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How Does Firm-Specific Investor Sentiment Affect the Value of Corporate Cash Holdings?

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We document a positive relation between firm-specific investor sentiment (FSIS) and the value of cash. We also show that FSIS has a stronger positive effect on the value of cash than the value of other types of assets, suggesting that our finding is not a simple reflection of firm-level overvaluation. Our finding is robust to alternative measures of change in cash, different cash regimes, FSIS measured by order imbalance, news sentiment and the tone of earnings conference call transcripts and controlling for market-wide sentiment, institutional monitoring, corporate governance and endogeneity. Cross-sectional analyses suggest that the positive relation between FSIS and the value of cash is stronger for firms with better future growth opportunities, larger investment, more innovation activities, higher information asymmetry and more liquid stocks. Overall, our paper sheds light on the important role of FSIS in corporate outcomes.

Introduction

Is investor sentiment one of the prominent drivers of corporate outcomes? According to Fisher's separation theorem (Fisher, 1930), a firm's investment decisions are separate from the preferences of the firm's shareholders. However, this view has been challenged by recent studies showing that market-level investor sentiment (MLIS) affects several important corporate activities and outcomes.[1] Similarly, management studies have also shown that behavioural biases and sentiment in organizations may affect managers' decision-making processes (e.g. Caporin, Corazzini and Costola, 2019; Latham and Braun, 2010; Maule and Hodgkinson, 2003).

Since MLIS measures only exhibit time-series variations, it would be desirable to know how investor sentiment at the firm level, with both time-series and cross-sectional variations, may affect

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[1]MLIS affects corporate discourse policies (Bergman and Roychowdhury, 2008), analysts' earnings forecast errors (Hribar and McInnis, 2012; Walther and Willis, 2013), stock market response to earnings news (Mian and Sankaraguruswamy, 2012), general corporate investment (Arif and Lee, 2014), external financing costs (McLean and Zhao, 2014), bidder announcement abnormal returns (Danbolt, Siganos and Vagenas-Nanos, 2015) and R&D investment (Dang and Xu, 2018).

managers' assessment of daily financial and investment decisions. Following Barberis, Shleifer and Vishny (1998), we take firm-specific investor sentiment (FSIS) as common judgement errors made by a group of investors when they assess firm value, rather than a series of uncorrelated mistakes. Shefrin and Belotti (2008) indicate that heterogenous beliefs can manifest in cross-sectional differences in investor sentiment. MLIS reflects the average level of sentiment across all stocks so that the cross-sectional differences in sentiment, such as excessive optimism and pessimism, may cancel out with each other (Kim and Kim, 2014). Confounding economic factors, such as business cycles and monetary policy, may also influence both MLIS and corporate outcomes, causing a spurious association. Since MLIS may have limited explanatory power when explaining firm-specific issues, the cross-sectional variations of FSIS may help researchers to establish a causal link between investor sentiment and corporate outcomes.

In this paper, we employ stock overnight (close-to-open) returns as our main proxy for FSIS. Berkman *et al.* (2012) suggest that overnight returns are suitable for measuring FSIS, since the positive pattern of overnight returns and the following return reversal during trading hours may be driven by the trading activities of attention-triggered investors. Compared with rational arbitrageurs, retail investors are more likely to be attracted by attention-generating events and place orders during non-trading hours (Barber, Odean and Zhu, 2009; Berkman *et al.*, 2012). Aboody *et al.* (2018) further propose to use overnight returns as a measure of FSIS, since overnight returns possess four characteristics expected of a sentiment measure: (i) overnight returns exhibit short-term persistence; (ii) firms that are difficult to value have high short-term persistence of overnight returns; (iii) firms with lower institutional ownership have a stronger persistence of overnight returns; and (iv) stocks with high overnight returns tend to underperform in the long run.[2] Unlike firm-level sentiment measures based on Europe's pre-IPO markets or social media (e.g. Cornelli, Goldreich and Ljungqvist, 2006; Dong and Gil-Bazo, 2020), our measure of FSIS has been available for most US public firms since 1992.

We study the impact of FSIS on corporate outcomes through an under-researched channel: the value of corporate cash holdings. In a market without friction, the market value of an additional dollar in a public firm's cash holdings is exactly one dollar. However, among US public firms, the value of cash exhibits significant cross-sectional variations due to market frictions.[3] Previous studies, either explicitly or implicitly, assume that market investors rationally adjust their valuation of cash holdings according to the market frictions. Nevertheless, the market value of an additional dollar in cash holdings depends not only on a firm's actual efficiency in using the extra dollar but also on market investors' perceived value of holding the extra dollar on the firm's balance sheet. According to the existing sentiment literature, investor optimism is associated with stock overvaluation, especially for stocks with high future growth opportunities (e.g. Baker and Wurgler, 2006; Lamont and Stein, 2004; Stambaugh, Yu and Yuan, 2012). If high FSIS leads to an increase in investors' expectations of a firm's future growth opportunities then, by extension, high FSIS will result in investors being more optimistic about financing these growth opportunities with the firm's internal cash holdings. The optimism may further manifest for hard-to-value firms with high information asymmetry. Cash reserves increase a firm's financial flexibility and enhance its future investment ability. We expect that high FSIS may increase investors' expected cash flows from firm investment and innovation projects financed by internal cash and reduce their perception of firm risk.[4] Therefore, we posit that FSIS is positively related to the market perceived value of corporate cash holdings. Since one extra dollar of cash is physically the same between firms with high and low FSIS, the impact of sentiment on the

[2]Using overnight returns as a proxy for FSIS, Hegde and Zhou (2019) show that the probability of accounting misconduct increases with FSIS when FSIS is moderate but decreases with FSIS when FSIS is high; Lan, Huang and Yan (2021) find that FSIS is positively related to the pre-announcement abnormal returns of Chinese SEOs; and Kim and Suh (2021) show that a sentiment-weighted trading strategy generates better performance in momentum and short-term reversal strategies.

[3]For example, financial policy and dividend tax (Faulkender and Wang, 2006), financial constraints (Denis and Sibilkov, 2010), institutional investor monitoring (Ward, Yin and Zeng, 2018), agency problems (Dittmar and Mahrt-Smith, 2007; Liu and Mauer, 2011) and financial hedging policy (Sun, Yin and Zeng, 2021).

[4]Baker and Wurgler (2007) argue that investor sentiment is 'a belief about future cash flows and investment risks that is not justified by the facts at hand'.

value of cash is less likely to be affected by the potential confounding firm characteristics than the impact of sentiment on the other corporate outcomes.

To empirically examine the effect of FSIS on the value of corporate cash holdings, we use a panel sample of US public firms over the period 1992–2018 and employ Faulkender and Wang's (2006) value-of-cash model. Using overnight returns as our main measure of FSIS, we find a positive relation between FSIS and the value of cash. Controlling for various observable factors that are expected to affect the value of cash, a one-standard-deviation increase in FSIS measured by overnight returns is associated with a $0.33 higher value of cash. Next, we follow the value of cash literature and verify that our main finding is robust after controlling for alternative measures of change in cash, three cash regimes, MLIS, external institutional investor monitoring and internal corporate governance.

To shed light on how FSIS affects the value of cash, we adopt a cross-sectional analysis approach to explore several plausible mechanisms. We find that FSIS has a stronger positive effect on the value of cash for firms with better future growth opportunities, suggesting that high FSIS leads to sentiment-driven investors being optimistic about firms' future growth. Since sentiment-driven investors tend to place a higher value on firm investment (Arif and Lee, 2014), they would overvalue the cash holdings of firms with better investment opportunities. Our finding is consistent with the view that high MLIS leads to the overvaluation of high-growth stocks (e.g. Baker and Wurgler, 2006; Lamont and Stein, 2004; Stambaugh, Yu and Yuan, 2012). Our cross-sectional analyses also show that FSIS has a stronger positive effect on the value of cash for firms with larger investment, more innovation activities, higher information asymmetry and more liquid stocks.

Faulkender and Wang's (2006) framework does not adjust for potential firm misvaluation. Therefore, any factor that causes firm misvaluation could also affect the estimated market value of cash. We adopt two tests to show that sentiment-driven firm overvaluation is not the only driver of the potential relation between FSIS and the value of cash. First, the positive relation between FSIS and the value of cash remains robust after we directly control for firm overvaluation, measured by the gap between a firm's market-to-book value ratio and the mean value of the ratio in the industry. Second, to provide more economic insights on how FSIS affects the pricing of firm assets, we classify firm assets as cash, non-cash current assets and non-current assets. Using Faulkender and Wang's (2006) framework, we find that FSIS has a positive effect on the value of cash and the value of non-cash current assets (much weaker than cash), but does not have a significant impact on the value of non-current assets. Our findings suggest that the positive relation between FSIS and the value of cash is not mechanically driven by the overall firm overvaluation caused by FSIS.

To improve the causal inferences of our analysis, we conduct three tests to mitigate the potential endogeneity due to omitted variables and reverse causality. First, we employ Oster's (2019) methodology to show that our main finding is unlikely to be driven by omitted variables. Second, our main finding is robust to Gormley and Matsa's (2014) high-dimensional fixed effects model, which controls for the firm and interacted industry–year fixed effects in our baseline regressions and alleviates the potential endogeneity concern due to unobserved heterogeneity across firms and time-varying heterogeneity across industries. Third, we show that the change in FSIS from year $t-1$ to year t has a positive impact on the value of cash in year t, which mitigates the potential simultaneity and reverse causality concerns. In our additional tests, we show that our main finding is robust to three alternative measures of FSIS: the buy–sell order imbalance of investors (e.g. Barber, Odean and Zhu, 2009; Kumar and Lee, 2006; Yuan, 2015); news sentiment based on RavenPack News Analytics (e.g. Bushman, Williams and Wittenberg-Moerman, 2017; Dai, Parwada and Zhang, 2015; Dang, Moshirian and Zhang, 2015); and the tone of earnings conference call transcripts (Hassan *et al.*, 2019).

Our paper contributes to the existing literature in two ways. First and more generally, our focus on FSIS adds to the nascent line of work that draws insights from behavioural finance to corporate activities. Although FSIS is better suited to address firm-level issues compared to MLIS, previous studies only explore how the time-series variations of MLIS can influence corporate major decisions due to the lack of firm-level sentiment measures. Cornelli, Goldreich and Ljungqvist (2006) use Europe's pre-IPO market for shares of 486 companies about to go public to test whether

firm-level retail investor sentiment can explain post-IPO price anomalies. However, the pre-IPO market price is not an available measure of FSIS that can be generalized to a panel of US public firms. In the Chinese stock market, Dong and Gil-Bazo (2020) employ the tone of Weibo post as the measure of FSIS, and Fu *et al.* (2021) form a FSIS index based on price-to-earnings ratio, average turnover rate and buy–sell imbalance. We use overnight returns as our primary proxy for FSIS and show that at the firm level, investor sentiment is positively related to the value of cash holdings in a large panel sample of US firms.

Second, previous management studies have shown that institutional investors and retail investors may affect the stock returns and corporate activities of their invested firms (e.g. Andreou *et al.*, 2021; Klettner, 2021; Stathopoulos and Voulgaris, 2016). There is also a significant body of finance literature studying how investor sentiment affects firms' decision-making and the price response to firm-level disclosures. It is relatively underexplored how FSIS, especially the sentiment of retail investors, may affect the value of firm assets and corporate policies. By explicitly connecting FSIS and the value of corporate cash holdings, our study sets up a new line of research on the real implications of firm-level investor sentiment on corporate outcomes. Since the value of cash is the value which firm shareholders place on an additional one dollar of a firm's cash holdings, we provide a unique perspective that FSIS influences the shareholders' perception of a firm's cash value. This paper improves our understanding of the role which investor sentiment plays in pricing corporate assets.

Research design and sample

Baseline regression model

To measure the market value of corporate cash holdings, we employ a widely used empirical framework proposed by Faulkender and Wang (2006) that examines a contemporaneous association between the unexpected change in a firm's cash holdings and the corresponding change in its market value of equity. We augment Faulkender and Wang's (2006) model with FSIS and its interaction with the change in cash holdings. Specifically, we adopt the following baseline regression:

$$\begin{aligned} r_{i,t} - R^{B}_{i,t} = {} & \beta_0 + \beta_1 \Delta\text{Cash holdings}_{i,t} + \beta_2 \text{FSIS}_{i,t} \\ & + \beta_3 \text{FSIS}_{i,t} \times \Delta\text{Cash holdings}_{i,t} \\ & + \beta_4 \Delta\text{Earnings}_{i,t} + \beta_5 \Delta\text{Net assets}_{i,t} \\ & + \beta_6 \Delta\text{R\&D}_{i,t} + \beta_7 \Delta\text{Interest expenses}_{i,t} \\ & + \beta_8 \Delta\text{Dividends}_{i,t} + \beta_9 \text{Net financing}_{i,t} \\ & + \beta_{10} \text{Cash holdings}_{i,t-1} \\ & + \beta_{11} \text{Cash holdings}_{i,t-1} \\ & \times \Delta\text{Cash holdings}_{i,t} + \beta_{12} \text{Leverage}_{i,t} \\ & + \beta_{13} \text{Leverage}_{i,t} \times \Delta\text{Cash holdings}_{i,t} \\ & + \epsilon_{i,t} \end{aligned} \quad (1)$$

where i is firm index; t is year index; the dependent variable $r - R^B$ is the annual return on a firm's stock minus the annual return on one of the Fama and French's (1993) 25 value-weighted portfolios, constructed by independently sorting stocks by firm size and book-to-market ratios, to which the firm is assigned at the beginning of a fiscal year; Δ indicates a change in the corresponding variables over a fiscal year; Cash holdings is cash and marketable securities; FSIS is firm-specific investor sentiment; Earnings is earnings before interest and extraordinary items; Net assets is total assets net of cash; R&D is research and development expenses; Interest expenses is interest expenses; Dividends is common dividends; Net financing is net financing proceeds; and Leverage is market leverage. All the above accounting variables are deflated by the 1-year lagged market value of equity. The detailed definitions of these variables are provided in Appendix A.[5] Apart from FSIS_t, the dependent and independent variables in the baseline regression are normalized by the market value of equity at the end of the fiscal year $t - 1$. Therefore, the estimated coefficient β_1 measures the value of cash, the dollar change in market value of equity resulting from a dollar increase in cash holdings. The estimated coefficient of β_3 can be interpreted as the effect of changes in the value of cash for different levels of FSIS. A positive β_3 indicates that FSIS is positively related to the value of cash.

