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Fiscal Confidence Shocks and the Market for the Japanese Government Bonds

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What I do

- Subject: Market for the Japanese Government Bonds (**JGBs**).
- Question: Does it react to **news** that might have changed people's perceptions about fiscal sustainability?
- Basic idea: **It matters where to look.** Here, we study the JGB **derivatives** market…
- with a special focus on the evolution of the **volatility smiles** computed from options.

Structure of talk

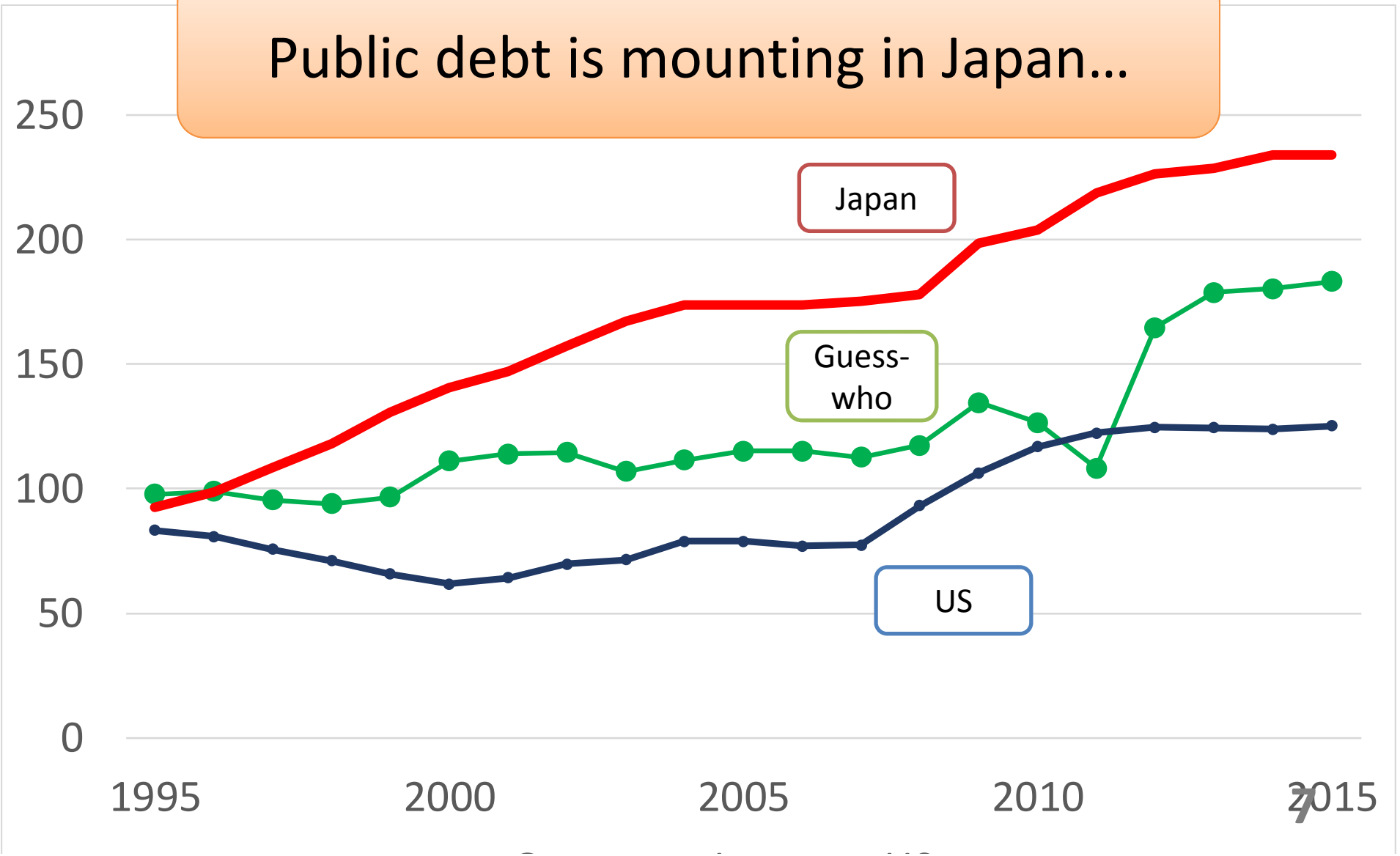
1. Question I ask
2. LHS = JGB indices
3. My Main RHS = News Dummies
4. Other RHS variables
5. Preview of data
6. Estimation results
7. Work ahead

1. Question I ask in this paper

Are the sovereign **default risks** priced in the market for the **Japanese Government Bonds**?

Background (1)

Public debt is mounting in Japan…



Background (2)

Japanese Government Bond (JGB) Yields

Does that mean that the market has no doubts at all?

This paper's approach:

THINK LOCALLY

Idea behind the paper

- Maybe the general trend in the market is determined by factors such as monetary policy…
- But we still expect that a **marginal** change in the likelihood of debt sustainability should be reflected **somewhere** in the market..
- ... unless the standard theory is completely useless!

Two step approach

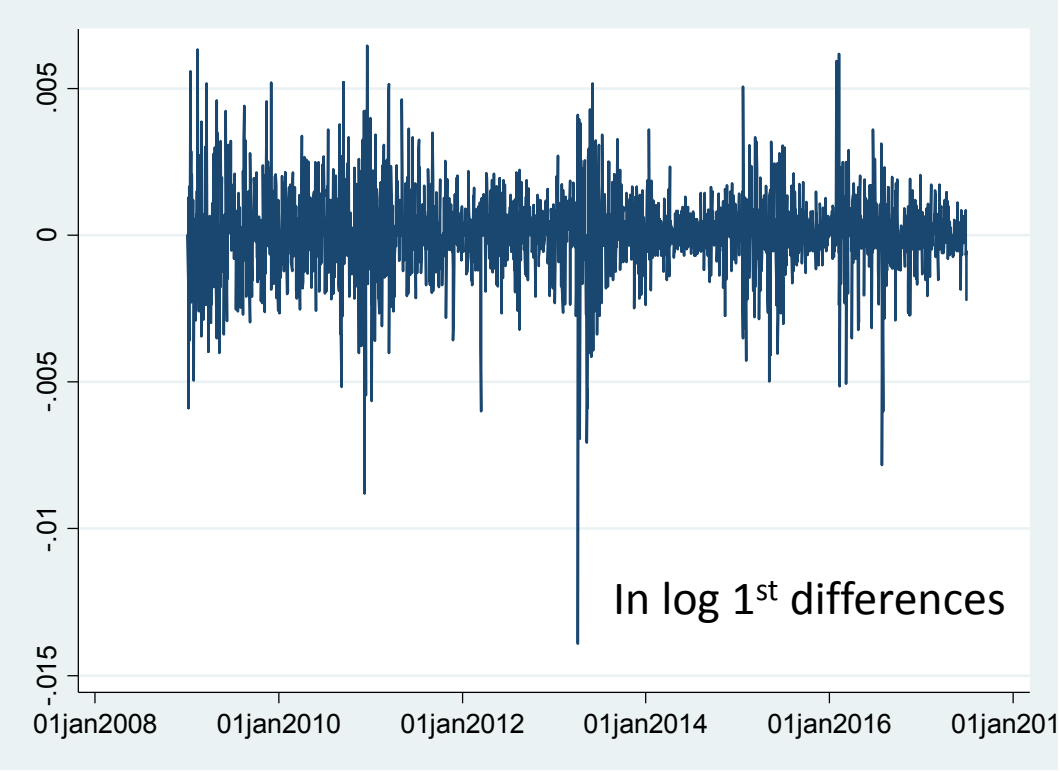
- Step 1: News analysis
  - Look for news that should have changed people's perceptions about future debt sustainability.

- Step 2: Study the reactions of JGB **derivatives** market

2. LHS = JGB indices

(1) JGB Futures

- Pro: highly liquid
- Con: Just the first moment



(2) JGBVIX

- Computed from options data.
- Pro : **Model-Free** Implied Volatility (**MFIV**)
- Con: Requires a large number of observations at each point in time.
  - i.e., lots of strike prices at which transactions are observed.
  - But actual data is limited!

  – also, this is just the 2nd moment.

