# EQUITY INVESTOR SENTIMENT AND BOND MARKET REACTION: TEST OF OVERINVESTMENT AND CAPITAL FLOW HYPOTHESES

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## Dedication

This dissertation is dedicated to my parents Ruiqing Chen and Zhimin Chen, for being the greatest supporters in my life.

**Abstract**

This paper examines the effect of equity investor sentiment on the bond market. While empirical evidence suggests that high investor sentiment leads to equity overvaluation, there is limited evidence of its effect on the bond market. Sentiment can have a negative impact on bond returns via two channels. First, in times of high investor sentiment, overvalued equity can lead to firm overinvestment, resulting in a negative impact on bond pricing due to an increase in default risk. Second, overvalued equity attracts capital flow to the equity market from the bond market which can create a downward pressure on bond pricing. Consistent with these channels, I find that equity investor sentiment exhibits a significant negative relation with contemporaneous bond returns; this effect is stronger for the sample of firms with overinvestment. In distinguishing the effects of the two channels, I find a *positive* relation between sentiment and *subsequent* bond returns, consistent with a return reversal predicted by the capital flow channel (due to the backflow of capital); however, there is no return reversal observed for the overinvestment sample, indicating that overinvestment has a more lasting impact. Additionally, I find a negative (but delayed) impact of equity investor sentiment on bond ratings for the overinvestment sample consistent with an increase in default risk of these firms. Overall, my study highlights that behavioral biases in the equity market do not automatically get transmitted to the bond market. In fact, the bond market reacts negatively to sentiment-induced overinvestment in a rational way, consistent with bond investors' payoff functions.

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## 1. Introduction

Investor sentiment refers to "a belief about future cash flows and investment risk that cannot be justified by the facts at hand" (Baker and Wurgler, 2007). The findings of several finance studies suggest that during periods of high market-wide sentiment, equity securities are overvalued as evidenced by reversals of subsequent returns.[1] While the impact of investor sentiment on equity pricing has been studied extensively, there is limited research examining whether equity investors' sentiment has any effect on debt market pricing, especially corporate bond pricing. Since stock and bond markets are integrated in many respects, including common knowledge, cross-market hedging, and bond-pricing of stock market uncertainty (e.g., Fleming, Kirby and Ostdiek, 1998, Connolly, Stivers and Sun, 2005, and Baker and Wurgler, 2012), predicting a relation between equity market sentiment and bond pricing is not straight-forward. In this paper, I rely on prior results of firm and investor behavior in the presence of high equity market sentiment, and develop and test hypotheses that relate equity market sentiment to bond market pricing.

The finance literature predicts that firms tend to overinvest when their stock is overvalued either through an equity issuance channel (Stein, 1996, Baker and Wurgler, 2002, Baker, Stein and Wurgler, 2003 and Jensen, 2004) due to a low cost of equity, or through a catering channel to maintain a high stock price in the short run (Polk and Sapienza, 2009). Given the evidence of stock overvaluation in periods of high equity investor sentiment, it is likely that firms overinvest during these times. Bondholders view

[1] See, for example, Brown and Cliff (2005), Baker and Wurgler (2006, 2007), Ben-Rephael, Kandel and Wohl (2012), and Stambaugh, Yu and Yuan (2012).

firm overinvestment negatively because it is associated with higher firm risk and reduction in the value of bonds (Jensen and Meckling, 1976). Consistent with this argument, empirical evidence shows that firm overinvestment results in greater earnings disappointments in subsequent periods (e.g., Titman, Wei and Xie, 2004, and Arif and Lee, 2014) which leads to an increase in bond default risk (e.g., Altman, 1968, Zmijewski, 1984, and Callen, Livnat and Segal, 2009). Thus, I hypothesize that, through the overinvestment channel, high equity market sentiment will have a negative impact on the bond market.[2]

The negative impact of high equity market sentiment on the bond market could also arise through another channel which is related to the flow of capital across the bond and equity markets. Prior studies argue that returns influence investors' trading such that positive (negative) returns lead to greater (fewer) trades (e.g., Ben-Rephael, Kandel and Wohl, 2011). Following this argument, several studies find that contemporaneous equity returns are strongly associated with re-balancing decisions between the equity and bond markets (e.g., Warther, 1995, Edwards and Zhang, 1998 and Fant, 1999). Ben-Rephael et al. (2012) in fact argue that shifts between bond funds and equity funds are indicative of investor sentiment. They show that the net exchange of equity funds is positively correlated with contemporaneous aggregate equity market returns and that this relation reverses in subsequent months. Consistent with these studies, I expect greater capital inflow to the

[2] The firm overinvestment channel predicts that bond investors react negatively to overinvestment but equity investors may not. First, the bond market is dominated by sophisticated institutional investors (TheCityUK 2012 report), while the equity market has more individual investors who can be influenced by the prevailing market-wide expectations (Jensen, 2004). Second, if firms engage in excessive risk-taking, the asymmetric bond pay-off structure implies a higher default risk for bond investors, while the upside potential benefits the equity-holders.

bond market during low equity sentiment periods and greater capital outflow from the bond market during high equity sentiment periods. The capital inflow (outflow) generates positive (negative) price pressure on the traded securities and can lead to overvaluation (undervaluation).[3] As long as individual bonds have downward-sloping demand curves, the capital flow channel predicts a negative relation between equity investor sentiment and contemporaneous bond returns, on average. Further, subsequent to the high sentiment period, a reversal of bond returns is expected due to the capital backflow from the equity market to the bond market; thus, I predict a positive relation between equity investor sentiment and subsequent bond returns, on average.

I also examine a competing hypothesis, the contagion effect, which predicts a positive rather than a negative contemporaneous bond market reaction to equity market sentiment. Stocks and bonds issued by the same firms represent claims on the same underlying assets. Any change in the expectation of future cash flows conceptually applies to both stocks and bonds. This suggests a contagion effect of sentiment from the stock market to the bond market. Opposite to the effects predicted by the capital flow channel, the contagion hypothesis predicts that equity investor sentiment is *positively* related to contemporaneous bond returns and *negatively* related to subsequent bond returns, on average.

I measure equity investor sentiment and corporate bond returns on a quarterly basis. Baker and Wurgler (2006) develop a measure of equity investor sentiment based on the

[3] See, for example, Coval and Stafford (2007) and Khan, Kogan and Serafeim (2012).

first principal component of six standardized sentiment proxies (adjusted for a common business cycle component). The sentiment proxies include the closed-end fund discount, NYSE share turnover, the number of IPOs, the average IPO first-day returns, the equity share in total new issues, and the dividend premium. To test the effect of overinvestment channel, I employ the capital expenditure (CAPX) investment model in Polk and Sapienza (2009) and use the residuals as a proxy for the deviation from the optimal CAPX investment level (CAPXRES). Following Biddle, Hilary, and Verdi (2009), I assign firm-quarter observations to the overinvestment (no-overinvestment) group if the residual falls in the top tercile (bottom two terciles) of the sample. I also use the incidence of merger and acquisition (M&A) events as a second proxy for overinvestment. As argued and illustrated in Jenson (2004), in the face of overvalued equity, managers tend to engage in M&A activities to fulfill unrealistic market expectations. If bond investors believe that such M&As increase their risk exposure, I expect equity investor sentiment to have a negative impact on bond returns of firms engaging in M&As during a period of high equity investor sentiment. I test the differential relation between equity investor sentiment and contemporaneous bond returns for the overinvestment and the no-overinvestment groups. I control for Fama-French risk factors, default risk, term risk, and bond characteristics associated with bond returns as documented by previous studies. Both time and industry fixed effects are included in the regressions and standard errors are clustered at the firm level.

I first establish that equity investor sentiment is positively associated with firm overinvestment.[4] Since the overinvestment and the capital flow channels have the same directional prediction with respect to the relation between equity investor sentiment and contemporaneous bond returns, it is difficult to attribute the result to one or the other of the channels. I attempt to resolve this issue by contrasting the effects on contemporaneous versus subsequent bond returns. If across-market capital flows drive the observed contemporaneous relation, I expect a reversal in subsequent bond returns due to the backflow of capital when the high equity investor expectations decline; such reversal is less likely if overinvestment drives the relation because the effects of overinvestment are likely to persist over a longer time period.

Using both proxies of overinvestment, CAPXRES and M&A, I find a significant negative relation between equity investor sentiment and contemporaneous bond returns for the full sample. The observed negative effect is significant for both the overinvestment and the no-overinvestment groups, consistent with the predicted effects of both channels, overinvestment and capital flow. Moreover, this finding rules out the contagion effect hypothesis which predicts a positive relation. In addition, the relation is significantly more negative for the overinvestment group supporting the effect of firm overinvestment channel. To further distinguish the effects of the overinvestment and the capital flow channels, I test the relation between equity investor sentiment and the *subsequent year's* bond returns. If

[4] While I directly test the relation using the firm-level overinvestment, my finding is consistent with McLean and Zhao (2014), who show a negative relation between equity investor sentiment and cash flow-investment sensitivity, and with Arif and Lee (2014), who find a positive concurrent relation between aggregate investment and the equity sentiment index (after controlling for aggregate ROA, stock return, lagged investment, book-to-market, term, default risk and T-bill rate).

the effect is mainly due to the capital flow channel, I expect a positive relation for both groups to reflect the reversal of returns in the subsequent period due to the backflow of capital. I find a significant bond return reversal subsequent to the high sentiment period for the no-overinvestment group; however, the overinvestment group exhibits an insignificant relation between sentiment and subsequent bond returns. Thus, my results suggest that, when there is no firm overinvestment, the contemporaneous negative bond market reaction to equity investor sentiment can be attributed to the flow of capital from the bond-market. On the other hand, given that I do not observe a subsequent return reversal, the capital flow channel is less likely to be the primary explanation for the overinvestment group; the bond investors' negative reaction is at least partially due to the effect of overinvestment resulting in a higher risk exposure for bondholders.

