Media and the Term-Structure of Unexpected Option-Implied Volatility

August 21, 2018

Abstract

This paper examines the relation between information disclosure and the term-structure of unexpected option-implied volatility. First, we use media coverage as a proxy for information disclosure and document that intensely covered firms exhibit future spot option-implied volatilities which are lower than corresponding forward option-implied volatilities over various horizons. On average, options on firms in the highest abnormal media coverage decile exhibit a roughly 0.55% drop in unexpected implied volatility relative to the lowest abnormal intensity decile over the next three weeks. An option strategy designed to capture this spread would have earned approximately 48% annually from 2011-2017. This relation is robust to various controls and econometric specifications and is also present within option-implied volatilities pertaining to developed country currencies. Second, we document that sentiment (i.e., coverage tone) and sentiment dispersion (standard deviation) are also related to future risks, but over longer horizons. These results suggest that media coverage contains information about unexpected future risk.

1. Introduction

Media coverage serves a paramount role in the dissemination of information and in the resolution of uncertainty pertaining to future firm risk. This paper examines the ability of three media coverage measures, which capture the intensity, sentiment and dispersion of opinions within media coverage, to explain the term-structure of unexpected option-implied volatility. Within our setting, the term-structure of unexpected option-implied volatility is the deviation of future spot option-implied volatilities from their corresponding current forward option-implied volatilities over distinct horizons. Froot, Lou, Ozik, and Sadka (2016) provide an account of the intuition underlying the three media measures used in this paper.

Information disclosure is fundamentally intertwined with the market's estimate of a firm's future risk. For example, Ederington and Lee (1996) find that scheduled announcements tend to lead to reductions in option-implied standard deviations. They posit that these announcements help to resolve the market's uncertainty regarding the impact of these announcements on security prices. Similarly, Rogers, Skinner, and Van Buskirk (2009) explore the ramifications of management earnings forecasts on stock market volatility. They find that management earnings forecasts which convey negative news increase option-implied volatilities over the short-term. This effect is more pronounced when firms release forecasts more sporadically.

Earnings announcements and earnings forecasts are inherently discrete in their release frequency. Measures which capture distinct dimensions of aggregated firm-related information within media coverage, over a relatively more continuous frequency, help to ameliorate these frictions. Specifically, the use of media coverage as a proxy for information disclosure provides more continuous firm-related information that is less dependent on the information release schedule of the firm. Within this paper, we find that media coverage provides a forward-looking view on unexpected future firm risk over the life of stock options. This suggests that media coverage contains information pertaining to future firm risk which is

not fully reflected in option-implied volatilities.

The first media coverage measure, intensity, captures changes in the number of media articles that reference a given asset. This measure is motivated by Merton (1987) who shows that investors may underinvest in relatively less familiar assets as they are not fully aware of the investment opportunities associated with these assets. Sentiment characterizes the tone of media coverage. This measure is buttressed by the work of Tetlock (2007) who finds that high media pessimism predicts downward pressure on market prices. Moreover, unusually high or low levels of pessimism are shown to predict high market trading volume. Ozik and Sadka (2013) demonstrate that distinct news item source groups may be systematically positively- or negatively- biased in their coverage. The third measure, disagreement, reflects the dispersion of media opinions pertaining to a given asset. Miller (1977) examines the ramifications of short-selling constraints on markets with heterogeneous estimates of risky asset returns. He shows that risky assets may underperform their less risky counterparts when short-selling constraints lead to overvaluations which reflect the beliefs of optimistic investors.

First, we find that intensely covered firms tend to exhibit future spot option-implied volatilities which are lower than corresponding forward option-implied volatilities over various horizons. This negative association between intensity and unexpected future changes in option-implied volatility is consistent with intense media coverage attenuating firm-related uncertainty. On average, options on firms in the highest media intensity decile exhibit a roughly 0.55% drop in unexpected implied volatility relative to the lowest media intensity decile over the next three weeks. An option strategy designed to capture this spread would have earned approximately 48% annually from 2011-2017. This intensity effect is robust to various controls and econometric specifications and is also present within option-implied volatilities pertaining to developed country currencies. We also document that sentiment (i.e., coverage tone) and sentiment dispersion (standard deviation) are related to future risks, but over longer horizons.

The remainder of this paper proceeds as follows. Section 2 describes the data as well as variable construction. Section 3 presents our empirical analyses and results and Section 4 concludes the paper.

2. Data and Variable Construction

We obtain data pertaining to the three media coverage indicators from MKT MediaStats, LLC. Within our primary analyses, we focus on media coverage measures constructed over a 4-week formation horizon for S&P 500 firms. We obtain firm option-implied volatility data from OptionMetrics' IVY DB US volatility surface database. We use firm option-implied volatilities that are derived from put options that are roughly at-the-money. The sample underlying Table 1 spans the date index t, which begins on 05/02/2011 and ends on 12/08/2017, inclusive and includes 746,258 observations over 1,606 days. We obtain option-implied volatility data pertaining to the currencies of developed countries from Bloomberg. The sample underlying the $\tau = 21$ case in Table 5 spans the date index t which covers 03/04/2013 through 03/14/2018, inclusive and includes 15,423 observations over 1,313 days. We consider 12 developed country currency pairs within this $\tau = 21$ setting.[1]

We construct the term-structure of unexpected option-implied volatility as:

$$\text{IV}[t+\tau, t+\tau, t+\tau+30] - \text{IV}[t, t+\tau, t+\tau+30] \tag{1}$$

where the term, $\text{IV}[t+\tau, t+\tau, t+\tau+30]$, is the spot option-implied volatility observed at date $t+\tau$ and spanning dates $t+\tau$ through $t+\tau+30$. Similarly, the term, $\text{IV}[t, t+\tau, t+\tau+30]$, is the forward option-implied volatility observed at date t and spanning dates $t+\tau$ through

[1]These 12 aforementioned developed country currency pairs are: AUDUSD, EURUSD, GBPUSD, NZDUSD, USDCAD, USDCHF, USDDKK, USDILS, USDJPY, USDNOK, USDSEK, USDSGD.