[5]Besides variable definitions and regression equations, we omit the firm index i in the main text.

Proxies for firm-specific investor sentiment

The main proxy for FSIS used in our main empirical analyses, $FSIS\_OR_{i,t}$, is firm i's average overnight returns over fiscal year t. Berkman *et al.* (2012) show that high-attention stocks, classified by large squared stock returns or strong net purchase by individual investors over a trading day, attract more retail buying near the open of the next trading day than low-attention stocks, and the retail buying of high-attention stocks concentrates during the first hour of the next trading day. Berkman *et al.* (2012) further find that since the majority of these attention-triggered buying orders are placed during non-trading hours, there exists a strong tendency for positive overnight returns followed by reversals during the next trading day. Berkman *et al.*'s (2012) findings suggest that overnight returns may be suitable for measuring FSIS. Aboody *et al.* (2018) confirm this suitability by showing that overnight returns possess four characteristics of a sentiment measure. First, short-term overnight returns are persistent, which is a characteristic to be expected from a measure of sentiment driven by the persistent share demand of sentiment-influenced investors (e.g. Barber, Odean and Zhu, 2009). Second, short-term overnight return persistence is stronger for harder-to-value firms, which is consistent with the empirical evidence that MLIS has a greater impact on the prices of firms that are harder to value (e.g. Baker and Wurgler, 2006; Berkman *et al.*, 2009; Hribar and McInnis, 2012; Mian and Sankaraguruswamy, 2012; Seybert and Yang, 2012). Third, short-term overnight return persistence is higher for firms with lower institutional ownership, which is consistent with the evidence that retail investors are less rational and more likely to be affected by sentiment than institutional investors (e.g. Yu and Yuan, 2011). Fourth, stocks with high overnight returns underperform those with low overnight returns over the longer term, which is consistent with the evidence that mispricing due to the sentiment-driven demand of investors is temporary (e.g. Hvidkjaer, 2008) and stocks with strong retail investor demand underperform those with weak retail investor demand (e.g. Barber, Odean and Zhu, 2009).

Following Aboody *et al.* (2018), we keep stocks in the Center for Research in Security Price (CRSP) database with end-of-prior-year prices greater than \$5 per share and market capitalizations of more than \$10 million. Our sample period is 1992–2018, because stock opening prices are only available in the CRSP database from 1992. The overnight return of firm i's stock on day j, $OR_{i,j}$, is calculated as:

$$OR_{i,j} = \frac{Open_{i,j} - Close_{i,j-1}}{Close_{i,j-1}} \quad (2)$$

where $Open_{i,j}$ is the opening price of firm i's stock on day j and $Close_{i,j-1}$ is the closing price of firm i's stock on day $j-1$. All opening and closing prices are adjusted for stock splits, stock dividends and cash dividends. We treat an overnight return on day j as missing if either the closing price on day $j-1$ or the opening price on day j is not available in the CRSP database. To construct an annualized proxy for FSIS, we define $FSIS\_OR_{i,t}$ as:

$$FSIS\_OR_{i,t} = 250 \times \frac{\sum_{j=1}^{N} OR_{i,j}}{N} \quad (3)$$

where 250 is the approximate number of trading days within fiscal year t and N is the number of non-missing $OR_{i,j}$ over the year. We treat $FSIS\_OR_{i,t}$ as missing if N is less than 100.

In our robustness tests, we adopt four alternative proxies for FSIS: $FSIS\_SOIB_t$, $FSIS\_OIB_t$, $FSIS\_CSS_t$, and $FSIS\_ECS_t$. The definitions of these proxies are discussed in Appendix B.

Data sources and summary statistics

Our analysis is based on a sample of US firms covered by the CRSP/Compustat Merged database over the period 1992–2018. Our sample starts from 1992 when the CRSP started to provide opening stock price data. All the firm–year observations have available stock return data from the CRSP and accounting data from Compustat. Following Faulkender and Wang (2006), we exclude financial firms (SIC codes between 6000 and 6999) and utility firms (SIC codes between 4900 and 4999), firms with stocks traded outside of the NYSE, NASDAQ and AMEX, and firm–year observations with negative net assets, negative equity or negative dividend. To mitigate the impact of outliers, we follow the literature and winsorize the

Table 1. Summary statistics

Variable	Obs.	Mean	SD	p1	p25	Median	p75	p99
$r_t - R_t^B$	64,548	−0.007	0.500	−0.922	−0.299	−0.064	0.189	1.877
ΔCash holdings$_t$	64,548	0.008	0.103	−0.287	−0.022	0.001	0.031	0.421
FSIS_OR$_t$	64,548	−0.030	0.560	−2.388	−0.232	0.004	0.217	1.645
ΔFSIS_OR$_t$	58,108	−0.003	0.571	−1.889	−0.270	0.001	0.269	1.908
ΔEarnings$_t$	64,548	0.001	0.138	−0.480	−0.023	0.004	0.028	0.459
ΔNet assets$_t$	64,548	0.054	0.316	−0.887	−0.033	0.022	0.107	1.447
ΔR&D$_t$	64,548	0.001	0.015	−0.047	0.000	0.000	0.001	0.061
ΔInterest expenses$_t$	64,548	0.001	0.014	−0.040	−0.001	0.000	0.002	0.061
ΔDividends$_t$	64,548	0.000	0.009	−0.049	0.000	0.000	0.000	0.040
Cash holdings$_{t-1}$	64,548	0.140	0.172	0.001	0.030	0.084	0.185	0.844
Leverage$_t$	64,548	0.198	0.206	0.000	0.017	0.138	0.309	0.825
Net financing$_t$	64,548	0.031	0.175	−0.353	−0.030	0.000	0.043	0.843
ΔAlternative cash holdings I$_t$	64,498	0.001	0.101	−0.289	−0.032	−0.004	0.026	0.408
ΔAlternative cash holdings II$_t$	64,548	0.000	0.102	−0.285	−0.034	−0.007	0.023	0.419
ΔAlternative cash holdings III$_t$	59,368	0.000	0.099	−0.279	−0.033	−0.007	0.023	0.401
TIO$_t$	63,509	0.557	0.282	0.006	0.332	0.595	0.789	1.000
MMIO$_t$	63,509	0.131	0.167	0.000	0.000	0.061	0.204	0.616
G-Index$_t$	10,965	9.317	2.645	4.000	7.000	9.000	11.000	15.000
E-Index$_t$	13,856	3.049	1.254	0.000	2.000	3.000	4.000	6.000
P/E$_t$	64,239	17.917	155.916	−207.571	5.000	15.691	25.196	300.000
Tobin's Q$_t$	64,439	2.015	1.838	0.652	1.132	1.513	2.238	8.765
IA-Index$_t$	54,994	12.380	3.401	6	10	12	15	20
REM$_t$	56,994	0.406	0.392	−0.052	0.220	0.364	0.542	1.268
FSIS_SOIB$_t$	28,465	−0.044	0.107	−0.337	−0.108	−0.034	0.018	0.226
FSIS_OIB$_t$	81,947	−0.035	0.097	−0.369	−0.078	−0.013	0.015	0.176
FSIS_CSS$_t$	26,024	0.504	0.022	0.418	0.495	0.507	0.516	0.555
FSIS_ECS$_t$	36,703	7.927	4.370	−2.422	4.993	7.788	10.742	18.885

Source: This table reports the summary statistics of all variables used in our main empirical analyses. The main sample consists of 64,548 firm–year observations over the fiscal years 1992–2018, with required data for our baseline regressions. The number of observations, mean, standard deviation, 1st percentile, 25th percentile, median, 75th percentile and 99th percentile are reported from left to right, in sequence for each variable. All variables are defined in Appendix A.

accounting and stock return variables at the 1% and 99% levels. All accounting data are converted to real values in 2018 dollars using the consumer price index from the website of the Federal Reserve Bank of St. Louis. After merging the value of cash data with FSIS_OR, our main sample consists of 64,548 firm–year observations.

We also obtain order imbalance data from TAQ, news sentiment data from RavenPack, data on the tone of earnings conference call transcripts from Tarek A. Hassan's website, institutional ownership data from Thomson Reuters s34 files, corporate governance data from the Institutional Shareholder Services (ISS, formerly RiskMetrics) database, Fama–French industry returns from Kenneth R. French's website, market sentiment data from the Federal Reserve Economic Data (FRED) database and Jeffrey Wurgler's website, short interest data from the CRSP and stock option trading status data from OptionMetrics.

The summary statistics for the variables used in our main empirical tests are shown in Table 1. The distribution of annual excess returns is right-skewed with a mean of −0.7% and a median of −6.4%. On average, corporate cash holdings have been slightly increasing over time, with ΔCash holdings$_t$'s mean, 25th percentile, and 75th percentile standing at 0.8%, −2.2%, and 3.1%, respectively. The average growth in net assets is 5.4%, whereas the average growth in earnings, R&D, interest expenses, and dividends are positive but negligible. Our prior cash holdings average nearly 14.0%, indicating that the previous cash balance, on average, accounts for 14.0% of the corresponding market value of equity. The average leverage is about 19.8% and the standard deviation of net financing is 17.5%. All these summary statistics

Table 2. Baseline regressions: firm-specific investor sentiment and the value of cash

Variables	(1)	(2)	(3)	(4)	(5)
ΔCash holdings$_t$	0.772***	1.529***	1.117***	1.127***	1.880***
	(38.502)	(39.938)	(36.114)	(35.972)	(35.425)
FSIS_OR$_t$			0.086***	0.093***	0.089***
			(20.838)	(22.250)	(21.644)
FSIS_OR$_t$ $\times$ ΔCash holdings$_t$			0.669***	0.661***	0.592***
			(11.433)	(11.330)	(10.477)
ΔEarnings$_t$	0.531***	0.526***	0.608***	0.613***	0.608***
	(41.433)	(41.512)	(28.532)	(28.570)	(28.597)
ΔNet assets$_t$	0.168***	0.177***	0.256***	0.251***	0.257***
	(26.191)	(27.984)	(22.648)	(22.094)	(23.014)
ΔR&D$_t$	1.259***	1.171***	0.912***	1.156***	1.065***
	(9.424)	(8.866)	(5.088)	(6.401)	(6.007)
ΔInterest expenses$_t$	−1.667***	−1.591***	−2.878***	−2.714***	−2.460***
	(−19.422)	(−18.753)	(−13.856)	(−12.912)	(−11.903)
ΔDividends$_t$	3.385***	3.345***	1.814***	1.864***	1.829***
	(16.856)	(16.761)	(8.823)	(9.092)	(8.909)
Cash holdings$_{t-1}$	0.314***	0.248***	0.222***	0.270***	0.223***
	(25.802)	(19.392)	(15.933)	(17.386)	(13.881)
Leverage$_t$	−0.494***	−0.491***	−0.427***	−0.512***	−0.510***
	(−58.333)	(−59.322)	(−45.199)	(−46.724)	(−46.950)
Net financing$_t$	0.093***	0.068***	−0.067***	−0.047**	−0.068***
	(7.279)	(5.463)	(−3.123)	(−2.178)	(−3.200)
Cash holdings$_{t-1}$ $\times$ ΔCash holdings$_t$		−0.728***			−0.816***
		(−12.508)			(−8.721)
Leverage$_t$ $\times$ ΔCash holdings$_t$		−1.609***			−2.290***
		(−21.162)			(−18.548)
Constant	0.058***	0.058***	0.026***	0.065***	0.061**
	(18.037)	(18.462)	(8.178)	(2.734)	(2.525)
Observations	89,555	89,555	64,548	64,548	64,548
R^2-adjusted	0.191	0.204	0.186	0.198	0.210
Year fixed effects	No	No	No	Yes	Yes
Industry fixed effects	No	No	No	Yes	Yes

Source: This table reports the ordinary least squares regressions of excess stock returns on the change in cash holdings, firm-specific investor sentiment, the interaction of the prior two variables and control variables. The sample consists of 67,548 firm–year observations of US firms over the sample period 1992–2018 with required data for the regressions. The dependent variable is $r_{it} - R^B_{it}$, the annual excess stock return relative to the Fama and French (1993) 25 size and book-to-market portfolios. Δ indicates the change in the corresponding variables from year t − 1 to year t. In columns (1) and (2), we replicate Faulkender and Wang's (2006) baseline regressions over the sample period 1972–2001. The coefficients of the year and Fama–French 48 industry fixed effects are suppressed for brevity in the respective columns. All variables are defined in Appendix A. Standard errors are clustered at the firm level. t-Statistics are reported in parentheses. *, ** and *** denote statistical significance at the 10%, 5% and 1% levels, respectively.

are comparable to those reported elsewhere in the previous value of cash literature. The means and standard deviations of FSIS_OR are −0.030 and 0.560.

