Measuring the Effects of Federal Reserve Forward Guidance and Asset Purchases on Financial Markets

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Background

In December 2008, U.S. Federal Reserve/FOMC lowered federal funds rate essentially to 0

U.S. economy was still in a severe recession

FOMC began to pursue "**unconventional monetary policy**" to try to lower longer-term interest rates and stimulate the economy:

- Forward guidance: information about the future path of the federal funds rate
- Large-scale asset purchases (LSAPs): purchases of hundreds of billions of $ of longer-term Treasury and mortgage-backed securities

FOMC Statement on March 18, 2009

The Committee will maintain the target range for the federal funds rate at 0 to 1/4 percent and anticipates that economic conditions are likely to warrant exceptionally low levels of the federal funds rate for an extended period. To provide greater support to mortgage lending and housing markets, the Committee decided today to increase the size of the Federal Reserve's balance sheet further by purchasing up to an additional $750 billion of agency mortgage-backed securities, bringing its total purchases of these securities to up to $1.25 trillion this year, and to increase its purchases of agency debt this year by up to $100 billion to a total of up to $200 billion. Moreover, to help improve conditions in private credit markets, the Committee decided to purchase up to $300 billion of longer-term Treasury securities over the next six months.

Unconventional Monetary Policy Announcements

Nov. 3, 2010	FOMC announces it will purchase an additional $600B of longer-term Treasuries (a.k.a. “QE2”)
Aug. 9, 2011	FOMC announces it expects to keep the federal funds rate between 0 and 25 bp “at least through mid-2013”
Sep. 21, 2011	FOMC announces it will sell $400B of short-term Treasuries and use the proceeds to buy $400B of long-term Treasuries (a.k.a. “Operation Twist”)
Jan. 25, 2012	FOMC announces it expects to keep the federal funds rate between 0 and 25 bp “at least through late 2014”
Sep. 13, 2012	FOMC announces it expects to keep the federal funds rate between 0 and 25 bp “at least through mid-2015”, and that it will purchase $40B of mortgage-backed securities per month for the indefinite future

Unconventional Monetary Policy Announcements

Dec. 12, 2012	FOMC announces it will purchase $45B of longer-term Treasuries per month for the indefinite future, and that it expects to keep the federal funds rate between 0 and 25 bp for at least as long as unemployment remains above 6.5 percent and inflation expectations remain subdued
Dec. 18, 2013	FOMC announces it will start to taper its purchases of longer-term Treasuries and mortgage-backed securities to paces of $40B and $35B per month, respectively
Dec. 17, 2014	FOMC announces that "it can be patient in beginning to normalize the stance of monetary policy"
Mar. 18, 2015	FOMC announces that "an increase in the target range for the federal funds rate remains unlikely at the April FOMC meeting"
Oct. 28, 2015	FOMC announces that it will decide whether to raise the funds rate at its next meeting.

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- Many FOMC announcements contain elements of both forward guidance **and** LSAPs

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- Many FOMC announcements contain elements of both forward guidance **and** LSAPs
- One way LSAPs can affect the economy is by signaling FOMC commitment to a future path for the federal funds rate
- Only **surprise** component of announcement should affect asset prices, but we don't have good data on what markets expected

Summary of This Paper

1. Extend the methods of Gürkaynak, Sack, and Swanson (2005) to **separately identify** the federal funds rate, forward guidance, and LSAP components of every FOMC announcement from July 1991 to June 2019

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1. Extend the methods of Gürkaynak, Sack, and Swanson (2005) to **separately identify** the federal funds rate, forward guidance, and LSAP components of every FOMC announcement from July 1991 to June 2019
2. Use high-frequency regressions around those FOMC announcements to estimate effects of **each type** of unconventional monetary policy on asset prices
3. Also look at effects across subsamples (pre-ZLB, ZLB, post-ZLB)
4. And look at **persistence** of these effects

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Idea: Matrix of asset price responses X is well described by a factor model with a small number of factors:

$$\underbrace{X}_{T\times N} = \underbrace{F}_{T\times k}\underbrace{\Lambda}_{k\times N} + \underbrace{\varepsilon}_{T\times N}$$