$t+\tau+30$. $\text{IV}[t, t+\tau, t+\tau+30]$ is defined as follows:

$$\sqrt{\frac{(\tau+30)\text{IV}^2[t,t,t+\tau+30]-(\tau)\text{IV}^2[t,t,t+\tau]}{30}} \tag{2}$$

Within our regression analyses, we consider $\tau \in [1,2,3,4,5,6,7,14,21,28]$ where τ is expressed in units of calendar days.

3. Results

Table 1 presents the Pearson correlation matrix of 4-week formation horizon media coverage indicators, option-implied volatility, and unexpected changes in option-implied volatility for S&P 500 firms. For brevity in the correlation table, we present correlations where $\tau = 21$ calendar days. Consistent with the positive association between information disclosure and the resolution of uncertainty, we find that intensely covered firms tend to experience future spot option-implied volatilities which are lower than corresponding current forward option-implied volatilities. Specifically, we find that media intensity is negatively correlated to the term $\text{IV}[t+21, t+21, t+51] - \text{IV}[t, t+21, t+51]$. We also find that media sentiment and media disagreement are negatively correlated to unexpected changes in option-implied volatility within this table. High media disagreement can portend future spot implied volatilities which are less than corresponding current forward implied volatilities. This effect may arise, in part, due to an overreaction to market disagreement.

Table 2 examines the economic significance of fluctuations in media coverage on unexpected option-implied volatility within scaled decile-rank regression frameworks. Independent variables are transformed by first calculating their decile-rank each day, from 0 to 9 inclusive, and then dividing by 9. The coefficient on the respective scaled decile-rank variable is the change in the corresponding dependent variable stemming from a bottom-to-top decile transition in the independent variable. We find that, on average, options on firms in the highest intensity decile exhibit a roughly .55% drop in unexpected implied volatility

relative to the lowest intensity decile over the next three weeks (column (9), $\tau = 21$, t-statistic = -18.32). Figure 1 presents the scaled decile-rank regressions intensity response function for S&P 500 firms. This is simply the plot of the coefficients and t-statistics of the scaled decile-rank of intensity over $\tau \in [1, 2, 3, 4, 5, 6, 7, 14, 21, 28]$ calendar days. Figure 2 focuses on the $\tau = 21$ case and plots the time-series of the 3-month moving average of the monthly average of daily scaled decile-rank regressions intensity cross-sectional coefficients for S&P 500 firms. Specifically, we estimate the model:

$$\begin{aligned} \text{IV}[t+21, t+21, t+51] - \text{IV}[t, t+21, t+51] = a &+ b \times \text{SDR}[\text{Intensity}[t-1]] \\ &+ c \times \text{SDR}[\text{Sentiment}[t-1]] \\ &+ d \times \text{SDR}[\text{Disagreement}[t-1]] + e \end{aligned} \tag{3}$$

on a daily basis and plot the coefficients of the scaled decile-rank of intensity. The date on the x-axis is the last month, inclusive, in each of the 3-month moving average windows. Calendar year-month membership is assigned based on the corresponding regression date index t.

To estimate the economic significance of a 0.55% change in implied volatility, we perform the following calculation: The price of a call option with S=100, X=100, dividend yield=0, interest rate=0, days-to-expiration=30, and volatility=20% is roughly 2.2872. Similarly, the vega of this call option is roughly 0.1143. Every three weeks, the return on a fully invested strategy designed to capture the aforementioned implied volatility spread is (0.55 × 0.1143) / 2.2872 which is roughly 2.7486%. If we replicate this strategy over 52 weeks, a conservative estimate of the annual return between 2011-2017 is 2.7486% × (52/3) or approximately 48%. Alternatively, an option strategy designed to capture the roughly .29% spread associated with $\tau = 7$ would have conservatively earned approximately 75% annually. The economic significance of sentiment and disagreement is less pronounced. Specifically, the unexpected implied volatility spread between companies in the highest and lowest sentiment deciles is

roughly -.09% over three weeks on average. The unexpected implied volatility spread between the highest and lowest media disagreement deciles is -.15% over four weeks.

Table 3 presents the results of analyses which examine if the effects of media on the term-structure of unexpected option-implied volatility are symmetric with respect to non-negative and negative values of the respective media indicators. The dummy variables, negative intensity, negative sentiment, and negative disagreement, take on a value of 1 if the underlying media coverage indicators are negative and 0 otherwise. For instance, negative intensity takes on a value of 1 if intensity is negative and 0 otherwise. We interact these dummy variables with their corresponding media coverage indicators. In columns (4)-(10), we find that the magnitude of the intensity effect appears greater for negative values of the intensity measure when compared to non-negative values of intensity. In contrast, we find that the interaction effect of sentiment with the negative sentiment dummy is positive and statistically significant in columns (4)-(5) and columns (7)-(8). The interaction effect of disagreement with the negative disagreement dummy is negative and statistically significant in columns (5)-(7).

In Table 4, we examine the size interaction effects of media coverage on the term-structure of unexpected option-implied volatility. The dummy variable large takes on a value of 1 if the market capitalization associated with a given ticker, on a given date, is in the upper half of market capitalizations of tickers within the S&P 500 and 0 otherwise. We interact this variable with the media coverage indicators in order to stratify the relevant media coverage effects into the upper and lower halves of daily market capitalizations within the S&P 500. The results in columns (1)-(9) suggest that the intensity effect is roughly symmetric within the lower and upper halves of daily market capitalizations of S&P 500 firms. We find that the negative relation between media disagreement and unexpected option-implied volatility appears to be primarily driven by relatively larger firms within columns (4)-(10).