Main results

Firm-specific investor sentiment and the value of cash

Faulkender and Wang (2006) show that an extra dollar of cash is valued by market investors at $0.75 on average and such value will increase to $1.47 for a firm without any cash holdings and leverage. In columns (1) and (2) of Table 2, we replicate Faulkender and Wang's (2006) main results over their sample period 1972–2001 and our results are comparable to theirs.[6] Column (1)

[6]Our replication sample includes 89,555 firm–year observations, which are slightly larger than the 82,187 reported in Faulkender and Wang (2006). Faulkender and Wang (2006) trim the accounting and stock return variables in their sample at the 1% and 99% tails, while we winsorize the corresponding variables at the 1% and 99% tails. Additionally, we use the CRSP/Compustat Merged database, which was not available in 2006.

shows that on average, a dollar increase in cash holdings is associated with a \$0.77 increase in firm market value. Column (2) indicates that the value of cash for a firm with zero cash and no leverage is approximately \$1.53. The coefficients of Cash holdings$_{t-1}$ × ΔCash holdings$_t$ and Leverage$_t$ × ΔCash holdings$_t$ are negative and statistically significant, consistent with Faulkender and Wang's (2006) findings that the value of cash decreases with cash liquidity and leverage.

To formally test whether the value of cash is contingent upon FSIS, we estimate Equation (1) and place emphasis on the coefficient of FSIS_OR$_t$ × ΔCash holdings$_t$. Column (3) of Table 2 presents the results from estimating Equation (1) without controlling for cash liquidity and leverage. In column (4), we extend the specification in column (3) by controlling for the year and Fama–French 48 industry (Fama and French, 1997) fixed effects. In column (5), we further extend the specification in column (4) by including two interaction terms Cash holdings$_{t-1}$ × ΔCash holdings$_t$ and Leverage$_t$ × ΔCash holdings$_t$. Column (3) shows that the value of an extra dollar of cash for an average firm is \$1.12, and column (5) implies that investors value an additional dollar of cash as \$1.88 for a firm with zero cash, leverage and FSIS. Both numbers are greater than those documented in Faulkender and Wang (2006), which are consistent with Bates, Chang and Chi's (2018) finding that the value of corporate cash holdings has increased significantly in recent decades. Faulkender and Wang's (2006) sample period is 1972–2001, while ours is 1992–2018.

The coefficients of the interaction term FSIS_OR$_t$ × ΔCash holdings$_t$ are all positive and statistically significant at the 1% level in columns (3)–(5), suggesting that there is a positive association between FSIS and the value of cash holdings.[7] Based on the estimated coefficient in column (3), a one-standard-deviation increase in FSIS_OR will lead to a \$0.37 (= 0.669 × 0.560) increase in the value of cash. After we add the industry and year fixed effects in column (4) and the additional control variables in column (5), a one-standard-deviation increase in *FSIS_OR* is associated with a \$0.37 (= 0.661 × 0.560) and \$0.33 (= 0.592 × 0.560) increase in the value of cash. The increase in the value of cash associated with FSIS is economically substantial.

Alternative measures of unexpected change in cash

The actual change in cash holdings can be decomposed into the expected and unexpected components. In an efficient market, the information of any expected change in cash holdings should have already been incorporated into stock prices by market investors at the beginning of the fiscal year. Only the unexpected change in cash holdings will lead to investors' revision of a firm's market value. In Faulkender and Wang's (2006) empirical framework, ΔCash holdings$_t$, the change in Cash holdings from fiscal year t − 1 to t, is a proxy for the unexpected change in corporate cash holdings. An implicit assumption is that market investors, on average, expect that cash holdings at the end of fiscal year t is the same as actual cash holdings at the end of fiscal year t − 1. However, if this implicit assumption is incorrect, then our estimation of the impact of FSIS on the value of cash may be biased. To address this concern, we follow Faulkender and Wang (2006) and replace ΔCash holdings$_t$ by three alternative measures of unexpected change in corporate cash holdings.

The first alternative measure, ΔAlternative cash holdings I_t, is equal to the difference between ΔCash holdings$_t$ and average ΔCash holdings$_t$ for all firms in one of the Fama–French 25 size and book-to-market matched portfolios. The average ΔCash holdings$_t$ in the matched benchmark portfolio is taken as the expected change in a firm's cash holdings. The dependent variable in Equation (1), $r_t - R_t^B$, is adjusted for the same benchmark portfolio returns, therefore it is likely that $r_t - R_t^B$ has already incorporated the information on the average change in cash of firms in the corresponding benchmark portfolio. The second and third alternative measures are developed in Almeida, Campello and Weisbach (2004), who use a firm's cash sources and uses of cash to predict the change in its cash holdings. The expected changes in cash are the fitted values of ΔCash holdings$_t$ in the following two regression equations:

$$\Delta\text{Cash holdings}_{i,t} = \beta_0 + \beta_1 \text{CF}_{i,t-1} + \beta_2 \text{Q}_{i,t-1} + \beta_3 \text{Size}_{i,t-1} + \theta_j + \epsilon_{i,t} \quad (4)$$

[7]The variance inflation factor (VIF) test shows that among all independent variables, ΔCash holdings$_t$ has the largest VIF value (3.60), which is less than 10. The VIF values indicate that our baseline regression is not subject to the multicollinearity concern.

$$\begin{aligned}\Delta\text{Cash holdings}_{i,t} = {} & \beta_0 + \beta_1 \text{CF}_{i,t-1} + \beta_2 \text{Q}_{i,t-1} \\ & + \beta_3 \text{Size}_{i,t-1} \\ & + \beta_4 \text{Expenditures}_{i,t-1} \\ & + \beta_5 \text{Acquisitions}_{i,t-1} \\ & + \beta_6 \Delta\text{NWC}_{i,t} + \beta_7 \Delta\text{SD}_{i,t} \\ & + \theta_j + \epsilon_{i,t} \qquad (5)\end{aligned}$$

where i is firm index, t is year index, CF is the ratio of earnings before extraordinary items and depreciation (minus dividends) scaled by the book value of total assets, Q is the market value scaled by the book value of total assets, Size is the natural log of the book value of total assets, Expenditures is capital expenditures scaled by the book value of total assets, Acquisitions is acquisition expenses scaled by the book value of total assets, ΔNWC is changes in non-cash net working capital scaled by the book value of total assets, ΔSD is changes in short-term debt scaled by the book value of total assets and θ_j is the Fama–French 48 industry fixed effects.[8] ΔAlternative cash holdings II and ΔAlternative cash holdings III are the residuals, $\epsilon_{i,t}$, estimated by Equations (4) and (5).[9]

The results of estimating regression Equation (1) with the three alternative measures of unexpected change in cash are reported in Table 3. For each alternative measure, we test three specifications similar to those reported in columns (3)–(5) of Table 2. Columns (1)–(9) of Table 3 show that the coefficients of $\text{FSIS\_OR}_t \times \Delta\text{Alternative cash holdings}_t$ are all positive and statistically significant at the 1% level. Columns (1)–(9) imply that a one-standard-deviation increase in FSIS_OR is associated with \$0.31 (= 0.545 × 0.560) to \$0.40 (= 0.707 × 0.560) higher value of cash. The positive effect of FSIS on the value of cash is also economically significant.

Cash regimes

Halford *et al.* (2017) draw the conclusion that it may lead to a biased estimation if cash regimes are not controlled in Faulkender and Wang's (2006) framework. Using interest coverage and industry market-to-book ratio, Faulkender and Wang (2006) classify firms into three ex-ante cash regimes: raising cash, distributing cash and servicing debt.[10] They show that the value of cash increases from \$0.45 in the servicing debt regime to \$1.16 in the raising cash regime, which is consistent with the view that the value of cash is a function of cash regimes. The marginal value of one dollar to investors is higher for a firm borrowing money externally to finance its growth than a firm distributing cash to its shareholders. In unreported tests, we follow Faulkender and Wang's (2006) classification and find that the positive relation between FSIS and the value of cash holds across these three ex-ante classified cash regimes.

Halford *et al.* (2017) also emphasize the importance of identifying cash regimes ex-post when analysing the value of cash. Given the assumption that stock prices unbiasedly incorporate firms' future activities, Halford *et al.* (2017) define three ex-post cash regimes as the following: firms that issue equity and do not pay dividends in fiscal year t are within the raising cash regime; firms that distribute cash to shareholders and do not issue equity in fiscal year t are within the distributing cash regime; and firms with market leverage ratios being in the top decile distribution of firms at the beginning of fiscal year t and without cash raising or distributing activities over year t are within the servicing debt regime. Table 4 presents the results of estimating regression Equation (1) across the three ex-post cash regimes. Similar to our baseline regression results, the coefficients of $\text{FSIS\_OR}_t \times \Delta\text{Cash holdings}_t$ remain positive and statistically significant. Columns (3), (6) and (9) imply that a one-standard-deviation increase in FSIS_OR is associated with a \$0.31 increase in the value of cash in the servicing debt regime, a \$0.47 increase in the value of cash in the raising cash regime and a \$0.18 increase in the value of cash in the distributing cash regime.[11] Taken together, the positive relation between FSIS and the value of cash remains robust after controlling for the cash regimes.

[8]We define 48 industry dummy variables that indicate whether a firm is in one of the Fama–French 48 industries. We include the first 47 industry dummy variables in Equations (4) and (5). The Fama–French 48 industry definitions are from Kenneth R. French's personal website.

[9]Almeida, Campello and Weisbach (2004) and Faulkender and Wang (2006) provide detailed discussions of these alternative measures.

[10]Interest coverage is the sum of cash holdings and earnings at the beginning of fiscal year t divided by the interest expense over year t.

[11]The standard deviations of FSIS_OR in these three cash regimes are 0.657, 0.750 and 0.377, respectively.

Table 3. Three alternative definitions of the unexpected change in cash holdings

	Portfolio average			Almeida, Campello and Weisbach (2004) I			Almeida, Campello and Weisbach (2004) II		
Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
ΔAlternative cash holdings$_t$	1.055***	1.061***	1.786***	1.142***	1.154***	1.927***	1.079***	1.093***	1.854***
	(34.612)	(34.545)	(33.265)	(36.767)	(36.548)	(35.676)	(33.370)	(33.319)	(32.078)
FSIS_OR$_t$	0.092***	0.098***	0.095***	0.092***	0.099***	0.095***	0.098***	0.105***	0.101***
	(21.740)	(23.062)	(22.566)	(21.546)	(22.851)	(22.189)	(21.945)	(23.102)	(22.509)
FSIS_OR$_t$ $\times$ ΔAlternative cash holdings$_t$	0.618***	0.613***	0.545***	0.707***	0.696***	0.619***	0.676***	0.665***	0.599***
	(10.510)	(10.452)	(9.628)	(11.996)	(11.823)	(10.890)	(10.481)	(10.328)	(9.611)
ΔEarnings$_t$	0.628***	0.631***	0.624***	0.588***	0.593***	0.587***	0.594***	0.599***	0.593***
	(29.155)	(29.154)	(29.198)	(27.454)	(27.513)	(27.594)	(26.344)	(26.446)	(26.573)
ΔNet assets$_t$	0.247***	0.243***	0.247***	0.265***	0.261***	0.265***	0.258***	0.256***	0.260***
	(21.890)	(21.390)	(22.229)	(23.156)	(22.650)	(23.495)	(21.712)	(21.395)	(22.128)
ΔR&D$_t$	0.971***	1.231***	1.148***	0.984***	1.211***	1.139***	0.993***	1.189***	1.106***
	(5.366)	(6.748)	(6.409)	(5.477)	(6.689)	(6.406)	(5.115)	(6.092)	(5.771)
ΔInterest expenses$_t$	−2.962***	−2.787***	−2.541***	−2.888***	−2.725***	−2.455***	−3.029***	−2.881***	−2.619***
	(−14.149)	(−13.184)	(−12.249)	(−13.879)	(−12.948)	(−11.878)	(−13.787)	(−12.933)	(−11.929)
ΔDividends$_t$	1.743***	1.832***	1.809***	1.916***	1.973***	1.938***	1.910***	1.996***	1.953***
	(8.460)	(8.922)	(8.819)	(9.337)	(9.635)	(9.449)	(9.218)	(9.626)	(9.412)
Net financing$_t$	−0.038*	−0.019	−0.039*	−0.076***	−0.061***	−0.083***	−0.065***	−0.052**	−0.070***
	(−1.773)	(−0.882)	(−1.846)	(−3.573)	(−2.798)	(−3.941)	(−2.871)	(−2.269)	(−3.168)
Cash holdings$_{t-1}$	0.208***	0.253***	0.201***	0.197***	0.244***	0.185***	0.190***	0.237***	0.181***
	(15.113)	(16.624)	(12.499)	(14.367)	(16.048)	(11.511)	(13.636)	(15.278)	(11.185)
Cash holdings$_{t-1}$ $\times$ ΔAlternative cash holdings$_t$			−0.849***			−0.944***			−0.979***
			(−8.390)			(−9.285)			(−9.078)

Table 3. (Continued)

	Portfolio average			Almeida, Campello and Weisbach (2004) I			Almeida, Campello and Weisbach (2004) II		
Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
$Leverage_t$	−0.439***	−0.523***	−0.530***	−0.447***	−0.532***	−0.546***	−0.442***	−0.521***	−0.535***
	(−45.999)	(−47.289)	(−47.998)	(−47.103)	(−48.263)	(−49.076)	(−45.183)	(−46.458)	(−47.267)
$Leverage_{t-1} \times \Delta$Alternative Cash $holding_t$			−2.246***			−2.329***			−2.214***
			(−17.952)			(−18.525)			(−16.581)
Constant	0.038***	0.038***	0.078***	0.042***	0.076***	0.079***	0.046***	0.082***	0.086***
	(12.294)	(12.294)	(3.199)	(13.563)	(3.156)	(3.230)	(14.695)	(3.342)	(3.460)
Observations	64,498	64,498	64,498	64,548	64,548	64,548	59,368	59,368	59,368
R^2-adjusted	0.18	0.192	0.203	0.188	0.200	0.212	0.186	0.198	0.209
Year fixed effects	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Industry fixed effects	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes

Source: This table reports the ordinary least squares regressions of excess stock returns on alternative proxies for the change in cash holdings, firm-specific investor sentiment, the interaction of the prior two variables and control variables. The sample consists of 64,548 firm–year observations of US firms over the sample period 1992–2018 with required data for the regressions. The dependent variable is $r_{it} - R^B_{it}$, the annual excess stock return relative to the Fama and French (1993) 25 size and book-to-market portfolios. Δ indicates the change in the corresponding variable from year t − 1 to year t. ΔAlternative cash holdings is the difference between the realized change in cash holdings and the expected change in cash holdings. Following Faulkender and Wang (2006), we define three alternative measures of the expected change in cash holdings from year t − 1 to year t: (1) the average change in cash holdings of firms in the Fama and French (1993) 25 size and book-to-market benchmark portfolios over fiscal year t; (2) the predicted value of Almeida, Campello and Weisbach's (2004) regression specification I: $\Delta\text{Cash holdings}_{i,t} = \beta_0 + \beta_1\text{Cash flow}_{i,t-1} + \beta_2 Q_{i,t-1} + \beta_3\text{Size}_{i.t-1} + \text{Industry fixed effects} + \epsilon_{i,t}$; (3) the predicted value of Almeida, Campello and Weisbach's (2004) regression specification II with the additional explanatory variables Capital expenditures, Acquisitions, Change in net working capital and Change in short-term debt, all normalized by the lagged market value of assets. The coefficients of the year and Fama–French 48 industry fixed effects are suppressed for brevity in the respective columns. All variables are defined in Appendix A. Standard errors are clustered at the firm level. t-Statistics are reported in parentheses. *, ** and *** denote statistical significance at the 10%, 5% and 1% levels, respectively.

