

Economics 210c/236a  
Fall 2011

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# LECTURE 9

## The Effects of Quantitative Easing



October 26, 2011

# Channels of Monetary Policy Transmission

- Expectations of future output growth and inflation.
- Nominal interest rates not yet at zero.
- The real exchange rate (and expectations about the real exchange rate).
- Asset prices and the extent of credit-market imperfections.

# Tools of Monetary Policy at the Zero Lower Bound

- Communication about future path of safe short-term interest rate (or of supply of high-powered money).
- Communication about objectives, or the formal adoption of new objectives.
- Communication about the channels of monetary policy (such as the exchange rate or future output).
- Purchases of assets other than short-term government debt.

# What do we mean by quantitative easing?

- Originally used to mean continued conventional open market operations (buying short-term government debt to increase reserves) at the zero nominal bound.
- Now used to mean unconventional OMO at the ZLB, such as buying long-term government bonds, MBS, or other assets.

I. CHRISTINA ROMER, “WHAT ENDED THE GREAT  
DEPRESSION?”

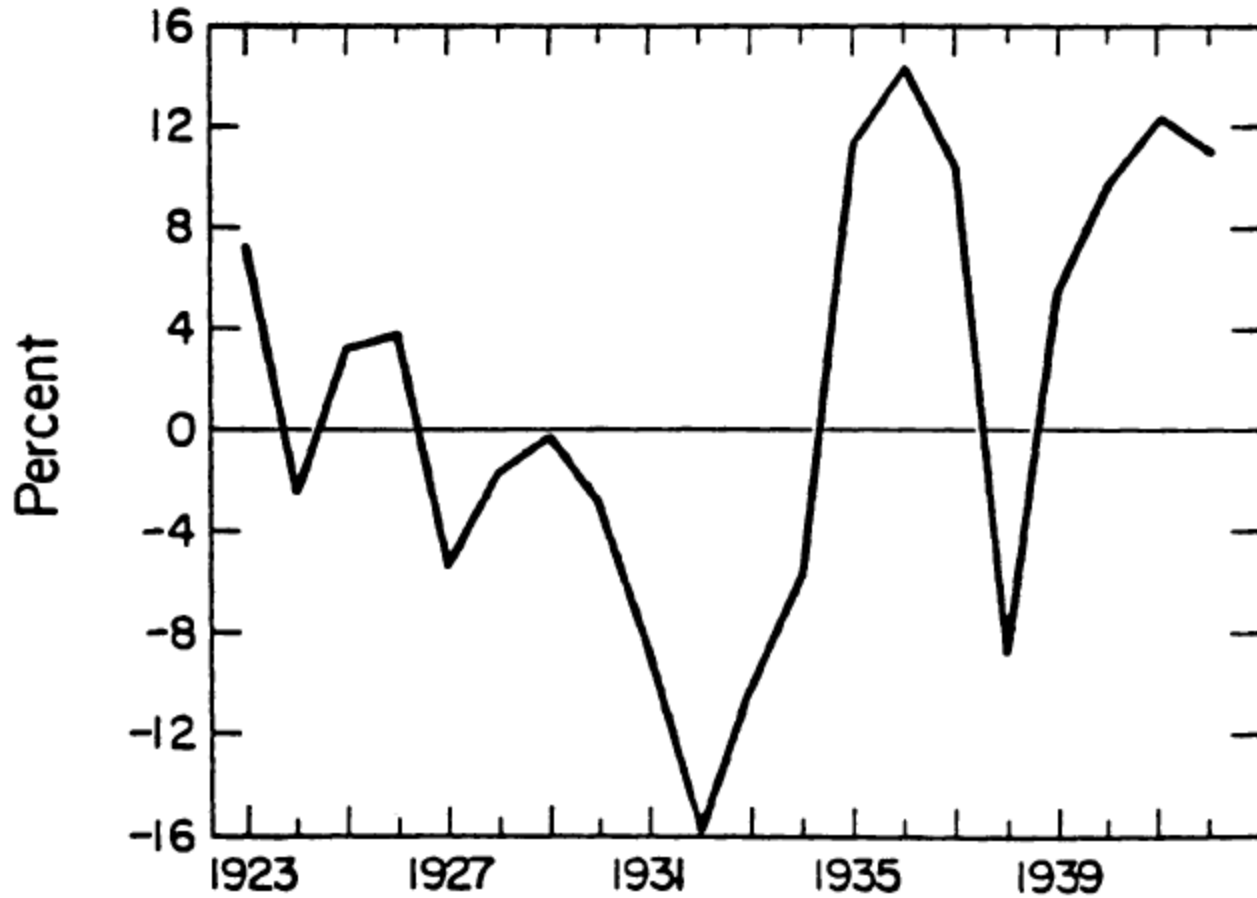
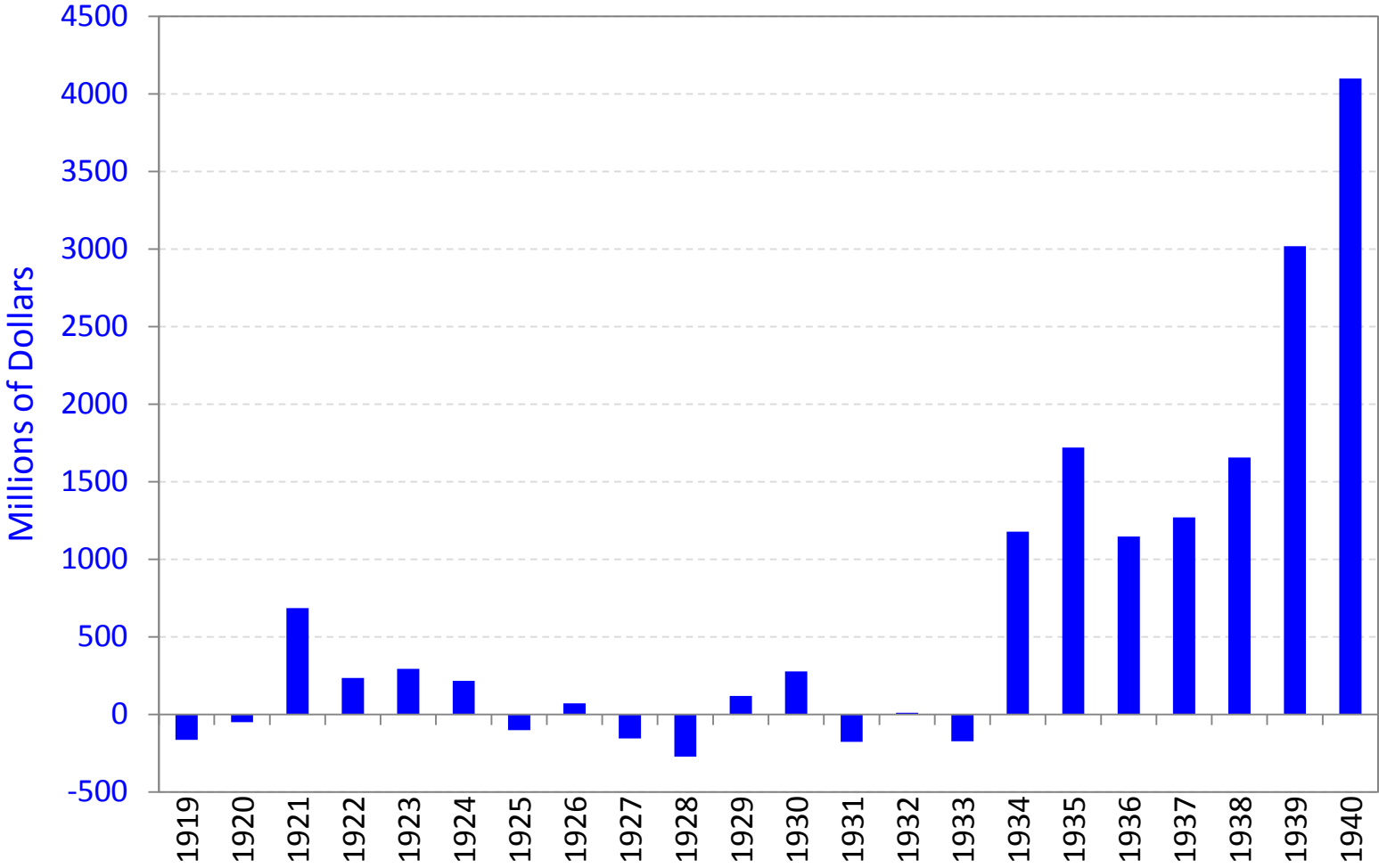


FIGURE 6

DEVIATIONS OF MONEY GROWTH RATE FROM NORMAL, 1923-1942

# Gold Inflows to the U.S.



## Can think of Roosevelt as doing QE

- Bought gold and put currency and reserves into circulation.
- Replenished the government's account using gold certificates.



Did Roosevelt's QE increase expected inflation  
and lower real interest rates?

# Mishkin Method of Estimating Ex Ante Real Rate

## Ex Post Real Rate:

$$r^{\text{ep}}_t = i_t - \pi_t$$

where  $i$  is the nominal rate and  $\pi$  is actual inflation.

## Ex Ante Real Rate:

$$r^{\text{ea}}_t = i_t - \pi^e_t$$

Where  $\pi^e$  is expected inflation.

The difference between  $r^{ep}$  and  $r^{ea}$  is unanticipated inflation ( $\varepsilon_t$ ):

$$r^{ep}_t = (i_t - \pi_t) + (\pi_t^e - \pi_t^e)$$

$$r^{ep}_t = (i_t - \pi_t^e) - (\pi_t - \pi_t^e)$$

$$= r^{ea}_t - \varepsilon_t$$

- Under rational expectations, expectation of unanticipated inflation at a point in time is zero.
- You can't expect to be surprised.

Think of constructing estimate of  $\pi^e$ :

$$\pi_t^e = \alpha i_t + \beta' X_t$$

where  $X$  is a vector of information known at time  $t$ .

$$r_t^{\text{ep}} = i_t - (\alpha i_t + \beta' X_t) + \varepsilon_t$$

$$r_t^{\text{ep}} = (1 - \alpha)i_t - \beta' X_t + \varepsilon_t$$

Regress  $r^{\text{ep}}$  on  $i$ , and other explanatory variables known at time  $t$ .

Fitted values are estimates of  $r^{\text{ea}}$ .

TABLE 2  
REGRESSION USED TO ESTIMATE EX ANTE REAL INTEREST RATES

Explanatory Variable	Coefficient	T-Statistic
<b>Monetary Policy Variable</b>		
Lag 0	0.044	0.29
Lag 1	-0.463	-3.02
Lag 2	0.182	1.09
Lag 3	-0.196	-1.20
Lag 4	0.352	2.30
<b>Nominal Commercial Paper Rate</b>		
Lag 0	0.834	0.25
Lag 1	0.191	0.04
Lag 2	1.181	0.22
Lag 3	0.954	0.18
Lag 4	-1.079	-0.32
<b>Inflation Rate</b>		
Lag 0	-0.396	-2.54
Lag 1	0.129	0.81
Lag 2	-0.014	-0.09
Lag 3	0.111	0.72
Lag 4	-0.031	-0.21
<b>Change in Industrial Production</b>		
Lag 0	-0.026	-0.47
Lag 1	0.045	0.78
Lag 2	-0.120	-2.00
Lag 3	0.012	0.22
Lag 4	-0.036	-0.67
<b>Quarterly Dummy Variables</b>		
Quarter 2	1.497	0.27
Quarter 3	-6.961	-1.76
Quarter 4	5.271	0.97
Constant	-1.804	-0.44

*Notes:* The dependent variable is the quarterly ex post real interest rate. The sample period used in the estimation is 1923:1 to 1942:2. The  $R^2$  of the regression is .52.

