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Disentangling Sentiment from Cyclicality in Firm Capital Structure

This study examines the relationship between capital structure choices and investor and managerial sentiment, finding that periods of positive sentiment are associated with reduced leverage within firms. We focus on the cyclicality of leverage using non-orthogonalized sentiment indices and find a strong negative relationship. Leverage, therefore, appears countercyclical, implying that the decision to take on debt is a consequence of either Admati *et al.*'s (2018) ratchet effect or a managerial attempt to time the market. Our findings lead us to question some fundamental capital structure theories, namely, trade-off (Kraus and Litzenberger, 1973), and Hackbarth's (2008) managerial traits theory. Instead, we favour the idea that leverage is a consequence of countercyclical market timing behaviour.

Key words: Growth perception bias; Market timing; Managerial traits; Pecking order theory; Risk perception bias; Trade-off theory.

What decides a firm's capital structure? This question is the subject of competing theories and endures as a contentious debate in the literature. Several theories compete to explain a firm's financing choice; Kraus and Litzenburger's (1973) trade-off theory says that managers must choose between debt's tax-deductibility and bankruptcy's costs. The pecking order theory developed conjointly in Myers (1984) and Myers and Majluf (1984) advances the idea that managers opt for cheaper and less complicated internal funding sources before reaching outside the organization for the capital needed to finance projects. The central assumption for both is that the protagonists in each story arrive at their decisions rationally.

Market timing theory points to managerial opportunism in the face of high investor sentiment where capital structure reflects a reversion to equity financing. The direction of the financing decision is motivated by a managerial perception of overvalued share prices (Loughran and Ritter, 1995; Baker and Wurgler, 2000).[1]

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[1] We know from existing literature that investor sentiment helps explain stock returns. This observation has prompted other papers to include investor or manager sentiment indices in their models. For example, Han (2008) examines the impact of investor sentiment on the options market. He finds that investor sentiments are significantly related to the S&P500 options' prices' risk-neutral skewness. Yu and Yuan (2011), using the Baker-Wurgler index, find that following a period of high sentiment, the positive relationship no longer holds between the expected return of the aggregate

The underpinning assumption of this theory is that investors behave irrationally. Investor sentiment then emerges as a feature to explain capital structure. Another perspective is that managers tend to display overconfidence in their capacity to make funding decisions. The cognitive biases shown by both managers and investors can often occur together, appearing to be closely related. An optimistic manager is more likely to be overconfident in their decision making, while a pessimistic one may harbour more self-doubt (Taylor and Brown, 1988).[2]. There is even managerial awareness of the propensity to be irrational; Graham and Harvey (2001) report survey results attesting that corporate managers generally agree that overvalued equity drives capital structure choice.

Using pooled OLS and fixed-effects regressions on 153,787 firm-year observations for 9,986 US non-financial firms over the period spanning from 1971 to 2016, we find that the relationship between the five sentiment indices and book leverage is negative and significant. The relationship with the four macroeconomic indices implies that managers issue more equity to debt when analysts are optimistic about a firm's long-term growth opportunities. Our findings remain robust whether or not these indices are orthogonal to macroeconomic factor components. We also achieve similar results when using the managerial sentiment index in our model. When we control other recognized capital structure determinants, our findings reject the managerial traits theory because we find a negative and significant relationship between the non-orthogonalized macroeconomic type sentiment indices and the market value of leverage ratio. This observation compels us to reject the trade-off theory explanation as the leverage ratio appears countercyclical. We also reject the risk perception and growth perception biases in favour of a countercyclical market timing behaviour argument.

Our aim in this study is to satisfy several objectives, and for each we produce findings that contribute to the literature. First, we test whether managerial bias determines capital structure or if, instead, it is the consequence of market timing. We do this by developing a model to answer this question. Our findings fall in favour of the market timing argument, where it is countercyclical in nature. We mark this as our first contribution. While both theoretical propositions result in more equity appearing in firms, it is during times when there is a high positive sentiment that managers exhibit a risk perception bias that is influenced by more than purely business cycle factors. Our second contribution helps to answer the question of whether there is an influential relationship between investor sentiment and capital structure. We find that leverage is negatively related to positive sentiment. We look to both the macroeconomic sentiment indices constructed by

market and its conditional volatility. Periods of high (positive) sentiment are associated with overpricing (Stambaugh *et al.*, 2012). The connection of sentiment with stock returns reaches beyond US boundaries. For instance, Baker *et al.* (2012) extend their original paper and determine that the investor sentiment relationship with stock returns applies to six additional countries.

[2] Huang *et al.* (2015) use the partial least squares method to remove noise from the Baker-Wurgler index and find that their new, cleaner index of investor sentiment predicts stock returns.

Baker and Wurgler (2006) and Huang *et al.* (2015), and the microeconomic index constructed by Jiang *et al.* (2019). The latter index focuses on firm-specific managerial bias. Unlike previous studies, which focus on investor-specific bias, the managerial sentiment index we use incorporates more market-wide factors and, therefore, the more generally held perspective. Third, to remove the possible influence of the business cycle components, we examine leverage's cyclicality using the lens provided by sentiment indices; these are orthogonal to macroeconomic fundamentals. We do this to test Hackbarth's (2008) hypothesis on the growth perception bias, where capital structure decisions are the function of an over-optimistic manager's preference for debt over equity. This situation tends to occur when managers overstate the potential for earnings growth. In such circumstances, debt financing then becomes associated with periods of higher positive investor sentiment. Our findings disagree with this hypothesis. Instead, we show that leverage is negatively related to positive sentiment. This conclusion agrees with the market timing argument. When there are funding efforts, these appear instead to target equity rather than debt during high investor sentiment periods.

We further investigate the propensity of managers to engage in market timing by looking at the relationship between leverage and the macroeconomic factors embedded in the sentiment indices. Using non-orthogonalized indices, we look for cyclicality in leveraging and find a robust negative association between the two. When we use the orthogonalized version, this becomes somewhat weaker. These findings agree with Huang and Ritter's (2009) conclusion on the countercyclical nature of the leveraging decision. Once again, the market timing explanation for incurring debt trumps a managerial attitude to the 'risk' hypothesis.

Finally, we test our findings' robustness by extending our investigation to include alternative panel methodologies and leveraging definitions. We vary our methods to counter the argument that our findings could result from a possible endogeneity effect due to our using lagged independent variables. A standard critique of using fixed-effects estimations is that the effect of independent variables in the model does not differ within groups. If the fixed effects are perfectly collinear with the dependent variable, we cannot disentangle the group factor from the independent variables in the model. Following Gormly and Matsa (2014), we address this issue using the two-step Hausman and Taylor (1981) method.

Utilizing this method allows us to find support for our earlier result that shows that the relationship between each of the five sentiment indices and the book value of leverage is negative and significant. Firm-level variables also continue to be associated with the book value of leverage. When we use the market value of leverage following the Hausman and Taylor (1981) method in our model, our results supporting market timing appear even more robust.

Our varied approach also responds to a similar view about endogeneity when the sentiment, leverage, and control variables are considered together. After robustness checks, our findings remain as initially stated.

BUSINESS CYCLES, SENTIMENT, AND CAPITAL STRUCTURE

Considerable debate exists about the cyclicality of both equity and firm leverage in the literature. Scholars disagree on whether a firm's equity and leverage ratio are countercyclical or procyclical. However, there is a broad consensus that debt tends to be accessed more in good times, implying that it is procyclical.

The mixed conclusions in the literature demonstrate the difficulty in arriving at a clear picture. Relaxing the constraint on debt during an economic expansion, Jermann and Quadrini (2006) find that equity is countercyclical. Conversely, Levy, and Hennessy (2007), using similar assumptions on equity during expansionary periods, find it procyclical. Covas and Haan (2007) conclude that both leverage and equity are procyclical. Individual firm characteristics can also play a part; for instance, Covas and Den Haan (2012) find that small firms' equity is more procyclical than their larger counterparts. During economic expansion, external financing increases more than investment, providing cushioning during economic downturns.

Karabarbounis *et al.* (2014) examine the relationship between business cycles and firm capital structure. They find that firms tend to issue more debt during economic expansions and that the cyclicality of equity depends on how it is defined. For example, if they use Jermann and Quadrini's (2012) definition of equity, the sale of a stock net of repurchases, equity appears countercyclical. However, if they use Covas and Haan's (2011) description, the change in the book value of equity seems procyclical. It is argued that leverage can also appear countercyclical as firms issue debt when the risk premium is higher during economic downturns (Huang and Ritter, 2009). Managers reach for equity when risk premiums are lower; this tends to occur during expansionary economic periods.

This positive relationship between equity issues and business cyclicality has some basis in the literature. Examples illustrating the relationship include Choe *et al.* (1993), Bayless and Chaplinsky (1996), and Baker and Wurgler (2000). Some studies argue for the persistence of a firm's capital structure. For example, Lemmon *et al.* (2008) observe that the year's leverage level before a firm's initial listing tends to predict its leverage 20 years on. The persistence is also a consequence of the ratchet effect, a term coined by Admati *et al.* (2018) describing shareholder reluctance to see a reduction in the firm leverage ratio. If a company increases in value, shareholders prefer to raise debt even if it becomes subordinate to existing credit and, therefore, more expensive.

Consequently, these two different forces can explain a firm's debt levels. The influence of which results in a state of countercyclical leverage, as firms become over-levered during recessions. Al-Zoubi *et al.* (2018) confirm the presence of leverage persistence within firms, suggesting that this is due to the capital structure decision's cyclicality. However, a persistent amount of equity in the firm's capital structure, regardless of current economic conditions, may stem from managers timing the market and only issuing equity during periods of high investor sentiment (Lewis and Tan, 2016). Since these periods are more likely to occur

during the business cycle's peak phases, the market timing theory of capital structure predicts that leverage is therefore countercyclical. Bhamra *et al.* (2010) find that aggregate leverage is countercyclical, but as the firm re-levers, it becomes procyclical. Korajczyk and Levy (2003) find that target leverage is countercyclical for the financially unconstrained firms and procyclical for those which are not.

HYPOTHESES DEVELOPMENT

The tendency of managers to issue equity when they believe that their existing stock is overvalued is the central idea behind market timing theory. Loughran and Ritter (1995) and Baker and Wurgler (2000, 2002), volunteer this argument to explain the capital structure puzzle. Shleifer and Vishny (2003) add to this by noting that similar timing motivations are in play for stock mergers. Similarly, the perception of overvaluation drives the frequency of IPOs (Loughran *et al.*, 1994). There is also evidence to suggest that managers attempt to capitalize on periods of high investor sentiment (Lee *et al.* 1991). These observations point to the vital role that market timing can play in driving critical managerial decisions. The actions of managers are not entirely cynical; their optimism also plays a role in their choices. Lewis and Tan (2016) find that a firm will capitalize with equity rather than debt when managers or analysts exhibit optimism about its growth opportunities. They also assert that because firms that issue equity tend to have lower stock returns than those that issue debt, managers decide when investor sentiment is particularly favourable.