Table 4. Three cash regimes

	Servicing debt			Raising cash			Distributing cash		
Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
ΔCash holdings$_t$	0.410***	0.367***	0.318	1.357***	1.302***	2.018***	0.734***	0.739***	1.239***
	(4.753)	(4.105)	(0.987)	(16.369)	(15.753)	(15.934)	(19.085)	(18.853)	(17.937)
FSIS_OR$_t$	0.096***	0.081***	0.079***	0.038***	0.035***	0.034***	0.099***	0.103***	0.102***
	(3.728)	(2.883)	(2.798)	(3.048)	(2.743)	(2.718)	(17.693)	(17.924)	(17.858)
FSIS_OR$_t$ $\times$ ΔCash holdings$_t$	0.423*	0.420*	0.465*	0.747***	0.679***	0.622***	0.477***	0.474***	0.479***
	(1.717)	(1.693)	(1.840)	(5.122)	(4.749)	(4.416)	(5.812)	(5.784)	(5.943)
ΔEarnings$_t$	0.276***	0.254***	0.249***	0.662***	0.649***	0.649***	0.584***	0.590***	0.590***
	(4.679)	(4.226)	(4.145)	(9.591)	(9.457)	(9.448)	(20.769)	(20.750)	(20.855)
ΔNet assets$_t$	0.119***	0.124***	0.125***	0.346***	0.305***	0.323***	0.189***	0.195***	0.195***
	(3.619)	(3.167)	(3.227)	(9.264)	(8.141)	(8.692)	(13.800)	(14.211)	(14.497)
ΔR&D$_t$	0.277	−0.595	−0.631	0.653	1.214***	1.108***	−0.133	0.048	0.042
	(0.222)	(−0.466)	(−0.517)	(1.621)	(2.993)	(2.786)	(−0.512)	(0.183)	(0.162)
ΔInterest expenses$_t$	−1.750***	−1.125**	−1.150**	−2.239***	−2.008***	−1.544**	−2.365***	−2.035***	−2.009***
	(−3.878)	(−2.344)	(−2.434)	(−3.625)	(−3.225)	(−2.514)	(−8.221)	(−7.034)	(−7.000)
ΔDividends$_t$	1.043	1.018	0.972	0.784	0.951	0.682	2.488***	2.492***	2.468***
	(0.603)	(0.571)	(0.541)	(0.734)	(0.873)	(0.643)	(11.225)	(11.276)	(11.128)
Cash holdings$_{t-1}$	0.264***	0.269***	0.240***	0.377***	0.551***	0.570***	0.142***	0.170***	0.141***
	(6.392)	(5.019)	(4.606)	(6.076)	(8.396)	(8.877)	(8.746)	(9.497)	(7.521)
Leverage$_t$	−2.820***	−3.174***	−3.169***	−0.890***	−1.134***	−0.991***	−0.317***	−0.359***	−0.370***
	(−16.420)	(−16.137)	(−16.124)	(−21.707)	(−23.586)	(−20.904)	(−28.788)	(−29.596)	(−30.088)
Net financing$_t$	0.099*	0.106	0.100	−0.004	0.034	−0.033	−0.165***	−0.170***	−0.161***
	(1.683)	(1.572)	(1.481)	(−0.063)	(0.517)	(−0.518)	(−6.077)	(−6.279)	(−6.013)
Cash holdings$_{t-1}$ $\times$ ΔCash holdings$_t$			−0.410			−0.808**			−0.589***
			(−1.365)			(−2.247)			(−5.322)
Leverage$_{t-1}$ $\times$ ΔCash holdings$_t$			0.638			−3.198***			−1.184***
			(1.251)			(−9.508)			(−7.984)

Table 4. (Continued)

	Servicing debt			Raising cash			Distributing cash		
Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Constant	1.895***	2.146***	2.165***	0.085***	0.052	0.043	0.009***	0.054*	0.055*
	(15.315)	(12.287)	(12.450)	(6.639)	(0.529)	(0.454)	(2.608)	(1.786)	(1.823)
Observations	824	824	824	8,465	8,465	8,465	35,188	35,188	35,188
R^2-adjusted	0.513	0.565	0.567	0.217	0.251	0.264	0.154	0.177	0.181
Year fixed effects	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Industry fixed effects	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes

Source: This table reports the ordinary least squares regressions of excess stock returns on alternative proxies for the change in cash holdings, firm-specific investor sentiment, the interaction of the prior two variables and control variables after controlling for three cash regimes. We follow Halford *et al.* (2017) and define three cash regimes. Firms in the servicing debt regime have market leverage ratio in the top decile of all firms and do not raise or distribute cash, firms in the raising cash regime issue equity and do not pay dividends and firms in the distributing cash regime pay dividends or repurchase equity. The sample consists of firm–year observations of US firms over the sample period 1992–2018 with required data for the regressions. The dependent variable is $r_{it} - R_{it}^{B}$, the annual excess stock return relative to the Fama and French (1993) 25 size and book-to-market portfolios. Δ indicates the change in the corresponding variable from year $t - 1$ to year t. The coefficients of the year and Fama–French 48 industry fixed effects are suppressed for brevity in the respective columns. All variables are defined in Appendix A. Standard errors are clustered at the firm level. t-Statistics are reported in parentheses. *, ** and *** denote statistical significance at the 10%, 5% and 1% levels, respectively.

Additional controls

In this section, we further control for market sentiment, institutional ownership and corporate governance in our estimation of the value of cash. We add both the additional control variable and its interaction with the change in cash in our baseline regression, Equation (1). Table 5 presents the results. Columns with odd numbers present the coefficient estimates of the specification reported in column (4) of Table 2, and columns with even numbers present the coefficient estimates of the specification reported in column (5) of Table 2.

Bates, Chang and Chi (2018) find that MLIS is weakly positively related to the value of cash in the 1980s, slightly more positive in the 1990s, but not statistically significant in the 2000s. Similar to FSIS, MLIS can affect the aggregate market perceived value of future investment opportunities, and thus the value of cash. In addition, Gao, Ren and Zhang (2018) find that following periods of positive MLIS, the media and financial analysts produce more firm-specific information and institutional investors conduct more informed trading. Mian and Sankaraguruswamy (2012) also show that stock price sensitivity to good (bad) earnings news is higher (lower) during high MLIS periods than during periods of low sentiment. To mitigate the concern that the positive relation between FSIS and the value of cash is driven by the time-varying MLIS, we control for the states of MLIS. We adopt two market sentiment measures: Baker and Wurgler's (2006) Sentiment Index (BWI) and the University of Michigan's Consumer Sentiment Index (CSI).[12] We calculate BWI and CSI as the summation of their monthly index values over a fiscal year. Columns (1)–(4) of Table 5 show that the coefficients of $FSIS\_OR_t \times \Delta Cash\ holdings_t$ remain positive and statistically significant at the 1% level, suggesting that the time-series variation of MLIS cannot fully explain the positive relation between FSIS and the value of cash. The coefficients of $BWI_t \times \Delta Cash\ holdings_t$ are not statistically significant, while the coefficients of $CSI_t \times \Delta Cash\ holdings_t$ are positive and statistically significant at the 1% level.

[12]CSI data is from the Federal Reserve Economic Data (FRED) database. BWI data is available at Jeffrey Wurgler's website: http://people.stern.nyu.edu/jwurgler/.

To compare the impact of FSIS and MLIS on the value of cash, we standardize FSIS_OR, BWI and CSI by subtracting the mean and dividing by the standard deviation. First, we estimate the specifications in columns (2) and (4) of Table 5 by using the standardized sentiment variables. Second, we estimate these two specifications using quarterly data instead of annual data. Last, we estimate these two specifications using quarterly data and use sentiment variables measured in the most recent month before a fiscal quarter. The tabulated results in our Online Appendix show that the coefficient of $FSIS\_OR_t \times \Delta Cash\ holdings_t$ is greater than the coefficient of $BWI(or\ CSI)_t \times \Delta Cash\ holdings_t$, and the difference in the two coefficients is statistically significant at the 1% level. Our findings suggest that FSIS has explanatory power over and above MLIS for the value of cash.

Previous studies show that institutional monitoring and activism are positively associated with corporate governance (e.g. Gillan and Starks, 2000). Ward, Yin and Zeng (2018) also find that greater motivated monitoring institutional ownership is associated with a higher value of cash. On the other hand, according to Liu *et al.* (2019), institutional investors are less subject to sentimental biases relative to individual investors. If our FSIS proxy somehow captures the time-series and cross-sectional heterogeneity of firm institutional ownership, then the positive impact on the value of cash could be explained by institutional investor monitoring rather than FSIS. In order to mitigate this concern, we control for total institutional ownership (TIO) and motivated monitoring institutional ownership (MMIO) in our baseline regressions. TIO is defined as the percentage of outstanding shares held by institutional investors. MMIO is the ownership of institutional investors whose holding value in a firm ranked among the top 10% of stocks in their portfolios (Fich, Harford and Tran, 2015). Columns (5)–(8) of Table 5 show that the coefficients of $FSIS\_OR_t \times \Delta Cash\ holdings_t$ are all positive and statistically significant at the 1% level, suggesting that the positive relation between FSIS and the value of cash is not driven by institutional investor monitoring. Consistent with previous literature (e.g. Ward, Yin and Zeng, 2018), the coefficients of $TIO_t \times \Delta Cash\ holdings_t$ and $MMIO_t \times \Delta Cash\ holdings_t$ are positive and statistically significant.

Table 5. *Additional control variables*

	BWI		CSI		TIO		MMIO		G-Index		E-Index	
Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
ΔCash holdings$_t$	1.121***	1.885***	-0.443**	0.648***	0.947***	1.760***	0.982***	1.720***	1.647***	2.286***	1.609***	2.161***
	(33.464)	(34.733)	(−2.012)	(3.004)	(16.472)	(22.492)	(28.047)	(30.059)	(7.451)	(8.813)	(9.904)	(11.009)
FSIS_OR$_t$	0.093***	0.089***	0.093***	0.089***	0.087***	0.083***	0.084***	0.081***	0.137***	0.132***	0.174***	0.169***
	(22.384)	(21.775)	(22.242)	(21.662)	(20.525)	(19.939)	(20.214)	(19.619)	(9.187)	(8.934)	(12.284)	(12.058)
FSIS_OR$_t$ × ΔCash holdings$_t$	0.669***	0.592***	0.654***	0.588***	0.663***	0.599***	0.637***	0.575***	0.891***	0.895***	1.003***	1.033***
	(11.374)	(10.397)	(11.230)	(10.403)	(11.234)	(10.505)	(10.985)	(10.223)	(3.990)	(4.190)	(4.985)	(5.285)
BWI$_t$	0.046***	0.048***										
	(4.272)	(4.530)										
BWI$_t$ × ΔCash holdings$_t$	0.025	−0.014										
	(0.530)	(−0.315)										
CSI$_t$			−0.002***	−0.002***								
			(−2.823)	(−2.940)								
CSI$_t$ × ΔCash holdings$_t$			0.018***	0.014***								
			(7.002)	(5.627)								
TIO$_t$					0.142***	0.140***						
					(17.833)	(17.836)						
TIO$_t$ × ΔCash holdings$_t$					0.400***	0.225**						
					(4.026)	(2.253)						
MMIO$_t$							0.396***	0.397***				
							(33.488)	(34.148)				
MMIO$_t$ × ΔCash holdings$_t$							2.127***	1.730***				
							(8.198)	(6.740)				
G-Index$_t$									0.006***	0.006***		
									(4.203)	(4.216)		

Table 5. (Continued)