Next, I test the cross-sectional variation in the effect of the capital flow channel based on the level of bond liquidity. Prior studies find that the price pressure generated by capital overflow has less influence on liquid bonds than on illiquid bonds (e.g., Brandt and Kavajecz, 2004). Consistent with this prior evidence, I find that the relation between equity investor sentiment and bond returns is weaker for liquid bonds within the no-overinvestment group, both in the concurrent and subsequent periods. However, as expected, I do not observe such differential relation for the overinvestment group, confirming overinvestment and capital flow as two distinct channels through which equity investor sentiment influences the bond market.

Finally, I examine the impact of equity investor sentiment on bond rating changes. Since bond ratings reflect the default risk of bond issues, a change in the expectation of the issuer's ability to fulfill its financial obligations should lead to a bond rating revision. Consistent with overinvestment increasing a firm's default risk, I find a positive relation between equity investor sentiment and downward revisions of bond ratings for the overinvestment group, but only in the subsequent period. This is consistent with the argument that bond rating agencies update bond ratings with a delay (e.g., Pinches and Singleton, 1978, and Beaver, Shakespeare, and Soliman, 2006). In contrast, I find an insignificant effect on bond ratings for the no-overinvestment group, consistent with the fact that the negative effect on bond returns due to the capital flow channel does not imply a change in bond default risk.

My paper contributes to the literature on equity market investor sentiment by examining its effects on the bond market. Prior empirical studies on investor sentiment mainly focus on the effect of sentiment on the behavior of equity market participants.[5] I focus on the bond market and provide empirical evidence on the negative relation between sentiment and contemporaneous bond returns, consistent with the effects of both the flow of capital and overinvestment channels. Similar to bond investors, rating agencies respond negatively to sentiment (although with a delay), but only for the overinvestment group due to their (potentially) higher default risk. Overall, my study highlights that behavioral biases in the equity market do not automatically get transmitted to the bond market. In fact, the

[5] For example, Baker and Wurgler (2006) study the impact of equity investor sentiment on the cross-section of stock returns. Mian and Sankaraguruswamy (2012) find that the stock price sensitivity to good (bad) earnings news is higher during high (low) sentiment periods than during periods of low (high) sentiment. Hribar and McInnis (2012) also show that analysts' forecast errors correlate with temporal variation in investor sentiment. Bergman and Roychowdhury (2008) provide evidence that managers strategically use management guidance to influence market pricing during both high and low sentiment periods.

bond market reacts negatively to sentiment-induced overinvestment in a rational way, consistent with bond investors' payoff functions.

The remainder of this paper unfolds as follows. I discuss related literature and develop my hypotheses in section 2. Section 3 describes the data, sample selection procedure, and definitions of main variables. Section 4 presents details of the research design and the empirical results. Section 5 presents additional tests and robustness checks. Section 6 concludes the paper.

## 2. Hypothesis development

### *2.1 Effect of sentiment on bond returns via overinvestment channel*

A high sentiment period is marked with market-wide unjustified optimism and overvalued equity. Jensen (2004) discusses the agency costs arising from a company's stock becoming overvalued. He argues that, due to the pressure to deliver performance that can justify the unrealistic stock price and with access to funds at below the firm's cost-of-capital, managers may engage in different kinds of misbehavior including accounting manipulation and value-destroying acquisitions and investments. Baker et al. (2003) develop a simple model and provide consistent empirical evidence that corporate investment is sensitive to non-fundamental movements in stock prices, especially in the case of firms in need of external financing. Polk and Sapienza (2009) explore the relation between stock market overvaluation and corporate investment from the perspective of catering theory. They argue that managers may try to boost short-run share prices by catering to the current sentiment if the market mispricing is related to the firm's level of investment.[6] The above arguments indicate that firms overinvest during a high sentiment period. Empirical evidence shows that aggregate overinvestment associated with investor sentiment is followed by greater earnings disappointments (Arif and Lee, 2014), thus leading to higher default risk (e.g., Altman, 1968, Zmijewski, 1984, and Callen et al., 2009). Given the asymmetric payoff structure of bond investors, I predict a negative relation between equity investor sentiment and bond returns for firms with overinvestment.

*2.2 Effect of sentiment on bond returns via capital flow channel*

Investors hold unjustified optimistic expectations during periods of high sentiment and these optimistic beliefs get reinforced by positive returns during such periods. This leads to investors chasing returns, consistent with feedback trading that causes positive (negative) fund flow following positive (negative) returns (e.g., Ben-Rephael et al., 2011). Based on this feedback trading argument, several studies present evidence that mutual fund flow from the bond market to the equity market is positively correlated with contemporaneous equity market returns, using both daily and monthly measurement windows (e.g., Warther, 1995, Edwards and Zhang, 1998, and Ben-Rephael et al., 2012). Brown, Goetzmann, Hiraki, Shirishi and Watanabe (2003) and Ben-Rephael et al. (2012) both argue that the net exchange of funds between the bond market and the equity market could be viewed as a measure of investor sentiment. Based on investors' feedback trading behavior, I expect capital outflow from the bond market into the equity market during

[6] McConnell and Muscarella (1985) provide evidence that announcements of increases in planned capital investments are generally associated with significantly positive excess stock returns. Blose and Shieh (1997) and Vogt (1997) find a significant positive relation between the magnitude of the stock market reaction to capital investment announcements and the level of new investment.

periods of high equity market sentiment and capital inflow from the equity market into the bond market during periods of low equity market sentiment. Such capital flows generate a downward (upward) price pressure on the bond market during high (low) equity market sentiment periods, thus inducing a negative relation between equity investor sentiment and contemporaneous bond returns. As equity investor sentiment reverses subsequently, investors revise their expectations downward resulting in a capital backflow. This capital backflow will lead to a positive relation between equity investor sentiment and subsequent bond returns.

### *2.3 Contagion effect of sentiment on bond returns*

Equity investor sentiment could represent unjustified beliefs about future cash flows and investment risk shared by both equity and bond investors. This implies a spillover effect of equity investor sentiment from the equity market to the bond market. Baker and Wurgler (2006) point out that sentiment-driven mispricing results from an uninformed demand shock in the presence of a binding arbitrage constraint.[7] If market-wide unjustified beliefs have a similar influence on bond investors as on equity investors, then the effect of equity investor sentiment on bond returns should mimic the effect on equity returns. Thus, the contagion hypothesis predicts a positive relation between equity investor sentiment and contemporaneous bond returns and a negative relation between equity investor sentiment and subsequent bond returns.

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[7] Asquith, Au, Covert and Pathak (2013) provide evidence on the existence of short sale constraints in the bond market and conclude that the cost of borrowing corporate bonds is comparable to the cost of borrowing stock.

*2.4 Distinguishing between overinvestment and capital flow channels*

A negative relation between equity investor sentiment and contemporaneous bond returns is predicted by both firm overinvestment and capital flow channels, but the two channels differ in the prediction of the relation between equity investor sentiment and subsequent bond returns. In the firm overinvestment scenario, firms engage in value-destroying overinvestment activities that will likely have a lasting negative impact on firm performance in the future. In the capital flow scenario, money is reallocated across the equity and bond markets due to investors' time-varying trading behavior associated with equity returns during different sentiment periods. This money reallocation reverses as equity investor sentiment level subsequently reverses and a positive relation between sentiment and subsequent bond returns is expected via the capital flow channel. Therefore, while I predict a negative effect of sentiment on contemporaneous bond returns through both the overinvestment and the capital flow channels, the effect on subsequent returns is expected to be positive for the capital flow channel and insignificant (negative) for the overinvestment channel if bond investors' reaction to firm overinvestment is complete (incomplete).

The overinvestment and capital flow channels are not mutually exclusive. The negative response to overinvestment is likely to be observed only among firms that engage in excessive investment activities. On the other hand, the capital flow channel applies to the bond market as a whole. Therefore, I view the overinvestment channel as predicting the incremental negative effect of equity investor sentiment on bond returns in addition to the effect predicted by the capital flow channel.

Similar to the effect of the capital flow channel, the contagion effect hypothesis also applies to the bond market as a whole; however, it has opposite predictions on the relation between equity market sentiment and bond returns. Which effect dominates is ultimately an empirical question. I state the hypotheses as supporting the predictions of the capital flow channel in alternate form.

<u>Equity investor sentiment and contemporaneous bond returns:</u>

H1a: The relation between equity investor sentiment and contemporaneous bond returns is negative.

H1b: The relation between equity investor sentiment and contemporaneous bond returns is more negative for the overinvestment group than for the no-overinvestment group.

<u>Equity investor sentiment and subsequent bond returns:</u>

H2a: The relation between equity investor sentiment and subsequent bond returns is positive.

H2b: The relation between equity investor sentiment and subsequent bond returns is positive for the no-overinvestment group.

H2c: The relation between equity investor sentiment and subsequent bond returns is lower for the overinvestment group relative to the no-overinvestment group.

## 3. Data, Sample and Variable Definitions

### *3.1 Data and Sample selection*

The data in this study come from a variety of sources. Bond price and trade data are from the Trade Reporting and Compliance Engine (TRACE) transactions database. Ratings and bond characteristics data are from the Mergent Fixed Income Securities Database (FISD). Accounting variables are from COMPUSTAT and stock return data are from CRSP. M&As are identified through the Securities Data Company's (SDC) online Mergers and Corporate Transactions database. The stock market (MKT) and SMB and HML factors are downloaded from Kenneth French's website.[8] Default and term factors are calculated using the data from the Federal Reserve Bank of St. Louis.[9] The sample period begins in 2003 and ends in 2010, after which equity investor sentiment index is not available.[10]

Table 1, Panel A, presents the sample selection procedure. I construct bond prices following Bessembinder, Kahle, Maxwell, and Xu (2009).[11] I delete trades if they are (1) canceled trades; (2) corrected trades; (3) commission trades; and (4) under $100,000. I keep only end-of-month bond price data to calculate quarterly and annual bond returns as detailed in Section 3.2.2. To prevent other confounding effects, I eliminate bonds that have

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[8] http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html

[9] http://research.stlouisfed.org/fred2/

[10] Equity investor sentiment index is obtained from Jeffrey Wurgler's website, http://people.stern.nyu.edu/jwurgler/.

