

The Effects of Quantitative Easing on Interest Rates: Channels and Implications for Policy

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1

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Objective:

Various QE policies have reduced a wide-spectrum of interest rates

- What are the channels through which QE affects rates?

Understanding channels is important:

- Evaluate the effectiveness of a given QE policy
- Conditions when policy may or may not work

Summary:

Variants of policies:

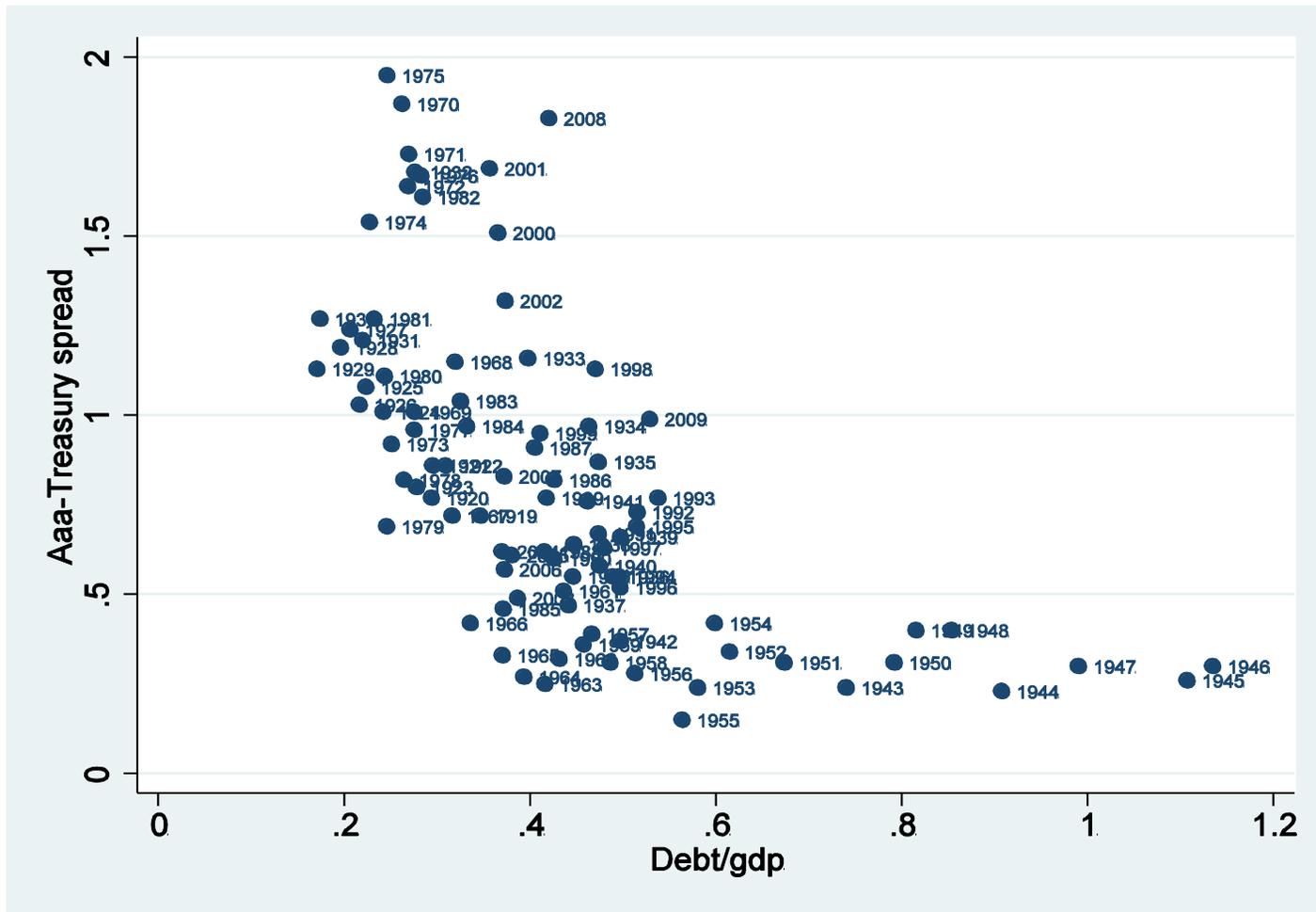
- Purchase long-term Treasuries; Purchase Agency MBS
- Fund by selling short-term Treasuries, or increasing reserve balances

We find:

