

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

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Seminar

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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

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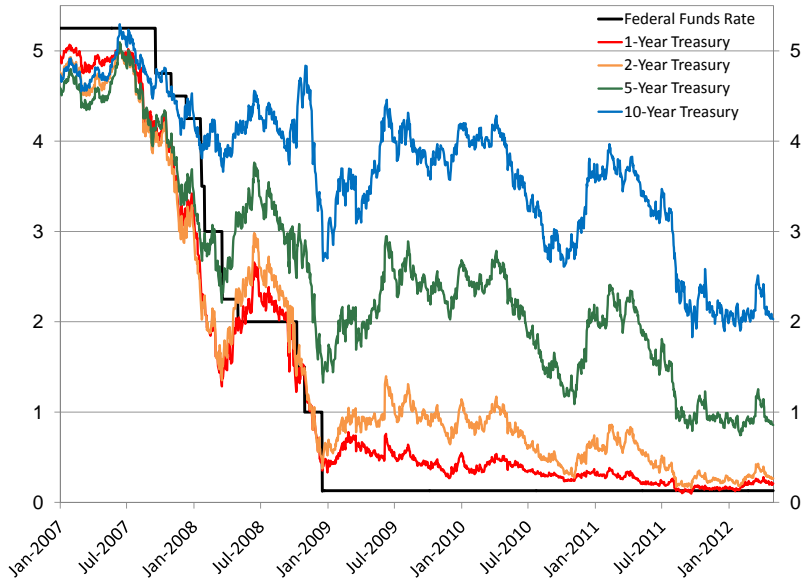
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- **Forward guidance**: information about the future path of the federal funds rate
- **Large-scale asset purchases (LSAPs)**: purchases of hundreds of billions of \$ of longer-term Treasury and mortgage-backed securities

Background



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**
- 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

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- 1 Extend the methods of Gürkaynak, Sack, and Swanson (2005) to **separately identify** the **forward guidance** and **LSAP** components of every FOMC announcement from January 2009 to October 2015

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- 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 the **persistence** of these effects, the effects of these policies on **uncertainty**, etc.

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asset price responses X

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
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Implications:

- no one factor is enough to explain effects of monetary policy
- two factors are also not enough
- three factors seem to explain the data well

Identification Problem

Given a 3-dimensional factor model

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

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

fits the data exactly as well as the original factor model

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- 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	8.78	5.55	5.21	4.43	3.68	2.04	0.95
change in fwd guidance	0.00	4.16	5.32	6.02	4.85	5.09	3.92
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- Forward guidance and LSAPs had substantially different effects

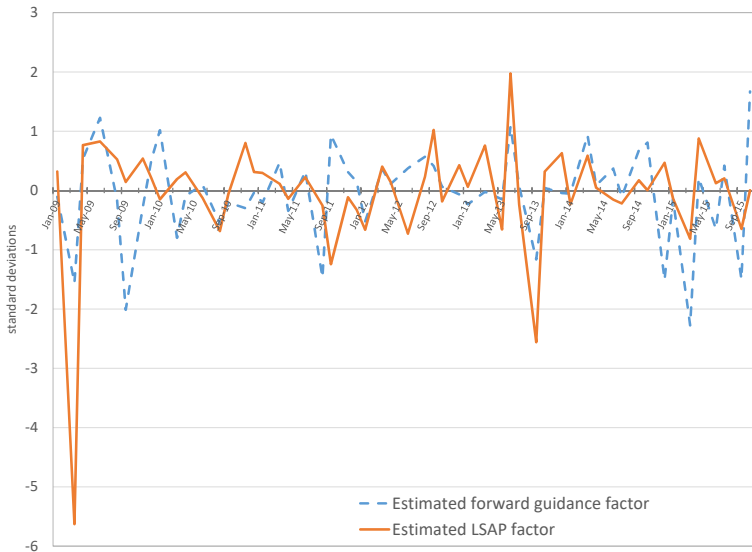
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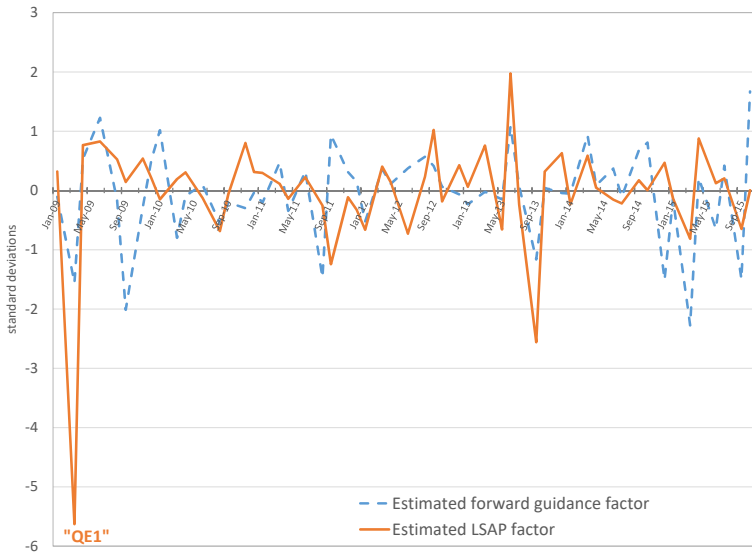
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- (And change in the 2-year Treasury yield is not a sufficient statistic for monetary policy announcements)

