The Role of Social Media in the Corporate Bond Market: Evidence from Twitter

Online Appendix

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TABLE OA1
Twitter Opinion, Bond Returns and Changes in CDS Spreads around Earnings Announcements – Alternative *OPI* Measure

$$BONDRET_{[-2;+2]} \text{ or } \Delta CDSSPREAD_{[-2;+2]} = \alpha + \beta_1{*}OPI\_BAYES_{[-10;-3]} + \beta_2{*}FE + \beta_3{*}STOCKRET_{[-2;+2]} + \beta_4{*}STOCKRET_{[-10;-3]} + \beta_5{*}RP\_OPI_{[-10;-3]} + \beta_6{*}LEV + \beta_7{*}ROA + \beta_8{*}SIZE + \beta_9{*}MB + \beta_{10}{*}ANL + \beta_{11}{*}INST + \beta_{12}{*}Q4 + \beta_{13}{*}LOSS + \beta_{14}{*}HORIZON + \beta_{15}{*}RATING + \beta_{16}{*}SPEC + \beta_{17}{*}SUBORD + \Sigma\delta_j{*}IND_j + \Sigma\delta_f{*}CALQTR_f + \varepsilon_{[-2;+2]}$$

Variable	$BONDRET_{[-2;+2]}$			$\Delta CDSSPREAD_{[-2;+2]}$		
	All	$FE < 0$	$FE \geq 0$	All	$FE < 0$	$FE \geq 0$
	I	II	III	IV	V	VI
OPI_BAYES	**0.034*****	**0.076*****	**0.013**	**-0.204*****	**-0.440*****	**-0.091**
	(3.33)	***(3.64)***	***(1.03)***	***(-2.89)***	***(-2.65)***	***(-1.23)***
FE	0.047	0.005	0.124**	-0.424**	-0.043	-0.784**
	(1.62)	*(0.22)*	*(2.08)*	*(-2.50)*	*(-0.27)*	*(-2.19)*
$STOCKRET_{[-2;-+2]}$	0.067***	0.074***	0.060***	-0.254***	-0.298***	-0.197***
	(13.53)	*(9.79)*	*(10.52)*	*(-8.80)*	*(-5.78)*	*(-6.06)*
$STOCKRET_{[-10;-3]}$	0.016***	0.007	0.018***	-0.090***	-0.143**	-0.052
	(3.22)	*(0.78)*	*(3.35)*	*(-2.73)*	*(-2.49)*	*(-1.30)*
RP_OPI	-0.096	0.065	-0.121	-1.401**	-0.072	-1.926**
	(-0.84)	*(0.29)*	*(-1.02)*	*(-1.97)*	*(-0.05)*	*(-2.36)*
LEV	-0.421***	-0.423*	-0.388**	-1.176	1.134	-1.398
	(-2.90)	*(-1.78)*	*(-2.20)*	*(-1.09)*	*(0.55)*	*(-1.04)*
ROA	-1.644	-4.754**	-0.330	4.621	-8.438	17.997
	(-1.24)	*(-2.25)*	*(-0.18)*	*(0.40)*	*(-0.40)*	*(1.40)*
SIZE	-0.050*	-0.015	-0.040	-0.168	-0.388	-0.027
	(-1.91)	*(-0.33)*	*(-1.38)*	*(-0.75)*	*(-0.87)*	*(-0.11)*
MB	0.001	-0.002	0.003	-0.048	-0.047	-0.065
	(0.27)	*(-0.20)*	*(0.47)*	*(-1.28)*	*(-0.53)*	*(-1.43)*
ANL	0.046	0.016	0.099	0.366	0.454	0.018
	(0.90)	*(0.15)*	*(1.70)*	*(1.00)*	*(0.65)*	*(0.04)*
INST	-0.129	-0.370	0.070	-0.600	-3.974	0.610
	(-1.16)	*(-1.83)*	*(0.53)*	*(-0.47)*	*(-1.63)*	*(0.55)*
Q4	0.018	0.184	-0.012	0.280	-0.805	0.629
	(0.28)	*(1.23)*	*(-0.17)*	*(0.69)*	*(-0.93)*	*(1.24)*
LOSS	0.109*	0.067	0.085	-0.875*	-0.194	-0.723
	(1.65)	*(0.61)*	*(1.03)*	*(-1.81)*	*(-0.20)*	*(-1.30)*
HORIZON	0.001	0.001	0.001	-0.001	-0.001	0.001
	(0.85)	*(0.52)*	*(0.72)*	*(-0.10)*	*(-1.38)*	*(1.00)*
RATING	0.002	-0.035**	0.019	-0.003	0.093	-0.068
	(0.15)	*(-2.20)*	*(1.54)*	*(-0.04)*	*(0.54)*	*(-0.78)*
SPEC	-0.150*	-0.064	-0.168*	0.694	-0.901	1.337**
	(-1.91)	*(-0.44)*	*(-1.87)*	*(1.29)*	*(-0.88)*	*(2.17)*
SUBORD	0.138**	0.147	0.106	-0.882**	-0.989	-1.042**
	(1.97)	*(1.11)*	*(1.26)*	*(-2.16)*	*(-0.96)*	*(-2.23)*
N	6,862	2,008	4,854	3,500	907	2,593
Adj. R^2 (%)	11.38	17.12	10.15	8.98	18.13	7.79

This table presents the regression results using standard errors clustered by firm. The sample consists of 7,356 firm-quarter observations (1,037 distinct firms), with earnings announcement dates between January 1, 2009 and December 31, 2012. Industry and calendar quarter fixed effects are included but not reported for brevity. Models II and V (Models III and VI) present results for the bad (good) earnings news subsample, which consists of 2,021 (4,946) firm-quarter observations, covering 696 (906) distinct firms, with earnings announcement dates between January 1, 2009 and December 31, 2012, and $FE < 0$ ($FE \geq 0$). For the variables of interest, coefficient estimates and *t*-statistics are bolded. ***, **, * represent statistical significance at $p < 0.01$, $p < 0.05$, and $p < 0.10$ (two-tailed), respectively. See Appendix A of the paper for variable definitions. To mitigate the influence of outliers, all continuous variables are winsorized at the 1st and 99th percentiles.

TABLE OA2
Twitter Opinion and Future Changes in Bond Yield Spreads – Alternative *OPI* Measure

$$\Delta YIELD_{[q\text{-}1;q+k]} = \alpha + \beta_1{*}OPI\_BAYES_{[-10;-3]} + \beta_2{*}FE + \beta_3{*}STOCKRET_{[-2;+2]} + \beta_4{*}STOCKRET_{[-10;-3]}$$
$$+ \beta_5{*}RP\_OPI_{[-10;-3]} + \beta_6{*}LEV + \beta_7{*}ROA + \beta_8{*}SIZE + \beta_9{*}MB + \beta_{10}{*}HORIZON$$
$$+ \beta_{11}{*}RATING + \beta_{12}{*}SPEC + \beta_{13}{*}SUBORD + \Sigma\delta_j{*}IND_j + \Sigma\delta_f{*}CALQTR_f + \varepsilon_{[q\text{-}1;q+k]}$$

Variable	$\Delta YIELD$	
	[q-1;q+1]	[q-1;q+3]
	I	II
OPI_BAYES	**-0.174*****	**-0.273*****
	(-6.40)	***(-7.17)***
FE	-0.209***	-0.022
	(-2.59)	*(-0.22)*
$STOCKRET_{[-2;-+2]}$	-0.005	0.004
	(-0.52)	*(0.35)*
$STOCKRET_{[-10;-3]}$	0.015	-0.029*
	(1.28)	*(-1.87)*
RP_OPI	0.214	0.134
	(0.92)	*(0.42)*
LEV	-1.149***	-1.521**
	(-2.67)	*(-2.29)*
ROA	5.514	9.027*
	(1.20)	*(1.81)*
SIZE	0.273***	0.446***
	(3.69)	*(3.81)*
MB	0.035*	0.081*
	(1.68)	*(1.69)*
HORIZON	-0.001	0.001
	(-0.09)	*(0.15)*
RATING	0.168***	0.307***
	(3.82)	*(4.19)*
SPEC	-0.364	-0.562
	(-1.49)	*(-1.36)*
SUBORD	0.070	-0.080
	(0.38)	*(-0.30)*
N	5,402	5,228
Adj. R^2 (%)	4.65	8.06

This table presents the regression results using standard errors clustered by firm. The sample consists of 7,356 firm-quarter observations (1,037 distinct firms), with earnings announcement dates between January 1, 2009 and December 31, 2012. Industry and calendar quarter fixed effects are included but not reported for brevity. *t*-statistics are in parentheses below coefficient estimates. For the variables of interest, coefficient estimates and *t*-statistics are bolded. ***,**,* represent statistical significance at $p < 0.01$, $p < 0.05$, and $p < 0.10$ (two-tailed), respectively. See Appendix A of the paper for variable definitions. To mitigate the influence of outliers, all continuous variables are winsorized at the 1st and 99th percentiles.

