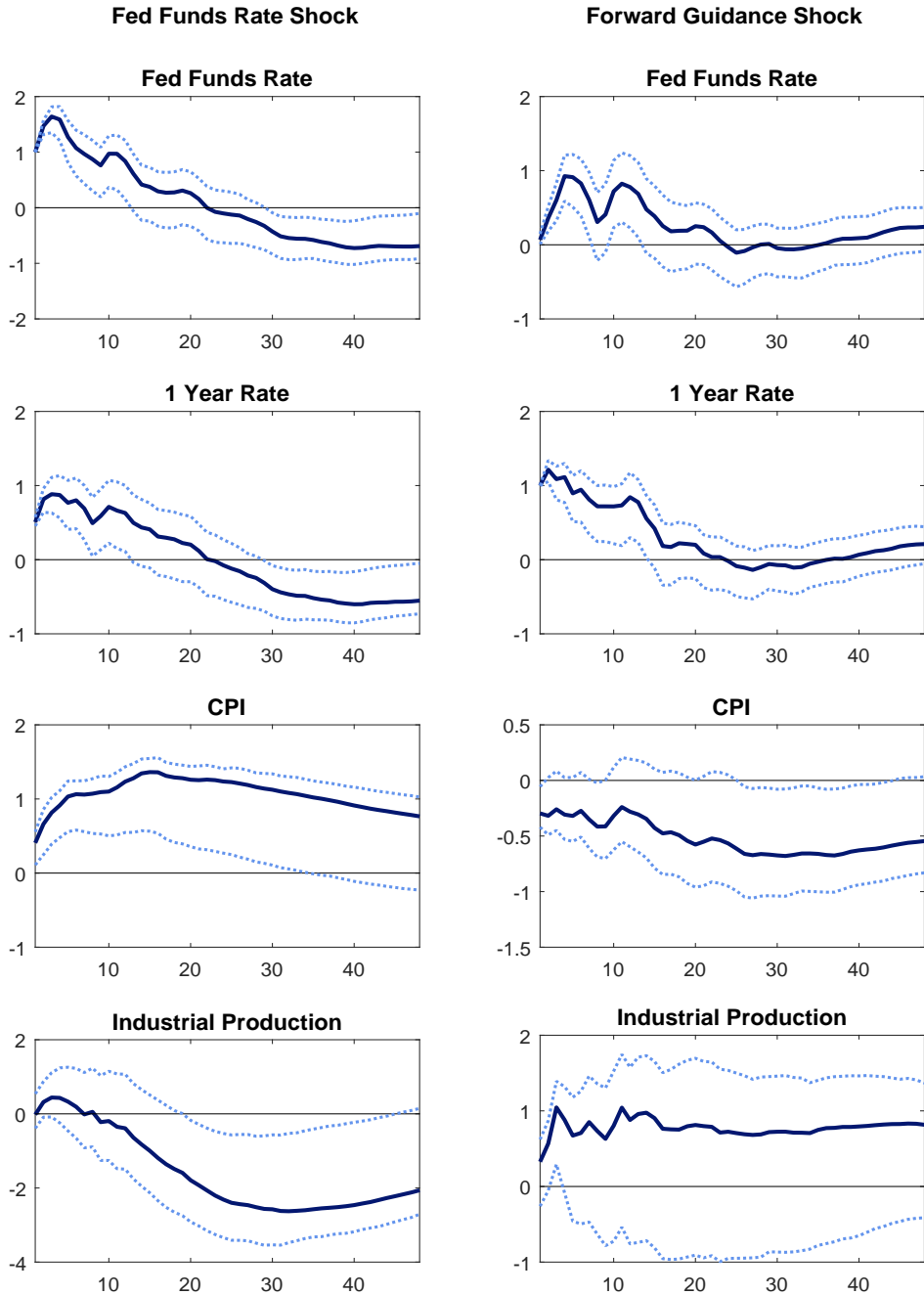


Figure 3: **Two day window.** The impulse responses to a unit monetary policy shock identified using the external instruments identification strategy I outlined in the text, with 90% confidence intervals. The monetary surprises are constructed using a two day window around FOMC announcements. The first column shows the response to a conventional monetary policy shock (i.e shock to the federal funds rate equation), while the second column shows the response to a forward guidance shock (i.e. shock to the 1 year rate equation)

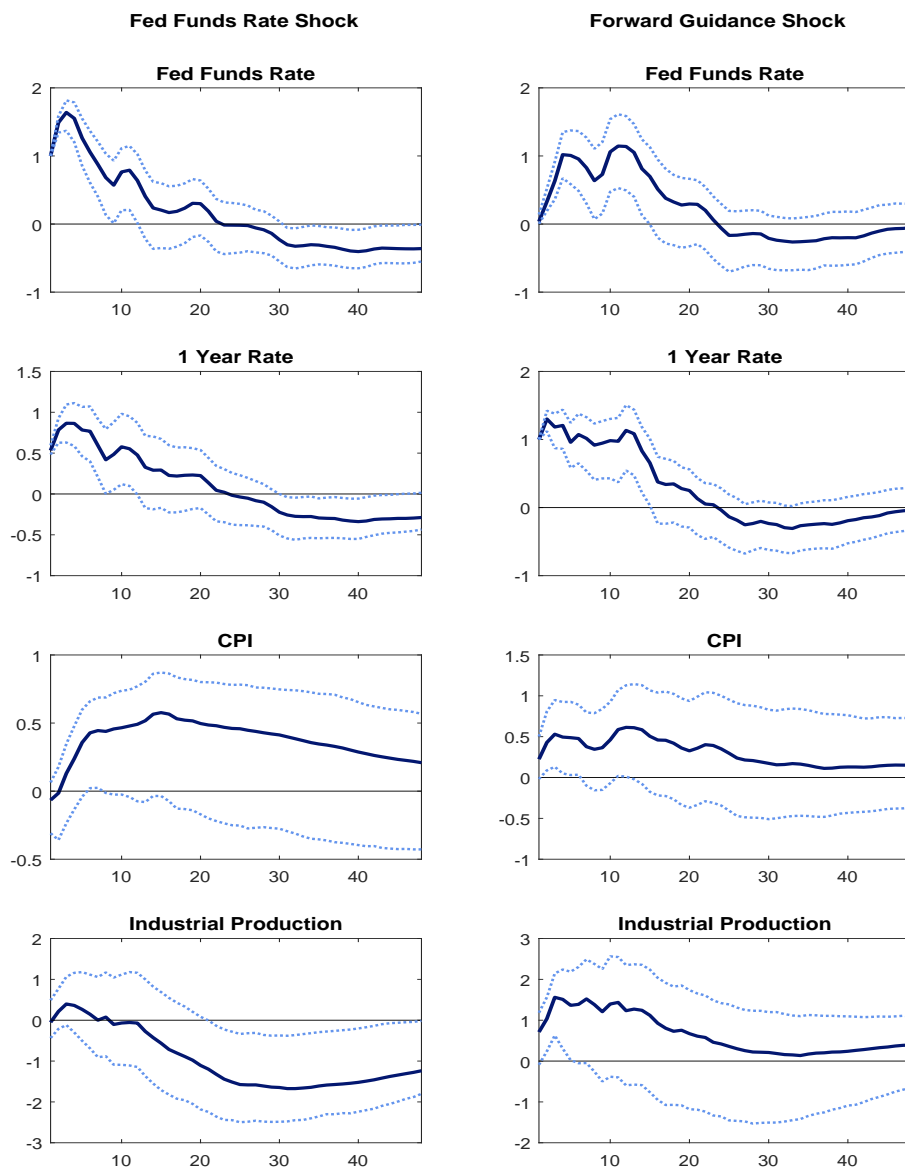


Figure 4: **Sample: July 1979 to November 2015** The impulse responses to a unit monetary policy shock identified using the external instruments identification strategy I outlined in the text, with 90% confidence intervals. The first column shows the response to a conventional monetary policy shock (i.e. shock to the federal funds rate equation), while the second column shows the response to a forward guidance shock (i.e. shock to the 1 year rate equation)

