

Online Appendix for

**Informed Trading around Stock Split Announcements: Evidence from the  
Option Market**

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## APPENDIX A

### Description of the Control Variables

The CAR regressions (equations (9) and (10)) and the BHAR regressions (equations (11) and (12)) employ the following control variables:

Size: is the natural logarithm of the firm's market capitalization at the end of the month prior to the announcement date.

Analyst: is the number of analysts following the firm for the earnings quarter before the announcement date.

Book-to-market ratio: is the firm's book value of equity at the end of the fiscal year preceding the calendar year of the announcement date divided by the firm's market capitalization at the end of the month prior to the announcement date.

Price: is the natural logarithm of the stock's price 20 days prior to the announcement date.

Volume: is the average dollar trading volume of the stock during the period [-250, -11].

Run-up: is the BHAR [-250, -11].

Arbitrage risk: is the standard deviation of the residuals from a market model regression using the past 48 months of stock returns.

Market risk: is the R-square of the regression used to estimate arbitrage risk.

Split factor.

In addition, the BHAR (+7, +60) regressions also include the CAR (0, +1) as a control variable.

## APPENDIX B

### Summary Statistics on Option Liquidity and Implied Volatility in the Market Cap Groups

Appendix B reports the liquidity and implied volatility for call and put options on stocks that belong to the S&P 500 (large cap stocks), S&P 400 (mid cap stocks) and S&P 600 indices (small cap stocks), and “other” stocks (stocks that are not part of any of these three indices). Panel A reports the mean/median open interest (OI), volume (Volu) and the average implied volatility (IV) for call options during the period [-100 to -20] where Day 0 is the split announcement date. Panel B reports the same information for put options.

<i>Panel A. Call Options</i>						
<u>Index</u>	<u>Option Delta</u>	<u>Mean OI</u>	<u>Median OI</u>	<u>Mean Volu</u>	<u>Median Volu</u>	<u>Mean IV</u>
S&P 500	0.02<delta<=0.125	2283	614	148	12	0.399
	0.125<delta<=0.375	1988	551	255	28	0.387
	0.375<delta<=0.625	1999	571	306	33	0.404
	0.625<delta<=0.875	1537	346	129	5	0.421
	0.875<delta<=0.98	996	153	31	0	0.530
S&P400	0.02<delta<=0.125	568	180	41	0	0.543
	0.125<delta<=0.375	479	124	56	2	0.509
	0.375<delta<=0.625	480	125	64	4	0.516
	0.625<delta<=0.875	369	77	26	0	0.517
	0.875<delta<=0.98	209	28	7	0	0.623
S&P 600	0.02<delta<=0.125	293	74	18	0	0.557
	0.125<delta<=0.375	219	55	22	0	0.500
	0.375<delta<=0.625	221	57	25	0	0.511
	0.625<delta<=0.875	165	33	11	0	0.524
	0.875<delta<=0.98	98	10	3	0	0.628
Other	0.02<delta<=0.125	617	181	52	0	0.779
	0.125<delta<=0.375	437	96	60	2	0.697
	0.375<delta<=0.625	378	82	63	4	0.724
	0.625<delta<=0.875	290	52	28	0	0.733
	0.875<delta<=0.98	221	31	8	0	0.813

APPENDIX B (continued)

<i>Panel B. Put Options</i>						
<u>Index</u>	<u>Option Delta</u>	<u>Mean OI</u>	<u>Median OI</u>	<u>Mean Volu</u>	<u>Median Volu</u>	<u>Mean IV</u>
S&P 500	-0.125<delta<=-0.02	2030	677	88	2	0.518
	-0.375<delta<=-0.125	1538	410	173	12	0.430
	-0.625<delta<=-0.375	927	152	138	5	0.411
	-0.875<delta<=-0.625	465	41	45	0	0.398
	-0.98<delta<=-0.875	270	10	13	0	0.450
S&P400	-0.125<delta<=-0.02	507	128	23	0	0.639
	-0.375<delta<=-0.125	375	72	41	0	0.540
	-0.625<delta<=-0.375	214	25	31	0	0.525
	-0.875<delta<=-0.625	110	4	10	0	0.499
	-0.98<delta<=-0.875	55	0	3	0	0.558
S&P 600	-0.125<delta<=-0.02	258	50	11	0	0.663
	-0.375<delta<=-0.125	164	26	16	0	0.552
	-0.625<delta<=-0.375	107	10	12	0	0.520
	-0.875<delta<=-0.625	58	0	4	0	0.498
	-0.98<delta<=-0.875	25	0	2	0	0.584
Other	-0.125<delta<=-0.02	414	95	25	0	0.881
	-0.375<delta<=-0.125	268	40	37	0	0.766
	-0.625<delta<=-0.375	157	11	25	0	0.742
	-0.875<delta<=-0.625	103	1	9	0	0.702
	-0.98<delta<=-0.875	67	0	4	0	0.798

