

Internet Appendix

**Can information be locked up?
Informed trading ahead of macro-news announcements**

October 2015

Table A1**FOMC announcement observations**

The table lists the detailed information of each FOMC scheduled announcement in our sample. The official time is the scheduled news release time according to the FOMC meeting minutes. The actual time is the earliest release time found from reports on Factiva. *Low* denotes the lower bound of the Federal funds target rate and *High* denotes the upper bound. *Exp Rate (Exp Rate 3month)* is the futures-implied Federal funds rate on the day before the FOMC policy announcement using all futures contracts (only contracts expiring within three months).

Date	Official time	Actual time	Low	High	ExpRate	ExpRate3month
19970930	14:15:00	14:13:00	5.5	5.5	5.918	5.923
19971112	14:15:00	14:12:00	5.5	5.5	5.595	5.591
19971216	14:15:00	14:15:00	5.5	5.5	5.614	5.612
19980204	14:15:00	14:12:00	5.5	5.5	5.442	5.446
19980331	14:15:00	14:14:00	5.5	5.5	5.57	5.574
19980519	14:15:00	14:13:00	5.5	5.5	5.566	5.548
19980701	14:15:00	14:14:00	5.5	5.5	5.528	5.52
19980818	14:15:00	14:12:00	5.5	5.5	5.484	5.49
19980929	14:15:00	14:12:00	5.25	5.25	5.173	5.179
19981117	14:15:00	14:19:00	4.75	4.75	4.857	4.866
19981222	14:15:00	14:13:00	4.75	4.75	4.727	4.776
19990203	14:15:00	14:12:00	4.75	4.75	4.741	4.741
19990330	14:15:00	14:12:00	4.75	4.75	4.803	4.788
19990518	14:15:00	14:11:00	4.75	4.75	4.833	4.82
19990630	14:15:00	14:15:00	5	5	5.167	5.134
19990824	14:15:00	14:14:00	5.25	5.25	5.25	5.238
19991005	14:15:00	14:12:00	5.25	5.25	5.322	5.322
19991116	14:15:00	14:16:00	5.5	5.5	5.413	5.404
19991221	14:15:00	14:13:00	5.5	5.5	5.661	5.627
20000202	14:15:00	14:14:00	5.75	5.75	5.927	5.895
20000321	14:15:00	14:14:00	6	6	6.065	6.032
20000516	14:15:00	14:13:00	6.5	6.5	6.528	6.5
20000628	14:15:00	14:15:00	6.5	6.5	6.572	6.571
20000822	14:15:00	14:14:00	6.5	6.5	6.541	6.533
20001003	14:15:00	14:12:00	6.5	6.5	6.488	6.488
20001115	14:15:00	14:12:00	6.5	6.5	6.516	6.516
20001219	14:15:00	14:16:00	6.5	6.5	6.288	6.356
20010131	14:15:00	14:14:00	5.5	5.5	5.294	5.332
20010320	14:15:00	14:13:00	5	5	4.886	4.924
20010515	14:15:00	14:15:00	4	4	4.066	4.07
20010627	14:15:00	14:12:00	3.75	3.75	3.641	3.703
20010821	14:15:00	14:13:00	3.5	3.5	3.415	3.465
20011002	14:15:00	14:15:00	2.5	2.5	2.315	2.315
20011106	14:15:00	14:19:00	2	2	2.005	2.008
20011211	14:15:00	14:14:00	1.75	1.75	1.753	1.733

Table A1 (continued)

Date	Official time	Actual time	Low	High	ExpRate	ExpRate3 – month
20020130	14:15:00	14:16:00	1.75	1.75	1.772	1.724
20020319	14:15:00	14:19:00	1.75	1.75	1.982	1.842
20020507	14:15:00	14:14:00	1.75	1.75	1.811	1.758
20020626	14:15:00	14:13:00	1.75	1.75	1.787	1.85
20020813	14:15:00	14:14:00	1.75	1.75	1.625	1.625
20020924	14:15:00	14:12:00	1.75	1.75	1.665	1.665
20021106	14:15:00	14:14:00	1.25	1.25	1.458	1.474
20021210	14:15:00	14:13:00	1.25	1.25	1.24	0
20030129	14:15:00	14:16:00	1.25	1.25	1.181	1.202
20030318	14:15:00	14:15:00	1.25	1.25	1.136	1.179
20030506	14:15:00	14:13:00	1.25	1.25	1.165	1.176
20030625	14:15:00	14:16:00	1	1	0.877	0.899
20030812	14:15:00	14:15:00	1	1	1.094	1.013
20030916	14:15:00	14:19:00	1	1	1.011	1.012
20031028	14:15:00	14:14:00	1	1	1.037	1.005
20031209	14:15:00	14:14:00	1	1	1.087	1.011
20040128	14:15:00	14:14:00	1	1	1.058	1.002
20040316	14:15:00	14:15:00	1	1	1.009	1.003
20040504	14:15:00	14:16:00	1	1	1.115	1.062
20040630	14:15:00	14:18:00	1.25	1.25	1.585	1.404
20040810	14:15:00	14:15:00	1.5	1.5	1.55	1.519
20040921	14:15:00	14:15:00	1.75	1.75	1.907	1.792
20041110	14:15:00	14:15:00	2	2	2.216	2.16
20041214	14:15:00	14:15:00	2.25	2.25	2.428	2.41
20050202	14:15:00	14:12:00	2.5	2.5	2.61	2.546
20050322	14:15:00	14:17:00	2.75	2.75	3.142	2.884
20050503	14:15:00	14:16:00	3	3	3.256	3.094
20050630	14:15:00	14:15:00	3.25	3.25	3.543	3.416
20050809	14:15:00	14:17:00	3.5	3.5	3.95	3.658
20050920	14:15:00	14:17:00	3.75	3.75	3.878	3.765
20051101	14:15:00	14:18:00	4	4	4.34	4.103
20051213	14:15:00	14:13:00	4.25	4.25	4.459	4.369
20060131	14:15:00	14:14:00	4.5	4.5	4.564	4.558
20060328	14:15:00	14:17:00	4.75	4.75	4.969	4.76
20060510	14:15:00	14:17:00	5	5	5.107	5.095
20060629	14:15:00	14:16:00	5.25	5.25	5.335	5.308
20060808	14:15:00	14:14:00	5.25	5.25	5.309	5.305
20060920	14:15:00	14:13:00	5.25	5.25	5.259	5.261
20061025	14:15:00	14:13:00	5.25	5.25	5.266	5.248
20061212	14:15:00	14:14:00	5.25	5.25	5.21	5.236
20070131	14:15:00	14:14:00	5.25	5.25	5.247	5.247
20070321	14:15:00	14:15:00	5.25	5.25	5.2	5.233
20070509	14:15:00	14:15:00	5.25	5.25	5.221	5.244
20070628	14:15:00	14:14:00	5.25	5.25	5.24	5.242
20070807	14:15:00	14:14:00	5.25	5.25	5.217	5.218