TABLE OA3
Twitter Opinion and Future Changes in Credit Ratings – Alternative *OPI* Measure

$$\log\left(\frac{\Pr(\Delta RATING_{[-2;+t]} = -1, 1)}{\Pr(\Delta RATING_{[-2;+t]} = 0)}\right) = \alpha + \beta_1 * OPI\_BAYES_{[-10;-3]} + \beta_2 * FE + \beta_3 * STOCKRET_{[-2;+2]}$$
$$+ \beta_4 * STOCKRET_{[-10;-3]} + \beta_5 * RP\_OPI_{[-10;-3]} + \beta_6 * LEV + \beta_7 * ROA + \beta_8 * SIZE + \beta_9 * MB$$
$$+ \beta_{10} * HORIZON + \beta_{11} * RATING + \beta_{12} * SPEC + \beta_{13} * SUBORD + \Sigma\delta_j * IND_j + \Sigma\delta_f * CALQTR_f + \varepsilon_{[-2;+t]}$$

Variable	[-2;+65]		[-2;+190]	
	DOWN GRADE	*UP GRADE*	*DOWN GRADE*	*UP GRADE*
	I	II	III	IV
OPI_BAYES	**-0.109*****	**-0.027**	**-0.086****	**-0.013**
	(-2.59)	***(-0.69)***	***(-2.31)***	***(-0.37)***
FE	-0.135***	0.035	-0.142***	0.101**
	(-2.87)	*(0.64)*	*(-3.32)*	*(2.49)*
$STOCKRET_{[-2;-+2]}$	-0.027***	0.005	-0.021***	0.011**
	(-2.89)	*(0.58)*	*(-3.18)*	*(2.05)*
$STOCKRET_{[-10;-3]}$	-0.009	-0.001	-0.013	-0.001
	(-0.77)	*(-0.13)*	*(-1.60)*	*(-0.13)*
RP_OPI	-1.141***	-0.051	-0.613**	-0.091
	(-3.48)	*(-0.14)*	*(-2.28)*	*(-0.34)*
LEV	1.540***	-0.063	2.011***	-0.167
	(3.27)	*(-0.13)*	*(4.14)*	*(-0.43)*
ROA	-13.362***	11.883**	-14.126***	8.798***
	(-4.55)	*(2.35)*	*(-4.90)*	*(2.76)*
SIZE	-0.480***	0.033	-0.520***	-0.019
	(-5.92)	*(0.50)*	*(-6.42)*	*(-0.30)*
MB	-0.054	0.021	-0.015	0.016
	(-1.49)	*(1.16)*	*(-0.62)*	*(1.06)*
HORIZON	-0.001**	-0.001**	-0.001***	-0.001***
	(-1.99)	*(-1.98)*	*(-2.63)*	*(-2.85)*
RATING	-0.279***	-0.028	-0.334***	-0.044**
	(-8.49)	*(-1.36)*	*(-10.06)*	*(-2.22)*
SPEC	0.963***	1.491***	1.181***	1.361***
	(3.33)	*(6.18)*	*(4.34)*	*(6.42)*
SUBORD	0.482**	0.070	0.533***	0.199
	(2.55)	*(0.37)*	*(2.89)*	*(1.14)*
N	6,862		6,862	
N *DOWNGRADE*=1	321		699	
N *UPGRADE*=1	274		707	
Pseudo R^2 (%)	12.43		12.75	

This table presents the multinomial logit regression results using standard errors clustered by firm. The sample consists of 7,356 firm-quarter observations (1,037 distinct firms), with earnings announcement dates between January 1, 2009 and December 31, 2012. Industry and calendar quarter fixed effects are included but not reported for brevity. *z*-statistics are in parentheses below coefficient estimates. For the variables of interest, coefficient estimates and *z*-statistics are bolded. ***, **, * represent statistical significance at $p < 0.01$, $p < 0.05$, and $p < 0.10$ (two-tailed), respectively. See Appendix A of the paper for variable definitions. To mitigate the influence of outliers, all continuous variables are winsorized at the 1st and 99th percentiles.

TABLE OA4
Twitter Opinion and Future Changes in Implied Default Probability – Alternative *OPI* Measure

$$\Delta PROB_{[q\text{-}1;q+k]} = \alpha + \beta_1{*}OPI\_BAYES_{[-10;-3]} + \beta_2{*}FE + \beta_3{*}STOCKRET_{[-2;+2]} + \beta_4{*}STOCKRET_{[-10;-3]} + \beta_5{*}RP\_OPI_{[-10;-3]} + \beta_6{*}LEV + \beta_7{*}ROA + \beta_8{*}SIZE + \beta_9{*}MB + \beta_{10}{*}HORIZON + \beta_{11}{*}RATING + \beta_{12}{*}SPEC + \beta_{13}{*}SUBORD + \Sigma\delta_j{*}IND_j + \Sigma\delta_f{*}CALQTR_f + \varepsilon_{[q\text{-}1;q+k]}$$

Variable	*ΔZ-PROB*		*ΔO-PROB*		*ΔBSM-PROB*	
	[*q*-1;*q*+1]	[*q*-1;*q*+3]	[*q*-1;*q*+1]	[*q*-1;*q*+3]	[*q*-1;*q*+1]	[*q*-1;*q*+3]
	I	II	III	IV	V	VI
OPI_BAYES	**-0.410*****	**-0.659*****	**-0.167*****	**-0.214*****	**-1.405*****	**-2.265*****
	(-7.99)	***(-8.82)***	***(-5.15)***	***(-5.36)***	***(-13.22)***	***(-13.80)***
FE	-0.413***	-0.246	-0.147	-0.045	-1.435***	-0.391
	(-2.89)	*(-1.59)*	*(-0.98)*	*(-0.30)*	*(-3.84)*	*(-0.79)*
$STOCKRET_{[-2;-+2]}$	-0.103***	-0.106***	-0.042***	-0.035***	-0.140***	-0.162***
	(-5.76)	*(-5.48)*	*(-3.12)*	*(-2.60)*	*(-3.59)*	*(-3.45)*
$STOCKRET_{[-10;-3]}$	-0.059**	-0.075***	0.007	-0.022	-0.083*	-0.136**
	(-2.41)	*(-2.81)*	*(0.38)*	*(-1.11)*	*(-1.77)*	*(-2.31)*
RP_OPI	-0.548	0.462	-0.163	0.017	0.174	4.106***
	(-0.92)	*(0.67)*	*(-0.40)*	*(0.04)*	*(0.18)*	*(3.18)*
LEV	-1.920**	-3.061***	-0.954	-0.567	-4.356***	-7.825***
	(-2.54)	*(-2.97)*	*(-1.25)*	*(-0.84)*	*(-2.85)*	*(-3.52)*
ROA	-27.153***	-4.899	-5.968	1.957	23.769*	64.350***
	(-3.01)	*(-0.38)*	*(-0.97)*	*(0.34)*	*(1.74)*	*(3.26)*
SIZE	0.150	0.065	0.033	0.098	0.463**	1.576***
	(1.45)	*(0.45)*	*(0.36)*	*(1.12)*	*(2.31)*	*(5.43)*
MB	-0.053	-0.012	-0.084**	-0.100***	0.005	0.159
	(-1.29)	*(-0.24)*	*(-2.19)*	*(-2.82)*	*(0.07)*	*(1.61)*
HORIZON	-0.001	-0.001	-0.001	-0.001**	0.001	0.001
	(-0.29)	*(-0.28)*	*(-0.79)*	*(-2.35)*	*(0.27)*	*(0.19)*
RATING	0.047	0.085	0.014	0.045*	0.094	0.372***
	(1.13)	*(1.32)*	*(0.51)*	*(1.67)*	*(1.33)*	*(3.54)*
SPEC	0.058	0.142	0.095	-0.021	-0.757	-0.313
	(0.18)	*(0.32)*	*(0.53)*	*(-0.12)*	*(-1.26)*	*(-0.32)*
SUBORD	-0.181	-0.192	-0.068	-0.188	-1.018*	-1.443
	(-0.59)	*(-0.41)*	*(-0.33)*	*(-0.72)*	*(-1.82)*	*(-1.53)*
N	6,227	6,107	5,368	5,276	6,755	6,749
Adj. R^2 (%)	6.40	7.48	3.40	2.98	8.48	10.95