[11] The SAS code for bond transaction cleaning is available at http://wmaxwell.cox.smu.edu/Trace_Clean.sas.

the following features: (1) issued by non-U.S. firms; (2) convertible; (3) with sinking funds; (4) no coupon rate or zero coupon rate; (5) no rating or "NR" rating; (6) odd interest_frequency (I only keep interest_frequency with values 1, 2, 4, 12); (7) in default (with a Standard & Poor's rating of D or a Moody's rating of C); and (8) issued by financial institutions (with SIC codes between 6000 and 6999). I delete observations with missing values for bond characteristics. Finally, I trim bond returns at 1% to mitigate potential data errors. After requiring data on CAPXRES, I obtain my main sample of 20,051 bond-quarter observations.

Panel B in Table 1 presents the sample composition by year. The TRACE database started on July 1, 2002 and initially only included about five hundred U.S. investment-grade corporate bonds with an original issue size of at least $1 billion; it gradually expanded coverage to all publicly traded corporate bonds until October, 2004.[12] The variation in coverage is reflected in the table - the number of observations increases dramatically in the first two years and is fairly evenly distributed across the remaining years.

### *3.2 Variable Definitions*

[12] I drop year 2002 in my main analysis since I only obtain 58 observations with quarterly bond returns. The results are not affected by the inclusion of these 58 observations.

*3.2.1 Measurement of firm overinvestment*

I use two empirical proxies to measure firm overinvestment. Prior studies have focused on capital expenditure as a key investment decision of a firm.[13] I first estimate the investment model in Polk and Sapienza (2009) to measure overinvestment. I regress a firm's capital expenditure in quarter *t* on Tobin's Q and cash flows, controlling for industry, year, and quarter fixed effects as follows:

$$Invest_{i,qt} = \alpha_1 Q_{i,qt-1} + \alpha_2 CF_{i,qt-1} + \delta_j + \delta_t + \delta_q + \varepsilon_{i,qt} \quad (1)$$

$Invest_{i,qt}$ is measured as capital expenditure (*CAPXQ*) deflated by beginning-of-quarter net property, plant, and equipment (net PP&E). $Q_{i,qt-1}$ is Tobin's Q measured as the beginning-of-quarter market value of assets to book value of assets, where market value of assets equals the book value of assets plus the market value of common stock less the sum of the book value of common stock and balance sheet deferred taxes. $CF_{i,qt-1}$ equals the sum of earnings before extraordinary items and depreciation divided by beginning-of-quarter net PP&E. $\delta_j$ represent industry fixed effects based on the 2-digit SIC code. $\delta_t$ and $\delta_q$ represent year and quarter fixed effects, respectively.[14] The residual from equation (1) (*CAPXRES*) represents the deviation from the optimal investment level. I assign a firm-quarter to the overinvestment (no-overinvestment) group if the residual from equation (1) is in the top tercile (bottom two terciles) of the sample.[15]

[13] See Stein (2003) for an early summary of the usage of this variable and more recent papers that use it (for example, Polk and Sapienza, 2009, Biddle and Hilary, 2006 and Biddle et al., 2009).

[14] I control for quarter one, two, three, and four fixed effects. My results are very similar if only year and industry fixed effects are included.

[15] I obtain similar inferences when the classification of overinvestment/no-overinvestment groups is based on the sample median.

I use the incidence of (stock) M&A events as a second proxy for overinvestment. Jensen (2004) argues that overvalued equity currency provides an enormous incentive to engage in material M&As since these activities can "give the appearance of growth and profitability" not only by creating a growth illusion but also by providing room for accounting manipulation surrounding the events. Such M&A activities destroy firms' core value and are detrimental to investors in the long run. Consistent with this view, Harford (1999) and Harford, Mansi, and Maxwell (2008) provide evidence that firms overinvest by undertaking acquisitions.

To identify M&As, I first restrict my sample to U.S. acquirers since equity investor sentiment index is based on the U.S. equity market. I select M&As classified by SDC as a merger or an acquisition of majority interest, following Datta, Datta, and Raman (2001). I further identify a subsample of M&As after excluding deals that use only cash as the form of payment. This is because bidders prefer to finance deals with stock (cash) when they believe their stock is overvalued (undervalued) by the market (Myers and Majluf, 1984, and Hansen, 1987). Firms that have no M&As during the entire sample period serve as the benchmark no-M&A group. I obtain 585 M&As during the sample period.

*3.2.2 Calculation of bond returns*

I use T-bill adjusted bond returns in this study following Easton, Monahan and Vasvari (2009) and Lin, Wang and Wu (2011). First, the buy-and-hold raw bond return is calculated as

$$R_t = \frac{(P_t + AI_t) + C_t - (P_{t-1} + AI_{t-1})}{P_{t-1} + AI_{t-1}} \quad (2)$$

where $P_t$ is the period $t$ last-day transaction price, $AI_t$ is the accrued interest for the period, and $C_t$ is the coupon payment, if any, in period $t$. To determine period $t$ last-day transaction price, I use price on the last trading day of period $t$ if available. If no trades occur on the last trading day, I search the 5-day window before the end of period $t$ and use the price of the last day with trades within this short window. If no trades occur during the 5-day window before the end of period t, I search the first 5 calendar days at the beginning of period $t+1$ and use the price of the first day with trades as the last-day transaction price for period $t$. The daily bond price is constructed following Bessembinder et al. (2009) and weighted by trade size. To calculate $AI_t$, I apply the following formula:

$$AI_t = Cp_t \times \frac{Days_t}{365} \tag{3}$$

where $Cp_t$ is the coupon rate, $Days_t$ is the number of days between the date on which $P_t$ is observed and the date on which the last coupon payment is due. Finally, I adjust the raw bond return by subtracting the contemporaneous compounded U.S. T-bill return to obtain the adjusted bond return, $BRet_t$.

### *3.2.3 Measurement of equity investor sentiment index*

I measure quarterly equity investor sentiment as the average of the monthly Baker and Wurlger (2006) sentiment index. Baker and Wurgler (2006) develop a measure of monthly equity investor sentiment (the BW sentiment index) employing six standardized sentiment proxies, including the closed-end fund discount, NYSE share turnover, the number of IPOs, the average IPO first-day returns, the equity share in total new issues, and the dividend premium. One concern regarding the BW sentiment index is that it may reflect some business cycle component. To mitigate this concern, Baker and Wurlger (2006) first regress each of the sentiment proxies on growth in the industrial production index, growth in consumer durables, nondurables, and services, and a dummy variable for recessions using NBER definition. The residuals of each of the sentiment proxies are taken from these regressions to form the composite sentiment index using the first principal component of the orthogonalized proxies.

Figure 1 plots the Baker and Wurlger monthly sentiment index and NBER recession months over time. As noticed by previous studies, the BW sentiment index is consistent with most anecdotal fluctuations of equity market sentiment.[16] However, the sentiment index does not consistently vary with economic conditions. Out of 83 recession months during the BW sentiment index period, 51 of them fall in high sentiment periods (based on the sample median). Therefore, the BW sentiment index primarily captures the equity market sentiment component rather than the business cycle component.

## 4. Empirical results

### *4.1 Descriptive statistics*

Table 2 provides descriptive statistics of the primary variables of interest for my final sample. The mean quarterly (annual) bond returns adjusted for the T-bill return is 1.2% (3.9%) consistent with prior studies (e.g., Bessembinder et al., 2008 and Easton et al., 2009). The average bond rating score for my sample is 4.0 which corresponds to the Standard & Poor's (S&P) BBB group (Moody's Baa group).[17] The average coupon rate is 6.4% with a

[16] For example, see the discussion in Baker and Wurgler (2007) and Stambaugh et al. (2012).

[17] Appendix B provides the conversion of letter credit ratings into numeric ratings.

standard deviation of 1.5%. The bond issues in my sample have an average maturity of 12.7 years and average bond age of 7 years. The quarterly sentiment index over the sample period has a mean (median) of -0.11 (-0.08) and a standard deviation of 0.27.

*4.2 Impact of equity investor sentiment on firm investment*

The prediction of the overinvestment channel is built on the premise that firms tend to overinvest during high sentiment periods. To validate this premise, I begin my analyses by first testing the relation between equity investor sentiment and firm investment using a modified Polk and Sapienza (2009) investment model:

$$Invest_{i,qt} = \alpha_1 Sentiment_{qt} + \alpha_2 Q_{i,qt-1} + \alpha_3 CF_{i,qt-1} + \delta_j + \delta_t + \delta_q + \varepsilon_{i,qt} \quad (4)$$

$Invest_{i,qt}$ equals *CAPX* (scaled by net PP&E) for quarter *qt*, $Q_{i,qt-1}$ is Tobin's Q at the beginning of quarter *qt*, $CF_{i,qt-1}$ is the cash flow variable at the beginning of quarter *qt* as defined in Section 3.2.1 and $Sentiment_{qt}$ is the quarterly equity investor sentiment measured as the average of the monthly index in Baker and Wurgler (2006). $\delta_j$ represent industry fixed effects, and $\delta_t$ and $\delta_q$ represent year and quarter fixed effects as defined in Section 3.2.1. If firms overinvest in periods of high investor sentiment, I expect a positive concurrent relation between the firm investment level and sentiment level, i.e., $\alpha_1 > 0$.

