

Internet Appendix to
“Why does the Option to Stock Volume Ratio Predict Stock Returns?”

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This Internet Appendix provides additional empirical results that supplement those in the main text. Section 1 examines the determinants of signed O/S measures. Section 2 provides additional evidence that the signed O/S measures predict returns using sequential double-sorted portfolios. Section 3 presents regression results controlling for lagged measures of investor disagreement. Section 4 tests the return predictability of O/S measures in the weeks before announcements of corporate events, while Section 5 examines whether O/S measures for ETF options predict the returns on the underlying ETFs. Section 6 examines the question of whether O/S measures are stronger predictors of future stock returns when contemporaneous stock returns are non-extreme by presenting the results of regressions that include interaction terms between signed O/S measures and a dummy variable for non-extreme stock returns. Section 7 uses an alternative two-stage regression approach. Finally, Section 8 examines the return predictability over different horizons.

1. Determinants of signed O/S measures

Following Roll, Schwartz, and Subrahmanyam (2010), we construct variables measuring the size (log of market capitalization), options bid-ask spread, implied volatility, open-interest

weighted average option delta, analyst coverage, analyst forecast dispersion, institutional holdings, and earnings announcement dates for the underlying stocks. Table IA1 shows that these variables are significant determinants of the signed components of ISEO/S. The estimated coefficients are generally consistent with the results in Roll, Schwartz, and Subrahmanyam (2010), showing that these variables explain overall O/S¹. One difference between our findings and those in Roll, Schwartz, and Subrahmanyam (2010) is the coefficient on analyst coverage. We find that options volume is lower when the number of analysts is higher, while Roll, Schwartz, and Subrahmanyam (2010) find a positive and insignificant relation between the two variables. One possible explanation of the negative coefficient on analyst coverage is that greater analyst coverage could lessen the incentive to produce private information, leading to less informed trading in the options market. Intuitive explanations for why the other variables predict O/S are provided by Roll, Schwartz, and Subrahmanyam (2010).

¹ In untabulated results, we find that OMO/S, OMC/S, OMP/S, ISEO/S, ISEC/S, and ISEP/S are strongly correlated with the above eight determinants, and the magnitudes of the *t*-statistics based on Newey-West (1987) standard errors are comparable to those in Roll, Schwartz, and Subrahmanyam (2010).

Table IA1. Determinants of signed options volume

Results from Fama-MacBeth (1973) regressions of the signed O/S measures on their determinants. The dependent variables are natural logarithms of the ISEO/S components, i.e. $\ln(\text{OBC/S})$, $\ln(\text{OSC/S})$, $\ln(\text{CBS/S})$, $\ln(\text{CSC/S})$, $\ln(\text{OBP/S})$, $\ln(\text{OSP/S})$, $\ln(\text{CBP/S})$, and $\ln(\text{CSP/S})$, which are constructed for each firm on each day. Following Roll, Schwartz, and Subrahmanyam (2010), we construct eight explanatory variables. Size is the natural logarithm of firm market capitalization, in millions. Bid-ask spread is the difference between the best offer and best bid, scaled by the average of the two (in percent). Impl_vol is the open-interest weighted average implied volatility across all options for each firm on each day. Delta is the open-interest weighted average delta across all options for each firm on each day, with the put deltas being reversed in sign. No. of analysts is the number of analysts for a firm, and analysts' dispersion is the standard deviation across their earnings forecasts scaled by the stock price at the end of the previous month. Institutional holding is the fraction of the firm's shares held by institutions (in percent). Earnings date is a dummy variable that takes the value 1 if the trading date or any of the next four trading dates is an earnings announcement date for the firm, and 0 otherwise. *t*-statistics based on Newey-West (1987) adjusted standard errors are shown in parentheses below the mean coefficient estimates. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

Model	1	2	3	4	5	6	7	8
Dependent Variable	OBC/S	OSC/S	CBC/S	CSC/S	OBP/S	OSP/S	CBP/S	CSP/S
Size	0.100*** (18.09)	0.120*** (23.81)	0.153*** (27.21)	0.085*** (13.44)	0.152*** (23.78)	0.149*** (26.24)	0.112*** (21.08)	0.098*** (14.89)
Bid-ask Spread	-0.008*** (-29.29)	-0.010*** (-35.26)	-0.007*** (-22.15)	-0.010*** (-30.03)	-0.012*** (-34.97)	-0.010*** (-32.21)	-0.008*** (-21.93)	-0.010*** (-25.34)
Impl_vol	2.373*** (44.21)	2.277*** (45.12)	2.342*** (40.79)	2.353*** (38.89)	2.320*** (41.17)	2.449*** (45.71)	2.108*** (42.98)	2.210*** (37.74)
Delta	-2.363*** (-29.48)	-2.794*** (-36.86)	-3.062*** (-38.09)	-2.133*** (-22.14)	-3.744*** (-44.45)	-4.225*** (-52.41)	-4.350*** (-48.53)	-4.638*** (-50.42)
No. of Analysts	-0.001** (-2.16)	-0.004*** (-7.34)	-0.008*** (-13.62)	-0.005*** (-7.50)	-0.006*** (-9.58)	-0.006*** (-10.62)	-0.010*** (-14.89)	-0.010*** (-14.54)
Analysts' Dispersion	-3.773*** (-11.65)	-3.252*** (-11.14)	-4.589*** (-14.31)	-5.672*** (-15.72)	-5.140*** (-13.01)	-4.517*** (-12.84)	-5.472*** (-15.35)	-5.914*** (-14.73)
Institutional Holding	-0.231*** (-15.44)	-0.158*** (-11.50)	-0.197*** (-13.74)	-0.278*** (-16.46)	0.198*** (12.62)	0.115*** (7.75)	0.032* (1.94)	0.174*** (10.42)
Earnings Date	0.397*** (23.63)	0.257*** (15.12)	0.089*** (4.98)	0.174*** (9.90)	0.435*** (22.09)	0.326*** (17.40)	0.150*** (7.20)	0.216*** (10.64)
Intercept	-5.267*** (-56.40)	-5.354*** (-61.24)	-6.492*** (-65.51)	-5.719*** (-53.00)	-5.906*** (-57.97)	-5.780*** (-60.60)	-6.186*** (-70.11)	-5.894*** (-53.08)
Industry dummy	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	0.084	0.085	0.074	0.09	0.086	0.093	0.076	0.089
<i>N</i>	376,364	376,364	376,364	376,364	376,364	376,364	376,364	376,364

2. Sequential double sort analysis of open trades in calls and puts

Table IA2 uses sequential double sorts to examine non-parametrically the information about future stock returns contained in the open buy and sell trades of calls and puts. We focus on open trades because both the results in Pan and Poteshman (2006) and the results in the main text indicate that open trades contain more information than close trades. In Panel A, for each week we first sort the sample into deciles by OSC/S and then by OBC/S within each OSC/S decile. The mean CAR(1) and t -statistics are shown for each sub-group. In nine out of the ten deciles of OSC/S, the return difference between OBC/S decile 10 and decile 1 is positive, and six of the differences are significant at or above the 10% level. These results are an additional piece of evidence that option trades that establish synthetic long positions contain information about future stock returns. In Panel B we first sort the sample into deciles by OBP/S and then by OSP/S within each decile. The differences in CAR(1) between OSP/S decile 10 and decile 1 are mostly positive although only one is significantly different from zero.

Table IA2. Sequential double sort analysis of the ability of signed O/S measures to predict returns

Average weekly cumulative abnormal returns of portfolios formed by sequential double sorting based on signed O/S measures. In Panel A, in each week we first sort our sample into deciles by OSC/S, and then by OBC/S within each OSC/S decile. In Panel B, in each week we first sort our sample into deciles by OBP/S, and then by OSP/S within each OBP/S decile. Panels A and B report the means and associated *t*-statistics of CAR(1) in the subsequent week for each decile. The last column shows the difference between the average returns of deciles 10 and 1.