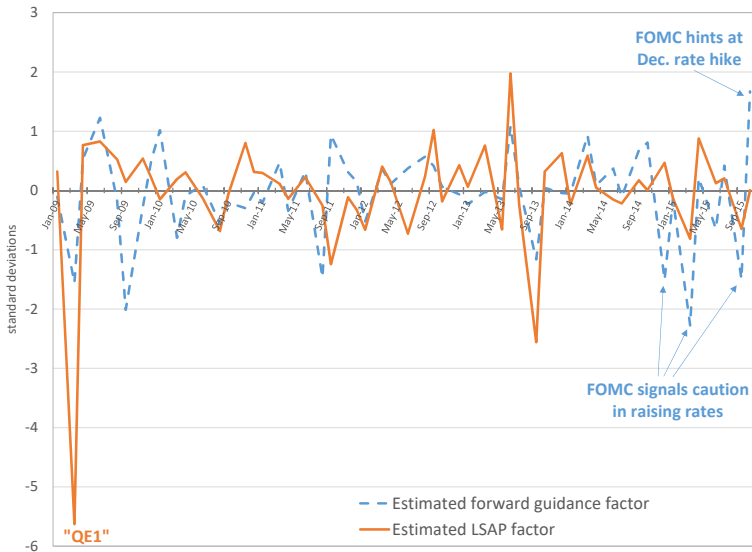
Forward Guidance and LSAP Factors, 2009–2015