*Source:* See the text.

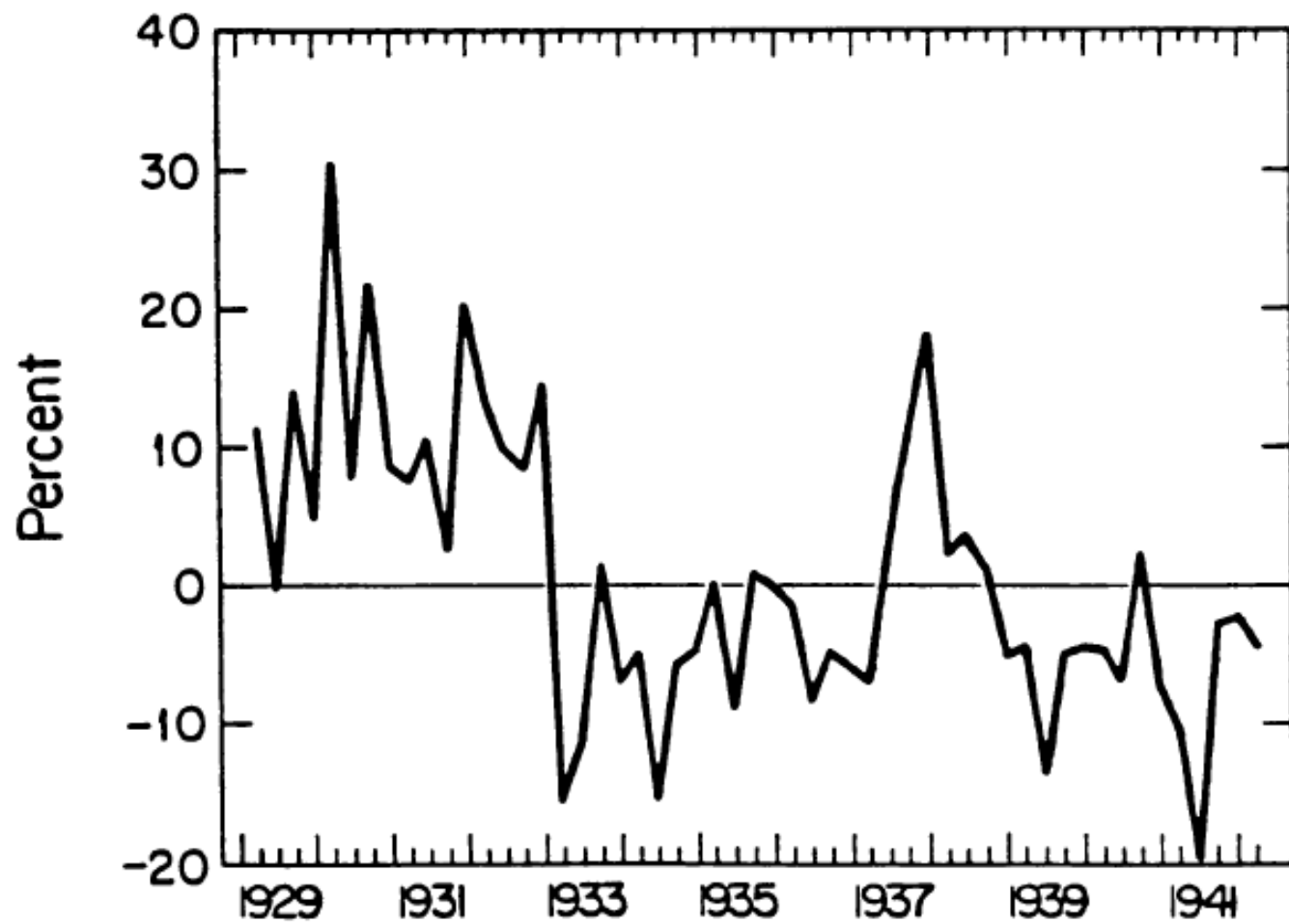


FIGURE 8

EX ANTE REAL COMMERCIAL PAPER RATES, 1929-1942

## How could we do this analysis better?

- Think harder about the empirical specification and the link to money growth.
- Narrative evidence.
- Event studies.

Did lower real rates stimulate the economy?