Table 5 presents an analysis of the relation between the three media coverage indicators and unexpected option-implied volatility for developed country currencies. As in the S&P

500 framework, we identify a negative relation between media intensity and unexpected option-implied volatility. For the $\tau = 21$ case, a three standard deviation shock to intensity would result in a 3 × -3.62 basis points or roughly a -11 basis points shock to unexpected option-implied volatility. Every three weeks, the return on a fully invested strategy designed to capture this implied volatility spread is (.11 × 0.1143) / 2.2872 which is roughly 0.5497%. If we replicate this strategy over 52 weeks, a conservative estimate of the annual return between 2013-2018 is 0.5497% × (52/3) or approximately 10%. Alternatively, an option strategy designed to capture the roughly .07% three standard deviation spread associated with $\tau = 7$ would have conservatively earned approximately 18% annually.

4. Conclusion

This paper examines the ability of three media coverage indicators to explain the term-structure of unexpected option-implied volatility. First, we find that media coverage intensity is negatively related to unexpected future changes in option-implied volatility for S&P 500 firms. On average, options on firms in the highest media intensity decile exhibit a 0.55% drop in unexpected implied volatility relative to their lowest intensity decile counterparts over the following three weeks. This negative association between intensity and future changes in option implied volatility is consistent with intense media coverage resolving firm-related uncertainty. This result is economically significant as a fully invested strategy designed to capture this difference would have earned approximately 48% annually from 2011-2017. This intensity effect is robust to various controls and econometric specifications and is also present within option-implied volatilities pertaining to developed country currencies. We also document that sentiment (i.e., coverage tone) and sentiment dispersion (standard deviation) are related to future risks, but over relatively longer horizons. These results suggest that measures capturing distinct quantitative dimensions of media coverage are valuable tools in better understanding unexpected future fluctuations in firm- and currency-related risk.

Empirical Tests

Table 1: Pearson Correlation Matrix of 4-Week Formation Horizon Media Coverage Indicators, Option-Implied Volatility, and Unexpected Changes in Option-Implied Volatility
STT S&P 500 Data

Implied volatilities are derived from put options that are roughly at-the-money. $\text{IV}[t+\tau, t+\tau, t+\tau+30]$ is a firm's observed option-implied volatility at date $t+\tau$ for the implied volatility horizon starting at date $t+\tau$ and ending at date $t+\tau+30$. $\text{IV}[t, t+\tau, t+\tau+30]$ is a firm's forward option-implied volatility at date t for the implied volatility horizon starting at date $t+\tau$ and ending at date $t+\tau+30$. All media coverage indicators below are measured at calendar date $t-1$. For brevity in the correlation table below, we present correlations where $\tau = 21$ calendar days. Within the $\tau = 21$ setting, t starts on 05/02/2011 and ends on 12/08/2017, inclusive.

	(1) Intensity	(2) Sentiment	(3) Disagreement	(4) $\text{IV}[t+21, t+21, t+51]$	(5) $\text{IV}[t, t+21, t+51]$	(6) $\text{IV}[t+21, t+21, t+51] - \text{IV}[t, t+21, t+51]$
Intensity	1					
Sentiment	-0.0270	1				
Disagreement	0.0199	-0.00319	1			
$\text{IV}[t+21, t+21, t+51]$	-0.0411	0.00513	0.0328	1		
$\text{IV}[t, t+21, t+51]$	-0.0259	0.00582	0.0395	0.872	1	
$\text{IV}[t+21, t+21, t+51] - \text{IV}[t, t+21, t+51]$	-0.0348	-0.000533	-0.00757	0.391	-0.111	1
Observations	746,258	746,258	746,258	746,258	746,258	746,258

Table 2: Effect of Media Coverage on the Term-Structure of Unexpected Option-Implied Volatility
STT S&P 500 Data
4-Week Formation Horizon Media Coverage Indicators:
Scaled Decile-Rank Regressions

The below specifications feature Fama-MacBeth daily cross-sectional regressions for each of the ten change in implied volatility prediction horizons. Implied volatilities are derived from put options that are roughly at-the-money. IV$[t+\tau, t+\tau, t+\tau+30]$ is a firm's observed option-implied volatility at date $t+\tau$ for the implied volatility horizon starting at date $t+\tau$ and ending at date $t+\tau+30$. IV$[t, t+\tau, t+\tau+30]$ is a firm's forward option-implied volatility at date t for the implied volatility horizon starting at date $t+\tau$ and ending at date $t+\tau+30$. Independent variables are transformed by first calculating their decile-rank each day, from 0 to 9 inclusive, and then dividing by 9. The coefficient on the respective scaled decile-rank variable is the change in the corresponding dependent variable stemming from a bottom-to-top decile transition in the independent variable. We include SDR[Intensity], SDR[Sentiment], SDR[Disagreement], and a constant as right-hand side variables in the daily cross-sectional regressions. Media coverage indicators are indexed at date $t-1$. All t-statistics in parentheses are based on Newey-West adjusted standard errors with a maximum lag order of autocorrelation of 1-day. The notation $*, **, ***$ indicates statistical significance at the 10%, 5%, and 1% levels, respectively.

$$\text{IV}[t+\tau, t+\tau, t+\tau+30] - \text{IV}[t, t+\tau, t+\tau+30] = a + b \times \text{SDR}[\text{Intensity}[t-1]] + c \times \text{SDR}[\text{Sentiment}[t-1]] + d \times \text{SDR}[\text{Disagreement}[t-1]] + e$$