Test for the Number of Factors

Apply Cragg-Donald (1997) test for the number of factors k needed to explain the data X (int. rate futures and bond yields, $N = 8$):

H_0: number of factors equals	degrees of freedom	Wald statistic	p-value
0	28	92.8	7.2×10^{-9}
1	20	56.8	.00002
2	13	28,5	.008
3	7	11.7	.111

Implications:

- no one factor is enough to explain effects of monetary policy
- two factors are also not enough over this sample (1991–2019)
- three factors seem to explain the data well

Identification Problem

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- Let U be any 3×3 orthogonal matrix ($U'U = I$)
- Let $\widetilde{F} \equiv FU'$, $\widetilde{\Lambda} \equiv U\Lambda$
- Then $F\Lambda = \widetilde{F}\widetilde{\Lambda}$, so

$$X = \widetilde{F}\widetilde{\Lambda} + \varepsilon$$

fits the data exactly as well as the original factor model

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3×3 rotation matrix U uniquely identified with 3 restrictions:

1. LSAPs have no effect on current fed funds rate
2. forward guidance has no effect on current fed funds rate
3. **minimize** size of LSAP factor from 1991–2008

Estimated Effects of Funds Rate, FG, and LSAPs

	FFR	ED2	ED3	ED4	2y Tr	5y Tr	10y Tr
change in fed funds rate	8.37	5.68	5.36	4.60	3.88	2.26	1.11
change in fwd guidance	0.00	3.85	5.00	5.71	4.61	4.95	3.85
change in LSAPs	0.00	1.70	1.68	1.34	−0.10	−3.41	−5.36

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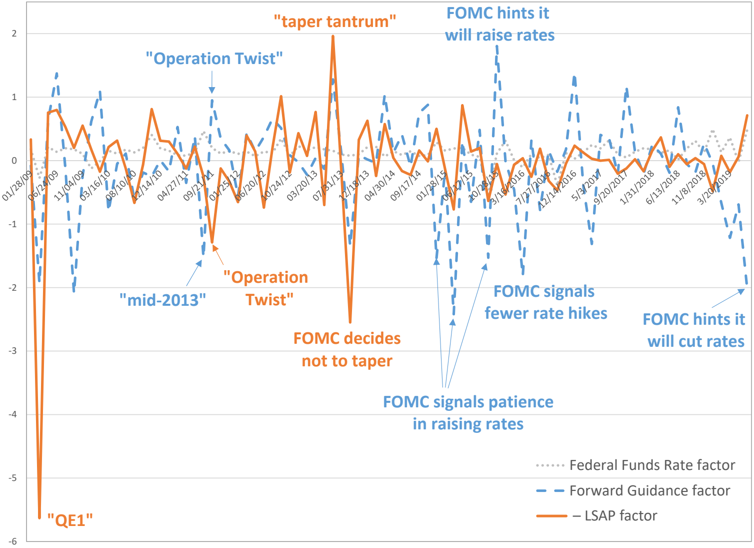
- (And change in the 2-year Treasury yield is not a sufficient statistic for monetary policy announcements)

Forward Guidance and LSAP Factors, 2009–2019



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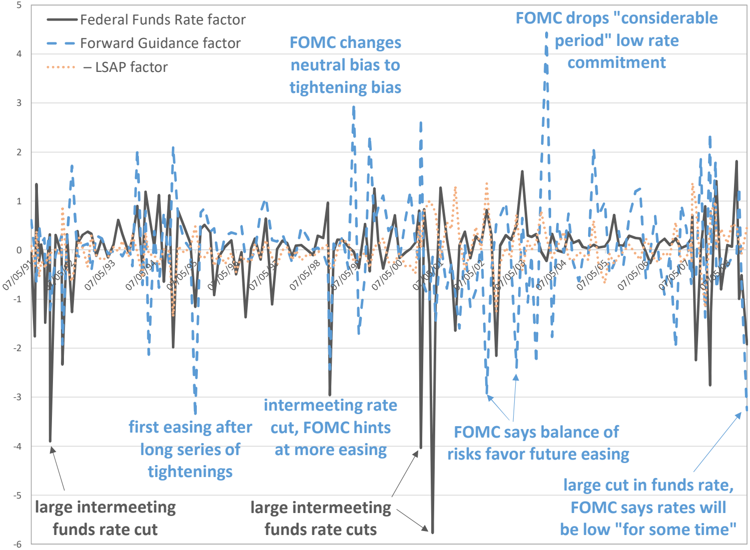