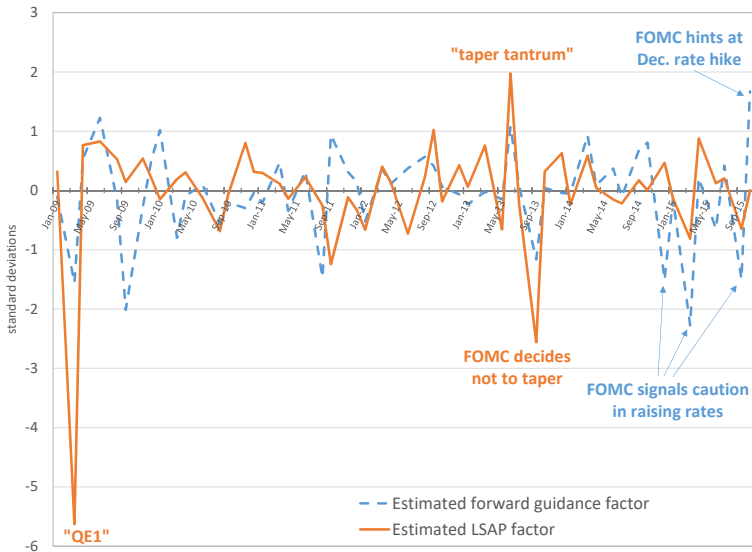
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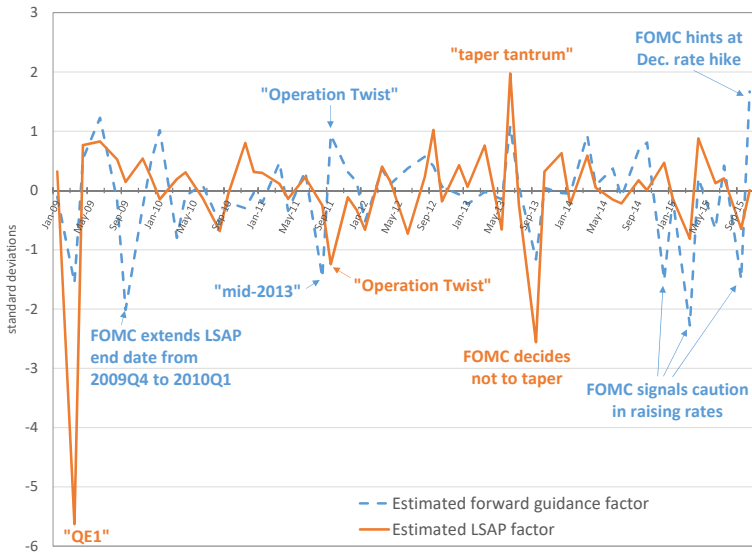
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Effects of Fwd Guidance, LSAPs on Treasury Yields

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

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	6-month	2-year	5-year	10-year	30-year
July 1991–Dec. 2008:					
change in fed funds rate	4.11***	3.70***	2.02***	0.82***	−0.15
[<i>t</i> -stat.]	[18.42]	[13.85]	[7.66]	[3.44]	[−0.70]
change in fwd guidance	2.87***	4.81***	4.59***	3.44***	2.22***
[<i>t</i> -stat.]	[5.71]	[5.75]	[5.58]	[5.34]	[4.82]
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Effects on Stocks and Exchange Rates

Results from regressions

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	S&P 500	\$/euro	\$/yen
July 1991–Dec. 2008:			
change in federal funds rate	−0.32***	−0.11**	−0.13***
[t-stat.]	[−7.26]	[−2.55]	[−2.91]
change in forward guidance	−0.16***	−0.16***	−0.14***
[t-stat.]	[−3.31]	[−3.15]	[−2.91]
Jan. 2009–Oct. 2015:			
change in forward guidance	−0.26***	−0.37***	−0.24**
[t-stat.]	[−2.79]	[−3.63]	[−2.50]
change in LSAPs	0.12	0.21***	0.29***
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Effects on Corporate Bond Yields and Spreads

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Corporate Yields

Spreads

Aaa

Baa

Aaa–10-yr.

Baa–10-yr.

July 1991–Dec. 2008:

change in fed funds rate

0.32

0.41

−0.41

−0.32

[t-stat.]

[0.82]

[1.05]

[−1.08]

[−0.84]

change in fwd guidance

2.08***

1.96***

−0.60*

−0.72*

[t-stat.]

[4.41]

[4.26]

[−1.65]

[−1.95]

Jan. 2009–Oct. 2015:

change in fwd guidance

0.48

−0.51

−1.64

−2.63**

[t-stat.]

[0.48]

[−0.51]

[−1.58]

[−2.42]

change in LSAPs

−4.51***

−5.25***

3.56***

2.81***

[t-stat.]

[−4.43]

[−4.72]

[3.64]

[3.09]

Are the Effects of Fwd Guidance, LSAPs Persistent?