Panel A. Sort by OSC/S and OBC/S													
		OBC/S											
		1	2	3	4	5	6	7	8	9	10	Diff.	
OSC/S	1	Mean	-0.01	0.27	-0.02	0.21	0.29	0.04	0.14	0.15	0.18	0.21	0.22
		<i>t</i> -stat.	(-0.08)	(3.42)	(-0.53)	(2.31)	(2.46)	(0.46)	(1.53)	(1.72)	(2.09)	(2.27)	(1.08)
	2	Mean	0.14	0.05	0.08	0.08	0.17	0.29	0.03	0.32	0.32	0.08	-0.06
		<i>t</i> -stat.	(1.34)	(0.57)	(0.84)	(0.96)	(1.78)	(2.90)	(0.33)	(2.72)	(3.28)	(0.72)	(-0.43)
	3	Mean	0.07	0.00	0.23	0.07	0.02	0.17	0.07	0.04	0.27	0.21	0.14
		<i>t</i> -stat.	(0.68)	(0.03)	(2.55)	(0.88)	(0.29)	(1.82)	(0.76)	(0.53)	(1.85)	(2.30)	(0.99)
	4	Mean	-0.04	0.08	0.17	0.02	0.07	0.00	-0.07	0.11	0.15	0.25	0.30
		<i>t</i> -stat.	(-0.50)	(1.18)	(2.02)	(0.19)	(0.77)	(0.03)	(-0.76)	(1.26)	(1.83)	(2.66)	(2.31)
	5	Mean	0.02	0.06	0.14	0.10	0.22	0.08	0.16	0.01	0.06	0.27	0.24
		<i>t</i> -stat.	(0.29)	(0.73)	(1.70)	(1.24)	(2.51)	(0.93)	(1.84)	(0.07)	(0.66)	(2.89)	(2.01)
	6	Mean	-0.09	0.01	-0.06	0.02	0.10	0.23	0.06	0.18	0.27	0.18	0.28
		<i>t</i> -stat.	(-1.24)	(0.11)	(-0.71)	(0.21)	(1.13)	(2.65)	(0.73)	(1.90)	(3.03)	(1.99)	(2.32)
	7	Mean	0.01	-0.10	-0.05	-0.06	-0.02	0.04	-0.01	0.19	0.18	0.35	0.34
		<i>t</i> -stat.	(0.09)	(-1.18)	(-0.60)	(-0.80)	(-0.25)	(0.47)	(-0.12)	(2.11)	(2.03)	(3.77)	(2.72)
	8	Mean	-0.07	0.13	0.07	0.02	-0.06	-0.01	0.07	0.12	0.04	0.26	0.34
		<i>t</i> -stat.	(-0.87)	(1.45)	(0.85)	(0.19)	(-0.67)	(-0.16)	(0.83)	(1.38)	(0.40)	(2.55)	(2.51)
	9	Mean	-0.09	0.02	0.02	-0.08	0.07	-0.03	0.10	0.01	-0.07	0.10	0.18
		<i>t</i> -stat.	(-0.81)	(0.25)	(0.29)	(-1.00)	(0.83)	(-0.33)	(1.11)	(0.16)	(-0.74)	(1.02)	(1.28)
	10	Mean	-0.19	-0.14	-0.16	-0.11	-0.03	0.01	0.00	-0.11	-0.05	0.08	0.27
		<i>t</i> -stat.	(-2.06)	(-1.56)	(-1.84)	(-1.16)	(-0.27)	(0.12)	(-0.02)	(-1.15)	(-0.46)	(0.64)	(1.74)

Panel B. Sort by OBP/S and OSP/S

		OSP/S											
		1	2	3	4	5	6	7	8	9	10	Diff.	
OBP/S	1	Mean	0.16	0.04	0.25	-0.04	0.32	0.35	0.28	0.31	0.18	0.37	0.21
		<i>t</i> -stat.	(0.69)	(0.44)	(3.09)	(-0.15)	(2.42)	(2.77)	(2.42)	(2.76)	(1.58)	(3.14)	(0.81)
	2	Mean	0.13	0.35	-0.04	0.17	0.31	0.00	0.13	-0.01	0.13	-0.02	-0.15
		<i>t</i> -stat.	(0.85)	(3.17)	(-1.22)	(1.60)	(2.68)	(0.02)	(1.90)	(-0.20)	(1.95)	(-0.29)	(-0.90)
	3	Mean	0.16	0.09	0.08	0.08	0.26	-0.01	0.31	0.34	-0.22	0.18	0.02
		<i>t</i> -stat.	(1.55)	(0.73)	(0.71)	(0.71)	(2.19)	(-0.09)	(2.49)	(2.69)	(-2.01)	(1.66)	(0.12)
	4	Mean	0.07	0.15	0.20	0.03	0.16	0.11	0.11	0.21	0.13	0.13	0.06
		<i>t</i> -stat.	(0.46)	(1.83)	(2.30)	(0.37)	(1.64)	(1.28)	(1.26)	(2.38)	(1.62)	(1.49)	(0.38)
	5	Mean	0.07	0.07	0.07	0.17	-0.02	0.06	-0.07	0.10	0.16	0.14	0.06
		<i>t</i> -stat.	(0.84)	(0.77)	(0.80)	(1.89)	(-0.26)	(0.70)	(-0.83)	(1.12)	(1.85)	(1.54)	(0.48)
	6	Mean	-0.09	0.15	0.16	0.05	-0.01	0.13	0.18	0.03	0.14	0.22	0.31
		<i>t</i> -stat.	(-0.99)	(1.74)	(1.90)	(0.55)	(-0.09)	(1.62)	(2.23)	(0.44)	(1.66)	(2.45)	(2.45)
	7	Mean	-0.03	0.21	-0.02	0.05	0.02	0.08	0.06	0.01	-0.05	-0.03	0.00
		<i>t</i> -stat.	(-0.30)	(2.05)	(-0.22)	(0.60)	(0.27)	(0.94)	(0.71)	(0.16)	(-0.54)	(-0.36)	(0.01)
	8	Mean	-0.08	0.03	0.17	0.17	-0.04	0.06	0.12	0.00	0.26	0.11	0.19
		<i>t</i> -stat.	(-0.84)	(0.37)	(2.11)	(1.90)	(-0.45)	(0.80)	(1.36)	(0.05)	(3.11)	(1.23)	(1.45)
	9	Mean	-0.06	0.01	-0.02	-0.11	-0.01	-0.14	0.02	-0.03	0.12	-0.02	0.04
		<i>t</i> -stat.	(-0.65)	(0.06)	(-0.24)	(-1.23)	(-0.16)	(-1.64)	(0.26)	(-0.39)	(1.36)	(-0.25)	(0.30)
	10	Mean	-0.11	-0.14	-0.08	-0.23	-0.17	-0.21	-0.07	-0.08	0.07	0.15	0.26
		<i>t</i> -stat.	(-1.08)	(-1.49)	(-0.81)	(-2.33)	(-1.85)	(-1.96)	(-0.77)	(-0.83)	(0.73)	(1.22)	(1.63)

3. Lagged disagreement measures

Table 7 in the main text shows that the components of O/S continue to predict returns even when we control for various measures of or proxies for investor disagreement constructed from options trading volume, stock trading volume (turnover), and analyst forecasts. This section presents the results of additional regressions in which we include lagged values of the disagreement variables. The predictive power of the decile variables based on signed components of ISEO/S remains as in Table 7 of the main text that includes the (non-lagged) disagreement measures and Panel A of Table 5 in the main text that does not include any disagreement measures.

Table IA3. Fama-MacBeth regressions including lagged disagreement measures

Results from Fama-MacBeth (1973) regressions of CAR(1) on both the decile signed O/S measures and disagreement measures based on options trading volume, stock trading volume (turnover), and analyst forecasts. The disagreement measures are the same as those used in Table 7, except that in this table we include lagged values of each measure. In Model 1 and 2, we include DecODisagmt, DecOCDisagmt, IdioVol, Turnover, and Analyst Dispersion in the week prior to week 0, which is the week we construct the decile signed O/S measures. Similarly, Models 3 and 4 (5 and 6, 7 and 8) include disagreement measures lagged two (three, four) weeks. All other variables are defined in Appendix A to the main text. As in Table 5 of the main text, we estimate weekly Fama-MacBeth (1973) regressions and report the time-series means of the coefficient estimates. Observations for which the O/S measures are from expiration weeks and observations from the last quarter of 2008 are excluded. N is the number of firm-weeks. t -statistics based on Newey-West (1987) adjusted standard errors with four lags are shown in parentheses below the mean coefficient estimates. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

Disagreement Measures	Lag=1		Lag=2		Lag=3		Lag=4	
	1	2	3	4	5	6	7	8
Model								
DecOBC/S	0.041*** (5.34)	0.041*** (5.34)	0.039*** (5.35)	0.040*** (5.38)	0.042*** (5.43)	0.042*** (5.45)	0.042*** (5.47)	0.042*** (5.49)
DecOSC/S	-0.026*** (-4.47)	-0.027*** (-4.51)	-0.027*** (-4.68)	-0.027*** (-4.71)	-0.029*** (-4.61)	-0.029*** (-4.61)	-0.028*** (-4.46)	-0.028*** (-4.43)
DecCBC/S	0.008 (1.59)	0.008 (1.58)	0.006 (1.08)	0.007 (1.17)	0.008 (1.45)	0.008 (1.55)	0.006 (1.12)	0.006 (1.15)
DecCSC/S	-0.036*** (-4.72)	-0.036*** (-4.74)	-0.031*** (-4.15)	-0.031*** (-4.15)	-0.032*** (-4.19)	-0.032*** (-4.16)	-0.032*** (-4.15)	-0.032*** (-4.11)
DecOBP/S	-0.015** (-2.05)	-0.015** (-2.03)	-0.016** (-2.32)	-0.016** (-2.31)	-0.015** (-2.07)	-0.015** (-2.04)	-0.019** (-2.51)	-0.018** (-2.49)
DecOSP/S	0.021*** (3.03)	0.021*** (3.02)	0.018*** (2.61)	0.018*** (2.66)	0.016** (2.19)	0.016** (2.20)	0.020*** (2.91)	0.020*** (2.96)
DecCBP/S	-0.006 (-0.90)	-0.005 (-0.85)	-0.004 (-0.74)	-0.004 (-0.70)	-0.003 (-0.54)	-0.003 (-0.50)	-0.004 (-0.61)	-0.003 (-0.56)
DecCSP/S	0.004 (0.59)	0.004 (0.62)	0.003 (0.47)	0.003 (0.53)	0.002 (0.33)	0.002 (0.36)	0.003 (0.55)	0.004 (0.64)
DecOMO_S	-0.005 (-0.43)	-0.005 (-0.43)	-0.003 (-0.23)	-0.003 (-0.22)	0.001 (0.06)	0.002 (0.13)	-0.007 (-0.53)	-0.005 (-0.37)
DecODisagmt	-0.002 (-0.37)		-0.001 (-0.20)		-0.007 (-1.58)		-0.002 (-0.35)	
DecOCDisagmt		-0.002 (-0.36)		-0.003 (-0.46)		-0.010* (-1.71)		-0.006 (-1.02)
IdioVol	-3.141 (-0.88)	-3.122 (-0.87)	-3.035 (-0.79)	-3.054 (-0.79)	-2.126 (-0.57)	-2.100 (-0.56)	-2.009 (-0.54)	-2.008 (-0.54)
Turnover	-6.197*** (-3.35)	-6.216*** (-3.36)	-6.692*** (-3.59)	-6.655*** (-3.57)	-6.864*** (-3.59)	-6.878*** (-3.60)	-6.618*** (-3.36)	-6.572*** (-3.33)
Analyst Dispersion	0.813 (0.69)	0.820 (0.70)	0.914 (0.84)	0.908 (0.84)	0.463 (0.43)	0.429 (0.40)	0.449 (0.42)	0.486 (0.45)
Amihud	-0.029*** (-3.10)	-0.029*** (-3.11)	-0.035*** (-3.59)	-0.035*** (-3.59)	-0.039*** (-3.80)	-0.039*** (-3.78)	-0.035*** (-3.61)	-0.035*** (-3.60)
CAR(0)	-0.006 (-1.08)	-0.006 (-1.11)	-0.006 (-1.24)	-0.006 (-1.25)	-0.006 (-1.06)	-0.006 (-1.08)	-0.007 (-1.31)	-0.007 (-1.32)
Dec Δ eqvol	-0.005 (-0.77)	-0.005 (-0.82)	-0.004 (-0.69)	-0.004 (-0.65)	-0.006 (-0.86)	-0.005 (-0.78)	-0.008 (-1.18)	-0.008 (-1.09)
Dec Δ opvol	-0.008 (-1.12)	-0.008 (-1.10)	-0.009 (-1.31)	-0.009 (-1.32)	-0.005 (-0.82)	-0.006 (-0.98)	-0.002 (-0.23)	-0.004 (-0.50)