Effects of Fwd Guidance, LSAPs on Treasury Yields

Run high-frequency regressions on FOMC announcement days:

$$\Delta y_t = \alpha + \beta \widetilde{F}_t + \varepsilon_t$$

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	6-month	2-year	5-year	10-year	30-year
pre-ZLB sample, July 1991–Dec. 2008:					
change in fed funds rate	4.39***	3.91***	2.24***	0.97***	−0.11
[*t*-stat.]	[20.62]	[17.16]	[8.91]	[4.56]	[−0.50]
change in fwd guidance	2.55***	4.59***	4.44***	3.37***	2.25***
[*t*-stat.]	[4.11]	[4.06]	[3.95]	[3.87]	[3.73]
ZLB sample, Jan. 2009–Nov. 2015:					
change in fwd guidance	1.10***	4.85***	5.95***	3.05***	0.27
[t-stat.]	[3.34]	[4.02]	[3.79]	[3.08]	[0.40]
change in LSAPs	0.24	0.45	−2.58***	−6.27***	−5.71***
[t-stat.]	[1.16]	[0.89]	[−4.29]	[−4.54]	[−4.07]

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Effects on Stocks and Exchange Rates

Results from regressions

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	S&P 500	$/euro	$/yen
pre-ZLB sample, July 1991–Dec. 2008:			
change in federal funds rate	-0.39^{***}	-0.11^{***}	-0.14^{***}
[t-stat.]	[-9.29]	[-2.95]	[-3.58]
change in forward guidance	-0.09^{**}	-0.15^{***}	-0.13^{***}
[t-stat.]	[-2.13]	[-2.92]	[-2.68]
ZLB sample, Jan. 2009–Nov. 2015:			
change in forward guidance	-0.25^{**}	-0.36^{***}	-0.24^{***}
[t-stat.]	[-2.50]	[-3.45]	[-3.18]
change in LSAPs	0.10	0.19^{***}	0.28^{***}
[t-stat.]	[1.27]	[2.96]	[3.87]

Effects on Corporate Bond Yields and Spreads

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	Corporate Yields		Spreads	
	Aaa	Baa	Aaa−10-yr.	Baa−10-yr.
pre-ZLB sample, July 1991–Dec. 2008:				
change in fed funds rate	0.34	0.38	−0.25	−0.21
[t-stat.]	[0.94]	[1.10]	[−0.89]	[−0.87]
change in fwd guidance	2.21***	2.10***	−0.71**	−0.82***
[t-stat.]	[3.41]	[3.39]	[−2.20]	[−2.68]
ZLB sample, Jan. 2009–Nov. 2015:				
change in fwd guidance	0.52	−0.39	−1.65*	−2.57***
[t-stat.]	[0.51]	[−0.40]	[−1.86]	[−2.64]
change in LSAPs	−4.47***	−5.26***	3.43***	2.65***
[t-stat.]	[−3.73]	[−3.92]	[3.66]	[3.35]