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- takes time for potential arbitrageurs to reallocate capital

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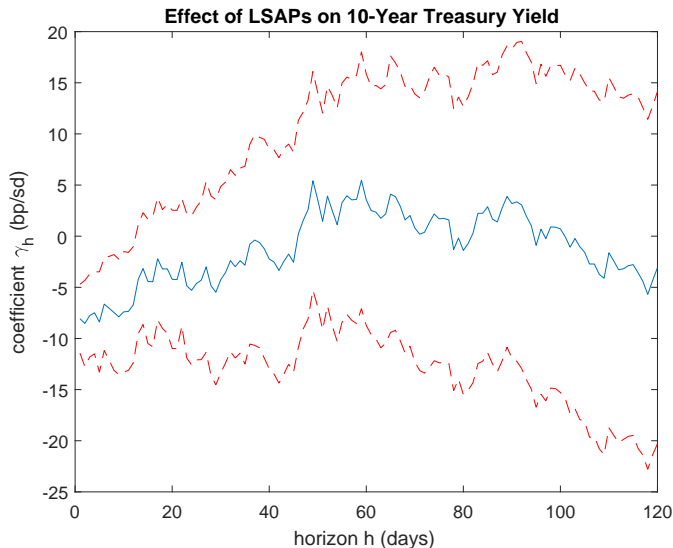
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Run daily regressions forecasting h -day change in yields:

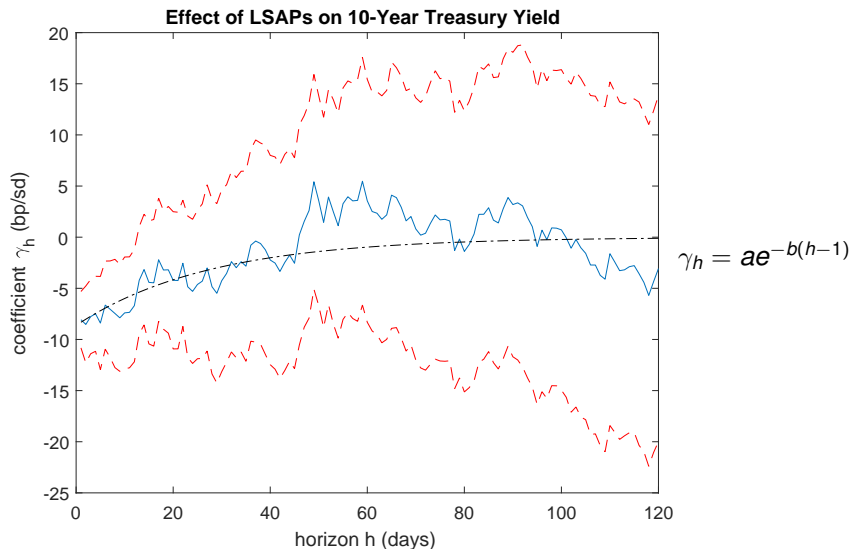
$$y_{t+h} = \alpha_h + \beta_h y_t + \gamma_h \tilde{F}_t + \varepsilon_t^{(h)}$$

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

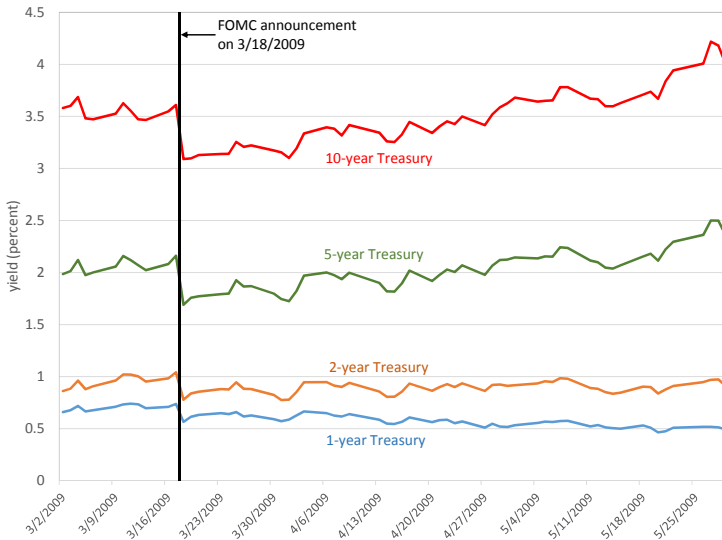
Persistence of LSAP Effects (on 10y Treasury)