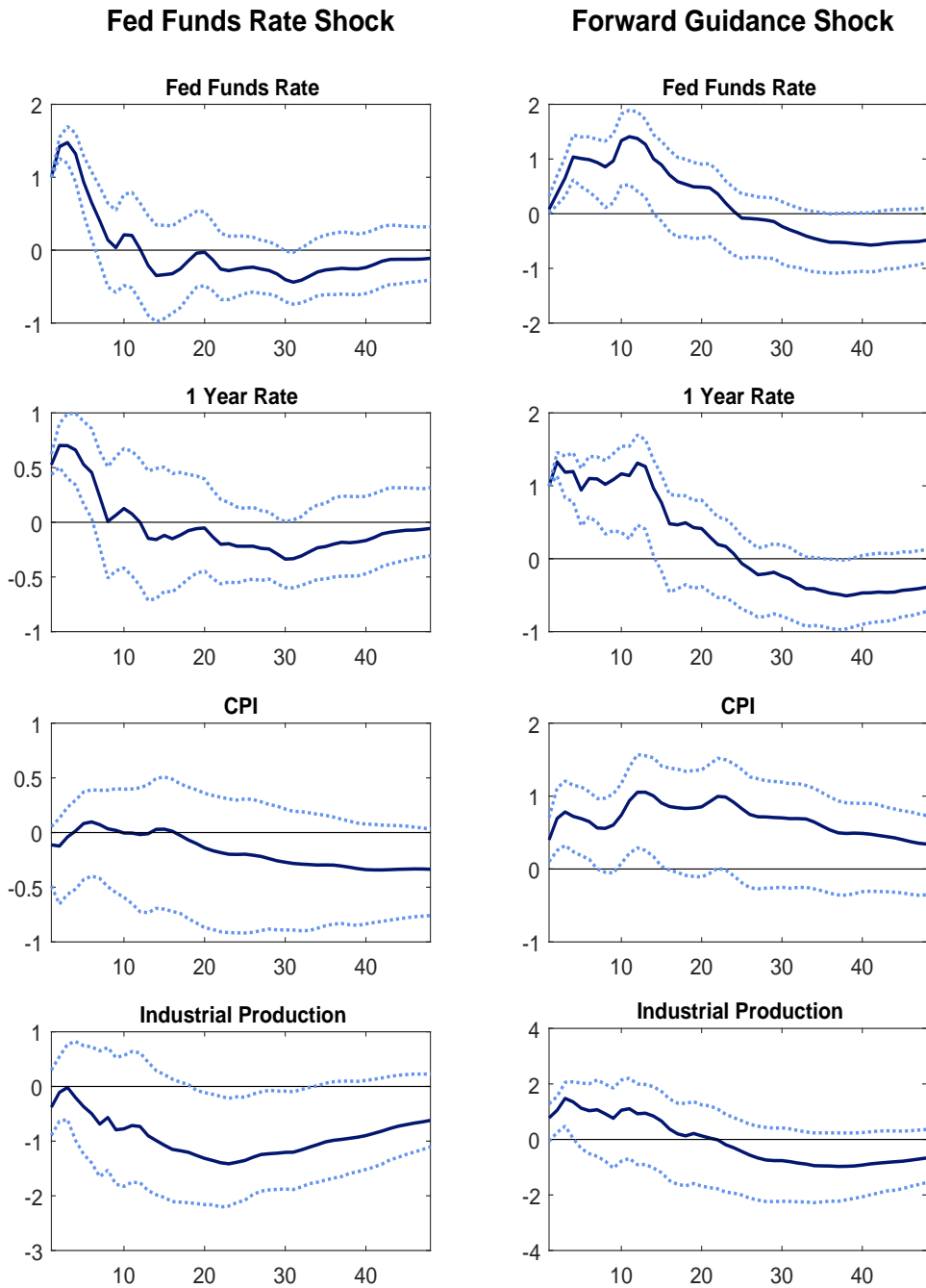


Figure 5: **Sample: July 1979 to December 2008.** The impulse responses to a unit monetary policy shock identified using the external instruments identification strategy I outlined in the text, with 90% confidence intervals. The first column shows the response to a conventional monetary policy shock (i.e shock to the federal funds rate equation), while the second column shows the response to a forward guidance shock (i.e. shock to the 1 year rate equation)