Stambaugh *et al.* (2012) argue that there are two reasons positive investor sentiment periods result in overpriced assets. The first is that sentiment acts as a broad brush, affecting the pricing of many securities simultaneously. The second is that regulatory barriers to short selling restrict the opportunity for speculators to exploit perceived overpricing. The implication here is that market behaviour tends to exhibit greater rationality across periods of negative investor sentiment.

A stifled propensity to short-sell assets affords managers the opportunity and time to recapitalize their firms with equity. This behaviour reduces the leverage ratios calculable from the balance sheet figures. In examining the determinants of capital structure, sentiment should be negatively associated with leverage ratios.

The countercyclicality of leverage is evident in scholarly work, where overpricing (underpricing) is more likely during economically good (bad) times. For example, Korajczyk and Levy (2003) find this to be the case in relatively financially unconstrained firms. Hackbarth *et al.* (2006) also note the countercyclical nature of leverage. However, they caution that capital structure adjustments are more extensive during recessionary times. Huang and Ritter (2009) also observe countercyclicality in leverage as firms attempt market timing. They do this by issuing equity during expansions and debt during contractions.

These observations lead to the idea that there can be substantial reductions in leverage because sentiment indices correlate with macroeconomic factors (non-orthogonalized to business cycle factors). In a similar dynamic to the ratchet effect

suggested in Admati *et al.* (2018), shareholders have a greater incentive to accentuate rather than retire debt, regardless of the impact on firm value. Firms, therefore, will only decrease leverage as the possibility of bankruptcy grows. Market timing motivations lead rational managers to issue more equity than debt during periods of heightened positive investor sentiment. This tendency results in reduced book value leverage ratios for the firm. Market leverage will also decrease as stock prices increase. This conclusion leads to our first hypothesis:

H1: Managerial attempts to time the market leads to persistent and countercyclical book and market value leverage.

The trade-off model for capital structure predicts higher firm leverage if the tax benefits of assuming debt are greater than bankruptcy costs. The marginal benefit of debt increases when default probabilities are low and its tax benefits increase alongside earnings. Hence there is a tendency for firms to raise leverage during economic expansions. Additionally, periods of economic downturn reduce the market value of equity more than that of debt. This effect is because a firms' equity market value has a greater sensitivity to economic slumps since it represents a residual claim on the organization.

If we are to use trade-off theory to explain the capital structure, then a firm's leverage should be procyclical. Studies that attest to the procyclicality of leverage include Jensen and Meckling (1976), Gertler and Gilchrist (1993), Zwiebel (1996), Korteweg (2010), and Covas and Den Haan (2012). Prior research also demonstrates that procyclical leverage is not the result of asset substitution (Jensen 1986), risk shifting (Vanden 2016), or debt overhang (Myers 1977). However, it may be the consequence of a firm holding lower levels of debt during economic contractions. This situation could arise because majority shareholders exploit the more precarious position of minority investors (see Zwiebel, 1996; Hart and Moore, 1994; or Lambrecht and Myers, 2008.). Another explanation could be that shareholders can secure advantageous new terms on their debt accounts from creditors (see Fan and Sundaresan, 2000; Garlappi *et al.*, 2006; Garlappi and Yan, 2011). Lower organizational levels of debt could also be attributable to a firm's efforts to increase its financial flexibility (Bhamra *et al.* 2010) or it may be because the benefits of holding debt become enhanced during expansionary periods (Korajczyk and Levy, 2003). The cyclicality of capital structure could also be due to the changing business conditions imposed by financial or productivity shocks or it may be a result of financial frictions (Jermann and Quadrini, 2012). Finally, the connection of a firm's leverage to the business cycle is perhaps due to the effect of default policies, as claimed by Hackbarth *et al.* (2006).

Therefore, investor sentiment should not affect trade-off decisions; at least the studies to date fail to connect the two. However, because periods of positive investor sentiment are more probable during expansions, non-orthogonalized sentiment indices would be positively correlated to firm leverage. On the other hand, an orthogonalized index not associated with macroeconomic factors would not correlate with firm leverage. We, therefore, form the following hypothesis:

H2: Book and market value leverage are procyclical. However, periods of positive investor and managerial sentiment that are not associated with economic expansion should result in no change in the book and market value of leverage.

Hackbarth (2008) suggests through 'managerial traits' theory that overconfident managers exhibit a risk perception bias.[3] In this account of capital structure, managers showing this bias underestimate a firm's riskiness and tend to believe that it is less likely to experience financial distress. These managers are more likely to underestimate future firm earnings riskiness and view their debt as undervalued by the market.

Consequently, managerial bias is an essential determinant of firm capital structure, a point which is covered extensively in existing literature (e.g., Heaton, 2002; Malmendier and Tate, 2005). For example, Aktas *et al.* (2019) find that financially constrained firms with overconfident CEOs are likely to suffer from underinvestment problems as they have more cash on their balance sheets. Conversely, firms that are unconstrained, tend to be overinvested.[4] As a result, these managers prefer to issue equity over debt.

The convexity of equity implies a managerial belief that it is overvalued. Overconfident managers often fail to connect the inflated value of their firm's stock and the business cycle. The rational market reaction to an equity issue is a price reduction, leaving the value of equity unchanged. For example, Czarnitzki and Kraft (2009) find that firms with higher leverage are more disciplined than firms with lower debt to equity ratios. Hackbarth (2008) proposed the risk perception bias that the rational market's response to a manager's issue of new equity is to adjust the share price down so that the market value of equity is unchanged. As a result, only the book value of leverage will decrease during periods of positive sentiment.[5]

As a result, overconfident managers who exhibit a risk perception bias prefer equity to debt and make capital structure decisions based on a reversed pecking

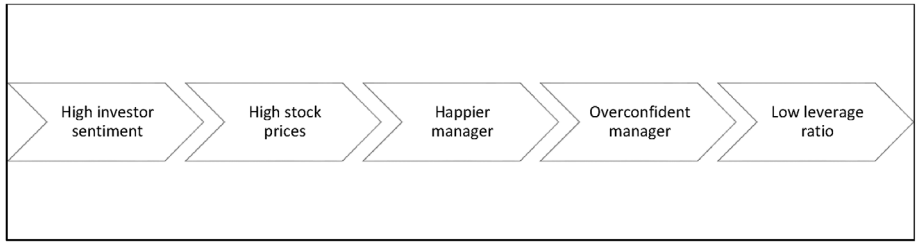
[3] Overconfidence may affect management's capital structure decisions following periods of distinctly positive or negative sentiment. Izard (1977) suggests that happy and contented people are more likely to project these emotions into their view of self and the world. Fredrickson (2001) develops this idea by proposing that a person's short-term positive emotions, like happiness and contentment, broaden their social and psychological resources that guide their long-term actions. Previous research, too, relates optimism to overconfidence. Bower (1992) suggests that investors buoyed by positive feelings are likely to be risk-tolerant and are quick to make decisions based on optimism, thereby displaying overconfidence. Similar correlations are apparent in Astebro *et al.* (2007), who find that optimism and overconfidence positively correlate with innovation and entrepreneurship.

[4] A recent study by Andreou *et al.* (2019) finds that diversified firms with overconfident CEOs will lose between 12.5%, and 14.1% of their value compared with those run by CEOs who exhibit more rationality. They argue that CEO overconfidence explains why firms engage in value-reducing corporate diversification policies and may subsequently implement value restoring refocusing policies.

[5] Overconfident managers may issue even more equity when the market values deepen, an action that results in persistent declines in both the book and market values of leverage that are more apparent during economic downturns.

FIGURE 1

HYPOTHESIS 3



order. Thus, the book value of leverage declines when managerial sentiment is positive. The market value of leverage may not change, as a decrease in stock prices could mitigate the effect. Therefore, high investor sentiment will lead to long-term managerial overconfidence resulting in non-cyclical leverage (see Figure 1). Therefore, we posit:

H3: The book value of leverage is non-cyclical and declines when managerial sentiment is positive.

Hackbarth's (2008) managerial traits theory suggests that optimistic managers exhibit a growth perception bias. They are then more likely to overestimate earnings growth and believe that their equity is undervalued. Managers appearing to have this biased view of external financing as too costly are more likely to follow the standard pecking order when making capital structure decisions (Heaton, 2002). These managers prefer debt to equity; this may increase the firm's bankruptcy risk and capital cost.

As a result, managers exhibiting this bias issue more debt than unbiased managers. Of the traditional theories, empirical work conducted by Lucas and McDonald (1990) points to the idea that pecking order and market timing theories may explain pre-issue price run-up, but not post-issue underperformance.

Concerning the involvement of sentiment in the literature, Cornell *et al.* (2017) examine whether difficult-to-value firms' accounting information can reduce sentiment-based mispricing. They find that this mispricing occurs less in firms with high-quality accounting information. Additional research shows that sentiment affects the recommendations of stock analysts. During periods of positive sentiment, analysts are more likely to issue buy recommendations for firms that are hard to value, overpriced, or riskier. Positive sentiment periods may see optimistic managers issue more debt relative to equity, resulting in higher market and book values of leverage. Optimistic managers are more likely to overestimate earnings growth and view their equity as undervalued by the market. For this reason, we hypothesize that:

TABLE 1

SUMMARY OF THE BEHAVIOUR OF LEVERAGE RATIO ACCORDING TO EACH HYPOTHESIS

Hypothesis	Orthognalized sentiment indices		Non-othognalized sentiment indices	
	Book Value Leverage	Market Value Leverage	Book Value Leverage	Market Value Leverage
H1: Market timing theory	**(–)**	**(–)**	(–) Countercyclical	(–) Countercyclical
H2: Trade-off theory	No Change	No Change	(+) Procyclical	(+) Procyclical
H3: Managerial traits theory: risk perception bias	**(–)**	No Change	(–) Not to macroeconomic factor	No Change
H4: Managerial traits theory: growth perception bias	**(+)**	**(+)**	(+) Not to macroeconomic factor	(+) Not to macroeconomic factor

This table summarizes our hypotheses and the expected relationships between sentiment and firm leverage.
*Countercyclical leverage results from firms' attempt to time the market and issue equity during expansions and debt during contractions. It may also be a result of the ratchet effect in which once leverage is issued, shareholders reject decreases in debt, regardless of its effect on firm value.

H4: The book and market values of leverage will increase when sentiment is positive.