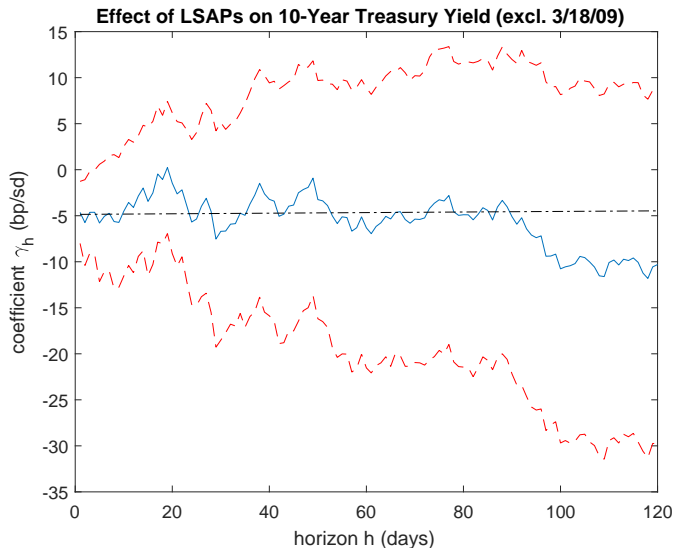
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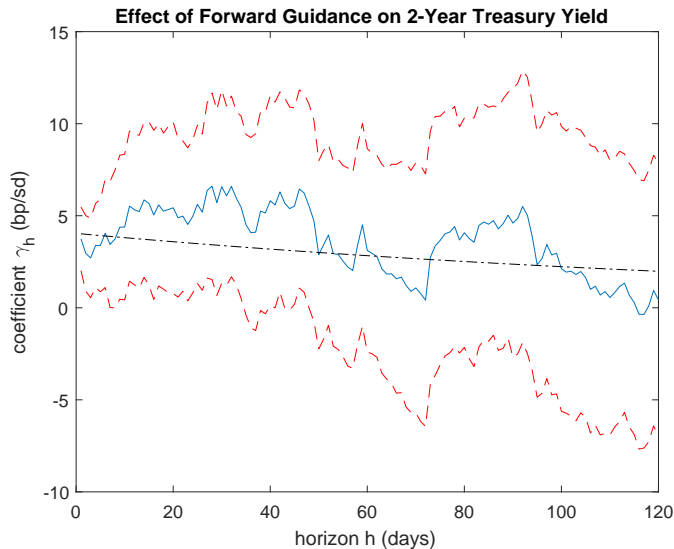
March 18, 2009, FOMC “QE1” Announcement



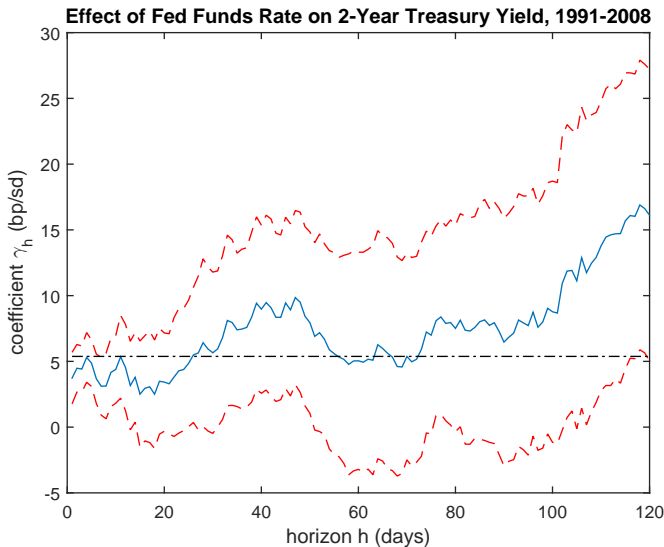
Persistence of LSAP Effects on 10Y Tr., excl. 3/18/09



Persistence of Forward Guidance Effects



Persistence of Federal Funds Rate Effects (pre-2009)



How Do FG, LSAPs Affect Uncertainty?