Impl_vol	-0.040	-0.040	0.010	0.009	0.037	0.038	-0.034	-0.032
	(-0.12)	(-0.12)	(0.03)	(0.03)	(0.11)	(0.12)	(-0.10)	(-0.09)
B/M	-0.004	-0.004	-0.005	-0.005	-0.005	-0.005	-0.006	-0.006
	(-0.75)	(-0.73)	(-0.93)	(-0.95)	(-0.93)	(-0.91)	(-1.12)	(-1.12)
Size	-0.032	-0.032	-0.032	-0.032	-0.034	-0.034	-0.032	-0.032
	(-1.38)	(-1.38)	(-1.41)	(-1.41)	(-1.53)	(-1.55)	(-1.43)	(-1.41)
Momen	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001
	(-0.48)	(-0.49)	(-0.40)	(-0.41)	(-0.57)	(-0.56)	(-0.69)	(-0.69)
Skewness	-0.003	-0.003	-0.007	-0.007	-0.001	-0.000	-0.003	-0.002
	(-0.19)	(-0.17)	(-0.41)	(-0.41)	(-0.06)	(-0.03)	(-0.15)	(-0.14)
Intercept	0.546*	0.546*	0.532*	0.533*	0.537*	0.542*	0.547*	0.552*
	(1.90)	(1.89)	(1.82)	(1.82)	(1.86)	(1.88)	(1.89)	(1.90)
Adjusted R^2	0.088	0.088	0.088	0.088	0.088	0.088	0.087	0.087
N	303,757	303,757	301,254	301,254	299,917	299,917	297,647	297,647

4. Signed O/S measures in the week before earnings announcements and corporate events

In this section, we analyze whether the signed O/S measures before earnings announcements and other corporate events contain information on the event announcement returns. We construct signed O/S measures using the stock and option trading volumes in the week before each announcement date. The event return is defined as the two-day cumulative abnormal returns on the announcement or event date and the following date. We find that DecOBC/S, DecOSC/S, DecCBC/S, and DecCSC/S constructed using data from the previous week significantly predict event-window returns, as expected. Other decile signed O/S measures have weaker predictive power. The results indicate that some informed investors hold private information about corporate events, and trade before the announcements in options market. This provides weak evidence on what information content do informed investors know.

Table IA4. Fama-MacBeth regressions explaining abnormal returns around earnings announcements and corporate events, using decile signed O/S measures in the prior week

Results of quarterly Fama-MacBeth (1973) regressions explaining two-day cumulative abnormal returns around earnings announcements and unscheduled corporate events. The unscheduled corporate events are seasoned equity offerings (SEOs), mergers and acquisition (M&A) activities, repurchases, stock splits, and cash dividends. We obtain earnings announcement dates from the Compustat quarterly file. The dates of SEOs, M&A activities, and repurchases are from the SDC Platinum database. Stock split and dividend dates are obtained from CRSP events-distribution file. We exclude dates of multiple events to eliminate cases in which option traders might be trading in different directions based on information about different events. There are 23,538 earnings announcements and corporate events in our sample period. We use the report dates for earnings announcements, issue dates for SEOs, announcement dates for M&A activities and repurchases, and the distribution declaration dates for splits and dividends. The dependent variable CAR(0,1) is the two-day cumulative abnormal return (CAR), in percent, from the event day and the following trading day, where the market value-weighted return is used as the benchmark in computing the abnormal return. The main independent variables of interest are decile variables constructed from the signed weekly O/S measures from the day prior to the event date. The decile variables are constructed by ranking the O/S measures into deciles in each calendar quarter. We exclude events for which the O/S measures are from an option expiration week, and also exclude events from the last quarter of 2008 to avoid the potential effect of the short-sale ban on option trading volume. $\Delta eqvol$ is the difference between total equity volume from the week prior to the event date and the average equity trading volume over the prior six months excluding the month prior to the event date, scaled by this average, in decile form. $\Delta opvol$ is defined analogously, based on total OptionMetrics trading volume. Amihud is the Amihud (2002) illiquidity measure in the week prior to the event date. Pre-return is the cumulative abnormal return over the previous month. Momen is the market-adjusted abnormal return over the previous six months excluding the month prior to the announcement. B/M and size (in logarithms) are calculated using data from the previous quarter. Impl_vol is the average of the daily implied volatility during one month prior to the event date, where we calculate the daily implied volatility using all options traded on that day and weight by the open interest of each option series. Skewness is the historical return skewness calculated using daily returns during one month prior to the event date. We estimate a cross-sectional regression for each quarter that contains at least 30 events, and report the weighted means of the coefficient estimates, where the weights are based on the number of observations in each quarter. *t*-statistics based on Newey-West (1987) adjusted standard errors with two lags are shown in parentheses below the mean coefficient estimates. *N* is the number of events. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

Model	1	2	3	4	5	6	7	8
DecOBC/S	0.057* (1.77)				0.075** (2.37)		0.084** (2.45)	0.102*** (2.90)
DecOSC/S	-0.058** (-2.14)				-0.065** (-2.08)		-0.066** (-2.08)	-0.051* (-1.75)
DecCBC/S		0.025 (1.52)			0.038* (1.81)		0.036 (1.69)	0.046** (2.12)
DecCSC/S		-0.035 (-1.62)			-0.054*** (-3.23)		-0.054*** (-3.17)	-0.044** (-2.23)
DecOBP/S			-0.044* (-1.79)			-0.042 (-1.61)	-0.053* (-1.82)	-0.037 (-1.22)
DecOSP/S			0.029 (1.02)			0.028 (0.92)	0.034 (1.15)	0.046 (1.68)
DecCBP/S				0.015 (0.59)		0.013 (0.45)	0.012 (0.44)	0.021 (0.74)
DecCSP/S				-0.025 (-1.57)		-0.015 (-0.89)	-0.010 (-0.56)	-0.003 (-0.14)
DecOMO/S								-0.098** (-2.57)
Amihud	0.026* (1.87)	0.025* (1.88)	0.026* (1.88)	0.027** (2.08)	0.025* (1.81)	0.027** (2.09)	0.027* (2.03)	0.028** (2.06)
Pre-return	-0.002 (-0.42)	-0.001 (-0.21)	-0.003 (-0.45)	-0.002 (-0.37)	-0.001 (-0.11)	-0.002 (-0.33)	-0.000 (-0.02)	-0.000 (-0.05)
Dec $\Delta eqvol$	0.015 (0.82)	0.014 (0.73)	0.012 (0.61)	0.015 (0.79)	0.015 (0.82)	0.013 (0.68)	0.015 (0.78)	0.001 (0.05)

Dec Δ opvol	-0.014 (-0.76)	-0.009 (-0.45)	-0.004 (-0.24)	-0.009 (-0.44)	-0.013 (-0.68)	-0.004 (-0.21)	-0.006 (-0.35)	0.014 (0.87)
Impl_vol	-0.945** (-2.72)	-0.884** (-2.40)	-0.987** (-2.62)	-0.929** (-2.35)	-0.875** (-2.42)	-0.968** (-2.35)	-0.893** (-2.19)	-0.861** (-2.09)
B/M	0.025 (1.44)	0.027 (1.52)	0.024 (1.34)	0.025 (1.41)	0.026 (1.50)	0.023 (1.28)	0.023 (1.30)	0.021 (1.17)
Size	-0.064 (-1.16)	-0.060 (-0.93)	-0.063 (-1.02)	-0.057 (-0.82)	-0.057 (-0.92)	-0.058 (-0.83)	-0.048 (-0.71)	-0.060 (-0.86)
Momen	-0.003 (-1.00)	-0.003 (-0.89)	-0.003 (-1.02)	-0.003 (-0.98)	-0.003 (-0.91)	-0.003 (-1.03)	-0.003 (-0.96)	-0.002 (-0.86)
Skewness	0.049 (1.00)	0.048 (1.00)	0.052 (1.09)	0.049 (1.00)	0.045 (0.92)	0.049 (1.01)	0.046 (0.94)	0.042 (0.90)
Intercept	1.149** (2.05)	1.121* (1.77)	1.195* (1.92)	1.091 (1.64)	1.087* (1.78)	1.132 (1.68)	1.029 (1.55)	1.070 (1.61)
Adjusted R^2	0.008	0.007	0.008	0.007	0.008	0.008	0.008	0.009
N	29,736	29,736	29,736	29,736	29,736	29,736	29,736	29,736

5. Return predictability of O/S measures for options on ETFs

The analyses reported in the main text focus on equity options. It is also interesting to examine non-equity options, such as the options on exchange-traded funds (ETFs) identified in the ISE data. We merge these options data with Center for Research in Security Prices (CRSP) and COMPUSTAT variables, and conduct Fama-MacBeth (1973) regressions of the cumulative abnormal return $CAR(1)$ of the underlying ETF on cross-sectional and time-series definitions of the signed O/S measures constructed from the ISE data.² Table IA5 shows no significant predictability in this sample. This finding is consistent with the argument in Subrahmanyam (1991) that the effects of information asymmetry and adverse selection costs are less significant in the markets for index derivatives than in the markets for individual securities. Thus, the finding that O/S measures for ETFs do not predict the returns on the underlying ETFs is unsurprising.