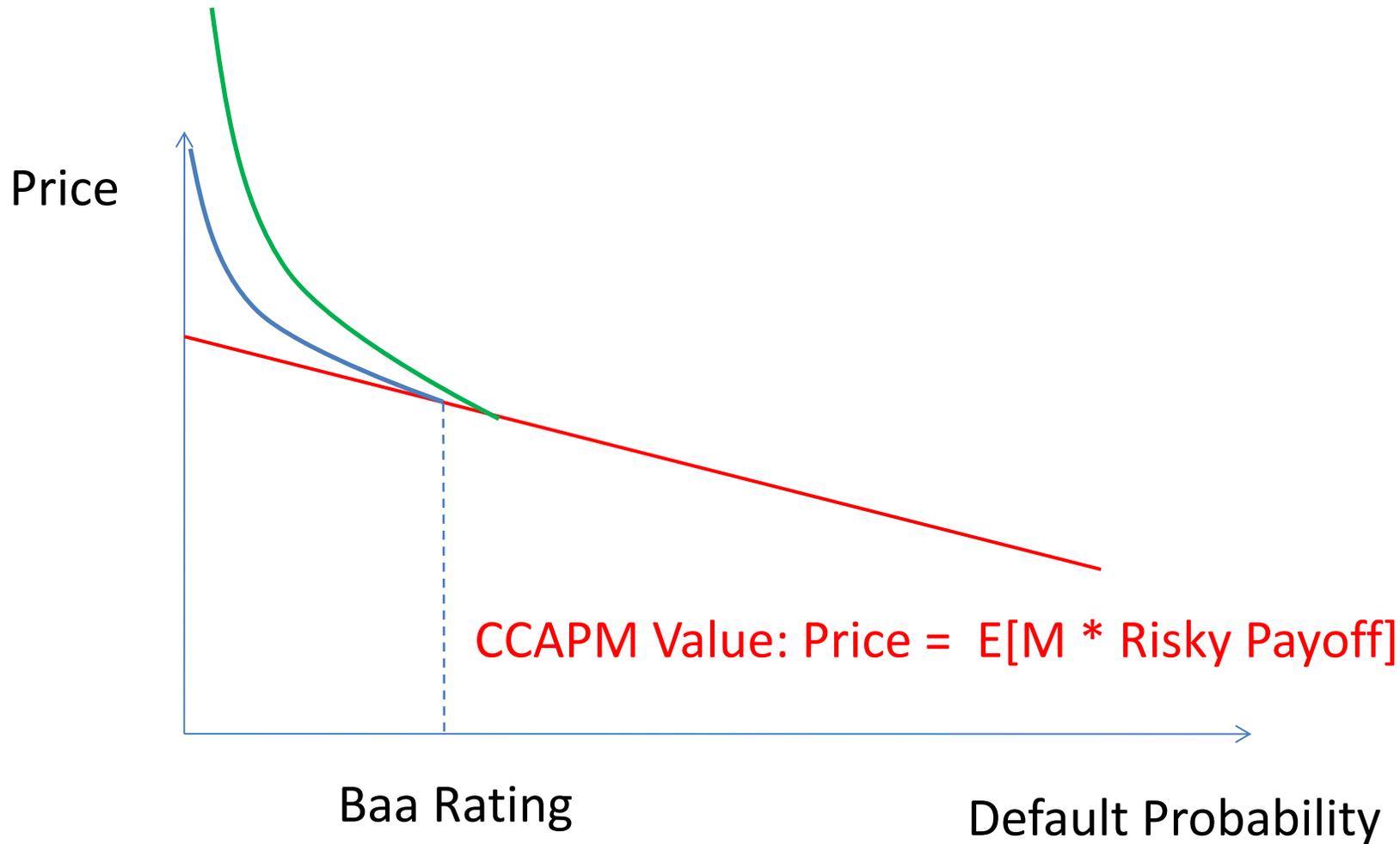
- Purchasing long-term Treasuries has limited benefit, and may even be detrimental
 - “Moneyness” of Treasuries \Rightarrow Contracting money
- Purchasing Agency MBS lowers private borrowing rates
- *Need to be careful in interpreting interest reductions because there are many channels at play.*

“Moneyness” of Treasuries

- Krishnamurthy and Vissing-Jorgensen (*Journal of Political Economy*, 2012): Evidence of a clientele-demand for safe/liquid long-term Treasuries (1925-2009)



Safety premium on bonds with near-zero default risk implies very steep relation between price and expected default rate near zero. Steeper with lower supply of Treasuries.