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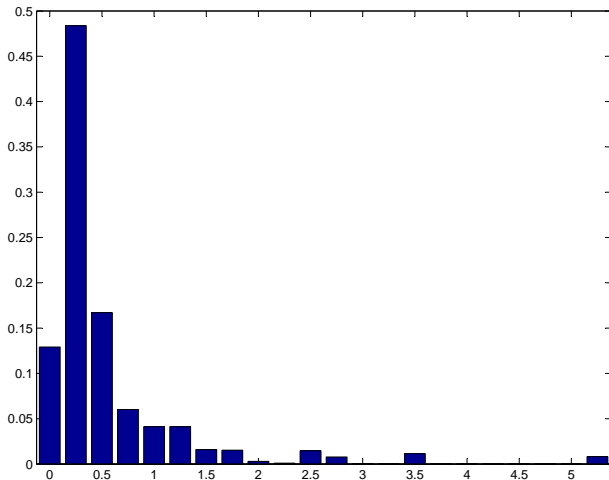
- Are these policies adding or removing variance from long-term bond yields?

Measuring Monetary Policy Uncertainty

We can measure monetary policy uncertainty using options data:

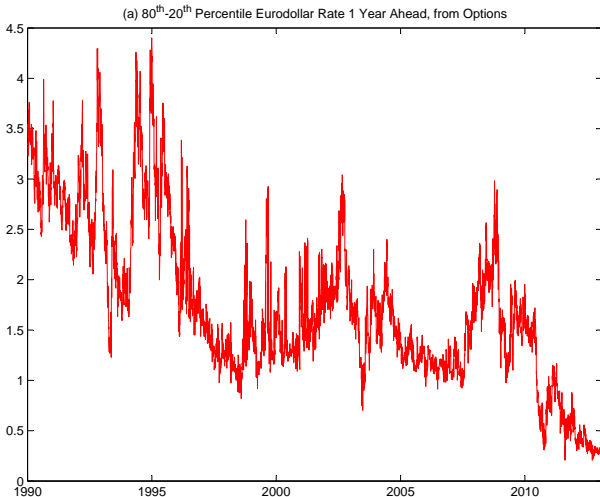
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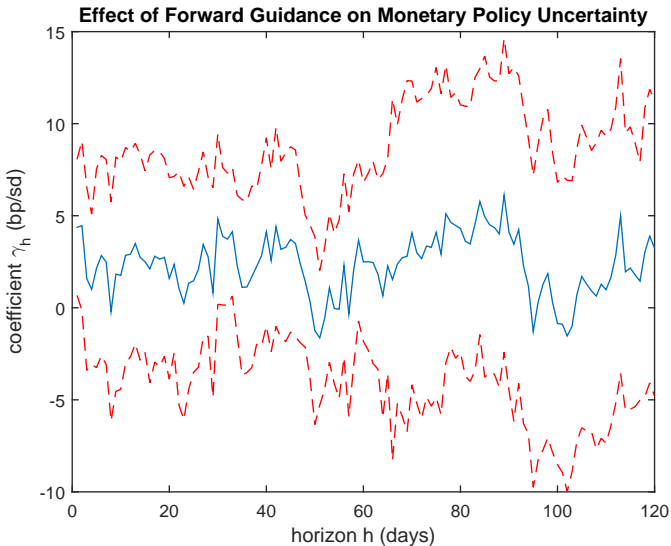