This table presents the regression results using standard errors clustered by firm. Changes in implied default probability (in %) are estimated based on changes in Z-Score (*Z-PROB*), O-Score (*O-PROB*), and the Black-Scholes-Merton model (*BSM-PROB*) between quarter *q*-1 and either quarter *q*+1 or quarter *q*+3, where quarter *q* is the quarter during which *OPI* is measured. The sample consists of 7,356 firm-quarter observations (1,037 distinct firms), with quarterly earnings announcement dates between January 1, 2009 and December 31, 2012. Industry and calendar quarter fixed effects are included but not reported for brevity. *t*-statistics are in parentheses below coefficient estimates. For the variables of interest, coefficient estimates and *t*-statistics are bolded. ***,**,* represent statistical significance at $p < 0.01$, $p < 0.05$, and $p < 0.10$ (two-tailed), respectively. See Appendix A of the paper for variable definitions. To mitigate the influence of outliers, all continuous variables are winsorized at the 1st and 99th percentiles.

TABLE OA5
Twitter Opinion, Bond Returns and Changes in CDS Spreads around Earnings Announcements – Original and Dissemination Tweets

$$BONDRET_{[-2;+2]} \text{ or } \Delta CDSSPREAD_{[-2;+2]} = \alpha + \beta_1 * OPI_{[-10;-3]} + \beta_2 * FE + \beta_3 * STOCKRET_{[-2;+2]} + \beta_4 * STOCKRET_{[-10;-3]} + \beta_5 * RP\_OPI_{[-10;-3]} + \beta_6 * LEV + \beta_7 * ROA + \beta_8 * SIZE + \beta_9 * MB + \beta_{10} * ANL + \beta_{11} * INST + \beta_{12} * Q4 + \beta_{13} * LOSS + \beta_{14} * HORIZON + \beta_{15} * RATING + \beta_{16} * SPEC + \beta_{17} * SUBORD + \Sigma\delta_j * IND_j + \Sigma\delta_f * CALQTR_f + \varepsilon_{[-2;+2]}$$

Variable	$BONDRET_{[-2;+2]}$		$\Delta CDSSPREAD_{[-2;+2]}$	
	ORIG	*DISSEM*	*ORIG*	*DISSEM*
	I	II	III	IV
OPI	**0.053****	**0.037****	**-0.257***	**-0.348*****
	(2.53)	***(2.24)***	***(-1.86)***	***(-2.99)***
FE	0.035	0.075**	-0.239*	-0.374*
	(1.30)	*(2.40)*	*(-1.72)*	*(-1.90)*
$STOCKRET_{[-2;-+2]}$	0.065***	0.067***	-0.272***	-0.260***
	(10.86)	*(12.96)*	*(-8.58)*	*(-8.70)*
$STOCKRET_{[-10;-3]}$	0.012**	0.016***	-0.091**	-0.082**
	(2.22)	*(3.41)*	*(-2.50)*	*(-2.36)*
RP_OPI	-0.025	-0.068	-2.045**	-1.298*
	(-0.18)	*(-0.62)*	*(-2.41)*	*(-1.81)*
LEV	-0.327*	-0.474***	-0.750	-1.490
	(-1.84)	*(-3.25)*	*(-0.58)*	*(-1.46)*
ROA	-1.070	-1.496	6.792	-3.434
	(-0.74)	*(-1.00)*	*(0.51)*	*(-0.34)*
SIZE	-0.061*	-0.029	-0.071	-0.375*
	(-1.83)	*(-1.14)*	*(-0.28)*	*(-1.68)*
MB	0.000	0.005	-0.060	-0.057
	(-0.03)	*(0.94)*	*(-1.28)*	*(-1.49)*
ANL	-0.027	0.047	1.023**	0.538
	(-0.40)	*(0.93)*	*(2.51)*	*(1.48)*
INST	-0.211	-0.083	0.586	-0.723
	(-1.49)	*(-0.74)*	*(0.39)*	*(-0.55)*
Q4	0.062	0.039	0.087	0.351
	(0.82)	*(0.58)*	*(0.16)*	*(0.88)*
LOSS	0.218***	0.081	-0.551	-0.616
	(2.70)	*(1.16)*	*(-1.01)*	*(-1.18)*
HORIZON	0.001	0.001	0.001	-0.001
	(0.33)	*(0.12)*	*(0.05)*	*(-0.21)*
RATING	-0.007	0.008	0.050	-0.060
	(-0.53)	*(0.73)*	*(0.63)*	*(-0.74)*
SPEC	-0.176	-0.195**	0.789	0.825
	(-1.79)	*(-2.44)*	*(1.32)*	*(1.56)*
SUBORD	0.213**	0.151**	-1.530***	-0.830**
	(2.33)	*(2.10)*	*(-2.94)*	*(-2.09)*
N	4,550	6,402	2,467	3,273
Adj. R^2 (%)	11.57	11.91	10.66	8.88

This table presents the regression results using standard errors clustered by firm. The sample consists of 7,356 firm-quarter observations (1,037 distinct firms), with earnings announcement dates between January 1, 2009 and December 31, 2012. Industry and calendar quarter fixed effects are included but not reported for brevity. Models I and III (Models II and IV) present results for original (dissemination) tweets. *t*-statistics are in parentheses below coefficient estimates. For the variables of interest, coefficient estimates and *t*-statistics are bolded. ***,**,* represent statistical significance at $p < 0.01$, $p < 0.05$, and $p < 0.10$ (two-tailed), respectively. See Appendix A of the paper for variable definitions. To mitigate the influence of outliers, all continuous variables are winsorized at the 1st and 99th percentiles.