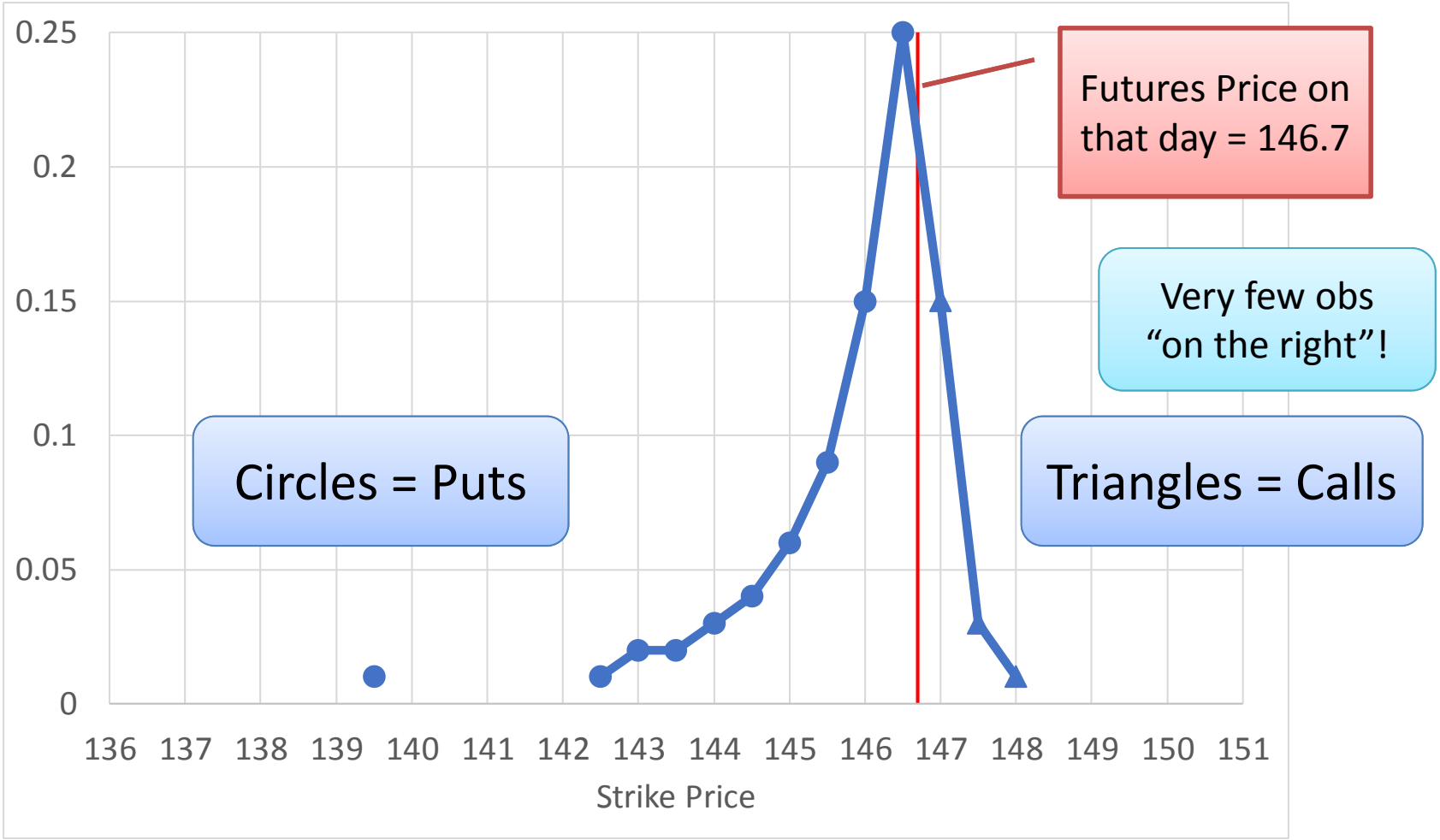
- Perhaps it is better to impose more theoretical restrictions! -> **My new indices**

(3) **Black** (1976) **Model Based Implied Volatility (BMIV)**

- We can compute IV at each Strike Price.
- Does not require lots of options.
- Allows me to infer about higher-than-second order properties.

Example: Option Prices on Nov 4, 2014 (Mon),

from the latest transaction before the market close (15:00)



Black (1976) Model

- “Black-Scholes for bonds”
- Lognormal
- Constant volatility.
- Assumes European Option.

Black Model: Formula

Call

$$c = e^{-rT}\left[F_0 N(d_1) - KN(d_2)\right]$$

Put

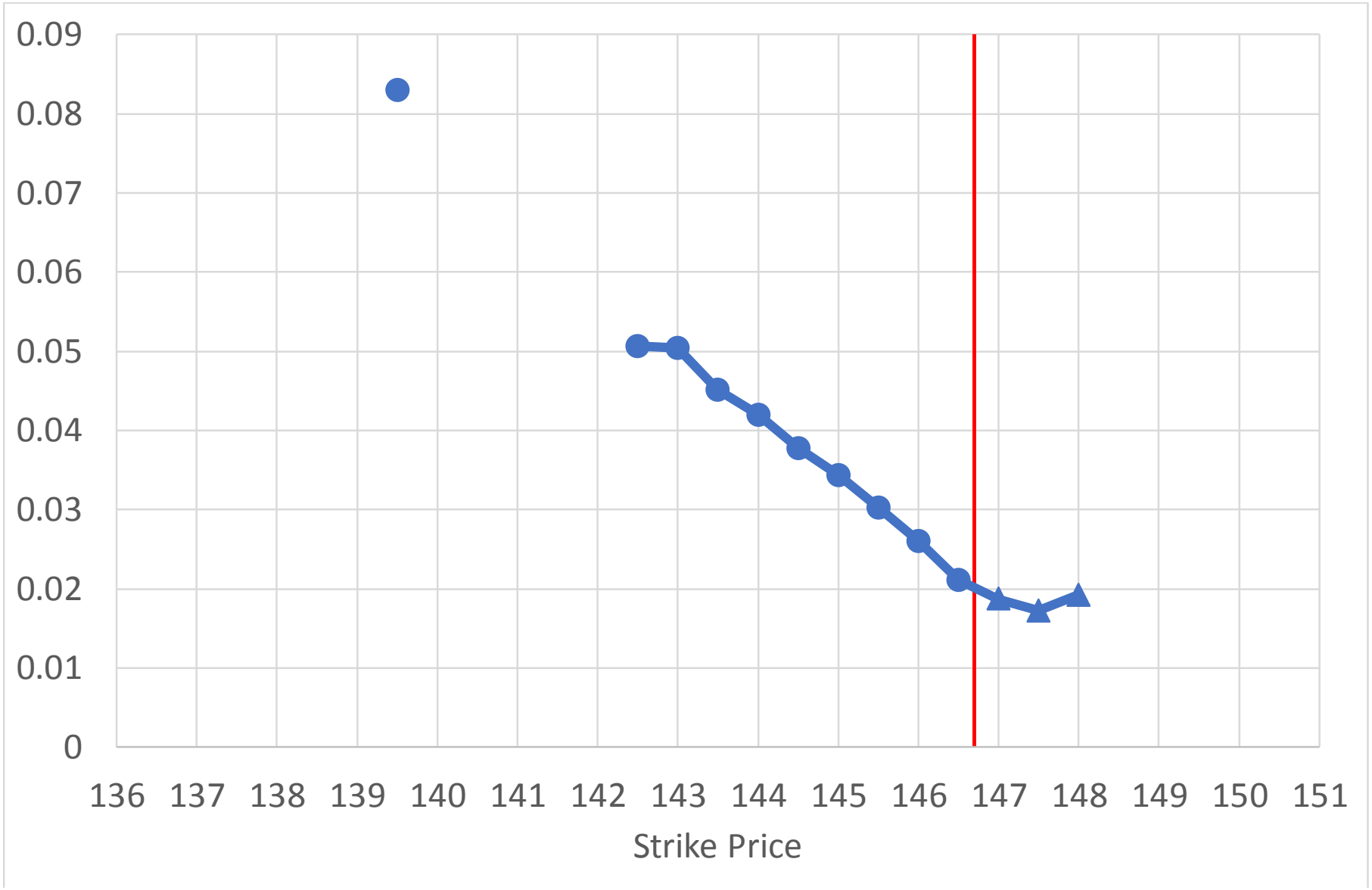
$$p = e^{-rT}\left[KN(-d_2) - F_0 N(-d_1)\right]$$

$$d_1 = \frac{\ln(F_0 / K) + \sigma^2 T / 2}{\sigma\sqrt{T}} \qquad d_2 = d_1 - \sigma\sqrt{T}$$

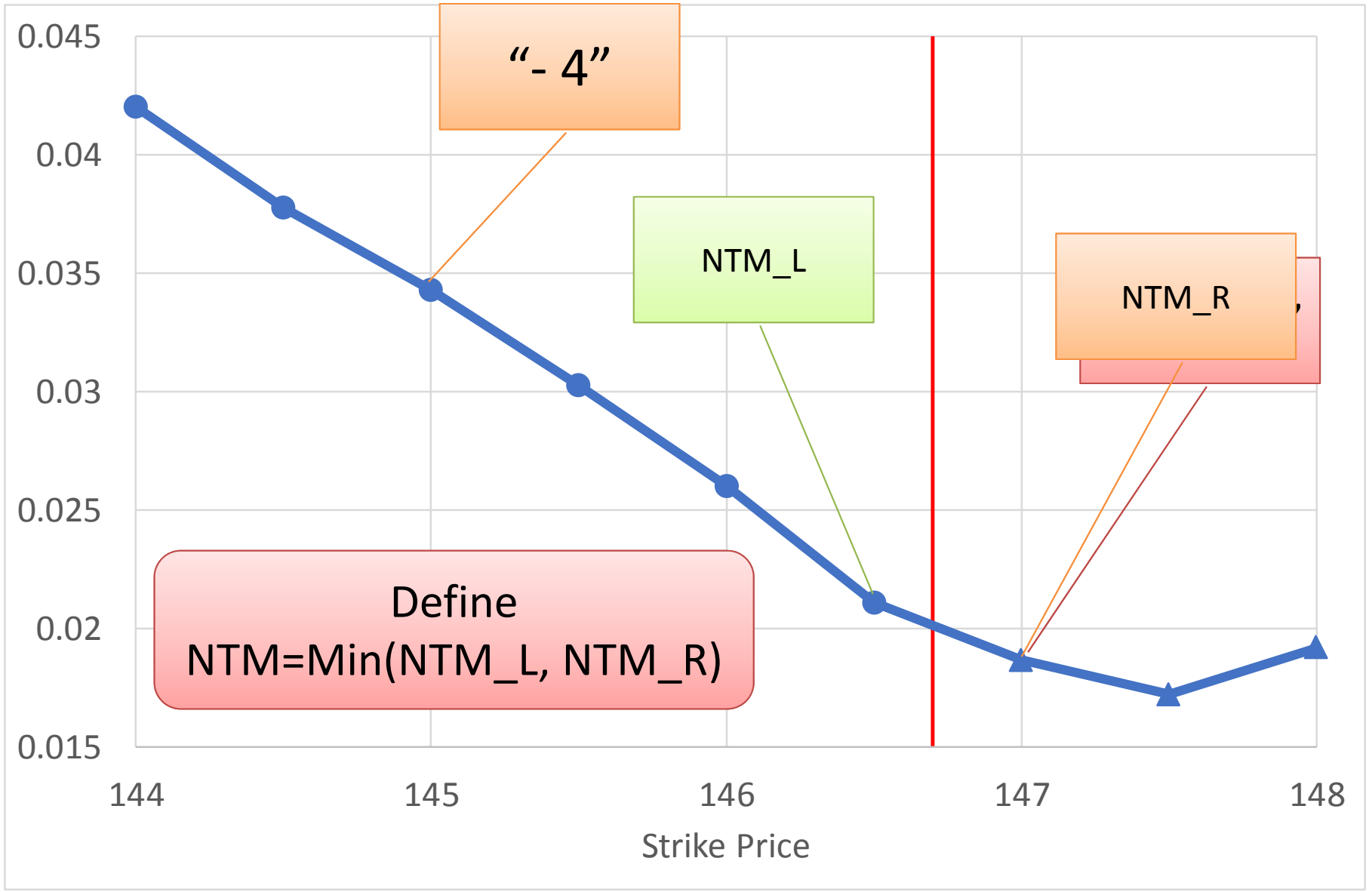
F: Future Price
K: Strike Price
r: interest rate
T: time to maturity of the option
σ: volatility of future price

In this paper, I assume ***r***=0.001.