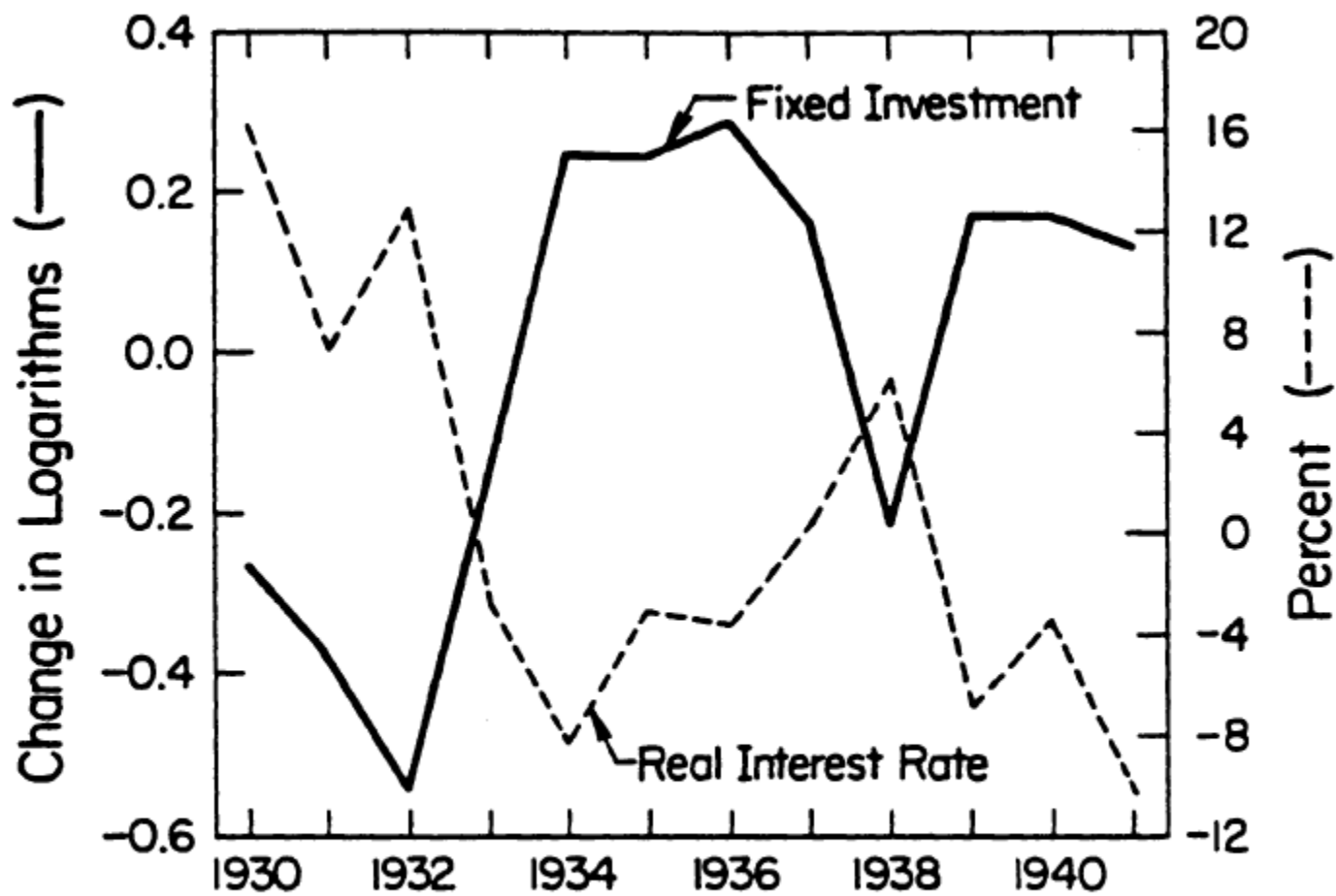


FIGURE 9

REAL FIXED INVESTMENT AND EX ANTE REAL RATES, 1930-1941

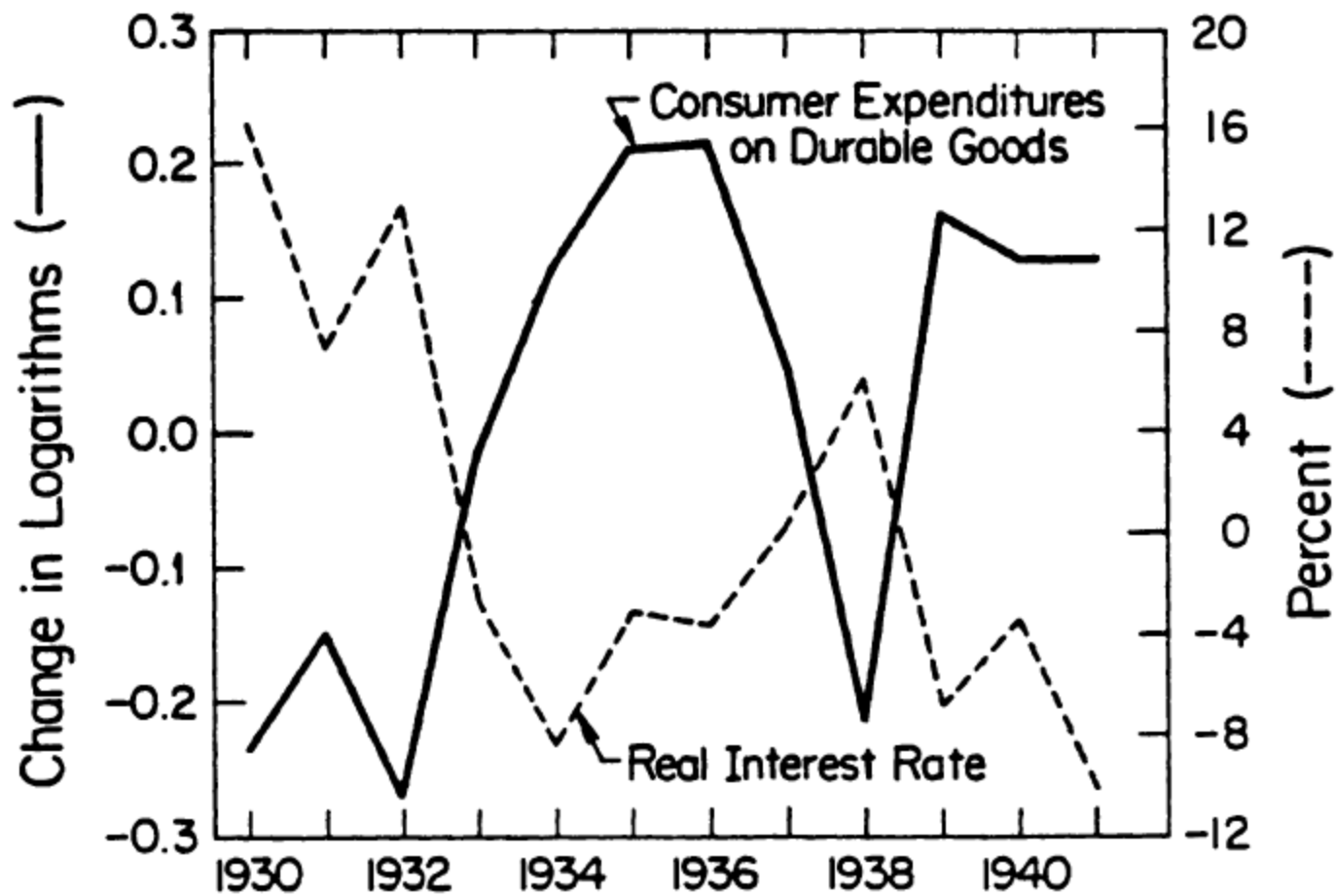
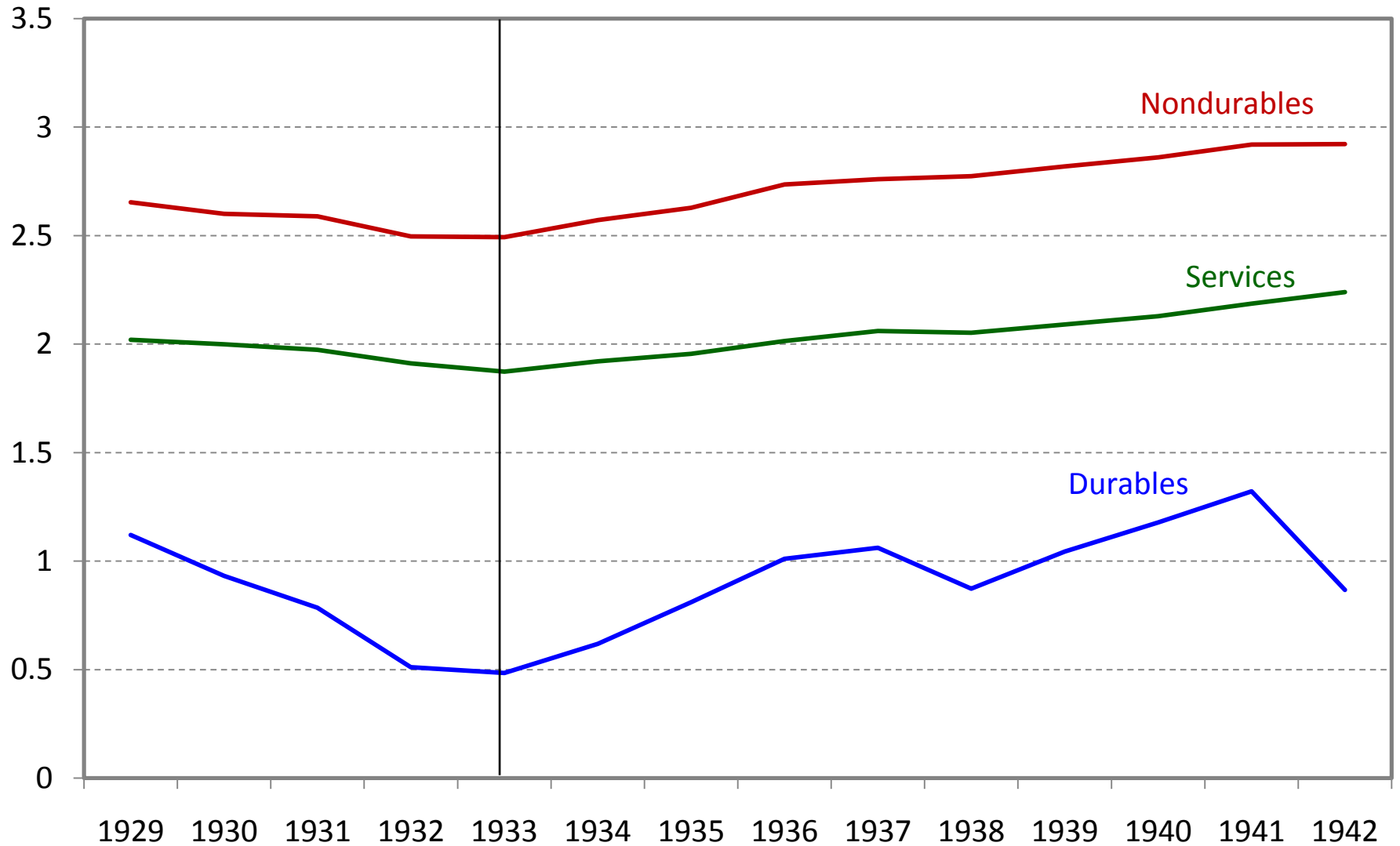


FIGURE 10

REAL CONSUMER EXPENDITURES ON DURABLE GOODS AND EX ANTE REAL RATES, 1930-1941

# Behavior of Different Types of Consumer Spending



II. ERIC SWANSON, “LET’S TWIST AGAIN: A HIGH-FREQUENCY EVENT-STUDY ANALYSIS OF OPERATION TWIST AND ITS IMPLICATIONS FOR QE2”

**Table 1. Comparing Operation Twist and QE2**

Billions of current dollars except where stated otherwise

	<i>Operation Twist</i>	<i>QE2</i>
Size of Federal Reserve program	8.8	600
GDP	528	14,871
Treasury marketable debt outstanding <sup>a</sup>	189.3	8,543
Agency debt outstanding <sup>b</sup>	7.4	6,379
Agency-guaranteed debt outstanding <sup>c</sup>	0.2	1,166
Size of Federal Reserve program		
As percent of GDP	1.7	4.0
As percent of Treasury debt outstanding	4.6	7.0
As percent of Treasury-guaranteed debt outstanding	4.5	3.7
Additional supporting program by Treasury? <sup>d</sup>	Yes	No

Sources: Meulendyke (1998), U.S. Treasury Bureau of the Public Debt, Federal Reserve Flow of Funds, and Bureau of Economic Analysis.

# Modigliani and Sutch

TABLE 1  
BEHAVIOR OF SOME KEY SHORT- AND LONG-TERM RATES FROM 1960-61 TO THE THIRD QUARTER OF 1965

Year and Quarter	A. LEVELS (%)								
	Bills Rate	Commercial Paper Rate	Average Rate on Time Deposits	Average Yield on S&L Shares	Long-term Government Bonds	Corporate Bonds (Moody's)		High Grade Municipals	Conventional Mortgage Yields
						Aaa	Baa		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
1960-3	2.36	3.37	2.57	3.86*	3.82	4.31	5.10	3.60	6.25
1961-1	2.35	3.01	2.65	3.90*	3.83	4.27	5.06	3.34	6.05
1965-3	3.85	4.38	4.15†	4.19‡	4.20	4.50	4.89	3.27	5.85§
	B. CHANGES								
1960-3 to 1965-3	1.49	1.01	1.58†	0.35*·‡	.37	.19	-.21	-.33	-.40§
1961-1 to 1965-3	1.50	1.37	1.50†	0.29*·‡	.36	.23	-.17	-.26	-.20§
1960-1 to 1965-3	-.09	-.31	1.64†	0.35*·‡	-.02	-.05	-.42	-.72	-.45§

## Modigliani and Sutch

$$(6) \quad R_t = \alpha + \beta_0 r_t + \sum_{i=1}^m \beta_i r_{t-i} + \eta_t^9$$

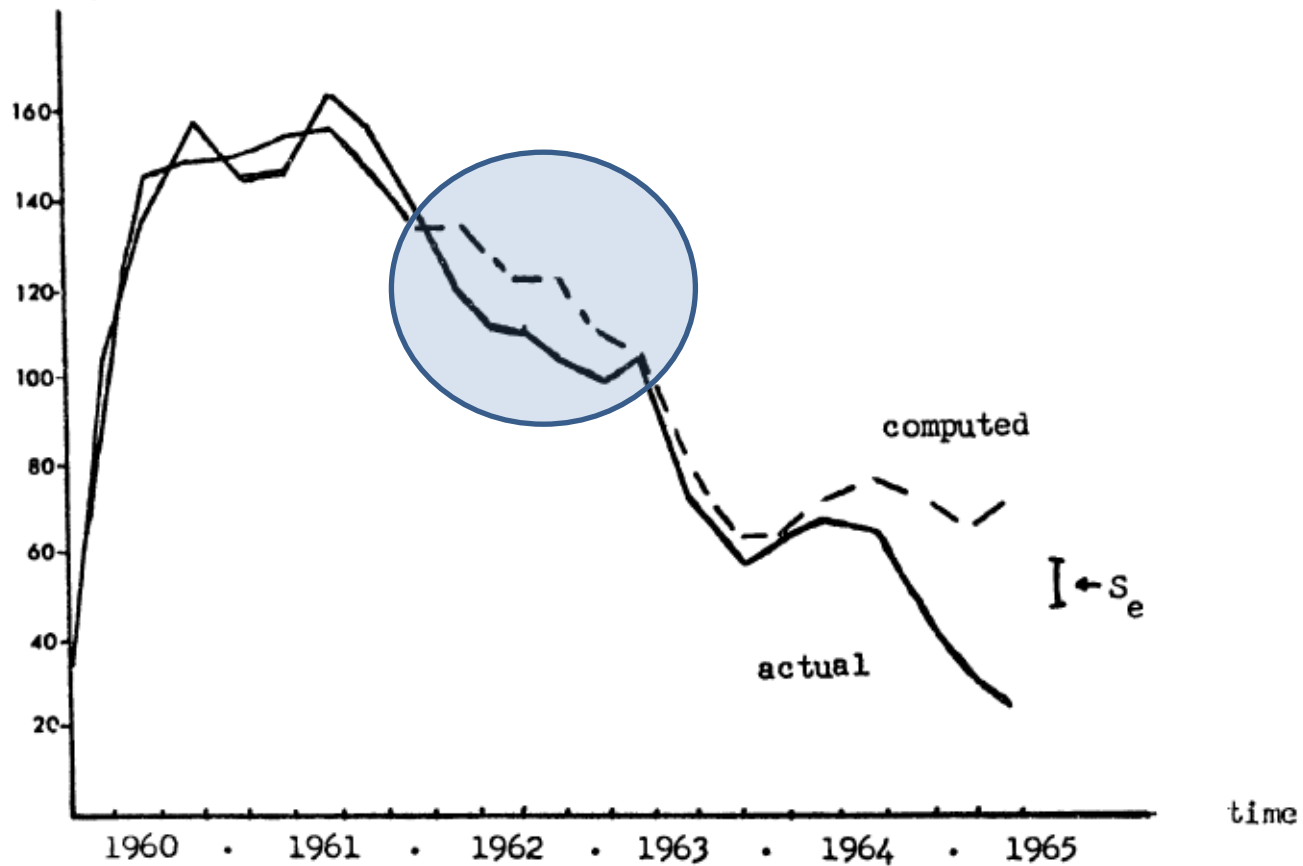
$$(7) \quad S_t = 1.239 - 0.684 r_t + \sum_{i=1}^{16} \beta_i r_{t-i}$$

$(0.028) \quad (0.030)$

$$R^2 = .975 \quad S_e = .093 \quad DW = 1.42$$

# Modigliani and Sutch's Time-Series Analysis

Spread:  $R_t - r_t$   
(Base points)



Equation (7) Extrapolated



# Swanson's Methodology

- High-frequency event study.
- How does he identify news?
- Evaluation of identification