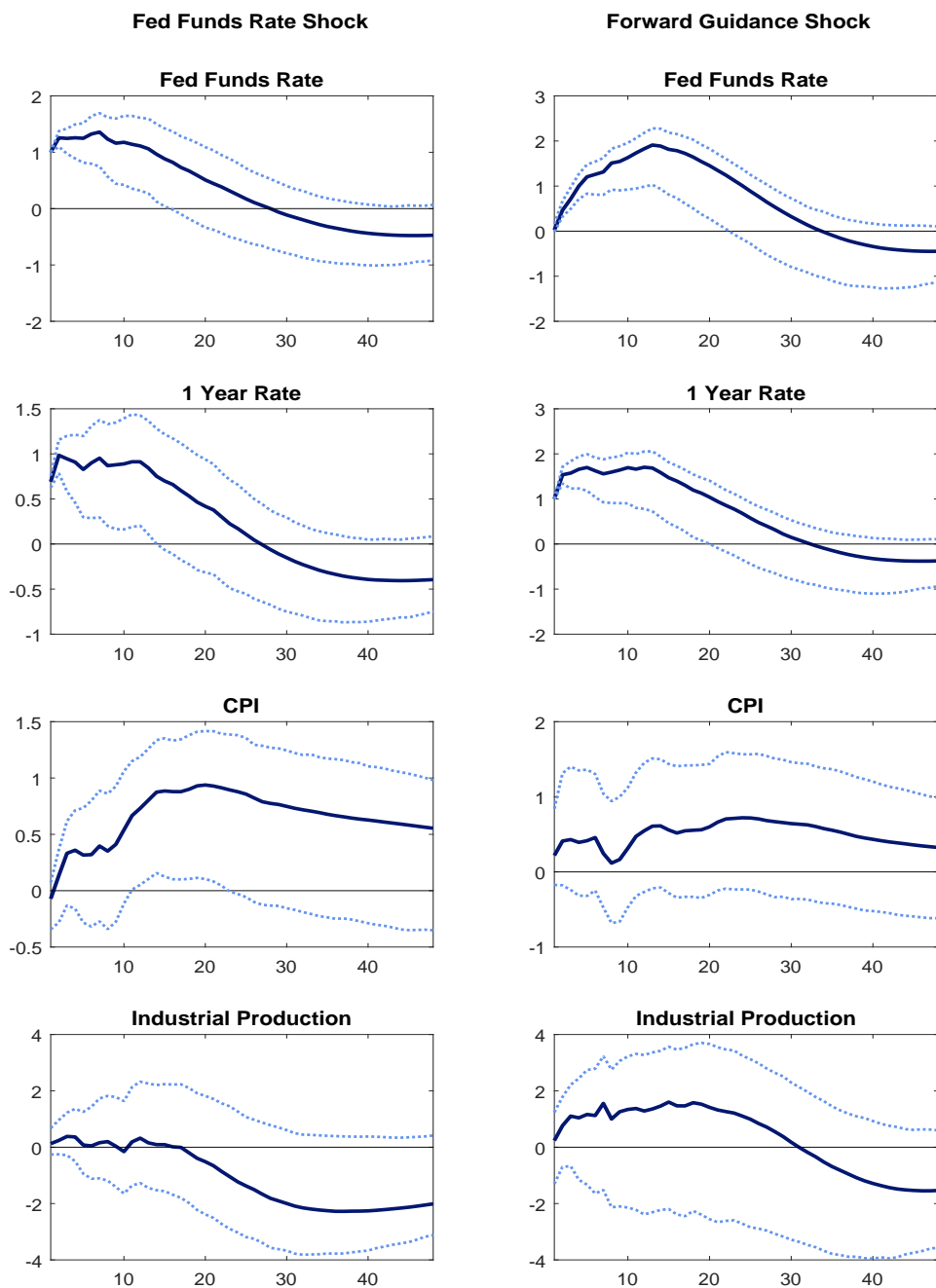


Figure 6: **Sample: July 1984 to December 2011.** The impulse responses to a unit monetary policy shock identified using the external instruments identification strategy I outlined in the text, with 90% confidence intervals. The first column shows the response to a conventional monetary policy shock (i.e shock to the federal funds rate equation), while the second column shows the response to a forward guidance shock (i.e. shock to the 1 year rate equation)

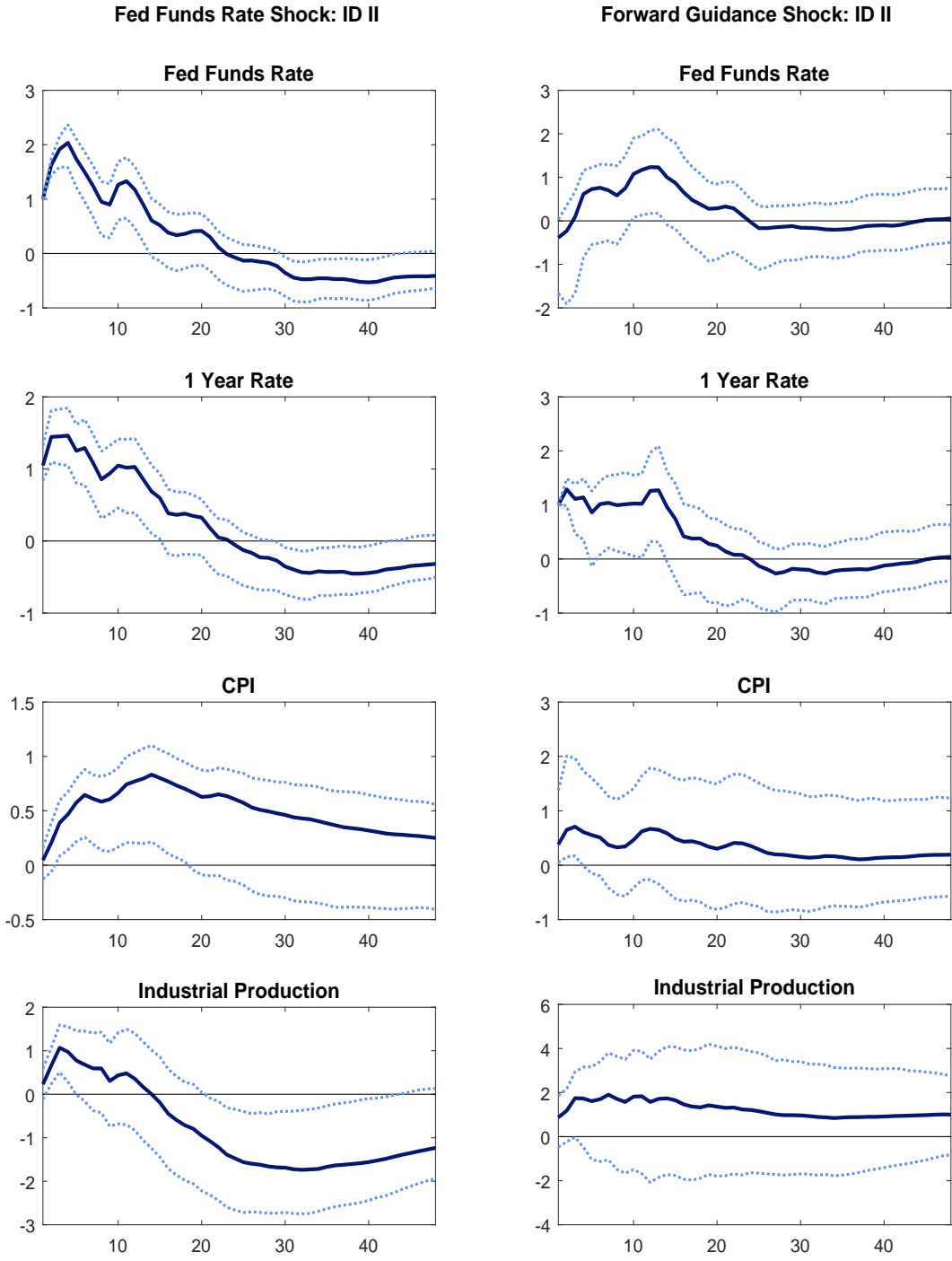


Figure 7: The impulse responses to a unit monetary policy shock identified using the external instruments identification strategy II outlined in the text, with 90% confidence intervals. The first column shows the response to a conventional monetary policy shock (i.e shock to the federal funds rate equation), while the second column shows the response to a forward guidance shock (i.e. shock to the 1 year rate equation)