Due to interactions between macroeconomic factors and sentiment, results may differ for the book or market value of leverage. Table 1 shows the relationships predicted by each hypothesis and the firm's book and market value of leverage. To better understand the sentiment effect over business cycles, we also present macroeconomic factors on the book and the market value of leverage. This effect can be captured by examining the non-orthogonalized indices' impact on the book and the market value of leverage. Non-orthogonalized sentiment indices are those which correlate with business cycle macroeconomic factors. Conclusions about competing hypotheses can be implied by the combined effect of sentiment and macroeconomic factors on both the book and market value of leverage.

METHOD AND VARIABLE DEFINITIONS

Method

We employ two widely used firm capital structure measures in this study; the book value of total debt ratio (BVD) and the market value of the total debt ratio (MVD). Using both pooled ordinary least squares regression and a fixed-effect panel data approach, we study the impact of investor sentiment on leverage across

our sample of firms. We control for the possible dynamic endogeneity of the independent variables by including it in a one-year lagged version form.[6] We do this in the spirit of preceding studies that adopt this process (Gupta, 2005; Hayo *et al*., 2010; Vergara, 2010; Kingsley and Graham, 2017). This approach is popular in the empirical literature because it aims to eliminate the bias of causal identification without requiring additional variables that may be unavailable in the dataset (Bellemare *et al*., 2017).

We incorporate already recognized determinants of capital structure as control variables. These include firm size, profitability, growth opportunity, tangibility, and taxation. We also use three economic environment indicators proposed by Korajczyk and Levy (2003) to capture the role of macroeconomic factors in leveraging decisions.

Our core specification is the following:

$$lev_{i,t} = \alpha_0 + \beta_s S_{i,t} + \beta_f X_{i,t} + \beta_m Y_t + \delta_i + \varepsilon_{i,t} \quad (1)$$

Where $lev_{i,t}$ is firm i's leverage ratio at time t, $S_{i,t}$ are sentiment indices, $X_{i,t}$ and Y_t, respectively, are vectors of firm-level and macroeconomic variables that determine the capital structure, δ_i is an unabsorbed firm fixed effect, and $\varepsilon_{i,t}$ is a random error term assumed to be independently identified and normally distributed with a zero mean and constant variance, $\varepsilon_{i,t} \sim iid\, N(0, \sigma^2)$.

Variable Definitions

We define all variables, as well as their sources, used in this analysis in Table 2.

Definition of leverage There are competing definitions for leverage in the literature; some studies use the book value of leverage as it exists independently of external influence (Fama and French, 2002; Thies and Klock, 1992). Other studies use the leverage ratio market value because it can reflect agency problems between creditors and shareholders, should these exist (Welch, 2004; Brisker and Wang, 2017). In our analysis, we use both measures. We define the book value of leverage ratio (BVD) as the total debt divided by the sum of the total debt and the book value of equity. The market value of leverage (MVD) we define as the total debt divided by the total sum of debt and the market value of equity.

Sentiment indices There are a wealth of studies to suggest that investor sentiment affects equity prices. Hence it makes sense to investigate the possible influence this may have on a firm's capital structure. In this study, we use the investor sentiment indices proposed in Baker and Wurgler (2006) and Huang *et al*. (2015). To capture sentiment, but from the executives' perspective, we use the manager sentiment index (MS) given by Jiang *et al*. (2019).

[6] Endogeneity arises when the current values of the independent variables are affected by the past values of the dependent variables, which can lead to bias in a fixed-effects estimator and invalid conclusions (Wooldridge, 2010).

TABLE 2

DESCRIPTION OF VARIABLES AND SOURCES

Variable	Description	Source
Leverage measure		
Book value of leverage ratio (BVD)	Ratio of total debt to the sum of total debt and the book value of equity	Compustat database
Market value of leverage ratio (MVD)	Ratio of total debt to the sum of total debt and the market value of equity	Compustat database
Firm-level variables		
Profitability (PROF)	Ratio of operating income to total assets	Compustat database
Tangibility (TANG)	Ratio of net property, plant and equipment to total assets	Compustat database
Size (SIZE)	Natural log of total assets	Compustat database
Effective tax rate (TAX)	Ratio of income taxes to pre-tax income	Compustat database
Market-to-book ratio (MB)	Ratio of the market value of equity to the book value of equity	Compustat database
Macroeconomic Variables		
2-year corp. profit growth (CPG)	Two-year aggregate domestic non-financial corporate profit growth, calculated using quarterly data from the Flow of Funds and matched with the firm quarter with the most overlap	Compustat database, authors' calculations
2-year equity market return (EMR)	Real return on CRSP value-weighted index of stocks traded on NYSE, AMEX, and NASDAQ.	CRSP, authors' calculations
Commercial paper spread (CPS)	Annualized rate on three-month commercial paper divided by the three-month Treasury bill	Federal Reserve Bank of St. Louis, authors' calculations
Sentiment Indices		
Sentiment index PC method (PCM)	The Baker-Wurgler (2006) index based on the first principal component (PC) of six proxies from market data	Guofu Zhou website: http://apps.olin.wustl.edu/faculty/zhou/
Sentiment index PC method orthogonalozed (PCMO)	The Baker-Wurgler (2006) index that controls for macroeconomic variables (orthogonal to six macroeconomic proxies)	Guofu Zhou website: http://apps.olin.wustl.edu/faculty/zhou
Sentiment index PLS method (PLSM)	Huang *et al.* (2015) index based on the partial least square method (PLS)	Guofu Zhou website: http://apps.olin.wustl.edu/faculty/zhou
Sentiment index PLS method orthognaized (PLSMO)	Huang *et al.* (2015) index that controls for macroeconomic variables (orthogonal to six macroeconomic proxies)	Guofu Zhou website: http://apps.olin.wustl.edu/faculty/zhou
Manager sentiment index	Jiang *et al.* (2019) index based on the aggregated textual tone of firm disclosures. The index is orthogonal to fourteen macroeconomic variables*	Guofu Zhou website: http://apps.olin.wustl.edu/faculty/zhou

This table presents the definitions of variables used in our analyses.
*Those are the 14 macroeconomic predictors used by Welch and Goyal (2008) such as the short-term interest rate, dividend yield, earnings-price ratio, term spreads, book-to-market ratio, stock volatility inflation, and IPOs.
Abbreviations of the variables are defined as the follows: BVD: Book value of leverage ratio; MVD: Market value of leverage ratio; PROF: Profitability; TANG: Tangibility; SIZE: Size; TAX: Effective tax rate; MB: Market-to-book ratio; CPG: 2-year corp. profit growth; EMR: 2-year equity market return; CPS: Commercial paper spread; PCM: Sentiment index PC method; PCMO: Sentiment index PC method orthogonalized; PLSM: Sentiment index PLS method; PLSMO: Sentiment index PLS method orthogonalized; MSI: Manager sentiment index.

Commenting on the influence of investor sentiment, Baker and Wurgler (2006) find that the effect is more potent on stocks that are hard to value and, therefore, more difficult to arbitrage. They conclude that investor sentiment relates to return differences and is consistent with the significance of these factors.[7]

Baker and Wurgler's (2006) sentiment index use six distinct factors that represent investor sentiment. These are: the closed-end fund discount, the number of IPOs, the first-day returns of IPOs, NYSE turnover, the equity share in total new issues, and the dividend premium.

The principal component (PC) index reduces idiosyncratic noise and captures the common sentiment component across the six measures. We also use the orthogonalized Baker and Wurgler (2006) sentiment index to control macroeconomic conditions. We compute this by regressing the six measures of investor sentiment on the growth of: industrial production, durable and non-durable consumption, service consumption, and employment. Included in this regression is a dummy variable for the National Bureau of Economic Research recorded recessions.

Huang *et al.* (2015) developed the aligned investor sentiment (AIS) index. This index is based on the partial least square method (PLS) and exhibits greater predictive power than the PC method. While PC analysis captures the common sentiment component drawn from the six measures, PLS identifies the factor with the best ability to predict the target variable. This factor may or may not be the most important source of variation in the predictors.

Following Huang *et al.* (2015), let $X_t = \pi r^2 = (X_{1,t}, \ldots, X_{N,t})'$ with $N \times 1$ denoting a vector of individual sentiment proxies at period $t(t = 1, \ldots T)$. The PLS-based estimation at time t is executed in two stages. First, for each proxy X_i, a time-series regression is run on the lagged proxy of the realized stock return at time t.

$$X_{i,t-1} = \propto_{t,0} + \pi_i R_t + \varepsilon_{i,t-1.} \tag{2}$$

Where the coefficient $\propto_i$ captures the sensitivity of each sentiment proxy to the actual investor sentiment.

Next, for each period t, a cross-sectional regression is run of $X_{i,t}$ on the corresponding coefficient π_i previously calculated. We note that $SENT_t$ in the model below is the estimated sentiment index.

$$X_{i,t} = a_t + \widehat{\pi}_i SENT_t + v_{i,t-1.} \tag{3}$$

Jiang *et al.* (2019) develop a managerial sentiment index (MSI), which they construct from the firm disclosures' aggregated textual tone. Using an approach

[7] Indices to measure managerial optimism and overconfidence have been developed in several studies. These include Hribar and Yang (2016), Hribar *et al.* (2017), and Jiang *et al.* (2019). Hribar and Yang (2016) create a CEO specific overconfidence index using press-based variables. They find that overconfident managers generate more optimistic earnings forecasts, which have a greater likelihood of falling short of their predictions.

specified in Loughran and McDonald (2011), they quantify textual tone as the difference between positive and negative words in the disclosure scaled by the total words contained in the message. The quality and frequency of firm disclosures have improved following the Securities and Exchange Commission's (SEC) Regulation Fair Disclosure ruling in 2000. This legislative change forced all publicly traded companies to disclose material information to all investors simultaneously. The Sarbanes-Oxley Act (SOX) in 2002 imposed further requirements on publicly traded companies to improve the quality of their financial reporting. Therefore, the disclosures and the managers' statements communicate managerial opinion on previous firm performance and their expectations for the future. Observations from the index confirm that more positive manager sentiment is associated with fewer earnings surprises and higher investment growth. Managerial sentiment also appears to accurately predict the market return as well as cross-sectional stock returns.

Firm-specific variables Previous studies indicate that firm-specific factors influence a company's capital structure choice. We bring these into our analysis. These include profitability, asset tangibility, firm size, effective tax rate, and growth opportunity (Rajan and Zingales, 1995; Titman and Wessels, 1988; Booth *et al*. 2001; Korajczyk and Levy, 2003; Kayo and Kimura, 2011; Graham *et al*. 2015; and others). We follow standard capital structure literature and calculate profitability as operating income divided by total assets. We then compute asset tangibility as the ratio of net property, plant, and equipment to total assets.

We also control for firm size using the natural log of total assets. The effective tax rate (tax shield) is calculated as the ratio of income taxes to pre-tax income. Finally, we use the market-to-book ratio to proxy for growth opportunities; we define the market-to-book ratio as the market value of equity divided by the book value of equity.