Table A1 (continued)

Date	Official time	Actual time	Low	High	ExpRate	ExpRate3 – month
20070918	14:15:00	14:15:00	4.75	4.75	4.73	4.855
20071031	14:15:00	14:15:00	4.5	4.5	4.44	4.501
20071211	14:15:00	14:15:00	4.25	4.25	4.037	4.134
20080130	14:15:00	14:14:00	3	3	3.061	3.079
20080318	14:15:00	14:14:00	2.25	2.25	1.795	1.847
20080430	14:15:00	14:15:00	2	2	2.021	2.017
20080625	14:15:00	14:09:00	2	2	2.164	2.063
20080805	14:15:00	14:13:00	2	2	2.105	2.056
20080916	14:15:00	14:14:00	2	2	1.794	1.795
20081029	14:15:00	14:17:00	0.5	1	0.905	0.907
20081216	14:15:00	14:11:00	0	0.25	0.33	0.33
20090128	14:15:00	14:14:00	0	0.25	0.252	0.23
20090318	14:15:00	14:17:00	0	0.25	0.225	0.225
20090624	14:15:00	14:18:00	0	0.25	0.359	0.229
20090812	14:15:00	14:16:00	0	0.25	0.355	0.198
20090923	14:15:00	14:16:00	0	0.25	0.28	0.185
20091104	14:15:00	14:18:00	0	0.25	0.319	0.154
20091216	14:15:00	14:15:00	0	0.25	0.282	0.171
20100127	14:15:00	14:16:00	0	0.25	0.234	0.138
20100316	14:15:00	14:14:00	0	0.25	0.268	0.195
20100428	14:15:00	14:14:00	0	0.25	0.357	0.217
20100623	14:15:00	14:15:00	0	0.25	0.292	0.204
20100810	14:15:00	14:14:00	0	0.25	0.218	0.177
20100921	14:15:00	14:14:00	0	0.25	0.193	0.185
20101103	14:15:00	14:16:00	0	0.25	0.189	0.175
20101214	14:15:00	14:15:00	0	0.25	0.255	0.182
20110126	14:15:00	14:16:00	0	0.25	0.24	0.172
20110315	14:15:00	14:13:00	0	0.25	0.245	0.139
20110427	12:30:00	12:32:00	0	0.25	0.271	0.115
20110622	12:30:00	12:27:00	0	0.25	0.208	0.109
20110809	14:15:00	14:18:00	0	0.25	0.101	0.085
20110921	14:15:00	14:24:00	0	0.25	0.071	0.069
20111102	12:30:00	12:32:00	0	0.25	0.114	0.085
20111213	14:15:00	14:13:00	0	0.25	0.11	0.092
20120125	12:30:00	12:28:00	0	0.25	0.112	0.085
20120313	14:15:00	14:15:00	0	0.25	0.143	0.116
20120425	12:30:00	12:32:00	0	0.25	0.15	0.135
20120620	12:30:00	12:32:00	0	0.25	0.168	0.167
20120801	14:15:00	14:13:00	0	0.25	0.136	0.14
20120913	12:30:00	12:31:00	0	0.25	0.126	0.128
20121024	14:15:00	14:15:00	0	0.25	0.146	0.149
20121212	12:30:00	12:30:00	0	0.25	0.138	0.142
20130130	14:15:00	14:15:00	0	0.25	0.137	0.133
20130320	14:00:00	14:00:00	0	0.25	0.14	0.143
20130501	14:00:00	14:01:00	0	0.25	0.125	0.125
20130619	14:00:00	14:00:00	0	0.25	0.105	0.103

Table A2**Market reaction to FOMC surprises**

This table reports OLS estimates of the relation between event-time cumulative returns on announcement days and the information in FOMC policy releases for 126 scheduled announcements between September 30, 1997 and June 19, 2013. The announcement returns are calculated in three event windows relative to the scheduled announcement time, 0, for E-mini S&P 500 futures in Panel A, E-mini Nasdaq 100 futures in Panel B, SPDR S&P 500 ETF in Panel C, and PowerShares QQQ ETF (tracking Nasdaq 100 index) in Panel D. *Expected* is the volume-weighted Federal funds future-implied rate on the day before FOMC announcements using all contracts. *Unexpected* is the announced Federal funds target rate minus the expected rate. The calculation method is described in Subsection 3.2. Robust *t*-statistics are reported in parentheses.

Variable	Ret[-5,5]	Ret[-15,15]	Ret[-30,30]
<i>Panel A: E-mini S&P 500 futures</i>			
Intercept	-7.918 (-2.11)	-13.324 (-2.79)	-11.461 (-1.77)
Expected	-39.792 (-3.01)	-23.286 (-1.38)	-29.095 (-1.28)
Unexpected	-147.485 (-4.30)	-158.107 (-3.62)	-160.762 (-2.72)
<i>Panel B: E-mini Nasdaq 100 futures</i>			
Intercept	-10.930 (-2.15)	-15.950 (-2.50)	-21.597 (-2.37)
Expected	-60.058 (-3.49)	-31.206 (-1.45)	-43.38 (-1.41)
Unexpected	-213.940 (-4.65)	-221.967 (-3.85)	-287.096 (-3.49)
<i>Panel C: SPDR S&P 500 ETF</i>			
Intercept	-6.020 (-1.55)	-13.285 (-2.79)	-8.084 (-1.30)
Expected	-31.469 (-2.32)	-24.799 (-1.49)	-27.155 (-1.25)
Unexpected	-139.569 (-3.98)	-159.421 (-3.70)	-154.157 (-2.73)
<i>Panel D: PowerShares QQQ ETF (tracking Nasdaq 100 index)</i>			
Intercept	-7.445 (-1.23)	-17.425 (-2.63)	-19.569 (-2.24)
Expected	-60.972 (-2.99)	-37.748 (-1.70)	-39.666 (-1.35)
Unexpected	-225.638 (-4.13)	-236.882 (-3.98)	-272.729 (-3.46)