	BWI		CSI		TIO		MMIO		G-Index		E-Index	
Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
$G\text{-}Index_t \times \Delta Cash\ holdings_t$									−0.078***	−0.066***		
									(−3.370)	(−2.756)		
$E\text{-}Index_t$											0.007***	0.007***
											(2.654)	(2.608)
$E\text{-}Index_t \times \Delta Cash\ holdings_t$											-0.211***	−0.195***
											(−4.463)	(−4.053)
$Cash\ holdings_{t-1} \times \Delta Cash\ holdings_t$		−0.817***		−0.770***		−0.719***		−0.651***		−0.892***		−0.479*
		(−8.689)		(−8.235)		(−7.528)		(−6.977)		(−3.153)		(−1.940)
$Leverage_{t-1} \times \Delta Cash\ holdings_t$		−2.292***		−2.243***		−2.017***		−2.031***		−1.880***		−1.803***
		(−18.532)		(−18.330)		(−18.414)		(−18.736)		(−6.448)		(−6.318)
Constant	0.043*	0.038	0.222***	0.223***	0.014	0.010	0.026	0.021	0.020	0.016	0.044	0.041
	(1.776)	(1.530)	(3.672)	(3.703)	(0.643)	(0.454)	(1.045)	(0.831)	(0.435)	(0.339)	(1.316)	(1.199)
Observations	64,548	64,548	64,548	64,548	63,509	63,509	63,509	63,509	10,965	10,965	13,856	13,856
R^2-adjusted	0.199	0.211	0.200	0.212	0.204	0.215	0.217	0.229	0.189	0.198	0.193	0.200
Control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Source: This table reports the ordinary least squares regressions of excess stock returns on the change in cash holdings, firm-specific investor sentiment, the interaction of the prior two variables, and control variables after controlling for market sentiment, institutional ownership and corporate governance. The sample consists of firm–year observations of US firms over the sample period 1992–2018 with required data for the regressions. The dependent variable is $r_{it} - R^B_{it}$, the annual excess stock return relative to the Fama and French (1993) 25 size and book-to-market portfolios. Δ indicates the change in the corresponding variable from year t − 1 to year t. In columns (1) and (2), BWI is the summation of monthly market-level sentiment measured by Baker and Wurgler's (2006) Sentiment Index over a fiscal year. In columns (3) and (4), CSI is the summation of monthly market-level sentiment measured by the University of Michigan's Consumer Sentiment Index over a fiscal year. In columns (5) and(6), TIO is the total institutional ownership. In columns (7) and (8), MMIO is the motivated monitoring institutional ownership defined in Fich, Harford and Tran (2015). In columns (9) and (10), G-Index is the Gompers, Ishii and Metrick (2003) entrenchment index. In columns (11) and (12), E-Index is the Bebchuk, Cohen and Ferrell (2009) entrenchment index. Columns with odd numbers present the coefficient estimates of the specification reported in column (4) of Table 2, and columns with even numbers present the coefficient estimates of the specification reported in column (5) of Table 2. The coefficients of the control variables, year fixed effects and Fama–French 48 industry fixed effects are suppressed for brevity in the respective columns. All variables are defined in Appendix A. Standard errors are clustered at the firm level. t-Statistics are reported in parentheses. *, ** and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

Dittmar and Mahrt-Smith (2007) document a positive relation between corporate governance and the value of cash in their US sample. Kalcheva and Lins (2007) and Pinkowitz, Stulz and Williamson (2006) also provide international evidence that shareholder protection is related to corporate cash policy. To attenuate the potential omitted variable bias due to the possibility that firms with better corporate governance may attract more investor attention and have a higher value of cash, we control for two corporate governance entrenchment indexes in our baseline regressions: the G-Index proposed by Gompers, Ishii and Metrick (2003) and the E-Index proposed by Bebchuk, Cohen and Ferrell (2009). Since the ISS stops reporting G-Index values after 2007, we follow Li and Li (2018) and extrapolate a firm's G-Index values after 2007 from its last G-Index value reported in the ISS. E-Index is the managerial entrenchment index composed of the six most important anti-takeover provisions from the 24 provisions included in the G-Index. A higher value of these two indexes indicates more managerial entrenchment and thus represents weaker corporate governance. It is worth noting that the number of firm–year observations falls substantially after controlling for corporate governance. Columns (9)–(12) of Table 5 show that the coefficients of $\text{FSIS\_OR}_t \times \Delta\text{Cash holdings}_t$ are all positive and statistically significant at the 1% level, suggesting that the positive relation between FSIS and the value of cash remains robust to the inclusion of corporate governance variables. The coefficients of $\text{G-Index}_t \times \Delta\text{Cash holdings}_t$ and $\text{E-Index}_t \times \Delta\text{Cash holdings}_t$ are negative and statistically significant, consistent with Dittmar and Mahrt-Smith's (2007) finding that the value of cash significantly increases with good corporate governance.

Cross-sectional analyses

In this section, we investigate potential mechanisms through which FSIS has a positive impact on the value of cash. Specifically, we examine whether the impact of FSIS on the value of cash exhibits cross-sectional variations with the following five sets of firm-level variables: growth opportunities, investment, innovation, information asymmetry and stock liquidity. We extend our baseline regression:

$$\begin{aligned} r_{i,t} - R^{B}_{i,t} = {} & \beta_0 + \beta_1 \Delta\text{Cash holdings}_{i,t} \\ & + \beta_2 \text{FSIS\_OR}_{i,t} + \beta_3 \text{FSIS\_OR}_{i,t} \\ & \times \Delta\text{Cash holdings}_{i,t} + \beta_4 \text{HighX}_{i,t} \\ & + \beta_5 \text{HighX}_{i,t} \times \text{FSIS\_OR}_{i,t} \\ & + \beta_6 \text{HighX}_{i,t} \times \Delta\text{Cash holdings}_{i,t} \\ & + \beta_7 \text{HighX}_{i,t} \times \text{FSIS\_OR}_{i,t} \\ & \times \Delta\text{Cash holdings}_{i,t} + B \\ & \times \text{Control Variables}_{i,t} + \epsilon_{i,t} \end{aligned} \quad (6)$$

where HighX represents an indicator variable that equals one if the firm-level variable X is above its annual sample median and zero otherwise. The coefficient of the three-way interaction term $\text{HighX}_t \times \text{FSIS\_OR}_t \times \Delta\text{Cash holdings}_t$ indicates the impact of X on the relation between FSIS and the value of cash. We tabulate the results of our cross-sectional analyses in Table 6.

First, previous studies show that stocks with high growth opportunities are more exposed to investor sentiment (e.g. Baker and Wurgler, 2006; Stambaugh, Yu and Yuan, 2012). If the increase in the value of cash associated with high FSIS is due to the reason that investors tend to overvalue firm future growth opportunities, we should observe a greater impact of FSIS on the value of cash for firms with more future growth opportunities. In columns (1) and (2), we adopt two indicator variables for high growth opportunities: HighPE (price-to-earnings ratio) and HighTBQ (Tobin's Q). The coefficients of the three-way interaction terms are positive and statistically significant, which is consistent with the notion that high sentiment may lead to a high valuation of firms' future cash flows, therefore the market investor perceived value of cash is higher for firms with more future growth opportunities.

Second, Denis and Sibilkov (2010) show that the differential value of cash is related to corporate investment policy. Arif and Lee (2014) also find that corporate investments peak during periods of positive investor sentiment. To examine the impact of corporate investment on our finding, we employ two indicator variables for high corporate investment: HighAG (asset growth rate) and

Table 6. Cross-sectional analyses

	Growth opportunities		Investment		Innovation		Information asymmetry		Liquidity	
X=	PE	TBQ	AG	CAPEX	RD	PATENT	IAI	REM	LIQ	VOL
Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
ΔCash holdings$_t$	1.653***	1.281***	1.605***	1.781***	1.852***	1.891***	1.688***	1.611***	1.800***	1.661***
	(29.569)	(21.788)	(26.232)	(32.160)	(20.825)	(3.702)	(20.860)	(22.321)	(30.950)	(29.889)
FSIS_OR$_t$	0.054***	0.041***	0.065***	0.081***	0.092***	0.075	0.063***	0.090***	0.071***	0.082***
	(11.417)	(9.835)	(13.097)	(15.068)	(11.961)	(1.155)	(7.029)	(13.254)	(15.311)	(17.427)
FSIS_OR$_t$ $\times$ ΔCash holdings$_t$	0.485***	0.224***	0.255***	0.463***	0.331***	0.063	0.310**	0.480***	0.470***	0.321***
	(7.801)	(3.776)	(3.500)	(6.716)	(3.278)	(0.108)	(2.547)	(5.270)	(7.360)	(4.735)
HighX_t	0.154***	0.243***	0.076***	0.024***	−0.049***	−0.000	0.018***	0.006	0.053***	0.015***
	(41.066)	(55.576)	(17.113)	(5.844)	(−7.095)	(−0.003)	(4.066)	(1.238)	(14.304)	(4.020)
HighX_t $\times$ FSIS_OR$_t$	0.097***	0.065***	0.032***	0.017**	−0.010	0.088	0.036***	0.017*	0.039***	0.005
	(11.373)	(7.937)	(3.863)	(2.046)	(−0.982)	(1.316)	(3.276)	(1.817)	(3.837)	(0.534)
HighX_t $\times$ ΔCash holdings$_t$	0.442***	0.753***	0.150***	0.254***	0.356***	0.422	0.369***	0.338***	0.130**	0.377***
	(7.613)	(12.098)	(2.695)	(4.696)	(4.612)	(0.839)	(5.434)	(5.304)	(2.207)	(6.469)
HighX_t $\times$ FSIS_OR$_t$ $\times$ ΔCash holdings$_t$	0.278***	0.442***	0.387***	0.197**	0.290***	1.013**	0.314***	0.316***	0.252**	0.296***
	(2.916)	(4.529)	(4.382)	(2.263)	(2.829)	(1.962)	(2.976)	(2.982)	(2.084)	(3.002)
Observations	64,239	64,439	64,457	63,841	39,691	12,877	49,217	51,461	64,442	64,441
R^2-adjusted	0.238	0.259	0.216	0.213	0.218	0.243	0.223	0.210	0.214	0.213
Control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Source: This table reports the results of our cross-sectional analyses of Equation (6). We extend the specification reported in column (5) of Table 2 by adding HighX_t, HighX_t $\times$ FSIS_OR$_t$, HighX_t $\times$ ΔCash holdings$_t$ and HighX_t $\times$ FSIS_OR$_t$ $\times$ ΔCash holdings$_t$, where X represents an indicator variable that equals one if a firm-level variable is above its annual sample median and zero otherwise. In columns (1) and (2), the indicator variables for high growth opportunities are HighPE (price-to-earnings ratio) and HighTBQ (Tobin's Q). In columns (3) and (4), the indicator variables for high investment are HighAG (asset growth rate) and HighCAPEX (the ratio of capital expenditure to total assets). In columns (5) and (6), the indicator variables for high innovation are HighRD (R&D expenses) and HighPATENT (patent numbers). In columns (7) and (8), the indicator variables for high information asymmetry are HighIAI (information asymmetry index) and HighREM (real earnings management). In columns (9) and (10), the indicator variables for stock liquidity are HighLIQ (the inverse of Amihud's (2002) illiquidity) and HighVOL (stock trading volume). The coefficients of the control variables, year fixed effects and Fama–French 48 industry fixed effects are suppressed for brevity in the respective columns. All variables are defined in Appendix A. Standard errors are clustered at the firm level. t-Statistics are reported in parentheses. *, ** and *** denote statistical significance at the 10%, 5% and 1% levels, respectively.

HighCAPEX (the ratio of capital expenditure to total assets). In columns (3) and (4), the coefficients of the three-way interaction terms are positive and statistically significant, suggesting that the positive relation between FSIS and the value of cash is stronger for firms with larger investment.

Third, Dang and Xu (2018) document a sentiment spillover channel whereby investor sentiment has a positive effect on corporate innovation activities through influencing manager sentiment. Since corporate innovation activities may lead investors to re-evaluate the importance of cash balances, we should observe a stronger relation between FSIS and the marginal of cash for firms with more innovation activities. We adopt two indicator variables for high innovation: HighRD (R&D expenses) and HighPATENT (patent numbers). In columns (5) and (6), the coefficients of the three-way interaction terms are positive and statistically significant, suggesting that investors appear to have a favourable belief in the ability of firms with more innovation activities to use internal cash reserves.

Fourth, it is difficult for investors to estimate the value of a firm's stocks when the firm has a high degree of information asymmetry. The behavioral finance literature suggests that retail investor sentiment may lead to the overvaluation of hard-to-value stocks (e.g. Baker and Wurgler, 2006; Stambaugh, Yu and Yuan, 2012). We adopt two indicator variable proxies for information asymmetry between firms and investors: HighIAI (information asymmetry index) and HighREM (real earnings management). In columns (7) and (8), the coefficients of the three-way interaction terms are positive and statistically significant, suggesting that information asymmetry increases the sensitivity of FSIS to the value of cash.

Fifth, we study the effect of FSIS on the value of cash separately for liquid and illiquid stocks. We employ the two indicator variables for high stock liquidity: HighLIQ (−1 times Amihud's (2002) illiquidity) and HighVOL (stock trading volume). In columns (9) and (10), the coefficients of the three-way interaction terms are positive and statistically significant, suggesting that the positive relation between FSIS and the value of cash increases with respect to stock liquidity.

Taken together, these results suggest that the positive relation between FSIS and the value of cash is more prominent for firms with more future growth opportunities, larger investment, more innovation activities, higher information asymmetry and more liquid stocks.

Sentiment, firm overvaluation and value of cash

In our empirical tests, we adopt Faulkender and Wang's (2006) framework to estimate the market value of cash by regressing the change in firm market value on various changes in firm policy, which do not include the potential misvaluation in firm value. Previous studies on investor sentiment suggest that stock misvaluation caused by investor sentiment is stronger for firms that are subject to arbitrage restrictions or difficult to value (e.g. Baker and Wurgler, 2006, 2007). Although we have shown that the empirical relation between FSIS and the value of cash does not vary with short-sale constraints and dispersion of investor opinion, other factors that cause overall firm misvaluation may still affect the estimated market value of cash holdings. To mitigate the concern that the positive relation between FSIS and the value of cash is only a side effect of sentiment-driven firm overvaluation, we adopt the following two empirical tests.