Macroeconomic variables Prior literature establishes that the difference in wealth between managers and shareholders determines agency costs and an optimal capital structure. Kiyotaki and Moore (1997) and Levy (2001) find that manager compensation ties to corporate profits and equity performance. Therefore, to account for these observations, we create three series to proxy for this distribution effect, using an approach pioneered in Korajczyk and Levy (2003). The first of these is the two-year aggregate domestic non-financial corporate profit growth rates. This figure is calculated using quarterly data from the Flow of Funds and matched to the firm quarter with the most overlap.

Next, we compute the two-year equity market return from the CRSP value-weighted index of stocks traded on the NYSE, AMEX, and NASDAQ. As Friedman and Kuttner (1992) find that the commercial paper spread can be used to predict future economic activity, we use commercial paper spread as a proxy for future corporate profits and, in turn, future managerial compensation. We

calculate the commercial paper spread as the annualized rate on three-month commercial paper divided by the three-month Treasury bill.

DATA

Our sample includes all US firms that provide information on total assets and liabilities listed on the NYSE, AMEX, and NASDAQ, extending from 1971 to 2016, corresponding to the availability of sentiment indices. We exclude financial firms (SIC codes 6000–6999) and regulated utilities (SIC codes 4900–4999) consistent with previous studies. The reason for this is that the capital structure for these firms is not market-driven as it is affected by regulation. We also eliminate firm-years with negative book value of equity. Our final sample consists of 9,986 US firms with a total of 153,787 firm-year observations. We retrieve all our data from Compustat annual files. Our sample period is determined by the availability of data, the managerial sentiment index is available up to 2015 and the other investor sentiment indices are available up to 2016.

To mitigate the potential impact of outliers on our analysis, we winsorsize all firm-level variables at the 1st and 99th percentile. All equity market data is taken from CRSP, while three-month commercial paper and rates are from the Federal Reserve Bank of St. Louis.

We obtain the investor sentiment indices of Baker and Wurgler (2006) and Huang *et al.* (2015) from Zhou's website (http://apps.olin.wustl.edu/faculty/zhou/); this is where we also obtained the manager sentiment index of Jiang *et al.* (2019). All data sources and variable calculation details are shown in Table 1. Table 3 reports summary statistics for all variables used in our analysis.

Average book and market value-based leverage ratios for all companies are 33.40% and 34.29%, respectively. These figures are comparable to those observed by Graham *et al.* (2015), who study the evolution and determination of corporate financial policy for US non-financial publicly traded firms over the last century. Summary statistics also show that our sample firms have a broad spectrum of leverage ratios with more minor variation in the market leverage ratio. Interestingly, the book-value leverage ratios range from 0% to 342.03%, while the market leverage ratio ranges from 0% to 100%.

We can also see in Table 3 that every firm-level control variable fluctuates over a wide range suggesting that our sample represents a wide array of firms.[8] Similarly, all six macroeconomic and investor sentiment indices that we use display substantial variation over time and signal their appropriateness for this analysis.

Table 4 presents the Pearson correlation coefficients between the sample's variables, together with their *p*-values. The market and book value-based leverage ratios are, as expected, positively correlated with each other.

[8] For example, profitability ranges from –58.14% to 55.57%, tangibility from 0% to 100%, size from 1.6383 to 4.9848, effective tax rate from –218.89% to 251.44%, and market-to-book ratio from 28.89% to 1148.15 %.

TABLE 3

PANEL DATA SUMMARY STATISTICS

Variable	Count	Mean	Std. Dev.	Min	25th Percentile	Median	Max	75th Percentile
BVD	128,760	0.3340	0.6474	0.0000	0.1459	0.2076	3.4203	0.4899
MVD	127,107	0.3429	0.3356	0.0000	0.1443	0.2394	1.0000	0.5515
PROF	128,760	–0.2383	1.7550	–0.5814	–0.3688	0.0527	0.5557	0.1064
TANG	128,760	0.6068	0.3136	0.0000	0.3460	0.6267	1.0000	0.9104
SIZE	122,714	2.3135	1.2462	–1.6383	1.5270	2.4170	4.9848	3.1960
TAX	125,176	0.1209	0.2842	–2.1889	–0.0148	0.1280	2.5144	0.4145
MB	125,038	2.0560	10.2323	0.2889	0.8957	1.4900	11.4815	2.8470
CPG	153,787	0.3333	0.7026	–0.6787	–0.1170	0.2387	2.3857	0.5216
EMR	153,787	0.1800	0.2539	–0.4192	0.0873	0.1467	0.6595	0.3923
CPS	153,787	3.2462	6.3540	0.0000	1.0972	1.1666	32.3333	1.6428
PCM	153,787	0.0576	0.6228	–2.1918	–0.2134	0.0127	2.1674	0.3062
PCMO	153,787	–0.0221	0.6317	–1.9575	–0.3616	0.0000	1.9844	0.2003
PLSM	153,787	–0.2610	0.7352	–1.1229	–0.7253	–0.5490	2.5739	0.0000
PLSMO	153,787	–0.1361	0.7031	–1.5046	–0.6080	–0.2645	2.3169	0.0000
MSI	72,445	0.4295	0.6629	–0.9838	–0.0220	0.3838	1.4785	1.15489

This table provides descriptive statistics of the variables. The sample consists of all non-financial firms in Compustat. After we delete firms with insufficient data to compute all required variables and winsorize all firm level variables at the 1st and 99th percentiles, the final sample consists of 153,787observations over the period 1971 to 2016. Equity market data is from CRSP, while three-month commercial paper rates are from the Federal Reserve Bank of St. Louis. We obtain the investor sentiment indices of Baker and Wurgler (2006) and Huang *et al.* (2015) from Zhou's website; this is where we also obtained the manager sentiment index of Jiang *et al.* (2019). The definition and construction details for each variable can be found in Table 2.
Abbreviations of the variables are defined as the follows: BVD: Book value of leverage ratio; MVD: Market value of leverage ratio; PROF: Profitability; TANG: Tangibility; SIZE: Size; TAX: Effective tax rate; MB: Market-to-book ratio; CPG: 2-year corp. profit growth; EMR: 2-year equity market return; CPS: Commercial paper spread; PCM: Sentiment index PC method; PCMO: Sentiment index PC method orthogonalized; PLSM: Sentiment index PLS method; PLSMO: Sentiment index PLS method orthogonalized; MSI: Manager sentiment index.

We find that both measures of leverage are positively and significantly correlated with firm size and asset tangibility. Consistent with the predictions of trade-off theory, both measures of leverage are positively correlated with profitability. According to pecking order theory, tax negatively correlates with both measures of leverage. Moreover, both leverage measures are negatively correlated with firm growth opportunities, an observation consistent with agency theory predictions. Both of our leverage measures, together with all macroeconomic variables, are significantly associated as expected. Again, consistent with our expectations, the leverage measures correlate with the four investment indices used in the analysis.

We also notice that several correlation coefficients between firm-level and macroeconomic variables are relatively low; this implies that multicollinearity is not a significant concern for our study. However, we find that the correlation coefficients between investor sentiment indices are relatively high; thus, we test each variable separately. We complete five regressions for each measure of

TABLE 4

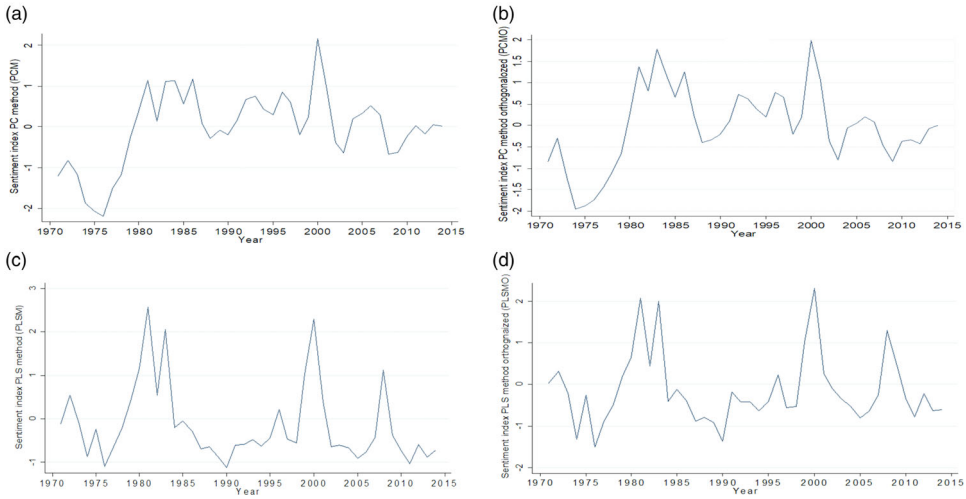
CORRELATION COEFFICIENTS BETWEEN VARIABLES

	BVD	MVD	PROF	TANG	SIZE	TAX	MB	CPG	EMR	CPS	PCM	PCMO	PLSM	PLSMO	MSI
BVD	1.0000														
MVD	0.2622***	1.000													
	(0.0000)														
PROF	0.5466***	0.0467***	1.000												
	(0.0000)	(0.0000)													
TANG	0.3004***	0.3585***	0.1584***	1.000											
	(0.0000)	(0.0000)	(0.0000)												
SIZE	0.1748***	0.1226***	0.3342***	0.2380***	1.000										
	(0.0000)	(0.0000)	(0.0000)	(0.0000)											
TAX	–0.0892***	–0.0724***	0.0866***	–0.0099**	0.1273***	1.000									
	(0.0000)	(0.0000)	(0.0000)	(0.0498)	(0.0000)										
MB	–0.1600***	–0.1026***	0.1955***	–0.0349***	0.0271***	0.0178***	1.000								
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)									
CPG	–0.0154***	–0.0371***	0.0125***	–0.0055	–0.0016	0.0105**	0.0229***	1.000							
	(0.0000)	(0.0000)	(0.0008)	(1.0000)	(1.0000)	(0.0211)	(0.0000)								
EMR	–0.0117***	–0.0486***	0.0035	–0.0178***	–0.0117***	0.0096*	0.0301***	0.3774***	1.000						
	(0.0027)	(0.0000)	(1.0000)	(0.0000)	(0.0047)	(0.0721)	(0.0000)	(0.0000)							
CPS	0.0169***	0.0245***	–0.0295***	0.0121***	0.0280***	–0.0394***	–0.0298***	–0.2607***	–0.4054***	1.000					
	(0.0000)	(0.0000)	(0.0000)	(0.0015)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)						
PCM	–0.0250***	–0.0545***	0.0194***	–0.0022	–0.0041	–0.0110**	0.0381***	0.0723***	0.2699***	–0.2437***	1.000				
	(0.0000)	(0.0000)	(0.0000)	(1.0000)	(1.0000)	(0.0109)	(0.0000)	(0.0000)	(0.0000)	(0.0000)					
PCMO	–0.0293***	–0.0409***	0.0323***	–0.0057	–0.0112***	0.0069	0.0380***	–0.0241***	0.2459***	–0.2075***	0.9603***	1.000			
	(0.0000)	(0.0000)	(0.0000)	(1.0000)	(0.0088)	(1.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)				
PLSM	–0.0158***	–0.0204***	0.0346***	–0.0020	–0.0048	0.0326***	0.0173***	–0.2517***	–0.2098***	0.2266***	0.3794***	0.4982***	1.000		
	(0.0000)	(0.0000)	(0.0000)	(1.0000)	(1.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)			
PLSMO	–0.0591***	–0.0082	0.0146***	0.0063	0.0060	0.0019	0.0099**	–0.2692***	–0.3239***	0.2913***	0.3119***	0.3982***	0.9426***		
	(0.0000)	(0.3809)	(0.0000)	(1.0000)	(1.0000)	(1.0000)	(0.0465)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	1.000	
MSI	–0.0127***	–0.0115***	–0.0021	–0.0012	0.0173***	–0.0073*	–0.0038	–0.4054***	0.2061***	0.4281***	0.2177***	0.5150***	0.3973***	0.1981***	1.000
	(0.0023)	(0.0062)	(0.6178)	(0.7698)	(0.0001)	(0.0857)	(0.3693)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	