**Table 2. Significant Announcements Regarding Operation Twist**

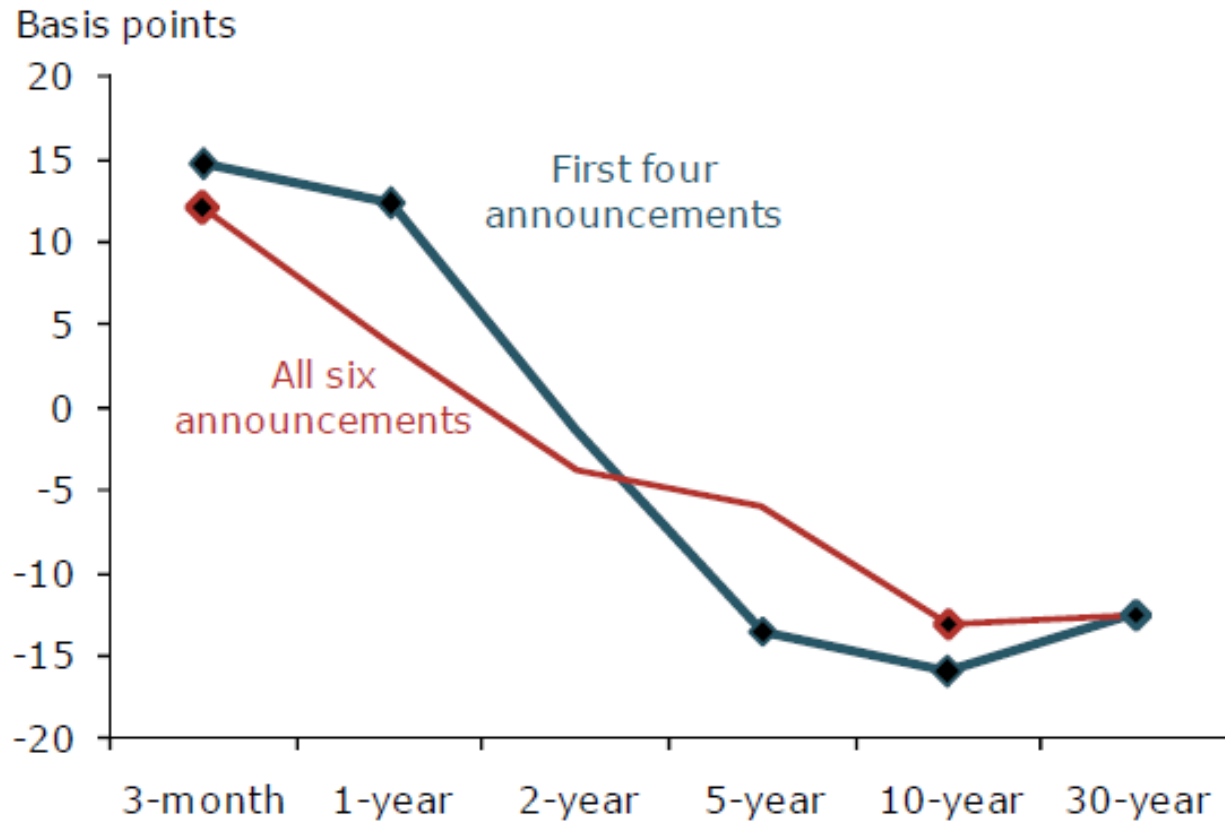
<i>Announcement date</i>	<i>Time<sup>a</sup></i>	<i>Description</i>	<i>Event window<sup>b</sup></i>	<i>Expected effect on long-term Treasury yields</i>
February 2, 1961 (Thursday)	“early Thursday”	President Kennedy announces goals and methods of Operation Twist, and says Federal Reserve and Treasury will both participate.	1 day (February 1–2)	Decrease
February 2, 1961 (Thursday)	“after the end of regular trading hours”	Treasury announces it will auction \$6.9 billion of new debt at only the 18-month maturity, instead of longer maturities.	1 day (February 2–3)	Decrease
February 9, 1961 (Thursday)	Not reported <sup>c</sup>	Federal Reserve statistics are released showing that the Fed made a rare purchase of longer-term Treasury securities.	2 days (February 8–10)	Decrease
February 20, 1961 (Monday)	2:45 p.m., “too late for the investment community . . . to become heavily involved in the market” <sup>c</sup>	Federal Reserve releases rare public statement explicitly endorsing Operation Twist and announces a new policy of buying Treasury securities with maturities longer than 5 years.	2 days (February 17–21)	Decrease
March 15, 1961 (Wednesday)	After the market close	Treasury announces a “surprise” refunding using 5- and 6-year notes, longer maturities than expected; markets interpret this as a decrease in Treasury and Federal Reserve commitment to Operation Twist.	1 day (March 15–16)	Increase
April 6, 1961 (Thursday)	“after the market had closed”	Federal Reserve statistics are released showing a sharp increase in Fed buying of longer-dated Treasuries on the open market, including maturities longer than 10 years for the first time.	1 day (April 6–7)	Decrease

Sources: *New York Times* and *Wall Street Journal*, various issues.

**Table 3. Treasury Yields and Estimated Impacts on Yields around Operation Twist Announcements**

<i>Date or change in yield</i>	<i>Maturity</i>					
	<i>3-month</i>	<i>1-year</i>	<i>2-year</i>	<i>5-year</i>	<i>10-year</i>	<i>30-year</i>
<i>Estimated responses to announcements (basis points)<sup>f</sup></i>						
1-day change, February 1–2	1	–0.7	–4.3*	–3.5*	–3.7**	–4***
1-day change, February 2–3	–0.2	3	3.7	–2	–3.3*	–1.5
2-day change, February 8–10	2.8	4	2	1	–1	–1
2-day change, February 17–21	11***	6*	–2.7	–9***	–8***	–6***
1-day change, March 15–16	–2.5	–3.5*	–1	8.5***	3.3*	1.5
1-day change, April 6–7	–0.2	–5**	–1.3	–1	–0.3	–1.5
Cumulative, first four announcements <sup>c</sup>	14.7***	12.3**	–1.3	–13.5***	–16***	–12.5***
Cumulative, all six announcements	12*	3.8	–3.7	–6	–13***	–12.5***
<i>Unconditional standard deviation of Treasury yield changes, 1962 (basis points)<sup>d</sup></i>						
1-day changes	2.14	1.99	2.25	1.93	1.73	1.15
2-day changes	3.18	3.08	3.50	2.95	2.58	1.67
6-day changes	5.41	5.19	5.88	4.99	4.39	2.87
8-day changes	6.20	5.90	6.68	5.68	5.02	3.30

**Figure 1**  
**Cumulative response of yield curve to Operation Twist**



Source: Data from Swanson (2011).

Note: Black nodes are statistically significant movements.

From: Alon and Swanson, “Operation Twist and the Effect of Large-Scale Asset Purchases”

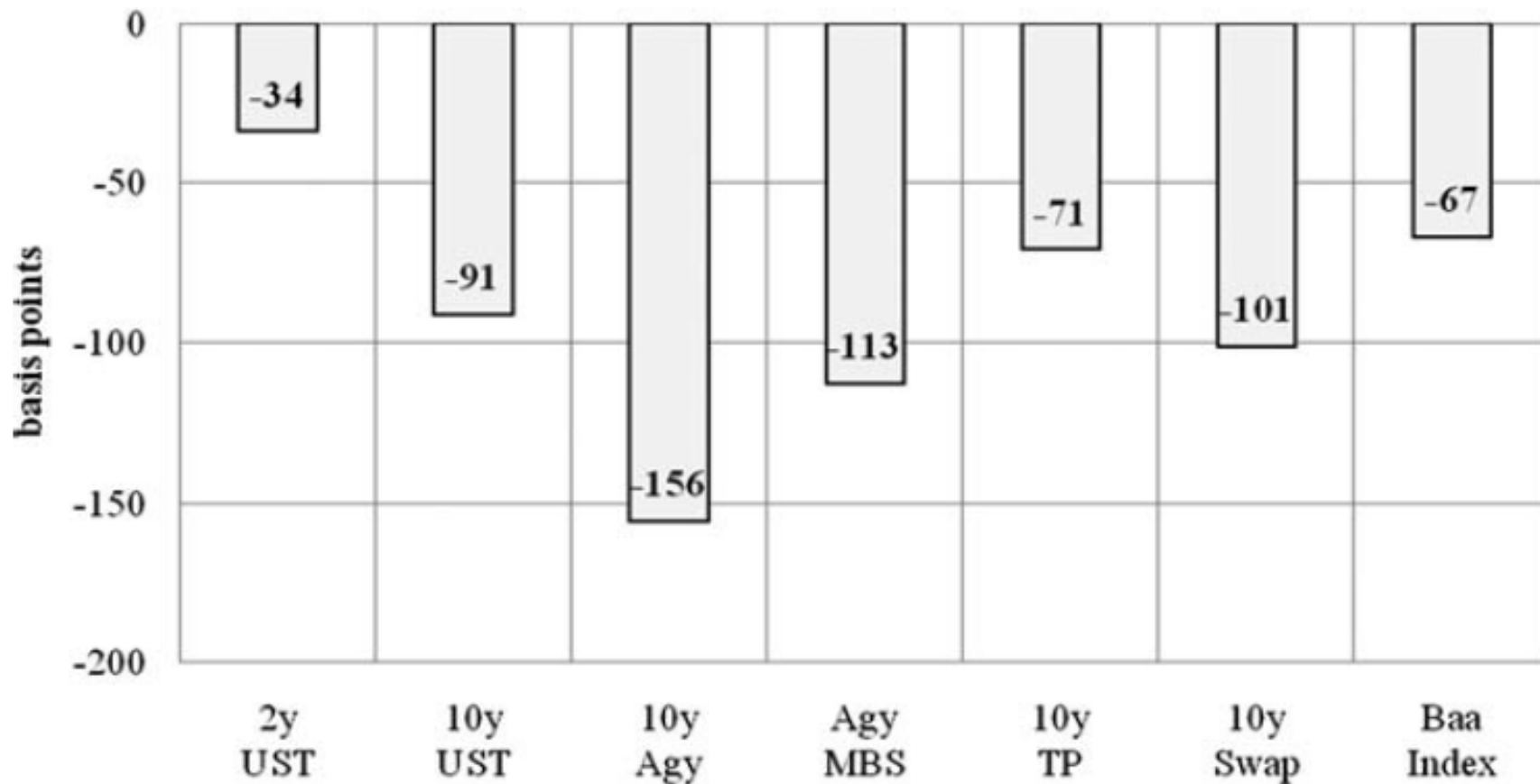
**Table 4. Agency and Corporate Yields and Estimated Impacts on Yieldsaround Operation Twist Announcements**