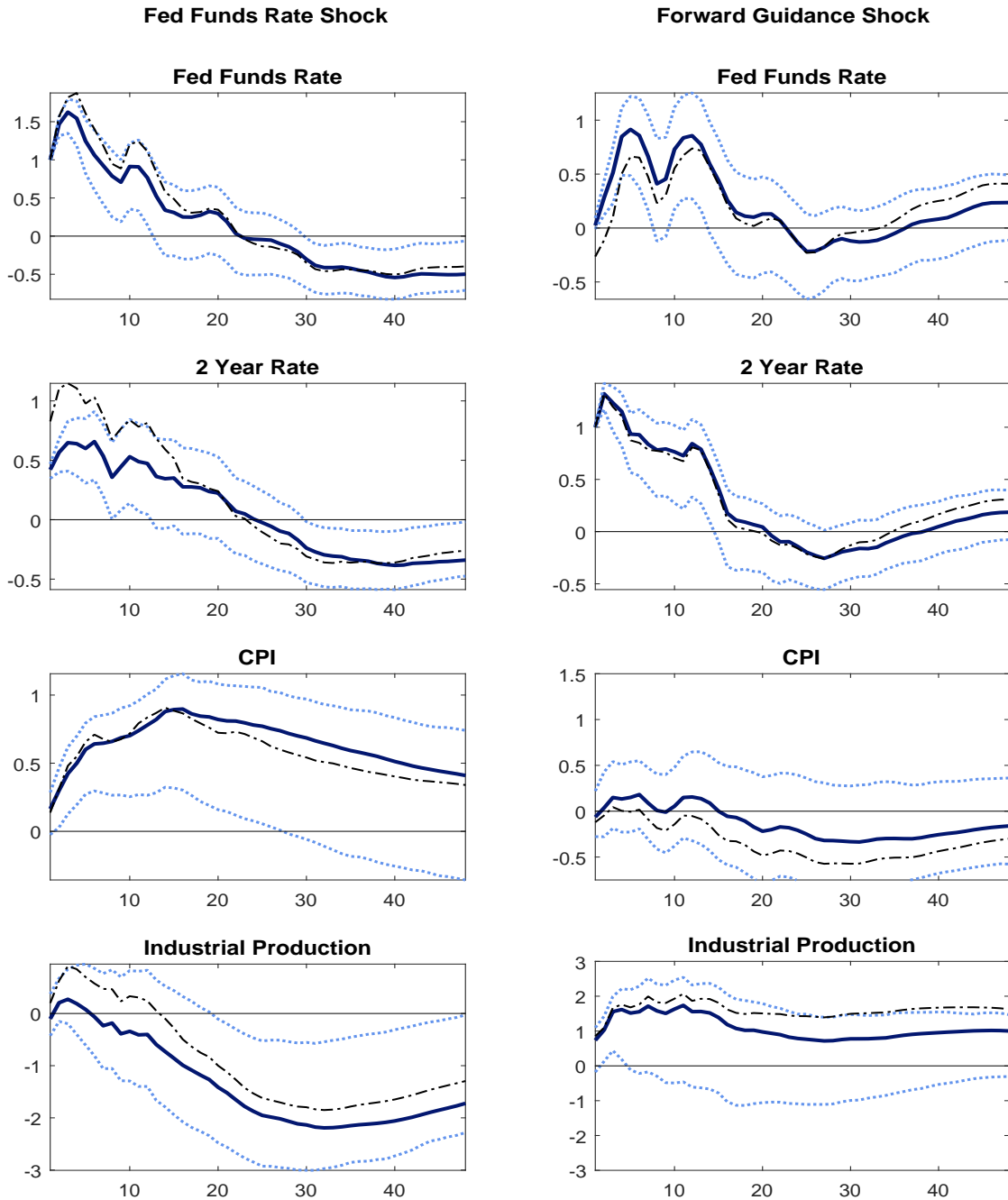


Figure 8: Impulse responses to a unit monetary policy shock with the 2 year rate as the forward guidance policy tool. The solid blue lines show responses using identification strategy I, with the dashed blue lines showing the 90% confidence intervals. The dashed black lines show the responses using identification strategy II. The first column shows the response to a conventional monetary policy shock (i.e shock to the federal funds rate equation), while the second column shows the response to a forward guidance shock (i.e. shock to the 1 year rate equation).

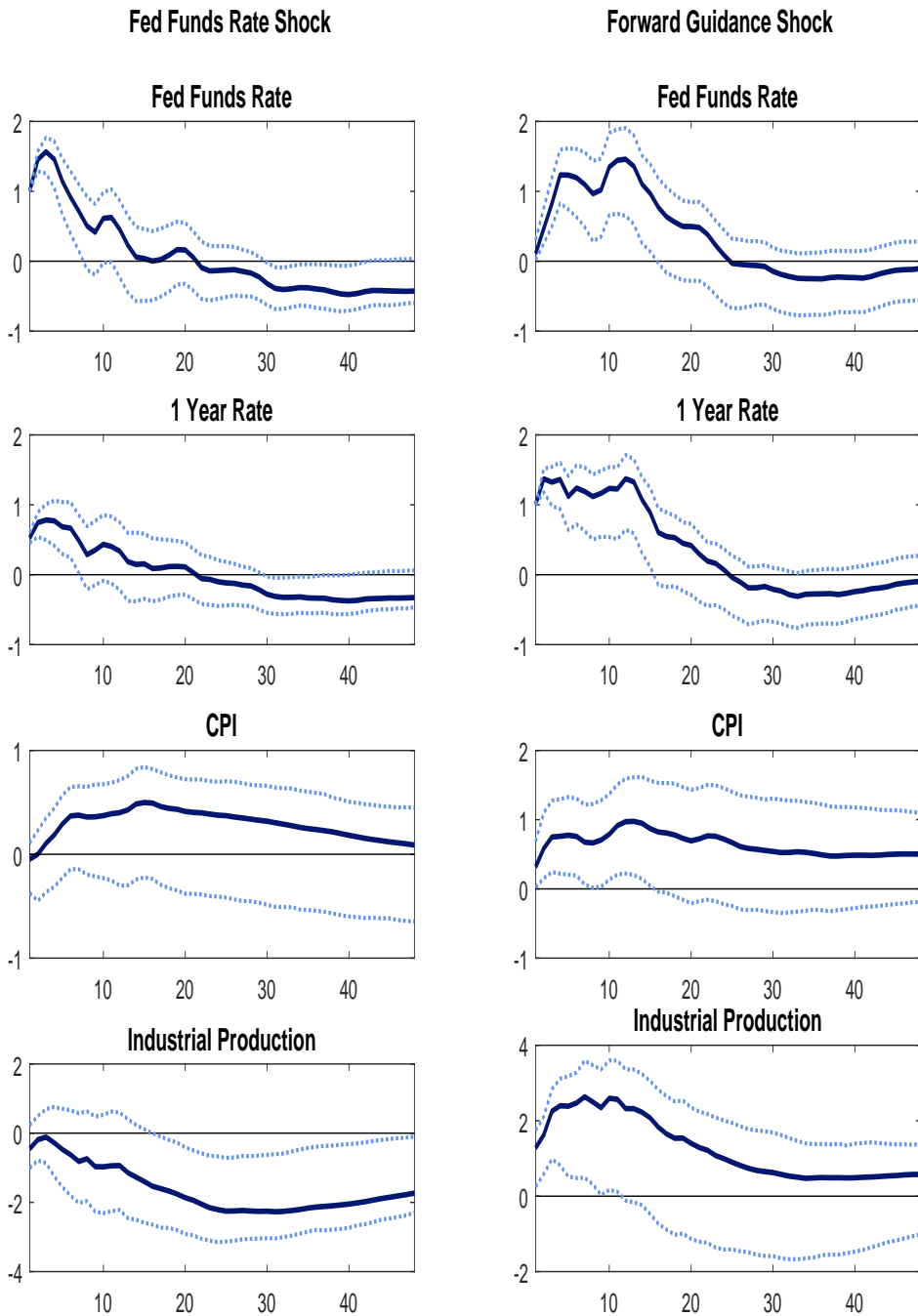


Figure 9: **Futures Data Sample: February 1994 to December 2011.** The impulse responses to a unit monetary policy shock identified using the external instruments identification strategy I outlined in the text, with 90% confidence intervals. The first column shows the response to a conventional monetary policy shock (i.e shock to the federal funds rate equation), while the second column shows the response to a forward guidance shock (i.e. shock to the 1 year rate equation)