QE decreases supply of long-term safe assets:

Treasury and agency bonds (agency MBS has significant prepayment risk which means that it is unlikely to meet clientele safety demands)

Predictions:

- i. QE involving Treasuries and agencies lowers the yields on very safe assets
- ii. But limited spillover: has no effects on lower-grade debt such as Baa bonds or bonds with prepayment risk such as MBS.
- iii. *Need to be careful in interpreting the fall in Treasury interest rates!*
- iv. *Also need to be careful in evaluating welfare effects*

Event-study across QE announcement dates

QE1 purchase magnitudes and event dates:

1. November 25, 2008: Initial LSAP announcement
Buy up to \$100B of agency debt, up to \$500B of agency MBS
2. December 1, 2008: Bernanke speech
3. December 16, 2008: FOMC statement
4. January 28, 2009: FOMC statement
Fed may expand agency and agency MBS purchases and is evaluating Treasury purchases
5. March 18, 2009: FOMC statement
Increase agency purchases up to \$200B, agency MBS up to \$1.25T, and buy up to \$300B of longer-term Treasuries.

Purchase of Long-Term Treasuries, Agencies, Agency-MBS

QE2 purchase magnitudes and event dates:

1. August 10, 2010: FOMC statement

"the Committee will keep constant the Federal Reserve's holdings of securities at their current level by reinvesting principal payments from agency debt and agency mortgage-backed securities in longer-term Treasury securities."

Prior to this announcement, market expectations were that the Fed would let its MBS portfolio run off.

2. September 21, 2010: FOMC statement

"maintain its existing policy of reinvesting principal payments"

"The Committee will continue to monitor the economic outlook and financial developments and is prepared to provide additional accommodation if needed to support the economic recovery [...]" (emphasis added)

The “additional” was read by many market participants as indicating new stimulus by the Fed, and particularly an expansion of its purchases of long-term Treasuries (e.g. Goldman Sachs commentary on 9/21/2010).

Purchase of Long-Term Treasuries only

Changes in yields using event-study methodology:

QE1, 2-day changes, sum across 5 event dates

Treasuries yields					Agency yields				Agency MBS	
30 yr	10 yr	5 yr	3 yr	1 yr	30 yr	10 yr	5 yr	3 yr	30 yr	15
-73	-107	-74	-39	-25	-144	-200	-150	-123	-107	-88
Corporate yields										
	Aaa	Aa	A	Baa	Ba	B				
Long	-77	-83	-93	-81	-60	-43				
Intermediate	-88	-93	-92	-76	-82	-130				

QE2, 1-day changes, sum across 2 event dates

Treasuries yields					Agency yields				Agency MBS	
30 yr	10 yr	5 yr	3 yr	1 yr	30 yr	10 yr	5 yr	3 yr	30 yr	15
-9	-18	-17	-8	-1	-9	-17	-17	-10	-9	-12
Corporate yields										
	Aaa	Aa	A	Baa	Ba	B				
Long	-9	-6	-8	-7	-10	-7				
Intermediate	-13	-11	-12	-13	-4	3				

Channels for reductions in interest rates:

(1) “Signaling”: QE signals lowers expected future fed funds rate

Portfolio-balance channels:

(2) Duration risk premium

(3) Prepayment/mortgage specific risk

(4) Liquidity premium

(5) Moneyness/safety of Treasuries

In the interest of time, I will omit discussion of expected inflation effects, effects on inflation uncertainty, credit risk.

(1) Signaling channel:

- QE announcements may have changed market expectations about future short rates (and 12/16/2008, 3/18/2009 statements mention keeping Fed funds rate low).
- **Prediction:** QE signals lower future short rates. This affects all securities of similar duration the same.
- Approach 1 (upper bound): Look at changes in longest Fed Funds futures, assume they apply to all medium and long rates.
- Approach 2: Use schedule of Fed Funds futures to work out how much the Fed funds rate cycle shifted forward in time. Calculate implied effect on each maturity bond.

Table 4. Federal Funds Futures Yield Changes

QE1, 2-day changes, sum across 5 event dates

Fed Funds Futures, Contract Maturity

3rd month	6th month	12th month	24th month
-28	-27	-33	-40

QE2, 1-day changes, sum across 2 event dates

Fed Funds Futures, Contract Maturity

3rd month	6th month	12th month	24th month
0	-1	-4	-11

- Approach 1:

QE1, 2-day: **40 bps** of decline at mat \geq 2 years due to signaling.