² The analysis uses only ETF options because there are very few index options in ISE data, and these indices are not covered by CRSP.

Table IA5. ETF options

Results from Fama-MacBeth (1973) regressions of CAR(1) on different signed O/S measures for ETF options. Using OBC/S as an example, in Model 1, we define OBC/S as ratio of open-buy call volumes to stock volume for each firm-week. In Model 2, we define Δ OBC/S as the difference between OBC/S and the average over the prior six months, scaled by the average. $\text{std}\Delta$ OBC/S in Model 3 is the standardized OBC/S which is equal to the difference between OBC/S and the average over the prior six months, scaled by the standard deviation over the prior six months. OBC/S, Δ OBC/S, and $\text{std}\Delta$ OBC/S are sorted into cross-sectional deciles in each week. In Model 4, we sort each firm-week into Ω OBC/S deciles by ranking it relative to the firm's OBC/S time series over the past six months. Ω OBC/S takes into account of the time-series variation within each firm. In this way, we construct four types of signed O/S measures using the ISE data, and four types of unsigned OMO/S measures using OptionMetrics data. All other control variables are defined in Appendix A to the main text. As in Table 5 of the main text, we estimate weekly Fama-MacBeth (1973) regressions and report the time-series means of the coefficient estimates for all ETF options. Observations for which the O/S measures are from expiration weeks and observations from the last quarter of 2008 are excluded. N is the number of firm-weeks. t -statistics based on Newey-West (1987) adjusted standard errors with four lags are shown in parentheses below the mean coefficient estimates. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

Model	1	2	3	4
DecOBC/S	-0.017 (-1.20)	Dec Δ OBC/S -0.041 (-1.47)	Decstd Δ OBC/S -0.019 (-1.25)	Dec Ω OBC/S -0.005 (-0.44)
DecOSC/S	-0.001 (-0.07)	Dec Δ OSC/S 0.068 (1.30)	Decstd Δ OSC/S 0.017 (0.76)	Dec Ω OSC/S 0.001 (0.09)
DecCBC/S	-0.002 (-0.12)	Dec Δ CBC/S 0.008 (0.23)	Decstd Δ CBC/S -0.005 (-0.21)	Dec Ω CBC/S -0.007 (-0.52)
DecCSC/S	0.005 (0.34)	Dec Δ CSC/S -0.000 (-0.01)	Decstd Δ CSC/S -0.002 (-0.11)	Dec Ω CSC/S 0.005 (0.39)
DecOBP/S	-0.001 (-0.06)	Dec Δ OBP/S 0.003 (0.14)	Decstd Δ OBP/S 0.014 (1.09)	Dec Ω OBP/S -0.011 (-0.74)
DecOSP/S	0.007 (0.47)	Dec Δ OSP/S -0.058 (-1.56)	Decstd Δ OSP/S -0.025 (-1.31)	Dec Ω OSP/S -0.010 (-0.69)
DecCBP/S	0.023 (1.47)	Dec Δ CBP/S -0.039 (-1.31)	Decstd Δ CBP/S -0.007 (-0.48)	Dec Ω CBP/S 0.026 (1.46)
DecCSP/S	-0.015 (-0.86)	Dec Δ CSP/S -0.016 (-0.91)	Decstd Δ CSP/S 0.018 (1.08)	Dec Ω CSP/S -0.015 (-1.14)
DecOMO/S	0.005 (0.26)	Dec Δ OMO/S -0.020 (-0.41)	Decstd Δ OMO/S -0.002 (-0.07)	Dec Ω OMO/S -0.002 (-0.09)
Amihud	0.203 (1.47)	Amihud -0.340 (-0.90)	Amihud 0.051 (0.29)	Amihud 0.220 (1.06)
CAR(0)	0.003 (0.11)	CAR(0) -0.055 (-0.83)	CAR(0) 0.019 (0.63)	CAR(0) -0.021 (-0.67)
Dec Δ eqvol	-0.008 (-0.75)	Dec Δ eqvol 0.003 (0.14)	Dec Δ eqvol -0.001 (-0.08)	Dec Δ eqvol -0.011 (-0.67)
Dec Δ opvol	-0.008 (-0.83)	Dec Δ opvol 0.031 (0.41)	Dec Δ opvol -0.014 (-0.51)	Dec Δ opvol -0.006 (-0.26)
Impl_vol	-0.050	Impl_vol -0.851	Impl_vol -0.587	Impl_vol -0.897

	(-0.08)		(-1.15)		(-1.15)		(-1.51)
Momen	0.005	Momen	0.016	Momen	0.007	Momen	0.012
	(0.85)		(1.58)		(1.06)		(1.60)
Skewness	0.113	Skewness	0.086	Skewness	0.081	Skewness	0.058
	(1.17)		(0.85)		(0.79)		(0.57)
Intercept	-0.066	Intercept	0.352	Intercept	0.026	Intercept	0.201
	(-0.43)		(1.33)		(0.12)		(0.93)
Adjusted R^2	0.408	Adjusted R^2	0.431	Adjusted R^2	0.444	Adjusted R^2	0.440
N	27,674	N	23,675	N	23,675	N	23,675

6. The interaction between signed O/S measures and non-extreme stock returns

As discussed in subsection 4.3 in the main text, the ability of signed O/S measures to predict subsequent equity returns could be affected by the contemporaneous returns. Based on the regression setting of Table 5 Panel A, we include the interaction terms of each of the signed O/S measures with the “Midret” dummy. In Table IA6 Panel A, “Midret” takes the value of 1 if the return in O/S formation week is in the middle 20% of the distribution of returns over the past six months, and 0 otherwise. We find some evidence that the predictability is stronger when contemporaneous stock returns are non-extreme, consistent with Conrad, Hameed, and Niden (1994) and Gervais, Kaniel, and Mingelgrin (2001). However, the results become statistically weaker when we use a wider band from the middle of the returns distribution. As shown in Table IA6 Panel B, there seems to be no significant effect of non-extreme returns when the “Midret” dummy is defined as the middle 35% or more of the returns distribution.

Table IA6. Interaction between signed O/S measures and non-extreme stock returns

Results from Fama-MacBeth (1973) regressions including interactions terms between decile signed O/S measures and a dummy variable for non-extreme stock returns. Following Gervais, Kaniel, and Mingelgrin (2001), for each firm-week we define a dummy variable "Midret" which equals 1 if the week 0 return is in the middle X percent of the distribution of the stock returns over the six months prior to the week for which we compute the O/S measures (week 0), and 0 otherwise. In Panel A, X takes the value of 20. In Panel B, X takes the values 20, 25, 30, 35, 40, 45, and 50 in Models 1 to 7, respectively. Each of our signed O/S measures is interacted with the "Midret" dummy. As in Table 5, we estimate weekly Fama-MacBeth (1973) regressions and report the time-series means of the coefficient estimates. Observations for which the O/S measures are from expiration weeks and observations from the last quarter of 2008 are excluded. N is the number of firm-weeks. t -statistics based on Newey-West (1987) adjusted standard errors with four lags are shown in parentheses below the mean coefficient estimates. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

Panel A. Midret = 20%								
Model	1	2	3	4	5	6	7	8
DecOBC/S	0.017* *				0.032***		0.033***	0.034***
	(2.34)				(4.78)		(4.46)	(4.43)
DecOSC/S	- 0.033* **				-0.028***		-0.029***	-0.029***
	(-5.58)				(-5.08)		(-5.10)	(-4.68)
DecCBC/S		-0.004			0.001		0.000	0.001
		(-0.59)			(0.10)		(0.05)	(0.09)
DecCSC/S		-0.029***			-0.036***		-0.035***	-0.035***
		(-3.58)			(-4.65)		(-4.27)	(-4.22)
DecOBP/S			-0.024***			-0.020***	-0.021***	-0.020***
			(-3.61)			(-3.02)	(-2.85)	(-2.69)
DecOSP/S			0.010			0.017**	0.023***	0.023***
			(1.26)			(2.18)	(3.08)	(3.27)
DecCBP/S				-0.012**		-0.014**	-0.008	-0.008
				(-2.04)		(-2.27)	(-1.36)	(-1.29)
DecCSP/S				-0.009		-0.005	0.002	0.001
				(-1.51)		(-0.84)	(0.27)	(0.23)
DecOMO/S								-0.003
								(-0.26)
DecOBC/S×Midret	0.018				0.015		0.023*	0.023*
	(1.60)				(1.24)		(1.95)	(1.93)
DecOSC/S×Midret	-0.003				-0.009		-0.001	-0.001
	(-0.24)				(-0.78)		(-0.08)	(-0.07)
DecCBC/S×Midret		0.019*			0.016		0.023**	0.023**
		(1.81)			(1.52)		(2.01)	(1.97)
DecCSC/S×Midret		0.001			-0.001		0.002	0.003
		(0.11)			(-0.08)		(0.17)	(0.19)
DecOBP/S×Midret			0.006			0.005	0.002	0.001