## APPENDIX C

### Summary Statistics on the Volatility Spread and Skew in the Market Cap Groups

Appendix C reports the distribution of the volatility spread and skew for the period [-100 to -20] in the market capitalization groups. The volatility spread is the weighted average of the difference in implied volatility across all valid call and put option pairs matched on the same strike price and maturity date. The weight is the average open interest of the call and put options. The volatility skew is the difference in implied volatility of out-of-the-money put and at-the-money call options. Out-of-the-money put options are those with delta closest to -0.3 and at-the-money call options are those with delta closest to 0.5.

<u>Index</u>		<u>Volatility Spread</u>	<u>Volatility Skew</u>
S&P 500	Mean	-0.0088	0.0310
	25th percentile	-0.0180	0.0136
	Median	-0.0054	0.0242
	75th percentile	0.0040	0.0391
	Standard deviation	0.0369	0.0371
S&P 400	Mean	-0.0103	0.0375
	25th percentile	-0.0227	0.0151
	Median	-0.0063	0.0288
	75th percentile	0.0055	0.0487
	Standard deviation	0.0456	0.0403
S&P 600	Mean	-0.0130	0.0430
	25th percentile	-0.0266	0.0163
	Median	-0.0073	0.0318
	75th percentile	0.0062	0.0556
	Standard deviation	0.0523	0.0427
Other	Mean	-0.0257	0.0521
	25th percentile	-0.0467	0.0196
	Median	-0.0167	0.0382
	75th percentile	0.0022	0.0681
	Standard deviation	0.0638	0.0512

## APPENDIX D

### Summary Statistics for the Change in Implied Volatility, Volatility Spread and Volatility Skew

Appendix D reports statistics on the change in option-implied volatility, volatility spread and volatility skew during the period [-100, -20] where Day 0 is the split announcement date. Numbers in parentheses are the t-statistic of the means.

	<u><math>\Delta IV</math> Call</u>	<u><math>\Delta IV</math> Put</u>	<u><math>\Delta VS</math></u>	<u><math>\Delta SKEW</math></u>
Mean	-0.000036 (-0.24)	-0.000060 (-0.57)	-0.000016 (-0.11)	-0.000041 (-0.35)
Median	-0.000330	-0.000311	0.000046	0.000032
Standard deviation	0.054	0.038	0.051	0.038
Skewness	-0.086	0.810	0.066	0.811
Kurtosis	64	102	128	146

## APPENDIX E

### Implied Volatility Changes in Moneyness Groups

Appendix E reports the change in implied volatility around the split announcement date for options partitioned into moneyness groups. Panels A, B and C report implied volatility changes for out-of-the-money, near-the-money and in-the-money options, respectively. Out-of-the-money options have an absolute value of delta between 0.02 and 0.375. Near-the-money options have an absolute value of delta between 0.375 and 0.625. In-the-money options have an absolute value of delta between 0.625 and 0.98. Numbers in parentheses are the t-statistic of the means. \*,\*\* indicate significance at the 10% and 5% level, respectively.

<i>Panel A. Out-of-the Money</i>				
<u>Day</u>	<u>Call Options</u>		<u>Put Options</u>	
	<u>Short Maturity</u>	<u>Long Maturity</u>	<u>Short Maturity</u>	<u>Long Maturity</u>
-5	0.0026** (2.20)	0.0017** (2.18)	0.0014 (1.34)	0.0000 (0.00)
-4	-0.0006 (-0.44)	-0.0005 (-0.70)	0.0002 (0.16)	0.0008 (1.14)
-3	0.0015 (1.10)	0.0006 (0.74)	0.0022* (1.89)	-0.0001 (-0.14)
-2	0.0029** (2.16)	-0.0025 (-1.51)	0.0043** (3.28)	0.0014** (2.16)
-1	0.0050** (3.98)	0.0014* (1.86)	0.0055** (3.55)	0.0001 (0.22)
0	0.0107** (5.13)	0.0093** (8.31)	0.0117** (6.74)	0.0102** (10.22)
1	-0.0024 (-1.05)	0.0091** (2.90)	-0.0070** (-3.51)	0.0033** (3.05)
2	-0.0026 (-1.47)	0.0008 (0.31)	-0.0025* (-1.74)	-0.0004 (-0.54)
3	0.0009 (0.55)	0.0025** (2.37)	0.0026* (1.76)	0.0012* (1.78)
4	0.0004 (0.27)	-0.0029* (-1.83)	-0.0022* (-1.71)	0.0001 (0.20)
5	-0.0014 (-1.06)	0.0007 (0.63)	-0.0001 (-0.06)	0.0004 (0.68)