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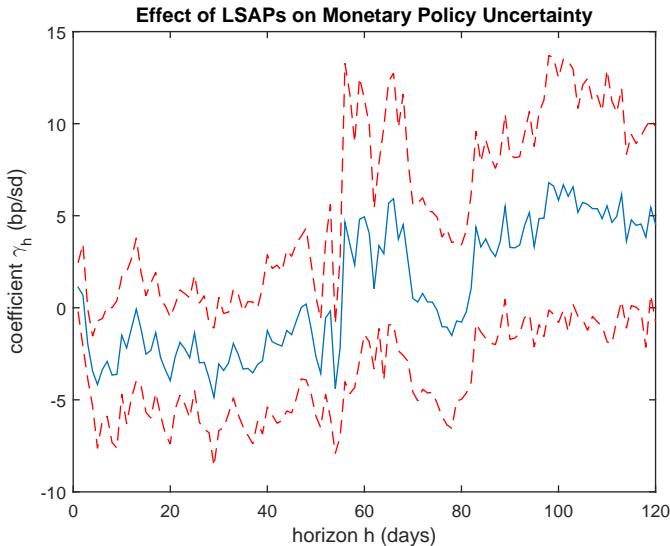
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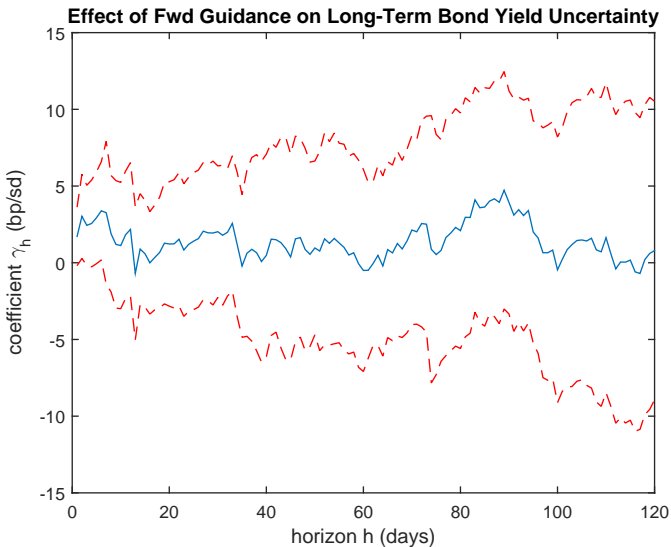
Effect of Forward Guidance on Mon. Pol. Uncertainty



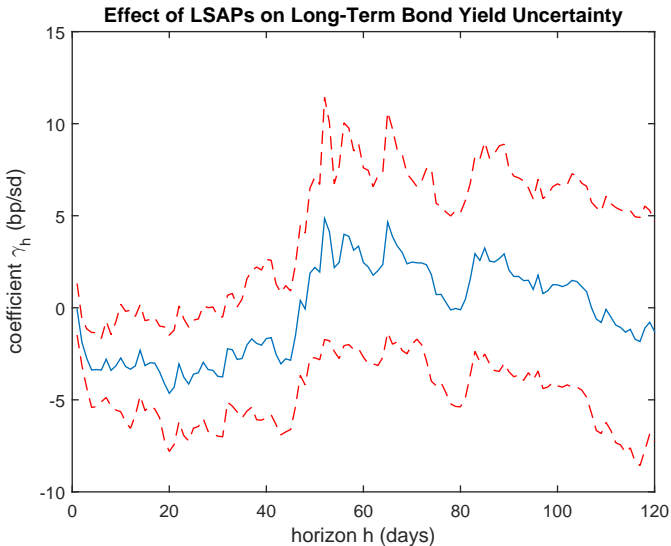
Effect of LSAPs on Monetary Policy Uncertainty



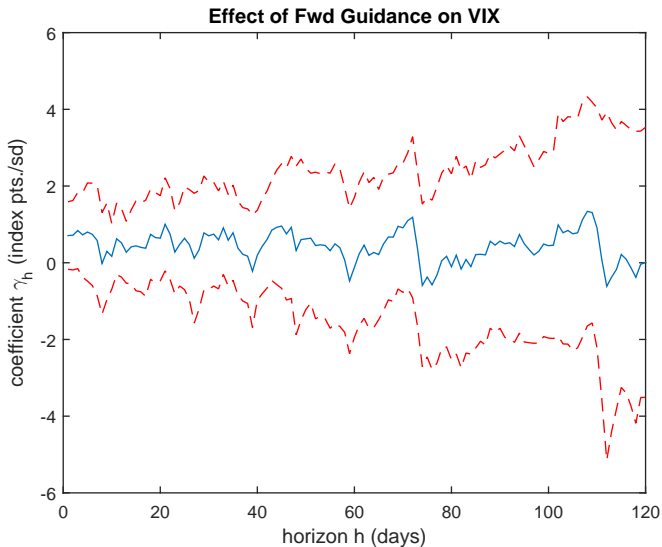
Effect of Forward Guidance on MOVE Index