TABLE OA6
Twitter Opinion and Future Changes in Bond Yield Spreads – Original and Dissemination Tweets

$$\Delta YIELD_{[q-1;q+1]} = \alpha + \beta_1 {*} OPI_{[-10;-3]} + \beta_2 {*} FE + \beta_3 {*} STOCKRET_{[-2;+2]} + \beta_4 {*} STOCKRET_{[-10;-3]} + \beta_5 {*} RP\_OPI_{[-10;-3]} + \beta_6 {*} LEV + \beta_7 {*} ROA + \beta_8 {*} SIZE + \beta_9 {*} MB + \beta_{10} {*} HORIZON + \beta_{11} {*} RATING + \beta_{12} {*} SPEC + \beta_{13} {*} SUBORD + \Sigma\delta_j {*} IND_j + \Sigma\delta_f {*} CALQTR_f + \varepsilon_{[q-1;q+1]}$$

Variable	$\Delta YIELD_{[q-1;q+1]}$	
	ORIG	*DISSEM*
	I	II
OPI	**-0.181*****	**-0.118*****
	(-3.09)	***(-2.58)***
FE	-0.180**	-0.244***
	(-2.15)	*(-3.17)*
$STOCKRET_{[-2;-+2]}$	-0.015	0.006
	(-1.34)	*(0.69)*
$STOCKRET_{[-10;-3]}$	0.017	0.019
	(1.26)	*(1.64)*
RP_OPI	0.230	0.274
	(0.78)	*(1.29)*
LEV	-1.300**	-1.164***
	(-2.45)	*(-2.90)*
ROA	3.562	8.623*
	(0.69)	*(1.94)*
SIZE	0.339***	0.214***
	(3.81)	*(2.88)*
MB	0.037	0.035*
	(1.43)	*(1.70)*
HORIZON	-0.001	-0.001
	(-0.16)	*(-0.15)*
RATING	0.165***	0.166***
	(3.24)	*(3.72)*
SPEC	-0.177	-0.261
	(-0.58)	*(-1.10)*
SUBORD	0.137	-0.026
	(0.57)	*(-0.14)*
N	3,724	5,068
Adj. R^2 (%)	4.80	4.70

This table presents the regression results using standard errors clustered by firm. The sample consists of 7,356 firm-quarter observations (1,037 distinct firms), with earnings announcement dates between January 1, 2009 and December 31, 2012. Industry and calendar quarter fixed effects are included but not reported for brevity. Models I (Model II) presents results for original (dissemination) tweets. *t*-statistics are in parentheses below coefficient estimates. For the variables of interest, coefficient estimates and *t*-statistics are bolded. ***, **, * represent statistical significance at $p < 0.01$, $p < 0.05$, and $p < 0.10$ (two-tailed), respectively. See Appendix A of the paper for variable definitions. To mitigate the influence of outliers, all continuous variables are winsorized at the 1st and 99th percentiles.

TABLE OA7
Twitter Opinion and Future Changes in Credit Ratings – Original and Dissemination Tweets

$$\log\left(\frac{\Pr(\Delta RATING_{[-2;+65]} = -1, 1)}{\Pr(\Delta RATING_{[-2;+65]} = 0)}\right) = \alpha + \beta_1 {*} OPI_{[-10;-3]} + \beta_2 {*} FE + \beta_3 {*} STOCKRET_{[-2;+2]} + \beta_4 {*} STOCKRET_{[-10;-3]}$$

$$+ \beta_5 {*} RP\_OPI_{[-10;-3]} + \beta_6 {*} LEV + \beta_7 {*} ROA + \beta_8 {*} SIZE + \beta_9 {*} MB + \beta_{10} {*} HORIZON$$

$$+ \beta_{11} {*} RATING + \beta_{12} {*} SPEC + \beta_{13} {*} SUBORD + \Sigma\delta_j {*} IND_j + \Sigma\delta_f {*} CALQTR_f + \varepsilon_{[-2;+65]}$$

Variable	*ORIG*		*DISSEM*	
	DOWN GRADE	*UP GRADE*	*DOWN GRADE*	*UP GRADE*
	I	II	III	IV
OPI	**-0.278*****	**-0.096**	**-0.262*****	**-0.050**
	(-3.90)	***(-1.15)***	***(-3.95)***	***(-0.75)***
FE	-0.097***	0.028	-0.166***	0.048
	(-2.98)	*(0.49)*	*(-2.91)*	*(0.76)*
$STOCKRET_{[-2;-+2]}$	-0.028**	-0.001	-0.029***	0.005
	(-2.57)	*(-0.08)*	*(-2.84)*	*(0.60)*
$STOCKRET_{[-10;-3]}$	0.002	0.005	-0.003	0.002
	(0.16)	*(0.42)*	*(-0.21)*	*(0.20)*
RP_OPI	-0.998***	0.286	-0.862***	0.025
	(-2.71)	*(0.69)*	*(-2.60)*	*(0.07)*
LEV	1.665***	0.097	1.514***	-0.043
	(3.23)	*(0.19)*	*(3.12)*	*(-0.09)*
ROA	-8.750***	9.503*	-17.663***	8.954*
	(-2.78)	*(1.69)*	*(-5.37)*	*(1.84)*
SIZE	-0.566***	0.020	-0.449***	0.052
	(-6.73)	*(0.25)*	*(-5.54)*	*(0.78)*
MB	-0.056	0.016	-0.046	0.022
	(-1.43)	*(0.80)*	*(-1.39)*	*(1.25)*
HORIZON	-0.001**	-0.001**	-0.001	-0.001*
	(-1.98)	*(-2.11)*	*(-1.59)*	*(-1.94)*
RATING	-0.286***	-0.033	-0.282***	-0.026
	(-7.39)	*(-1.29)*	*(-8.31)*	*(-1.19)*
SPEC	1.000***	1.404***	1.070***	1.520***
	(3.41)	*(4.42)*	*(3.54)*	*(6.23)*
SUBORD	0.556**	0.164	0.606***	0.077
	(2.46)	*(0.76)*	*(3.07)*	*(0.39)*
N	4,550		6,402	
N *DOWNGRADE*=1	245		281	
N *UPGRADE*=1	181		260	
Pseudo R^2 (%)	14.57		12.60	

This table presents the multinomial logit regression results using standard errors clustered by firm. The sample consists of 7,356 firm-quarter observations (1,037 distinct firms), with earnings announcement dates between January 1, 2009 and December 31, 2012. Industry and calendar quarter fixed effects are included but not reported for brevity. Models I and III (Models II and IV) present results for original (dissemination) tweets. *z*-statistics are in parentheses below coefficient estimates. For the variables of interest, coefficient estimates and *z*-statistics are bolded. ***, **, * represent statistical significance at $p < 0.01$, $p < 0.05$, and $p < 0.10$ (two-tailed), respectively. See Appendix A of the paper for variable definitions. To mitigate the influence of outliers, all continuous variables are winsorized at the 1st and 99th percentiles.

TABLE OA8
Twitter Opinion and Future Changes in Implied Default Probability – Original and Dissemination Tweets

$$\Delta PROB_{[q\text{-}1;q+1]} = \alpha + \beta_1{*}OPI_{[-10;-3]} + \beta_2{*}FE + \beta_3{*}STOCKRET_{[-2;+2]} + \beta_4{*}STOCKRET_{[-10;-3]} + \beta_5{*}RP\_OPI_{[-10;-3]} + \beta_6{*}LEV + \beta_7{*}ROA + \beta_8{*}SIZE + \beta_9{*}MB + \beta_{10}{*}HORIZON + \beta_{11}{*}RATING + \beta_{12}{*}SPEC + \beta_{13}{*}SUBORD + \Sigma\delta_j{*}IND_j + \Sigma\delta_f{*}CALQTR_f + \varepsilon_{[q\text{-}1;q+1]}$$