QE2, 1-day: **11 bps** of decline at mat \geq 2 years due to signaling.

Figure 3. Yield Curves from Fed Funds Futures, pre- and post QE1 Event Days

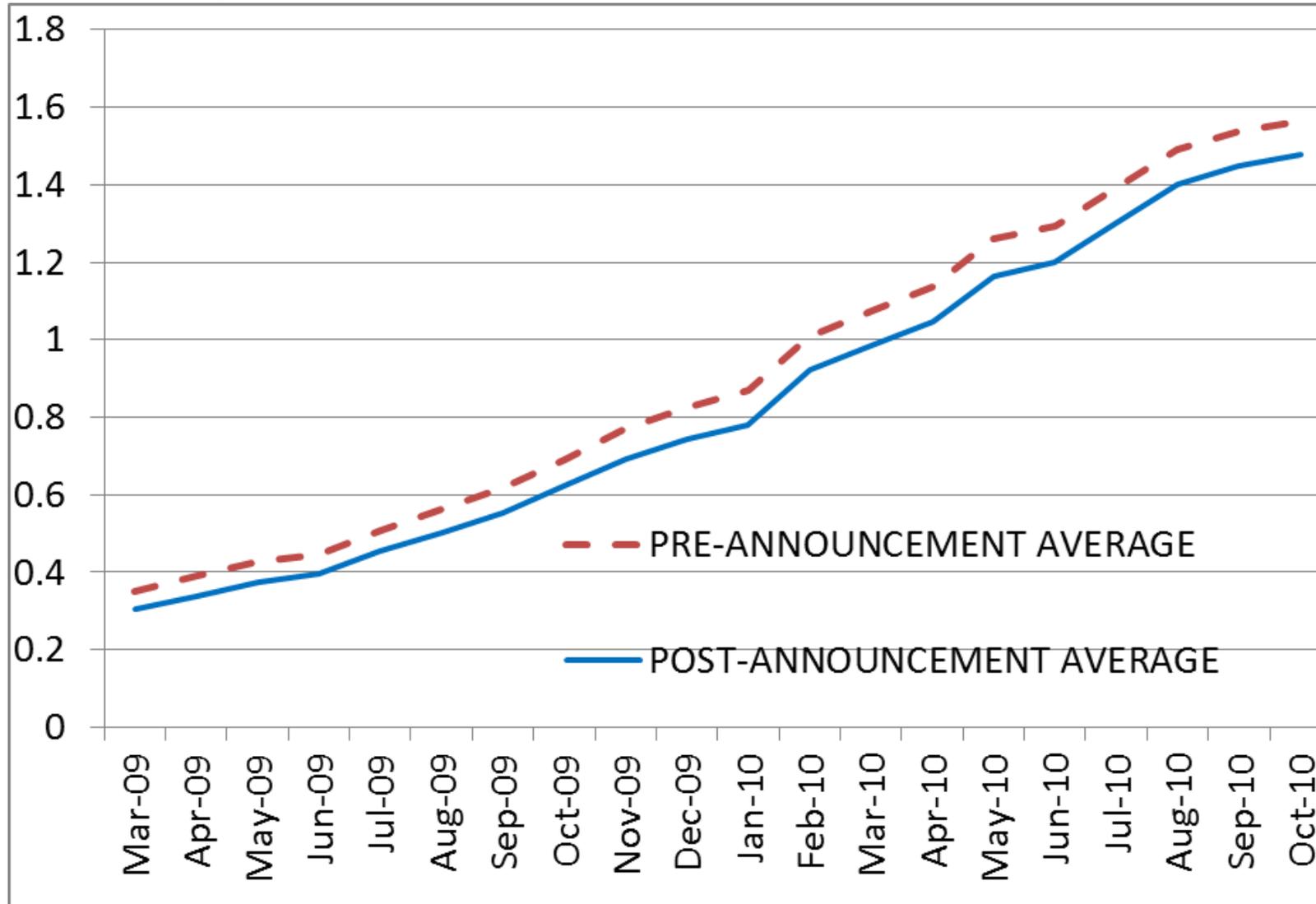
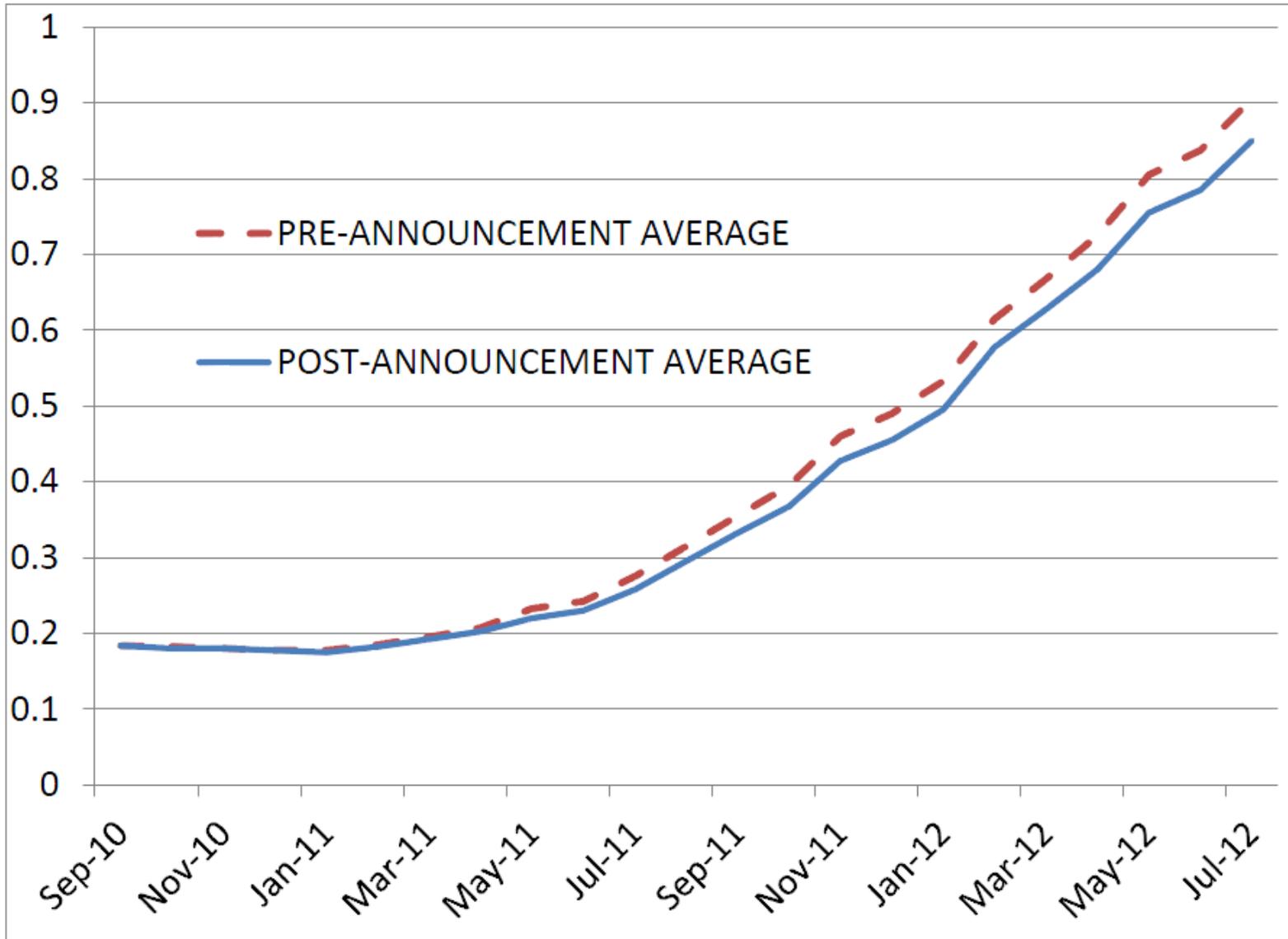