	(1) $\tau=1$	(2) $\tau=2$	(3) $\tau=3$	(4) $\tau=4$	(5) $\tau=5$	(6) $\tau=6$	(7) $\tau=7$	(8) $\tau=14$	(9) $\tau=21$	(10) $\tau=28$
SDR[Intensity]	-0.000701***	-0.001363***	-0.001633***	-0.001785***	-0.002244***	-0.002586***	-0.002905***	-0.004778***	-0.005533***	-0.004335***
	(-5.83)	(-6.87)	(-7.79)	(-8.38)	(-9.19)	(-11.07)	(-12.82)	(-16.96)	(-18.32)	(-14.17)
SDR[Sentiment]	-0.000347*	-0.000670**	-0.000356	-0.000429	-0.000031	-0.000200	-0.000549*	-0.000695*	-0.000867**	-0.000891**
	(-1.76)	(-2.20)	(-1.09)	(-1.36)	(-0.09)	(-0.61)	(-1.78)	(-1.85)	(-2.34)	(-2.12)
SDR[Disagreement]	-0.000206	-0.000421*	-0.000318	-0.000203	-0.000289	-0.000538**	-0.000699***	-0.001137***	-0.001231***	-0.001488***
	(-1.54)	(-1.94)	(-1.47)	(-0.94)	(-1.25)	(-2.50)	(-3.39)	(-4.83)	(-4.86)	(-5.70)
Daily Cross-Sections	1,315	980	941	940	977	1,310	1,620	1,611	1,606	1,604
Observations	613,179	456,951	438,615	438,129	455,547	610,750	755,111	749,875	746,258	744,178

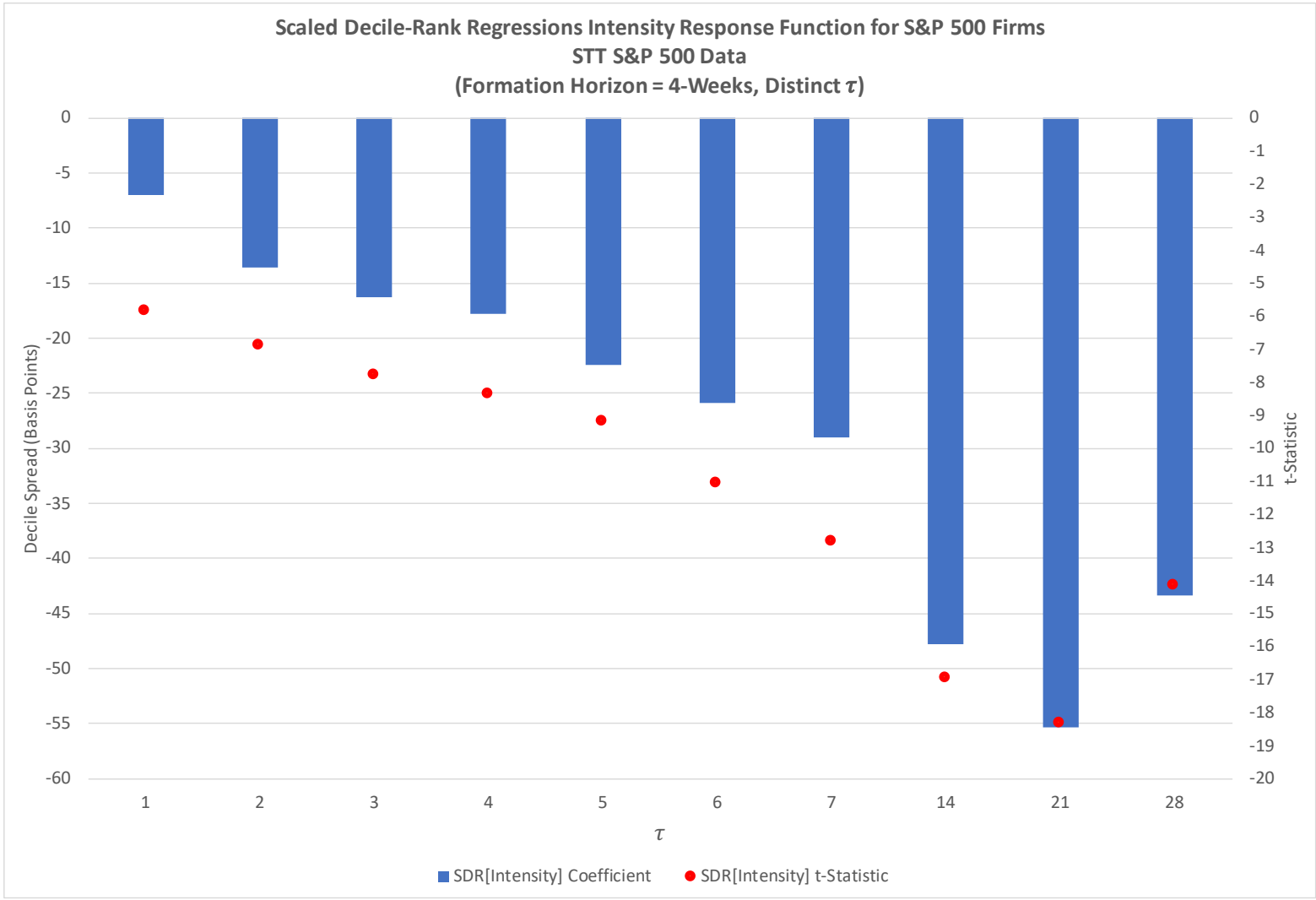

Figure 1: This figure presents the scaled decile-rank regressions intensity response function for S&P 500 firms. We estimate the model: $\text{IV}[t+\tau, t+\tau, t+\tau+30] - \text{IV}[t, t+\tau, t+\tau+30] = a + b \times \text{SDR}[\text{Intensity}[t-1]] + c \times \text{SDR}[\text{Sentiment}[t-1]] + d \times \text{SDR}[\text{Disagreement}[t-1]] + e$ by using Fama-MacBeth daily cross-sectional regressions for distinct values of τ. τ is expressed in units of calendar days.