Variable	*ΔZ-PROB*		*ΔO-PROB*		*ΔBSM-PROB*	
	ORIG	*DISSEM*	*ORIG*	*DISSEM*	*ORIG*	*DISSEM*
	I	II	III	IV	V	VI
OPI	**-0.576*****	**-0.507*****	**-0.269*****	**-0.126*****	**-2.053*****	**-1.603*****
	(-5.10)	***(-5.89)***	***(-3.09)***	***(-2.04)***	***(-9.45)***	***(-8.70)***
FE	-0.268*	-0.440***	-0.059	-0.181	-1.296***	-1.503***
	(-1.81)	*(-2.86)*	*(-0.33)*	*(-1.07)*	*(-4.19)*	*(-3.66)*
$STOCKRET_{[-2;-+2]}$	-0.109***	-0.086***	-0.037*	-0.036**	-0.163***	-0.121***
	(-4.57)	*(-4.61)*	*(-1.92)*	*(-2.54)*	*(-3.08)*	*(-3.30)*
$STOCKRET_{[-10;-3]}$	-0.069**	-0.037	0.010	0.020	-0.071	-0.026
	(-2.29)	*(-1.49)*	*(0.39)*	*(1.07)*	*(-1.29)*	*(-0.56)*
RP_OPI	0.004	-0.687	-0.006	-0.282	-0.318	0.803
	(0.01)	*(-1.11)*	*(-0.01)*	*(-0.67)*	*(-0.27)*	*(0.86)*
LEV	-2.393**	-1.648**	-1.291	-0.629	-4.525**	-4.072***
	(-2.21)	*(-2.32)*	*(-1.10)*	*(-0.80)*	*(-2.40)*	*(-2.76)*
ROA	-38.492***	-24.499***	-9.084	-4.173	12.825	23.080*
	(-3.66)	*(-2.70)*	*(-1.20)*	*(-0.68)*	*(0.80)*	*(1.73)*
SIZE	0.376**	-0.049	0.226	-0.074	0.517*	0.139
	(2.47)	*(-0.47)*	*(1.50)*	*(-0.77)*	*(1.77)*	*(0.69)*
MB	-0.055	-0.051	-0.110**	-0.084**	-0.041	-0.003
	(-0.98)	*(-1.29)*	*(-2.00)*	*(-2.17)*	*(-0.40)*	*(-0.04)*
HORIZON	0.001	-0.001	0.001	-0.001	0.001	0.001
	(0.89)	*(-0.04)*	*(0.28)*	*(-1.19)*	*(0.08)*	*(1.58)*
RATING	0.068	0.027	0.018	0.006	0.143	0.081
	(1.18)	*(0.65)*	*(0.43)*	*(0.23)*	*(1.52)*	*(1.18)*
SPEC	0.161	0.165	0.325	0.048	-1.574	-0.290
	(0.36)	*(0.54)*	*(1.14)*	*(0.27)*	*(-1.95)*	*(-0.53)*
SUBORD	-0.426	-0.167	-0.106	-0.017	-1.144	-1.054*
	(-0.97)	*(-0.58)*	*(-0.32)*	*(-0.09)*	*(-1.50)*	*(-1.88)*
N	4,135	5,806	3,636	4,997	4,483	6,301
Adj. R^2 (%)	6.77	5.69	3.34	2.98	8.80	6.91

This table presents the regression results using standard errors clustered by firm. Changes in implied default probability (in %) are estimated based on changes in Z-Score (*Z-PROB*), O-Score (*O-PROB*), and the Black-Scholes-Merton model (*BSM-PROB*) between quarter *q*-1 and quarter *q*+1, where quarter *q* is the quarter during which *OPI* is measured. The sample consists of 7,356 firm-quarter observations (1,037 distinct firms), with quarterly earnings announcement dates between January 1, 2009 and December 31, 2012. Industry and calendar quarter fixed effects are included but not reported for brevity. Models I, III, and V (Models II, IV, and VI) present results for original (dissemination) tweets. *t*-statistics are in parentheses below coefficient estimates. For the variables of interest, coefficient estimates and *t*-statistics are bolded. ***,**,* represent statistical significance at $p < 0.01$, $p < 0.05$, and $p < 0.10$ (two-tailed), respectively. See Appendix A of the paper for variable definitions. To mitigate the influence of outliers, all continuous variables are winsorized at the 1st and 99th percentiles.

TABLE OA9
Twitter Opinion, Bond Returns and Changes in CDS Spreads around Earnings Announcements – by Twitter Activity

$$BONDRET_{[-2;+2]} \text{ or } \Delta CDSSPREAD_{[-2;+2]} = \alpha + \beta_1{*}OPI_{[-10;-3]} + \beta_2{*}FE + \beta_3{*}STOCKRET_{[-2;+2]} + \beta_4{*}STOCKRET_{[-10;-3]} + \beta_5{*}RP\_OPI_{[-10;-3]} + \beta_6{*}LEV + \beta_7{*}ROA + \beta_8{*}SIZE + \beta_9{*}MB + \beta_{10}{*}ANL + \beta_{11}{*}INST + \beta_{12}{*}Q4 + \beta_{13}{*}LOSS + \beta_{14}{*}HORIZON + \beta_{15}{*}RATING + \beta_{16}{*}SPEC + \beta_{17}{*}SUBORD + \Sigma\delta_j{*}IND_j + \Sigma\delta_f{*}CALQTR_f + \varepsilon_{[-2;+2]}$$

Variable	$BONDRET_{[-2;+2]}$			$\Delta CDSSPREAD_{[-2;+2]}$		
	High Activity	*Low Activity*	*Diff*	*High Activity*	*Low Activity*	*Diff*
	I	II		III	IV	
OPI	**0.068*****	**0.042**	**0.026**	**-0.536*****	**-0.473****	**-0.064**
	(2.99)	***(1.41)***	***(0.70)***	***(-3.54)***	***(-2.28)***	***(-0.25)***
N	3,452	3,410		2,089	1,411	
Adj. R^2 (%)	15.16	10.27		10.66	10.29	

This table presents the regression results using standard errors clustered by firm. The sample consists of 7,356 firm-quarter observations (1,037 distinct firms), with earnings announcement dates between January 1, 2009 and December 31, 2012. Industry and calendar quarter fixed effects as well as control variables are included but not reported for brevity. Models I and III (Models II and IV) present results for high (low) Twitter activity. The high (low) Twitter activity subsample consists of 3,685 (3,671) firm-quarter observations, covering 685 (928) distinct firms, with earnings announcement dates between January 1, 2009 and December 31, 2012, and observations above (below) sample median number of tweets for each calendar quarter. *t*-statistics are in parentheses below coefficient estimates. For the variables of interest, coefficient estimates and *t*-statistics are bolded. ***,**,* represent statistical significance at $p < 0.01$, $p < 0.05$, and $p < 0.10$ (two-tailed), respectively. See Appendix A of the paper for variable definitions. To mitigate the influence of outliers, all continuous variables are winsorized at the 1st and 99th percentiles.

TABLE OA10
Twitter Opinion and Future Changes in Bond Yield Spreads – by Twitter Activity

$$\Delta YIELD_{[q-1;q+1]} = \alpha + \beta_1{*}OPI_{[-10;-3]} + \beta_2{*}FE + \beta_3{*}STOCKRET_{[-2;+2]} + \beta_4{*}STOCKRET_{[-10;-3]} + \beta_5{*}RP\_OPI_{[-10;-3]} + \beta_6{*}LEV + \beta_7{*}ROA + \beta_8{*}SIZE + \beta_9{*}MB + \beta_{10}{*}HORIZON + \beta_{11}{*}RATING + \beta_{12}{*}SPEC + \beta_{13}{*}SUBORD + \Sigma\delta_j{*}IND_j + \Sigma\delta_f{*}CALQTR_f + \varepsilon_{[q-1;q+1]}$$

Variable	$\Delta YIELD_{[q-1;q+1]}$		
	High Activity	*Low Activity*	*Diff*
	I	II	
OPI	**-0.261*****	**-0.115**	**-0.146**
	(-4.32)	***(-1.04)***	***(-1.16)***
N	2,985	2,417	
Adj. R^2 (%)	6.04	7.17	

This table presents the regression results using standard errors clustered by firm. The sample consists of 7,356 firm-quarter observations (1,037 distinct firms), with earnings announcement dates between January 1, 2009 and December 31, 2012. Industry and calendar quarter fixed effects as well as control variables are included but not reported for brevity. Models I (Model II) presents results for high (low) Twitter activity. The high (low) Twitter activity subsample consists of 3,685 (3,671) firm-quarter observations, covering 685 (928) distinct firms, with earnings announcement dates between January 1, 2009 and December 31, 2012, and observations above (below) sample median number of tweets for each calendar quarter. *t*-statistics are in parentheses below coefficient estimates. For the variables of interest, coefficient estimates and *t*-statistics are bolded. ***,**,* represent statistical significance at $p < 0.01$, $p < 0.05$, and $p < 0.10$ (two-tailed), respectively. See Appendix A of the paper for variable definitions. To mitigate the influence of outliers, all continuous variables are winsorized at the 1st and 99th percentiles.