APPENDIX E (continued)

<i>Panel B. Near-the-Money</i>				
<u>Day</u>	<u>Call Options</u>		<u>Put Options</u>	
	<u>Short Maturity</u>	<u>Long Maturity</u>	<u>Short Maturity</u>	<u>Long Maturity</u>
-5	0.0012 (0.86)	0.0010 (1.22)	0.0014 (1.06)	0.0008 (1.14)
-4	-0.0001 (-0.06)	-0.0005 (-0.44)	0.0005 (0.42)	0.0007 (0.95)
-3	0.0013 (0.86)	-0.0001 (-0.11)	0.0000 (0.00)	-0.0011 (-1.60)
-2	0.0029** (2.00)	0.0013* (1.73)	0.0029** (2.42)	0.0013** (2.02)
-1	0.0072** (4.95)	0.0004 (0.60)	0.0040** (3.14)	0.0005 (0.82)
0	0.0144** (7.27)	0.0135** (10.70)	0.0145** (8.15)	0.0112** (10.72)
1	-0.0041* (-1.81)	0.0054** (4.29)	-0.0074** (-3.40)	0.0028** (2.34)
2	-0.0044** (-2.45)	-0.0007 (-0.87)	-0.0008 (-0.48)	0.0000 (-0.01)
3	-0.0013 (-0.85)	0.0002 (0.29)	-0.0001 (-0.09)	0.0013* (1.80)
4	-0.0017 (-1.15)	-0.0003 (-0.43)	-0.0009 (-0.61)	-0.0002 (-0.35)
5	0.0005 (0.41)	-0.0002 (-0.19)	0.0007 (0.59)	0.0012* (1.75)

<i>Panel C. In-the-Money</i>				
<u>Day</u>	<u>Call Options</u>		<u>Put Options</u>	
	<u>Short Maturity</u>	<u>Long Maturity</u>	<u>Short Maturity</u>	<u>Long Maturity</u>
-5	0.0055** (1.97)	0.0018 (1.07)	0.0013 (0.65)	0.0012 (1.00)
-4	-0.0003 (-0.11)	-0.0007 (-0.42)	0.0035* (1.73)	0.0022* (1.66)
-3	0.0081** (2.53)	-0.0017 (-0.98)	0.0029 (1.44)	-0.0016 (-1.40)
-2	0.0088** (2.65)	0.0041** (2.85)	0.0069** (3.21)	0.0016 (1.49)
-1	0.0083** (2.56)	0.0021 (1.34)	0.0054** (2.47)	-0.0010 (-0.99)
0	0.0116** (3.28)	0.0087** (4.51)	0.0164** (5.72)	0.0092** (6.56)
1	-0.0032 (-0.88)	0.0074** (4.04)	-0.0032 (-1.02)	0.0036** (2.21)
2	0.0060 (1.56)	0.0005 (0.28)	0.0040 (1.29)	0.0024* (1.81)
3	0.0074* (1.84)	-0.0001 (-0.03)	0.0014 (0.57)	0.0018 (1.42)
4	0.0020 (0.54)	-0.0005 (-0.32)	0.0055** (1.99)	0.0004 (0.31)
5	-0.0001 (-0.03)	-0.0001 (-0.08)	0.0043 (1.59)	0.0026** (2.13)



## APPENDIX F1

### Announcement Volatility Regressions with Option Volume Interaction Terms

Appendix F1 reports the output from the cross sectional regressions of abnormal daily stock volatility (AbVol) on the change in implied volatility ( $\Delta IV$ ) and the change in implied volatility interacted with the log of option trading volume ( $\Delta IV \times \ln Volu$ ). Option trading volume is averaged over the five days prior. For day -1, as an example, volume is averaged over days -5 to -1. Panels A and B report the output for call and put options, respectively. The analysis on the predictability of announcement stock volatility focuses on short maturity options. Given this, the regression output on long maturity options is suppressed for brevity. Numbers in parentheses are the t-statistic of the coefficient estimates. \*,\*\* indicate significance at the 10% and 5% level, respectively.