Figure 5. Yield Curves from Fed Funds Futures, pre- and post QE2 Event Days



- Approach 2: Forward shift in rate cycle
 QE1: 6.3 months (evaluated from March 2010 point)
 QE2: 3.2 months (evaluated from July 2012 point)

Implied change in rates: Expectations term for a T-year bond:

$$E[i_T] = \frac{1}{T} \int_{t=0}^T i_t^{ff} dt,$$

Suppose that QE policy signals: Rate is going to be held at $i_{0,prior}^{ff}$ for the next X months, and thereafter follow the path indicated by $i_{t,prior}^{ff}$ (i.e. shift rate hike cycle later by X months).

$$\Delta E[i_T] = \frac{1}{T} \int_{t=T-X/12}^T (i_{0,prior}^{ff} - i_{t,prior}^{ff}) dt.$$

Use $i_{t,prior}^{ff} = 4\%$ for 10- and 30-year bonds

Use $i_{t,prior}^{ff} = 3.5\%$ for 5-year bonds

QE1 signaling effects:

35 bps for 5-yr bond, **20 bps** for 10-yr bond, **7 bps** for 30-yr bond

QE2 signaling effects using 3.2 months:

18 bps for 5-yr bond, **12 bps** for 10-yr bond, **4 bps** for 30-yr bond

- Benchmark numbers to keep in mind:

QE1: 35 bps

QE2: 10 bps

(2) Duration risk premium channel:

- In QE, government is buying long-duration assets from private sector → Reduction in market price of duration risk.
- **Predictions:**
 - i. QE decreases yields on all long-term nominal assets, including Treasuries, corporate bonds, and mortgages.
 - ii. The effects are larger effects for longer duration assets.
- Is there spillover? Pre-payment risk premium reduction affects long MBS more (not for QE2).
- So use corporate bonds to isolate duration risk channel. Adjust yield changes for CDS changes (i.e. macro default risk changes) +signaling.

QE1, 2-day changes

Corporate yields						
	Aaa	Aa	A	Baa	Ba	B
Long	-77	-83	-93	-81	-60	-43
Intermediate	-88	-93	-92	-76	-82	-130
Credit default swaps						
	Aaa	Aa	A	Baa	Ba	B
10 yr	-7	-14	-32	-40	-78	-1354
5 yr	-6	-17	-33	-51	-98	-991
Corporate yields, minus effect of CDS						
	Aaa	Aa	A	Baa	Ba	B
Long	-70	-69	-61	-41	18	1311
Intermediate	-82	-76	-59	-25	16	861

QE2, 1-day changes

Corporate yields						
	Aaa	Aa	A	Baa	Ba	B
Long	-9	-6	-8	-7	-10	-7
Intermediate	-13	-11	-12	-13	-4	3
Credit default swaps						
	Aaa	Aa	A	Baa	Ba	B
10 yr	2	2	2	2	6	8
5 yr	0	4	3	4	9	13
Corporate yields, minus effect of CDS						
	Aaa	Aa	A	Baa	Ba	B
Long	-11	-8	-10	-9	-16	-15
Intermediate	-13	-15	-15	-17	-13	-10

QE1: No evidence of duration risk premium effect

- No change in CDS-adj. yields of Baa and lower, beyond signaling
- Intermediate > Long for corporates
- *Also, in other tables, 30 year > 10 year for all types of bonds.*

QE1, 2-day changes

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5 yr	0	4	3	4	9	13
Corporate yields, minus effect of CDS						
	Aaa	Aa	A	Baa	Ba	B
Long	-11	-8	-10	-9	-16	-15
Intermediate	-13	-15	-15	-17	-13	-10

QE2: No clear evidence of duration risk premium effect

- CDS-adj. yields of Baa and lower bonds down and MBS down by about the amount of the signaling effect
- Intermediate > Long

(3) MBS prepayment risk premium channel:

- Gabaix, Krishnamurthy, and Vigneron (2007) present theory and evidence that mortgage prepayment risk carries a positive risk premium.
- Requires pre-payment risk to be borne by subset of investors to get substantial effects (segmented MBS market).
- **Predictions:**
 - i. In QE1 MBS rates fall by more than the signaling effect
 - ii. In QE2, which does not involve MBS purchases, MBS rates fall only by the signaling effect.

QE1, 2-day changes, sum across 5 event dates

Treasuries yields					Agency yields				Agency MBS		
30 yr	10 yr	5 yr	3 yr	1 yr	30 yr	10 yr	5 yr	3 yr	30 yr	15	
-73	-107	-74	-39	-25	-144	-200	-150	-123	-107	-88	
Corporate yields											
	Aaa	Aa	A	Baa	Ba	B					
Long	-77	-83	-93	-81	-60	-43					
Intermediate	-88	-93	-92	-76	-82	-130					

QE2, 1-day changes, sum across 2 event dates

Treasuries yields					Agency yields				Agency MBS		
30 yr	10 yr	5 yr	3 yr	1 yr	30 yr	10 yr	5 yr	3 yr	30 yr	15	
-9	-18	-17	-8	-1	-9	-17	-17	-10	-9	-12	
Corporate yields											
	Aaa	Aa	A	Baa	Ba	B					
Long	-9	-6	-8	-7	-10	-7					
Intermediate	-13	-11	-12	-13	-4	3					

QE1: Excess of 35bps (signaling) = prepayment risk effect

QE2: Prepayment risk premium channel is zero, as expected. Signaling of 10bps fully accounts for effects.