First, we directly control for stock overvaluation in Faulkender and Wang's (2006) framework. We measure stock overvaluation by MTB spread, the gap between a firm's market-to-book value ratio and the mean value of the ratio in the industry. In column (1) of Table 7, we augment the specification reported in column (5) of Table 2 with MTB spread. The coefficient of $\text{FSIS\_OR}_t \times \Delta\text{Cash holdings}_t$ remains positive and statistically significant at the 1% level. After directly controlling for the impact of firm overvaluation on stock excess returns, a one-standard-deviation increase in FSIS_OR is associated with a \$0.31 (= 0.555 × 0.560) increase in the value of cash. In column (2) of Table 7, we further add the interaction of MTB spread and ΔCash holdings, which captures the impact of firm overvaluation on the value of cash. After adjusting for firm overvaluation and its impact on the value of cash, our main result remains robust. A one-standard-deviation increase in FSIS_OR is associated with a \$0.23 (= 0.409 × 0.560) increase in the value of cash. Although the increase in the value of cash associated with FSIS drops from \$0.33 (column (5) of Table 2) to \$0.23, around 70% (= 0.23/0.33) of the increase is not explained by overall firm overvaluation.

Table 7. Sentiment, firm overvaluation and the value of cash

Variables	(1)	(2)
ΔCash holdings$_t$	1.828***	1.760***
	(36.856)	(38.799)
FSIS_OR$_t$	0.067***	0.065***
	(17.163)	(16.944)
FSIS_OR$_t$ $\times$ ΔCash holdings$_t$	0.555***	0.409***
	(10.624)	(8.182)
MTB spread$_t$	0.118***	0.109***
	(34.476)	(32.784)
MTB spread$_t$ $\times$ ΔCash holdings$_t$		0.582***
		(16.185)
Constant	−0.053**	−0.046*
	(−2.051)	(−1.872)
Observations	64,548	64,548
R-squared	0.293	0.309
Control variables	Yes	Yes
Year fixed effects	Yes	Yes
Industry fixed effects	Yes	Yes

Source: This table reports the ordinary least squares regressions of excess stock returns on the change in cash holdings, firm-specific investor sentiment, the interaction of the prior two variables and control variables after controlling for firm overvaluation. The sample consists of firm–year observations of US firms over the sample period 1992–2018 with required data for the regressions. The dependent variable is $r_{it} - R^B_{it}$, the annual excess stock return relative to the Fama and French (1993) 25 size and book-to-market portfolios. Δ indicates the change in the corresponding variable from year t − 1 to year t. MTB spread is the difference between a firm's market-to-book value ratio and the mean value of the ratio in the industry. In column (1), we augment the specification reported in column (5) of Table 2 with MTB spread. In column (2), we augment the specification reported in column (5) of Table 2 with MTB spread and the interaction of FSIS_OR and MTB spread. Control variables in columns (1) and (2) are the same as those included in the specification reported in column (5) of Table 2. The coefficients of the control variables, year fixed effects and Fama–French 48 industry fixed effects are suppressed for brevity in the respective columns. All variables are defined in Appendix A. Standard errors are clustered at the firm level. t-Statistics are reported in parentheses. *, ** and *** denote statistical significance at the 10%, 5% and 1% levels, respectively.

Second, if the positive impact of FSIS on the value of cash is merely one aspect of firm assets' overvaluation caused by high FSIS, then we naturally expect that the market perceived value of other types of firm assets will also increase with FSIS. In Faulkender and Wang's (2006) framework, total assets is decomposed into Cash holdings and Net assets. We augment the specification reported in column (5) of Table 2 with the interaction of FSIS_OR and Net assets. The coefficient of FSIS_OR$_t$ $\times$ ΔNet assets$_t$ can be interpreted as the impact of FSIS on the market perceived value of Net assets. Column (1) of Table 8 shows that the coefficient of FSIS_OR$_t$ $\times$ ΔCash holdings$_t$ is 0.590 and the coefficient of FSIS_OR$_t$ $\times$ ΔNet assets$_t$ is 0.055. Both of them are statistically significant at the 1% level. A one-standard-deviation increase in FSIS_OR is associated with a \$0.33 (= 0.590 $\times$ 0.560) increase in the value of cash, but only a \$0.03 (= 0.055 $\times$ 0.560) increase in the marginal value of Net assets. To provide more economic insights on our findings, we further decompose Net assets into Non-cash current assets and Non-current assets. Column (2) of Table 8 shows that the coefficients of FSIS_OR$_t$ $\times$ ΔCash holdings$_t$ and FSIS_OR$_t$ $\times$ ΔNon-cash current assets$_t$ are positive and statistically significant, while the coefficient of FSIS_OR$_t$ $\times$ ΔNon-current assets$_t$ is statistically insignificant. In column (3) of Table 8, we decompose Non-cash current assets into Inventories, Receivables and Other current assets. In column (4) of Table 8, we decompose Non-current assets into Property, plant and equipment, Investment & advances, Intangible assets, and Other non-current assets.[13] We find that FSIS only has a positive impact on the value of cash holdings, receivables, other current assets and intangible assets. Our results suggest that the positive relation between FSIS and the value of cash is not a simple reflection of sentiment-driven firm overvaluation.

Robustness tests and further discussions

Alternative measures of firm-specific investor sentiment

Recent studies show mixed evidence in the suitability of overnight returns as a FSIS measure in international equity markets. Weißofner and Wessels (2020) confirm the validity of overnight returns as a FSIS measure in 20 developed non-US equity markets. However, Xiong *et al.* (2020) suggest that overnight returns may not be a satisfactory proxy for FSIS outside the US stock market.[14] Although

[13]Our classification follows the data variable definition in Compustat.

[14]Among six G7 countries (excluding the United States) and five Asia-Pacific countries (New Zealand, Singapore, Austria, China and India), overnight returns possess three characteristics expected of a sentiment measure only in the Chinese stock market: (i) short-term persistence; (ii) persistence more pronounced for difficult-to-value stocks; and (iii) long-run reversal.

Table 8. Sentiment and the valuation of different firm assets

Variables	(1)	(2)	(3)	(4)
ΔCash holdings$_t$	1.874***	1.754***	1.720***	1.759***
	(35.207)	(32.924)	(32.224)	(32.736)
FSIS_OR$_t$	0.088***	0.087***	0.088***	0.089***
	(21.517)	(20.821)	(21.177)	(21.369)
FSIS_OR$_t$ $\times$ ΔCash holdings$_t$	0.590***	0.568***	0.564***	0.575***
	(10.461)	(9.955)	(9.920)	(10.110)
ΔNet assets$_t$	0.254***			
	(22.957)			
FSIS_OR$_t$ $\times$ ΔNet assets$_t$	0.055***			
	(4.328)			
ΔNon-cash current assets$_t$		0.304***		
		(6.440)		
FSIS_OR$_t$ $\times$ ΔNon-cash current assets$_t$		0.100**		
		(2.222)		
ΔInventories$_t$			0.266***	0.245***
			(4.042)	(3.774)
FSIS_OR$_t$ $\times$ ΔInventories$_t$			0.036	0.031
			(0.572)	(0.496)
ΔReceivables$_t$			0.327***	0.283***
			(5.900)	(5.021)
FSIS_OR$_t$ $\times$ ΔReceivables$_t$			0.110**	0.098**
			(2.255)	(2.058)
ΔOther current assets$_t$			0.206***	0.220***
			(3.954)	(4.808)
FSIS_OR$_t$ $\times$ ΔOther current assets$_t$			−0.020	−0.002
			(−0.305)	(−0.041)
ΔNon-current assets$_t$		0.008	−0.034*	
		(0.570)	(−1.673)	
FSIS_OR$_t$ $\times$ ΔNon-current assets$_t$		0.016	0.022	
		(1.108)	(1.532)	
ΔProperty, plant and equipment$_t$				0.073***
				(3.605)
FSIS_OR$_t$ $\times$ ΔProperty, plant and equipment$_t$				−0.026
				(−1.083)
ΔInvestment & advances$_t$				−0.174**
				(−2.044)
FSIS_OR$_t$ $\times$ ΔInvestment & advances$_t$				−0.016
				(−0.369)
ΔIntangible assets$_t$				0.036*
				(1.919)
FSIS_OR$_t$ $\times$ ΔIntangible assets$_t$				0.068**
				(2.366)
ΔOther non-current assets$_t$				0.061
				(1.303)
FSIS_OR$_t$ $\times$ ΔOther non-current assets$_t$				0.020
				(0.329)
Constant	0.060**	0.065***	0.070***	0.068***
	(2.467)	(2.729)	(2.948)	(2.903)
Observations	64,548	64,355	64,355	64,355
R^2-adjusted	0.211	0.207	0.205	0.207
Control variables	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes

Source: This table reports the ordinary least squares regressions of excess stock returns on the change in different types of firm assets, firm-specific investor sentiment, the interaction of the prior two variables and control variables. The sample consists of firm–year observations of US firms over the sample period 1992–2018 with required data for the regressions. The dependent variable is $r_{it} - R^B_{it}$, the annual excess stock return relative to the Fama and French (1993) 25 size and book-to-market portfolios. Δ indicates the change

Table 8. (Continued)

in the corresponding variable from year t − 1 to year t. In column (1), we augment the specification reported in column (5) of Table 2 with the interaction of FSIS_OR and the change in Net assets. In column (2), we decompose Net assets into Non-cash current assets and Non-current assets. In column (3), we further decompose Non-cash current assets into Inventories, Receivables and Other current assets. In column (4), we further decompose Non-current assets into Property, plant and equipment, Investment & advances, Intangible assets and Other non-current assets. Control variables in columns (1)–(4) are the same as those included in the specification reported in column (5) of Table 2, except for ΔNet assets. The coefficients of all the control variables, year and Fama–French 48 industry fixed effects are suppressed for brevity in the respective columns. All variables are defined in Appendix A. Standard errors are clustered at the firm level. t-Statistics are reported in parentheses. *, ** and *** denote statistical significance at the 10%, 5% and 1% levels, respectively.

Table 9. Alternative measures of firm-specific investor sentiment

	1993–2000		1993–2018	2004–2018	2002–2018
Variables	(1)	(2)	(3)	(4)	(5)
ΔCash holdings$_t$	2.171***	2.180***	2.017***	−0.094	0.962***
	(27.155)	(26.478)	(42.865)	(−0.165)	(14.375)
FSIS_SOIB$_t$	0.535***				
	(16.339)				
FSIS_SOIB$_t$ × ΔCash holdings$_t$	1.758***				
	(3.797)				
FSIS_OIB$_t$		0.943***	0.999***		
		(30.465)	(43.625)		
FSIS_OIB$_t$ × ΔCash holdings$_t$		1.821***	1.116***		
		(4.408)	(4.387)		
FSIS_CSS$_t$				3.072***	
				(23.210)	
FSIS_CSS$_t$ × ΔCash holdings$_t$				2.552**	
				(2.223)	
FSIS_ECS$_t$					0.014***
					(22.488)
FSIS_ECS$_t$ × ΔCash holdings$_t$					0.040***
					(5.006)
Constant	0.104**	0.127**	0.126***	−1.607***	−0.123***
	(1.981)	(2.279)	(3.832)	(−20.646)	(−3.295)
Observations	28,465	28,512	81,947	26,024	36,703
R^2-adjusted	0.246	0.263	0.236	0.211	0.225
Control variables	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes	Yes

Source: This table reports the ordinary least squares regressions of excess stock returns on the change in cash holdings, alternative measures of firm-specific investor sentiment, the interaction of the prior two variables and control variables. The dependent variable is $r_{it} - R^B_{it}$, the annual excess stock return relative to the Fama and French (1993) 25 size and book-to-market portfolios. Δ indicates the change in the corresponding variable from year t − 1 to year t. FSIS_SOIB is the order imbalance of noise traders. FSIS_OIB is the order imbalance of all traders. FSIS_CSS is the news-based sentiment measure. FSIS_ECS is the sentiment measure based on the tone of earnings conference call transcripts. The sample period of the regression in each column is indicated at the top of the table. Control variables in columns (1)–(5) are the same as those included in the specification reported in column (5) of Table 2. The coefficients of all the control variables, year and Fama–French 48 industry fixed effects are suppressed for brevity in the respective columns. All variables are defined in Appendix A. Standard errors are clustered at the firm level. t-Statistics are reported in parentheses. *, ** and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

Xiong *et al.* (2020) do not challenge the validity of overnight returns as a sentiment measure in the US stock market, we check the robustness of the empirical relation between FSIS and the value of cash in our US sample, using three alternative measures of FSIS. First, we adopt order imbalance, FSIS_OIB and FSIS_SOIB. The small order imbalance FSIS_SOIB, constructed by trades with less than $10,000 value over the period 1993–2000, is a relatively precise proxy for firm-specific retail

Table 10. Mitigating endogeneity concerns: high-dimensional fixed effects model

Variables	(1)	(2)	(3)	(4)
ΔCash holdings$_t$	0.979***	1.886***	0.926***	1.787***
	(47.098)	(53.194)	(45.121)	(51.104)
FSIS_OR$_t$	0.126***	0.120***	0.116***	0.110***
	(30.619)	(29.489)	(28.228)	(27.175)
FSIS_OR$_t$ $\times$ ΔCash holdings$_t$	0.851***	0.771***	0.777***	0.704***
	(20.712)	(18.912)	(19.196)	(17.508)
Constant	−0.020***	−0.029***	−0.019***	−0.027***
	(−10.581)	(−15.227)	(−10.492)	(−14.935)
Observations	63,262	63,262	63,257	63,257
R^2-adjusted	0.257	0.270	0.309	0.321
Control variables	Yes	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	No	No
Industry $\times$ Year fixed effects	No	No	Yes	Yes

Source: This table reports the high-dimensional fixed effects regressions of excess stock returns on the change in cash holdings, firm-specific investor sentiment, the interaction of the prior two variables and control variables. The sample consists of firm–year observations of US firms over the sample period 1992–2018 with required data for the regressions. The dependent variable is $r_{it} - R^B_{it}$, the annual excess stock return relative to the Fama and French (1993) 25 size and book-to-market portfolios. Δ indicates the change in the corresponding variable from year t − 1 to year t. Following Gormley and Matsa (2014), we use the high-dimensional fixed effects model to control for unobserved firm characteristics. In columns (1) and (2), we control for the firm and year fixed effects. In columns (3) and (4), we control for the firm and interacted industry–year fixed effects. Control variables in columns (1) and (3) are the same as those included in the specification reported in column (4) of Table 2, and control variables in columns (2) and (4) are the same as those included in the specification reported in column (5) of Table 2. The coefficients of the control variables and fixed effects are suppressed for brevity. All variables are defined in Appendix A. Standard errors are clustered at the firm level. t-Statistics are reported in parentheses. *, ** and *** denote statistical significance at the 10%, 5% and 1% levels, respectively.

investor sentiment (Yuan, 2015). Second, we adopt a news-based sentiment measure, FSIS_CSS, constructed by the data on RavenPack News Analytics. Third, we use a sentiment measure based on the tone of earnings conference call transcripts, FSIS_ECS.