<i>Panel A. Short Maturity Call Options</i>				
<u>Day</u>	<u>Day 0 AbVol</u>		<u>Day 1 AbVol</u>	
	<u><math>\Delta IV</math></u>	<u><math>\Delta IV \times \ln Volu</math></u>	<u><math>\Delta IV</math></u>	<u><math>\Delta IV \times \ln Volu</math></u>
-5	0.0046 (1.50)	-0.0002 (-0.21)	-0.0018 (-0.18)	-0.0021 (-0.77)
-4	-0.0032 (-1.16)	0.0016 (1.50)	-0.0111 (-1.23)	0.0043 (1.35)
-3	0.0047 (1.13)	-0.0003 (-0.25)	0.0004 (0.12)	-0.0004 (-0.15)
-2	-0.0052 (-1.37)	0.0015 (1.02)	0.0146** (2.45)	-0.0006 (-0.46)
-1	-0.0040 (-0.70)	0.0022 (1.39)	0.0013 (0.29)	0.0026 (1.39)

  

<i>Panel B. Short Maturity Put Options</i>				
<u>Day</u>	<u>Day 0 AbVol</u>		<u>Day 1 AbVol</u>	
	<u><math>\Delta IV</math></u>	<u><math>\Delta IV \times \ln Volu</math></u>	<u><math>\Delta IV</math></u>	<u><math>\Delta IV \times \ln Volu</math></u>
-5	0.0064 (0.90)	0.0058 (1.32)	0.0278* (1.82)	-0.0016 (-0.39)
-4	0.0026 (0.54)	0.0024 (0.88)	-0.0181 (-0.79)	0.0010 (0.25)
-3	0.0023 (0.39)	0.0003 (0.21)	0.0230* (1.92)	-0.0005 (-0.21)
-2	0.0146 (1.45)	0.0013 (0.41)	0.0339** (2.29)	-0.0018 (-0.63)
-1	0.0377 (1.35)	0.0086 (1.06)	0.0123 (1.04)	0.0050* (1.81)

## APPENDIX F2

### Post-Split Volatility Regressions with Option Volume Interaction Terms

Appendix F2 reports the output from the cross sectional regressions of the change in stock volatility following the effective date on the change in implied volatility ( $\Delta IV$ ) and the change in implied volatility interacted with the log of option trading volume ( $\Delta IV \times \ln \text{Volu}$ ). Option trading volume is averaged over the five days prior. For day 0, as an example, volume is averaged over days -4 to 0. The analysis on the predictability of post-split stock volatility changes focuses on long maturity options. Given this, the regression output on short maturity options is suppressed for brevity. Numbers in parentheses are the t-statistic of the coefficient estimates. \*,\*\* indicate significance at the 10% and 5% level, respectively.

<u>Day</u>	<u>Long Maturity Call Options</u>		<u>Long Maturity Put Options</u>	
	<u><math>\Delta IV</math></u>	<u><math>\Delta IV \times \ln \text{Volu}</math></u>	<u><math>\Delta IV</math></u>	<u><math>\Delta IV \times \ln \text{Volu}</math></u>
0	-0.3314 (-0.98)	0.0646 (0.58)	0.1456 (0.19)	-0.1546 (-0.56)
1	0.8833* (1.66)	-0.0024 (-0.02)	1.0291 (1.36)	0.1602 (0.74)
2	-1.3211 (-1.33)	0.4574* (1.71)	0.7499 (0.48)	-0.0667 (-0.15)
3	0.6605 (0.94)	0.0297 (0.11)	0.8518 (0.69)	0.4760 (1.01)
4	0.0783 (0.14)	-0.2698 (-1.21)	0.4434 (0.53)	-0.6033 (-1.45)
5	-0.1452 (-0.27)	0.4793 (1.57)	2.7198 (1.37)	0.3836 (0.85)

## APPENDIX G1

### Announcement Volatility Regressions in Moneyness Groups

Appendix G1 reports the output from the cross sectional regressions of abnormal daily stock volatility (AbVol) on the change in implied volatility for options partitioned into moneyness groups. Panels A, B and C report the output for the out-of-the-money, near-the-money and in-the-money option groups, respectively. Refer to appendix E for the moneyness definitions. The analysis on the predictability of announcement stock volatility focuses on short maturity options. Given this, the regression output on long maturity options is suppressed for brevity. Numbers in parentheses are the t-statistic of the coefficient estimates. \*,\*\* indicate significance at the 10% and 5% level, respectively.