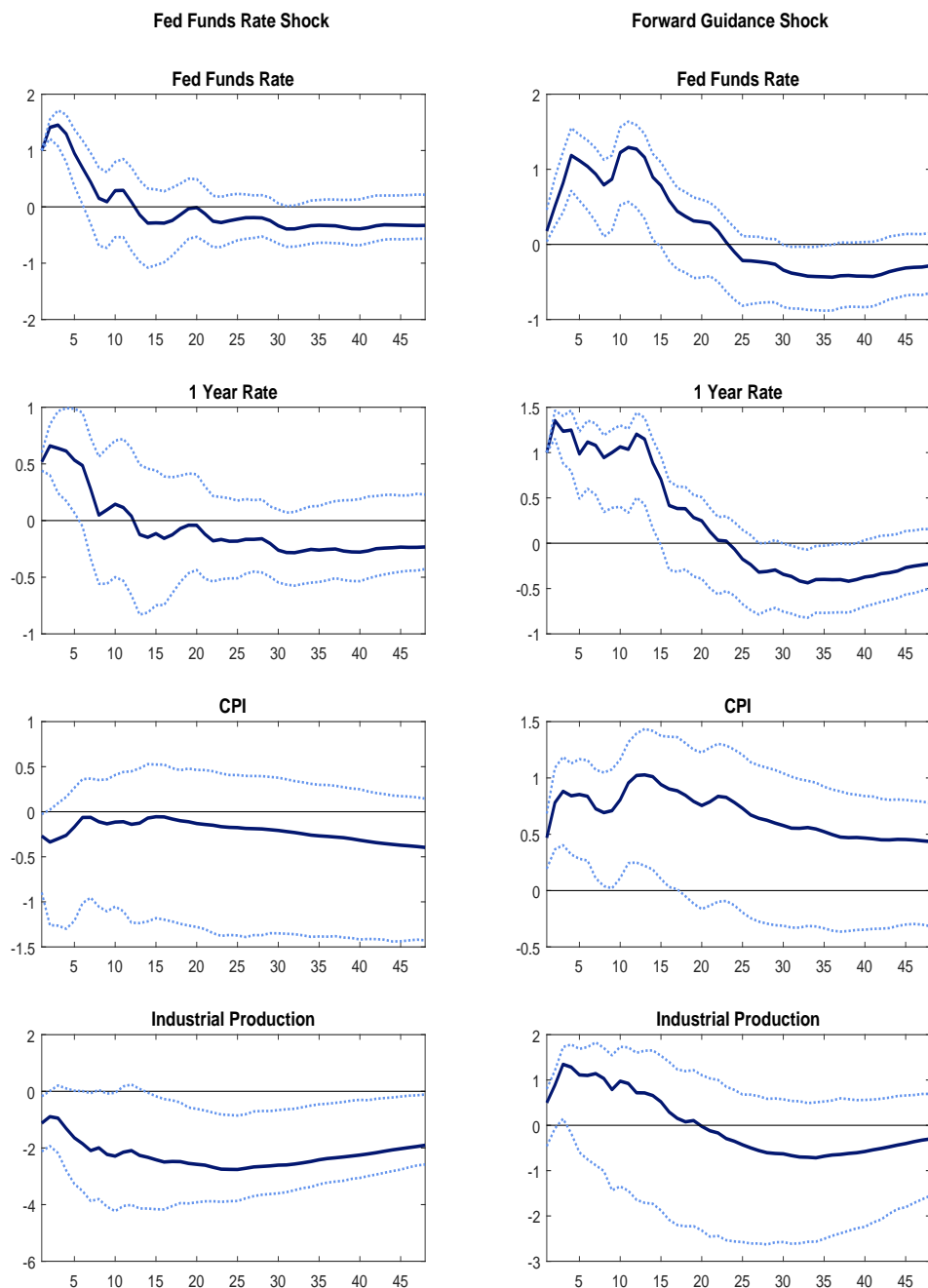


Figure 10: The impulse responses to a unit monetary policy shock identified using the external instruments identification strategy I outlined in the text, with 90% confidence intervals. The first column shows the response to a conventional monetary policy shock (i.e shock to the federal funds rate equation), while the second column shows the response to a forward guidance shock (i.e. shock to the 1 year rate equation). The daily futures shock series is aggregated to a monthly series by weighing it based on which day of the month the FOMC meeting occurred. If the FOMC meeting occurs in the final 5 days of the month, then the shock is assigned to the next month.

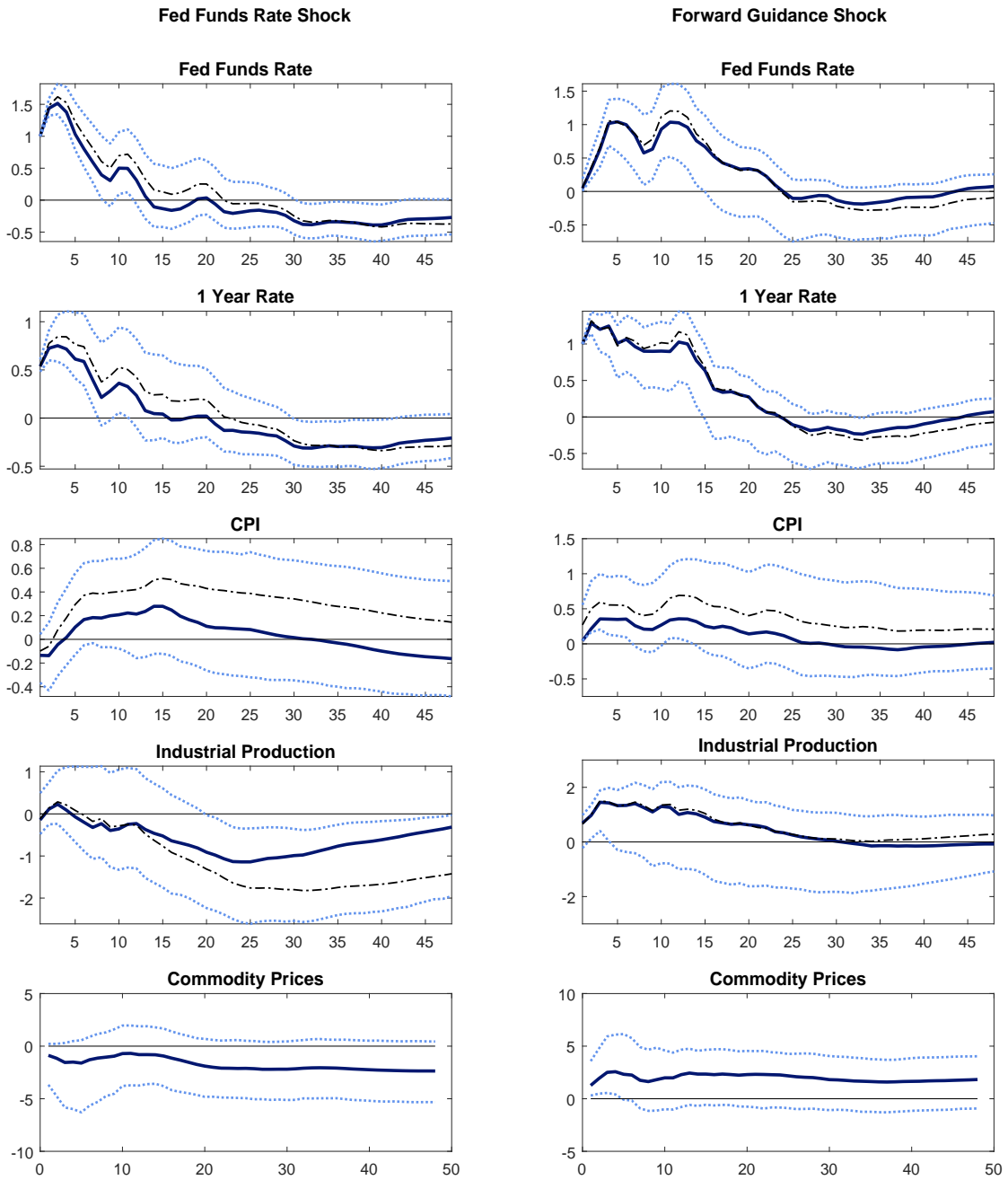


Figure 11: The solid blue lines show the impulse responses to a unit monetary policy shock for the VAR with commodity prices added to the baseline specification, using identification strategy I. The dashed black lines show the responses from the baseline specification. The dashed blue lines show the 90% confidence intervals. The first column shows the response to a conventional monetary policy shock (i.e. shock to the federal funds rate equation), while the second column shows the response to a forward guidance shock (i.e. shock to the 1 year rate equation)