This table presents the Pearson correlation matrix between variables used in this study. Definitions and data sources for all variables are provided in Table 2. ***, **, and * refer to significance levels at 1%, 5%, and 10%, respectively. Figures reported in parentheses are *p*-values.
Abbreviations of the variables are defined as the follows: BVD: Book value of leverage ratio; MVD: Market value of leverage ratio; PROF: Profitability; TANG: Tangibility; SIZE: Size; TAX: Effective tax rate; MB: Market-to-book ratio; CPG: 2-year corp. profit growth; EMR: 2-year equity market return; CPS: Commercial paper spread; PCM: Sentiment index PC method; PCMO: Sentiment index PC method orthogonalized; PLSM: Sentiment index PLS method; PLSMO: Sentiment index PLS method orthogonalized; MSI: Manager sentiment index.

FIGURE 2

INVESTOR SENTIMENT INDICES



These figures plot the annual investor sentiment indices over the period 1971 to 2014. Figure (a) represents the Baker-Wurgler (2006) index based on the first principal component (PC) of six proxies from market data, figure (b) represents the Baker-Wurgler (2006) index that controls for macroeconomic variables (orthogonal to six macroeconomic proxies), figure (c) represents the Huang *et al.* (2015) index based on the partial least square method (PLS), and figure (d) represents the Huang *et al.* (2015) index that controls for macroeconomic variables (orthogonal to six macroeconomic proxies). All data are obtained from Guofu Zhou's website, http://apps.olin.wustl.edu/faculty/zhou/.

FIGURE 3

MANAGER SENTIMENT INDEX

This figure plots the annual manager sentiment index over the period 2003 to 2014. Jiang *et al.* (2019) constructed this index based on the aggregated textual tone of firm disclosures. The index is orthogonal to fourteen macroeconomic variables. The manager sentiment index is obtained from Guofu Zhou's website, http://apps.olin.wustl.edu/faculty/zhou/.

leverage to determine the impact of each of the different investor sentiment indices.

We plot the investor sentiment indices in Figure 2. The indices appear to capture the most significant fluctuations in sentiment. The events capture the sentiment that reflects the 1961 crash of growth stocks, the electronics bubble of 1968/69, the formation of OPEC and its effect on oil price, and the biotech bubble of the early 1980s. We can also see that sentiment decreased following the market crash in the late 1980s but reversed during the 1990s Internet bubble. Investor sentiment also peaked in the early 2000s, dropping sharply during the 2008–2009 subprime crisis. Since 2010, investor sentiment has risen steadily.

In Figure 3, we plot the Jiang *et al*. (2019) manager sentiment index. In a similar manner to the investor sentiment indices, we see that the manager sentiment index displayed low values in the early 2000s following the Internet bubble. It peaked in 2007 but dropped sharply during the 2008–2009 subprime crisis, as one might expect. Since 2010, managerial sentiment appears to increase alongside the gradual recovery of the US economy.

EMPIRICAL ANALYSIS

To examine if sentiment affects firm leverage, we run pooled ordinary least squares and fixed-effect panel regressions using data from all non-financial firms available on Compustat from 1971 to 2015. We start the analysis by documenting the effect of firm-level and macroeconomic factors on firm leverage. Following that, we examine the impact of each of the different iterations of sentiment on firm leverage. Finally, we check the robustness of our results using alternative estimation methods.

Control Variables

We report panel regression results in Tables 5 and 6, based on model (1) using the OLS and fixed-effects (FE) estimation techniques. We include the industry and time dummies to control for time-invariant industry-specific characteristics and a common time effect across firms in all OLS specifications. The FE estimation technique controls for unobserved firm heterogeneity (individual differences). We control for firm and year-specific variables that may have been omitted in the study using both firm and year fixed effects. As fixed effects contain all unobserved firm variables, we drop industry dummies from the regression to avoid collinearity. Each of the five investor sentiment factors is examined in separate regressions to avoid multicollinearity problems. Book leverage results are reported in columns (1) to (6) of both Tables 4 and 5; likewise, market leverage results are reported in columns (7) to (12). We find that both estimation techniques, OLS and fixed effects, are qualitatively similar and unchanged significantly.

The pooled regressions of firm-level control variables on both book and market leverage are shown in Tables 5 and 6. Our results support previous research

TABLE 5

POOLED PANEL OLS RESULTS OF DETERMINANTS OF LEVERAGE

	Panel A: Book value of total debt ratio (BVD)					**Panel B: Market value of total debt ratio (MVD)**						
	(1)	(2)	(3)	(4)	(No. 5)	(No. 6)	(No. 7)	(No. 8)	(No. 9)	(10)	(11)	(12)
PCM_{t-1}		–0.0356***						–0.0137***				
		(0.0000)						(0.0000)				
$PCMO_{t-1}$			–0.0372***						4.0E–5			
			(0.0000)						(0.5570)			
$PLSM_{t-1}$				–0.0178***						–0.0053**		
				(0.0000)						(0.0100)		
$PLSMO_{t-1}$					–0.0145***						0.0011	
					(0.0030)						(0.6330)	
MSI_{t-1}						–0.0193**						–0.0196***
						(0.0410)						(0.0000)
Control variables												
$PROF_{t-1}$	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	(0.8830)	(0.8820)	(0.8700)	(0.8680)	(0.8710)	(0.7200)	(0.5570)	(0.5560)	(0.5570)	(0.5660)	(0.5590)	(0.7010)
$TANG_{t-1}$	0.0230**	0.0238**	0.0237**	0.0232**	0.0231**	0.0380***	0.0959***	0.0956***	0.0959***	0.0959***	0.0959***	1.01E–1***
	(0.0180)	(0.0150)	(0.0150)	(0.0180)	(0.0180)	(0.0080)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
$SIZE_{t-1}$	0.0040*	0.0040*	0.0040*	0.0040**	0.0040*	0.0031	0.0107***	0.0107***	0.0106***	0.0107***	0.0107***	0.0081***
	(0.0810)	(0.0780)	(0.0790)	(0.0810)	(0.0810)	(0.3340)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
TAX_{t-1}	–0.0008	–0.0008	–0.0008	–0.0008	–0.0008	–0.0006	0.0002	0.0002	0.0002	0.0002	0.0002	2.5E–5
	(0.2660)	(0.2640)	(0.2660)	(0.2770)	(0.2740)	(0.2010)	(0.4850)	(0.4860)	(0.4850)	(0.4960)	(0.4870)	(0.9490)
MB_{t-1}	–1.83E–5**	–1.84E–5**	–1.83E–5**	–1.83E–5**	–9.96E–6**	–1.75E–6	9.95E–6***	9.98E–6***	9.95E–6***	9.95E–6***	9.95E–6***	1.78E–5**
	(0.0160)	(0.0170)	(0.0170)	(0.0160)	(0.0170)	(0.8070)	(0.0060)	(0.0060)	(0.0060)	(0.0060)	(0.0060)	(0.0150)
CPG_{t-1}	–0.0156***	–0.0164***	–0.0197***	–0.0187***	–0.0174***	–0.0280***	–0.0069***	–0.0070***	–0.0069***	–0.0059***	–0.0068***	–0.0098***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0010)	(0.0010)	(0.0010)	(0.0050)	(0.0010)	(0.0020)
EMR_{t-1}	0.0043	0.0180	0.0209	–0.0022	–0.0060	0.1308***	–0.0375***	–0.0321***	–0.0375***	–0.0355***	–0.0367***	0.0202
	(0.7500)	(0.1830)	(0.1230)	(0.8730)	(0.6660)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.1820)
CPS_{t-1}	0.0011**	0.0004	0.0005	0.0013***	0.0013***	0.0024***	0.0009***	0.0006***	0.0009***	0.0008***	0.0009***	0.0030
	(0.0300)	(0.4120)	(0.3380)	(0.0060)	(0.0090)	(0.0070)	(0.0000)	(0.0060)	(0.0000)	(0.0000)	(0.0000)	(0.0000
Constant	0.3546***	0.3569***	0.3538***	0.3508***	0.3544***	0.3655***	0.2581***	0.2590***	0.2581***	0.2592***	0.2581***	0.2403
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)

(Continues)

TABLE 5

CONTINUED

	Panel A: Book value of total debt ratio (BVD)					Panel B: Market value of total debt ratio (MVD)						
	(1)	(2)	(3)	(4)	(No. 5)	(No. 6)	(No. 7)	(No. 8)	(No. 9)	(10)	(11)	(12)
Industry effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sample size	153,787	153,787	153,787	153,787	153,787	72,445	153,787	153,787	153,787	153,787	153,787	72,445
Adjusted R-squared	0.120	0.141	0.140	0.132	0.124	0.118	0.134	0.139	0.134	0.135	0.134	0.147

This table presents the OLS regressions with cluster effects at the firm level. See Table 2 for variable definitions. Each regression specification includes time and industry dummies. Panel A reports the results of the book total debt ratio. Panel B reports the results of the market total debt ratio. The full sample comprises 153,787 observations over the period 1971 to 2016. The models take the following functional form:

$$lev_{i,t} = \alpha_0 + \beta_s S_{i,t} + \beta_f X_{i,t} + \beta_m Y_t + \delta_i + \varepsilon_{i,t}$$

where $lev_{i,t}$ is firm i's leverage ratio at time t, $S_{i,t}$ are sentiment indices, $X_{i,t}$ and Y_t, respectively, are vectors of firm-level and macroeconomic variables that determine the capital structure, δ_i is an unabsorbed firm fixed effect, and $\varepsilon_{i,t}$ is a random error term assumed to be independently identical and normally distributed with a zero mean and constant variance, $\varepsilon_{i,t} \sim iid\, N(0, \sigma^2)$. ***, ** and * refer to significance levels at 1%, 5%, and 10%, respectively. Figures reported in parentheses are *p*-values. Abbreviations of the variables are defined as the follows: BVD: Book value of leverage ratio; MVD: Market value of leverage ratio; PROF: Profitability; TANG: Tangibility; SIZE: Size; TAX: Effective tax rate; MB: Market-to-book ratio; CPG: 2-year corp. profit growth; EMR: 2-year equity market return; CPS: Commercial paper spread; PCM: Sentiment index PC method; PCMO: Sentiment index PC method orthogonalized; PLSM: Sentiment index PLS method; PLSMO: Sentiment index PLS method orthogonalized; MSI: Manager sentiment index.