<i>Date or change in yield</i>	<i>Type of debt and maturity</i>										
	<i>Agency debt<sup>a</sup></i>				<i>Commercial paper<sup>b</sup></i>			<i>Corporate bonds (Moody's indexes)<sup>c</sup></i>		<i>Memorandum: Treasury debt</i>	
	<i>1-year</i>	<i>2-year</i>	<i>5-year</i>	<i>10-year</i>	<i>1-month</i>	<i>3-month</i>	<i>6-month</i>	<i>Aaa</i>	<i>Baa</i>	<i>1-year</i>	<i>10-year</i>
<i>Estimated responses to announcements (basis points)<sup>e</sup></i>											
1-day change, February 1–2	-0.3	-0.7	0	0	0	0	0	-1*	1	-0.7	-3.7**
2-day change, February 2–6	-2.3	3.7	-3.3	-4.3**	0	0	0	-1	-2**	4	-2.3
3-day change, February 8–14	8.3*	-2	1	-1.3	0	0	0	0	1	3	-1
3-day change, February 17–23	-1.7	-2.7	-7**	-8.7***	12.5	12.5**	0	-2**	-2*	5.7	-8.7***
2-day change, March 15–17	-2.3	-2	3.3	0	0	0	0	0	0	-4.5	4.3*
2-day change, April 6–10	-2.3	-0.7	0.7	1	0	0	0	0	-1	-3.5	1.3
Cumulative, first four announcements <sup>f</sup>	4	-1.7	-9.3	-14.3***	12.5	12.5	0	-4**	-2	12*	-15.7***
Cumulative, all six announcements	-0.7	-4.3	-5.3	-13.3**	12.5	12.5	0	-4**	-3	4	-10
<i>Unconditional standard deviation of yield changes, 1962 (basis points)<sup>g</sup></i>											
1-day changes	2.15	2.19	2.01	1.52	4.44	3.63	5.00	0.56	0.62	1.99	1.73
2-day changes	3.04	3.10	2.84	2.15	6.28	5.14	7.07	0.72	0.87	3.08	2.58
3-day changes	3.72	3.80	3.48	2.64	7.69	5.90	8.65	0.90	1.05	4.17	3.31
9-day changes	6.44	6.58	6.03	4.57	13.32	10.45	14.99	1.56	1.83	6.94	5.62
13-day changes	7.74	7.91	7.25	5.49	16.01	12.73	18.01	1.87	2.21	8.20	6.70

Sources: *Wall Street Journal*, various issues; Federal Reserve H15 report, various issues; *Moody's Bond Survey*, various issues; author's calculations.

III. ANDREAS FUSTER AND PAUL WILLEN, “\$1.25 TRILLION IS STILL REAL MONEY: SOME FACTS ABOUT THE EFFECTS OF THE FEDERAL RESERVE'S MORTGAGE MARKET INVESTMENTS”

Figure 5. Cumulative Interest Changes on Baseline Event Set Days



Source: Bloomberg, Barclays Capital.

From: Gagnon et al.

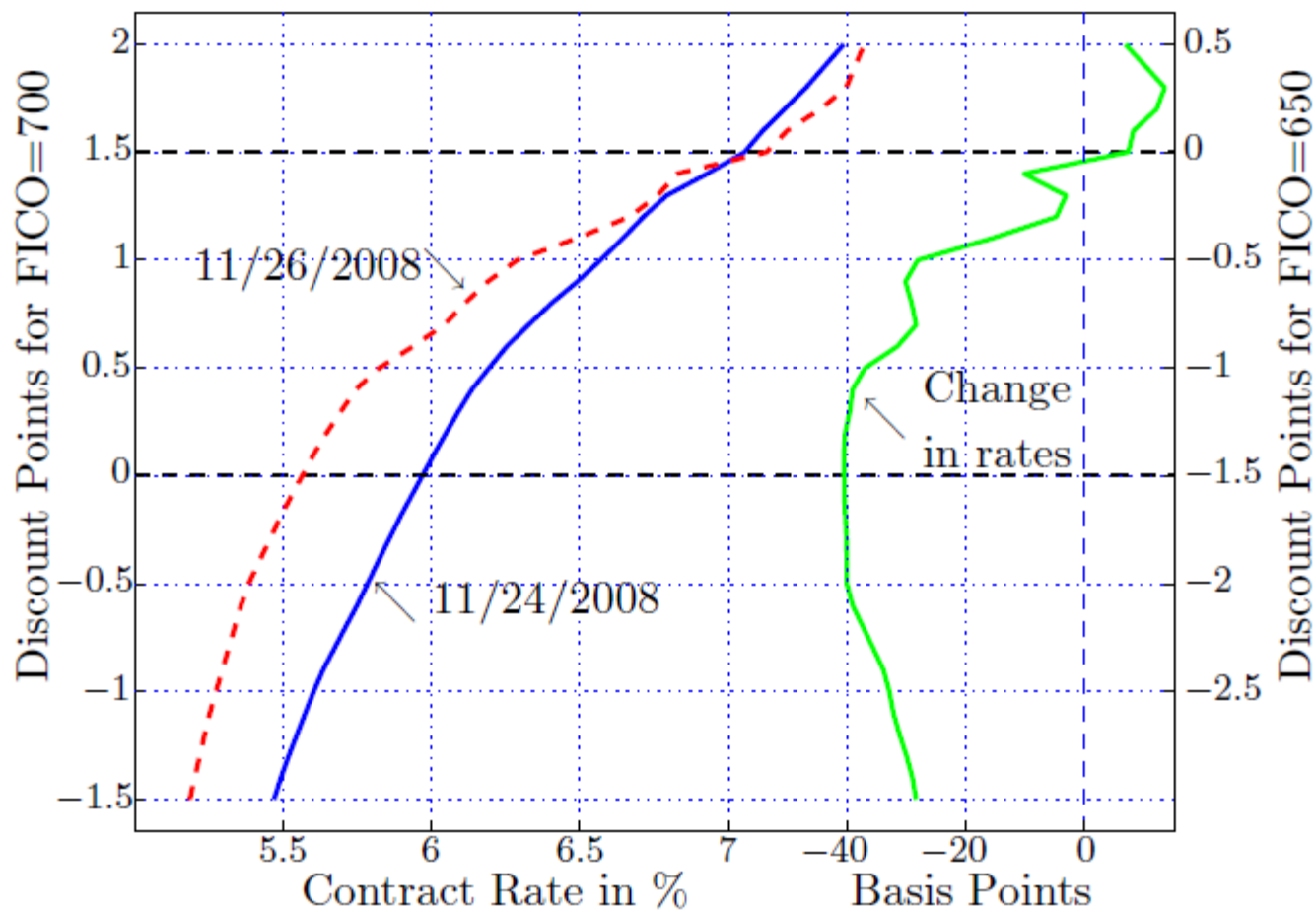
**Table 1. Interest Rate Changes around Baseline and Extended Event Set Announcements**

<b>Date</b>	<b>Event</b>	<b>2y UST</b>	<b>10y UST</b>	<b>10y Agy</b>	<b>Agy MBS<sup>b</sup></b>	<b>10y TP</b>	<b>10y Swap</b>	<b>Baa Index</b>
11/25/2008 <sup>a</sup>	Initial LSAP Announcement	-2	-22	-58	-44	-17	-29	-18
12/1/2008 <sup>a</sup>	Chairman Speech	-8	-19	-39	-15	-17	-17	-12
12/16/2008 <sup>a</sup>	FOMC Statement	-9	-26	-29	-37	-12	-32	-11
1/28/2009 <sup>a</sup>	FOMC Statement	10	14	14	11	9	14	2
3/18/2009 <sup>a</sup>	FOMC Statement	-22	-47	-52	-31	-40	-39	-29
4/29/2009	FOMC Statement	1	10	-1	6	6	8	-3
6/24/2009	FOMC Statement	10	6	3	2	4	4	5
8/12/2009 <sup>a</sup>	FOMC Statement	-2	5	4	2	3	1	2
9/23/2009 <sup>a</sup>	FOMC Statement	1	-3	-3	-1	-1	-5	-4
11/4/2009 <sup>a</sup>	FOMC Statement	-2	6	8	1	5	5	3
<i>Baseline Event Set</i>		<i>-34</i>	<i>-91</i>	<i>-156</i>	<i>-113</i>	<i>-71</i>	<i>-101</i>	<i>-67</i>
<i>Baseline Set + All FOMC</i>		<i>-1</i>	<i>-55</i>	<i>-134</i>	<i>-114</i>	<i>-47</i>	<i>-75</i>	<i>-72</i>
<i>Cumulative Change: 11/24/08 to 3/31/2010</i>		<i>-19</i>	<i>50</i>	<i>-75</i>	<i>-95</i>	<i>30</i>	<i>28</i>	<i>-489</i>
<i>Std Dev of Daily Changes: 11/24/08 to 3/31/10</i>		<i>5</i>	<i>8</i>	<i>9</i>	<i>10</i>	<i>6</i>	<i>9</i>	<i>7</i>

From: Gagnon et al.



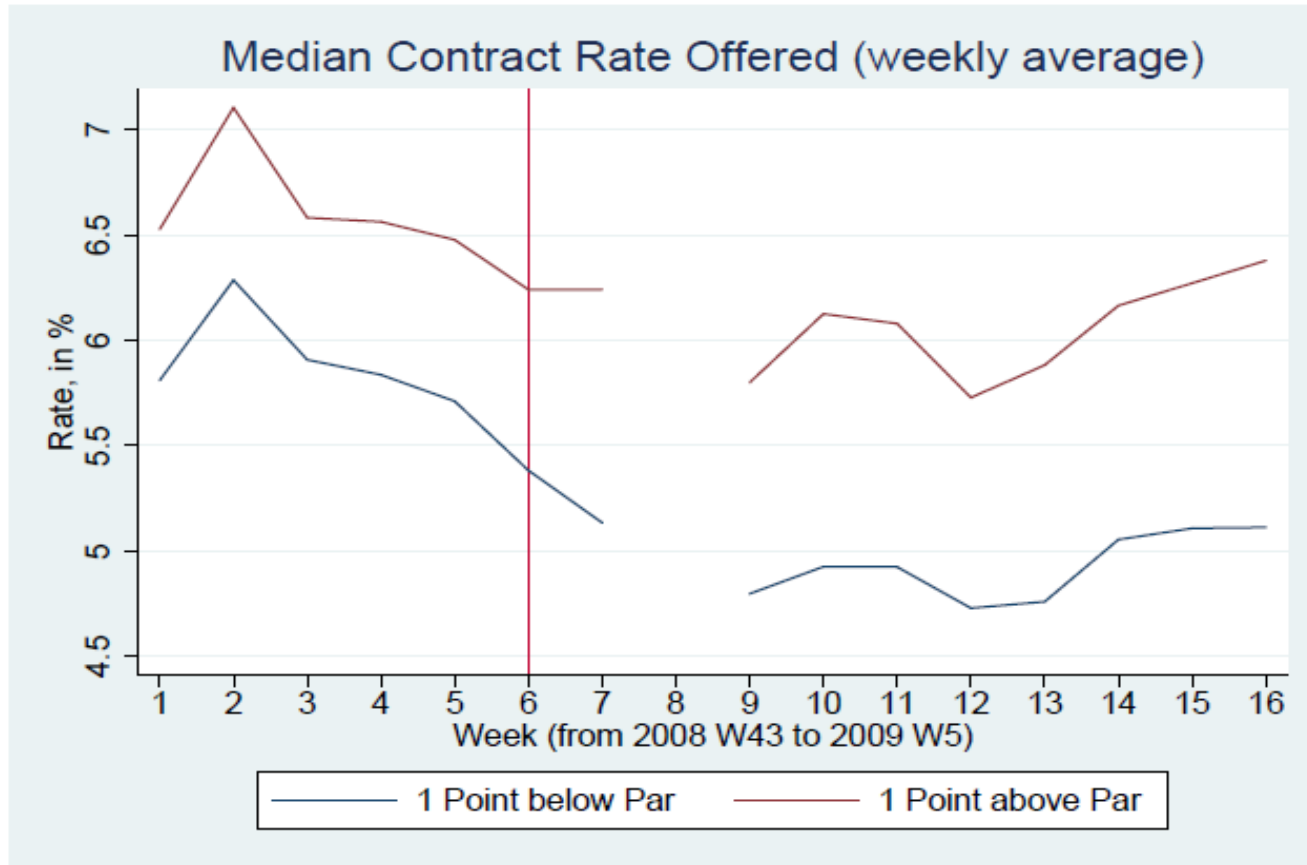
Figure 3: The Effect on Borrower Options of the November 25, 2008 LSAP Program Announcement



Source: LoanSifter and authors' calculations.