Columns (1) and (2) of Table 9 report the results using small trade order imbalance (FSIS_SOIB) and order imbalance (FSIS_OIB) as the proxy for FSIS over the sample period 1993–2000. In column (3), we use FSIS_OIB but extend the sample period to 1993–2018. In column (4), we use FSIS_CSS over the sample period 2004–2018. In column (5), we use FSIS_ECS over the sample period 2002–2018. The specification in Table 9 is the same as in column (5) of Table 2. Table 9 shows that the coefficients of the interaction terms, FSIS$_t$ $\times$ ΔCash holdings$_t$, are positive and statistically significant at the 1% or 5% level. Our results remain robust for the alternative measures of FSIS.[15]

[15]We also replace the alternative measures of FSIS by ΔFSIS. The tabulated results in our Online Appendix show that the coefficient of ΔFSIS_CSS$_t$ $\times$ ΔCash holdings$_t$ is not statistically significant and the coefficient of ΔFSIS_ECS$_t$ $\times$ ΔCash holdings$_t$ is statistically significant only at the 10% level, suggesting that the positive impact of the change in the news-based and earnings-conference-call-transcript-based sentiment measures on the value of cash is relatively weak over the period 2002–2018.

Endogeneity

Our empirical analyses may be subject to the endogeneity bias due to unobservable firm characteristics affecting both FSIS and the value of cash. Furthermore, previous literature has shown that the value of cash is associated with many firm characteristics and managerial traits. It is not feasible for us to control for all of them in our empirical tests.

First, we employ Oster's (2019) method to investigate the importance of unobservable variables. In column (5) of Table 2, our baseline regression shows that the coefficient of FSIS_OR$_t$ $\times$ ΔCash holdings$_t$ is 0.592 and the R^2 of the regression is 0.210. Following the identification method proposed by Oster (2019), we use Stata code psacalc to calculate the estimation bounds. We assume that the observed and unobserved factors have an

Table 11. Mitigating endogeneity concerns: change in firm-specific investor sentiment

Variables	(1)	(2)	(3)
ΔCash holdings$_t$	1.107***	1.116***	1.886***
	(32.133)	(32.070)	(32.071)
ΔFSIS_OR$_t$	0.087***	0.089***	0.087***
	(21.128)	(21.795)	(21.402)
ΔFSIS_OR$_t$ × ΔCash holdings$_t$	0.185***	0.177***	0.170***
	(3.713)	(3.544)	(3.550)
Constant	0.030***	0.018	0.016
	(9.363)	(0.734)	(0.636)
Observations	58,108	58,108	58,108
R^2-adjusted	0.176	0.189	0.201
Control variables	Yes	Yes	Yes
Year fixed effects	No	Yes	Yes
Industry fixed effects	No	Yes	Yes

Source: This table reports the ordinary least squares regressions of excess stock returns on the change in cash holdings, change in firm-specific investor sentiment, the interaction of the prior two variables and control variables. The sample consists of firm–year observations of US firms over the sample period 1992–2018 with required data for the regressions. The dependent variable is $r_{it} - R^B_{it}$, the annual excess stock return relative to the Fama and French (1993) 25 size and book-to-market portfolios. Δ indicates the change in the corresponding variable from year t − 1 to year t. Control variables in columns (1)–(3) are the same as those included in the specifications reported in columns (3)–(5) of Table 2. The coefficients of all the control variables, year and Fama–French 48 industry fixed effects are suppressed for brevity in the respective columns. All variables are defined in Appendix A. Standard errors are clustered at the firm level. t-Statistics are reported in parentheses. *, ** and *** denote statistical significance at the 10%, 5% and 1% levels, respectively.

equally important effect on the coefficient of interest ($\delta = 1$). We also define the R_{max} upper bound as 1.3 times the R^2 (0.210) in column (5) of Table 2 that controls for all observables. R_{max} specifies the maximum R^2 which would result if all unobservables were included in our baseline regression. The estimation bounds are (0.402,0.592), which show very limited movement in the coefficient and do not include zero. We also estimate Oster's delta, which indicates the degree of selection on unobservables relative to observables that would be required to fully explain our result by omitted variable bias. According to Oster (2019), high delta values indicate that the unobservables have less effect on the coefficient of interest than the observables. We find that Oster's delta is equal to 2.96, which is reassuring. It is very unlikely that unobservables are almost three times as important as all observables included in our baseline regression.

To further mitigate the potential endogeneity concern due to unobserved heterogeneity, we follow Gormley and Matsa's (2014) advice and adopt a high-dimensional fixed effects model.[16] In columns (1) and (2) of Table 10, we estimate the specifications reported in columns (4) and (5) of Table 2 with the firm and year fixed effects. In columns (3) and (4) of Table 10, we estimate the specifications reported in columns (4) and (5) of Table 2 with the firm and year×industry fixed effects, which control for unobserved time-invariable firm characteristics and time-varying industry effects. The estimated coefficients of FSIS_OR$_t$ × ΔCash holdings$_t$ are all positive and statistically significant at the 1% level. Columns (1)–(4) imply that a one-standard-deviation increase in FSIS_OR is associated with \$0.29 (= 0.520 × 0.560) to \$0.35 (= 0.627 × 0.560) higher value of cash. The positive effect of FSIS on the value of cash remains both statistically and economically significant after controlling for unobserved firm characteristics.

Another cause of endogeneity is simultaneity, where the explanatory variable is jointly determined with the dependent variable. Similar to most of the value of cash studies using Faulkender and Wang's (2006) empirical framework, we measure both the explanatory variable of interest FSIS_OR and the dependent variable excess returns in year t. An alternative explanation of our main finding is that firms with a higher value of cash might attract more investors with high sentiment, leading to higher contemporaneous FSIS. To mitigate the

[16]Refer to Gormley and Matsa (2014) for the benefits and limitations of high-dimensional fixed effect models.

potential endogeneity due to the simultaneity between FSIS and the value of cash, we repeat our baseline analysis after replacing $FSIS\_OR_t$ with $\Delta FSIS\_OR_t$, the change in FSIS from year $t-1$ to year t. Table 11 presents the results. Columns (1)–(3) of Table 11 are the specifications reported in columns (3)–(5) of Table 2. We find that the coefficients on the interaction term, $\Delta FSIS\_OR_t \times \Delta Cash\ holdings_t$, are positive and statistically significant at the 1% level.

We also repeat our analyses in Tables 3, 4, 5 and 9 after replacing FSIS by ΔFSIS. We tabulate these results in our Online Appendix. We find that the coefficients of the interaction terms, $\Delta FSIS_t \times \Delta Cash\ holdings_t$, are mainly positive and statistically significant. In the replication of Table 4, the coefficients of $\Delta FSIS\_OR_t \times \Delta Cash\ holdings_t$ are positive and statistically significant in the raising cash and distributing cash regimes, but are statistically insignificant in the servicing debt regime. According to the definitions of our three ex-post cash regimes, firms in the raising cash and distributing cash regimes are more likely to have better future growth opportunities, larger investment and more innovation activities. Consistent with the results of our cross-sectional analyses, the impact of FSIS on the value of cash is more prominent in these two cash regimes. Furthermore, the number of firm–year observations in the servicing debt regime is much smaller than those in the other two regimes. Therefore, the small sample size in the servicing debt regime may reduce the power of our regressions, leading to statistically insignificant coefficients. In the replication of Table 9, the coefficient of $\Delta FSIS\_CSS_t \times \Delta Cash\ holdings_t$ is not statistically significant in column (4) and the coefficient of $\Delta FSIS\_ECS_t \times \Delta Cash\ holdings_t$ is statistically significant only at the 10% level in column (5). We acknowledge that the positive impact of the change in the news-based and earnings-conference-call-transcript-based sentiment measures on the value of cash is relatively weak over the period 2002–2018.

Overall, it is unlikely that our inferences are driven by the potential endogeneity due to omitted variables and simultaneity.

Further discussions

Does the impact of sentiment on the value of cash change over time?. Bates, Chang and Chi (2018) find that the impact of MLIS on the value of cash changes over time. MLIS is weakly positively related to the value of cash in the 1980s and 1990s, but such positive relation disappears in the 2000s. In the previous sections, we have shown that the impact of FSIS on the value of cash is robust after controlling for MLIS. Following the spirit of Bates, Chang and Chi (2018), we divide our sample into three time periods: 1992–1999, 2000–2009 and 2010–2018. The first two time periods overlap with the last two examined in Bates, Chang and Chi (2018). Using the specifications reported in column (5) of Table 2, the tabulated results in our Online Appendix suggest that the coefficients of $FSIS\_OR_t \times \Delta Cash\ holdings_t$ are all positive and statistically significant at the 1% level over these three time periods. Seemingly unrelated estimations show that the differences in the coefficients of $FSIS\_OR_t \times \Delta Cash\ holdings_t$ between any two of these three time periods are not statistically significant. Our results indicate that FSIS is strongly positively related to the value of cash, and that such positive relation does not vary over time. Compared with Bates, Chang and Chi's (2018) findings, the cross-sectional variations of FSIS offer greater explanatory power than MLIS in explaining the marginal value of corporate cash holdings.

Excluding marketable securities from the definition of cash holdings. Following Faulkender and Wang (2006), we define $Cash\ holdings_t$ as pure cash plus marketable securities normalized by the lag of market value of equity. Previous sentiment studies find that high MLIS is positively associated with the contemporaneous stock overvaluation (e.g. Baker and Wurgler, 2006; Huang *et al.*, 2015; Stambaugh, Yu and Yuan, 2012). Therefore the market value of marketable securities may be different from their book value and the difference might be correlated with FSIS. To make sure that our finding is not merely driven by this potential effect, we replicate the baseline regression results using pure cash balance (Compustat code CE) instead of cash plus marketable securities (Compustat code CHE). Untabulated results suggest that the coefficients of $FSIS\_OR_t \times \Delta Pure\ cash\ holdings_t$ are all positive and statistically significant at the 1% level in the specifications reported in Table 2.

Mechanical relation between overnight returns and excess stock returns. In Faulkender and Wang's (2006) empirical framework, the dependent

variable is excess stock returns, $r_t - R_t^B$. Since we use overnight returns as a proxy for FSIS in our main empirical analyses, one may claim that overnight returns might be mechanically correlated with excess stock returns that aggregate both stock returns during trading hours and overnight stock returns. We believe that it is unlikely the case, for the following four reasons. First, Berkman *et al.* (2012) find a strong tendency for positive overnight returns followed by reversals during the trading day. It is not necessary that the combined stock returns during trading hours and overnight returns are positively related to overnight returns. Second, our main results rely on the coefficient of the interaction term, $FSIS\_OR_t \times \Delta Cash\ holdings_t$, not $FSIS\_OR_t$ itself. Third, our main results remain robust when we use alternative measures of FSIS, which are insulated from the concern about a mechanical correlation between FSIS and value of cash. Finally, we find that $\Delta FSIS\_OR_t$, the change in overnight returns from year $t-1$ to year t, has a positive impact on the value of cash. In untabulated tests, we replace $FSIS\_OR_t$ by FSIS_OR measured over a 1-year or 1-month period before the start of fiscal year t in our baseline regression. We find that both of these lagged *FSIS_OR* measures have a positive impact on the value of cash in year t. This finding also mitigates the concern that overnight returns and the value of cash are contemporaneously measured.

Momentum trading. Momentum trading is an investment strategy of buying stocks that have had high returns over the past 3–12 months and selling those that have had poor returns over the same period. Antoniou, Doukas and Subrahmanyam (2013) find that momentum profits are positively related to investor optimism. The contemporaneous relation between FSIS and excess stock returns in our baseline regression may be a combined result of the following. Stocks with high historical returns attract sentiment-driven investors and momentum profits are positive. To mitigate the concern that our main result is driven by momentum trading, we add 1-year-lagged excess stock returns as a control variable in our baseline regression equation. Untabulated results suggest that the relation between FSIS and the value of cash remains positive and statistically significant.