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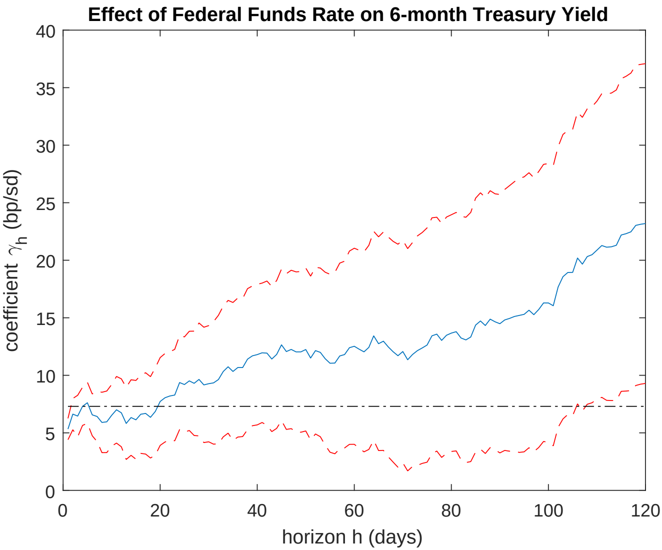
Run daily regressions forecasting *h*-day change in yields:

$$y_{t+h} = \alpha_h + \beta_h y_t + \gamma_h \widetilde{F}_t + \varepsilon_t^{(h)}$$

$$y_{t+h} - y_t = \gamma_h \widetilde{F}_t + \varepsilon_t^{(h)}$$

Persistence of Federal Funds Rate Effects



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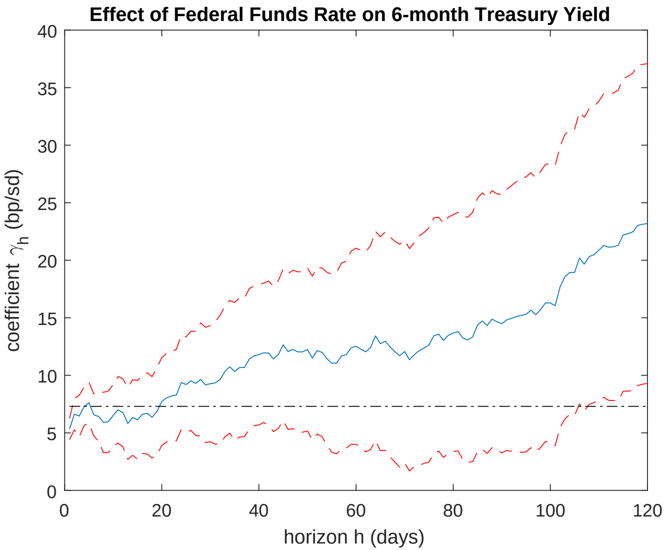
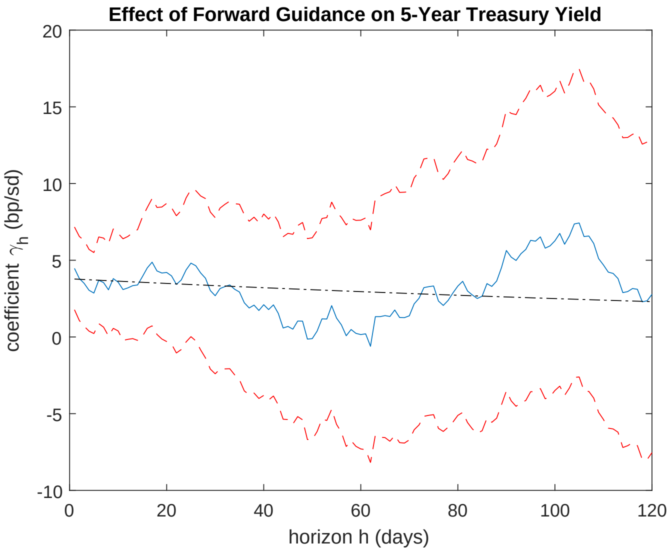
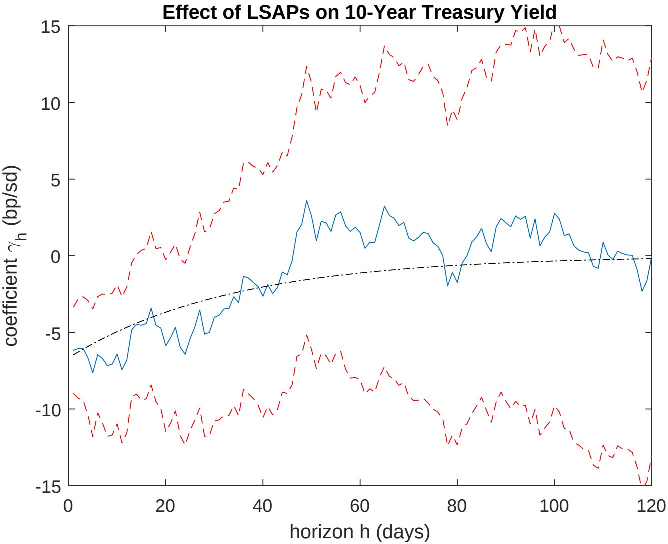