			(0.44)			(0.37)	(0.15)	(0.07)
DecOSP/S×Midret			-0.011			-0.015	-0.030**	-0.031**
			(-0.83)			(-1.05)	(-2.02)	(-2.05)
DecCBP/S×Midret				0.003		0.008	0.001	0.002
				(0.27)		(0.63)	(0.05)	(0.11)
DecCSP/S×Midret				-0.007		-0.004	-0.011	-0.011
				(-0.56)		(-0.30)	(-0.82)	(-0.83)
Midret	-0.099*	-0.128*	0.018	0.008	-0.131**	0.018	-0.068	-0.061
	(-1.79)	(-1.95)	(0.33)	(0.14)	(-2.01)	(0.28)	(-0.95)	(-0.85)
Amihud	-	-0.022***	-0.022***	-0.022***	-0.022***	-0.022***	-0.022***	-0.022***
	0.021*							
	**							
	(-4.54)	(-4.66)	(-4.75)	(-4.76)	(-4.66)	(-4.80)	(-4.66)	(-4.55)
CAR(0)	-0.007	-0.007	-0.008	-0.008*	-0.006	-0.008	-0.006	-0.006
	(-1.54)	(-1.40)	(-1.59)	(-1.69)	(-1.26)	(-1.60)	(-1.18)	(-1.18)
DecΔeqvol	-0.005	-0.003	-0.003	-0.002	-0.003	-0.002	-0.002	-0.003
	(-0.89)	(-0.46)	(-0.49)	(-0.36)	(-0.57)	(-0.34)	(-0.40)	(-0.46)
DecΔopvol	-0.005	-0.001	-0.004	-0.005	-0.004	-0.004	-0.002	-0.002
	(-0.82)	(-0.26)	(-0.77)	(-1.08)	(-0.59)	(-0.70)	(-0.41)	(-0.31)
Impl_vol	-0.412	-0.332	-0.452	-0.373	-0.325	-0.392	-0.317	-0.309
	(-1.12)	(-0.91)	(-1.22)	(-1.02)	(-0.88)	(-1.07)	(-0.87)	(-0.84)
B/M	-0.003	-0.004	-0.004	-0.004	-0.003	-0.004	-0.003	-0.004
	(-0.66)	(-0.74)	(-0.78)	(-0.73)	(-0.65)	(-0.76)	(-0.66)	(-0.72)
Size	-0.039*	-0.030	-0.039*	-0.031	-0.029	-0.031	-0.024	-0.024
	(-1.91)	(-1.45)	(-1.83)	(-1.50)	(-1.40)	(-1.49)	(-1.15)	(-1.13)
Momen	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001
	(-0.68)	(-0.57)	(-0.64)	(-0.72)	(-0.53)	(-0.67)	(-0.51)	(-0.49)
Skewness	-0.006	-0.004	-0.005	-0.005	-0.005	-0.005	-0.004	-0.005
	(-0.35)	(-0.24)	(-0.29)	(-0.29)	(-0.28)	(-0.30)	(-0.21)	(-0.27)
Intercept	0.639*	0.588**	0.618**	0.569**	0.584**	0.569**	0.544**	0.533**
	*							
	(2.36)	(2.18)	(2.26)	(2.11)	(2.15)	(2.10)	(2.00)	(1.97)
Adjusted R ²	0.067	0.067	0.067	0.067	0.068	0.068	0.070	0.071
N		340,758	340,758	340,758	340,758	340,758	340,758	340,758
	340,758							
	8							

Panel B. Different Definitions of Midret							
	Mid 20%	Mid 25%	Mid 30%	Mid 35%	Mid 40%	Mid 45%	Mid 50%
Model	1	2	3	4	5	6	7
DecOBC/S	0.034*** (4.43)	0.034*** (4.19)	0.034*** (4.19)	0.038*** (4.40)	0.036*** (3.74)	0.036*** (3.74)	0.037*** (3.58)
DecOSC/S	-0.029*** (-4.68)	-0.028*** (-4.42)	-0.028*** (-4.42)	-0.029*** (-4.27)	-0.029*** (-3.79)	-0.029*** (-3.79)	-0.027*** (-3.37)
DecCBC/S	0.001 (0.09)	0.004 (0.64)	0.004 (0.64)	-0.000 (-0.03)	0.002 (0.28)	0.002 (0.28)	-0.000 (-0.02)
DecCSC/S	-0.035*** (-4.22)	-0.039*** (-4.70)	-0.039*** (-4.70)	-0.038*** (-4.44)	-0.037*** (-4.04)	-0.037*** (-4.04)	-0.035*** (-3.51)
DecOBP/S	-0.020*** (-2.69)	-0.019** (-2.54)	-0.019** (-2.54)	-0.021*** (-2.64)	-0.019** (-2.26)	-0.019** (-2.26)	-0.021** (-2.36)
DecOSP/S	0.023*** (3.27)	0.025*** (3.40)	0.025*** (3.40)	0.028*** (3.78)	0.028*** (3.54)	0.028*** (3.54)	0.033*** (3.80)
DecCBP/S	-0.008 (-1.29)	-0.009 (-1.39)	-0.009 (-1.39)	-0.010 (-1.49)	-0.008 (-1.11)	-0.008 (-1.11)	-0.012 (-1.42)
DecCSP/S	0.001 (0.23)	-0.001 (-0.23)	-0.001 (-0.23)	-0.004 (-0.55)	-0.010 (-1.35)	-0.010 (-1.35)	-0.009 (-1.14)
DecOMO/S	-0.003 (-0.26)	-0.004 (-0.35)	-0.004 (-0.35)	-0.004 (-0.37)	-0.005 (-0.40)	-0.005 (-0.40)	-0.004 (-0.35)
DecOBC/S×Midret	0.023* (1.93)	0.021** (2.12)	0.021** (2.12)	0.004 (0.41)	0.010 (0.92)	0.010 (0.92)	0.007 (0.67)
DecOSC/S×Midret	-0.001 (-0.07)	-0.005 (-0.44)	-0.005 (-0.44)	0.003 (0.32)	0.000 (0.02)	0.000 (0.02)	-0.004 (-0.36)
DecCBC/S×Midret	0.023** (1.97)	0.007 (0.64)	0.007 (0.64)	0.017 (1.63)	0.010 (1.01)	0.010 (1.01)	0.012 (1.29)
DecCSC/S×Midret	0.003 (0.19)	0.017 (1.48)	0.017 (1.48)	0.008 (0.77)	0.003 (0.32)	0.003 (0.32)	0.002 (0.17)
DecOBP/S×Midret	0.001 (0.07)	-0.004 (-0.32)	-0.004 (-0.32)	0.001 (0.09)	-0.004 (-0.42)	-0.004 (-0.42)	0.001 (0.06)
DecOSP/S×Midret	-0.031** (-2.05)	-0.025* (-1.87)	-0.025* (-1.87)	-0.027** (-2.20)	-0.020* (-1.89)	-0.020* (-1.89)	-0.027** (-2.36)
DecCBP/S×Midret	0.002 (0.11)	0.008 (0.62)	0.008 (0.62)	0.007 (0.60)	0.004 (0.31)	0.004 (0.31)	0.010 (0.85)
DecCSP/S×Midret	-0.011 (-0.83)	0.002 (0.23)	0.002 (0.23)	0.010 (0.94)	0.020** (2.08)	0.020** (2.08)	0.015 (1.40)
Midret	-0.061 (-0.85)	-0.135** (-2.24)	-0.135** (-2.24)	-0.155*** (-2.96)	-0.147*** (-2.81)	-0.147*** (-2.81)	-0.121** (-2.01)
Amihud	-0.022*** (-4.55)	-0.022*** (-4.53)	-0.022*** (-4.53)	-0.022*** (-4.69)	-0.023*** (-4.74)	-0.023*** (-4.74)	-0.022*** (-4.66)
CAR(0)	-0.006 (-1.18)	-0.005 (-1.15)	-0.005 (-1.15)	-0.005 (-1.15)	-0.006 (-1.17)	-0.006 (-1.17)	-0.005 (-1.14)