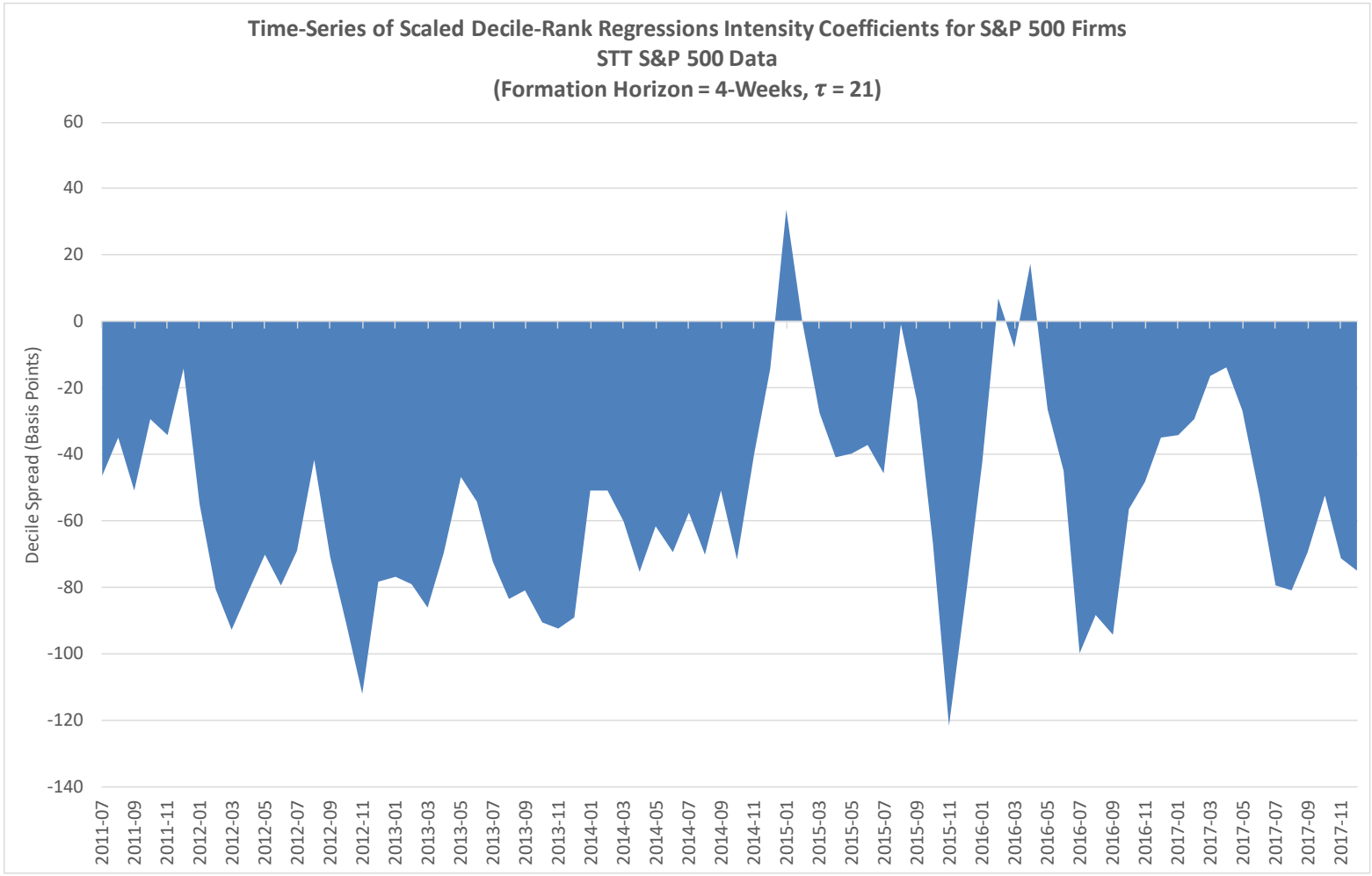

Figure 2: This figure presents the time-series of the 3-month moving average of the monthly average of daily scaled decile-rank regressions intensity cross-sectional coefficients for S&P 500 firms. We estimate the model: $\text{IV}[t+21, t+21, t+51] - \text{IV}[t, t+21, t+51] = a + b \times \text{SDR}[\text{Intensity}[t-1]] + c \times \text{SDR}[\text{Sentiment}[t-1]] + d \times \text{SDR}[\text{Disagreement}[t-1]] + e$ on a daily basis and plot the coefficients of the scaled decile-rank of intensity. Calendar year-month membership is assigned based on the associated regression index at date t. The month on the x-axis is the last month, inclusive, in the respective 3-month moving average window.

Table 3: Effect of Media Coverage on the Term-Structure of Unexpected Option-Implied Volatility
STT S&P 500 Data
4-Week Formation Horizon Media Coverage Indicators:
Differential Effects

The below specifications feature Fama-MacBeth daily cross-sectional regressions for each of the ten change in implied volatility prediction horizons. Implied volatilities are derived from put options that are roughly at-the-money. IV$[t+\tau, t+\tau, t+\tau+30]$ is a firm's observed option-implied volatility at date $t+\tau$ for the implied volatility horizon starting at date $t+\tau$ and ending at date $t+\tau+30$. IV$[t, t+\tau, t+\tau+30]$ is a firm's forward option-implied volatility at date t for the implied volatility horizon starting at date $t+\tau$ and ending at date $t+\tau+30$. Negative intensity takes on a value of 1 if intensity is negative and 0 otherwise. Negative sentiment takes on a value of 1 if sentiment is negative and 0 otherwise. Negative disagreement takes on a value of 1 if disagreement is negative and 0 otherwise. We include intensity, intensity × negative intensity, sentiment, sentiment × negative sentiment, disagreement, disagreement × negative disagreement, and a constant as right-hand side variables in the daily cross-sectional regressions. Media coverage indicators as well as corresponding negative media indicator dummy variables are indexed at date $t-1$. All t-statistics in parentheses are based on Newey-West adjusted standard errors with a maximum lag order of autocorrelation of 1-day. The notation $*, **, ***$ indicates statistical significance at the 10%, 5%, and 1% levels, respectively.