$$\gamma_h = ae^{-b(h-1)}$$

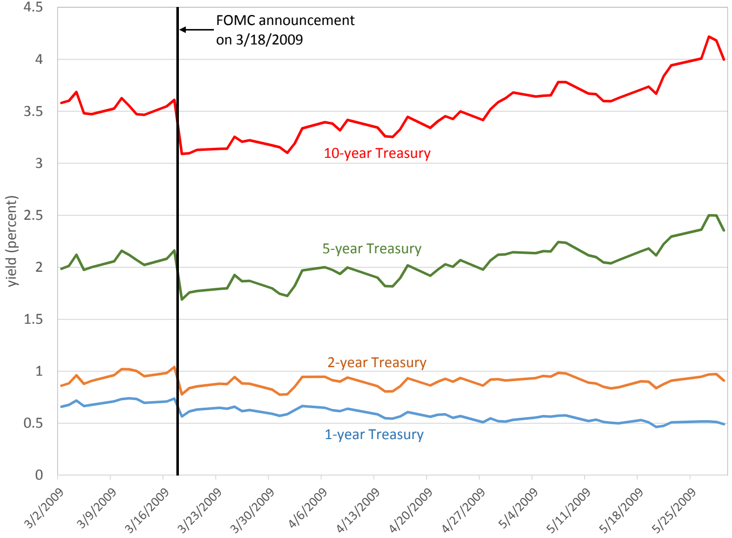
Persistence of Forward Guidance Effects



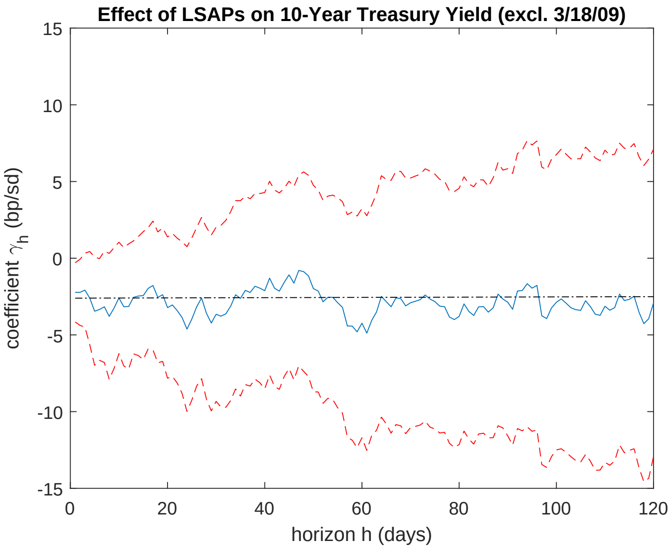
Persistence of LSAP Effects



March 18, 2009, FOMC “QE1” Announcement



Persistence of LSAP Effects on 10Y Tr., excl. 3/18/09



Conclusions

1. Unconventional monetary policy was effective (at moving financial markets)
   - suggests Fed does not need to raise its inflation target
2. **Both** forward guidance and LSAPs were effective:
   - about as effective as federal funds rate in normal times
   - forward guidance and LSAPs about equally effective for medium-term Treasury yields, exchange rates
   - fwd guidance had larger effects on short-term Treasuries, stocks
   - LSAPs had larger effects on long-term Treasury, corporate yields
3. Effects of both policies seem to be very persistent:
   - no significant tendency to die out over time
   - one exception: LSAP effects after “QE1” announcement
4. Future work: estimate effects on macro variables

Principal Components Loadings