Estimated BMIV at each Strike Price ="Volatility Smile"



Magnify around the bottom



Three indices

BMIV0: Evaluated at “Point 0”.

BMIV-4: = “Volatility to the left”

Evaluated at “Point -4” (¥2 lower)

Reflects not just vol but skewness etc.

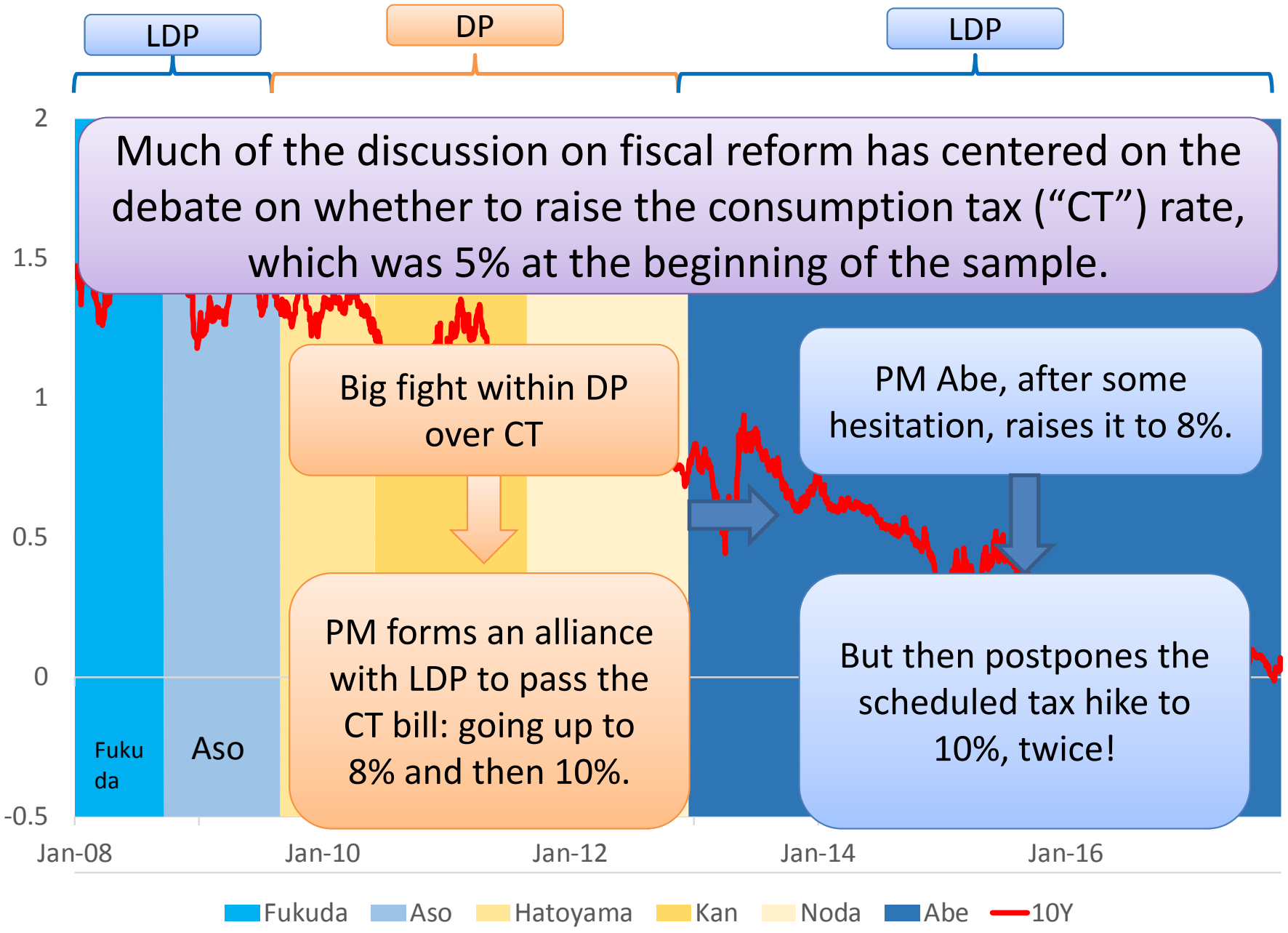
BMIVdiff = BMIV-4 – BMIV0

3. My main RHS variable
= Fiscal news date dummies

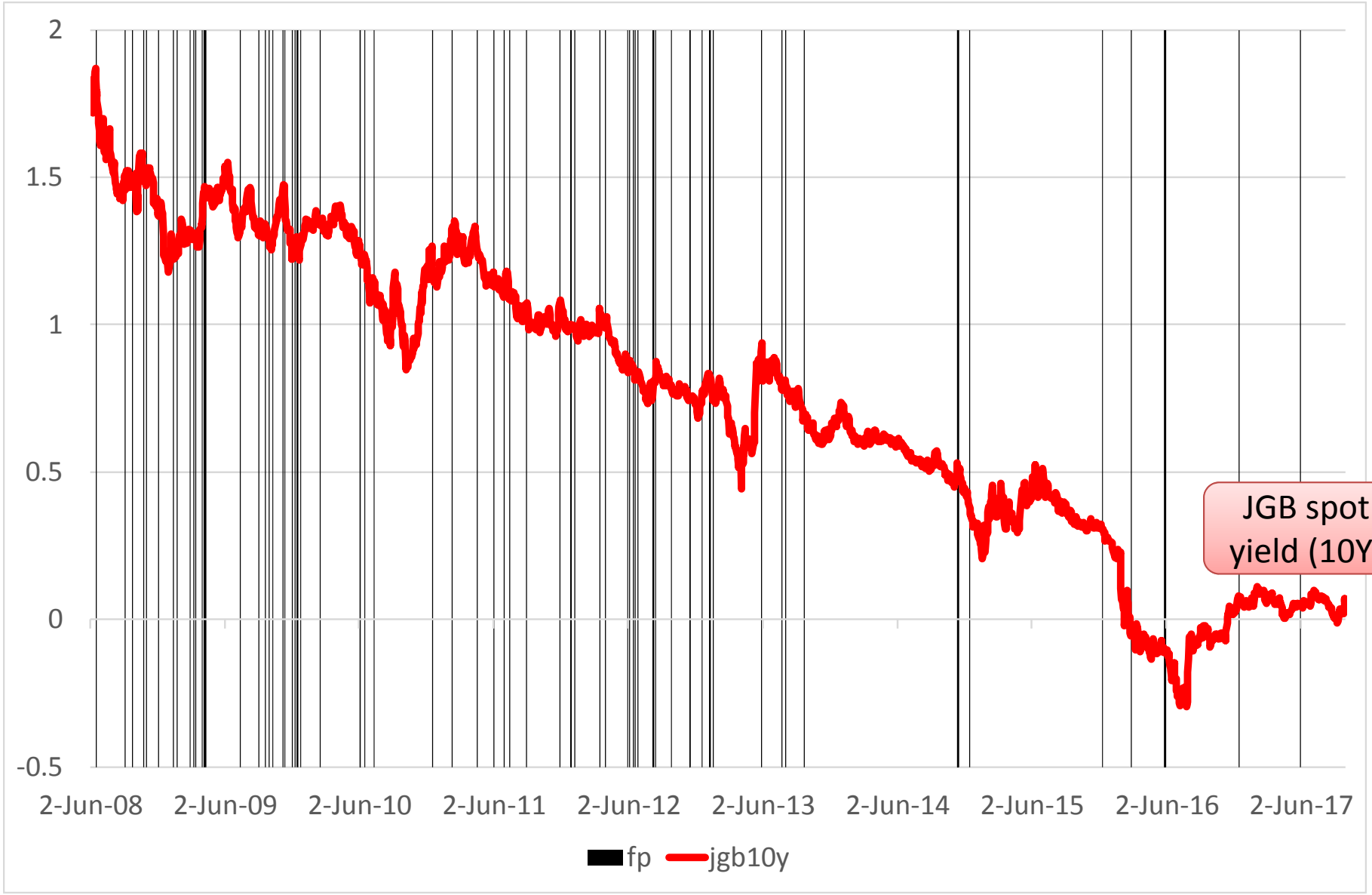
Read Newspapers carefully
-> Create a list of news that (might) have changed the public's confidence in fiscal sustainability.