TABLE OA11
Twitter Opinion and Future Changes in Credit Ratings – by Twitter Activity

$$\log\left(\frac{\Pr(\Delta RATING_{[-2;+65]} = -1, 1)}{\Pr(\Delta RATING_{[-2;+65]} = 0)}\right) = \alpha + \beta_1 * OPI_{[-10;-3]} + \beta_2 * FE + \beta_3 * STOCKRET_{[-2;+2]} + \beta_4 * STOCKRET_{[-10;-3]}$$
$$+ \beta_5 * RP\_OPI_{[-10;-3]} + \beta_6 * LEV + \beta_7 * ROA + \beta_8 * SIZE + \beta_9 * MB + \beta_{10} * HORIZON$$
$$+ \beta_{11} * RATING + \beta_{12} * SPEC + \beta_{13} * SUBORD + \Sigma\delta_j * IND_j + \Sigma\delta_f * CALQTR_f + \varepsilon_{[-2;+65]}$$

Variable	*DOWNGRADE*$_{[-2;+65]}$			*UPGRADE*$_{[-2;+65]}$		
	High Activity	*Low Activity*	*Diff*	*High Activity*	*Low Activity*	*Diff*
	I	II		III	IV	
OPI	**-0.250***** ***(-3.46)***	**-0.038** ***(-0.34)***	**-0.212** ***(-1.61)***	**-0.080** ***(-0.78)***	**-0.061** ***(-0.61)***	**-0.020** ***(-0.14)***
N	3,452	3,410		3,452	3,410	
N *DOWNGRADE=1*	178	143		178	143	
N *UPGRADE*=1	124	150		124	150	
Pseudo R^2 (%)	11.08	18.55		9.72	10.56	

This table presents the separate logit regression results using standard errors clustered by firm. The sample consists of 7,356 firm-quarter observations (1,037 distinct firms), with earnings announcement dates between January 1, 2009 and December 31, 2012. Industry and calendar quarter fixed effects as well as control variables are included but not reported for brevity. Models I and III (Models II and IV) present results for high (low) Twitter activity. The high (low) Twitter activity subsample consists of 3,685 (3,671) firm-quarter observations, covering 685 (928) distinct firms, with earnings announcement dates between January 1, 2009 and December 31, 2012, and observations above (below) sample median number of tweets for each calendar quarter. *z*-statistics are in parentheses below coefficient estimates. For the variables of interest, coefficient estimates and *z*-statistics are bolded. ***,**,* represent statistical significance at $p < 0.01$, $p < 0.05$, and $p < 0.10$ (two-tailed), respectively. See Appendix A of the paper for variable definitions. To mitigate the influence of outliers, all continuous variables are winsorized at the 1st and 99th percentiles.

TABLE OA12
Twitter Opinion and Future Changes in Implied Default Probability – by Twitter Activity

$$\Delta PROB_{[q-1;q+1]} = \alpha + \beta_1 * OPI_{[-10;-3]} + \beta_2 * FE + \beta_3 * STOCKRET_{[-2;+2]} + \beta_4 * STOCKRET_{[-10;-3]}$$
$$+ \beta_5 * RP\_OPI_{[-10;-3]} + \beta_6 * LEV + \beta_7 * ROA + \beta_8 * SIZE + \beta_9 * MB + \beta_{10} * HORIZON$$
$$+ \beta_{11} * RATING + \beta_{12} * SPEC + \beta_{13} * SUBORD + \Sigma\delta_j * IND_j + \Sigma\delta_f * CALQTR_f + \varepsilon_{[q-1;q+1]}$$

Variable	*ΔZ-PROB*$_{[q-1;q+1]}$			*ΔO-PROB*$_{[q-1;q+1]}$			*ΔBSM-PROB*$_{[q-1;q+1]}$		
	High Activity	*Low Activity*	*Diff*	*High Activity*	*Low Activity*	*Diff*	*High Activity*	*Low Activity*	*Diff*
	I	II		III	IV		V	VI	
OPI	**-0.506***** ***(-4.06)***	**-0.632***** ***(-4.60)***	**0.126** ***(0.68)***	**-0.154*** ***(-1.86)***	**-0.206**** ***(-2.19)***	**0.053** ***(0.42)***	**-2.239***** ***(-8.56)***	**-1.901***** ***(-7.94)***	**-0.438** ***(-1.21)***
N	3,083	3,144		2,721	2,647		3,413	3,342	
Adj. R^2 (%)	7.30	5.97		3.38	3.84		11.45	5.87	

This table presents the regression results using standard errors clustered by firm. Changes in implied default probability (in %) are estimated based on changes in Z-Score (*Z-PROB*), O-Score (*O-PROB*), and the Black-Scholes-Merton model (*BSM-PROB*) between quarter *q*-1 and quarter *q*+1, where quarter *q* is the quarter during which *OPI* is measured. The sample consists of 7,356 firm-quarter observations (1,037 distinct firms), with quarterly earnings announcement dates between January 1, 2009 and December 31, 2012. Industry and calendar quarter fixed effects as well as control variables are included but not reported for brevity. Models I, III, and V (Models II, IV, and VI) present results for high (low) Twitter activity. The high (low) Twitter activity subsample consists of 3,685 (3,671) firm-quarter observations, covering 685 (928) distinct firms, with earnings announcement dates between January 1, 2009 and December 31, 2012, and observations above (below) sample median number of tweets for each calendar quarter. *t*-statistics are in parentheses below coefficient estimates. For the variables of interest, coefficient estimates and *t*-statistics are bolded. ***,**,* represent statistical significance at $p < 0.01$, $p < 0.05$, and $p < 0.10$ (two-tailed), respectively. See Appendix A of the paper for variable definitions. To mitigate the influence of outliers, all continuous variables are winsorized at the 1st and 99th percentiles.

TABLE OA13
Twitter Opinion and Future Changes in Bond Yield Spreads –
Sensitivity Tests with Control Variables

$$\Delta YIELD_{[q\text{-}1;q+k]} = \alpha + \beta_1 {*} OPI_{[-10;-3]} + \beta_2 {*} FE + \beta_3 {*} STOCKRET_{[-2;+2]} + \beta_4 {*} STOCKRET_{[-10;-3]} + \beta_5 {*} RP\_OPI_{[-10;-3]} + \beta_6 {*} LEV + \beta_7 {*} ROA + \beta_8 {*} SIZE + \beta_9 {*} MB + \beta_{10} {*} HORIZON + \beta_{11} {*} RATING + \beta_{12} {*} SPEC + \beta_{13} {*} SUBORD + \Sigma\delta_j {*} IND_j + \Sigma\delta_f {*} CALQTR_f + \varepsilon_{[q\text{-}1;q+k]}$$