Table A3**Description of the E-mini S&P500 market around the announcement**

This table reports summary statistics for the cumulative returns and order imbalances of the E-mini S&P500 futures around macroeconomic announcement. *ANN*, *SUR*, *OIN*, and *OID* are as defined in Table 4. *ANN*=0 identifies non-announcement days; *SUR*=0 identifies days of non-surprise announcements; and $|SUR|=1$ identifies days of surprise announcements. The event windows are: $[-60,-30]$, from one hour before to half an hour before the official release time; $[-30,0]$, from half hour before to the official release time; and $[0,60]$, from the official release time to one hour afterwards. For observations in the surprise announcement group ($|SUR|=1$), the signs of the return and order imbalance variables are adjusted to reflect the effects of good news across all surprises.

Period	Mean			Standard deviation			Median			
	<i>OIN</i>	<i>OID</i>	Return	<i>OIN</i>	<i>OID</i>	Return	<i>OIN</i>	<i>OID</i>	Return	
<i>Panel A: FOMC</i>										
<i>ANN</i> =0	$[-60,-30]$	0.106	-0.336	0.545	12.047	14.560	24.663	-0.051	-0.641	0.493
	$[-30,0]$	-0.494	-0.590	-1.103	9.942	12.941	24.527	-0.338	-0.808	-0.081
	$[0,60]$	-0.155	-0.154	1.131	6.458	9.083	43.485	-0.147	-0.429	0.702
<i>SUR</i> =0	$[-60,-30]$	-0.448	0.922	1.970	11.493	15.037	15.648	0.532	1.384	0.000
	$[-30,0]$	-0.513	-0.098	-5.116	10.025	11.238	24.582	-0.690	-0.285	-1.678
	$[0,60]$	-0.569	0.094	8.685	4.163	6.506	69.733	-0.309	0.703	9.297
$ SUR =1$	$[-60,-30]$	-0.790	-4.494	0.323	12.077	19.150	15.687	1.038	-2.492	-2.151
	$[-30,0]$	7.913	9.268	17.038	11.208	13.538	31.836	9.034	8.680	8.813
	$[0,60]$	-0.313	0.066	2.607	4.387	7.934	104.141	-0.629	-0.927	0.000
<i>Panel B: Nonfarm Payroll</i>										
<i>ANN</i> =0	$[-60,-30]$	0.306	0.340	-0.310	21.347	26.174	14.894	0.000	-0.004	0.000
	$[-30,0]$	0.108	0.471	0.167	16.211	20.847	17.247	0.000	0.051	0.000
	$[0,60]$	-1.214	-1.349	-1.384	10.551	14.175	26.703	-0.876	-1.186	-1.622
<i>SUR</i> =0	$[-60,-30]$	0.678	0.982	-0.720	19.394	23.695	12.447	0.000	0.873	0.000
	$[-30,0]$	3.066	5.078	5.673	11.932	14.297	18.202	2.761	3.656	4.987
	$[0,60]$	0.177	0.431	-2.526	7.042	10.527	61.707	-0.273	-0.393	4.242
$ SUR =1$	$[-60,-30]$	-0.063	2.455	3.062	20.333	26.279	14.188	3.704	4.260	2.820
	$[-30,0]$	-2.149	2.046	5.905	10.765	16.663	20.843	-1.393	5.836	0.000
	$[0,60]$	0.121	1.997	31.682	5.208	7.099	53.803	-1.818	2.980	30.731

Table A3 (continued)

	Period	Mean			Standard deviation			Median		
		<i>OIN</i>	<i>OID</i>	Return	<i>OIN</i>	<i>OID</i>	Return	<i>OIN</i>	<i>OID</i>	Return
<i>Panel C: PPI</i>										
<i>ANN=0</i>	[-60,-30]	0.352	0.413	-0.260	21.371	26.147	14.754	0.000	0.007	0.000
	[-30,0]	0.062	0.387	0.036	16.332	20.916	16.940	0.000	0.004	0.000
	[0,60]	-1.227	-1.337	-1.335	10.531	14.097	26.535	-0.876	-1.219	-1.622
<i>SUR=0</i>	[-60,-30]	2.513	5.060	2.566	20.692	23.881	15.262	1.066	7.394	2.286
	[-30,0]	0.308	1.455	0.431	14.355	17.854	13.767	0.437	1.923	0.000
	[0,60]	-1.961	-1.922	-2.416	10.861	13.503	33.293	-1.862	-1.380	-1.399
<i> SUR =1</i>	[-60,-30]	-7.906	-11.62	-4.955	16.748	26.576	12.781	-7.227	-13.247	-4.190
	[-30,0]	-0.870	-0.067	3.185	14.748	24.466	28.143	2.153	-2.241	1.619
	[0,60]	0.151	2.417	14.134	7.744	11.101	53.300	-0.818	1.690	4.830
<i>Panel D: GDP</i>										
<i>ANN=0</i>	[-60,-30]	0.344	0.393	-0.310	21.180	26.001	14.926	0.000	0.009	0.000
	[-30,0]	0.050	0.383	0.084	16.296	20.866	17.313	0.000	0.016	0.000
	[0,60]	-1.258	-1.374	-1.397	10.546	14.116	26.657	-0.893	-1.211	-1.622
<i>SUR=0</i>	[-60,-30]	1.283	3.685	0.515	19.217	24.897	14.347	0.597	1.255	0.376
	[-30,0]	1.478	3.418	4.037	14.285	19.760	17.369	0.659	3.170	2.479
	[0,60]	0.477	0.015	-2.816	8.749	12.476	37.286	-0.092	-1.069	-3.629
<i> SUR =1</i>	[-60,-30]	1.425	-0.314	-3.054	19.881	23.144	19.004	2.349	0.242	-0.875
	[-30,0]	1.593	5.806	5.502	10.027	15.563	16.404	2.128	5.569	5.428
	[0,60]	4.390	6.007	29.972	6.987	8.142	38.171	4.110	7.062	19.902

Table A4**Market dynamics around macroeconomic announcements**

This table reports pooled OLS regression estimates of the relation between E-mini S&P 500 futures market order imbalances and announcement day indicators, conditional on the timing of the order imbalances. The event windows for each announcement are: $[-60,-30]$, $[-30,0]$, and $[0,60]$, where 0 is the official release time. The dependent variables are the order imbalances calculated using number of trades (*OIN*) or dollar volume (*OID*). *ANN* and *SUR* are as defined in Table 4. *Lockup* is a dummy equal to one for observations in the window $[-30,0]$, and zero otherwise. *Post* is a dummy equal to one for observations in the window $[0,60]$, and zero otherwise. Robust *t*-statistics are reported in parentheses.