<i>Panel A. Out-of-the-Money</i>				
<u>Day</u>	<u>Short Maturity Call Options</u>		<u>Short Maturity Put Options</u>	
	<u>Day 0 AbVol</u>	<u>Day 1 AbVol</u>	<u>Day 0 AbVol</u>	<u>Day 1 AbVol</u>
-5	0.0267** (1.98)	0.0143* (1.65)	0.0306 (1.19)	0.0463** (2.27)
-4	0.0168 (1.19)	-0.0001 (-0.01)	0.0085 (1.11)	-0.0250 (-1.04)
-3	-0.0076 (-0.84)	0.0143** (2.30)	0.0115 (1.30)	0.0384** (2.36)
-2	-0.0013 (-0.18)	0.0186** (2.02)	0.0329 (1.28)	0.0501** (2.72)
-1	0.0078 (1.58)	0.0019 (0.34)	0.0924* (1.75)	0.0424** (2.90)

  

<i>Panel B. Near-the-Money</i>				
<u>Day</u>	<u>Short Maturity Call Options</u>		<u>Short Maturity Put Options</u>	
	<u>Day 0 AbVol</u>	<u>Day 1 AbVol</u>	<u>Day 0 AbVol</u>	<u>Day 1 AbVol</u>
-5	0.0149 (1.36)	0.0044 (0.43)	0.0165* (1.72)	0.0171 (1.27)
-4	0.0072 (1.28)	0.0042 (0.57)	0.0155 (1.46)	0.0062 (0.68)
-3	-0.0008 (-0.11)	0.0214** (3.07)	-0.0024 (-0.40)	0.0221** (2.53)
-2	-0.0014 (-0.21)	0.0297** (2.97)	0.0072 (0.90)	0.0374** (2.85)
-1	0.0090* (1.75)	0.0034 (0.58)	0.0015 (0.31)	0.0027 (0.36)

APPENDIX G1 (continued)

<i>Panel C. In-the-Money</i>				
<u>Day</u>	Short Maturity Call Options		Short Maturity Put Options	
	<u>Day 0 AbVol</u>	<u>Day 1 AbVol</u>	<u>Day 0 AbVol</u>	<u>Day 1 AbVol</u>
-5	0.0010 (0.60)	-0.0039 (-0.91)	0.0031 (1.23)	0.0013 (0.53)
-4	0.0006 (0.41)	-0.0006 (-0.13)	0.0046 (1.49)	0.0005 (0.18)
-3	0.0028** (1.97)	-0.0006 (-0.20)	0.0021 (0.75)	0.0017 (0.79)
-2	-0.0008 (-0.48)	0.0055** (2.32)	-0.0019 (-1.19)	0.0057* (1.95)
-1	0.0022 (1.31)	0.0045 (1.21)	0.0004 (0.24)	0.0003 (0.10)

## APPENDIX G2

### Post-Split Volatility Regressions in Moneyness Groups

Appendix G2 reports the output from the cross sectional regressions of the change in stock volatility following the effective date on the change in implied volatility for options partitioned into moneyness groups. Panels A, B and C report the output for the out-of-the-money, near-the-money and in-the-money option groups, respectively. Refer to appendix E for the moneyness definitions. The analysis on the predictability of post-split stock volatility changes focuses on long maturity options. Given this, the regression output on short maturity options is suppressed for brevity. Numbers in parentheses are the t-statistic of the coefficient estimates. \*,\*\* indicate significance at the 10% and 5% level, respectively.

<i>Panel A. Out-of-the-Money</i>		
Day	Long Maturity	
	<u>Call Options</u>	<u>Put Options</u>
0	-1.6087** (-2.31)	0.1183 (0.20)
1	0.5632 (0.86)	1.3681** (2.25)
2	0.6382 (0.69)	0.8749 (0.92)
3	0.7008 (0.56)	2.1100 (1.44)
4	-0.7779 (-0.76)	-0.6654 (-0.82)
5	-0.2723 (-0.19)	3.5197* (1.82)

APPENDIX G2 (continued)

<i>Panel B. Near-the-Money</i>		
<u>Day</u>	Long Maturity	
	<u>Call Options</u>	<u>Put Options</u>
0	-0.3916 (-0.99)	-0.1903 (-0.40)
1	1.1533** (2.05)	0.7518 (1.36)
2	0.1733 (0.16)	1.6453* (1.65)
3	0.7618 (0.94)	0.6957 (0.62)
4	-0.3933 (-0.58)	-0.8944 (-1.03)
5	2.4843 (1.45)	3.6639* (1.87)

  

<i>Panel C. In-the-Money</i>		
<u>Day</u>	Long Maturity	
	<u>Call Options</u>	<u>Put Options</u>
0	-0.1455 (-0.93)	-0.3510 (-0.72)
1	0.6334** (2.63)	0.1087 (0.31)
2	-0.3108 (-0.87)	0.6997 (1.21)
3	0.6156** (2.33)	-0.4645 (-0.81)
4	-0.4593* (-1.80)	-0.3654 (-0.71)
5	0.4172 (0.99)	0.5385 (1.24)