Variable	$\Delta YIELD$			
	[q-1;q+1]		[q-1;q+3]	
	I	II	III	IV
OPI	**-0.133*****	**-0.130*****	**-0.294*****	**-0.285*****
	(-2.65)	***(-2.59)***	***(-3.92)***	***(-3.81)***
FE	-0.157*	-0.146*	-0.157	-0.163
	(-1.91)	*(-1.76)*	*(-1.48)*	*(-1.54)*
$STOCKRET_{[-2;-+2]}$	-0.015	-0.015	0.011	0.012
	(-1.53)	*(-1.50)*	*(0.94)*	*(0.98)*
$STOCKRET_{[-10;-3]}$	0.014	0.015	-0.024	-0.023
	(1.28)	*(1.30)*	*(-1.53)*	*(-1.44)*
RP_OPI	0.226	0.243	-0.157	-0.171
	(1.01)	*(1.09)*	*(-0.48)*	*(-0.52)*
LEV_q	-1.469***	-0.443	-2.574***	-1.949
	(-3.15)	*(-0.63)*	*(-3.54)*	*(-1.17)*
$\Delta LEV_{[q\text{-}k\text{-}1;q]}$	1.259		2.098	
	(1.47)		*(1.16)*	
$LEV_{q\text{-}k\text{-}1}$		-0.978		-0.503
		(-1.32)		*(-0.31)*
ROA_q	25.306***	4.216	6.772	0.381
	(4.66)	*(0.98)*	*(1.04)*	*(0.08)*
$\Delta ROA_{[q\text{-}k\text{-}1;q]}$	-21.158***		-6.774	
	(-5.20)		*(-1.64)*	
$ROA_{q\text{-}k\text{-}1}$		20.629***		8.836
		(5.06)		*(2.14)*
$SIZE_q$	0.228***	-0.770***	0.149	1.787***
	(3.04)	*(-3.23)*	*(1.31)*	*(6.36)*
$\Delta SIZE_{[q\text{-}k\text{-}1;q]}$	-0.972***		1.867***	
	(-3.62)		*(5.69)*	
$SIZE_{q\text{-}k\text{-}1}$		1.004***		-1.650***
		(4.69)		*(-6.36)*
MB_q	0.043	0.061*	0.128*	0.045
	(1.08)	*(1.73)*	*(1.69)*	*(0.83)*
$\Delta MB_{[q\text{-}k\text{-}1;q]}$	-0.020		-0.263	
	(-0.21)		*(-1.64)*	
$MB_{q\text{-}k\text{-}1}$		-0.028		0.093
		(-0.61)		*(1.34)*
HORIZON	-0.001	-0.001	0.001	0.001
	(-0.44)	*(-0.40)*	*(0.02)*	*(0.03)*
RATING	0.168	0.169***	0.229***	0.231***
	(3.76)	*(3.66)*	*(3.35)*	*(3.15)*
SPEC	-0.137	-0.149	-0.362	-0.381
	(-0.59)	*(-0.63)*	*(-0.90)*	*(-0.94)*
SUBORD	-0.079	-0.073	-0.116	-0.130
	(-0.44)	*(-0.41)*	*(-0.45)*	*(-0.51)*
N	5,034	5,034	4,853	4,853
Adj. R^2 (%)	6.31	6.09	9.56	9.30

TABLE OA13 (cont'd)

This table presents the regression results using standard errors clustered by firm. The sample consists of 7,543 firm-quarter observations (1,044 distinct firms), with earnings announcement dates between January 1, 2009 and December 31, 2012. Industry and calendar quarter fixed effects are included but not reported for brevity. *t*-statistics are in parentheses below coefficient estimates. For the variables of interest, coefficient estimates and *t*-statistics are bolded. ***, **, * represent statistical significance at $p < 0.01$, $p < 0.05$, and $p < 0.10$ (two-tailed), respectively. See Appendix A of the paper for variable definitions. To mitigate the influence of outliers, all continuous variables are winsorized at the 1st and 99th percentiles.

TABLE OA14
Twitter Opinion and Future Changes in Implied Default Probability – Sensitivity Tests with Control Variables

$$\Delta PROB_{[q\text{-}1;q+k]} = \alpha + \beta_1{*}OPI\_BONDFUNDA_{[-10;-3]} + \beta_2{*}OPI\_NONBONDFUNDA_{[-10;-3]} + \beta_3{*}FE + \beta_4{*}STOCKRET_{[-2;+2]} + \beta_5{*}STOCKRET_{[-10;-3]} + \beta_6{*}RP\_OPI_{[-10;-3]} + \beta_7{*}LEV + \beta_8{*}ROA + \beta_9{*}SIZE + \beta_{10}{*}MB + \beta_{11}{*}HORIZON + \beta_{12}{*}RATING + \beta_{13}{*}SPEC + \beta_{14}{*}SUBORD + \Sigma\delta_j{*}IND_j + \Sigma\delta_f{*}CALQTR_f + \varepsilon_{[q\text{-}1;q+k]}$$

Variable	*ΔZ-PROB*		*ΔO-PROB*		*ΔBSM-PROB*	
	[q-1;q+1]	[q-1;q+3]	[q-1;q+1]	[q-1;q+3]	[q-1;q+1]	[q-1;q+3]
	I	II	III	IV	V	VI
OPI	**-0.460*****	**-0.962*****	**-0.179*****	**-0.317*****	**-1.744*****	**-2.858*****
	(-5.35)	***(-8.17)***	***(-2.94)***	***(-4.93)***	***(-10.25)***	***(-9.98)***
FE	-0.384**	-0.345*	-0.219	-0.191	-1.022***	-1.046*
	(-2.48)	*(-1.91)*	*(-1.37)*	*(-1.24)*	*(-2.62)*	*(-1.95)*
$STOCKRET_{[-2;-+2]}$	-0.094***	-0.089***	-0.032**	-0.026*	-0.153***	-0.119**
	(-5.33)	*(-4.40)*	*(-2.50)*	*(-1.94)*	*(-3.88)*	*(-2.41)*
$STOCKRET_{[-10;-3]}$	-0.061**	-0.060**	0.014	-0.011	-0.085*	-0.077
	(-2.41)	*(-2.15)*	*(0.73)*	*(-0.57)*	*(-1.90)*	*(-1.31)*
RP_OPI	-0.256	0.702	-0.112	0.009	1.333	2.732**
	(-0.44)	*(0.97)*	*(-0.27)*	*(0.02)*	*(1.41)*	*(1.98)*
LEV	-1.687**	-3.218**	-0.202	0.040	-5.747***	-10.994***
	(-2.14)	*(-2.56)*	*(-0.34)*	*(0.06)*	*(-3.34)*	*(-4.30)*
$\Delta LEV_{[q\text{-}k\text{-}1;q]}$	1.317	-4.570	-4.716*	-4.027**	5.069*	-0.335
	(0.60)	*(-1.23)*	*(-1.66)*	*(-2.03)*	*(1.72)*	*(-0.05)*
ROA	-7.761	-12.422	-14.245**	-7.984	100.639***	56.215**
	(-0.68)	*(-0.74)*	*(-2.23)*	*(-1.25)*	*(6.25)*	*(2.30)*
$\Delta ROA_{[q\text{-}k\text{-}1;q]}$	-31.298***	-8.134	0.877	3.980	-83.512	-59.963***
	(-3.50)	*(-0.78)*	*(0.18)*	*(0.92)*	*(-6.56)*	*(-3.29)*
SIZE	0.243**	0.047	0.181**	0.154*	0.845***	0.592*
	(2.25)	*(0.28)*	*(2.27)*	*(1.78)*	*(4.17)*	*(1.84)*
$\Delta SIZE_{[q\text{-}k\text{-}1;q]}$	-1.996***	0.321	-0.151	0.215	-12.979***	9.144
	(-3.91)	*(0.74)*	*(-0.42)*	*(0.72)*	*(-13.44)*	*(9.63)*
MB	-0.039	0.052	-0.103***	-0.101***	0.094	0.205*
	(-0.91)	*(0.90)*	*(-3.24)*	*(-2.66)*	*(1.11)*	*(1.71)*
$\Delta MB_{[q\text{-}k\text{-}1;q]}$	-0.530***	-0.419	-0.291	-0.152*	0.036	-0.630**
	(-4.34)	*(-3.13)*	*(-2.64)*	*(-1.69)*	*(0.19)*	*(-2.54)*
HORIZON	-0.001	0.001	-0.001	-0.001	0.001	0.001
	(-0.89)	*(0.01)*	*(-1.34)*	*(-2.38)*	*(0.16)*	*(0.55)*
RATING	0.100**	0.079	0.028	0.041	0.306***	0.273**
	(2.53)	*(1.18)*	*(1.16)*	*(1.43)*	*(4.49)*	*(2.35)*
SPEC	0.177	0.368	0.086	-0.055	0.311	-0.273
	(0.58)	*(0.82)*	*(0.52)*	*(-0.30)*	*(0.53)*	*(-0.27)*
SUBORD	-0.047	-0.197	-0.041	-0.173	-0.989*	-1.768*
	(-0.15)	*(-0.38)*	*(-0.19)*	*(-0.65)*	*(-1.79)*	*(-1.81)*
N	5,750	5,592	5,229	5,106	6,260	6,216
Adj. R^2 (%)	9.76	7.78	4.89	3.71	18.80	12.86