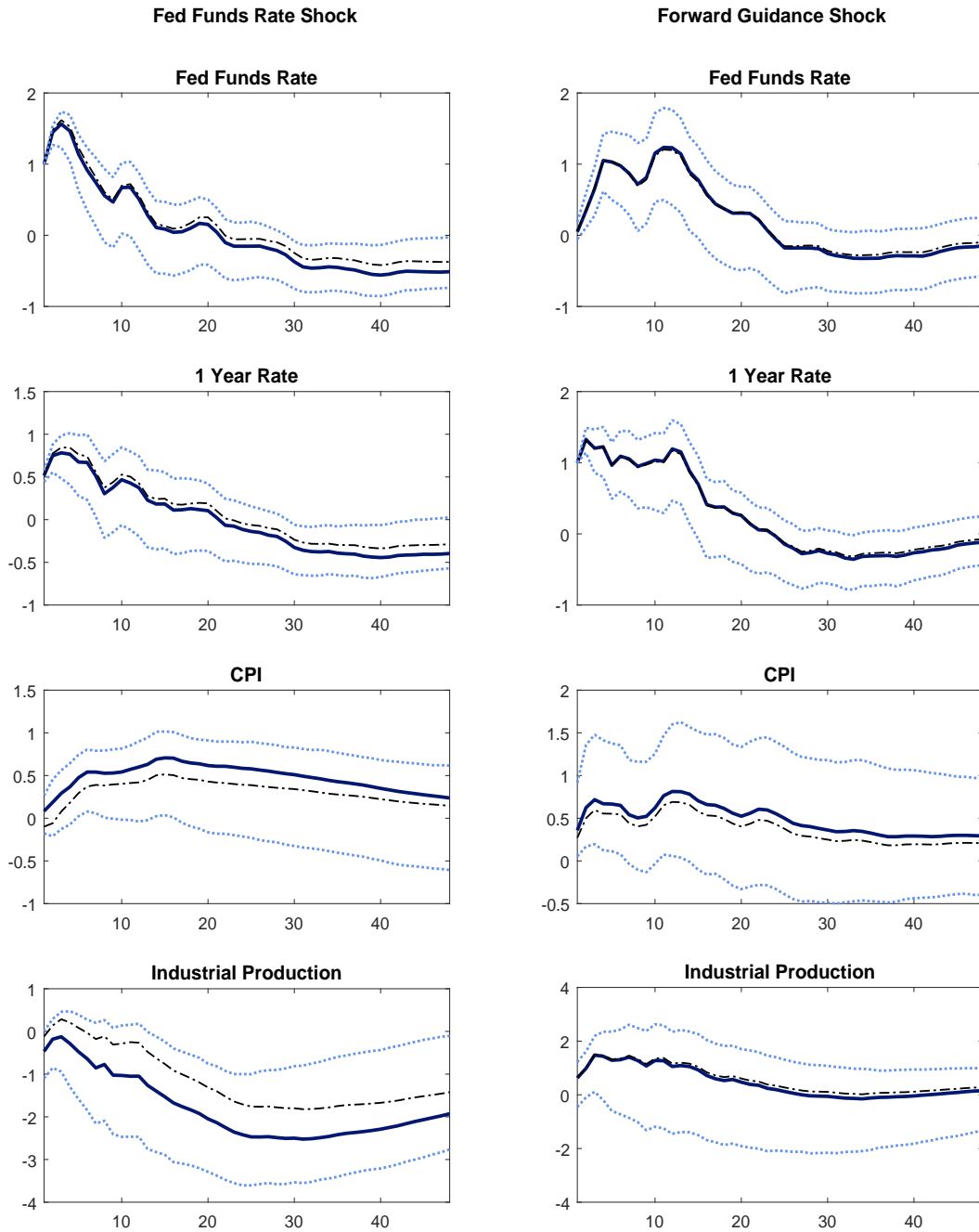


Figure 12: The impulse responses to a unit monetary policy shock with 90% confidence intervals. The solid blue lines show the responses where only the scheduled FOMC meetings are used, while the dashed black line shows the baseline specification with both scheduled and unscheduled meetings. The first column shows the response to a conventional monetary policy shock (i.e shock to the federal funds rate equation), while the second column shows the response to a forward guidance shock (i.e. shock to the 1 year rate equation).