TABLE 6

FIXED-EFFECT RESULTS OF DETERMINANTS OF LEVERAGE

	Panel A: Book value of total debt ratio (BVD)					**Panel B: Market value of total debt ratio (MVD)**						
	(1)	(2)	(3)	(4)	(No. 5)	(No. 6)	(No. 7)	(No. 8)	(No. 9)	(10)	(11)	(12)
PCM_{t-1}		−0.0354***						−0.0364***				
		(0.0000)						(0.0040)				
$PCMO_{t-1}$			−0.0366***						0.0068			
			(0.0000)						(0.4605)			
$PLSM_{t-1}$				−0.0173***						−0.0086**		
				(0.0050)						(0.0351)		
$PLSMO_{t-1}$					−0.0142**						0.0076	
					(0.0240)						(0.5150)	
MSI_{t-1}						−0.0193***						−0.0199*
						(0.0260)						(0.0530)
Control variables												
$PROF_{t-1}$	0.0071**	0.0072**	0.0064**	0.0066**	0.0067**	3.01E-5	0.0025	0.0022	0.0019	0.0020	0.0020	0.0002
	(0.0101)	(0.0138)	(0.0150)	(0.0120)	(0.0110)	(0.7100)	(0.1561)	(0.1592)	(0.1690)	(0.1510)	(0.1540)	(0.8050)
$TANG_{t-1}$	0.0216***	0.0225***	0.0217***	0.0212***	−0.0211**	−0.0380***	0.0972***	0.0974***	0.0966***	0.0967***	0.0967***	0.1004***
	(0.0010)	(0.0010)	(0.0010)	(0.0010)	(0.0010)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
$SIZE_{t-1}$	0.0076***	0.0075***	0.0066***	0.0066***	0.0067***	0.0031	0.0123***	0.0122***	0.0118***	0.0118***	0.0118***	0.0082***
	(0.0031)	(0.0032)	(0.0030)	(0.0040)	(0.0030)	(0.1190)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
TAX_{t-1}	−0.0235***	−0.0213**	−0.0209**	−0.0214**	−0.0221***	−0.0006**	0.0006	0.0007	0.0003	−0.0001	−0.0001	−0.0001
	(0.009)	(0.0160)	(0.0180)	(0.0130)	(0.0100)	(0.0980)	(0.9895)	(0.9812)	(0.9480)	(0.9800)	(0.9900)	(0.9610)
MB_{t-1}	−2.95E−4	−3.33E-4	−0.0003	−0.0003	0.0003	1.80E-4	−1.02E-4	−1.01E-4	0.0001	0.0001	0.0001	0.0001
	(0.3112)	(0.2587)	(0.2520)	(0.2740)	(0.2860)	(0.8090)	(0.3882)	(0.3471)	(0.3720)	(0.3870)	(0.3770)	(0.2040)
CPG_{t-1}	−0.0151	−0.0164*	−0.0193**	−0.0184*	−0.0171	−0.0280***	−0.0156*	−0.0187**	−0.0198**	−0.0134	−0.0166*	−0.0102
	(0.1549)	(0.0626)	(0.0330)	(0.0840)	(0.1230)	(0.0010)	(0.0981)	(0.0470)	(0.0380)	(0.1550)	(0.0660)	(0.2060)
EMR_{t-1}	0.0048	0.0185	0.0204	−0.0022	−0.0060	0.0030	−0.0669	−0.0374	−0.0422	−0.0668	−0.0690	−0.0235
	(0.9182)	(0.6380)	(0.5810)	(0.9481)	(0.8670)	(0.2020)	(0.1330)	(0.2956)	(0.2450)	(0.1370)	(0.1190)	(0.5510)
CPS_{t-1}	0.0001	0.0003	0.0005	0.0013	0.0013	0.0024*	−0.0018	−0.0021	−0.0016*	−0.0015	−0.0012	0.0031
	(0.1131)	(0.5155)	(0.3900)	(0.4430)	(0.3901)	(0.0500)	(0.1645)	(0.1458)	(0.1000)	(0.1060)	(0.2260)	(0.1010)
Constant	0.3484***	0.3507***	0.3471***	0.3441***	0.3474***	0.3655***	0.3024***	0.3008***	0.2982***	0.3035***	0.3016***	0.2385***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)

(Continues)

TABLE 6

CONTINUED

	Panel A: Book value of total debt ratio (BVD)				Panel B: Market value of total debt ratio (MVD)							
	(1)	(2)	(3)	(4)	(No. 5)	(No. 6)	(No. 7)	(No. 8)	(No. 9)	(10)	(11)	(12)
Industry effect	No	No	No	No	No	No	No	No	No	No	No	No
Year effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sample size	153,787	153,787	153,787	153,787	153,787	72,445	153,787	153,787	153,787	153,787	153,787	72,445
Adjusted R-squared	0.089	0.224	0.263	0.129	0.117	0.184	0.131	0.139	0.263	0.113	0.121	0.157

Notes: This table presents the fixed-effects regressions. See Table 2 for the definition of all variables. Each regression specification includes time dummies. Panel A reports the results of the book total debt ratio. Panel B reports the results of the market total debt ratio. The sample consists of 153,787 observations over the period 1971 to 2016.The models take the following functional form:

$$lev_{i,t} = \alpha_0 + \beta_s S_{i,t} + \beta_f X_{i,t} + \beta_m Y_t + \delta_i + \varepsilon_{i,t}$$

where $lev_{i,t}$ is firm i's leverage ratio at time t, $S_{i,t}$ are sentiment indices, $X_{i,t}$ and Y_t, respectively, are vectors of firm-level and macroeconomic variables that determine the capital structure, δ_i is an unabsorbed firm fixed effect, and $\varepsilon_{i,t}$ is a random error term assumed to be independently identical and normally distributed with a zero mean and constant variance, $\varepsilon_{i,t} \sim iid\,N(0, \sigma^2)$. ***, ** and * refer to significance levels at 1%, 5%, and 10%, respectively. Figures reported in parentheses are *p*-values. Abbreviations of the variables are defined as the follows: BVD: Book value of leverage ratio; MVD: Market value of leverage ratio; PROF: Profitability; TANG: Tangibility; SIZE: Size; TAX: Effective tax rate; MB: Market-to-book ratio; CPG: 2-year corp. profit growth; EMR: 2-year equity market return; CPS: Commercial paper spread; PCM: Sentiment index PC method; PCMO: Sentiment index PC method orthogonalized; PLSM: Sentiment index PLS method; PLSMO: Sentiment index PLS method orthogonalized; MSI: Manager sentiment index.

regarding the firm-specific determinants of capital structure. We find that the coefficients of tangibility are positive and significant.

across the two measures; this is consistent with the trade-off and pecking order theories asserted across a range of studies, including Rajan and Zingales (1995), Myers and Rajan (1998), Korajczyk and Levy (2003), Frank and Goyal (2009), and many others. Similarly, we find that firm size and corporate leverage are positive and significant across the two leverage measures. This finding is consistent with the trade-off and agency theories in the studies of Rajan and Zingales (1995), Korajczyk and Levy (2003), Hanousek and Shamshur (2011), Lim (2012), and Graham *et al*. (2015).

Larger firms are more diversified and face lower default risk; consequently, they have more borrowing capacity than smaller firms. We can also see in Tables 5 and 6 that profitability, taxes, and growth opportunities are sensitive to model specifications, specifically whether book or market leverage is used. There is also sensitivity to which econometric method is employed. For example, our OLS results show that profitability and leverage are unrelated, while the fixed-effect model shows that profitability is positive and significant in-market leverage regressions. This observation implies that more profitable firms are likely to have more corporate debt, which contradicts the previous findings of Rajan and Zingales (1995), Booth *et al*. (2001), Graham *et al*. (2015), and several others. However, this finding is consistent with trade-off theory; firms facing a choice between a tax shield or increased bankruptcy risk will use more debt to reduce taxes.

Moreover, profitable firms with many fixed assets that can be used as collateral should have greater access to external funds and therefore use more debt. We note that debt's tax benefit is only negative and significant in the book value of leverage regressions. Following previous research, we proxy growth opportunities using the market to book equity ratio. We find that growth opportunities have a negative and significant effect on both book and market values of leverage in fixed-effects regressions.

Another interesting finding is that more profitable firms have less debt, which supports the previous research of Rajan and Zingales (1995), Graham *et al*. (2015), and others. This observation is consistent with agency theory; firms with more growth opportunities keep leverage low to fund profitable investments and prevent the wealth transfer from shareholders to creditors.

Looking at the macroeconomic variables in our study, we can see that the coefficients on both 2-year corporate profit growth and 2-year equity market return are negative, regardless of the econometric method or measure of leverage used. However, our findings are not robust; the coefficients become statistically and economically insignificant when we estimate the model using the fixed-effects method. We also find that the commercial paper spread is positive and statistically significant in OLS regressions for both leverage measures. This finding implies that more profitable firms have lower leverage during expansionary periods; this is consistent with Levy's theoretical work (2001) and Korajczyk and Levy's (2003) empirical findings.