Newspapers = Nikkei & Asahi

JGB yields (10 years) and recent history of the Japanese government



Fiscal news dates



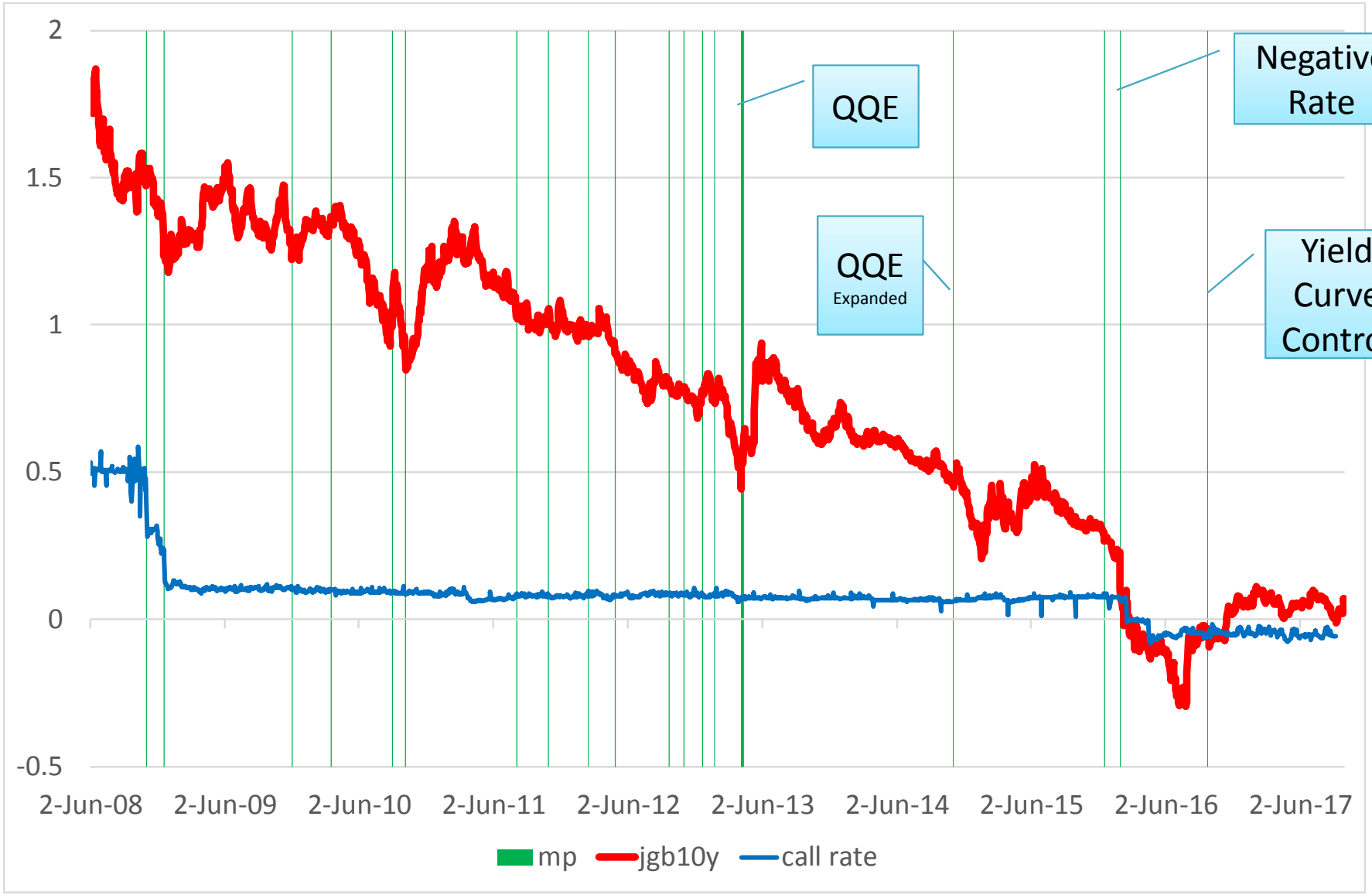
4. Other RHS variables

Non-policy variables

- Analysis (1) = JGB Futures
  - Lagged dependent variables
  - Foreign Bond Futures
  - Exchange Rates
  - Dummies for the big earthquake in 2011

- Analysis (2)-(5) = JGBVIX and the new measures
  - Lagged dependent variables
  - US Bond VIX
  - Exchange Rate VIX
  - Foreign Bond Futures
  - Exchange Rates (include square term)
  - Lagged JGB Futures (allow asymmetric coeffs)
  - Dummies for the big earthquake

BOJ policy announcements



Foreign MP Announcements

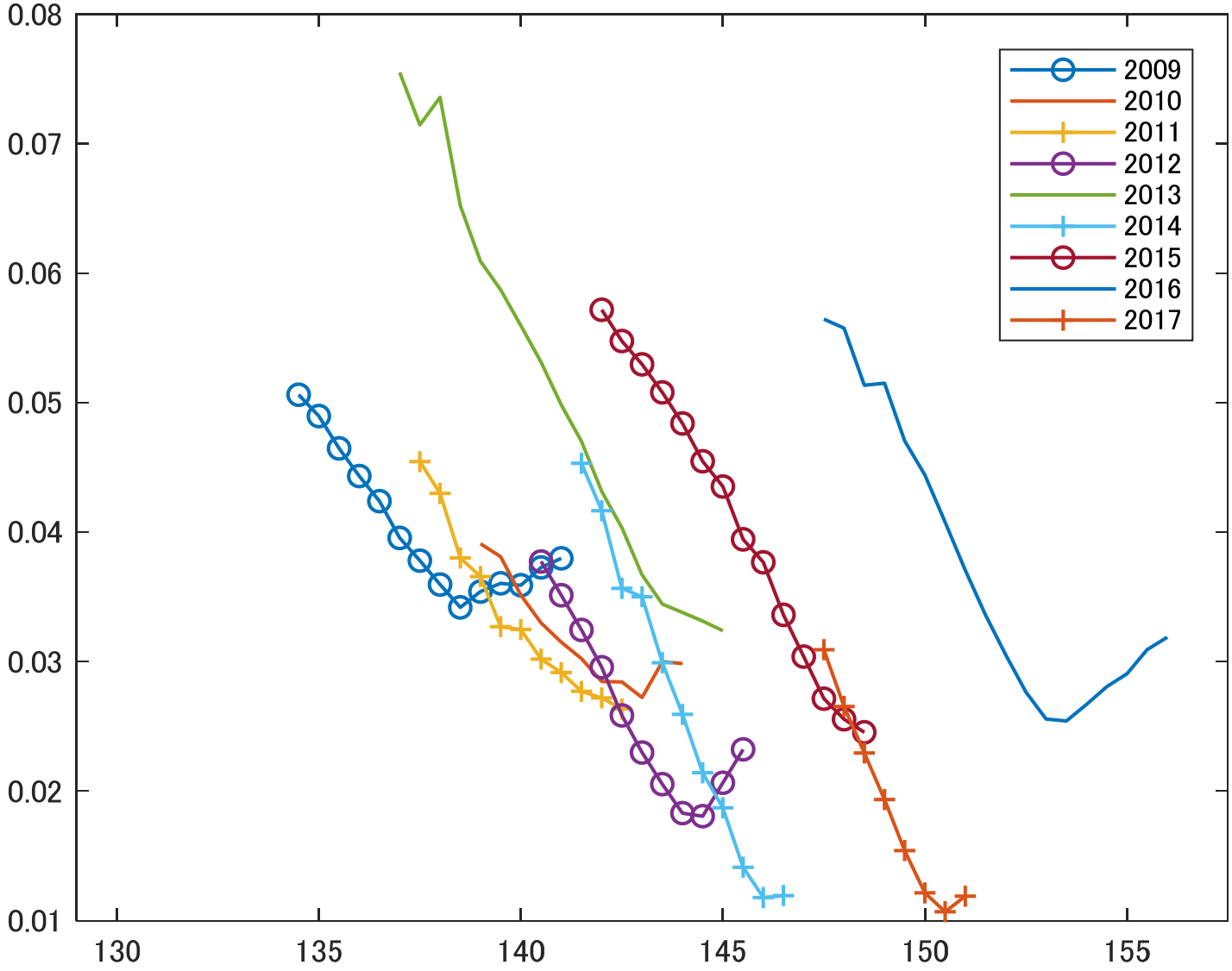
- Fed: Fawley & Neely (2013), Gang (2017)
- ECB: Ambler & Rumler (2016)