Variable	FOMC		Nonfarm payroll		PPI		GDP	
	<i>OIN</i>	<i>OID</i>	<i>OIN</i>	<i>OID</i>	<i>OIN</i>	<i>OID</i>	<i>OIN</i>	<i>OID</i>
Intercept	0.113 (0.58)	-0.336 (-1.35)	0.306 (1.06)	0.340 (0.93)	0.352 (1.20)	0.413 (1.12)	0.344 (1.19)	0.393 (1.07)
<i>ANN</i>	-0.505 (-0.55)	1.046 (0.90)	0.812 (0.66)	1.249 (0.80)	2.161 (1.62)	4.648 (2.76)	0.125 (0.10)	2.756 (1.77)
<i>SUR</i>	-0.586 (-0.29)	-4.863 (-1.91)	-0.129 (-0.03)	2.361 (0.47)	1.933 (0.55)	1.210 (0.27)	1.403 (0.39)	-0.464 (-0.10)
<i>Lockup</i>	1.308 (1.01)	0.584 (0.36)	2.107 (1.21)	3.167 (1.44)	-1.945 (-1.06)	-3.587 (-1.56)	1.573 (0.90)	0.821 (0.37)
<i>ANN*Lockup</i>	0.045 (0.03)	-1.103 (-0.67)	0.440 (0.25)	0.269 (0.12)	-3.074 (-1.68)	-5.348 (-2.32)	1.792 (1.03)	-0.975 (-0.44)
<i>SUR*Lockup</i>	8.337 (2.94)	13.590 (3.77)	-2.199 (-0.39)	-0.603 (-0.08)	-2.739 (-0.57)	-0.943 (-0.16)	0.108 (0.02)	6.081 (0.95)
<i>Post</i>	0.593 (0.21)	5.039 (1.40)	0.248 (0.04)	-0.374 (-0.05)	-2.276 (-0.47)	0.737 (0.12)	2.956 (0.58)	6.452 (1.00)
<i>ANN*Post</i>	-0.605 (-2.19)	-0.254 (-0.72)	-0.198 (-0.48)	0.132 (0.26)	-0.290 (-0.70)	-0.026 (-0.05)	-0.294 (-0.72)	-0.009 (-0.02)
<i>SUR*Post</i>	-0.268 (-0.97)	0.182 (0.52)	-1.521 (-3.72)	-1.688 (-3.28)	-1.579 (-3.82)	-1.750 (-3.37)	-1.602 (-3.92)	-1.766 (-3.42)

Table A5**Abnormal market activity in lockup subwindows**

This table replicates the analysis in Table 6 for FOMC announcements, conditional on the news media accreditation of Need To Know News. *OIN*, *OID*, *ANN*, and *SUR* are as defined in Table 4, while *NTKN* is as defined in Table 5. The dependent variables, *OIN* and *OID*, are calculated separately in three pre-announcement windows: $[-30,-20]$, $[-20,-10]$, and $[-10,0]$, where 0 is the official release time of FOMC announcements. Robust *t*-statistics are reported in parentheses.

Period	$[-30,-20]$		$[-20,-10]$		$[-10,0]$	
Model	1	2	3	4	5	6
Dependent	<i>OIN</i>	<i>OID</i>	<i>OIN</i>	<i>OID</i>	<i>OIN</i>	<i>OID</i>
Intercept	-1.183 (-2.78)	-1.834 (-3.55)	-0.070 (-0.16)	-0.258 (-0.49)	-1.026 (-2.50)	-1.197 (-2.45)
<i>ANN</i>	0.884 (0.43)	0.931 (0.37)	-0.043 (-0.02)	1.064 (0.42)	-0.578 (-0.29)	0.785 (0.33)
<i>SUR</i>	3.884 (0.97)	4.711 (0.97)	7.980 (1.98)	9.257 (1.88)	9.539 (2.48)	9.449 (2.06)
<i>NTKN</i>	1.466 (2.12)	2.440 (2.90)	-1.175 (-1.68)	-0.848 (-0.99)	1.178 (1.76)	1.188 (1.49)
<i>ANN*NTKN</i>	-2.626 (-0.81)	-1.527 (-0.39)	5.682 (1.74)	3.548 (0.89)	2.706 (0.87)	3.569 (0.96)
<i>SUR*NTKN</i>	-4.988 (-0.59)	-0.147 (-0.01)	2.302 (0.27)	3.377 (0.32)	-9.358 (-1.14)	-3.614 (-0.37)

Table A6**Scheduled and actual release time**

This table replicates the analysis in Tables 4 and 6 using alternative definitions of the FOMC policy announcement time. *OIN*, *OID*, *ANN*, and *SUR* are as defined in Table 4. In Panels A and B, the event time is the time-stamp of the earliest news report available on Factiva. In Panel C, the event time is the earlier between the official release time and the earliest news report time-stamp. In Panel A, the start of the pre-announcement windows is set relative to the corresponding event time. In Panels B and C, the start of the pre-announcement windows is set relative to the official release time. Robust *t*-statistics are reported in parentheses.