Dec Δ eqvol	-0.003	-0.003	-0.003	-0.003	-0.003	-0.003	-0.004
	(-0.46)	(-0.44)	(-0.44)	(-0.54)	(-0.49)	(-0.49)	(-0.56)
Dec Δ opvol	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.003
	(-0.31)	(-0.27)	(-0.27)	(-0.24)	(-0.26)	(-0.26)	(-0.41)
Impl_vol	-0.309	-0.314	-0.314	-0.300	-0.302	-0.302	-0.313
	(-0.84)	(-0.86)	(-0.86)	(-0.82)	(-0.83)	(-0.83)	(-0.86)
B/M	-0.004	-0.004	-0.004	-0.004	-0.004	-0.004	-0.005
	(-0.72)	(-0.75)	(-0.75)	(-0.77)	(-0.83)	(-0.83)	(-0.94)
Size	-0.024	-0.024	-0.024	-0.023	-0.023	-0.023	-0.023
	(-1.13)	(-1.13)	(-1.13)	(-1.10)	(-1.12)	(-1.12)	(-1.13)
Momen	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001
	(-0.49)	(-0.47)	(-0.47)	(-0.51)	(-0.48)	(-0.48)	(-0.47)
Skewness	-0.005	-0.005	-0.005	-0.006	-0.005	-0.005	-0.005
	(-0.27)	(-0.29)	(-0.29)	(-0.37)	(-0.30)	(-0.30)	(-0.31)
Intercept	0.533**	0.554**	0.554**	0.561**	0.575**	0.575**	0.578**
	(1.97)	(2.05)	(2.05)	(2.11)	(2.17)	(2.17)	(2.18)
Adjusted R^2	0.071	0.071	0.071	0.071	0.071	0.071	0.071
N	340,758	340,758	340,758	340,758	340,758	340,758	340,758

7. Alternative two-stage regressions

In the main results reported in the main text, we estimate cross-sectional regressions that include multiple decile signed O/S measures to investigate the impact of each component of option volume while controlling for the impacts of the others. An alternative is to use a two-stage regression approach, where we estimate a first-stage cross-sectional regression that explains one of the signed O/S measures and then use the first-stage residual as the main explanatory variable in a second-stage cross-sectional regression. Using OBC/S as an example, the two-stage regressions are

$$\begin{aligned} \text{DecOBC/S} = & \alpha + \beta_1 \text{Dec(ISEO/S} - \text{OBC/S)} + \gamma_1 \text{Amihud} + \gamma_2 \text{CAR}(0) + \gamma_3 \Delta \text{eqvol} + \gamma_4 \Delta \text{opvol} \\ & + \gamma_5 \text{Impl_vol} + \gamma_6 \text{B/M} + \gamma_7 \text{Size} + \gamma_8 \text{Momen} + \gamma_9 \text{Skewness} + \varepsilon, \end{aligned} \quad (\text{IA.1})$$

$$\begin{aligned} \text{CAR}(1) = & \alpha + \beta_2 \text{Residual} + \gamma_1 \text{Amihud} + \gamma_2 \text{CAR}(0) + \gamma_3 \Delta \text{eqvol} + \gamma_4 \Delta \text{opvol} \\ & + \gamma_5 \text{Impl_vol} + \gamma_6 \text{B/M} + \gamma_7 \text{Size} + \gamma_8 \text{Momen} + \gamma_9 \text{Skewness} + \eta, \end{aligned} \quad (\text{IA.2})$$

where ISEO/S – OBC/S is the difference between ISEO/S and OBC/S, Dec(ISEO/S – OBC/S) is a decile variable constructed from it, and Residual is the estimated value of ε from Eq. (IA.1). In the first stage, the decile variable formed from the difference ISEO/S – OBC/S captures the part of DecOBC/S that is correlated with other option volume, i.e. the volume in ISEO/S excluding OBC/S. The residual from the first-stage, i.e., the variable Residual, captures the part of DecOBC/S that is not explained by Dec(ISEO/S – OBC/S). This residual can be interpreted as the part of DecOBC/S that might carry information beyond that in the total ISE volume measured by ISEO/S except for OBC/S itself.

To implement this approach, we estimate the first-stage regression (Eq. (IA.1)) separately for every week, and obtain the residuals for each firm in each week. Then we estimate the second set of weekly cross-sectional regressions in which we regress CAR(1) on the first-stage residual

and controls as in Eq. (IA.2). We repeat this process for each of the seven other components of ISEO/S, in each case replacing OBC/S in the equations above with another component of ISEO/S. For both stages, we report the time-series means of the coefficients from the cross-sectional regressions along with t -statistics computed from Newey-West (1987) standard errors. We use only the non-expiration weeks and exclude data from the last quarter of 2008.

Panels A and B of Table IA7 present the results for the opening trades and closing trades, respectively. For example, in Panel A, the column headed “1a” presents the results for the first-stage regression explaining DecOBC/S, and the column headed “1b” reports the results from the second-stage regression using the first-stage residual to explain CAR(1). In the column headed “1a”, the results show that DecOBC/S is explained by the difference Dec(ISEO/S – OBC/S) with an estimated coefficient of 0.578 and a t -statistic of 68.67. This result is consistent with the finding in Tables 2 and 3 that when one component of O/S is high all others tend to be high. Model 1b shows that the residual from the regression explaining DecOBC/S is positively correlated with future returns (coefficient = 0.019, t -statistic = 2.46). In the columns headed “2b” and “3b”, we show that the residuals from the first-stage regressions explaining DecOSC/S and DecOBP/S also predict returns as expected. These findings that the residuals from the first-stage regressions explaining DecOBC/S, DecOSC/S, and DecOBP/S predict returns are consistent with the predictability of signed options volume documented in Table 5. A difference occurs in the column headed “4b.” Here the sign of the coefficient on the residual from the first-stage predicting DecOSP/S is positive, as expected. However, in contrast to the results in Table 5, the estimated coefficient is not significantly different from zero at conventional levels.

Turning to the results for the close trades in Panel B, in the column headed “2b” the estimated coefficient on the residual from the first stage explaining DecCSC/S is large and

highly significant, consistent with the main results in Table 5. The sign of the coefficient in the column headed “3b” is also consistent with the main results, though in Table IA7 the coefficient is significant but in Table 5 the corresponding coefficient is not. The estimated coefficients in the columns headed “1b” and “4b” are of the “wrong” signs, though significant at only the 10% level.

Notwithstanding the two “wrong” signs of the estimated coefficients in the close trade regressions in Panel B, overall the two-stage regressions show consistent results as in Table 5. They imply that open trades predict returns, though only three of the four relevant coefficients are significantly different from zero. Also, closing sell call trades strongly predict returns. Thus, the main findings from Table 5 are confirmed here.

Table IA7. Robustness checks using two-stage regressions

Results of two-stage Fama-MacBeth (1973) regressions. In the first stage, each of the decile signed O/S measures, i.e. DecOBC/S, DecOSC/S, DecOBP/S, and DecOSP/S in Panel A, and DecCBC/S, DecCSC/S, DecCBP/S, and DecCSP/S in Panel B, is regressed on a decile variable based on the difference between ISEO/S and itself, controlling for firm characteristics. In the second stage, CAR(1) is regressed on the residual from the first stage and other control variables. All control variables are defined in Appendix A to the main text. Observations for which the O/S measures are from expiration weeks and observations from the last quarter of 2008 are excluded. *t*-statistics based on Newey-West (1987) adjusted standard errors with four lags are shown in parentheses below the mean coefficient estimates. *N* is the number of firm-week. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

Panel A. Opening trades								
Model	1a	1b	2a	2b	3a	3b	4a	4b
Dependent variable	DecOBC/S	CAR(1)	DecOSC/S	CAR(1)	DecOBP/S	CAR(1)	DecOSP/S	CAR(1)
Residual		0.019** (2.46)		-0.020*** (-3.68)		-0.016** (-2.58)		0.004 (0.69)
Dec(ISO/S-OBC/S)	0.578*** (68.67)							
Dec(ISO/S-OSC/S)			0.621*** (88.23)					
Dec(ISO/S-OBP/S)					0.537*** (82.39)			
Dec(ISO/S-OSP/S)							0.595*** (87.21)	
Amihud	0.007*** (2.98)	-0.015*** (-4.55)	-0.001 (-0.54)	-0.015*** (-4.55)	-0.039*** (-6.32)	-0.017*** (-4.05)	-0.018*** (-4.08)	-0.017*** (-4.05)
CAR(0)	0.020*** (15.17)	-0.006 (-1.29)	0.019*** (14.24)	-0.006 (-1.29)	-0.020*** (-15.52)	-0.008 (-1.62)	-0.030*** (-16.20)	-0.008 (-1.62)
DecΔeqvol	0.025*** (5.54)	-0.001 (-0.19)	-0.003 (-0.46)	-0.001 (-0.19)	0.035*** (7.91)	-0.002 (-0.34)	0.027*** (7.27)	-0.002 (-0.34)
DecΔopvol	0.138*** (32.37)	-0.010** (-2.08)	0.058*** (19.39)	-0.010** (-2.08)	0.102*** (27.80)	-0.011** (-2.38)	0.026*** (8.13)	-0.011** (-2.38)
Impl_vol	1.872*** (17.58)	-0.496 (-1.36)	2.139*** (22.97)	-0.496 (-1.36)	0.629*** (7.40)	-0.514 (-1.38)	1.775*** (21.54)	-0.514 (-1.38)
B/M	-0.006*** (-4.93)	-0.004 (-0.84)	-0.007*** (-4.56)	-0.004 (-0.84)	0.001 (0.38)	-0.004 (-0.84)	0.007*** (4.08)	-0.004 (-0.84)
Size	0.159*** (21.03)	-0.042** (-1.98)	0.238*** (27.34)	-0.042** (-1.98)	0.308*** (26.25)	-0.042** (-1.97)	0.314*** (31.67)	-0.042** (-1.97)
Momen	-0.001** (-2.13)	-0.001 (-0.62)	0.000 (0.16)	-0.001 (-0.62)	0.001*** (3.16)	-0.001 (-0.72)	-0.001*** (-3.81)	-0.001 (-0.72)
Skewness	0.019*** (3.91)	-0.006 (-0.38)	-0.005 (-0.93)	-0.006 (-0.38)	0.020*** (3.99)	-0.003 (-0.19)	0.003 (0.71)	-0.003 (-0.19)
Intercept	-0.140* (-1.78)	0.594** (2.46)	-0.493*** (-10.1)	0.594** (2.46)	-0.442*** (-10.1)	0.619** (2.58)	-0.779*** (-16.2)	0.619** (2.58)