5. Data Preview

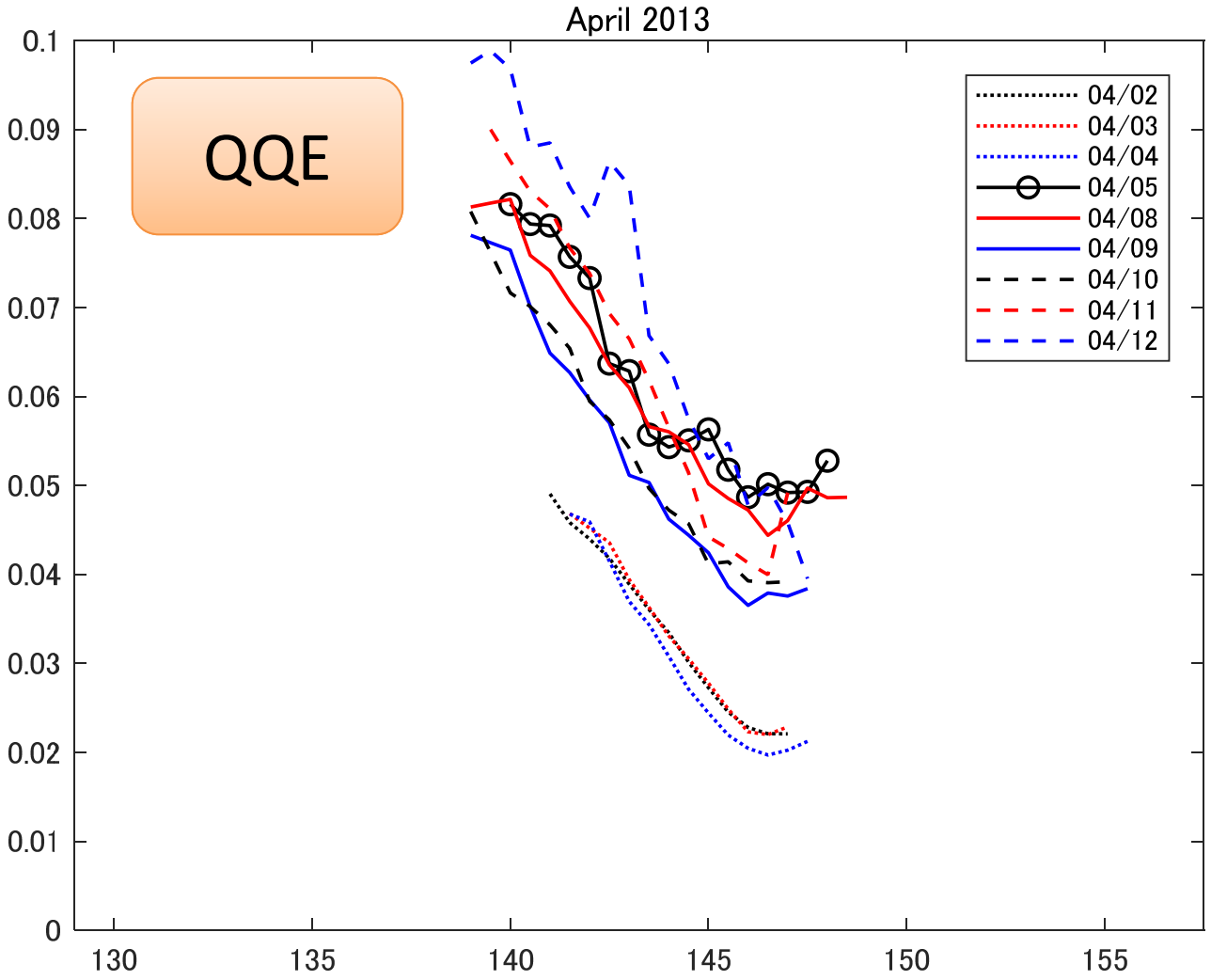
or, “how are the smiles smiling?”

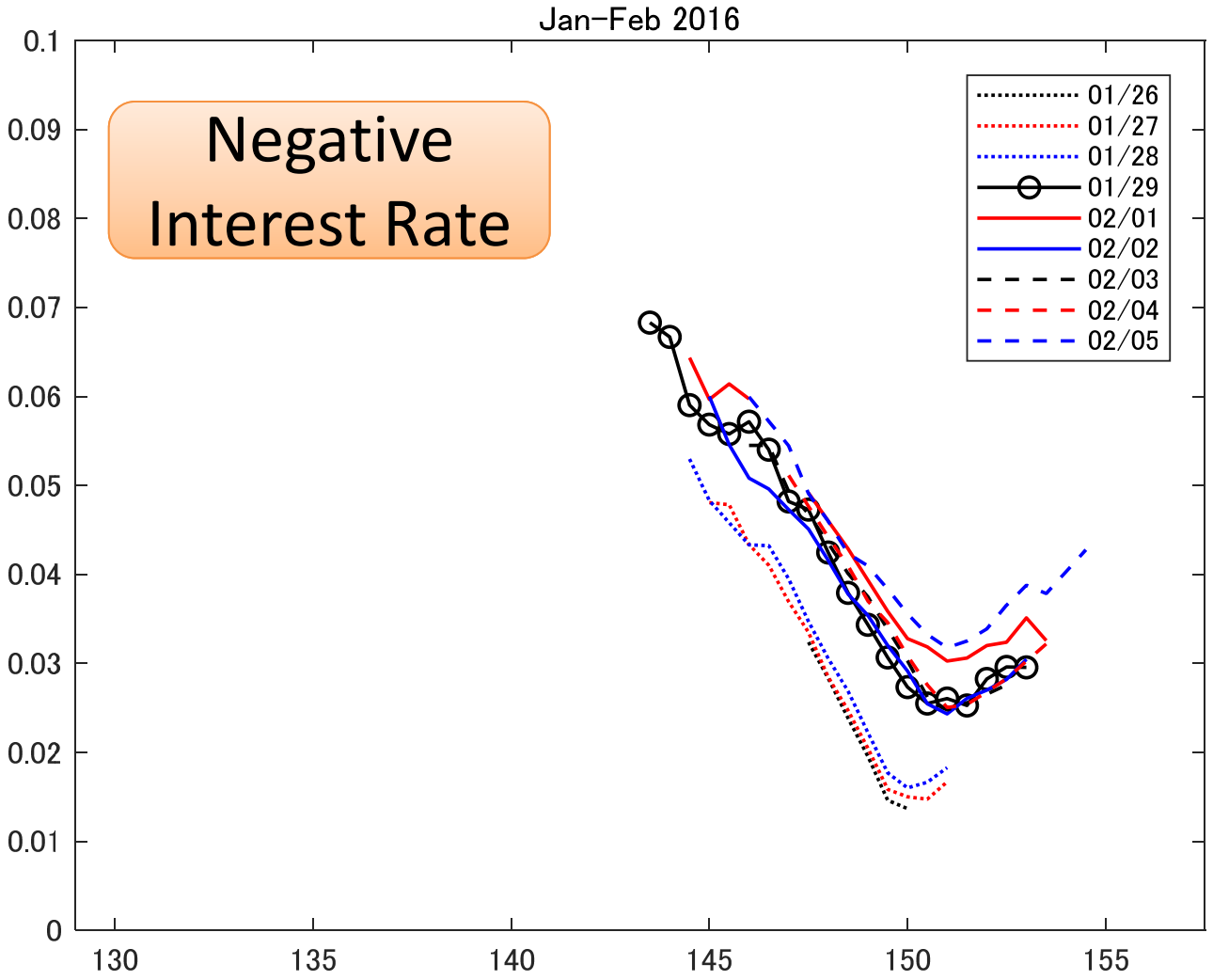
The smile over years

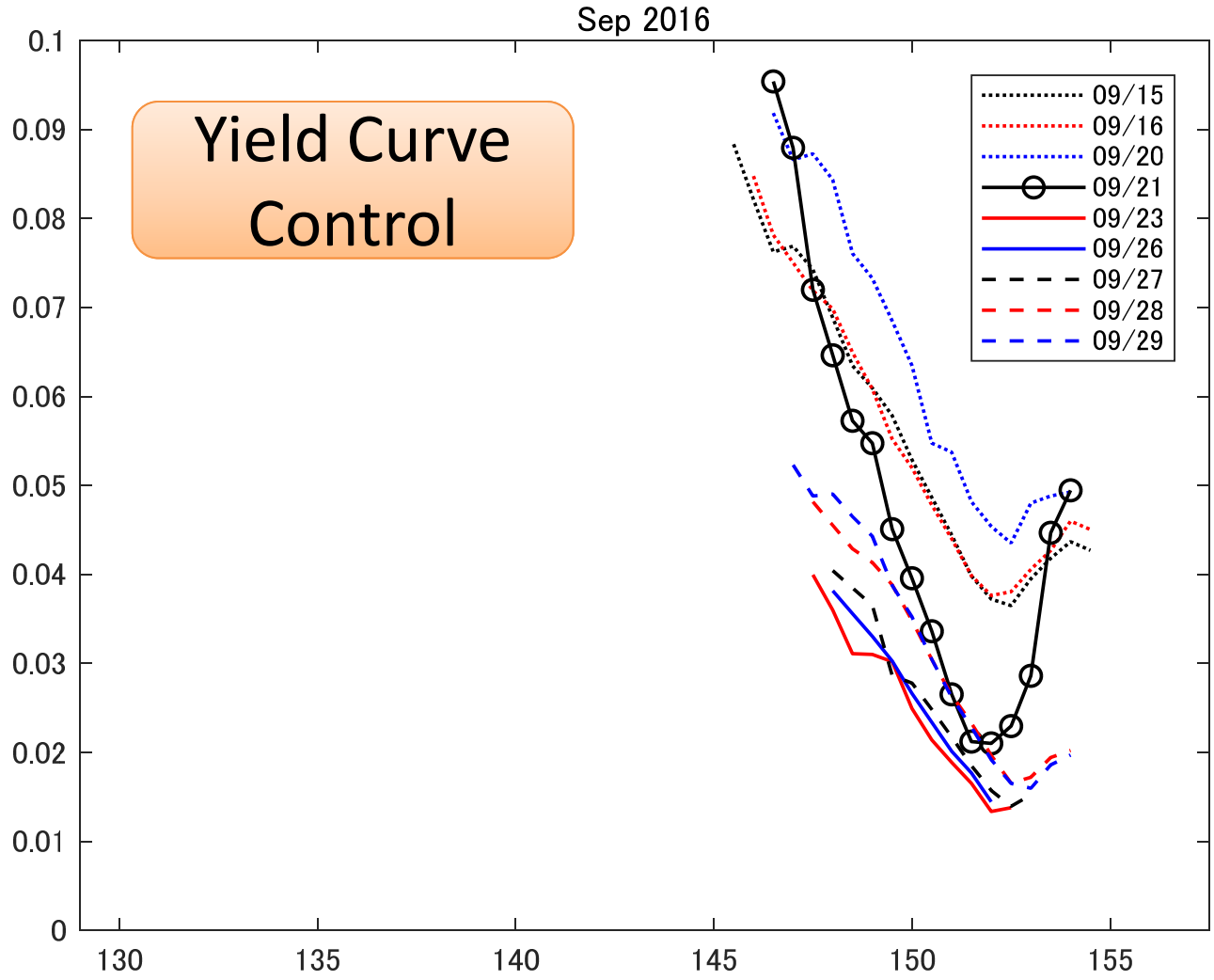
(beginning of July)