There may be a concern that the BW sentiment index captures economic conditions and thus the relation between $Sentiment_t$ and firm investment could be spurious. To mitigate this concern, I further control for beginning-of-quarter Consumer Price index (*CPI*), the T-bill rate, term and default risk factors (Arif and Lee, 2014). These variables are defined below in Section 4.2.2.

Table 3, Panel A, summarizes the descriptive statistics of investment-related firm characteristics. The distributions of $Invest_{i,qt}$, $Q_{i,qt-1}$ and $CF_{i,qt-1}$ are comparable to those reported by Polk and Sapienza (2009). Panel B reports the results of regression (4) estimated over the sample period. As expected, $\alpha_1$, the coefficient estimate on equity investor sentiment is significantly positive, even after controlling for the macro variables, consistent with firms overinvesting during high sentiment periods. The coefficient estimates on control variables are significantly positive, consistent with Polk and Sapienza (2009).

*4.3 Relation between equity investor sentiment and bond returns*

*4.3.1 Research design*

To test the effect of sentiment on bond returns through the capital flow channel versus the contagion hypothesis (H1a and H2a), I estimate the following regressions to examine the average relation between equity investor sentiment and bond returns for my sample:

$$Adj\_QBRet_{i,qt} = \beta_1 Sentiment_{qt} + \sum\beta_{2j} RFactor + \sum\beta_{3j} Controls + \delta_j + \delta_t + \delta_q + \mu_{i,qt} \quad (5)$$

$$Adj\_AnnBRet_{i,t+1} = \beta'_1 Sentiment_{qt} + \sum\beta'_{2j} RFactor + \sum\beta'_{3j} Controls + \delta_j + \delta_{t+1} + \delta_q + \mu_{i,t+1} \quad (6)$$

Equation (5) tests the relation between equity investor sentiment and contemporaneous bond returns and equation (6) tests the relation between sentiment and subsequent year's bond returns. The dependent variable in equation (5), $Adj\_QBRet_{i,qt}$, is the quarterly excess bond return (adjusted for the one-month T-bill rate) in the regression using CAPXRES as the overinvestment proxy. The dependent variable in equation (6),

$Adj\_AnnBRet_{i,t+1}$, is the 12-month bond return following quarter *qt* adjusted for the T-bill rate. $Sentiment_{qt}$ is the quarterly equity investor sentiment for the test using CAPXRES. When I use M&A as the overinvestment proxy, I replace $Adj\_QBRet_{i,qt}$ and $Sentiment_{qt}$ in equation (5) with monthly adjusted bond returns and monthly equity investor sentiment index. $\delta_j$ represent industry fixed effects, and $\delta_t$ and $\delta_q$ represent year and quarter fixed effects. Standard errors are clustered at the firm level.

*RFactor* includes the five risk factors identified by Fama and French (1993) that can explain corporate bond returns: *MKT*, *SMB*, *HML*, *TERM*, and *DEF*. *MKT* equals the value-weighted stock market index in excess of the risk-free rate. *SMB* equals the returns of small stocks minus the returns of big stocks. *HML* equals the returns of value stocks minus the returns of growth stocks. *TERM* is the difference between long-term government bond yield and one-month T-bill rate. *DEF* is the difference between long-term Moody's BAA bond yield and long-term Moody's AAA bond yield. In addition to factor loadings, I also include as control variables bond characteristics including bond rating (*Rating*), time to maturity (*Maturity*) as a common measure of the term risk of the bond, interest rate (*coupon*), bond age (*age*), and logarithm of the bond issue amount (*LogAmt*). (Green and Odegaard, 1997, and Longstaff, Mithal and Neis, 1997). I use the most recent bond rating issued by S&P before the end of period *t*. If no rating is available from S&P, I use the most recent bond rating issued by Moody's.

The effect of contagion and the capital flow channel have opposite predictions on the relation between equity investor sentiment and bond returns. The effect of the capital flow channel is a result of money reallocation from the bond market to the equity market, due to investors chasing higher returns during high sentiment periods, and subsequent capital backflow as equity investor sentiment reverses. Thus, the capital flow channel predicts a negative $\beta_1$ in equation (5) and a positive $\beta'_1$ in equation (6). In contrast, the contagion effect hypothesis argues that bond investors may share the same optimistic/pessimistic beliefs of equity investors; thus, the relation between equity market sentiment and bond returns should mimic the relation in the equity market. Therefore, the contagion effect hypothesis predicts a positive $\beta_1$ in equation (5) and a negative $\beta'_1$ in equation (6).

To distinguish the firm overinvestment and the capital flow channels, I modify equation (5) and equation (6) by interacting *Sentiment* with a dummy variable for overinvestment to capture the incremental impact of equity investor sentiment on bond returns due to the effect of firm overinvestment. The modified specifications are as follows.

$$Adj\_QBRet_{i,qt}=\beta_1 Sentiment_{qt} + \beta_2 OverInvest_{i,qt} + \beta_3 Sentiment_{qt}*OverInvest_{i,qt} + \sum\beta_{4j} RFactor + \sum\beta_{5j} Controls + \delta_j + \delta_t + \delta_q + \mu_{i,qt} \quad (7)$$

$$Adj\_AnnBRet_{i,t+1}=\beta'_1 Sentiment_{qt} + \beta'_2 OverInvest_{i,qt} + \beta'_3 Sentiment_{qt}*OverInvest_{i,qt} + \sum\beta'_{4j} RFactor + \sum\beta'_{5j} Controls + \delta_j + \delta_{t+1} + \delta_q + \mu_{i,t+1} \quad (8)$$

The overinvestment dummy ($OverInvest_{i,qt}$) is determined by (i) abnormal CAPX investment (CAPXRES) and (ii) the incidence of M&A as described in Section 3.2.1. The coefficient on the interaction between $Sentiment_{qt}$ and $OverInvest_{i,qt}$ in equation (7), $\beta_3$, captures the differential effect of firm overinvestment in times of high equity investor sentiment on contemporaneous bond returns. Based on H1b, I expect the differential coefficient estimate to be negative reflecting the effect of the increase in default risk exposure due to overinvestment. The coefficient on the interaction term in equation (8), $\beta'_3$, is also expected to be negative since the effect of overinvestment on default risk exposure is likely to persist in subsequent periods, thus reducing the positive impact of capital backflow on subsequent bond returns (H2c).

*4.3.2 Results*

Table 4 presents evidence on the relation between equity investor sentiment and contemporaneous bond returns. In Panel A, I use CAPXRES to identify overinvestment. Column (1) reports the estimation results of equation (5) as the baseline model. Consistent with the prediction of the capital flow channel (H1a), I find a significant negative effect of equity investor sentiment on contemporaneous bond returns, opposite to the positive effect observed in the equity market. Column (2) reports the results of equation (7), which allows the coefficient on $Sentiment_{qt}$ to be different for overinvestment and no-overinvestment firms. The coefficient estimate on the interaction of $Sentiment_{qt}$ and $OverInvest_{i,qt}$ is negative (p=0.003), consistent with my prediction that the overinvestment group experiences an incremental negative effect of sentiment on contemporaneous bond returns (H1b). The F-test of the sum of the coefficients on $Sentiment_{qt}$ and $Sentiment_{qt}*OverInvest_{i,qt}$ confirms an overall negative relation between equity investor sentiment and contemporaneous bond returns for the overinvestment group (p<0.01). The main effect of $Sentiment_{qt}$, $\beta_1$, which captures the overall effect of equity sentiment on contemporaneous bond returns for the no-overinvestment group is also negative (p<0.01), as expected.

Panel B reports similar results using M&A as the proxy of overinvestment. Consistent with H1a, I find a significant negative association between equity investor sentiment and contemporaneous bond returns. The coefficient on the interaction of $Sentiment_{qt}$ and $OverInvest_{i,qt}$ is significantly negative, consistent with the results in Panel A. These findings provide initial empirical evidence to support the predictions of both the overinvestment and the capital flow channels but are inconsistent with the contagion effect hypothesis. Furthermore, the stronger negative relation for the overinvestment group is consistent with the incremental effect of the overinvestment channel as predicted in H1b.

Table 5 summarizes the results on the relation between equity investor sentiment and *subsequent* bond returns. CAPXRES is used as the proxy of overinvestment in Panel A. Column (1) presents the estimation results of equation (6). Consistent with the argument of capital backflow, I find a positive relation between equity investor sentiment and subsequent bond returns on average (H2a). A one standard deviation increase in sentiment is associated with an increase in the subsequent year's bond returns of 86 basis points (i.e., a 22% increase in the average bond return). Column (2) reports the estimation results of equation (8). The coefficient estimate on $Sentiment_{qt}$ is significantly positive, indicating a positive association between equity investor sentiment and subsequent bond returns for the no-overinvestment group (H2b). The coefficient estimate on the interaction term, $Sentiment_{qt}*OverInvest_{i,qt}$, is significantly negative (p=0.001), suggesting a significantly lower reversal of bond returns due to capital backflow for the overinvestment firms (H2c). Moreover, the F-test cannot reject the null that the sum of the coefficients on $Sentiment_{qt}$ and $Sentiment_{qt}*OverInvest_{i,qt}$ (p=0.30) is zero, suggesting that equity investor sentiment is unrelated to subsequent bond returns for the overinvestment group.[18] This evidence is consistent with two scenarios for the overinvestment group: (i) the insignificant impact on subsequent bond returns implies that the overinvestment channel rather than the capital flow channel is the primary mechanism through which equity sentiment affects bond returns, and (ii) the negative impact due to overinvestment persists in subsequent periods and it swamps the positive impact on subsequent returns due to capital backflow. Panel B reports similar results using M&A as the proxy of overinvestment.

The above analysis of investor sentiment and subsequent bond returns helps to distinguish the impact of the overinvestment and the capital flow channels. The overall positive association between equity investor sentiment and subsequent bond returns is predicted by the capital flow argument but not the overinvestment explanation. Yet, the insignificant relation between sentiment and subsequent bond returns for the overinvestment group is consistent with the overinvestment argument but not predicted by the capital flow channel. My findings therefore suggest that equity investor sentiment affects the bond market through both channels, although for the overinvestment group, the capital flow channel does not appear to be primary.