Conclusions

When a firm's investor sentiment is high, the market perceived value of the firm's cash holdings may be higher than what would be justified based on the actual use of cash. We document a strong positive relation between FSIS and the value of cash. This positive relation is consistent with the explanation that when FSIS is high, retail investors are optimistic about the potential use of cash in financing firms' future growth opportunities, especially for firms with larger investment, more innovation activities, higher information asymmetry and more liquid stocks. We also provide evidence that FSIS has a positive effect on the value of cash, a weaker but positive effect on the value of non-cash current assets and no impact on the value of non-current assets. The positive relation between FSIS and the value of cash is also robust to various empirical specifications and controls. Overall, our findings provide additional rationales for firm managers to incorporate investors' sentiment with corporate activities. It would be fruitful to investigate the effects of FSIS on the valuation of other types of assets and on the managerial decision-making process. In corporate finance and management studies, real options analysis is used to evaluate investment decisions where decisions are sequential and involve a high degree of uncertainty (e.g. Dalziel, 2009; Latham and Braun, 2010). FSIS may affect the value of firm assets, which in turn affects the real options in corporate investment decisions.

Appendix A

Table A1

Table A1. Variable definitions

Variable	Definition	Source
$r_t - R_t^B$	Excess stock returns with the benchmark portfolios defined as Fama–French 25 portfolios formed on size and book-to-market (Faulkender and Wang, 2006).	CRSP, Compustat, and FF
MV_t	Market value of equity, defined as the number of shares outstanding (CSHPRI) multiplied by stock price (PRCC_F) (Faulkender and Wang, 2006).	Compustat
Cash holdings$_t$	Cash plus marketable securities (CHE) normalized by MV (Faulkender and Wang, 2006).	Compustat
ΔCash holdings$_t$	Change in cash holdings from fiscal year t − 1 to year t, normalized by *MV* at the start of fiscal year t (Faulkender and Wang, 2006).	Compustat
FSIS_OR$_t$	Firm-specified investor sentiment proxy defined as 250 × the average daily overnight returns over fiscal year t (Aboody *et al.*, 2018).	CRSP
ΔEarnings$_t$	Change in earnings from fiscal year t − 1 to year t, normalized by MV at the start of fiscal year t. Earnings are calculated as earnings before extraordinary items (IB) plus interest (XINT), deferred tax credits (TXDI), and investment tax credits (ITCI) (Faulkender and Wang, 2006).	Compustat
ΔNet assets$_t$	Change in net assets from fiscal year t − 1 to year t, normalized by MV at the start of fiscal year t. Net assets are calculated as total assets (AT) minus cash holdings (CHE) (Faulkender and Wang, 2006).	Compustat
ΔR&D$_t$	Change in R&D expenditure (XRD) from fiscal year t − 1 to year t, normalized by MV at the start of fiscal year t (Faulkender and Wang, 2006).	Compustat
ΔInterest expenses$_t$	Change in interest expenses (XINT) from fiscal year t − 1 to year t, normalized by MV at the start of fiscal year t (Faulkender and Wang, 2006).	Compustat
ΔDividends$_t$	Change in total common share dividends (DVC) from fiscal year t − 1 to year t, normalized by MV at the start of fiscal year t (Faulkender and Wang, 2006).	Compustat
Leverage$_t$	Calculated as total debt (DLC + DLTT) divided by the sum of total debt and MV (Faulkender and Wang, 2006).	Compustat
ΔNet financing$_t$	Change in net financing proceeds from from fiscal year t − 1 to year t, normalized by MV at the start of fiscal year t. Net financing proceeds are defined as equity issuance (SSTK) minus repurchases (PRSTKC), plus debt issuance (DLTIS) minus debt redemption (DLTR) (Faulkender and Wang, 2006).	Compustat
BWI_t	The summation of monthly Baker and Wurgler's Sentiment Index over a fiscal year (Baker and Wurgler, 2006, 2007).	BW
CSI_t	The summation of monthly University of Michigan's Consumer Sentiment Index over a fiscal year.	FRED
TIO_t	The percentage of a firm's outstanding stocks held by institutional investors.	s34 files
$MMIO_t$	The ownership of institutional investors whose holding value in a firm ranked as the top 10% of the stocks in their portfolios (Fich, Harford and Tran, 2015).	s34 files
G-Index$_t$	Corporate governance index composed of twenty-four provisions on investor rights and takeover protections applied to the company (Gompers, Ishii and Metrick, 2003).	ISS
E-Index$_t$	Entrenchment index composed of the six most important provisions in G-index (Bebchuk, Cohen and Ferrell, 2009).	ISS
$HighPE_t$	An indicator variable equal to one (zero) if the ratio of price (PRCC_F) to earnings(EPSFI) is above (below) its annual sample median (Basu, 1977).	Compustat

Table A1. (Continued)

Variable	Definition	Source
$HighTBQ_t$	An indicator variable equal to one (zero) if Tobin's Q is above (below) its annual sample median. Tobin's Q is defined as (AT + MV − book value of equity)/AT (Gompers, Ishii and Metrick, 2003).	Compustat
$HighAG_t$	An indicator variable equal to one (zero) if asset growth is above (below) its annual sample median. Asset growth is defined as the growth rate of AT over one year.	Compustat
$HighCAPEX_t$	An indicator variable equal to one (zero) if the ratio of capital expenditure (CAPEX) to AT is above (below) its annual sample median.	Compustat
$HighRD_t$	An indicator variable equal to one (zero) if the ratio of XRD to AT is above (below) its annual sample median.	Compustat
$HighPATENT_t$	An indicator variable equal to one (zero) if the number of patents is above (below) its annual sample median.	Compustat
$HighIAI_t$	An indicator variable equal to one (zero) if IA-Index is above (below) its annual sample median. IA-Index is an information asymmetry index based on the rankings of five dimensions of information asymmetry: larger error in financial analysts' forecasts, smaller firm size, higher R&D expenses, larger Tobin's Q, and a smaller number of analysts following. For each dimension, we calculate a firm's quintile ranking each year. A firm has a score of 5 (1) if it is among the 20% of the firms that have the highest (lowest) degree of information asymmetry in each dimension. IA-Index is the summation of the scores over all five dimensions (Drobetz, Grüninger and Hirschvogl, 2010; Cai *et al.*, 2015).	Compustat & IBES
$HighREM_t$	An indicator variable equal to one (zero) if REM is above (below) its annual sample median. REM is real earnings management, defined as the summation of a firm's abnormal operational cash flows, negative abnormal discretionary expenses, and abnormal production costs (Roychowdhury, 2006).	Compustat
$HighLIQ_t$	An indicator variable equal to one (zero) if -1 times annualized Amihud's (2002) illiquidity measure is above (below) its annual sample median.	CRSP
$HighVOL_t$	An indicator variable equal to one (zero) if annualized stock trading volume is above (below) its annual sample median.	CRSP
MTB $spread_t$	The gap between a firm's market-to-book ratio and the mean value of the ratio in one of Fama–French 48 industries. The market-to-book ratio is defined as the market price per share divided by the book value per share.	Compustat
$\Delta FSIS\_OR_t$	The difference between $FSIS\_OR_t$ and $FSIS\_OR_{t-1}$.	CRSP
$FSIS\_SOIB_t$	Alternative FSIS proxy: noise trader order imbalance defined as (buyer-initiated dollar trading volume − sell-initiated dollar trading volume)/(buyer-initiated dollar trading volume + sell-initiated dollar trading volume), including only trades with the real dollar value in 1992 being less than $10,000 (Yuan, 2015).	TAQ
$FSIS\_OIB_t$	Alternative FSIS proxy: aggregate order imbalance defined as (buyer-initiated dollar trading volume − sell-initiated dollar trading volume)/(buyer-initiated dollar trading volume + sell-initiated dollar trading volume), consider all the trades (Yuan, 2015).	TAQ
$FSIS\_CSS_t$	Alternative FSIS proxy, defined as the average of composite sentiment score for all the news events about a firm over a fiscal year.	RavenPack
$FSIS\_ECS_t$	Alternative FSIS proxy, defined as the average of quarterly sentiment in a firm's earnings conference call transcript (Hassan *et al.*, 2019).	HHLT

Appendix B

In this appendix, we present the definitions of three alternative measures of FSIS used in our robustness tests.

The first alternative measure of FSIS, $FSIS\_OIB_{i,t}$, is order imbalance. Kumar and Lee (2006) find that retail investor sentiment, proxied by the buy–sell order imbalance of retail investors, explains the return comovements for stocks that are costly to arbitrage and are with high retail investor ownership. Moreover, Barber, Odean and Zhu (2009) show that annual small trade order imbalance is correlated with future stock returns, that is, stocks heavily bought by retail investors underperform stocks heavily sold by retail investors by 4.4% over the next year. Barber, Odean and Zhu's (2009) finding that high net retail investor purchase is followed by low subsequent stock returns is consistent with the studies on MLIS (e.g., Baker and Wurgler, 2006, 2007; Stambaugh, Yu and Yuan, 2012). The empirical evidence documented in Kumar and Lee (2006) and Barber, Odean and Zhu (2009) suggests that trade order imbalance is a suitable gauge of investor sentiment.

Following Kumar and Lee (2006), we calculate the daily order imbalance of each stock using the transaction data from the Trade and Quote (TAQ) database. The sample period is 1993–2018, since the TAQ database starts from 1993. Specifically, the order imbalance of firm i's stock on day j, $OIB_{i,j}$, is calculated as:

$$OIB_{i,j} = \frac{Buy_{i,j} - Sell_{i,j}}{Buy_{i,j} + Sell_{i,j}} \tag{B.1}$$

where $Buy_{i,j}$ ($Sell_{i,j}$) is the aggregate buyer-initiated (seller-initiated) dollar trading volume of stock *i* on day *j*. We classify buyer-initiated and seller-initiated trading volume, following the algorithm of Lee and Ready (1991). A trade is buyer-initiated (seller-initiated) if the trade price is above (below) the midpoint of the recent (previous second) bid–ask quote. If the transaction price is equal to the midpoint of the bid–ask quote, we take a trade as a buyer-initiated (seller-initiated) one if the trade price is above (below) the last executed trading price. We then define our annualized FSIS $FSIS\_OIB_{i,t}$ as:

$$FSIS\_OIB_{i,t} = 250 \times \frac{\sum_{j=1}^{N} OIB_{i,j}}{N} \tag{B.2}$$

where N is the number of non-missing $OIB_{i,j}$ over fiscal year t. Similar to $FSIS\_OR_{i,t}$, we treat $FSIS\_OIB_{i,t}$ as missing if N is less than 100.

When we construct $FSIS\_OIB_t$, we do not differentiate orders by their size. We further define a small order imbalance measure, $FSIS\_SOIB_t$, based on just small size trades, which is a more precise proxy for firm-specific retail investor sentiment. Specifically, we follow Yuan (2015) and consider only small size buy and sell trades that are less than \$10,000 based on real values in 1991 dollars. Yuan (2015) and Barber, Odean and Zhu (2009) find that institutional investors have started breaking down large orders into small ones in order to reduce transaction costs during recent years. Following the order imbalance literature, we only define $FSIS\_SOIB_t$ over the period of 1993–2000 so that the accuracy of identifying trades initiated by retail investors is not undermined.

The second alternative measure of FSIS, $FSIS\_CSS_{i,t}$, is a news-based sentiment measure. We collect the data from RavenPack News Analytics. By collecting information from all major newspapers, press releases, regulatory disclosures, and governments updates, RavenPack establishes a comprehensive news database and analytical tool. RavenPack has been widely used in the finance and accounting literature (e.g., Bushman, Williams and Wittenberg-Moerman, 2017; Dai, Parwada and Zhang, 2015; Dang, Moshirian and Zhang, 2015). Specifically, we use the Composite Sentiment Score (CSS) in RavenPack as the measure of sentiment for a specific news event.

CSS represents the news-based sentiment of a specific news story by three different sentiment analysis tools. The first tool is the "Traditional Tagging" methodology that maps the text of news with a set of predetermined rules, assigning different sentiment values to different keywords and calculating the sentiment of the news. The second tool is the "Expert Consensus" methodology that relies on the financial experts' feedbacks on a large set of news articles to provide a training set for a computer program, used for an automated article sentiment classification. The third tool is the "Market Response" methodology that uses the stock price

reaction to news articles in the past to train a computer program so that it can be used to predict the market reaction to news articles in the future. The first two tools help to determine the direction of the sentiment (positive, negative, or neutral), while the third tool helps to determine the strength of the sentiment. We define $FSIS\_CSS_{i,t}$ as the average of CSS for all the news events about a firm over a fiscal year:

$$FSIS\_CSS_{i,t} = \frac{\sum_{j=1}^{N} CSS_{i,j}}{N} \quad (B.3)$$

where N is the number of news events for firm i in fiscal year t and j is the news event index.

The third alternative measure of FSIS, $FSIS\_ECS_{i,t}$, is a sentiment measure based on the tone of earnings conference call transcripts. In every fiscal year, a firm usually host four quarterly earnings conference calls, which typically include a top executive's presentation and a question-and-answer session with market participants. We adopt Hassan *et al.*'s (2019) overall sentiment measure, $Sentiment_{i,t}$, which counts the frequency of mentions of positive words, deducts the frequency of mentions of negative words, and then divides by the length of the transcript. The positive and negative words are defined by Loughran and McDonald's (2011) sentiment dictionary. The data on $Sentiment_{i,t}$ is from Professor Hassan and his coauthors' website: http://www.firmlevelrisk.com. We define $FSIS\_ECS_{i,t}$ as the average of quarterly $Sentiment_{i,t}$ over a fiscal year

$$FSIS\_ECS_{i,t} = \frac{\sum_{j=1}^{N} ECS_{i,j}}{N * 100} \quad (B.4)$$

where N is the number of earnings conference call for firm i over fiscal year t and j is the earnings conference call index.

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