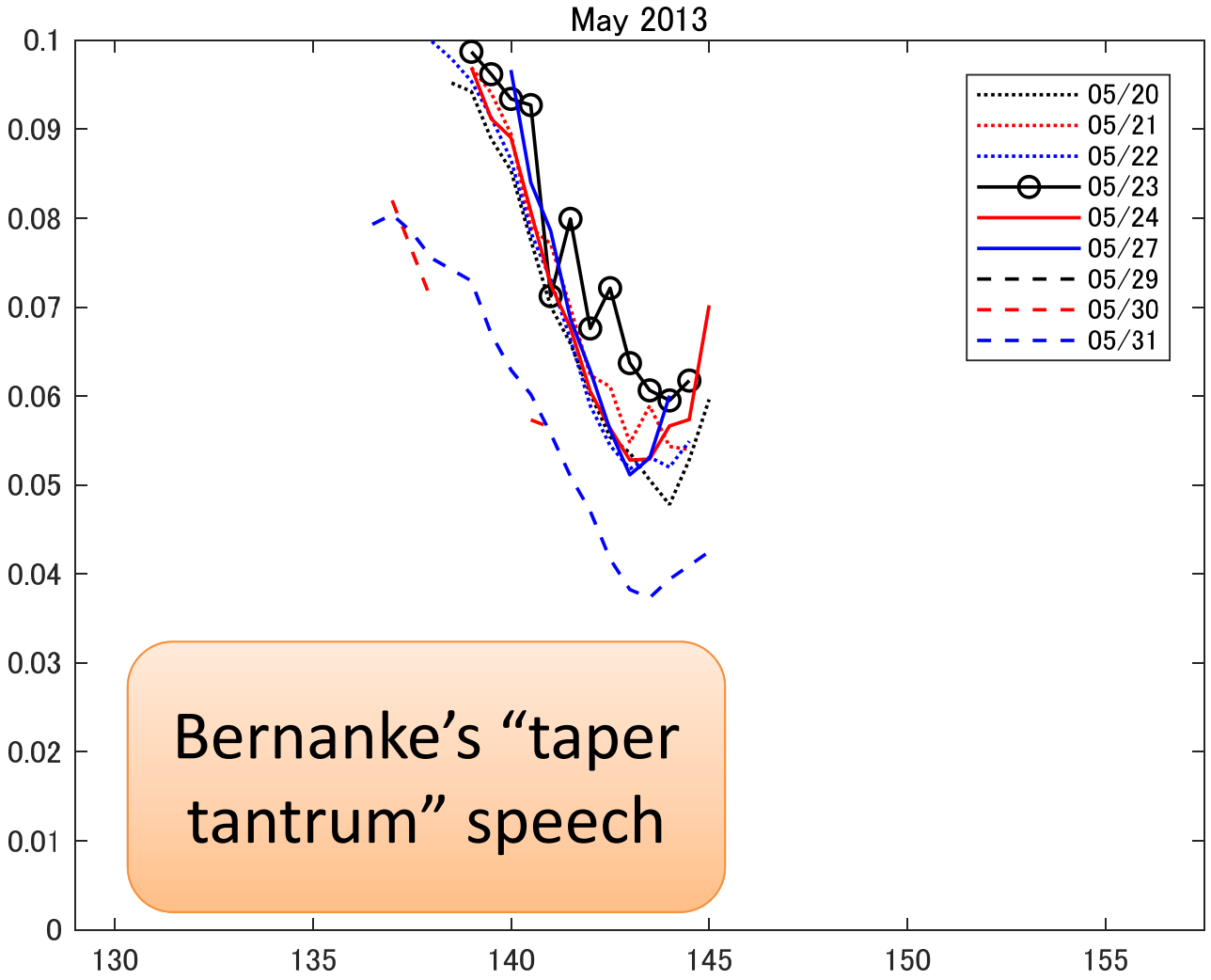
The smile appears quite responsive to major BOJ announcements…



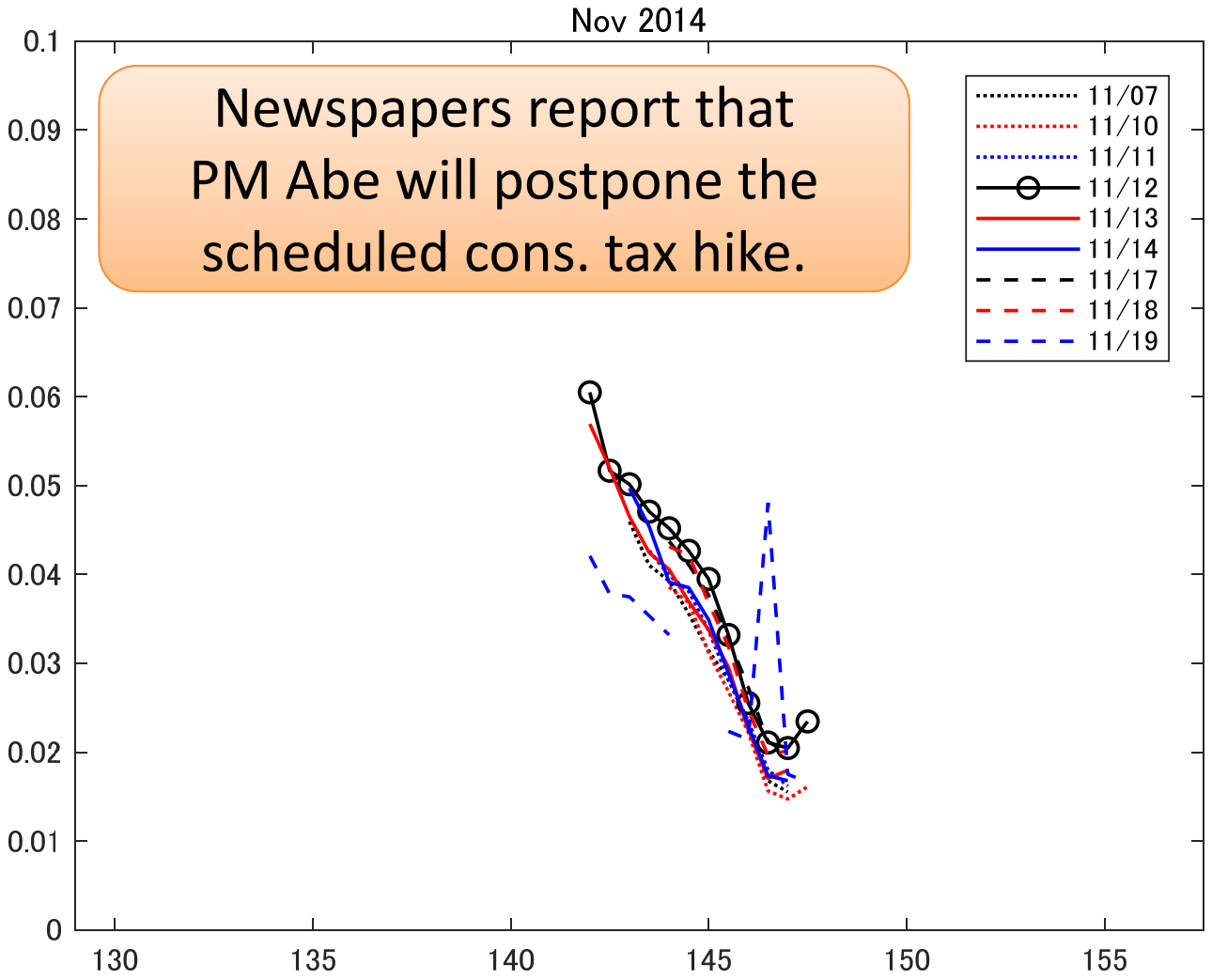

Jan-Feb 2016
Negative Interest Rate
01/26
01/27
01/28
01/29
02/01
02/02
02/03
02/04
02/05
0.1
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0
130
135
140
145
150
155