To summarize, I find a negative relation between equity investor sentiment and contemporaneous bond returns, consistent with investor sentiment affecting the bond market through either the capital flow channel or the overinvestment channel or both, but

[18] I construct a trading strategy to provide evidence of the economic significance of the differential impact of sentiment on subsequent bond returns for the two groups. At the end of each quarter, I form a hedge portfolio by buying (shorting) bonds of firms in the no-overinvestment (overinvestment) group and I hold the portfolio for the subsequent 12 months. Controlling for the Fama and French (1993) market, SMB, HML, term and default risk factors, I find that one standard deviation change in the quarterly sentiment index yields an annualized hedge-portfolio bond return of 1.1% (untabulated).

inconsistent with the contagion hypothesis. Further examination of the relation between equity investor sentiment and subsequent bond returns, where the two channels have different predictions, identifies the presence of both channels. Thus, combining my findings from Tables 4 and 5, I find evidence supporting both the firm overinvestment and capital flow channels while ruling out the contagion effect hypothesis.

*4.4 Cross-sectional variation in the effect of the capital flow channel*

The bond market impact of equity investor sentiment through the capital flow channel is a result of price pressure due to investors rebalancing portfolios between stock and bond securities. The impact of capital flow on bond returns is likely to vary across bonds based on bond liquidity. Examining the U.S. Treasury market, Brandt and Kavajecz (2004) find that the effect of capital overflow (excess buying or selling pressure) on bond yields is weaker when bond liquidity is higher. Similarly in the equity investor sentiment setting, I expect the impact of the capital flow channel to be less pronounced for more liquid bond issues. In other words, I predict the relation between equity investor sentiment and contemporaneous bond returns to be less negative for the highly liquid bonds. Consistently, bonds that are highly liquid should be less affected by the backflow of capital and exhibit a less positive relation between equity investor sentiment and subsequent bond returns. I test these predictions using the following regression models:

$$Adj\_QBRet_{i,qt}=\beta_1 Sentiment_{qt} + \beta_2 Liq_{i,t-1} + \beta_3 Sentiment_{qt}*Liq_{i,t-1} + \sum\beta_{4j} RFactor + \sum\beta_{5j} Controls + \delta_j + \delta_t + \delta_q + \mu_{i,qt} \quad (9)$$

$$Adj\_AnnBRet_{i,t+1}=\beta'_1 Sentiment_{qt} + \beta'_2 Liq_{i,t-1} + \beta'_3 Sentiment_{qt}*Liq_{i,t-1} + \sum\beta'_{4j} RFactor +$$

$$\sum\beta'_{5j}Controls + \delta_j + \delta_{t+1} + \delta_q + \mu_{i,t+1} \quad (10)$$

Equation (9) examines how the relation between sentiment and contemporaneous bond returns varies with bond liquidity. Following Bao, Pan, and Wang (2011), I measure bond liquidity by the autocovariance of price changes at the trade-by-trade level, $cov(\Delta price_t, \Delta price_{t+1})$. I compute this measure over one year prior to quarter *qt* and require at least 10 paired price changes as in Bao et al. (2011). Bonds in the top liquidity tercile are classified as liquid bonds. The variable $Liq_{i,t-1}$ is set to one for liquid bonds and zero otherwise. Brandt and Kavajecz's (2004) provide evidence that the negative impact of equity investor sentiment is attenuated by liquidity, predicting $\beta_3 > 0$. Equation (10) focuses on the relation between sentiment and subsequent bond returns. I expect the positive relation between sentiment and subsequent returns to be attenuated by bond liquidity, that is, $\beta'_3 < 0$.

Table 6 summarizes how the impact of equity sentiment varies cross-sectionally with bond liquidity. Column (1) of Panel A reports the estimation results of equation (9). As expected, the coefficient estimate on $Sentiment_{qt}*Liq_{i,t-1}$ is positive at the 1% significance level, indicating that the effect of equity investor sentiment on contemporaneous bond returns is less pronounced for highly liquid bonds. Yet, the sum of the coefficients on $Sentiment_{qt}$ and $Sentiment_{qt}*Liq_{i,t-1}$ is still significantly negative. In Column (2), I estimate a variation of equation (9), allowing the impact of liquidity to vary with overinvestment. The coefficient estimate on $Sentiment_{qt}*OverInvest_{i,qt}*Liq_{i,t-1}$ turns out to be insignificant, consistent with my expectation that the bond market impact of equity investor sentiment through the overinvestment channel does not vary with bond liquidity.

Panel B provides evidence on the role of bond liquidity in the relation between equity investor sentiment and subsequent bond returns. Column (1) reports the estimation results of equation (10). As predicted, the coefficient estimate on $Sentiment_{qt}*Liq_{i,t-1}$ is significantly negative, suggesting that the effect of capital backflow is less pronounced for liquid bonds. In Column (2), the coefficient on the three-way interaction $Sentiment_{qt}*OverInvest_{i,qt}*Liq_{i,t-1}$ continues to be insignificant. The relation between equity investor sentiment and subsequent bond returns is insignificant for both liquid bonds and illiquid bonds of the overinvestment group, consistent with the main effect reported in Table 5, column (2).

In summary, I find that bond liquidity reduces the impact of equity investor sentiment on contemporaneous and subsequent bond returns, consistent with the argument that the impact of capital flow is less pronounced for liquid bonds. However, bond liquidity does not fully eliminate the effect of the capital flow channel. In fact, the negative relation between sentiment and contemporaneous bond returns and the positive relation between sentiment and subsequent returns, although dampened, continue to be significant for the subsample of liquid bonds.

### *4.5 Robustness tests*

I conduct two additional tests to confirm the robustness of my results. First I explore the extent to which my results are driven by the recent financial crisis period. I re-run my main regressions in equations (5) to (8) separately for both the non-financial-crisis period, ended in 2007, and the financial crisis period, from 2008 onwards. The results are reported in Table 7. Panel A summarizes the relation between equity investor sentiment and contemporaneous bond returns for the two sub-periods. Columns (1) and (2) report the estimation results of equation (5). Both the non-financial-crisis period and the financial crisis period have significant negative coefficients on $Sentiment_{qt}$, although the magnitude is much larger for the financial crisis period. Columns (3) and (4) test the differential effect due to the overinvestment channel using equation (7). Consistent with my finding in Section 4.3.2, the overinvestment group experiences incremental negative impact on contemporaneous bond returns in both sub-periods.

Panel B reports the impact of equity investor sentiment on the subsequent 12-month bond returns for both the non-financial-crisis period and the financial crisis period. Columns (1) and (2) present the estimation of the baseline model using equation (6) and columns (3) and (4) test the differential effect for the overinvestment group using equation (8). Consistent with the main findings, the main effect on $Sentiment_{qt}$ is positive and the incremental effect is negative for the overinvestment group in both periods, supporting the co-existence of the capital flow and overinvestment mechanisms. Thus, the main results reported in Section 4.3.2 are not driven by the recent financial crisis alone but are observed in both sub-periods.

Second, I attempt to address the potential hindsight bias in the overinvestment proxy CAPXRES, which is calculated using information from the entire sample period. To mitigate the concern that all information is not available in the year of estimation, I re-estimate equation (1) annually using the most recent 5 years' observations and then rank the residual from the rolling regressions (*CAPXRES2*). I classify the top tercile as the overinvestment group and the rest as the no-overinvestment group. I re-run equation (6) and (8) using this new overinvestment proxy and report results in Table 8. The results are similar to what are reported in Table 4, Panel A, and Table 5, Panel A, and all the inferences remain unchanged.

**5. Relation between equity investor sentiment and bond ratings**

In this section, I conduct analyses using bond rating revisions to provide more evidence on the effect of equity investor sentiment on the bond market. In particular, this analysis helps to differentiate the effects of the overinvestment and capital flow channels. Credit ratings for corporate bonds represent a summary of forward-looking opinions about the credit risk of bond issues and issuers' ability to meet the financial obligations in full and on time.[19] Changes in the expectation of a firm's default risk lead to a bond rating revision. If the impact of equity investor sentiment on bond returns is driven by the effects of capital flows, the movement of bond prices is unrelated to changes in bond default risk. Consequently, the capital flow argument predicts no correlation between bond rating revisions and equity investor sentiment. By contrast, under the overinvestment argument, a firm's default risk increases when it overinvests in riskier projects and exhibits poor ex post operating performance. Thus, the overinvestment channel predicts a positive relation between bond rating downgrades and equity investor sentiment for the overinvestment

[19] See http://www.standardandpoors.com/ratings/definitions-and-faqs/en/us.

group. To test these two predictions, I base my estimation on the bond rating prediction model of Shi (2003) and Cheng and Neamtiu (2009). The following logistic regressions are estimated:

$$Downgrade_{i,qt}=\beta_1 Sentiment_{qt}+\sum\beta_{2j}Perf+\sum\beta_{3j}BondChar+\beta_4 Def_{qt}+\delta_j+\delta_t+\delta_q+\varepsilon_{i,qt} \quad (11)$$

$$Downgrade_{i,qt}=\beta_1 Sentiment_{qt}+\beta_2 OverInvest_{i,qt}+\beta_3 Sentiment_{qt}*OverInvest_{i,qt}+\sum_{4j}Perf + \sum\beta_{5j}BondChar+\beta_6 Def_{qt}+\delta_j+\delta_t+\delta_q+\varepsilon_{i,qt} \quad (12)$$

Equations (11) and (12) test the association between bond rating downgrades and equity investor sentiment. While equation (11) focuses on the average association, I allow the association to vary with the extent of overinvestment in equation (12). As discussed above, I expect $\beta_1$ in equations (11) and (12) to be insignificant. I expect $\beta_3$ in equation (12) to be positive as $Sentiment_{qt}*OverInvest_{i,qt}$ captures the higher default risk associated with sentiment-induced overinvestment.