Period	[-30,-20]		[-20,-10]		[-10,t]		[-30,t]	
Model	1	2	3	4	5	6	7	8
Dependent	<i>OIN</i>	<i>OID</i>	<i>OIN</i>	<i>OID</i>	<i>OIN</i>	<i>OID</i>	<i>OIN</i>	<i>OID</i>
<i>Panel A: Both time 0 and time t are the actual release time</i>								
Intercept	-0.472 (-1.38)	-0.618 (-1.49)	-0.749 (-2.21)	-0.793 (-1.93)	-0.578 (-1.75)	-0.635 (-1.60)	-0.545 (-2.68)	-0.581 (-2.21)
<i>ANN</i>	0.394 (0.25)	0.690 (0.36)	1.811 (1.15)	1.810 (0.94)	3.108 (2.01)	4.679 (2.52)	1.800 (1.90)	2.331 (1.90)
<i>SUR</i>	5.698 (1.63)	8.802 (2.07)	6.465 (1.87)	6.492 (1.54)	3.472 (1.03)	4.977 (1.22)	5.912 (2.84)	7.781 (2.90)
<i>Panel B: Time 0 is the scheduled time and t is the actual time</i>								
Intercept	-0.630 (-1.88)	-0.914 (-2.24)	-0.513 (-1.52)	-0.578 (-1.40)	-0.650 (-1.93)	-0.801 (-1.98)	-0.527 (-2.59)	-0.593 (-2.25)
<i>ANN</i>	0.019 (0.01)	0.380 (0.20)	2.127 (1.35)	2.358 (1.22)	2.694 (1.72)	4.263 (2.26)	1.663 (1.75)	2.233 (1.82)
<i>SUR</i>	3.095 (0.90)	4.453 (1.07)	7.362 (2.12)	9.318 (2.21)	4.258 (1.24)	5.830 (1.41)	5.430 (2.61)	7.308 (2.71)
<i>Panel C: Time 0 is the scheduled time and t is MIN{scheduled time, actual time}</i>								
Intercept	-0.630 (-1.88)	-0.914 (-2.24)	-0.513 (-1.52)	-0.578 (-1.40)	-0.646 (-1.89)	-0.832 (-2.04)	-0.520 (-2.55)	-0.613 (-2.33)
<i>ANN</i>	0.019 (0.01)	0.380 (0.20)	2.127 (1.35)	2.358 (1.22)	2.621 (1.65)	4.332 (2.28)	1.529 (1.60)	2.234 (1.82)
<i>SUR</i>	3.095 (0.90)	4.453 (1.07)	7.362 (2.12)	9.318 (2.21)	5.519 (1.58)	7.034 (1.69)	6.116 (2.93)	7.919 (2.94)

Table A7**Alternative surprise definitions**

This table replicates Table 4 using alternative definitions for FOMC surprise announcements. The pre-announcement window starts 30 minutes before and ends at: the official release time in Columns 1 and 2; the actual time in Columns 3 and 4; and the earlier of the two in Columns 5 and 6. *OIN*, *OID*, and *ANN* are as defined in Table 4. In Panels A and B, *SUR*=1 (−1) when the target rate is below (above) the futures-implied rate by at least 17.5 and 20 basis points, respectively. In Panel C, *DIFF* is the announced minus the expected Federal funds rate. In Panel D, we follow the classification scheme in Table 4 while using only Federal funds rate futures expiring within three months to calculate the expected target rate. In Panel E, *ANNRET* is the cumulative return of the Emini S&P 500 futures from 30 minutes before the announcement to one minute after. Panels F and G use the surprise definitions of Kuttner (2001) and Gurkaynak, Sack, and Swanson (2005b), respectively. Panels H and I use the current month and non-current month Federal funds future contracts to calculate the announcement surprise, respectively. Robust *t*-statistics are reported in parentheses.

Event time	Scheduled		Actual		MIN{Scheduled, Actual}	
Model	1	2	3	4	5	6
Dependent	<i>OIN</i>	<i>OID</i>	<i>OIN</i>	<i>OID</i>	<i>OIN</i>	<i>OID</i>
<i>Panel A: SUR=1 (−1) if DIFF >17.5 (<−17.5) bp, 20 surprises</i>						
Intercept	−0.492 (−2.46)	−0.590 (−2.28)	−0.527 (−2.59)	−0.593 (−2.25)	−0.520 (−2.55)	−0.613 (−2.33)
<i>ANN</i>	1.147 (1.25)	2.019 (1.69)	1.891 (2.02)	2.539 (2.10)	1.789 (1.90)	2.578 (2.13)
<i>SUR</i>	7.172 (3.18)	8.047 (2.76)	5.231 (2.28)	7.043 (2.37)	5.848 (2.54)	7.456 (2.51)
<i>Panel B: SUR=1 (−1) if DIFF >20 (<−20) bp, 17 surprises</i>						
Intercept	−0.492 (−2.46)	−0.590 (−2.28)	−0.527 (−2.59)	−0.593 (−2.25)	−0.520 (−2.55)	−0.613 (−2.33)
<i>ANN</i>	1.175 (1.28)	2.074 (1.74)	1.925 (2.06)	2.595 (2.14)	1.822 (1.94)	2.632 (2.17)
<i>SUR</i>	7.699 (3.15)	8.200 (2.59)	5.380 (2.17)	7.052 (2.19)	6.101 (2.45)	7.541 (2.34)

Table A7 (continued)

Event time	Scheduled		Actual		MIN{Scheduled, Actual}	
Model	1	2	3	4	5	6
Dependent	<i>OIN</i>	<i>OID</i>	<i>OIN</i>	<i>OID</i>	<i>OIN</i>	<i>OID</i>
<i>Panel C: Actual policy surprise, DIFF, instead of categorical variable, SUR</i>						
Intercept	-0.492 (-2.46)	-0.590 (-2.28)	-0.527 (-2.59)	-0.593 (-2.25)	-0.520 (-2.55)	-0.613 (-2.33)
ANN	0.581 (0.61)	1.372 (1.12)	1.498 (1.56)	2.045 (1.64)	1.354 (1.40)	2.034 (1.63)
DIFF	-27.955 (-3.89)	-31.693 (-3.41)	-19.856 (-2.72)	-25.756 (-2.73)	-22.075 (-3.01)	-27.819 (-2.94)
<i>Panel D: Expected target rate from contracts expiring within three months, 16 surprises</i>						
Intercept	-0.491 (-2.45)	-0.585 (-2.26)	-0.524 (-2.58)	-0.587 (-2.23)	-0.518 (-2.54)	-0.608 (-2.30)
ANN	1.195 (1.30)	2.095 (1.76)	1.856 (1.99)	2.553 (2.11)	1.771 (1.88)	2.614 (2.15)
SUR	8.418 (3.35)	7.363 (2.26)	7.001 (2.74)	7.080 (2.14)	7.454 (2.91)	7.172 (2.17)
<i>Panel E: Surprise based on ES announcement returns</i>						
Intercept	-0.524 (-2.61)	-0.584 (-2.25)	-0.530 (-2.62)	-0.541 (-2.08)	-0.513 (-2.50)	-0.562 (-2.14)
ANN	11.940 (4.19)	13.026 (3.55)	6.789 (2.36)	6.510 (1.76)	7.210 (2.48)	6.949 (1.86)
ANNRET	1.637 (1.79)	2.525 (2.15)	2.369 (2.57)	2.953 (2.49)	2.152 (2.31)	2.875 (2.41)