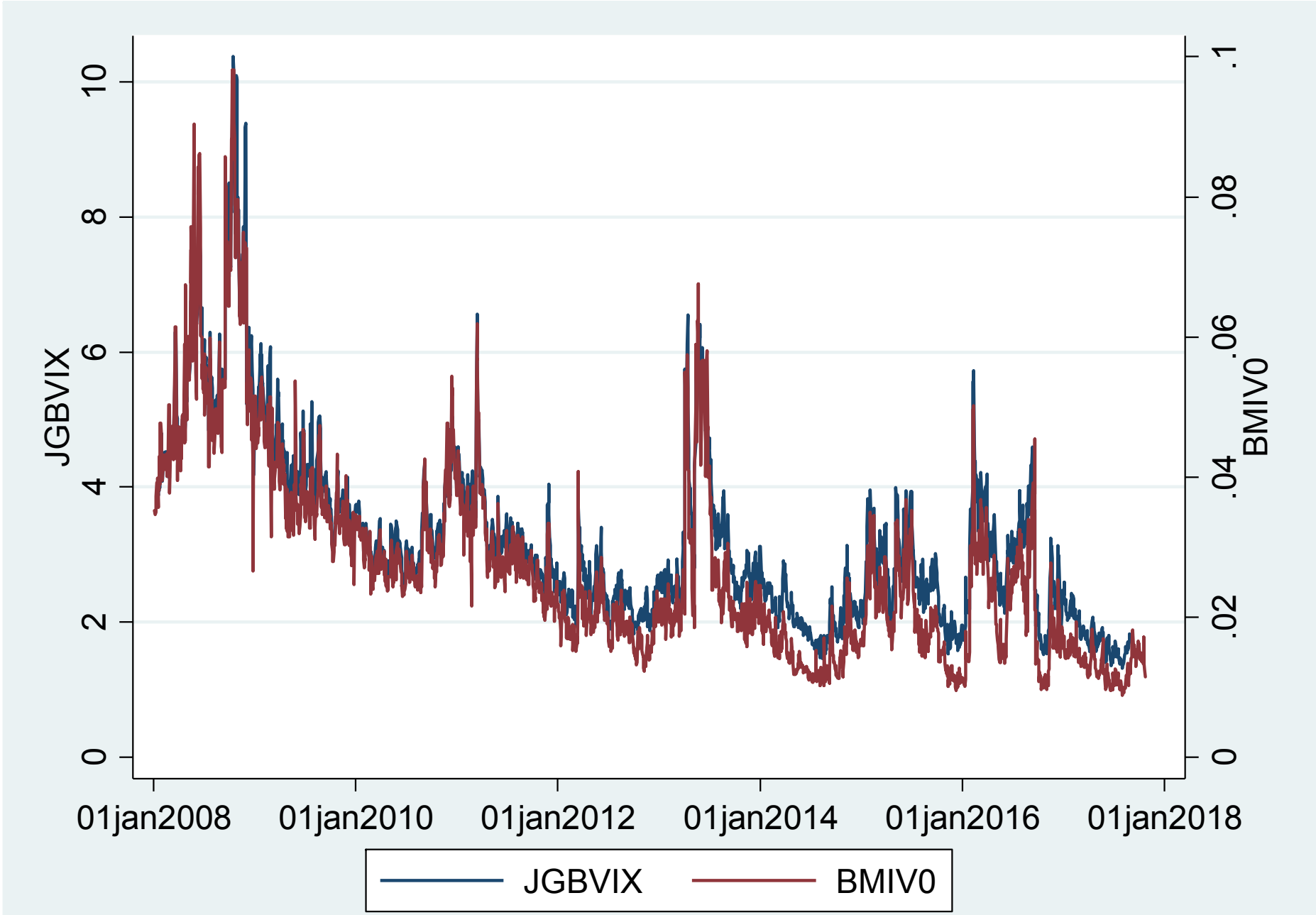

Sep 2016
Yield Curve Control
0.1
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0
130
135
140
145
150
155
09/15
09/16
09/20
09/21
09/23
09/26
09/27
09/28
09/29

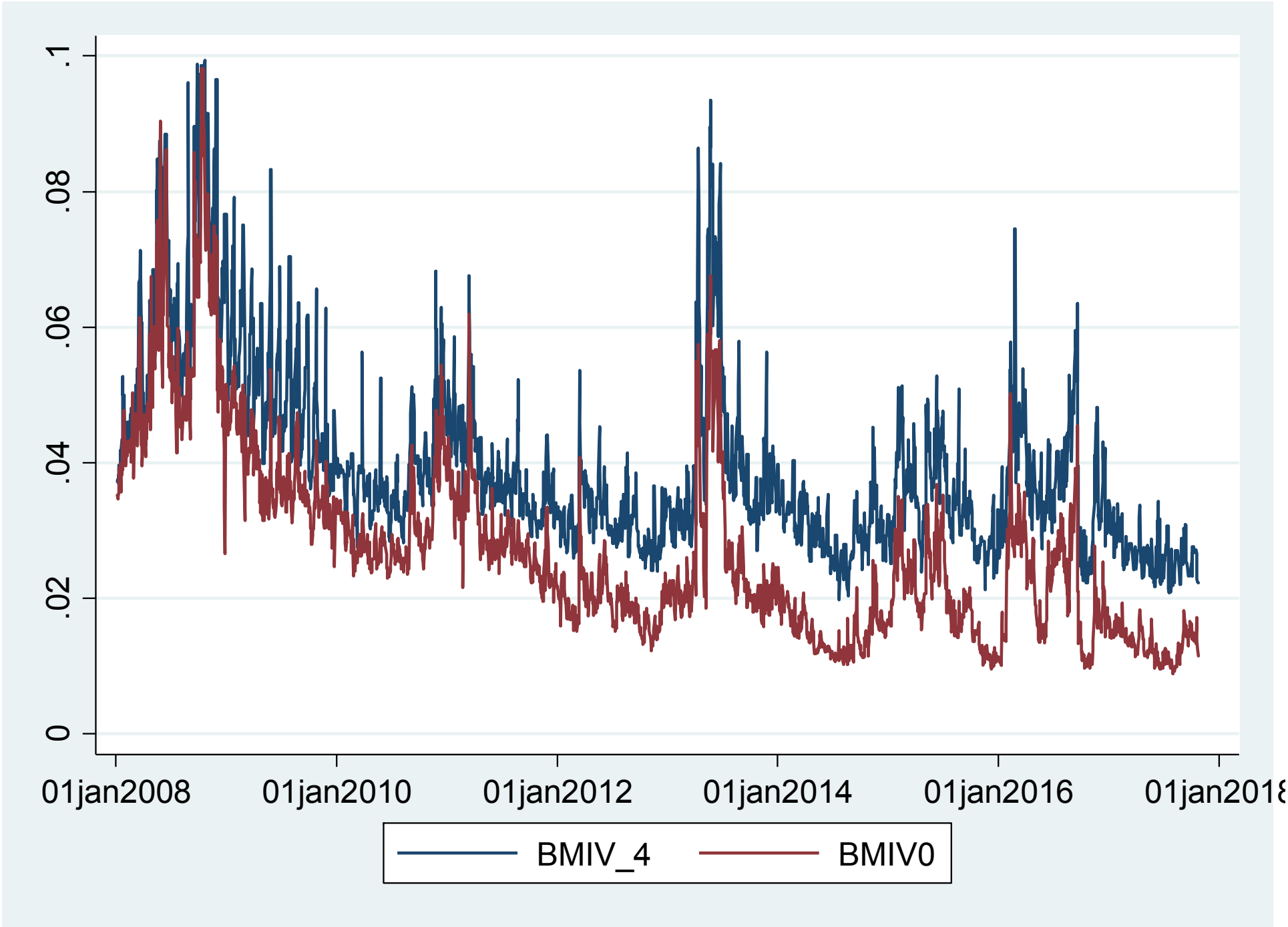
It reacts even to foreign monetary policy…

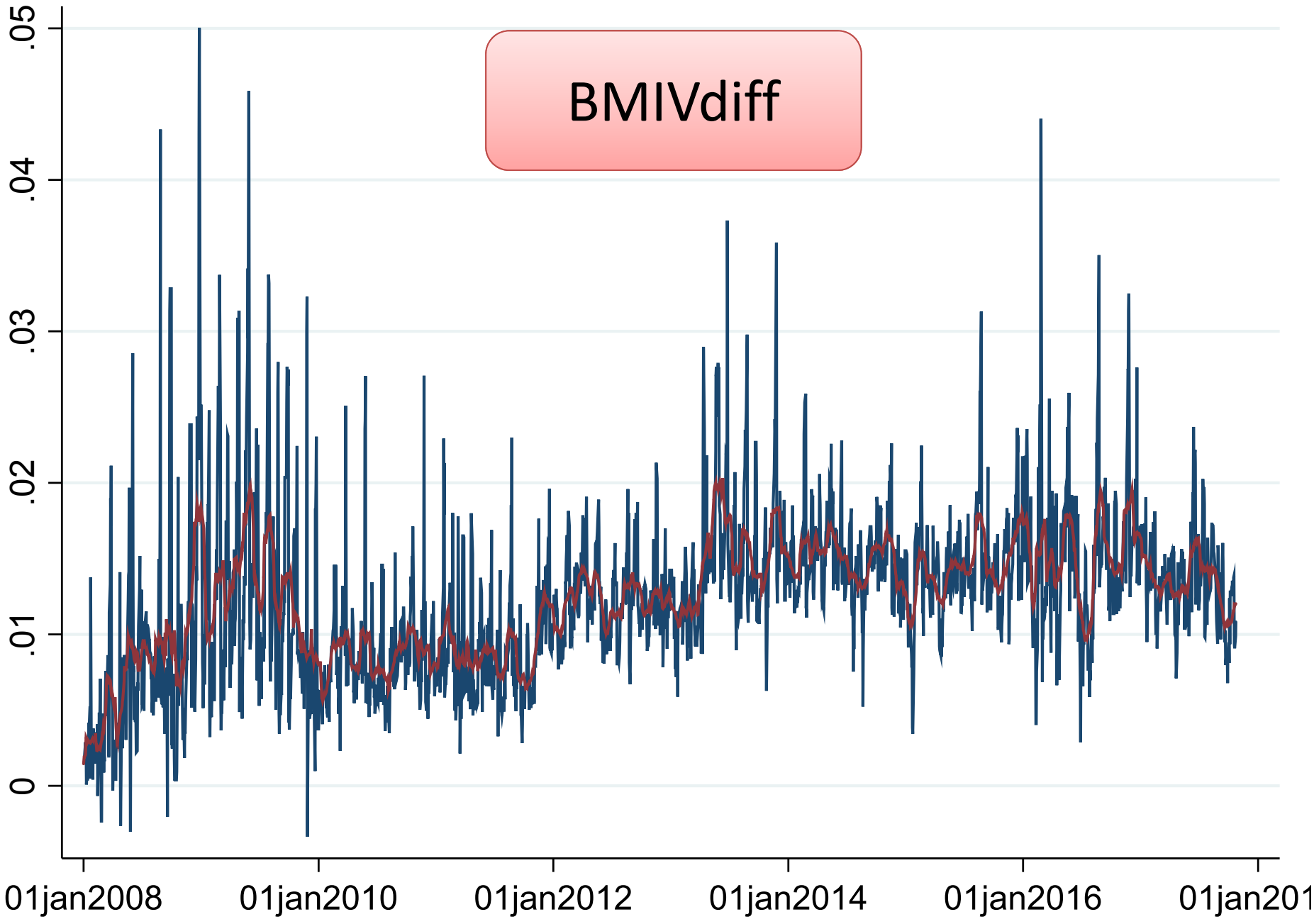


But not so much to fiscal policy news!