To mitigate the influence of potential data errors and outliers, I exclude the extreme 1% of bond rating revisions, i.e., any rating revision beyond 3 notches. I use the most recent bond rating issued by S&P before the end of quarter *q* in year *t*. If no rating is available from S&P, I use the most recent bond rating issued by Moody's. Following Asquith, Beatty and Weber (2005), I convert the bond letter ratings to numeric ratings by sequentially assigning 1 to 21 to S&P AAA rating (Moody's Aaa) through S&P C or D rating (Moody's C). If a new rating is issued during the period and it is lower than the previous rating, I code it as a downward revision, setting $Downgrade_{i,qt}$ to one. If no new bond rating or an upward bond revision is issued during the period, I code $Downgrade_{i,qt}$ as zero. As in Shi (2003), I include a number of accounting performance variables in the rating prediction model. The debt-to-equity ratio, $DE_{i,qt}$, is computed as long term debt over book value of equity. A higher debt-to-equity ratio indicates a higher default risk. Firm size, $LogMVE_{i,qt}$, is computed as the logarithm of market value of common equity outstanding at the end of the period. Larger firms are expected to have lower default risk. $Profit_{i,qt}$ is calculated as net income over net sales. Profitable firms are less likely to default on loan repayments. Finally, I include $Times_{i,qt}$ measured as income before extraordinary items divided by interest expense. $Times_{i,qt}$ is positively correlated with issuers' ability to fulfill their financial obligations and thus negatively correlated with default risk.[20]

I include bond characteristics $LogAmt_{i,qt}$ and $Maturity_{i,qt}$ as defined in Section 4. I add a dummy variable, $SUB_{i,qt}$, which takes the value of one for subordinate bonds and zero otherwise, to control for the riskiness of subordinate bonds. I add $Def_{qt}$ to control for the time-series variation in default risk in the regression. Industry, year and quarter fixed effects are included and standard errors are clustered at the firm level.

Table 9, Panel A reports the estimation results of equations (11) and (12) on bond rating downgrades and contemporaneous equity investor sentiment. The coefficient estimates on $Sentiment_{qt}$ in both equations and on $Sentiment_{qt}*OverInvest_{i,qt}$ in equation (12) are insignificant, suggesting no impact of equity investor sentiment on contemporaneous bond rating downgrades. However, bond rating revisions are generally considered to be untimely, raising the possibility that the impact of sentiment on ratings is lagged. I therefore re-estimate equations (11) and (12) with bond rating downgrades in the

[20] The results are very similar if I replace *Profit* and *Times* with the change in *Profit* and the change in *Times* in equations (11) to (12).

*subsequent* year as the dependent variable and report the results in Panel B. I find that the coefficient estimate on the interaction variable $Sentiment_{qt}*OverInvest_{i,qt}$ is significantly positive ($p<0.05$), with the F-test indicating that the sum of the coefficients on $Sentiment_{qt}$ and $Sentiment_{qt}*OverInvest_{i,qt}$ is significantly positive. This result documents a positive association between bond rating downgrades and *lagged* equity investor sentiment for the overinvestment group.[21] This finding is consistent with prior criticism that bond rating agencies do not update bond ratings in a timely fashion (e.g., Pinches and Singleton, 1978 and Beaver et al., 2006). The coefficient estimates on most control variables are significant and in the predicted direction.

Table 10 reports the differential test for the overinvestment group using CAPXRES2 as the overinvestment proxy to mitigate potential hindsight bias. I re-run equation (12) for both the contemporaneous and subsequent 12-month periods. Similar to the results presented in Table 9, although no significant relation is detected in the contemporaneous period for both the no-overinvestment and the overinvestment groups, the coefficient on $Sentiment_{qt}*OverInvest_{i,qt}$ and the F-test in Column (2) indicate that higher investor sentiment leads to a higher likelihood of bond downgrades in the subsequent period.

In summary, the tests using bond ratings further corroborate the impact of equity investor sentiment on the bond market. In addition, these results help to isolate the effects

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[21] In a robustness test, I use the number of notches by which bond ratings change as the dependent variable in place of the binary variable used in my main tests. I find that, consistent with the reported results, equity investor sentiment has a negative impact on subsequent bond rating changes for the overinvestment group.

of the two mechanisms that may explain the effect - capital flow and overinvestment. My results show that when the negative impact of sentiment on bond returns is likely driven by overinvestment, it also has a negative (but delayed) impact on credit ratings consistent with an increase in expected default risk. In contrast, when the negative impact of sentiment on bond returns is likely driven by capital flow (i.e., for no-overinvestment firms), there is no impact on credit ratings since capital flow effects are less likely to be related to changes in default risk.

## 6. Equity investor sentiment and the stock-bond relation

In this section, I briefly discuss the potential role of equity investor sentiment in explaining the relation between the stock market and the bond market.

The stock-bond relation is of interest to researchers, regulators and market participants. However, there does not seem to be a consensus as to what this relation should be. As pointed out by Shiller and Beltratti (1992), different arguments may lead to different conclusions. The simple models of time-varying discount rates imply a positive relation between the prices of bonds and stocks (Shiller, 1982), other things being equal. On the other hand, the dividend streams for these two categories of assets have different stochastic properties and such differences may lead to an insignificant or negative relation between stock prices and bond prices.[22]

[22] Shiller and Beltratti (1992) discuss two possible explanations for the insignificant or negative prediction of the stock-bond relation. First, the dividend stream is in nominal terms for bonds while it is relatively stable in real terms for stocks. If there is substantial inflation, it will be reflected through the change in bond prices but have little effect on stock prices. Second, the long-term interest rate might be positively correlated with firms' future performance and thus stock prices, while it is negatively related to bond prices.

Consistent with these arguments, the empirical relation between these two markets has proven to be highly unstable. Shiller (1982) reports that there is little co-movement between the value of the stocks and the prices of corporate bonds. Using daily stock index and government bond returns, Baele, Bekart, and Inghelbrecht (2010) find a modest positive relation with a range anywhere from +0.60 to -0.60 over the past four decades. Many studies attempt to explain this time variation. For example, Connolly, Stivers, and Sun (2005) attribute the negative stock-bond correlation to the "flight-to-safety" phenomenon. Campbell and Ammer (1993) propose that changing fundamentals may cause changes in the stock-bond co-movement and Fleming, Kirby, and Ostdiek (1998) examine the impact of cross-market hedging on the stock-bond relation. In this study, my findings shed light on the potential role of investor sentiment in explaining the time variation of the stock-bond relation.

The existing literature provides extensive evidence on the contemporaneous co-movement between the stock market and investor sentiment due to a combination of the existence of noise traders and the limits to arbitrage. In this study, I find no evidence of such co-movement in the bond market since the bond market is dominated by more sophisticated institutional investors. Moreover, these sophisticated investors respond negatively to the overinvestment induced by equity overvaluation during high sentiment periods. Combined with the existing evidence, the main results reported in this study suggest investor sentiment as one of the potential drivers of the decoupling of stock-bond returns.

To further examine the role of investor sentiment on the stock-bond relation, I first calculate the correlation between daily CRSP value-weighted stock market index and corporate bond return index on a quarterly basis from 1987 to 2010.[23] Similar to what is reported in Baele et al. (2010), I find an insignificant positive stock-bond correlation (0.012 with t-value 0.61), with a range from -0.69 to 0.72. Next, I plot the level of investor sentiment and the stock-bond correlation in Figure 2. As shown in the figure, the two lines tend to move in opposite directions. The positive stock-bond relation is associated with low investor sentiment. When investor sentiment rises, the co-movement of the stock market and the bond market declines. Untabulated results confirm that there is a significant negative correlation between investor sentiment and the stock-bond correlation (-0.148; p-value 0.01). When the sample is partitioned into terciles based on the investor sentiment level, the stock-bond relation is positive when the investor sentiment level is neither too high nor too low (0.164; t-stat 5.03). When the investor sentiment falls in the bottom tercile, the correlation between these two markets is low (down to 0.082; t-stat 2.24). When the investor sentiment is in the top tercile, the stock-bond correlation turns negative (although insignificant). This significant drop in the stock-bond correlation is consistent with the incremental negative impact on bond returns due to equity overvaluation induced overinvestment. Thus, the results in this study shed some light on the association between investor sentiment and the time variation in the stock-bond relation.

[23] The corporate bond return index is based on the daily returns of investment grade rated public corporate debt (from https://research.stlouisfed.org/fred2/series/BAMLCC0A0CMTRIV/).

## 7. Conclusion

Equity investor sentiment has been shown to have a significant impact on the equity market. However, limited empirical evidence has been offered regarding its effect on the bond market. This study fills this void by examining whether equity investor sentiment affects the bond market. I show that equity investor sentiment affects bond returns through (i) the price pressure generated by money reallocation across the equity and bond markets as a result of investors chasing high returns (capital flow channel), and (ii) an increase in default risk due to firm overinvestment (firm overinvestment channel). I find a negative association between equity investor sentiment and contemporaneous bond returns on average, which supports both the capital flow and firm overinvestment channels, and rules out the contagion effect hypothesis which predicts a positive relation. Further, the negative relation is stronger for the overinvestment group relative to the no-overinvestment group, indicating the co-existence of the capital flow and firm overinvestment channels. In testing the relation between equity investor sentiment and subsequent bond returns, consistent with the effect of the capital flow channel, I find a positive relation for the full sample and for the no-overinvestment group, indicating the backflow of capital as equity investor sentiment reverses subsequently. By contrast, the relation for the overinvestment group is insignificant because the negative effect of sentiment-driven overinvestment does not reverse in subsequent periods. In other words, the effect of the capital flow channel is temporal and reverses subsequently while the effect of the firm overinvestment channel is lasting.