Table A7 (continued)

Event time	Scheduled		Actual		MIN{Scheduled, Actual}	
	1	2	3	4	5	6
Model	1	2	3	4	5	6
Dependent	<i>OIN</i>	<i>OID</i>	<i>OIN</i>	<i>OID</i>	<i>OIN</i>	<i>OID</i>
<i>Panel F: Kuttner (2001) Method, 4 surprises</i>						
Intercept	-0.492 (-2.45)	-0.590 (-2.27)	-0.527 (-2.59)	-0.593 (-2.25)	-0.520 (-2.54)	-0.613 (-2.32)
<i>ANN</i>	1.603 (1.76)	2.530 (2.15)	2.223 (2.40)	2.987 (2.49)	2.160 (2.32)	3.051 (2.54)
<i>SUR</i>	4.832 (0.97)	5.899 (0.91)	0.844 (0.17)	2.384 (0.36)	1.035 (0.20)	2.496 (0.38)
<i>Panel G: Gurkaynak, Sack, and Swanson (2005b) Method</i>						
Intercept	-0.397 (-1.34)	-0.928 (-2.44)	-0.486 (-1.61)	-0.946 (-2.41)	-0.456 (-1.50)	-0.954 (-2.44)
<i>ANN</i>	1.340 (0.96)	2.190 (1.22)	2.864 (2.02)	3.844 (2.08)	2.720 (1.91)	3.778 (2.06)
Target	0.063 (0.28)	-0.130 (-0.46)	0.366 (1.61)	0.085 (0.29)	0.325 (1.42)	0.065 (0.22)
Path	-0.206 (-2.09)	-0.268 (-2.12)	-0.062 (-0.62)	-0.163 (-1.25)	-0.078 (-0.77)	-0.169 (-1.30)
<i>Panel H: Current month contract only, 14 surprises</i>						
Intercept	-0.492 (-2.45)	-0.590 (-2.27)	-0.527 (-2.59)	-0.593 (-2.25)	-0.520 (-2.54)	-0.613 (-2.32)
<i>ANN</i>	1.545 (1.69)	2.553 (2.16)	2.187 (2.35)	2.998 (2.49)	2.123 (2.27)	3.064 (2.54)
<i>SUR</i>	1.815 (0.68)	-0.721 (-0.21)	1.151 (0.42)	-0.359 (-0.10)	1.169 (0.43)	-0.388 (-0.11)
<i>Panel I: Non-current month contracts, 13 surprises</i>						
Intercept	-0.492 (-2.46)	-0.590 (-2.28)	-0.527 (-2.59)	-0.593 (-2.25)	-0.520 (-2.55)	-0.613 (-2.33)
<i>ANN</i>	1.200 (1.30)	1.996 (1.68)	1.956 (2.10)	2.558 (2.12)	1.860 (1.98)	2.586 (2.14)
<i>SUR</i>	5.080 (3.11)	6.722 (3.18)	3.363 (2.03)	5.398 (2.51)	3.791 (2.27)	5.856 (2.72)

Table A8**Alternative surprise definitions for the QE period**

This table replicates Table 4 using alternative definitions for FOMC surprise announcements during the Quantitative Easing (QE) period. The pre-announcement window starts 30 minutes before and ends at: the official release time in Columns 1 and 2; the actual time in Columns 3 and 4; and the earlier of the two in Columns 5 and 6. *OIN*, *OID*, and *ANN* are as defined in Table 4. In Panel A, we use the mid-point of the target range and the 12.5 bp threshold to define surprise in the QE period. For the announcements before QE, we use the same definition of surprise as in Table 4. In Panel B, we use the realized rate changes in the ten-year treasury yield to define surprise. *SUR* is equal to 1 (−1) if the magnitude of the realized rate change on the announcement day exceeds −1.75 (1.75) times its standard deviation calculated using data from 10 days before and 10 days after the announcement. Robust *t*-statistics are reported in parentheses.

Event time	Scheduled		Actual		MIN{Scheduled, Actual}	
	1 <i>OIN</i>	2 <i>OID</i>	3 <i>OIN</i>	4 <i>OID</i>	5 <i>OIN</i>	6 <i>OID</i>
<i>Panel A: Using the mean of target range as the target rate, 38 observations</i>						
Intercept	−0.492 (−2.46)	−0.590 (−2.28)	−0.527 (−2.59)	−0.593 (−2.25)	−0.520 (−2.55)	−0.613 (−2.33)
<i>ANN</i>	0.396 (0.40)	1.195 (0.94)	1.489 (1.50)	2.027 (1.57)	1.311 (1.31)	1.994 (1.55)
<i>SUR</i>	5.848 (3.35)	6.469 (2.87)	3.558 (2.01)	4.652 (2.03)	4.117 (2.31)	5.125 (2.23)
<i>Panel B: Using realized rate change, 31 observations</i>						
Intercept	−0.492 (−2.46)	−0.590 (−2.28)	−0.527 (−2.59)	−0.593 (−2.25)	−0.520 (−2.55)	−0.613 (−2.33)
<i>ANN</i>	1.040 (1.13)	1.930 (1.62)	1.816 (1.94)	2.478 (2.04)	1.707 (1.81)	2.504 (2.06)
<i>SUR</i>	6.450 (3.55)	6.872 (2.92)	4.663 (2.53)	5.827 (2.44)	5.198 (2.80)	6.268 (2.62)

Table A9**Volatility trading before FOMC announcements**

This table reports OLS estimates of the relation between volatility trading activity in the S&P 500 options market and FOMC announcement day indicators. *SUR* and *ANN* are as defined in Table 4. The dependent variables are options' vega order imbalances calculated using both number of trades (*VOIN*) and volume (*VOIV*) during the FOMC pre-announcement window following Holowczak, Hu, and Wu (2014). The pre-announcement window starts 30 minutes before and ends at: the official release time in Columns 1 and 2; the actual time in Columns 3 and 4; and the earlier of the two in Columns 5 and 6. Robust *t*-statistics are reported in parentheses.