From: Fuster and Willen, "\$1.25 Trillion Is Still Real Money"

Figure 7: Rates For Borrowers Willing to Pay or Receive One Discount Point



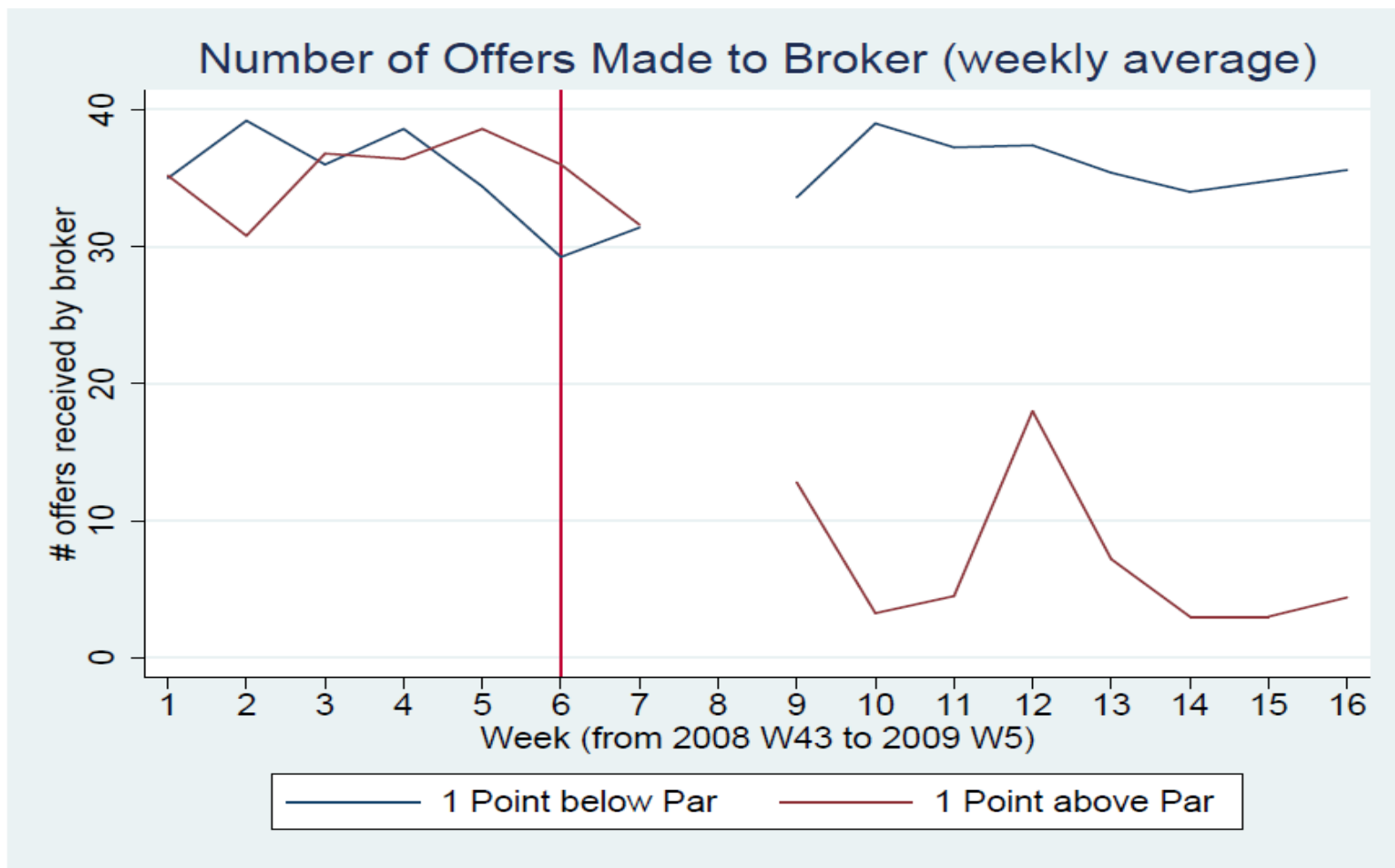
*Source:* LoanSifter and authors' calculations.

*Note:* Vertical lines indicate week of November 25, 2008.

The week of December 8, 2008 is missing from the dataset.

From: Fuster and Willen, "\$1.25 Trillion Is Still Real Money"

Figure 8: Number of Lenders Who Offer a Loan that Pays One Discount Point



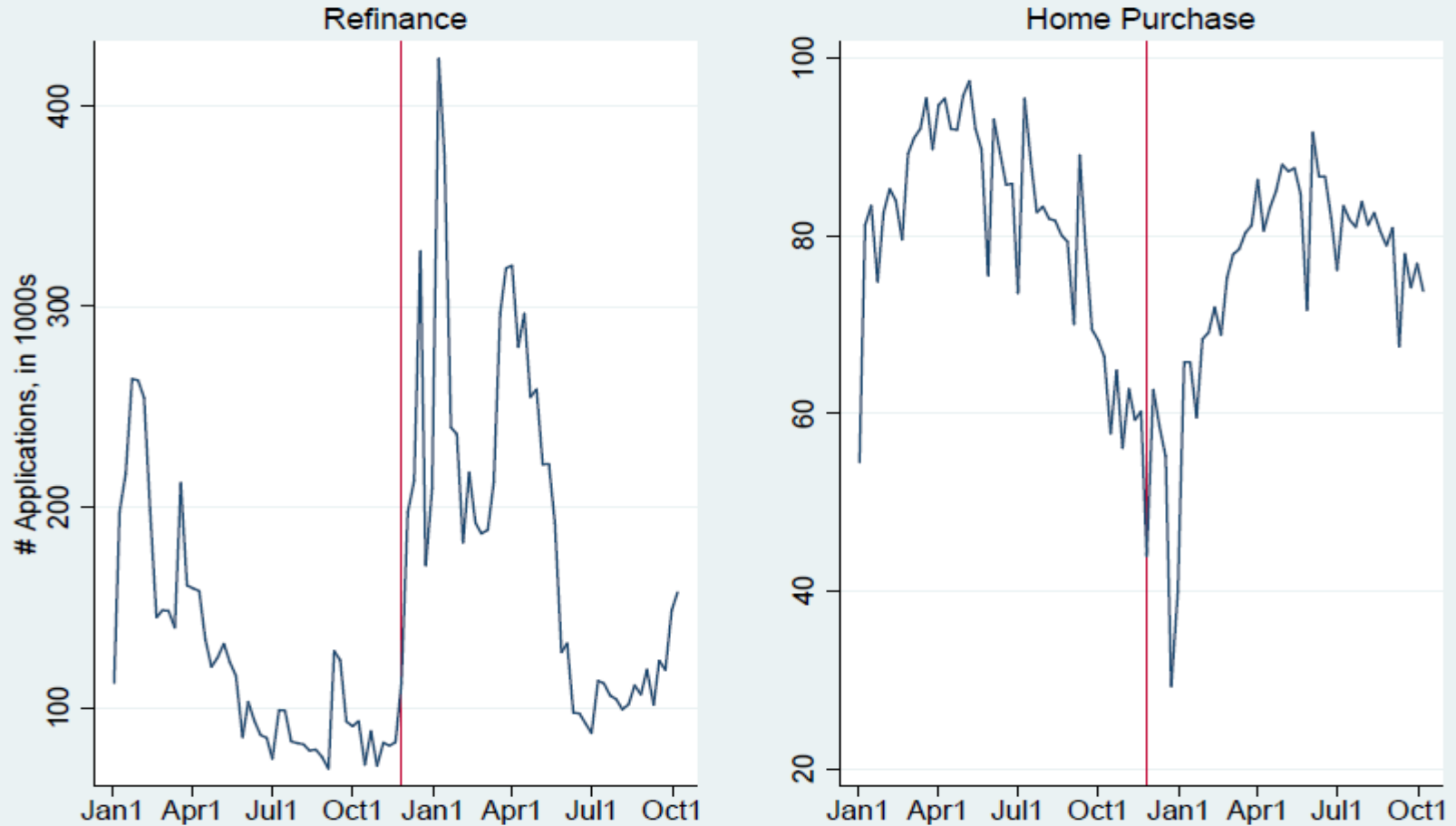
Source: LoanSifter and authors' calculations.

Note: Vertical line indicates week of November 25, 2008.

From: Fuster and Willen, "\$1.25 Trillion Is Still Real Money"

Figure 10: Volume of Mortgage Applications in HMDA

## Weekly Mortgage Application Volume, Jan. 2008 to Oct. 2009



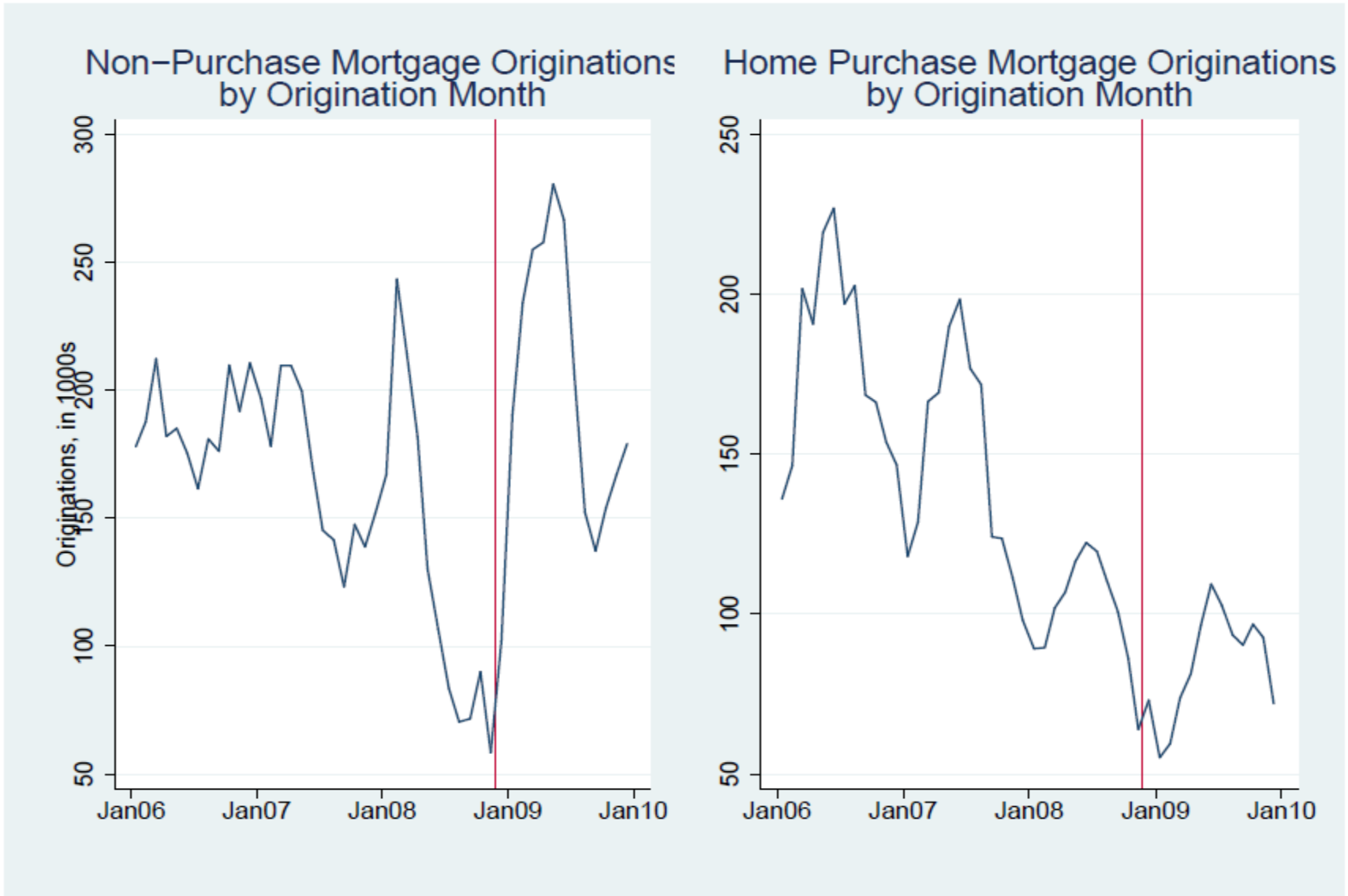
From: Fuster and Willen, "\$1.25 Trillion Is Still Real Money"