I further explore the cross-sectional effect of bond liquidity on the relation between equity investor sentiment and bond returns predicted by the capital flow channel. Consistent with prior research, I find that bond liquidity alleviates the effect of equity investor sentiment on bond returns due to price pressure generated by capital flow; however, liquidity has no impact on bond returns of the overinvestment group. This provides additional evidence differentiating the firm overinvestment and the capital flow channels.

Finally, I explore the consequences of equity investor sentiment on bond ratings, another important element of the bond market. Consistent with the differential implications regarding firm default risk suggested by the capital flow channel and the firm overinvestment channel, I find that, higher equity investor sentiment leads to more downward revisions of bond ratings in the subsequent period only for the overinvestment group as a result of the increased default risk.

My findings present empirical evidence on the impact of equity investor sentiment on the bond market. The results highlight the differences between the bond market and the equity market in the presence of equity investor sentiment. I find there is no contagion of unjustified expectations from the equity market to the bond market. In fact, bond investors and rating agencies respond to equity investor sentiment in a rational way that is consistent with bond investors' payoff structures.

**Table 1: Sample selection and distribution**

Panel A: Sample selection procedure

| | |
|---|---|
| After deleting bond trades that are less than 100,000, canceled, corrected, and commission trades | |
| Observations with daily price data | 4,169,987 |
| After deleting bonds that are convertible or with sinking fund | 3,886,573 |
| After deleting bonds with no rating or in default | 3,305,681 |
| After deleting bonds with no coupon, zero coupon or odd interest_frequency | 3,270,108 |
| Observations with end-of-month bond price data | 375,828 |
| After deleting issues by financial institutions | 227,938 |
| Observations with quarterly bond return | 53,164 |
| After deleting non-US bonds | 47,083 |
| After trimming the extreme bond returns | 46,143 |
| Observations with CAPXRES available | 20,051 |

Panel B: Sample distribution by year

| | Bond-quarter observations | |
|---|---|---|
| Year | Frequency | Percent |
| 2003 | 1,090 | 5.44 |
| 2004 | 1,476 | 7.36 |
| 2005 | 2,959 | 14.76 |
| 2006 | 2,973 | 14.83 |
| 2007 | 3,024 | 15.08 |
| 2008 | 2,670 | 13.32 |
| 2009 | 2,537 | 12.65 |
| 2010 | 3,322 | 16.57 |
| Total | 20,051 | |

**Table 2: Descriptive statistics of bond characteristics and sentiment**

This table reports the descriptive statistics of bond characteristics and equity investor sentiment. Variable definitions are in Appendix A.

| Variable | N | Mean | 25th Pctl | Median | 75th Pctl | Std Dev |
|---|---|---|---|---|---|---|
| Bond characteristics | | | | | | |
| $QBRet_{qt}$ (%) | 20,051 | 1.785 | -0.245 | 1.363 | 3.501 | 4.146 |
| $AnnBRet_{t+1}$ (%) | 18,082 | 6.336 | 2.351 | 5.502 | 8.942 | 10.428 |
| $Adj\_QBRet_{qt}$ (%) | 20,051 | 1.212 | -0.980 | 0.680 | 3.001 | 4.255 |
| $Adj\_AnnBRet_{t+1}$ (%) | 18,082 | 3.892 | -0.727 | 2.100 | 7.085 | 11.060 |
| Rating | 20,051 | 4.013 | 3 | 4 | 5 | 1.154 |
| Maturity | 20,051 | 12.665 | 8 | 10 | 12 | 8.449 |
| Coupon | 20,051 | 6.398 | 5.500 | 6.450 | 7.375 | 1.518 |
| Age | 20,051 | 7 | 6 | 7 | 8 | 1 |
| LogAmt | 20,051 | 13.075 | 12.612 | 13.122 | 13.528 | 0.647 |
| Sentiment index | | | | | | |
| Sentiment | 32 | -0.108 | -0.185 | -0.083 | 0.020 | 0.273 |

**Table 3: Impact of equity investor sentiment on firm investment**

This table presents the test of association between equity investor sentiment and firm investment using Polk and Sapienza's (2009) investment model. Panel A presents the descriptive statistics of firm characteristics used in the regression. $Invest_{i,qt}$ is defined as capital expenditure (*CAPXQ*) deflated by beginning-of-quarter net property, plant, and equipment (net PP&E). $Q_{i,qt-1}$ is Tobin's Q measured as the beginning-of-quarter market value of assets to book value of assets, where market value of assets equals the book value of assets plus the market value of common stock less the sum of the book value of common stock and balance sheet deferred taxes. $CF_{i,qt-1}$ equals the sum of earnings before extraordinary items and depreciation over beginning-of-quarter net PP&E. Panel B reports the estimation results of the following regression using firm-quarter data, controlling for firm characteristics and macro variables (as defined in Appendix A). Year, quarter, and industry fixed effects (2-digit SIC code) are included in the regressions and standard errors are clustered at the firm level.

$$Invest_{i,qt} = \alpha_1 Sentiment_{qt} + \sum \alpha_j Controls + \delta_j + \delta_t + \delta_q + \varepsilon_{i,qt}$$

Panel A: Descriptive of firm characteristics

| Variable | N | Mean | 25th Pctl | Median | 75th Pctl | Std Dev |
|---|---|---|---|---|---|---|
| *Invest* | 103,256 | 0.069 | 0.025 | 0.047 | 0.085 | 0.072 |
| Tobin's Q (*Q*) | 103,256 | 1.845 | 1.119 | 1.458 | 2.086 | 1.525 |
| Cash Flow (*CF*) | 103,256 | 0.423 | 0.048 | 0.103 | 0.246 | 12.763 |

Panel B: Regression results

| | $Invest_{i,qt}$ (1) | | $Invest_{i,qt}$ (2) | |
|---|---|---|---|---|
| | Estimate | P-value | Estimate | P-value |
| $Sentiment_t$ | **0.0054** | **<.0001** | **0.0042** | **0.0002** |
| $Q_{i,qt-1}$ | 0.0096 | <.0001 | 0.0096 | <.0001 |
| $CF_{i,qt-1}$ | 0.0001 | 0.0608 | 0.0001 | 0.0608 |
| $CPI_{qt-1}$ | | | 0.0003 | <.0001 |
| $Term_{qt-1}$ | | | -0.0033 | <.0001 |
| $Def_{qt-1}$ | | | 0.0035 | <.0001 |
| $T\text{-}bill_{qt-1}$ | | | -0.0004 | 0.6342 |
| R-sq | 0.1484 | | 0.1501 | |
| # of obs | 103,256 | | 103,256 | |

**Table 4: Equity investor sentiment and contemporaneous bond returns**

This table presents the test of the impact of equity investor sentiment on contemporaneous bond returns.

**Panel A: CAPXRES as the overinvestment proxy**

Variations of the following regressions are estimated:

Baseline model:

$Adj\_QBRet_{i,qt} = \beta_1 Sentiment_{qt} + \sum\beta_{2j} RFactor + \sum\beta_{3j} Controls + \delta_j + \delta_t + \delta_q + \mu_{i,qt}$

Test for the differential relation of the overinvestment group:

$Adj\_QBRet_{i,qt} = \beta_1 Sentiment_{qt} + \beta_2 OverInvest_{i,qt} + \beta_3 Sentiment_{qt} * OverInvest_{i,qt} + \sum\beta_{4j} RFactor + \sum\beta_{5j} Controls + \delta_j + \delta_t + \delta_q + \mu_{i,qt}$

$Adj\_QBRet_{i,qt}$ is the quarterly bond return in excess of the T-bill return. $Sentiment_{qt}$ is the quarterly equity investor sentiment. *RFactor* are the five factors identified in Fama and French (1993), including *MKT*, *SMB*, *HML*, *TERM*, and *DEFAULT*. *Term* is the bond yield difference between long-term government bonds and one-month treasury bills. *Def* is the bond yield difference between long-term Moody's BAA bonds and long-term Moody's AAA bonds. *Controls* include the most recent bond rating (*Rating*), maturity (*Maturity*), interest rate (*Coupon*), bond age (*Age*), and logarithm of the bond issue offering amount (*LogAmt*). $OverInvest_{i,qt}$ takes value of one (zero) if CAPXRES is in the top tercile (bottom two terciles) of the sample. Columns (1) report the estimation results of the baseline model and columns (2) report the estimation results of the differential test. Industry, year, and quarter fixed effects are included and standard errors are clustered at firm level.

| | Baseline model | | Differential test | |
|---|---|---|---|---|
| | (1) | | (2) | |
| | Estimate | P-value | Estimate | P-value |
| $Sentiment_{qt}$ | **-5.6906** | **<.0001** | **-5.4268** | **<.0001** |
| $Overinvest_{i,qt}$ | | | -0.2890 | 0.0068 |
| $Sentiment_{qt}$*$Overinvest_{i,qt}$ | | | **-1.5312** | **0.0030** |
| $MKT_{qt}$ | 0.0716 | <.0001 | 0.0708 | <.0001 |
| $SMB_{qt}$ | -0.1063 | <.0001 | -0.1047 | <.0001 |
| $HML_{qt}$ | 0.0269 | 0.0036 | 0.0258 | 0.0050 |
| $Term_{qt}$ | -0.4857 | 0.0009 | -0.4955 | 0.0004 |
| $Def_{qt}$ | 0.8799 | <.0001 | 0.8429 | <.0001 |
| $Rating_{i,qt}$ | 0.1235 | <.0001 | 0.1268 | <.0001 |
| $Maturity_{i,qt}$ | 0.0264 | <.0001 | 0.0268 | <.0001 |
| $Coupon_{i,qt}$ | 0.1355 | <.0001 | 0.1345 | <.0001 |
| $Age_{i,qt}$ | -0.0748 | 0.0251 | -0.0794 | 0.0165 |
| $LogAmt_{i,qt}$ | 0.0039 | 0.9320 | 0.0022 | 0.9618 |
| F-test of $\beta_1 + \beta_3$ | | | <.0001 | |
| R-sq | 0.236 | | 0.238 | |
| # of obs | 20,051 | | 20,051 | |