Event time	Scheduled		Actual		MIN{Scheduled, Actual}	
	1 VOIN	2 VOIV	3 VOIN	4 VOIV	5 VOIN	6 VOIV
Intercept	0.006 (0.51)	-0.001 (-0.12)	0.014 (1.73)	0.015 (1.66)	0.014 (1.73)	0.015 (1.66)
<i>ANN</i>	0.020 (0.34)	-0.054 (-0.80)	0.016 (0.34)	-0.055 (-1.02)	0.011 (0.23)	-0.063 (-1.16)
<i>SUR</i>	0.240 (1.96)	0.264 (1.87)	0.214 (2.21)	0.217 (1.95)	0.259 (2.67)	0.306 (2.74)

Table A10**Predicting announcement surprise and returns using order flow**

This table replicates the analysis in Table 10 while using the earlier between the official release time and the earliest news report time-stamp as event time 0. Panel A reports the OLS estimates of the following model:

$$\text{SUR} = \beta_0 + \beta_1 \text{OI}_{t-1,t-x} + \beta_2 \text{OI}_{t-x-1,t-y} + \beta_3 \text{Ret}_{t-1,t-x} + \beta_4 \text{Ret}_{t-x-1,t-y} + \beta_5 \text{Ret}_{t-1,t-x}^2 + \beta_6 \text{Ret}_{t-x-1,t-y}^2 + \varepsilon,$$

where the dependent variable is the FOMC policy surprise as defined in Table 4, and the independent variables include the E-mini S&P 500 futures order imbalances, S&P 500 index returns, and the squared S&P 500 index returns, all measured relative to t (i.e., earlier between the official release time and the earliest news report time-stamp). All variables except the surprise indicator are adjusted by subtracting the average value of the corresponding variable during the same time window in the five trading days prior to announcement. *OIN* and *OID* are order imbalances calculated using the number of trades and dollar transaction volumes, respectively. Robust t -statistics are reported in parentheses. Panel B reports OLS estimates of the relation between the S&P 500's announcement returns, $\text{Ret}_{t,t+z}$, and the fitted FOMC policy surprises, $FSUR$, from the corresponding model in Panel A. The t -statistics reported in parentheses are calculated using Heckman-correction.

Period	$x=30,y=60$		$x=30,y=90$		$x=20,y=60$		$x=15,y=60$		$x=10,y=60$	
	1	2	3	4	5	6	7	8	9	10
Dependent	<i>OIN</i>	<i>OID</i>	<i>OIN</i>	<i>OID</i>	<i>OIN</i>	<i>OID</i>	<i>OIN</i>	<i>OID</i>	<i>OIN</i>	<i>OID</i>
<i>Stage one: Predicting announcement surprise</i>										
Intercept	0.085 (1.79)	0.087 (1.78)	0.074 (1.50)	0.086 (1.77)	0.093 (1.94)	0.099 (2.07)	0.089 (1.83)	0.087 (1.76)	0.091 (1.94)	0.084 (1.75)
$\text{OI}_{t-1,t-x}$	1.671 (3.90)	1.363 (3.43)	1.771 (4.04)	1.516 (3.90)	1.628 (3.58)	1.529 (3.89)	1.138 (3.09)	0.948 (2.73)	0.916 (2.67)	0.862 (2.69)
$\text{OI}_{t-x-1,t-y}$	0.255 (0.71)	-0.217 (-0.78)	-0.529 (-1.06)	-0.849 (-2.11)	-0.229 (-0.35)	-0.660 (-1.39)	0.599 (1.41)	0.139 (0.42)	0.736 (1.51)	0.282 (0.74)
$\text{Ret}_{t-1,t-x}$	-0.331 (-1.09)	-0.348 (-1.11)	-0.392 (-1.27)	-0.479 (-1.54)	-0.255 (-0.80)	-0.348 (-1.10)	0.056 (0.15)	-0.005 (-0.01)	0.227 (0.53)	0.119 (0.26)
$\text{Ret}_{t-x-1,t-y}$	0.288 (0.93)	0.285 (0.89)	0.335 (1.38)	0.341 (1.34)	-0.020 (-0.10)	-0.054 (-0.29)	-0.034 (-0.16)	-0.020 (-0.09)	-0.086 (-0.36)	-0.088 (-0.35)
$\text{Ret}_{t-1,t-x}^2$	0.209 (0.75)	0.296 (0.69)	0.240 (0.69)	0.120 (0.54)	0.169 (0.25)	0.008 (0.00)	0.112 (0.13)	0.304 (0.42)	-0.132 (-0.31)	-0.166 (-0.32)
$\text{Ret}_{t-x-1,t-y}^2$	-0.254 (-0.52)	-0.078 (-0.21)	-0.217 (-0.71)	-0.277 (-0.64)	0.071 (0.19)	0.022 (0.02)	0.120 (0.16)	0.140 (0.27)	0.266 (0.47)	0.324 (0.67)

Table A10 (continued)