	(-1.82)	(2.21)	(-6.48)	(2.21)	(-3.94)	(2.29)	(-9.52)	(2.29)
Adjusted R^2	0.488	0.063	0.492	0.063	0.432	0.065	0.447	0.064
N	368,086	368,086	368,086	368,086	348,936	348,936	348,936	348,936

Panel B. Closing trades								
Model	1a	1b	2a	2b	3a	3b	4a	4b
Dependent variable	DecCBC/S	CAR(1)	DecCSC/S	CAR(1)	DecCBP/S	CAR(1)	DecCSP/S	CAR(1)
Residual		-0.010*		-0.032***		-0.012**		-0.011*
		(-1.79)		(-4.28)		(-2.21)		(-1.80)
Dec(ISEO/S-CBC/S)	0.512*** (56.75)							
Dec(ISEO/S-CSC/S)			0.499*** (54.47)					
Dec(ISEO/S-CBP/S)					0.504*** (63.65)			
Dec(ISEO/S-CSP/S)							0.484*** (51.41)	
Amihud	-0.026*** (-7.31)	-0.015*** (-4.55)	-0.027*** (-7.86)	-0.015*** (-4.55)	-0.036*** (-6.30)	-0.017*** (-4.05)	-0.048*** (-6.39)	-0.017*** (-4.05)
CAR(0)	-0.008*** (-5.13)	-0.006 (-1.29)	0.042*** (12.01)	-0.006 (-1.29)	0.003* (1.86)	-0.008 (-1.62)	-0.031*** (-13.02)	-0.008 (-1.62)
Dec Δ eqvol	0.100*** (15.21)	-0.001 (-0.19)	0.111*** (18.87)	-0.001 (-0.19)	0.091*** (19.46)	-0.002 (-0.34)	0.129*** (32.45)	-0.002 (-0.34)
Dec Δ opvol	-0.036*** (-10.79)	-0.010** (-2.08)	0.019*** (5.32)	-0.010** (-2.08)	-0.055*** (-14.41)	-0.011** (-2.38)	-0.030*** (-6.54)	-0.011** (-2.38)
Impl_vol	3.085*** (23.14)	-0.496 (-1.36)	2.879*** (22.69)	-0.496 (-1.36)	2.794*** (29.86)	-0.514 (-1.38)	1.825*** (18.97)	-0.514 (-1.38)
B/M	-0.001 (-0.61)	-0.004 (-0.84)	0.006*** (3.12)	-0.004 (-0.84)	0.012*** (6.58)	-0.004 (-0.84)	0.007*** (3.46)	-0.004 (-0.84)
Size	0.432*** (39.28)	-0.042** (-1.98)	0.331*** (25.05)	-0.042** (-1.98)	0.476*** (34.50)	-0.042** (-1.97)	0.429*** (25.77)	-0.042** (-1.97)
Momen	0.002*** (5.60)	-0.001 (-0.62)	0.008*** (14.09)	-0.001 (-0.62)	-0.001*** (-3.33)	-0.001 (-0.72)	0.000 (0.58)	-0.001 (-0.72)
Skewness	-0.000 (-0.06)	-0.006 (-0.38)	0.041*** (7.41)	-0.006 (-0.38)	-0.003 (-0.49)	-0.003 (-0.19)	0.001 (0.20)	-0.003 (-0.19)
Intercept	-1.992*** (-24.03)	0.594** (2.21)	-1.413*** (-12.55)	0.594** (2.21)	-2.040*** (-17.52)	0.619** (2.29)	-1.461*** (-10.53)	0.619** (2.29)
Adjusted R^2	0.406	0.063	0.423	0.064	0.381	0.065	0.388	0.065
N	368,086	368,086	368,086	368,086	348,936	348,936	348,936	348,936

8. Return predictability for different horizons

As an additional robustness check, we test whether our main findings are found when we use returns over a shorter two-day window instead of the one-week horizon used in the results in the main text. On each day t , we calculate the CAR from day t to $t+1$ as the dependent variable and the signed O/S measures from day $t-5$ to day $t-1$ as the main independent variables. Daily Fama-MacBeth (1973) regressions are conducted (Table IA8). Most of our signed O/S measures still significantly predict returns in the next two days, with slightly smaller coefficients compared with those in Table 5 in the main text. These smaller coefficients are expected; to the extent that the returns on the third through fifth days of each week are predictable, the coefficients in the regressions predicting two-day returns will be smaller than the coefficients in the regressions predicting weekly returns.

We also test whether the return predictability of signed O/S measures remains beyond one week. In Table IA9, the dependent variable takes the value of the CAR in week 1, 2, ..., and 8, respectively. In general, the predictability of decile signed O/S measures on stock returns is significant only in the first few weeks, and there is almost no significant predicative power beyond one month.

Table IA8. The ability of signed O/S measures to predict two-day returns

Results from Fama-MacBeth (1973) regressions of two-day CAR on decile signed O/S measures constructed using data from the prior week. On each day for each firm, we calculate the two-day return as CAR from day t to $t+1$, using the market value-weighted return as the benchmark for the abnormal return. We then calculate the decile signed O/S measures using ISE data for the week before, i.e. from day $t-5$ to $t-1$, as the main independent variables. Similar to Table 5 of the main text, we construct other control variables using data prior to day t . We then estimate daily Fama-MacBeth (1973) regressions and report the time-series means of the coefficient estimates. Panel A reports results for the sample in which the decile O/S measures are in non-expiration weeks, while Panel B report results for expiration weeks. We also exclude observations in the last quarter of 2008. N is the number of firm-day. t -statistics based on Newey-West (1987) adjusted standard errors, with six lags in Panel A and five lags in Panel B, are shown in parentheses below the mean coefficient estimates. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

Panel A. Signed O/S measures in non-expiration weeks								
Model	1	2	3	4	5	6	7	8
DecOBC/S	0.015*** (5.88)				0.021*** (9.04)		0.022*** (8.96)	0.023*** (9.26)
DecOSC/S	-0.014*** (-6.65)				-0.013*** (-6.30)		-0.014*** (-6.45)	-0.013*** (-5.92)
DecCBC/S		0.001 (0.46)			0.002 (0.94)		0.002 (1.22)	0.003 (1.56)
DecCSC/S		-0.008*** (-3.10)			-0.014*** (-5.48)		-0.014*** (-5.04)	-0.013*** (-4.92)
DecOBP/S			-0.013*** (-5.16)			-0.013*** (-5.09)	-0.014*** (-5.31)	-0.014*** (-4.84)
DecOSP/S			0.009*** (3.53)			0.011*** (4.62)	0.012*** (5.14)	0.013*** (5.85)
DecCBP/S				-0.004** (-1.98)		-0.006*** (-2.75)	-0.005** (-2.48)	-0.004** (-2.10)
DecCSP/S				-0.002 (-0.70)		0.001 (0.49)	0.002 (1.12)	0.003 (1.32)
DecOMO/S								-0.007* (-1.72)
Amihud	0.001 (0.24)	0.000 (0.05)	-0.000 (-0.01)	0.000 (0.05)	0.000 (0.02)	-0.000 (-0.06)	-0.000 (-0.17)	-0.000 (-0.06)
CAR(0)	-0.004* (-1.74)	-0.004 (-1.63)	-0.004* (-1.75)	-0.004* (-1.80)	-0.004 (-1.54)	-0.004* (-1.73)	-0.004 (-1.52)	-0.003 (-1.50)
Dec Δ eqvol	0.002 (0.90)	0.002 (0.78)	0.002 (0.97)	0.002 (0.96)	0.002 (0.88)	0.002 (0.95)	0.002 (0.94)	0.001 (0.48)
Dec Δ opvol	-0.005** (-2.38)	-0.002 (-0.98)	-0.002 (-1.14)	-0.003* (-1.72)	-0.004** (-2.05)	-0.002 (-1.15)	-0.003 (-1.56)	-0.001 (-0.67)
Impl_vol	-0.182 (-1.12)	-0.148 (-0.91)	-0.182 (-1.12)	-0.154 (-0.95)	-0.152 (-0.93)	-0.168 (-1.03)	-0.155 (-0.95)	-0.153 (-0.94)
B/M	-0.002 (-0.82)	-0.002 (-0.90)	-0.002 (-0.85)	-0.002 (-0.85)	-0.002 (-0.81)	-0.002 (-0.85)	-0.002 (-0.77)	-0.002 (-0.86)
Size	-0.012	-0.009	-0.010	-0.008	-0.008	-0.009	-0.007	-0.007

	(-1.51)	(-1.06)	(-1.29)	(-1.04)	(-1.03)	(-1.05)	(-0.79)	(-0.82)
Momen	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
	(-0.49)	(-0.48)	(-0.50)	(-0.54)	(-0.39)	(-0.52)	(-0.41)	(-0.38)
Skewness	-0.010	-0.009	-0.009	-0.009	-0.009	-0.009	-0.008	-0.008
	(-1.40)	(-1.29)	(-1.20)	(-1.31)	(-1.28)	(-1.21)	(-1.16)	(-1.16)
Intercept	0.181	0.169	0.181	0.168	0.165	0.176	0.165	0.161
	(1.64)	(1.52)	(1.64)	(1.52)	(1.49)	(1.59)	(1.48)	(1.45)
Adjusted R^2	0.072	0.073	0.072	0.072	0.073	0.073	0.075	0.076
N	1,567,144	1,567,144	1,567,144	1,567,144	1,567,144	1,567,144	1,567,144	1,567,144