Sentiment Variables

To examine the effects of sentiment on leverage, we use two different sentiment indices types which have theoretically solid backing. The first type takes a macroeconomic perspective incorporating market-wide factors; this includes the principal component (PC) method proposed by Baker and Wurgler (2006) and the partial least squares (PLS) approach of Huang *et al.* (2015). The second type adopts a microeconomic perspective in the form of an index developed by Jiang *et al.* (2019), the construction of which is based on the aggregated textual tone of firm disclosures. One problem with using either of the macroeconomic type indices as proxies for sentiment is that they cannot distinguish between the common sentiment or business cycle components. We solve this problem by following Baker and Wurgler (2006) and Huang *et al.* (2015) and use both indices' orthogonalized versions. We label these as PCMO and PLSMO. These are orthogonal to the industrial production index, consumer durables, non-durables, services, employment, and a dummy variable for NBER recorded recessionary periods. However, despite orthogonalizing both indices, there is still a danger that these are not orthogonalized to other macroeconomic factors (e.g., the interest rate per Sibley *et al.*, 2016 and the liquidity risk factor as per Karolyi et al., 2012). This observation provides a rationale for future investigation using Jiang *et al.*'s (2019) managerial sentiment index, as this is orthogonalized to a more comprehensive set of macroeconomic factors.[9]

Panel A of Tables 5 and 6 report the OLS and fixed-effect estimations of the sentiment capital structure model where we use the book value definition for leverage. The results show that the relationship between each of the five sentiment indices and book leverage is negative and significant using both estimation methods. Specifically, the findings that we produce when we examine the four macroeconomic type sentiment indices imply that when analysts are optimistic about a firm's long-term growth opportunities, managers issue more equity relative to debt. Consequently, the book value of leverage decreases. The results are robust regardless of whether the macroeconomic type indices are orthogonal to macroeconomic factor components. We get similar results when we use the manager sentiment index in our model.

After controlling for other recognized capital structure determinants, we find evidence to reject hypothesis H3. Optimistic managers do not overstate earnings growth and, therefore, do not prefer debt to equity. We conclude that managers do not make capital structure decisions based on standard pecking order theory. Panel B of Tables 5 and 6 reports OLS and fixed-effect estimations when we use the market-value leverage ratio in our sentiment capital structure model. Although our results are similar to previous tests using the book value of leverage, the results differ depending on which sentiment index we examine. We find a

[9] Fourteen factors in total including the log dividend-price ratio, log dividend yield, log earnings-price ratio, log dividend-payout ratio, stock return variance, book-to-market ratio, net equity expansion, Treasury bill rate, long-term bond yield, long-term bond return, term spread, default yield spread, default return spread, and inflation rate.

negative and significant relationship between the non-orthogonalized macroeconomic type sentiment indices and the market value of leverage ratio. Contrary to the trade-off explanation, we find that the leverage ratio is countercyclical (H1). We firmly reject hypotheses H2, H3, and H4 in favour of a countercyclical market timing behaviour argument.

We note that the relationship becomes positive and not statistically significant between the orthogonalized sentiment indices (PCMO and PLSMO) and the market value of leverage ratio. This finding suggests that the negative relationship between macroeconomic and sentiment indices and the market-value leverage ratio is due to macroeconomic factors rather than sentiment. When the economy is good, macroeconomic factors are high, which fundamentally drives stock prices up.

The neoclassical view of market efficiency indicates that managers will choose to issue equity over debt when stock prices are high to fund their positive NPV project opportunities. This choice decreases its market-value leverage ratios. Moreover, when stock prices are high due to capital being redistributed to firms with the most positive NPV project opportunities, mergers become more valuable (Jovanovic and Rousseau, 2002). Our test also shows weak support for the behavioural version of pecking order theory. When managers believe their stock price to be overvalued, they are more likely to issue equity (Loughran and Ritter, 1995; Baker and Wurgler, 2000). We find strong evidence to support hypothesis H1 and to reject hypothesis H2. We conclude that the market value of the leverage ratio is countercyclical. We also contend that macroeconomic factors strengthen the negative relationship between sentiment indices and the market value of leverage owing to business cycle factors.

Also shown in Panel B of Tables 5 and 6 are the OLS and fixed-effects estimations using the manager sentiment index with the market-value leverage ratio. We find that the manager sentiment index is negative and significant at the 5% level using the OLS method and at the 10% level using the fixed-effect method. Thus, we find strong evidence supporting the market timing hypothesis (H1) that the market value of leverage negatively correlates with manager sentiment.

However, when we bring the orthogonalized investor sentiment index into our model, we find little evidence of the market timing hypothesis. Our results may be due to business cycle factors or to an over-extrapolation bias.

As managers become more optimistic (pessimistic) during business cycle peaks (troughs), they may be exhibiting a bias that would lead to incorrect security valuation and return reversal.

Furthermore, as job losses and uncertainty increase during market downturns, investors become more distressed (Garcia, 2013). Such a situation could result in increased market sensitivity to managerial sentiment during these periods. Furthermore, the manager sentiment index's explanatory power on stock returns may directly result from the manager's optimistic or pessimistic language concerning the business cycle. Although the index is orthogonalized to variables that link to a wide range of macroeconomic fundamentals (The manager

sentiment index is orthogonal to 14 macro factors reviewed in Goyal and Welch (2008).)

Research by Baker and Wurgler (2006) and Huang *et al.* (2015) use business cycle proxies to orthogonalize their macroeconomic type indices.[10] Therefore, a robustness test is needed to determine whether the orthogonalized investor sentiment indices negatively correlate with the market value of leverage.

ROBUSTNESS CHECKS

Critics of fixed-effects estimation argue that the effect of independent variables in the model does not differ within groups. This can be a problem because if the fixed effects are perfectly collinear with the variable that does not vary, we cannot disentangle the group factor from the independent variables in the model. Following Gormley and Matsa (2014), we can address this issue using the Hausman and Taylor (1981) two-step process. We first run a fixed-effects model to estimate the coefficients for the variables that differ within groups. Next, we regress the resulting group average residuals on the covariates that do not differ within groups while using the covariates that differ within groups (and are not correlated to the unobserved heterogeneity) as instruments. This method allows for potential endogenous variables that may arise as a result of lagged regressors in our model or possible endogeneity between sentiment, leverage, and control variables (market to book, for instance). Another benefit of using this method is that, according to Baltagi *et al.* (2003), it combines the consistency of a fixed-effects model with the efficiency and applicability of a random-effects model.

As shown in Table 7, we can see that our results reported in Tables 5 and 6 continue to hold when we use the Hausman and Taylor (1981) method. We find support for our earlier result that the relationship between each of the five sentiment indices and the book value of leverage is negative and significant. Firm-level variables also continue to be associated with the book value of leverage as reported in Panel A of Tables 5 and 6. When we use the market value of leverage in the model, our results supporting hypothesis H1 are even stronger after using the Hausman and Taylor (1981) method. We can see that the manger sentiment index is negatively correlated with the market value of leverage and significant at the 5% level. Further, we observe that non-orthogonalized investor sentiment indices are more negatively significant than those orthogonalized, which suggests countercyclical leverage. We note that the orthogonalized Baker and Wurgler index is now negatively significant at the 5% level. The results strongly confirm our findings in support of market timing behaviour.

We conduct additional tests to ensure the robustness of our results to alternative measures of leverage. Table 8 shows the results when we use the book value of

[10] The growth of: industrial production, durable consumption, nondurable consumption, service consumption, employment, and a dummy variable for the National Bureau of Economic Research recorded recessionary periods.

TABLE 7

ROBUSTNESS TESTS (*HAUSMAN-TAYLOR 1981 (HT) METHOD)*

	Panel A: Book value of total debt ratio (BVD)					**Panel B: Market value of total debt ratio (MVD)**				
	(1)	(2)	(3)	(4)	(No. 5)	(No. 6)	(No. 7)	(No. 8)	(No. 9)	(10)
PCM_{t-1}	−0.0092***					−0.0437***				
	(0.0060)					(0.0000)				
$PCMO_{t-1}$		−0.0126***					−0.0360***			
		(0.0010)					(0.0040)			
$PLSM_{t-1}$			−0.0108					−0.0091**		
			(0.0020)					(0.0469)		
$PLSMO_{t-1}$				−0.0079***					0.00884	
				(0.0070)					(0.5070)	
MSI_{t-1}					−0.0186**					−0.0155**
					(0.0261)					(0.0490)
Control variables										
$PROF_{t-1}$	0.0055**	0.0055**	0.0055**	0.0055**	0.0041**	6.80E-5***	6.80E-5***	6.80E-5***	6.80E-5***	6.00E-5**
	(0.0110)	(0.0150)	(0.0150)	(0.0150)	(0.0270)	(0.0050)	(0.0050)	(0.0050)	(0.0050)	(0.0340)
$TANG_{t-1}$	0.1503***	0.1503***	0.1502***	0.1502***	0.1234	0.3515***	0.3515***	0.3515***	0.3515***	0.3542***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
$SIZE_{t-1}$	0.0820***	0.0820***	0.0820***	0.0820***	0.1154***	0.0103***	0.0103***	0.0103***	0.0103***	0.0145***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
TAX_{t-1}	−7.85E-6	−7.85E-6	−7.90E-6	7.87E-6	−0.0001	2.07E-06	−2.07E-06	−2.07E-06	−2.07E-06	−1.83E-06
	(0.2230)	(0.2290)	(0.2250)	(0.2270)	(0.6710)	(0.4210)	(0.4210)	(0.4210)	(0.4210)	(0.5960)
MB_{t-1}	−1.00E-5**	−1.00E-5*	−1.00E-5*	−1.00E-5*	−9.69E-6	−0.0230	−0.0264	−0.0175	−0.0213	−0.0091
	(0.0680)	(0.0740)	(0.0740)	(0.0740)	(0.4600)	(0.1830)	(0.1400)	(0.3370)	(0.2430)	(0.1210)
CPG_{t-1}	−0.00879	−0.0105	−0.01078	−0.0098	−0.0195	−0.0324	−0.0393	−0.07594	−0.07703	0.0144
	(0.1810)	(0.1160)	(0.1230)	(0.1800)	(0.0010)	(0.4670)	(0.3930)	(0.0880)	(0.0840)	(0.6210)
EMR_{t-1}	0.0039	0.0002	0.01057	0.0123	0.0618**	0.0027	0.0027	0.0026	0.0022	0.0029***
	(0.8190)	(0.9890)	(0.5120)	(0.4620)	(0.0100)	(0.1950)	(0.2000)	(0.2290)	(0.3090)	(0.0000)
CPS_{t-1}	0.0013***	0.0013***	0.0016***	0.0016***	0.0015**	0.1406***	0.1430***	0.1490***	0.1471***	0.0403***

(Continues)

TABLE 7

CONTINUED

	Panel A: Book value of total debt ratio (BVD)					Panel B: Market value of total debt ratio (MVD)				
	(1)	(2)	(3)	(4)	(No. 5)	(No. 6)	(No. 7)	(No. 8)	(No. 9)	(10)
	(0.0050)	(0.0040)	(0.0000)	(0.0000)	(0.0250)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Constant	0.3864***	0.3863***	0.3858***	0.3864***	0.5006***	−6.80E-5	−6.80E-5***	−6.80E-5***	−6.80E-5***	−6.00E-5**
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0050)	(0.0050)	(0.0050)	(0.0050)	(0.0340)
Year effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sample size	153,787	153,787	153,787	153,787	72,445	153,787	153,787	153,787	153,787	72,445

This table presents our robustness tests. All models are estimated using the Hausman-Taylor 1981 method. All variables are defined in Table 2. All models are estimated with a switched on clustering option. Panel A reports the results of the book total debt ratio. Panel B reports the results of the market total debt ratio. The sample consists of 153,787 observations over the period 1971 to 2016.The models take the following functional form:

$$lev_{i,t} = \alpha_0 + \beta_s S_{i,t} + \beta_f X_{i,t} + \beta_m Y_t + \delta_i + \varepsilon_{i,t}$$

where $lev_{i,t}$ is firm i's leverage ratio at time t, $S_{i,t}$ are sentiment indices, $X_{i,t}$ and Y_t, respectively, are vectors of firm-level and macroeconomic variables that determine the capital structure, δ_i is an unabsorbed firm fixed effect, and $\varepsilon_{i,t}$ is a random error term assumed to be independently identical and normally distributed with a zero mean and constant variance, $\varepsilon_{i,t} \sim iid\, N(0, \sigma^2)$. ***, ** and * refer to significance levels at 1%, 5%, and 10%, respectively. Figures reported in parentheses are *p*-values.