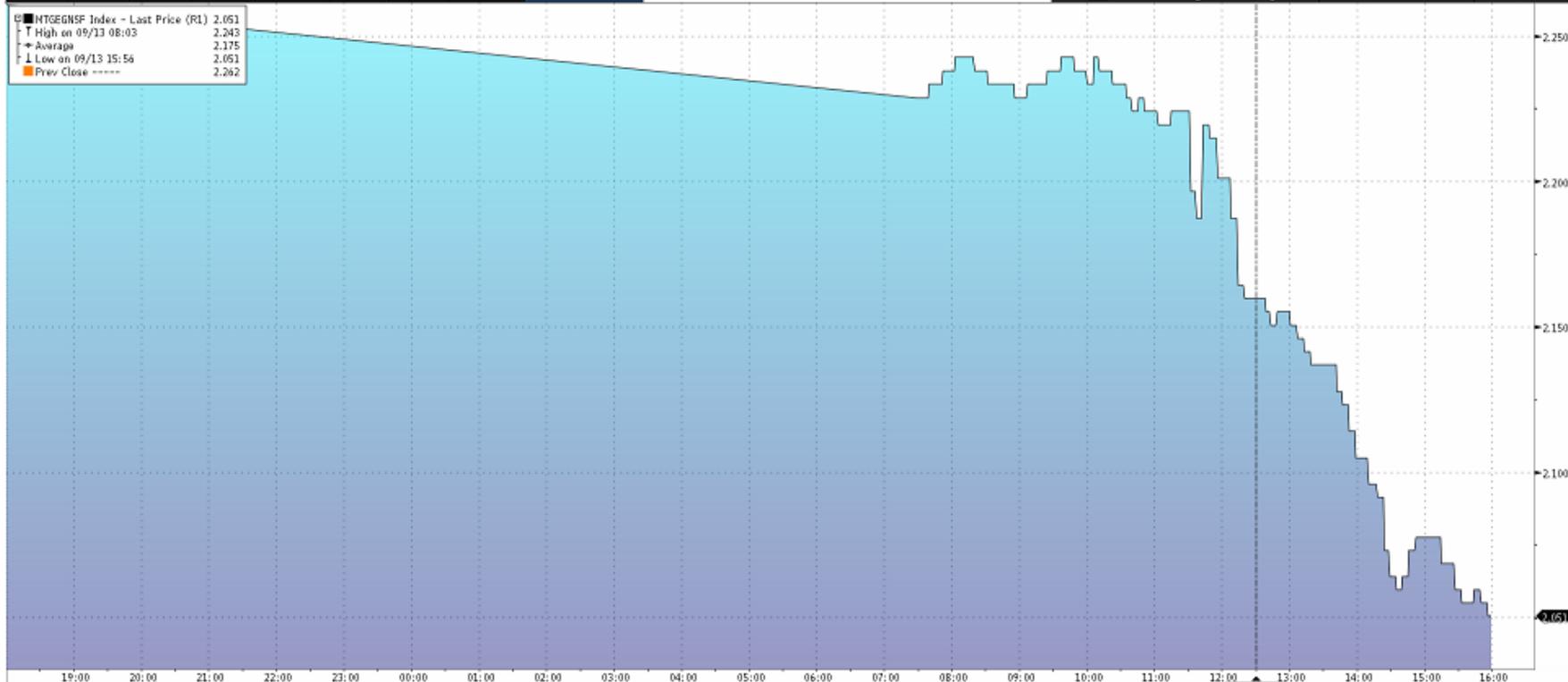
More on prepayment risk channel: 9/21/2011 GNMA 30yr



Asset	One-day change in Yield
1-year Treasury	+2 basis points (bps)
3-year Treasury	+7 bps
7-year Treasury	-3 bps
10-year Treasury	-7 bps
15-year MBS	-7 bps
30-year MBS	-23 bps

Source: Federal Reserve, Bloomberg (MBS is average of current coupon of GNMA, FNMA, FHLMC).