Dependent Variable: IV$[t+\tau, t+\tau, t+\tau+30]$ − IV$[t, t+\tau, t+\tau+30]$										
	(1) $\tau=1$	(2) $\tau=2$	(3) $\tau=3$	(4) $\tau=4$	(5) $\tau=5$	(6) $\tau=6$	(7) $\tau=7$	(8) $\tau=14$	(9) $\tau=21$	(10) $\tau=28$
Intensity	-0.000228***	-0.000460***	-0.000523***	-0.000457***	-0.000590***	-0.000678***	-0.000776***	-0.001107***	-0.001233***	-0.000967***
	(-3.34)	(-4.07)	(-4.50)	(-4.22)	(-4.76)	(-5.66)	(-6.60)	(-8.01)	(-8.81)	(-6.79)
Int. × Neg. Int.	-0.000086	-0.000164	-0.000226	-0.000406**	-0.000408*	-0.000554***	-0.000630***	-0.001371***	-0.001665***	-0.001276***
	(-0.73)	(-0.87)	(-1.18)	(-2.22)	(-1.91)	(-2.73)	(-3.22)	(-6.07)	(-7.31)	(-5.23)
Sentiment	-0.000084	-0.000131	-0.000077	-0.000127	-0.000170*	-0.000155*	-0.000213**	-0.000268***	-0.000230**	-0.000194*
	(-1.50)	(-1.51)	(-0.90)	(-1.56)	(-1.87)	(-1.78)	(-2.53)	(-2.84)	(-2.31)	(-1.80)
Sent. × Neg. Sent.	0.000061	0.000086	0.000139	0.000275*	0.000324*	0.000262	0.000287**	0.000342**	0.000260	0.000240
	(0.59)	(0.52)	(0.97)	(1.89)	(1.78)	(1.60)	(1.96)	(1.99)	(1.48)	(1.28)
Disagreement	-0.000049	-0.000029	0.000034	0.000029	0.000122	0.000054	0.000010	-0.000202	-0.000350**	-0.000611***
	(-0.64)	(-0.24)	(0.28)	(0.24)	(0.97)	(0.45)	(0.09)	(-1.46)	(-2.33)	(-4.15)
Disag. × Neg. Disag.	-0.000044	-0.000230	-0.000328	-0.000232	-0.000467**	-0.000463**	-0.000497**	-0.000293	-0.000034	0.000292
	(-0.31)	(-1.03)	(-1.45)	(-1.05)	(-2.03)	(-2.21)	(-2.39)	(-1.21)	(-0.13)	(1.10)
Daily Cross-Sections	1,315	980	941	940	977	1,310	1,620	1,611	1,606	1,604
Observations	613,179	456,951	438,615	438,129	455,547	610,750	755,111	749,875	746,258	744,178

Table 4: Effect of Media Coverage on the Term-Structure of Unexpected Option-Implied Volatility
STT S&P 500 Data
4-Week Formation Horizon Media Coverage Indicators:
Size Interactions

The below specifications feature Fama-MacBeth daily cross-sectional regressions for each of the ten change in implied volatility prediction horizons. Implied volatilities are derived from put options that are roughly at-the-money. IV$[t+\tau, t+\tau, t+\tau+30]$ is a firm's observed option-implied volatility at date $t+\tau$ for the implied volatility horizon starting at date $t+\tau$ and ending at date $t+\tau+30$. IV$[t, t+\tau, t+\tau+30]$ is a firm's forward option-implied volatility at date t for the implied volatility horizon starting at date $t+\tau$ and ending at date $t+\tau+30$. Large takes on a value of 1 if the market capitalization associated with a given ticker, when available on a given date, is in the upper half of market capitalizations of tickers within the S&P 500 and 0 otherwise. We include intensity, intensity × large, sentiment, sentiment × large, disagreement, disagreement × large, large, and a constant as right-hand side variables in the daily cross-sectional regressions. Media coverage indicators are indexed at date $t-1$. Large is indexed at date t. All t-statistics in parentheses are based on Newey-West adjusted standard errors with a maximum lag order of autocorrelation of 1-day. The notation $*, **, ***$ indicates statistical significance at the 10%, 5%, and 1% levels, respectively.