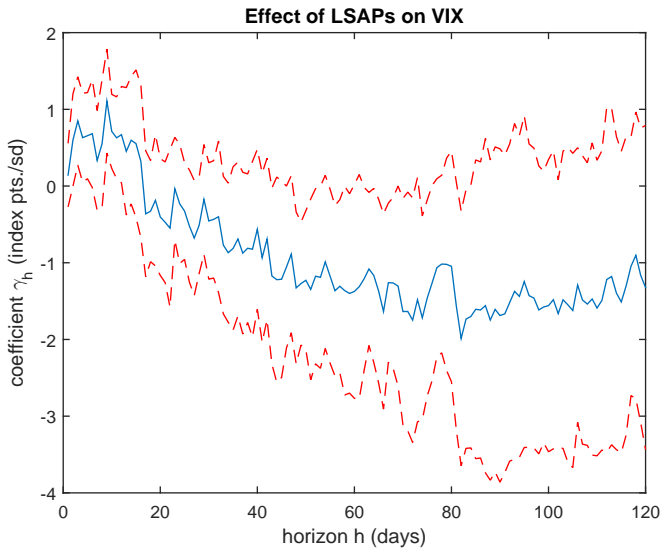
Effect of LSAPs on MOVE Index



Effect of Forward Guidance on VIX



Effect of LSAPs on VIX

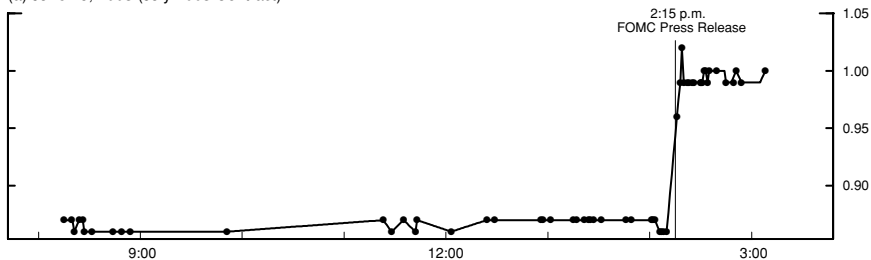


Conclusions

- 1 Unconventional monetary policy was effective:
 - about as effective as conventional monetary policy before ZLB
 - suggests Fed does not need to raise its inflation target
- 2 Both **forward guidance** and **LSAPs** were effective:
 - **FG** and **LSAPs** about equally effective for medium-term Treasury yields, stocks, and exchange rates
 - **Forward guidance** had larger effects on short-term Treasury yields
 - **LSAPs** had larger effects on long-term Treasury yields, corporate bond yields, and interest rate uncertainty
- 3 These effects are largely persistent:
 - Effects of **federal funds rate** completely persistent
 - Effects of **LSAPs** completely persistent (excluding 3/18/09)
 - Effects of **forward guidance** less persistent, but attenuation not statistically significant, likely due to finite horizon of forward guidance

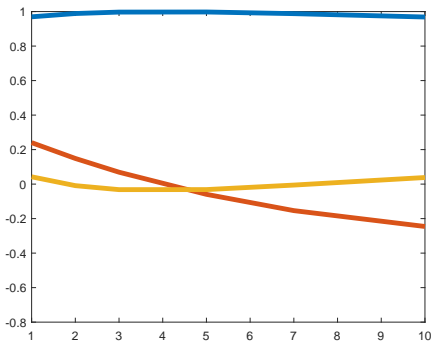
Intraday Futures Response to FOMC Announcement

(a) June 25, 2003 (July 2003 Contract)



Principal Components Loadings

All Days



FOMC Announcement Windows