Period	$x=30,y=60$		$x=30,y=90$		$x=20,y=60$		$x=15,y=60$		$x=10,y=60$	
Model	1	2	3	4	5	6	7	8	9	10
Dependent	OIN	OID	OIN	OID	OIN	OID	OIN	OID	OIN	OID
<i>Stage two: Predicting announcement returns $z=1$</i>										
Intercept	-3.662	-4.148	-3.495	-3.754	-3.580	-3.709	-2.789	-3.617	-1.932	-2.217
	(-1.28)	(-1.39)	(-1.51)	(-1.56)	(-1.41)	(-1.41)	(-1.15)	(-1.32)	(-0.87)	(-0.89)
FSUR	19.360	23.363	17.988	20.119	18.688	19.746	11.378	18.193	4.328	6.671
	(2.13)	(2.35)	(2.18)	(2.47)	(2.17)	(2.16)	(1.71)	(1.80)	(0.93)	(1.07)
<i>Stage two: Predicting announcement returns $z=15$</i>										
Intercept	-6.188	-4.740	-6.156	-5.632	-6.506	-5.688	-3.348	-0.498	-1.328	0.456
	(-1.01)	(-0.75)	(-1.01)	(-0.93)	(-1.06)	(-0.92)	(-0.54)	(-0.07)	(-0.19)	(0.06)
FSUR	19.784	7.864	19.524	15.209	22.405	15.671	13.110	26.574	19.737	14.426
	(1.98)	(1.29)	(2.01)	(1.82)	(2.08)	(1.81)	(1.15)	(1.63)	(1.74)	(1.31)
<i>Stage two: Predicting announcement returns $z=30$</i>										
Intercept	-3.558	-2.947	-4.464	-4.472	-5.848	-5.056	-2.261	1.473	-0.080	1.471
	(-0.48)	(-0.41)	(-0.59)	(-0.61)	(-0.76)	(-0.68)	(-0.30)	(0.19)	(-0.01)	(0.17)
FSUR	12.881	7.854	20.344	20.410	31.732	25.209	2.815	27.922	15.139	27.909
	(1.47)	(1.34)	(1.71)	(1.86)	(1.93)	(1.80)	(0.09)	(1.95)	(1.44)	(1.88)
<i>Stage two: Predicting announcement returns $z=60$</i>										
Intercept	1.925	3.298	-0.300	0.533	0.427	1.806	4.248	9.709	6.855	10.445
	(0.19)	(0.33)	(-0.03)	(0.05)	(0.04)	(0.18)	(0.42)	(0.94)	(0.62)	(0.95)
FSUR	5.789	5.515	24.097	17.241	18.114	6.768	12.668	17.614	24.120	23.671
	(0.87)	(0.65)	(1.67)	(1.48)	(1.46)	(0.89)	(1.32)	(1.39)	(1.24)	(1.46)

Table A11**Predicting announcement surprise and returns using subperiod order imbalances during lockups**

This table replicates the analysis in Table 10 using E-mini S&P 500 order imbalances in three subwindows of the lockup period: $[t-30, t-21]$, $[t-20, t-11]$, and $[t-10, t-1]$, where t is the scheduled release time in Columns 1 and 2, the actual time in Columns 3 and 4, and the earlier of the two in Columns 5 and 6. *OIN* and *OID* are order imbalances calculated using the number of trades and dollar transaction volumes, respectively. Robust t -statistics are reported in parentheses. Panel B reports OLS estimates of the relation between the S&P 500's announcement returns, $Ret_{t,t+1}$, and the fitted FOMC policy surprises, $FSUR$, from the corresponding model in Panel A. The t -statistics reported in parentheses are calculated using Heckman-correction.

Event time Model Dependent	Scheduled		Actual		MIN{Scheduled, Actual}	
	1 <i>OIN</i>	2 <i>OID</i>	3 <i>OIN</i>	4 <i>OID</i>	5 <i>OIN</i>	6 <i>OID</i>
<i>Panel A: Predicting announcement surprise</i>						
Intercept	0.110 (2.17)	0.103 (2.05)	0.126 (2.45)	0.121 (2.30)	0.115 (2.24)	0.109 (2.08)
$OI_{t-21,t-30}$	0.321 (1.25)	0.267 (1.18)	0.338 (1.29)	0.272 (1.18)	0.166 (0.66)	0.226 (1.02)
$OI_{t-11,t-20}$	0.415 (1.62)	0.438 (1.90)	0.355 (1.39)	0.414 (1.91)	0.419 (1.65)	0.330 (1.47)
$OI_{t-1,t-10}$	0.205 (0.63)	0.528 (1.69)	0.095 (0.29)	0.242 (0.75)	0.201 (0.63)	0.354 (1.14)
$OI_{t-31,t-60}$	0.400 (1.11)	-0.081 (-0.29)	0.572 (1.37)	-0.045 (-0.14)	0.485 (1.25)	-0.033 (-0.11)
$Ret_{t-21,t-30}$	-0.374 (-0.74)	-0.581 (-1.11)	-0.711 (-1.15)	-0.828 (-1.33)	-0.235 (-0.45)	-0.296 (-0.55)
$Ret_{t-11,t-20}$	-0.178 (-0.41)	-0.326 (-0.73)	-0.004 (-0.01)	-0.080 (-0.16)	-0.170 (-0.36)	-0.285 (-0.59)
$Ret_{t-1,t-10}$	1.166 (2.91)	0.861 (2.19)	0.881 (1.88)	0.630 (1.53)	0.846 (1.76)	0.632 (1.57)
$Ret_{t-31,t-60}$	0.565 (1.75)	0.660 (2.03)	0.015 (0.05)	0.139 (0.42)	0.209 (0.62)	0.299 (0.85)
$Ret_{t-21,t-30}^2$	0.875 (0.45)	0.509 (0.26)	3.937 (1.83)	3.305 (1.50)	3.141 (1.36)	2.829 (1.21)
$Ret_{t-11,t-20}^2$	1.831 (1.01)	2.5 (1.38)	0.562 (0.53)	0.498 (0.45)	1.053 (0.74)	1.138 (0.79)
$Ret_{t-1,t-10}^2$	1.422 (1.84)	1.252 (1.63)	-1.941 (-1.07)	-1.258 (-0.68)	-1.830 (-1.11)	-1.488 (-0.89)
$Ret_{t-31,t-60}^2$	-0.832 (-1.37)	-0.644 (-1.09)	-0.124 (-0.23)	0.026 (0.05)	-0.147 (-0.25)	-0.055 (-0.09)
<i>Panel B: Predicting announcement $Ret_{t,t+1}$</i>						
Intercept	-3.857 (-1.50)	-4.496 (-1.57)	-3.970 (-1.05)	-4.172 (-1.05)	-3.173 (-0.97)	-3.412 (-0.93)
FSUR	25.022 (2.48)	20.830 (2.58)	16.080 (1.86)	17.742 (1.99)	19.926 (1.77)	18.896 (1.95)