Table 2: Changes in Daily Application and Search Activity Before and After the Two Main LSAP Announcements

Day	Date	# Applications	Originated	Denied	Withdrawn	# Searches
Tue	18-Nov-08	16857	5808 (34.5%)	6402 (38.0%)	2719 (16.1%)	1586
Wed	19-Nov-08	16006	5683 (35.5%)	5806 (36.3%)	2563 (16.0%)	1849
Thu	20-Nov-08	15815	5860 (37.1%)	5528 (35.0%)	2503 (15.8%)	2202
Fri	21-Nov-08	14004	5376 (38.4%)	4729 (33.8%)	2122 (15.2%)	1266
Mon	24-Nov-08	17207	6275 (36.5%)	6078 (35.3%)	2793 (16.2%)	1645
<b>Tue</b>	<b>25-Nov-08</b>	<b>39523</b>	<b>21194 (53.6%)</b>	<b>8496 (21.5%)</b>	<b>5546 (14.0%)</b>	<b>6536</b>
Wed	26-Nov-08	34062	18240 (53.5%)	7393 (21.7%)	4583 (13.5%)	3449
Mon	1-Dec-08	42485	23119 (54.4%)	9539 (22.5%)	5853 (13.8%)	5880
Tue	2-Dec-08	41208	21759 (52.8%)	9506 (23.1%)	5715 (13.9%)	4962
Wed	11-Mar-09	38096	21228 (55.7%)	7910 (20.8%)	5011 (13.2%)	4871
Thu	12-Mar-09	41446	24273 (58.6%)	8256 (19.9%)	5069 (12.2%)	4883
Fri	13-Mar-09	39624	23751 (59.9%)	7577 (19.1%)	4715 (11.9%)	3580
Mon	16-Mar-09	42419	24387 (57.5%)	8639 (20.4%)	5468 (12.9%)	3812
Tue	17-Mar-09	40710	23783 (58.4%)	8221 (20.2%)	4982 (12.2%)	5275
<b>Wed</b>	<b>18-Mar-09</b>	<b>47278</b>	<b>29195 (61.8%)</b>	<b>8583 (18.2%)</b>	<b>5483 (11.6%)</b>	<b>7202</b>
Thu	19-Mar-09	79926	54320 (68.0%)	11895 (14.9%)	8174 (10.2%)	11404
Fri	20-Mar-09	64081	41823 (65.3%)	10431 (16.3%)	6925 (10.8%)	8251
Mon	23-Mar-09	63747	40647 (63.8%)	10634 (16.7%)	7473 (11.7%)	5045
Tue	24-Mar-09	58893	36860 (62.6%)	10118 (17.2%)	7186 (12.2%)	6373
Wed	25-Mar-09	58607	36706 (62.6%)	10097 (17.2%)	7014 (12.0%)	5689

From: Fuster and Willen, “\$1.25 Trillion Is Still Real Money”

Figure 9: Volume of Purchase and Non-purchase Mortgage Originations in LPS



From: Fuster and Willen, "\$1.25 Trillion Is Still Real Money"

Table 3: Number of Loans Originated by FICO Score and Application Date

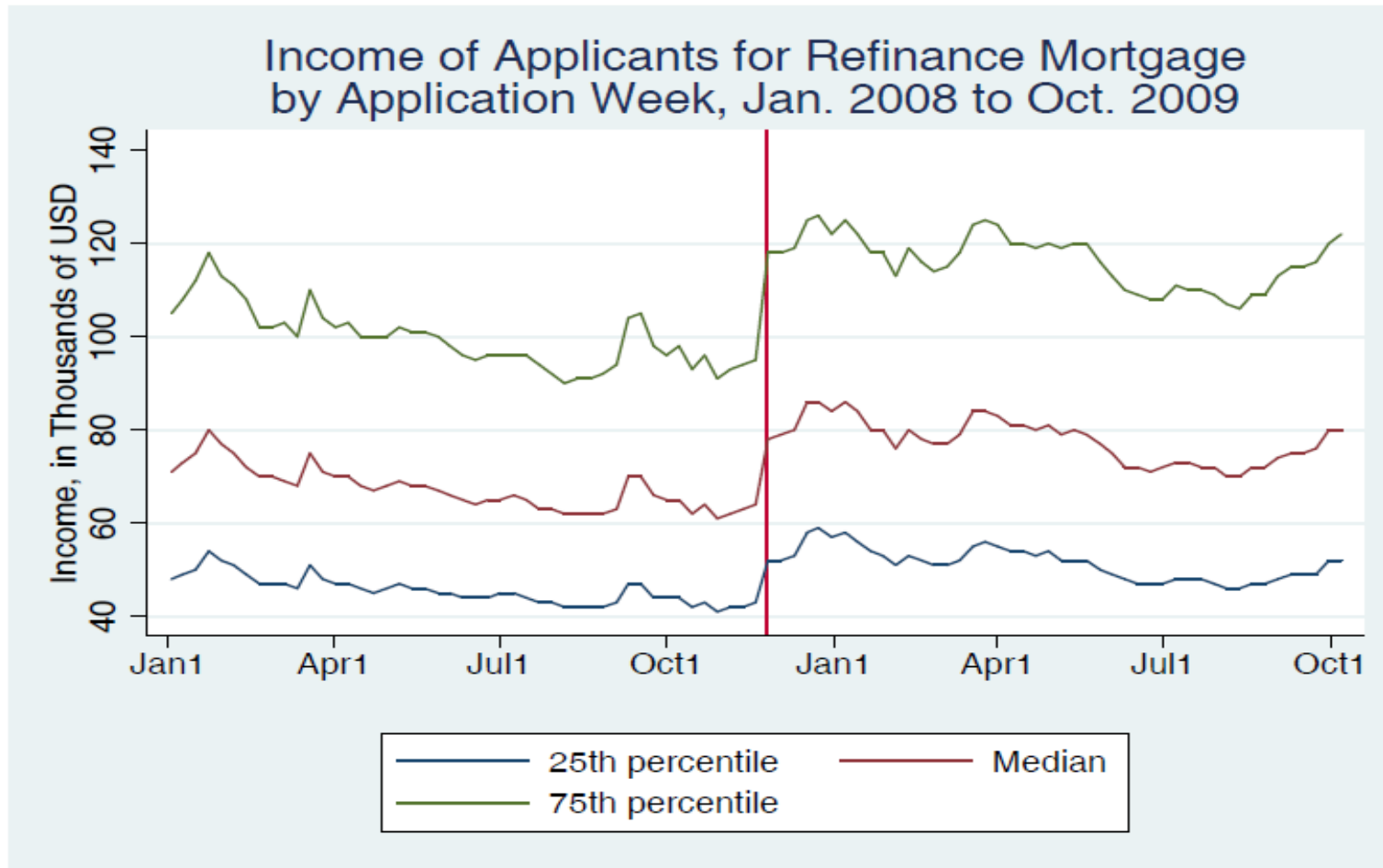
Month	Day	Total #	<700	700-720	720-740	740-760	>760	
			11/24/08=100					
November	18	693	93	114	72	81	63	
	19	671	81	88	68	68	64	
	20	724	97	84	53	73	76	
	21	668	93	81	62	76	67	
	24	897	100	100	100	100	100	
	25	3636	245	365	383	476	604	
	26	4239	226	382	454	532	747	
December	1	4789	287	481	469	635	876	
	2	4370	272	461	426	557	732	
	3	3461	221	347	333	452	558	

Source: LPS, HMDA, and authors' calculations.

Note: Sample limited to loans with matched origination information from LPS and application date from HMDA. Weekends and Thanksgiving Thursday and Friday (November 27–28, 2008) are not shown.

From: Fuster and Willen, “\$1.25 Trillion Is Still Real Money”

Figure 16: Income Distribution of Refinance Mortgage Applicants



Source: HMDA.

Note: Data includes only first-lien mortgages for owner-occupants of 1-4 unit houses or condominiums. Vertical lines indicate week of November 25, 2008.

From: Fuster and Willen, "\$1.25 Trillion Is Still Real Money"



# Why Were the Effects So Heterogeneous by Creditworthiness?

IV. ARVIND KRISHNAMURTHY AND ANNETTE VISSING-  
JORGENSEN, “THE EFFECTS OF QUANTITATIVE EASING  
ON INTEREST RATES”

# Krishnamurthy and Vissing-Jorgensen's Channels

- Duration risk.
- Liquidity.
- Safety premium.
- Signaling.
- Prepayment risk.
- Default risk.
- Inflation.

$$\begin{aligned}
r_{\text{risky, illiq, long-term}} = & E[i_{\text{safe, liq, short-term}}] - \pi^e \\
& + \text{Duration} \times P_{\text{DurationRisk}} \\
& + \text{Illiquidity} \times P_{\text{Liquidity}} \\
& + \text{LackofSafety} \times P_{\text{Safety}} \\
& + \text{DefaultRisk} \times P_{\text{DefaultRisk}} \\
& + \text{PrepaymentRisk} \times P_{\text{PrepaymentRisk}}.
\end{aligned}$$

From: Krishnamurthy and Vissing-Jorgensen, “The Effects of Quantitative Easing on Interest Rates” (Oct. 2011 draft)

**Table 1. Treasury, Agency and Agency MBS yields on QE1 event dates****Two-day changes (in basis points)**

Date	Event	Treasury yields (constant maturity)				Agency yields			Agency MBS yields	
		30 year	10 year	5 year	1 year	10 year	5 year	3 year	30 year	15 year
11/25/2008	Initial announcement	-24	-36	-23	-2	-76	-57	-42	-75	-147
12/1/2008	Bernanke speech	-27	-25	-28	-13	-67	-50	-28	-10	58
12/16/2008	FOMC statement	-32	-33	-15	-5	-39	-26	-28	-30	-7
1/28/2009	FOMC statement	31	28	28	4	28	27	16	6	16
3/18/2009	FOMC statement	-21	-41	-36	-9	-45	-44	-38	-19	-18
Above 5 dates	Above 5 events	-73*	-107**	-74	-25*	-199***	-150**	-120***	-128**	-98

Note: The Treasury yields are from FRED (the constant maturity series). The agency yields are for FNMA bonds and the MBS yields are for the current coupon GNMA. Both are from Bloomberg.