Dependent Variable: IV$[t+\tau, t+\tau, t+\tau+30]$ − IV$[t, t+\tau, t+\tau+30]$										
	(1) $\tau=1$	(2) $\tau=2$	(3) $\tau=3$	(4) $\tau=4$	(5) $\tau=5$	(6) $\tau=6$	(7) $\tau=7$	(8) $\tau=14$	(9) $\tau=21$	(10) $\tau=28$
Intensity	-0.000239***	-0.000474***	-0.000625***	-0.000726***	-0.000896***	-0.000987***	-0.001117***	-0.001769***	-0.002009***	-0.001475***
	(-3.69)	(-4.69)	(-6.09)	(-6.72)	(-7.42)	(-8.65)	(-10.22)	(-13.22)	(-13.32)	(-9.82)
Int. × Large	-0.000026	-0.000043	0.000039	0.000123	0.000138	0.000055	0.000065	0.000014	-0.000062	-0.000260*
	(-0.37)	(-0.39)	(0.35)	(1.08)	(1.14)	(0.49)	(0.59)	(0.10)	(-0.41)	(-1.69)
Sentiment	-0.000110	-0.000142	0.000025	-0.000048	-0.000073	-0.000021	-0.000109	-0.000146	-0.000084	0.000038
	(-1.35)	(-1.09)	(0.21)	(-0.42)	(-0.53)	(-0.17)	(-0.95)	(-1.11)	(-0.60)	(0.26)
Sent. × Large	0.000089	0.000071	-0.000048	0.000116	0.000147	0.000039	0.000102	0.000128	0.000044	-0.000108
	(1.07)	(0.52)	(-0.38)	(0.98)	(1.03)	(0.29)	(0.85)	(0.91)	(0.29)	(-0.69)
Disagreement	-0.000103	-0.000235**	-0.000093	0.000114	0.000164	0.000081	-0.000002	0.000120	0.000343***	0.000387***
	(-1.46)	(-2.15)	(-0.86)	(1.08)	(1.47)	(0.80)	(-0.02)	(1.04)	(2.73)	(3.09)
Disag. × Large	0.000048	0.000158	0.000012	-0.000241**	-0.000332***	-0.000280**	-0.000234**	-0.000531***	-0.000850***	-0.000963***
	(0.63)	(1.32)	(0.10)	(-2.08)	(-2.73)	(-2.47)	(-2.16)	(-4.06)	(-6.01)	(-6.76)
Large	0.000123	0.000339**	-0.000224	-0.001143***	-0.001711***	-0.001567***	-0.001536***	-0.002870***	-0.003706***	-0.004601***
	(1.15)	(2.14)	(-1.30)	(-6.13)	(-8.43)	(-8.32)	(-8.37)	(-13.04)	(-16.11)	(-18.35)
Daily Cross-Sections	1,315	980	941	940	977	1,310	1,620	1,611	1,606	1,604
Observations	606,919	452,267	434,138	433,659	450,951	604,579	747,430	742,256	738,675	736,641

Table 5: Effect of Media Coverage on the Term-Structure of Unexpected Option-Implied Volatility
FX-Developed Countries: Unfiltered Media Coverage Indicator Data
4-Week Formation Horizon Media Coverage Indicators:
Daily Cross-Sectionally Standardized Media Coverage Indicators

The below specifications feature Fama-MacBeth daily cross-sectional regressions for each of the ten change in implied volatility prediction horizons. IV$[t+\tau, t+\tau, t+\tau+30]$ is a currency pair's observed option-implied volatility at date $t+\tau$ for the implied volatility horizon starting at date $t+\tau$ and ending at date $t+\tau+30$. IV$[t, t+\tau, t+\tau+30]$ is a currency pair's forward option-implied volatility at date t for the implied volatility horizon starting at date $t+\tau$ and ending at date $t+\tau+30$. We include intensity, sentiment, disagreement, and a constant as right-hand side variables in the daily cross-sectional regressions. Media coverage indicators are indexed at date $t-1$. All t-statistics in parentheses are based on Newey-West adjusted standard errors with a maximum lag order of autocorrelation of 1-day. The notation $*, **, ***$ indicates statistical significance at the 10%, 5%, and 1% levels, respectively.

Dependent Variable: IV$[t+\tau, t+\tau, t+\tau+30]$ − IV$[t, t+\tau, t+\tau+30]$										
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	$\tau=1$	$\tau=2$	$\tau=3$	$\tau=4$	$\tau=5$	$\tau=6$	$\tau=7$	$\tau=14$	$\tau=21$	$\tau=28$
Intensity	-0.000061**	-0.000116**	-0.000113**	-0.000126**	-0.000142**	-0.000177***	-0.000229***	-0.000319***	-0.000362***	-0.000334***
	(-1.99)	(-2.07)	(-2.01)	(-2.13)	(-2.11)	(-2.68)	(-3.38)	(-3.40)	(-3.51)	(-3.17)
Sentiment	0.000036	0.000112	0.000019	-0.000101*	-0.000119	-0.000085	-0.000086	0.000010	0.000337***	0.000553***
	(1.05)	(1.64)	(0.30)	(-1.66)	(-1.52)	(-1.04)	(-1.00)	(0.09)	(2.73)	(4.21)
Disagreement	0.000013	0.000027	0.000042	0.000008	-0.000019	0.000001	0.000021	0.000048	0.000146	0.000173
	(0.42)	(0.42)	(0.69)	(0.13)	(-0.26)	(0.01)	(0.27)	(0.47)	(1.37)	(1.52)
Daily Cross-Sections	1,062	796	795	795	795	1,059	1,323	1,318	1,313	1,308
Observations	12,481	9,361	9,345	9,338	9,332	12,435	15,543	15,483	15,423	15,363

Appendix A:

Robustness Tests

Table 6: Effect of Media Coverage on the Term-Structure of Unexpected Option-Implied Volatility
STT S&P 500 Data
1-Week Formation Horizon Media Coverage Indicators:
Scaled Decile-Rank Regressions

The below specifications feature Fama-MacBeth daily cross-sectional regressions for each of the ten change in implied volatility prediction horizons. Implied volatilities are derived from put options that are roughly at-the-money. IV$[t+\tau, t+\tau, t+\tau+30]$ is a firm's observed option-implied volatility at date $t+\tau$ for the implied volatility horizon starting at date $t+\tau$ and ending at date $t+\tau+30$. IV$[t, t+\tau, t+\tau+30]$ is a firm's forward option-implied volatility at date t for the implied volatility horizon starting at date $t+\tau$ and ending at date $t+\tau+30$. Independent variables are transformed by first calculating their decile-rank each day, from 0 to 9 inclusive, and then dividing by 9. The coefficient on the respective scaled decile-rank variable is the change in the corresponding dependent variable stemming from a bottom-to-top decile transition in the independent variable. We include SDR[Intensity], SDR[Sentiment], SDR[Disagreement], and a constant as right-hand side variables in the daily cross-sectional regressions. Media coverage indicators are indexed at date $t-1$. All t-statistics in parentheses are based on Newey-West adjusted standard errors with a maximum lag order of autocorrelation of 1-day. The notation $*, **, ***$ indicates statistical significance at the 10%, 5%, and 1% levels, respectively.