JGBVIX
0
2
4
6
8
10
BMIV0
0
.02
.04
.06
.08
.1
01jan2008
01jan2010
01jan2012
01jan2014
01jan2016
01jan2018
JGBVIX
BMIV0


.1
.08
.06
.04
.02
0
01jan2008
01jan2010
01jan2012
01jan2014
01jan2016
01jan2018
BMIV_4
BMIV0


BMIVdiff
.05
.04
.03
.02
.01
0
01jan2008
01jan2010
01jan2012
01jan2014
01jan2016
01jan201

6. Estimation results

Estimation details

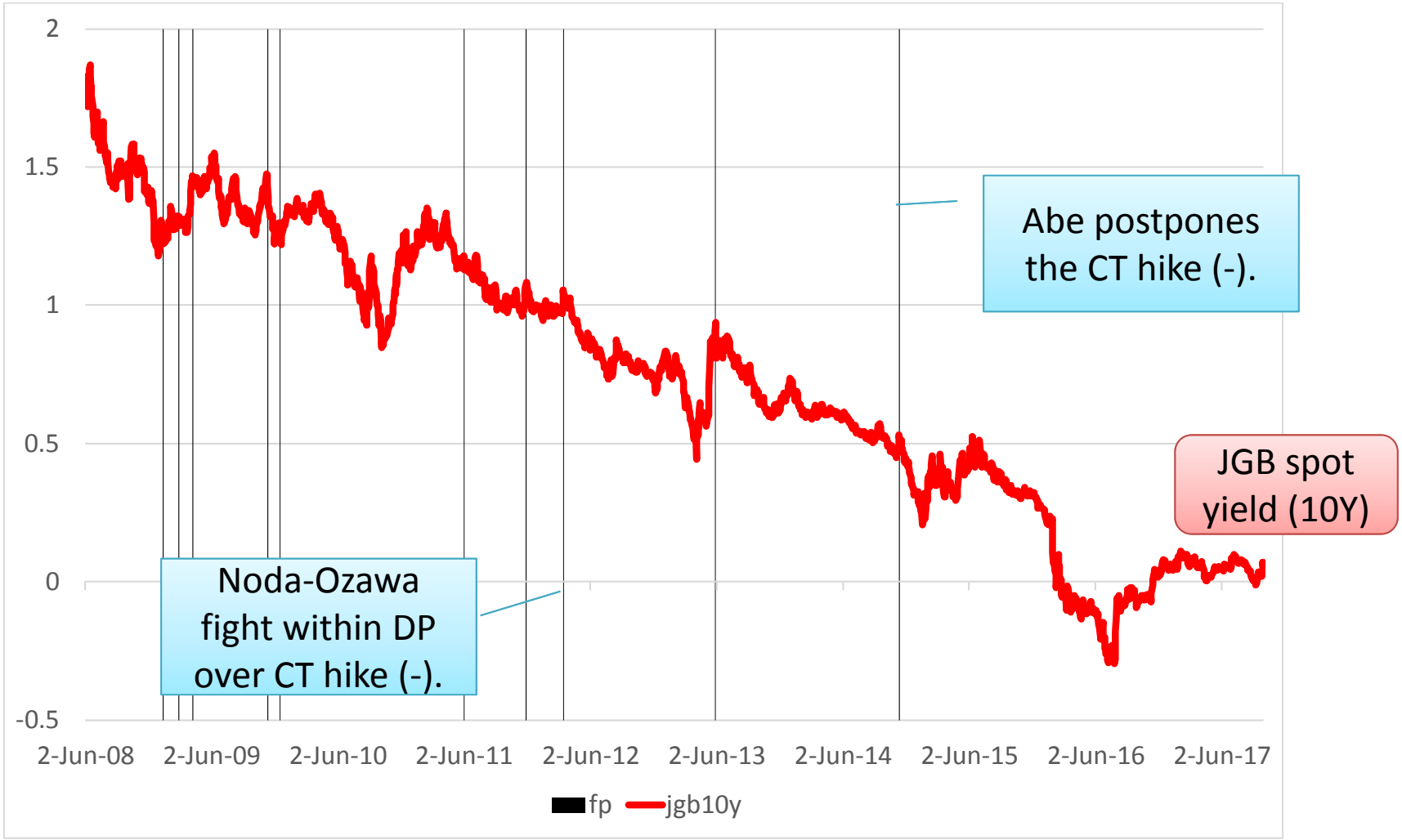
- Method: OLS
- Data frequency: daily (no weekends)
- Sample period: January 2009 - June 2017

Regression 1: LHS = JGB Futures

- LOTS of significant BOJ dummies!
  - March 18, 2009
  - December 1, 2009
  - April 4, 5 and 9, 2013 (**QQE**)
  - January 29, 2016 (**Negative Interest Rate Policy**)
  - September 21, 2016 (**Yield Curve Control**)

- Two Fed dummies appeared significant:
  - May 1, 2013 = FOMC, first sign of tapering
  - May 22, 2013 = Bernanke tapering speech

Significant Fiscal Policy Dummies for JGB Futures



Only ten remained and half of them were during 2009!!

Regression 2-4: LHS = Volatility Measures

- AGAIN, very significant BOJ dummies
  - February 19, 2009 (CP&CB buying extended) (-)
  - December 1, 2009 (SFSO to expire as scheduled) (+)
  - April 4 and 5, 2013 (**QQE**) (- & +)
  - January 29, 2016 (**Negative Interest Rate Policy**) (+)
  - September 21, 2016 (**Yield Curve Control**)(-)

- Some Fed dummies were significant:
  - December 12, 2012 = FOMC, Fed will continue to buy treasuries. (+)
  - May 1, 2013 = FOMC, first sign of tapering (-)
  - May 22, 2013 = Bernanke tapering speech (+)

	(1) JGBVIX		(2) BMIV0		(3) BMIV-4	
lagged dependent variable (lag 1)	0.873	***	0.76836	***	0.66057	***
same (lag 2)	-0.013		0.08234	***	0.04519	*
same (lag 3)	0.077	***	0.05326	**	0.08314	***
US Bond VIX (lag 1)	0.098	***	0.00117	***	0.00076	***
same (lag 2)	-0.037	*	-0.00057	**	0.00019	
same (lag 3)	-0.051	***	-0.00040	**	-0.00082	***
JPY-USD VIX (lag 1)	0.005	**	0.00007	**	0.00016	***
JGB Futures (log diff., lag 1) when positive	35.298	***	0.41384	***	0.67276	***
same, when negative	-18.541	***	-0.36265	***	-0.60415	***
JPY-USD (log diff., lag 1)	0.002		-0.00518		0.01029	
same, squared	122.295	**	1.28032	*	0.45055	
US Bond Futures (log diff., lag 1)	-1.983		-0.04745	***	-0.10576	***
EU Bond Futures (log diff., lag 1)	-5.168	***	-0.05974	**	-0.07239	*
Earthquake March 11, 2011	-0.056		0.00059		0.01293	***
Earthquake March 14, 2011	1.825	***	0.01882	***	0.01010	***
Earthquake March 15, 2011	1.164	***	0.01265	***	0.01120	***
Earthquake March 16, 2011	-0.205		-0.00081		0.00343	
Earthquake March 17, 2011	-0.328	*	-0.00007		-0.00406	
Earthquake March 18, 2011	-0.678	***	-0.00568	**	-0.00497	

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	(1) JGBVIX		(2) BMIV0		(3) BMIV-4	
BOJ February 19, 2009	-0.479	**	-0.00537	**	-0.00253	
BOJ December 2, 2009	-0.601	***	-0.00461	*	-0.00846	**
BOJ April 4, 2013 (QQE)	-0.439	**	-0.00353		-0.00445	
BOJ April 5, 2013 (QQE, the day after)	3.087	***	0.03123	***	0.02853	***
BOJ January 9, 2016 (NIRP)	0.782	***	0.00976	***	0.00800	**
BOJ September 21, 2016 (YCC)	-1.135	***	-0.02115	***	-0.01906	***
FED December 12, 2012 (lag)	0.432	**	0.00496	**	0.00484	
FED May 1, 2013 (lag)	-0.418	**	-0.00426	*	-0.00493	
FED May 22, 2013 (lag)	0.700	***	0.01191	***	0.01554	***
FED June 19, 2013 (lag)	0.227		0.00877	***	0.01037	***

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	(1) JGBVIX		(2) BMIV0		(3) BMIV-4	
Fiscal March 14, 2012	0.666	***	0.00900	***	0.00529	
Fiscal May 28, 2013	0.384	**	0.00266		0.01046	***
Fiscal August 2, 2013	0.329	*	0.00190		0.00630	*
Fiscal November 12, 2014	0.606	***	0.00728	***	0.00644	*
Fiscal November 13, 2014	-0.506	***	-0.00753	***	-0.00706	*
Constant Term	YES		YES		YES	
Dummies to Control for Time to Expiration	NO		YES		YES	
Number of Obs.	**2001**		**1904**		**1893**	
R Square	**0.962**		**0.944**		**0.886**	
Adj. R Square	**0.961**		**0.942**		**0.883**	
Note: * means" p<0.1", ** means "p<0.05", and *** means "p<0.01".						

Regression 5: LHS = BMIVdiff

- Not much significant result!

7. Summary and Work Ahead

Summary

- It is **hard** to find fiscal news that was priced…

- Still, two episodes seem more “hopeful” :
  - In 2011-12: In-fighting within DP over the proposed consumption tax hike.
  - In 2014: Abe postpones a scheduled consumption tax hike.

Possible Venues for Future Research

- Look at a broader range of option prices along the strike price axis, not just “0” and “-4”.
- Refine the news analysis: pick up only “important” news (how??).
- Look at other market indices, such as liquidity of the JGB market or the CDS.

THANK YOU!!

Suggestions welcome!