FOMC Meeting	Sched?	Stat?	FOMC Meeting	Sched?	Stat?	FOMC Meeting	Sched?	FOMC Meeting	Sched?	Stat?
1/8/1991	0	0	7/3/1996	1	0	11/6/2002	1	3/18/2009	1	1
2/1/1991	0	0	8/20/1996	1	0	12/10/2002	1	4/29/2009	1	1
2/7/1991	1	0	9/24/1996	1	0	1/29/2003	1	6/24/2009	1	1
3/8/1991	0	0	11/13/1996	1	0	3/18/2003	1	8/12/2009	1	1
3/27/1991	1	0	12/17/1996	1	0	5/6/2003	1	9/23/2009	1	1
4/30/1991	0	0	2/5/1997	1	0	6/25/2003	1	11/4/2009	1	1
5/15/1991	1	0	3/25/1997	1	1	8/12/2003	1	12/16/2009	1	1
7/5/1991	1	0	5/20/1997	1	0	9/16/2003	1	1/27/2010	1	1
8/6/1991	0	0	7/2/1997	1	0	10/28/2003	1	3/16/2010	1	1
8/21/1991	1	0	8/19/1997	1	0	12/9/2003	1	4/28/2010	1	1
9/13/1991	0	0	9/30/1997	1	0	1/28/2004	1	6/23/2010	1	1
10/2/1991	1	0	11/12/1997	1	0	3/16/2004	1	8/10/2010	1	1
10/30/1991	0	0	12/16/1997	1	0	5/4/2004	1	9/21/2010	1	1
11/6/1991	1	0	2/4/1998	1	0	6/30/2004	1	11/3/2010	1	1
12/6/1991	0	0	3/31/1998	1	0	8/10/2004	1	12/14/2010	1	1
12/18/1991	1	0	5/19/1998	1	0	9/21/2004	1	1/26/2011	1	1
12/20/1991	0	0	7/1/1998	1	0	11/10/2004	1	3/15/2011	1	1
2/6/1992	1	0	8/18/1998	1	0	12/14/2004	1	4/27/2011	1	1
4/1/1992	1	0	9/29/1998	1	1	2/2/2005	1	6/22/2011	1	1
4/9/1992	0	0	10/15/1998	0	1	3/22/2005	1	8/9/2011	1	1
5/20/1992	1	0	11/17/1998	1	1	5/3/2005	1	9/21/2011	1	1
7/2/1992	1	0	12/22/1998	1	0	6/30/2005	1	11/2/2011	1	1
8/19/1992	1	0	2/3/1999	1	0	8/9/2005	1	12/13/2011	1	1
9/4/1992	0	0	3/30/1999	1	0	9/20/2005	1	1/25/2012	1	1
10/7/1992	1	0	5/18/1999	1	1	11/1/2005	1	3/13/2012	1	1
11/18/1992	1	0	6/30/1999	1	1	12/13/2005	1	4/25/2012	1	1
12/23/1992	1	0	8/24/1999	1	1	1/31/2006	1	6/20/2012	1	1
2/4/1993	1	0	10/5/1999	1	1	3/28/2006	1	8/1/2012	1	1
3/24/1993	1	0	11/16/1999	1	1	5/10/2006	1	9/13/2012	1	1
5/19/1993	1	0	12/21/1999	1	1	6/29/2006	1	10/24/2012	1	1
7/8/1993	1	0	2/2/2000	1	1	8/8/2006	1	12/12/2012	1	1
8/18/1993	1	0	3/21/2000	1	1	9/20/2006	1	1/30/2013	1	1
9/22/1993	1	0	5/16/2000	1	1	10/25/2006	1	3/20/2013	1	1
11/17/1993	1	0	6/28/2000	1	1	12/12/2006	1	5/1/2013	1	1
12/22/1993	1	0	8/22/2000	1	1	1/31/2007	1	6/19/2013	1	1
2/4/1994	1	1	10/3/2000	1	1	3/21/2007	1	7/31/2013	1	1
3/22/1994	1	1	11/15/2000	1	1	5/9/2007	1	9/18/2013	1	1
4/18/1994	0	1	12/19/2000	1	1	6/28/2007	1	10/30/2013	1	1
5/17/1994	1	1	1/3/2001	0	1	8/7/2007	1	12/18/2013	1	1
7/6/1994	1	0	1/31/2001	1	1	8/17/2007	0	1/29/2014	1	1
8/16/1994	1	1	3/20/2001	1	1	9/18/2007	1	3/19/2014	1	1
9/27/1994	1	0	4/18/2001	0	1	10/31/2007	1	4/30/2014	1	1
11/15/1994	1	1	5/15/2001	1	1	12/11/2007	1	6/18/2014	1	1
12/20/1994	1	0	6/27/2001	1	1	1/22/2008	0	7/30/2014	1	1
2/1/1995	1	1	8/21/2001	1	1	1/30/2008	1	9/17/2014	1	1
3/28/1995	1	0	9/17/2001	0	1	3/18/2008	1	10/29/2014	1	1
5/23/1995	1	0	10/2/2001	1	1	4/30/2008	1	12/17/2014	1	1
7/6/1995	1	1	11/6/2001	1	1	6/25/2008	1	1/28/2015	1	1
8/22/1995	1	0	12/11/2001	1	1	8/5/2008	1	3/18/2015	1	1
9/26/1995	1	0	1/30/2002	1	1	9/16/2008	1	4/29/2015	1	1
11/15/1995	1	0	3/19/2002	1	1	10/8/2008	0	6/17/2015	1	1
12/19/1995	1	1	5/7/2002	1	1	10/29/2008	1	7/29/2015	1	1
1/31/1996	1	1	6/26/2002	1	1	11/25/2008	0	9/17/2015	1	1
3/26/1996	1	0	8/13/2002	1	1	12/16/2008	1	10/28/2015	1	1
5/21/1996	1	0	9/24/2002	1	1	1/28/2009	1	12/16/2015	1	1

Table 1: FOMC meeting dates with a 1 in the “Sched?” (“Stat?”) column indicating a scheduled meeting (released statement) and a 0 indicating an unscheduled meeting (no released statement).

	(a)	(b)	(c)	(d)
VARIABLES	FFR residual	1 year residual	FFR residual	1 year residual
Target Factor	0.662*** (0.134)	0.763*** (0.140)	0.852*** (0.195)	1.032*** (0.235)
Path Factor	-0.168 (0.131)	0.324** (0.161)	-0.217 (0.221)	0.177 (0.330)
Constant	-0.005 (0.010)	0.000 (0.012)	-0.006 (0.010)	-0.000 (0.013)
Observations	252	252	252	252
R-squared	0.106	0.108	0.090	0.082
Adjusted R-squared	0.0991	0.101	0.0830	0.0749
Robust F-statistic	12.49	17.37	10.23	9.777

Table 2: First stage regression of residuals from the reduced form VAR on the target and path factors. Columns (a) and (b) show the results using a 2 day window, while columns (c) and (d) show the results using a 30 minute window. Robust standard errors in parentheses, *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

	(1)	(2)
VARIABLES	FFR residual	1 year residual
Target Factor	0.809*** (0.128)	0.893*** (0.167)
Path Factor	-0.150 (0.168)	0.310 (0.219)
Constant	-0.006 (0.008)	0.000 (0.011)
Observations	299	299
R-squared	0.115	0.099
Adjusted R-squared	0.109	0.0930
Robust F-statistic	20.75	14.59

Table 3: **Sample: July 1979 to November 2015** : First stage regression of residuals from the reduced form VAR on the target and path factors, from the baseline specification. Robust standard errors in parentheses, *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

VARIABLES	(1) FFR residual	(2) 1 year residual
Target Factor	0.780*** (0.140)	0.951*** (0.175)
Path Factor	-0.207 (0.188)	0.350 (0.252)
Constant	-0.004 (0.011)	-0.002 (0.014)
Observations	216	216
R-squared	0.121	0.111
Adjusted R-squared	0.113	0.102
Robust F-statistic	16.32	14.95

Table 4: **Sample: July 1979 to December 2008.** : First stage regression of residuals from the reduced form VAR on the target and path factors, from the baseline specification. Robust standard errors in parentheses, *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

VARIABLES	FFR residual	1 year residual
Target Factor	0.819*** (0.110)	0.724*** (0.172)
Path Factor	-0.033 (0.131)	0.301 (0.191)
Constant	-0.010 (0.007)	-0.002 (0.011)
Observations	252	252
R-squared	0.229	0.093
Adjusted R-squared	0.223	0.0862
Robust F-statistic	27.76	9.422

Table 5: **Sample: July 1984 to December 2011.** : First stage regression of residuals from the reduced form VAR on the target and path factors, from the baseline specification. Robust standard errors in parentheses, *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

	(1)	(2)
VARIABLES	FFR residual	1 year residual
Target Factor	0.732***	0.792***
	(0.135)	(0.158)
Path Factor	-0.212	0.206
	(0.177)	(0.218)
Constant	-0.008	-0.004
	(0.010)	(0.012)
Observations	252	252
R-squared	0.099	0.080
Adjusted R-squared	0.0919	0.0726
Robust F-statistic	15.37	12.67

Table 6: First stage regression of residuals from the reduced form VAR on the target and path factors, from the model with the excess bond premium added to the baseline specification. Robust standard errors in parentheses, *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

	(1)	(2)
VARIABLES	FFR residual	1 year residual
Target Factor	0.671***	0.814***
	(0.147)	(0.182)
Path Factor	-0.119	0.356
	(0.163)	(0.233)
Constant	-0.002	0.004
	(0.010)	(0.012)
Observations	252	252
R-squared	0.085	0.088
Adjusted R-squared	0.0776	0.0807
Robust F-statistic	10.67	10.80