	Dependent Variable: IV$[t+\tau, t+\tau, t+\tau+30]$ − IV$[t, t+\tau, t+\tau+30]$									
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	$\tau=1$	$\tau=2$	$\tau=3$	$\tau=4$	$\tau=5$	$\tau=6$	$\tau=7$	$\tau=14$	$\tau=21$	$\tau=28$
SDR[Intensity]	-0.001094***	-0.002167***	-0.001953***	-0.001637***	-0.001742***	-0.002104***	-0.002380***	-0.002973***	-0.003688***	-0.003705***
	(-8.70)	(-11.16)	(-9.10)	(-7.52)	(-7.26)	(-9.46)	(-11.39)	(-11.82)	(-14.43)	(-13.83)
SDR[Sentiment]	0.000135	-0.000295	-0.000212	0.000393	0.000207	0.000022	0.000087	-0.000363	-0.000196	-0.000031
	(0.63)	(-1.04)	(-0.79)	(1.43)	(0.64)	(0.08)	(0.33)	(-1.17)	(-0.60)	(-0.10)
SDR[Disagreement]	-0.000141	-0.000282	-0.000142	0.000244	-0.000055	-0.000151	-0.000335*	-0.001115***	-0.001092***	-0.000946***
	(-1.07)	(-1.43)	(-0.68)	(1.23)	(-0.26)	(-0.77)	(-1.76)	(-4.98)	(-4.72)	(-3.93)
Daily Cross-Sections	1,315	980	941	940	977	1,310	1,620	1,611	1,606	1,604
Observations	589,310	439,090	421,086	420,707	437,855	586,937	725,422	720,769	716,947	714,793

Table 7: Effect of Media Coverage on the Term-Structure of Unexpected Option-Implied Volatility
FX-Developed Countries: Unfiltered Media Coverage Indicator Data
1-Week Formation Horizon Media Coverage Indicators:
Daily Cross-Sectionally Standardized Media Coverage Indicators

The below specifications feature Fama-MacBeth daily cross-sectional regressions for each of the ten change in implied volatility prediction horizons. $\text{IV}[t+\tau, t+\tau, t+\tau+30]$ is a currency pair's observed option-implied volatility at date $t+\tau$ for the implied volatility horizon starting at date $t+\tau$ and ending at date $t+\tau+30$. $\text{IV}[t, t+\tau, t+\tau+30]$ is a currency pair's forward option-implied volatility at date t for the implied volatility horizon starting at date $t+\tau$ and ending at date $t+\tau+30$. We include intensity, sentiment, disagreement, and a constant as right-hand side variables in the daily cross-sectional regressions. Media coverage indicators are indexed at date $t-1$. All t-statistics in parentheses are based on Newey-West adjusted standard errors with a maximum lag order of autocorrelation of 1-day. The notation $*, **, ***$ indicates statistical significance at the 10%, 5%, and 1% levels, respectively.

Dependent Variable: $\text{IV}[t+\tau, t+\tau, t+\tau+30] - \text{IV}[t, t+\tau, t+\tau+30]$										
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	$\tau = 1$	$\tau = 2$	$\tau = 3$	$\tau = 4$	$\tau = 5$	$\tau = 6$	$\tau = 7$	$\tau = 14$	$\tau = 21$	$\tau = 28$
Intensity	-0.000072**	-0.000091	-0.000063	-0.000160**	-0.000311***	-0.000299***	-0.000311***	-0.000216**	-0.000150	-0.000183
	(-2.01)	(-1.47)	(-0.91)	(-2.09)	(-3.85)	(-3.60)	(-3.49)	(-1.98)	(-1.24)	(-1.33)
Sentiment	-0.000015	-0.000040	-0.000031	-0.000112	-0.000196**	-0.000216**	-0.000221**	-0.000341***	-0.000165	-0.000075
	(-0.42)	(-0.58)	(-0.42)	(-1.48)	(-2.44)	(-2.35)	(-2.19)	(-3.04)	(-1.40)	(-0.62)
Disagreement	0.000046	0.000111*	0.000076	0.000047	0.000061	0.000165*	0.000271***	0.000276**	0.000339***	0.000147
	(1.40)	(1.87)	(1.22)	(0.69)	(0.81)	(1.83)	(2.82)	(2.39)	(2.92)	(1.16)
Daily Cross-Sections	1,062	796	795	795	795	1,059	1,323	1,318	1,313	1,308
Observations	11,002	8,246	8,247	8,252	8,250	10,978	13,714	13,654	13,599	13,540

References

Ederington, L. H., Lee, J. H., 1996. The creation and resolution of market uncertainty: the impact of information releases on implied volatility. *Journal of Financial and Quantitative Analysis* 31, 513–539.

Froot, K., Lou, X., Ozik, G., Sadka, R., 2016. Investing with media indicators .

Merton, R. C., 1987. A simple model of capital market equilibrium with incomplete information. *Journal of Finance* 42, 483–510.

Miller, E. M., 1977. Risk, uncertainty, and divergence of opinion. *Journal of Finance* 32, 1151–1168.

Ozik, G., Sadka, R., 2013. Media coverage and hedge fund returns. *Financial Analysts Journal* 69, 57–75.

Rogers, J. L., Skinner, D. J., Van Buskirk, A., 2009. Earnings guidance and market uncertainty. *Journal of Accounting and Economics* 48, 90–109.

Tetlock, P. C., 2007. Giving content to investor sentiment: The role of media in the stock market. *Journal of Finance* 62, 1139–1168.