\* denotes significance at 10% level, \*\* denotes significance at 5% level and \*\*\* denotes significance at 1% level.

From: Krishnamurthy and Vissing-Jorgensen, “The Effects of Quantitative Easing on Interest Rates”

**Table 2. Corporate Yields, and Corporate Yields Adjusted by CDS on QE1 Event Dates**

**Two-day changes (in basis points)**

<u>Corporate Yields</u>												
	Aaa long	Aa long	A long	Baa long	Ba long	B long	Aaa int	Aa int	A int	Baa int	Ba int	B int
11/25/2008	-28	-18	-23	-19	-4	4	-17	-15	-18	-18	1	-47
12/1/2008	-24	-24	-21	-17	-13	28	-21	-15	-18	-8	-5	6
12/16/2008	-43	-37	-45	-39	1	-11	-19	-21	-24	-27	-28	-42
1/28/2009	34	17	17	14	-16	-25	12	8	7	3	-32	-25
3/18/2009	-16	-21	-21	-20	-28	-39	-43	-50	-39	-26	-18	-22
Above 5 dates	-77	-83**	-93**	-81**	-60**	-43	-88**	-93**	-92**	-76**	-82***	-130***
<u>Credit Default Swaps (5 year tenor)</u>												
	Aaa	Aa	A	Baa	Ba	B						
11/25/2008	3	-1	-5	-19	-35	-32						
12/1/2008	2	7	12	1	0	124						
12/16/2008	5	-4	-5	-17	-15	13						
1/28/2009	-3	-5	-8	-9	-17	-118						
3/18/2009	-1	-2	-4	-7	-14	-45						
Above 5 dates	6	-5	-10	-50	-81	-58						

From: Krishnamurthy and Vissing-Jorgensen, “The Effects of Quantitative Easing on Interest Rates”

**Table 2. Corporate Yields, and Corporate Yields Adjusted by CDS on QE1 Event Dates**  
**Two-day changes (in basis points)**

<u>Corporate Yields-Credit Default Swaps</u>												
	Aaa long	Aa long	A long	Baa long	Ba long	B long	Aaa int	Aa int	A int	Baa int	Ba int	B int
11/25/2008	-31	-17	-18	0	31	36	-20	-14	-13	1	36	-15
12/1/2008	-26	-31	-33	-18	-13	-96	-23	-22	-30	-9	-5	-118
12/16/2008	-48	-33	-40	-22	16	-24	-24	-17	-19	-10	-13	-55
1/28/2009	37	22	25	23	1	93	15	13	15	12	-15	93
3/18/2009	-15	-19	-17	-13	-14	6	-42	-48	-35	-19	-4	23
Above 5 dates	-83	-78	-83	-31	21	15	-94	-88	-82	-26	-1	-72

Note: The corporate yield indices are from Barclay's and downloaded from Datastream. The CDS rates by ratings are Moody's indices. \* denotes significance at 10% level, \*\* denotes significance at 5% level and \*\*\* denotes significance at 1% level.

From: Krishnamurthy and Vissing-Jorgensen, "The Effects of Quantitative Easing on Interest Rates"

**Table 4. Inflation Swaps, TIPS, and Implied Interest Rate Volatility on QE1 Event Dates**  
**Two-day changes (in basis points)**

<u>Date</u>	<u>Event</u>	Inflation swaps				TIPS real yields (constant maturity)			Interest rate volatility
		30 year	10 year	5 year	1 year	20 year	10 year	5 year	
11/25/2008	Initial Announcement	1	-6	-28	48	-22	-43	5	1
12/1/2008	Bernanke speech	15	27	11	-40	-38	-34	-51 <sup>15</sup>	-7
12/16/2008	FOMC Statement	4	37	35	-17	-45	-57	-83	-20
1/28/2009	FOMC Statement	14	15	-6	5	15	6	13	0
3/18/2009	FOMC Statement	2	22	24	45	-45	-59	-43	-11
Above 5 dates	Above 5 events	36 <sup>**</sup>	95 <sup>**</sup>	36	41	-135 <sup>***</sup>	-187 <sup>***</sup>	-144 <sup>***</sup>	-37 <sup>***</sup>

Note: Inflation swap rates and interest rate volatility (ticker BBOX) is from Bloomberg. TIPS yields are from FRED. \* denotes significance at 10% level, \*\* denotes significance at 5% level and \*\*\* denotes significance at 1% level.

From: Krishnamurthy and Vissing-Jorgensen, “The Effects of Quantitative Easing on Interest Rates”



**Table 6. Treasury, Agency and Agency MBS Yields on QE2 Event Dates**

**One and two-day changes (in basis points)**

<u>Date</u>	<u>Event</u>	<u>Changes</u>	Treasury yields (constant maturity)				Agency yields		Agency MBS yields	
			30 year	10 year	5 year	1 year	10 year	5 year	30 year	15 year
8/9/2010 to 11/4/2010	Day before 8/10 FOMC statement to day after 11/3 FOMC statement)		3	-33	-50	-5	-41	-53	-36	-26
8/10/2010	FOMC meeting	1-day	-1	-7	-8	-1	-7	-9	1	-5
		2-day	-8	-14	-10	-1	-13	-9	-8	-4
9/21/2010	FOMC meeting	1-day	-8	-11	-9	0	-11	-9	-7	1
		2-day	-13	-16	-10	-1	-16	-10	4	5
11/3/2010	FOMC meeting	1-day	16	4	-4	0	5	-5	-5	-2
		2-day	11	-10	-11	-1	-10	-14	-13	-3
8/10 and 9/21		1-day	-9*	-18***	-17***	-1	-18***	-18***	-6	-4
		2-day	-21***	-30***	-20***	-2	-29***	-19***	-4	1

Note: Data sources are as for QE1. \* denotes significance at 10% level, \*\* denotes significance at 5% level and \*\*\* denotes significance at 1% level.

From: Krishnamurthy and Vissing-Jorgensen, “The Effects of Quantitative Easing on Interest Rates”

**Table 7. Corporate Yields, and Corporate Yields Adjusted by CDS on QE2 Event Dates**

**One and two-day changes (in basis points)**

Date	Changes	Corporate yields				Credit default swaps		Corporate yields-CDS			
		Inv grade long	Inv grade intermediate	High yield long	High yield intermediate	Inv. grade	High yield	Inv grade long	Inv grade intermediate	High yield long	High yield intermediate
8/9/2010 to 11/4/2010		-11	-51	-58	-120	-13	-70	2	-38	12	-50
8/10/2010	1-day	2	-3	-5	3	-2	-11	4	-1	6	14
	2-day	-6	-6	-3	17	1	2	-7	-7	-5	15
9/21/2010	1-day	-9	-9	-5	-3	3	-10	-12	-12	5	7
	2-day	-13	-10	-10	0	4	-4	-17	-14	-6	4
11/3/2010	1-day	11	-2	17	-4	-2	-6	13	0	23	2
	2-day	2	-13	10	-19	-3	-15	5	-10	25	-4
8/10 and 9/21	1-day	-7	-12 <sup>***</sup>	-10 <sup>***</sup>	0	0	-21	-7	-12	11	21
	2-day	-19 <sup>***</sup>	-16 <sup>***</sup>	-13 <sup>**</sup>	17 <sup>*</sup>	5	-2	-24	-21	-11	19

Note: The corporate yield indices are from Barclay's and downloaded from Datastream. The CDS rates are from the Financial Times and are for 5-year tenor. \* denotes significance at 10% level, \*\* denotes significance at 5% level and \*\*\* denotes significance at 1% level.

From: Krishnamurthy and Vissing-Jorgensen, "The Effects of Quantitative Easing on Interest Rates"

**Table 8. Inflation Swaps, TIPS, and Implied Interest Rate Volatility on QE2 Event Dates**

**One and two-day changes (in basis points)**

Date	Event	Changes	Inflation swaps				TIPS real yields (constant maturity)			10 year interest rate volatility
			30 year	10 year	5 year	1 year	20 year	10 year	5 year	
8/9/2010 to 11/4/2010	Day before 8/10 FOMC statement to day after 11/3 FOMC statement)		37	17	16	19	-53	-60	-54	-1
8/10/2010	FOMC meeting	1-day	5	-1	-3	0	-10	-9	-8	-2
		2-day	-2	0	-3	-4	-6	-9	-5	-3
9/21/2010	FOMC meeting	1-day	6	6	6	-1	-14	-16	-14	-1
		2-day	6	4	7	9	-17	-20	-18	-2
11/3/2010	FOMC meeting	1-day	6	-3	2	1	4	1	-6	-2
		2-day	1	-10	4	14	2	-5	-14	-3
8/10 and 9/21		1-day	11 <sup>***</sup>	5	3	-1	-24 <sup>***</sup>	-25 <sup>***</sup>	-22 <sup>***</sup>	-3 <sup>***</sup>
		2-day	4	4	4	5	-23 <sup>***</sup>	-29 <sup>***</sup>	-23 <sup>***</sup>	-5 <sup>***</sup>

Note: Data sources are as for QE1. \* denotes significance at 10% level, \*\* denotes significance at 5% level and \*\*\* denotes significance at 1% level.

From: Krishnamurthy and Vissing-Jorgensen, “The Effects of Quantitative Easing on Interest Rates”

## FOMC Statement, September 21, 2011

“The Committee intends to purchase, by the end of June 2012, \$400 billion of Treasury securities with remaining maturities of 6 years to 30 years and to sell an equal amount of Treasury securities with remaining maturities of 3 years or less. This program should put downward pressure on longer-term interest rates and help make broader financial conditions more accommodative. ...

“To help support conditions in mortgage markets, the Committee will now reinvest principal payments from its holdings of agency debt and agency mortgage-backed securities in agency mortgage-backed securities.”

“From September 21 to 22, [2011,] long-term interest rates decline substantially and across the board. The largest decline of 23 bps is in the 30 year MBS ..., with the comparable duration 10 year Treasury declining by 7 bps, 10 year Agency declining by 2 bps, and corporate rates from the long Aaa to Baa category declining by between 15 and 17 bps. These moves are plausibly affected by an MBS risk premium channel with attendant effects for corporate borrowing rates, as in QE1. On the other hand, the market responses differ in three other ways to QE1. First, the federal funds futures contract barely moves ..., suggesting a negligible signaling channel. ... Second, default risk rises, with 5 year investment grade CDS rising by 8 bps and high yield CDS rising by 34 bps. ... The rise in perceived default risk despite an observed decrease in corporate bond yields is unlike QE1 and is puzzling to us. One possible answer .... Finally, unlike both QE1 and QE2, inflation expectations measured from inflation swaps are down 8 bps at the 30 year horizon and 4 bps at the 10-year horizon. It is possible that since QE3 involved no change in the monetary base, markets perceived the operation to not be inflationary. ...”

**From: Krishnamurthy and Vissing-Jorgensen (Oct. 2011 version)**