Abbreviations of the variables are defined as the follows: BVD: Book value of leverage ratio; MVD: Market value of leverage ratio; PROF: Profitability; TANG: Tangibility; SIZE: Size; TAX: Effective tax rate; MB: Market-to-book ratio; CPG: 2-year corp. profit growth; EMR: 2-year equity market return; CPS: Commercial paper spread; PCM: Sentiment index PC method; PCMO: Sentiment index PC method orthogonalized; PLSM: Sentiment index PLS method; PLSMO: Sentiment index PLS method orthogonalized; MSI: Manager sentiment index.

TABLE 8

ROBUSTNESS TESTS (ALTERNATIVE LEVERAGE MEASURE)

	Panel A: Book long-term debt ratio					**Panel B: Market long-term debt ratio**				
	(1)	(2)	(3)	(4)	(No. 5)	(No. 6)	(No. 7)	(No. 8)	(No. 9)	(10)
PCM_{t-1}	−0.0129***					−0.0228***				
	(0.0000)					(0.0000)				
$PCMO_{t-1}$		−0.0093***					−0.0155***			
		(0.0000)					(0.0000)			
$PLSM_{t-1}$			0.0018**					−0.0058***		
			(0.0250)					(0.0000)		
$PLSMO_{t-1}$				−0.0024					−0.0033***	
				(0.0070)					(0.0010)	
MSI_{t-1}					−0.0035*					−0.0131***
Control variables					(0.0890)					(0.0000)
$PROF_{t-1}$	0.0003***	0.0003***	0.0003***	0.0003***	0.0003***	−2.9E-05	−2.60E-5	−3.00E-5	−2.70E-5	−6.80E-5
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.5850)	(0.6180)	(0.5700)	(0.6020)	(0.2030)
$TANG_{t-1}$	0.1555***	0.1555***	0.1556***	0.1555***	0.1419***	0.2982***	0.2982***	0.2984***	0.2984***	0.3142***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
$SIZE_{t-1}$	0.0153***	0.0152***	0.0152***	0.0152***	0.0142***	0.0273***	0.0273***	0.0273***	0.0273***	0.0304***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
TAX_{t-1}	5.45E-6	5.38E-6	5.16E-6	5.32E-6	−0.0002	7.36E-6	7.22E-6	6.70E-6	7.10E-6	−0.00014
	(0.6860)	(0.6900)	(0.7020)	(0.6930)	(0.3800)	(0.6400)	(0.6460)	(0.6700)	(0.6520)	(0.5710)
MB_{t-1}	−1.10E-7	−9.02E-8	−6.76E-8	8.57E-8	−1.42E-6	−2.28E-7	−2.65E-7	−3.06E-7	−2.75E-7	1.08E-6
	(0.9600)	(0.9680)	(0.9760)	(0.9690)	(0.7120)	(0.9300)	(0.9180)	(0.9060)	(0.9150)	(0.7930)
CPG_{t-1}	−0.0092***	−0.0099***	−0.0081***	−0.0089***	−0.0054***	−0.0092***	−0.0102***	−0.0067***	−0.0084***	−0.0049***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0010)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0050)
EMR_{t-1}	0.0061**	0.0046*	0.0010	0.0024	0.0207**	0.0210***	0.0243***	0.0333***	0.0357***	0.0088***
	(0.0250)	(0.0920)	(0.7100)	(0.3810)	(0.0100)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.3050)
CPS_{t-1}	0.0008***	0.0007***	0.0006***	0.0005***	0.0004**	0.0006***	0.0005***	0.0004***	0.0002*	0.0020***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0470)	(0.0000)	(0.0000)	(0.0020)	(0.0690)	(0.0000)
Constant	0.0634***	0.0629***	0.0633***	0.0628***	0.0570***	−0.0008	−0.0017	−0.0007	−0.0019	−0.0527***

(Continues)

TABLE 8

CONTINUED

	Panel A: Book long-term debt ratio					Panel B: Market long-term debt ratio				
	(1)	(2)	(3)	(4)	(No. 5)	(No. 6)	(No. 7)	(No. 8)	(No. 9)	(10)
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.6860)	(0.3920)	(0.7140)	(0.3550)	(0.0000)
Industry effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sample size	153,787	153,787	153,787	153,787	72,445	153,787	153,787	153,787	153,787	72,445
Adjusted R-squared	0.1671	0.1664	0.1657	0.1657	0.1523	0.2579	0.2563	0.2551	0.2550	0.2892

This table presents our robustness tests. Panel A reports the results of the book long-term debt ratio as the dependent variable. Panel B reports the results of the market long-term debt ratio as the dependent variable. All variables are defined in Table 2. All models are estimated using OLS method with a switched on clustering option. The sample consists of 153,787 observations over the period 1971 to 2016.The models take the following functional form:

$$lev_{i,t} = \alpha_0 + \beta_s S_{i,t} + \beta_f X_{i,t} + \beta_m Y_t + \delta_i + \varepsilon_{i,t}$$

where $lev_{i,t}$ is firm i's long-term debt ratio at time t, $S_{i,t}$ are sentiment indices, $X_{i,t}$ and Y_t, respectively, are vectors of firm-level and macroeconomic variables that determine the capital structure, δ_i is an unabsorbed firm fixed effect, and $\varepsilon_{i,t}$ is a random error term assumed to be independently identical and normally distributed with a zero mean and constant variance, $\varepsilon_{i,t} \sim iid\, N(0, \sigma^2)$. ***, ** and * refer to significance levels at 1%, 5%, and 10%, respectively. Figures reported in parentheses are *p*-values.

Abbreviations of the variables are defined as the follows: BVD: Book value of leverage ratio; MVD: Market value of leverage ratio; PROF: Profitability; TANG: Tangibility; SIZE: Size; TAX: Effective tax rate; MB: Market-to-book ratio; CPG: 2-year corp. profit growth; EMR: 2-year equity market return; CPS: Commercial paper spread; PCM: Sentiment index PC method; PCMO: Sentiment index PC method orthogonalized; PLSM: Sentiment index PLS method; PLSMO: Sentiment index PLS method orthogonalized; MSI: Manager sentiment index.

long-term debt ratio as our measure of leverage (see Panel A), as well as the market value of long-term debt ratio (see Panel B). Again, we find support for the negative and significant impact of the five sentiment indices on firms' leverage. Most importantly, we discover that both orthogonalized investor sentiment indices are now negatively and significantly associated with the market value of leverage. Other control variables also continue to be associated with firm leverage and indicates that using alternative measures of leverage does not affect the robustness of our findings.

CONCLUSION

Previous research argues that a firm's capital structure is the product of either managerial bias, a manager's attempt to time the market, or a trade-off. However, these conclusions largely ignore the question of whether sentiment can somehow play a role in the financing decision; this is surprising as sentiment has demonstrably accounted for other aspects of market and organizational behaviour. Our paper addresses this omission by looking at how different iterations of sentiment affect companies' capital structure.

We find a strong and significant negative relationship between leverage and sentiment. Therefore, we can reject the argument that managers decide their firm's capital structure according to a bias emanating from their perception of growth perception bias. Instead, we establish a countercyclicality of leverage argument by comparing the orthogonalized predictions with non-orthogonalized indices. When we do this, we find favour with the market timing explanation. We also reject the argument that capital structure decisions result from managerial trade-offs and that leverage is procyclical. Our findings support a behavioural view that as an investor and manager's optimism increases, equity prices rise. When this occurs, managers issue more equity relative to debt, and both the market and book values of leverage decrease.

To test our findings' robustness, we use different definitions of leverage and alternative panel estimations to confirm our results. We conclude that firm managers tend to decide on the capital structure to time the market rather than their perception of their growth prospects. Our paper also adds to current capital structure research in three critical ways. This study is the first to examine the effect of sentiment on capital structure thoroughly. It is also the first to test the effect of managerial sentiment on choosing a source of capital. We also introduce an innovative method to test for the cyclicality of financing decisions using sentiment indices. Our work, therefore, opens the possibility to bring sentiment into the capital structure argument in a more meaningful way. We can support the market timing theory over alternative explanations for capital structure by disentangling cyclicality from sentiment indices, as these appear in their orthogonalized and non-orthogonalized forms.

The findings of our study carry specific implications for how we think about the problem of capital structure in the firm. The first is that we can now understand

that countercyclical leveraging in part results from a ratcheting effect. To appease investors, management fails to reduce leveraging in challenging times. An asymmetry exists where shareholders have a perverse incentive to approve of increasing leverage under challenging times, even when it is better for firm value to reduce debt. When creditors squeeze managers to reduce debt, the shareholders favour selling assets rather than choosing a more potentially efficient alternative such as pure recapitalizations. The second implication of our work is that we can support the thesis proposed by Hackbarth *et al.* (2006), who argue that the value-maximizing leverage ratio is higher in recessionary than in boom times. Our work, therefore, confirms the predictions of their countercyclical market leverage dynamics model. The framework of this model allows that the numerator (debt) and the denominator (present value of future cash flows) that create the optimal market leverage ratio vary pro-cyclically. This idea implies that the ratio should be larger during expansionary periods. However, Hackbarth *et al.* (2006) find that the denominator tends to overshadow the numerator, resulting in countercyclical market leverage ratios. We then see an implication with regards to the question of market timing. For example, Huang and Ritter (2009) observe countercyclicality among leveraging firms that attempt to engage in market timing. This observation implies that firms issue equity during expansions and debt during contractions. Our findings support these ideas around market timing. We can document a negative relationship between book/market value leverage and investor sentiment indices. This situation means that when sentiment is high, and stocks are overvalued in good times, firms will choose to finance through equity, resulting in low leverage ratios. Conversely, when sentiment is low and stocks undervalued, firms increase their debt holdings and display high leverage ratios. The findings also echo the microeconomic perspective articulated in Jiang *et al.* (2019), confirming that leverage ratios increase when stock markets are surging.

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