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 At 16:00 Op 2.229 Hi 2.243 Lo 2.051 Prev 2.262
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 1D 3D 1M 6M YTD 1Y 5Y Max 1 Min Security/Study Event



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 Japan 81 3 3201 8900 Singapore 65 6212 1000 U.S. 1 212 318 2000
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9/13/2012: GNMA 30 year

(4) Liquidity channel:

- QE involves purchasing long-term securities and paying by increasing reserve balances which are likely more liquid → Reduction in price premium of liquid assets (yield increase).
- **Prediction: The liquidity effect raises yields on liquid assets**

QE1, 2-day changes, sum across 5 event dates

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30 yr	10 yr	5 yr	3 yr	1 yr	30 yr	10 yr	5 yr	3 yr	30 yr	15	
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QE2, 1-day changes, sum across 2 event dates

Treasuries yields					Agency yields				Agency MBS		
30 yr	10 yr	5 yr	3 yr	1 yr	30 yr	10 yr	5 yr	3 yr	30 yr	15	
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QE1: Strong liquidity effect. Yields on Treasuries (more liquid) fall less than yields on agencies (less liquid). 10 yr Agency-Treasury spread falls $200-107=93$ bps

QE2: No liquidity effect – but markets are much more liquid

(5) Moneyness/safety of Treasuries

- QE decreases supply of long-term safe assets: Treasury and agency bonds (agency MBS has significant prepayment risk which means that it is unlikely to meet clientele safety demands)
- **Predictions:**
 - v. Safety-channel implies that QE involving Treasuries and agencies lowers the yields on very safe assets
 - vi. Safety-channel has no effects on lower-grade debt such as Baa bonds or bonds with prepayment risk such as MBS.

Best place to isolate this effect: Agency bonds - these are affected by signaling, but not pre-payment risk (we tabulate non-callable agency bonds), or default (was taken over by govt. pre-QE1).

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Agency yield reduction due to safety effect (netting out signaling):

QE1:

At least 200 bps-35 bps=**165 bps** for the 10 yr agency

At least 150 bps-35 bps=**115 bps** for the 5 yr agency

QE2:

At least 17 bps-12 bps=**5 bps** for the 10 yr agency

At least 17 bps-18 bps=**-1 bps** for the 5 yr agency

- Effect also for Treasuries, but these are also affected by liquidity issues (working in the opposite direction)
- QE1 evidence for corporate bonds also consistent with a **safety-effect for higher-grade corporate bonds**. Aaa, Aa and A-rated bonds CDS-adjusted fall by about 75 bps, i.e. more than can be explained by signaling, and more than for lower-grade corporates.

Summary:

Signaling channel: For all bonds

- QE1: 20-40 bps at the 10 yr horizon, 35-40 bps at 5 yr horizon
- QE2: 8-12 bps at the 10 yr horizon, 11-18 bps at 5 yr horizon

Duration risk premium channel: Doesn't seem important

Pre-payment risk premium channel: For MBS

- QE1: At least 48 bps for the 15 yr MBS, 67 bps for the 30 yr MBS.
- QE2: Pre-payment risk premium channel is zero, as expected.

31

Moneyness/Safety channel: For agencies and Treasuries

- QE1: At least 165 bps for the 10 yrs, 115 bps for the 5 yrs
- QE2: At least 5 bps for the 10 yrs, 0 bps for the 5 yrs

Inflation channel:

- QE1: 10-year expected inflation up 96-146 bps
- QE2: 10-year expected inflation up 5-16 bps

Policy implications:

(1) It matters what you buy

- MBS purchases in QE1 crucial for lowering MBS rates and likely driver of lower corporate credit risk and thus corporate yields.
- We have examined other QE involving MBS and have found similar effects
- Treasuries-only QE in QE2 has disproportionate effect on Treasuries and agencies relative to MBS and corporates.

(2) Treasury effect may be detrimental

- We think the world is one where Treasury rates are low because of a global scarcity of safe assets
- Treasury rates are not true “riskless” benchmark rates; they are lower because of moneyness/safety demand
- Friedman rule
 - *Social cost of money creation = 0 = opportunity cost*
 - Provide more of the scarce Treasuries
 - Long-term Treasuries have high premia compared to Treasury bills
 - Optimal policy is reverse of the Fed’s Treasury QE

(3) Signaling played a non-negligible role

- So perhaps some of the QE effect may have been achievable through forward guidance, without balance sheet risk.