Table 7: First stage regression of residuals from the reduced form VAR on the target and path factors, from the model with commodity prices added to the baseline specification. Robust standard errors in parentheses, *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

	(1)	(2)
VARIABLES	FFR residual	1 year residual
Target Factor	0.798*** (0.146)	0.828*** (0.169)
Path Factor	-0.143 (0.185)	0.309 (0.228)
Constant	-0.005 (0.010)	0.004 (0.013)
Observations	252	252
R-squared	0.106	0.082
Adjusted R-squared	0.0986	0.0750
Robust F-statistic	15.44	12.09

Table 8: First stage regression of residuals from the reduced form VAR on the target and path factors, from the model with the unemployment rate added to the baseline specification. Robust standard errors in parentheses, *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

	(1)	(2)
VARIABLES	FFR residual	1 year residual
Target Factor	0.725*** (0.167)	0.857*** (0.199)
Path Factor	-0.195 (0.187)	0.205 (0.286)
Constant	-0.005 (0.010)	0.000 (0.013)
Observations	252	252
R-squared	0.069	0.061
Adjusted R-squared	0.0613	0.0532
Robust F-statistic	10.10	9.340

Table 9: First stage regression of residuals from the reduced form VAR on the target and path factors where the FOMC meeting dates without an accompanying statement are excluded. Robust standard errors in parentheses, *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

VARIABLES	(1) FFR residual	(2) 1 year residual
Target Factor	0.783*** (0.157)	0.836*** (0.193)
Path Factor	-0.205 (0.192)	0.245 (0.276)
Constant	0.004 (0.010)	0.014 (0.014)
Observations	216	216
R-squared	0.105	0.073
Adjusted R-squared	0.0966	0.0642
Robust F-statistic	13.03	9.382

Table 10: **Futures Data Sample: February 1994 to December 2011.** First stage regression of residuals from the reduced form VAR on the target and path factors. Robust standard errors in parentheses, *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

VARIABLES	(1) FFR residual	(2) 1 year residual
Target Factor	0.907*** (0.230)	1.071*** (0.237)
Path Factor	0.005 (0.186)	0.412* (0.247)
Constant	-0.005 (0.010)	0.000 (0.013)
Observations	252	252
R-squared	0.078	0.089
Adjusted R-squared	0.0710	0.0819
Robust F-statistic	7.888	12.43

Table 11: First stage regression of residuals from the reduced form VAR on the target and path factors. The daily futures shock series is aggregated to a monthly series by weighing it based on which day of the month the FOMC meeting occurred. If the FOMC meeting occurs in the final 5 days of the month, then the shock is assigned to the next month. Robust standard errors in parentheses, *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

	(a)	(b)
Variables	FFR residual	1 year residual
MP1	1.090*** (0.123)	
FF4		1.138*** (0.237)
Constant	0.014 (0.011)	0.018 (0.013)
Observations	252	252
R-squared	0.188	0.102
Adjusted R-squared	0.185	0.0980
Robust F-statistic	78.58	23.11

Table 12: First stage regression of residuals from the reduced form VAR with only one policy tool. Panel (a) is the model with only fed funds rate as policy tool and MP1 as the instrument. Panel (b) is the model with only the 1 year rate as the policy tool with FF4 as the instrument. Robust standard errors in parentheses, *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

	(1)	(2)
VARIABLES	FFR residual	1 year residual
Target Factor	0.790*** (0.132)	0.929*** (0.169)
Path Factor (Pvt Res)	-0.082 (0.183)	0.402 (0.252)
Constant	-0.006 (0.010)	-0.001 (0.013)
Observations	241	241
R-squared	0.108	0.107
Adjusted R-squared	0.100	0.0990
Robust F-statistic	18.59	15.36

Table 13: First stage regression of residuals from the reduced form VAR on the target factor and cleansed path factor (Pvt Res). Robust standard errors in parentheses, *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

	(a)	(b)
Variables	FFR residual	1 year residual
Target Factor	0.896*** (0.287)	0.810** (0.340)
Path Factor	-0.237 (0.192)	0.234 (0.263)
Constant	-0.006 (0.010)	0.000 (0.013)
Observations	252	252
R-squared	0.048	0.027
Adjusted R-squared	0.0401	0.0191
Robust F-statistic	5.081	3.458

Table 14: First stage regression of residuals from the reduced form VAR on the target and path factors with only the scheduled FOMC meeting dates. Robust standard errors in parentheses, *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

	(1)				(2)			
	Target Factor				Path Factor			
GDPt1	0.009 (0.013)	GDPt1lag	0.011 (0.013)	GDPt1	0.003 (0.015)	GDPt1lag	-0.005 (0.012)	
GDPt2	0.005 (0.016)	GDPt2lag	-0.022 (0.012)	GDPt2	0.005 (0.014)	GDPt2lag	-0.007 (0.012)	
GDPt3	-0.008 (0.015)	GDPt3lag	0.020 (0.016)	GDPt3	0.019 (0.015)	GDPt3lag	0.018 (0.015)	
GDPt4	0.020 (0.022)	GDPt4lag	-0.014 (0.020)	GDPt4	0.027 (0.018)	GDPt4lag	-0.051 (0.021)	
CPIt1	-0.001 (0.009)	CPIt1lag	-0.001 (0.007)	CPIt1	0.008 (0.008)	CPIt1lag	-0.001 (0.007)	
CPIt2	-0.010 (0.019)	CPIt2lag	0.032 (0.017)	CPIt2	-0.058*** (0.022)	CPIt2lag	-0.015 (0.023)	
CPIt3	0.033 (0.039)	CPIt3lag	-0.079 (0.037)	CPIt3	0.003 (0.039)	CPIt3lag	0.089 (0.037)	
CPIt4	-0.031 (0.042)	CPIt4lag	0.038 (0.042)	CPIt4	0.077 (0.050)	CPIt4lag	-0.097 (0.052)	
Ut1	-0.146 (0.082)	Ut1lag	-0.111 (0.078)	Ut1	-0.134 (0.103)	Ut1lag	-0.001 (0.100)	
Ut2	-0.010 (0.120)	Ut2lag	0.392 (0.123)	Ut2	-0.029 (0.135)	Ut2lag	0.043 (0.176)	
Ut3	0.141 (0.132)	Ut3lag	-0.173 (0.122)	Ut3	0.113 (0.146)	Ut3lag	-0.033 (0.145)	
Ut4	-0.023 (0.116)	Ut4lag	-0.112 (0.117)	Ut4	0.001 (0.114)	Ut4lag	-0.067 (0.118)	
Constant		0.002 (0.010)				0.010 (0.012)		
Observations		177				177		
R-squared		0.134				0.188		
Adjusted R-squared		-0.00307				0.0588		

Table 15: Regression results of target and path factor on measure of Federal Reserve private information, which are forecasts differences between Greenbook and Blue Chip forecasts for GDP, CPI and unemployment. Robust standard errors are presented in parentheses.

Stock & Yogo (2005) critical values (2 endogenous variables, 2 instruments)								
Maximal IV size	5% significance level				10% significance level			
	0.1	0.15	0.2	0.25	0.1	0.15	0.2	0.25
	7.03	4.58	3.95	3.63	5.86	3.71	3.14	2.84

Sanderson-Windmeijer (2016) multivariate F test of excluded instruments		
	F-statistic	p-value
FFR residual	4.59	0.033
1 year residual	5.08	0.025

Table 16: The table reports statistics for weak instrument hypothesis testing for the baseline results.