This table presents the regression results using standard errors clustered by firm. Changes in implied default probability (in %) are estimated based on changes in Z-Score (*Z-PROB*), O-Score (*O-PROB*), and the Black-Scholes-Merton model (*BSM-PROB*) between quarter q-1 and either quarter q+1 or quarter q+3, where quarter q is the quarter during which *OPI* is measured. The sample consists of 7,543 firm-quarter observations (1,044 distinct firms), with quarterly earnings announcement dates between January 1, 2009 and December 31, 2012. Industry and calendar quarter fixed effects are included but not reported for brevity. t-statistics are in parentheses below coefficient estimates. For the variables of interest, coefficient estimates and t-statistics are bolded. ***,**,* represent statistical significance at $p < 0.01$, $p < 0.05$, and $p < 0.10$ (two-tailed), respectively. See Appendix A of the paper for variable definitions. To mitigate the influence of outliers, all continuous variables are winsorized at the 1st and 99th percentiles.

TABLE OA15
Twitter Opinion and Future Changes in Implied Default Probability – Sensitivity Tests with Control Variables (Cont'd)

$$\Delta PROB_{[q\text{-}1;q+k]} = \alpha + \beta_1 {*} OPI\_BONDFUNDA_{[-10;-3]} + \beta_2 {*} OPI\_NONBONDFUNDA_{[-10;-3]} + \beta_3 {*} FE + \beta_4 {*} STOCKRET_{[-2;+2]} + \beta_5 {*} STOCKRET_{[-10;-3]} + \beta_6 {*} RP\_OPI_{[-10;-3]} + \beta_7 {*} LEV + \beta_8 {*} ROA + \beta_9 {*} SIZE + \beta_{10} {*} MB + \beta_{11} {*} HORIZON + \beta_{12} {*} RATING + \beta_{13} {*} SPEC + \beta_{14} {*} SUBORD + \Sigma\delta_j {*} IND_j + \Sigma\delta_f {*} CALQTR_f + \varepsilon_{[q\text{-}1;q+k]}$$

Variable	*ΔZ-PROB*		*ΔO-PROB*		*ΔBSM-PROB*	
	[q-1;q+1]	[q-1;q+3]	[q-1;q+1]	[q-1;q+3]	[q-1;q+1]	[q-1;q+3]
	I	II	III	IV	V	VI
OPI	**-0.452*****	**-0.950*****	**-0.174*****	**-0.318*****	**-1.735*****	**-2.825*****
	(-5.25)	***(-8.06)***	***(-2.83)***	***(-4.97)***	***(-10.08)***	***(-9.93)***
FE	-0.373***	-0.349*	-0.225	-0.192	-0.958**	-1.052*
	(-2.41)	*(-1.93)*	*(-1.40)*	*(-1.25)*	*(-2.44)*	*(-1.93)*
$STOCKRET_{[-2;-+2]}$	-0.093***	-0.087***	-0.030**	-0.025*	-0.150***	-0.121**
	(-5.24)	*(-4.28)*	*(-2.35)*	*(-1.87)*	*(-3.83)*	*(-2.46)*
$STOCKRET_{[-10;-3]}$	-0.061**	-0.059**	0.014	-0.011	-0.088*	-0.073
	(-2.38)	*(-2.12)*	*(0.74)*	*(-0.57)*	*(-1.94)*	*(-1.24)*
RP_OPI	-0.230	0.680	-0.102	0.014	1.365	2.636*
	(-0.39)	*(0.95)*	*(-0.25)*	*(0.03)*	*(1.44)*	*(1.91)*
LEV	-0.726	-5.525*	-3.732	-3.089*	-0.654	-9.177
	(-0.38)	*(-1.73)*	*(-1.30)*	*(-1.67)*	*(-0.23)*	*(-1.46)*
$LEV_{q\text{-}k\text{-}1}$	-0.998	1.946	3.353	3.051	-5.139*	-2.275
	(-0.53)	*(0.56)*	*(1.22)*	*(1.54)*	*(-1.87)*	*(-0.32)*
ROA	-38.494***	-20.839	-13.956*	-4.693	12.687	2.597
	(-3.98)	*(-1.61)*	*(-1.89)*	*(-0.71)*	*(0.93)*	*(0.13)*
$ROA_{q\text{-}k\text{-}1}$	34.488***	11.090	1.531	-3.338	92.387***	60.041***
	(3.78)	*(1.12)*	*(0.25)*	*(-0.73)*	*(6.84)*	*(3.53)*
SIZE	-1.955	0.381	0.074	0.429	-11.602***	8.965***
	(-3.89)	*(0.87)*	*(0.19)*	*(1.41)*	*(-12.78)*	*(9.42)*
$SIZE_{q\text{-}k\text{-}1}$	2.160***	-0.379	0.063	-0.296	12.457***	-8.392***
	(4.28)	*(-0.87)*	*(0.16)*	*(-0.99)*	*(13.72)*	*(-9.11)*
MB	-0.254***	-0.184*	-0.270***	-0.209***	0.106	-0.012
	(-2.99)	*(-1.94)*	*(-3.33)*	*(-2.97)*	*(0.63)*	*(-0.07)*
$MB_{q\text{-}k\text{-}1}$	0.287***	0.314***	0.229**	0.145**	-0.019	0.256
	(3.16)	*(2.99)*	*(2.42)*	*(2.06)*	*(-0.11)*	*(1.21)*
HORIZON	-0.001	0.001	-0.001	-0.001	0.001	0.001
	(-0.78)	*(0.01)*	*(-1.23)*	*(-2.37)*	*(0.12)*	*(0.53)*
RATING	0.104***	0.080	0.026	0.041	0.324	0.289**
	(2.61)	*(1.21)*	*(1.11)*	*(1.42)*	*(4.74)*	*(2.50)*
SPEC	0.143	0.392	0.093	-0.056	0.211	-0.224
	(0.47)	*(0.87)*	*(0.57)*	*(-0.31)*	*(0.36)*	*(-0.23)*
SUBORD	-0.019	-0.180	-0.051	-0.180	-0.890	-1.750*
	(-0.06)	*(-0.35)*	*(-0.24)*	*(-0.67)*	*(-1.62)*	*(-1.79)*
N	5,750	5,592	5,229	5,106	6,260	6,216
Adj. R^2 (%)	9.23	7.51	4.69	3.72	19.21	12.66

This table presents the regression results using standard errors clustered by firm. Changes in implied default probability (in %) are estimated based on changes in Z-Score (*Z-PROB*), O-Score (*O-PROB*), and the Black-Scholes-Merton model (*BSM-PROB*) between quarter q-1 and either quarter q+1 or quarter q+3, where quarter q is the quarter during which *OPI* is measured. The sample consists of 7,543 firm-quarter observations (1,044 distinct firms), with quarterly earnings announcement dates between January 1, 2009 and December 31, 2012. Industry and calendar quarter fixed effects are included but not reported for brevity. t-statistics are in parentheses below coefficient estimates. For the variables of interest, coefficient estimates and t-statistics are bolded. ***,**,* represent statistical significance at $p < 0.01$, $p < 0.05$, and $p < 0.10$ (two-tailed), respectively. See Appendix A of the paper for variable definitions. To mitigate the influence of outliers, all continuous variables are winsorized at the 1st and 99th percentiles.