Panel B. Signed O/S measures in expiration weeks								
Model	1	2	3	4	5	6	7	8
DecOBC/S	0.021*** (4.95)				0.026*** (5.60)		0.027*** (5.80)	0.028*** (6.11)
DecOSC/S	-0.015*** (-4.16)				-0.012*** (-3.21)		-0.012*** (-3.29)	-0.011*** (-2.81)
DecCBC/S		-0.006** (-2.05)			-0.006* (-1.82)		-0.004 (-1.34)	-0.004 (-1.20)
DecCSC/S		0.003 (0.81)			-0.006 (-1.64)		-0.005 (-1.26)	-0.005 (-1.13)
DecOBP/S			-0.022*** (-5.46)			-0.021*** (-4.82)	-0.023*** (-5.25)	-0.023*** (-4.97)
DecOSP/S			0.016*** (4.70)			0.018*** (4.93)	0.017*** (5.00)	0.018*** (5.23)
DecCBP/S				0.001 (0.25)		-0.003 (-0.79)	-0.003 (-0.80)	-0.002 (-0.69)
DecCSP/S				-0.007** (-2.10)		-0.003 (-0.71)	-0.002 (-0.65)	-0.002 (-0.49)
DecOMO/S								-0.004 (-0.70)
Amihud	-0.000 (-0.12)	-0.001 (-0.23)	-0.001 (-0.25)	-0.001 (-0.25)	-0.001 (-0.27)	-0.001 (-0.30)	-0.002 (-0.41)	-0.002 (-0.44)
CAR(0)	-0.009*** (-2.93)	-0.009*** (-2.87)	-0.009*** (-2.82)	-0.009*** (-2.95)	-0.009*** (-2.82)	-0.009*** (-2.81)	-0.009*** (-2.81)	-0.009*** (-2.80)
Dec Δ eqvol	0.009** (2.04)	0.008* (1.91)	0.008** (1.98)	0.009** (1.99)	0.009* (1.95)	0.008* (1.95)	0.008* (1.85)	0.007 (1.62)
Dec Δ opvol	-0.011*** (-2.63)	-0.008** (-1.98)	-0.005 (-1.51)	-0.007* (-1.87)	-0.011** (-2.57)	-0.005 (-1.45)	-0.008** (-2.09)	-0.008* (-1.90)
Impl_vol	0.223 (1.05)	0.278 (1.31)	0.244 (1.15)	0.274 (1.32)	0.258 (1.22)	0.255 (1.22)	0.257 (1.22)	0.260 (1.23)
B/M	0.004 (1.08)	0.004 (1.04)	0.004 (1.01)	0.004 (1.07)	0.004 (1.10)	0.004 (1.01)	0.004 (1.06)	0.004 (1.07)
Size	-0.012 (-0.84)	-0.007 (-0.44)	-0.008 (-0.53)	-0.005 (-0.36)	-0.008 (-0.55)	-0.005 (-0.37)	-0.004 (-0.30)	-0.005 (-0.34)
Momen	0.001 (1.33)	0.001 (1.35)	0.001 (1.34)	0.001 (1.31)	0.001 (1.42)	0.001 (1.35)	0.001 (1.47)	0.001 (1.50)
Skewness	0.021* (1.91)	0.021* (1.93)	0.023** (2.09)	0.022** (1.97)	0.021* (1.90)	0.023** (2.05)	0.022* (1.95)	0.021* (1.89)
Intercept	0.019 (0.11)	-0.010 (-0.06)	0.014 (0.08)	-0.004 (-0.03)	0.000 (0.00)	0.006 (0.04)	0.000 (0.00)	0.002 (0.01)
Adjusted R ²	0.059	0.059	0.059	0.059	0.060	0.059	0.061	0.062
N	501,162	501,162	501,162	501,162	501,162	501,162	501,162	501,162

Table IA9. Stock return predictability of signed O/S measures beyond the first week

Results from Fama-MacBeth (1973) regressions of $CAR(j)$ on decile signed O/S measures, where $j = 1, 2, \dots, 8$ indexes the weeks following week 0 when the O/S measures are constructed. All other variables are defined in Appendix A to the main text. As in Table 5 of the main text, we estimate weekly Fama-MacBeth (1973) regressions and report the time-series means of the coefficient estimates. Observations for which the O/S measures are from expiration weeks and observations from the last quarter of 2008 are excluded. N is the number of firm-weeks. t -statistics based on Newey-West (1987) adjusted standard errors with four lags are shown in parentheses below the mean coefficient estimates. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

Dependent Variable	CAR(1)	CAR(2)	CAR(3)	CAR(4)	CAR(5)	CAR(6)	CAR(7)	CAR(8)
Model	1	2	3	4	5	6	7	8
DecOBC/S	0.039*** (5.24)	0.009 (1.54)	0.010 (1.52)	0.015** (2.18)	0.013* (1.77)	0.000 (0.06)	0.002 (0.36)	-0.005 (-0.80)
DecOSC/S	-0.029*** (-5.18)	0.007 (1.55)	-0.008 (-1.31)	-0.008 (-1.37)	-0.003 (-0.51)	0.003 (0.49)	-0.014** (-2.28)	-0.003 (-0.53)
DecCBC/S	0.006 (1.08)	-0.008 (-1.31)	0.001 (0.14)	-0.001 (-0.17)	0.002 (0.38)	-0.007 (-1.32)	0.005 (0.88)	0.010* (1.76)
DecCSC/S	-0.034*** (-4.38)	-0.006 (-0.81)	-0.015** (-2.21)	-0.005 (-0.78)	-0.004 (-0.63)	0.004 (0.70)	-0.009 (-1.49)	-0.002 (-0.36)
DecOBP/S	-0.019*** (-2.80)	-0.012* (-1.89)	-0.026*** (-4.03)	-0.019*** (-3.20)	-0.008 (-1.29)	-0.009 (-1.38)	-0.002 (-0.35)	-0.008 (-1.44)
DecOSP/S	0.018*** (2.68)	0.013** (2.37)	0.022*** (4.33)	0.010* (1.82)	0.004 (0.67)	0.004 (0.69)	-0.008 (-1.23)	0.004 (0.73)
DecCBP/S	-0.007 (-1.14)	-0.006 (-1.06)	-0.008 (-1.45)	-0.002 (-0.35)	-0.004 (-0.99)	-0.004 (-0.74)	-0.001 (-0.21)	-0.008 (-1.49)
DecCSP/S	-0.001 (-0.12)	0.003 (0.52)	-0.007 (-1.09)	-0.002 (-0.31)	0.004 (0.76)	-0.000 (-0.03)	0.000 (0.05)	-0.005 (-0.78)
DecOMO/S	-0.004 (-0.33)	-0.001 (-0.13)	0.005 (0.49)	0.001 (0.11)	-0.017* (-1.75)	-0.005 (-0.46)	0.004 (0.38)	-0.008 (-0.71)
Amihud	-0.022*** (-4.56)	0.001 (0.10)	0.001 (0.19)	-0.003 (-0.63)	-0.002 (-0.28)	-0.007* (-1.77)	0.005 (1.00)	-0.002 (-0.31)
CAR(0)	-0.006 (-1.27)	-0.002 (-0.27)	-0.006 (-1.01)	0.006 (0.93)	-0.004 (-0.71)	-0.008 (-1.20)	-0.006 (-1.08)	0.011* (1.92)
Dec Δ eqvol	-0.002 (-0.34)	-0.000 (-0.06)	0.005 (0.78)	0.003 (0.61)	0.002 (0.40)	0.002 (0.39)	0.014** (2.19)	0.008 (1.18)
Dec Δ opvol	-0.002 (-0.37)	-0.003 (-0.50)	-0.003 (-0.56)	-0.014** (-2.36)	0.004 (0.56)	-0.003 (-0.35)	-0.004 (-0.58)	0.004 (0.50)
Impl_vol	-0.316 (-0.86)	-0.380 (-1.08)	-0.279 (-0.75)	-0.348 (-0.90)	0.148 (0.38)	0.019 (0.05)	-0.290 (-0.87)	0.006 (0.02)
B/M	-0.004 (-0.78)	-0.001 (-0.27)	0.002 (0.39)	-0.001 (-0.19)	0.002 (0.38)	-0.007 (-1.31)	-0.003 (-0.64)	-0.004 (-0.81)
Size	-0.024	-0.027	0.037* (1.76)	-0.023	0.017	0.011	-0.009	0.007

	(-1.16)	(-1.30)	(1.67)	(-1.07)	(0.79)	(0.59)	(-0.42)	(0.36)
Momen	-0.001	0.002	0.002	0.003**	0.001	0.001	0.001	0.001
	(-0.48)	(1.15)	(1.42)	(2.07)	(0.76)	(0.63)	(0.82)	(0.48)
Skewness	-0.005	-0.010	-0.032*	-0.019	-0.036**	-0.034**	-0.003	-0.020
	(-0.27)	(-0.53)	(-1.86)	(-1.22)	(-2.19)	(-2.06)	(-0.13)	(-1.06)
Intercept	0.519*	0.412	-0.093	0.453*	-0.170	-0.065	0.249	-0.024
	(1.96)	(1.60)	(-0.35)	(1.72)	(-0.63)	(-0.24)	(1.03)	(-0.09)
Adjusted R^2	0.070	0.064	0.064	0.065	0.064	0.065	0.064	0.061
N	340,758	340,598	340,440	340,251	340,078	339,880	339,682	339,482

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