**Panel B: M&A as the overinvestment proxy**

Variations of the following regressions are estimated:
Baseline model:

$$Adj\_MBRet_{i,mt}= \beta_1 Sentiment_{mt} + \sum\beta_{2j} RFactor + \sum\beta_{3j} Controls + \delta_j + \delta_t + \delta_q + \mu_{i,mt}$$

Test for the differential relation of the overinvestment group:

$$Adj\_MBRet_{i,mt}=\beta_1 Sentiment_{mt} + \beta_2 OverInvest_{i,mt} + \beta_3 Sentiment_{mt}*OverInvest_{i,mt} + \sum\beta_{4j} RFactor + \sum\beta_{5j} Controls + \delta_j + \delta_t + \delta_q + \mu_{i,qt}$$

$Adj\_BRet_{i,mt}$ is the monthly bond return in excess of the T-bill return. $Sentiment_{mt}$ is the monthly equity investor sentiment. $OverInvest_{i,mt}$ takes value of one for the incidence of stock M&A events and zero otherwise. *RFactor* and *Controls* are the risk factors and bond characteristics as defined in Appendix A. Columns (1) report the estimation results of the baseline model and columns (2) report the estimation results of the differential test. Industry, year, and quarter fixed effects are included and standard errors are clustered at firm level.

| | Baseline model (1) | | Differential test (2) | |
|---|---|---|---|---|
| | Estimate | P-value | Estimate | P-value |
| $Sentiment_{mt}$ | **-0.3882** | **0.0002** | **-0.3775** | **0.0002** |
| $Overinvest_{i,mt}$ | | | -0.1326 | 0.0895 |
| $Sentiment_{mt}*Overinvest_{i,mt}$ | | | **-0.6015** | **0.0496** |
| $MKT_{mt}$ | 0.0930 | <.0001 | 0.0929 | <.0001 |
| $SMB_{mt}$ | -0.0104 | 0.0552 | -0.0102 | 0.0598 |
| $HML_{mt}$ | 0.0477 | <.0001 | 0.0477 | <.0001 |
| $Term_{mt}$ | -0.2176 | <.0001 | -0.2171 | <.0001 |
| $Def_{mt}$ | 0.0654 | 0.1712 | 0.0648 | 0.1756 |
| $Rating_{i,mt}$ | 0.1299 | <.0001 | 0.1289 | <.0001 |
| $Maturity_{i,mt}$ | 0.0087 | <.0001 | 0.0087 | <.0001 |
| $Coupon_{i,mt}$ | 0.1732 | <.0001 | 0.1731 | <.0001 |
| $Age_{i,mt}$ | -0.0950 | <.0001 | -0.0949 | <.0001 |
| $LogAmt_{i,mt}$ | -0.0400 | 0.0182 | -0.0397 | 0.0189 |
| | | | | |
| F-test of $\beta_1+\beta_3$ | | | 0.0020 | |
| R-sq | 0.0981 | | 0.0982 | |
| # of obs | 49,805 | | 49,805 | |

**Table 5: Equity investor sentiment and subsequent 12-month bond returns**

This table presents the test of the relation between equity investor sentiment and subsequent 12-month bond returns.

**Panel A: CAPXRES as the overinvestment proxy**

Variations of the following regressions are estimated:

Baseline model:

$Adj\_AnnBRet_{i,t+1} = \beta'_1 Sentiment_{qt} + \sum\beta'_{2j} RFactor + \sum\beta'_{3j} Controls + \delta_j + \delta_{t+1} + \delta_q + \mu_{i,t+1}$

Test for the differential relation of the overinvestment group:

$Adj\_AnnBRet_{i,t+1} = \beta'_1 Sentiment_{qt} + \beta'_2 OverInvest_{i,qt} + \beta'_3 Sentiment_{qt}*OverInvest_{i,qt} + \sum\beta'_{4j} RFactor + \sum\beta'_{5j} Controls + \delta_j + \delta_{t+1} + \delta_q + \mu_{i,t+1}$

$Adj\_AnnBRet_{i,t+1}$ is the subsequent 12-month bond return following quarter *qt* adjusted for T-bill rate. $Sentiment_{qt}$ is the previous quarterly equity investor sentiment. *RFactor* and *Controls* are the risk factors and bond characteristics as defined in Appendix A. $OverInvest_{i,qt}$ takes value of one (zero) if CAPXRES is in the top tercile (bottom two terciles) of the sample. Columns (1) report the estimation results of the baseline model and columns (2) report the estimation results of the differential test. Industry, year, and quarter fixed effects are included and standard errors are clustered at firm level.

| | Baseline model (1) | | Differential test (2) | |
|---|---|---|---|---|
| | Estimate | P-value | Estimate | P-value |
| $Sentiment_{qt}$ | **3.9601** | **0.0002** | **4.7023** | **<.0001** |
| $Overinvest_{i,qt}$ | | | -0.5548 | 0.0539 |
| $Sentiment_{qt}*Overinvest_{i,qt}$ | | | **-3.4184** | **0.0010** |
| $MKT_{t+1}$ | 0.1367 | <.0001 | 0.1373 | <.0001 |
| $SMB_{t+1}$ | -0.0953 | <.0001 | -0.0981 | <.0001 |
| $HML_{t+1}$ | -0.0691 | 0.0004 | -0.0697 | 0.0003 |
| $Term_{t+1}$ | -2.0237 | <.0001 | -2.0214 | <.0001 |
| $Def_{t+1}$ | 3.4213 | <.0001 | 3.4130 | <.0001 |
| $Rating_{i,t+1}$ | 0.1557 | 0.3853 | 0.1662 | 0.3568 |
| $Maturity_{i,t+1}$ | 0.0677 | <.0001 | 0.0683 | <.0001 |
| $Coupon_{i,t+1}$ | 0.4059 | <.0001 | 0.4086 | <.0001 |
| $Age_{i,t+1}$ | -0.4023 | 0.0140 | -0.4096 | 0.0116 |
| $LogAmt_{i,t+1}$ | -0.0674 | 0.6095 | -0.0730 | 0.5839 |
| F-test of $\beta'_1 + \beta'_3$ | | | 0.3025 | |
| R-sq | 0.4292 | | 0.4304 | |
| # of obs | 18,082 | | 18,082 | |

**Panel B: M&A as the overinvestment proxy**

Variations of the following regressions are estimated:
Baseline model:

$$Adj\_AnnBRet_{i,t+1} = \beta'_1 Sentiment_{mt} + \sum \beta'_{2j} RFactor + \sum \beta'_{3j} Controls + \delta_j + \delta_{t+1} + \delta_q + \mu_{i,t+1}$$

Test for the differential relation of the overinvestment group:

$$Adj\_AnnBRet_{i,t+1} = \beta'_1 Sentiment_{mt} + \beta'_2 OverInvest_{i,mt} + \beta'_3 Sentiment_{mt} * OverInvest_{i,mt} + \sum \beta'_{4j} RFactor + \sum \beta'_{5j} Controls + \delta_j + \delta_{t+1} + \delta_q + \mu_{i,t+1}$$

$Adj\_AnnBRet_{i,t+1}$ is the subsequent 12-month bond return following month *mt* adjusted for the T-bill rate. $Sentiment_t$ is the previous monthly equity investor sentiment. $OverInvest_{i,mt}$ takes value of one for the incidence of stock M&A events and zero otherwise. *RFactor* and *Controls* are the risk factors and bond characteristics as defined in Appendix A. Columns (1) report the estimation results of the baseline model and columns (2) report the estimation results of the differential test. Industry, year, and quarter fixed effects are included and standard errors are clustered at firm level.

| | Baseline model (1) | | Differential test (2) | |
|---|---|---|---|---|
| | Estimate | P-value | Estimate | P-value |
| $Sentiment_{mt}$ | **1.3672** | **0.0109** | **1.7541** | **0.0006** |
| $Overinvest_{i,mt}$ | | | 0.1182 | 0.7919 |
| $Sentiment_{mt}$*$Overinvest_{i,mt}$ | | | **-3.1940** | **0.0107** |
| $MKT_{t+1}$ | 0.1160 | <.0001 | 0.0850 | <.0001 |
| $SMB_{t+1}$ | -0.0866 | <.0001 | -0.1100 | 0.0022 |
| $HML_{t+1}$ | -0.1219 | <.0001 | -0.1349 | <.0001 |
| $Term_{t+1}$ | -2.0633 | <.0001 | -2.0803 | <.0001 |
| $Def_{t+1}$ | 3.8702 | <.0001 | 3.9700 | <.0001 |
| $Rating_{i,t+1}$ | -0.0194 | 0.9095 | 0.0056 | 0.9718 |
| $Maturity_{i,t+1}$ | 0.0223 | 0.1498 | 0.0188 | 0.2063 |
| $Coupon_{i,t+1}$ | 0.0918 | 0.4527 | 0.0802 | 0.4879 |
| $Age_{i,t+1}$ | -0.2739 | 0.1164 | -0.2736 | 0.0982 |
| $LogAmt_{i,t+1}$ | -0.0403 | 0.7647 | -0.0204 | 0.8711 |
| | | | | |
| F-test of $\beta'_1 + \beta'_3$ | | | 0.2495 | |
| R-sq | 0.4671 | | 0.4845 | |
| # of obs | 22,001 | | 22,001 | |

**Table 6: Liquidity and the capital flow channel**

This table presents empirical results on the role of bond liquidity in the relation between equity investor sentiment and contemporaneous and subsequent bond returns.

**Panel A: Test of the impact of bond liquidity on the relation between sentiment and contemporaneous bond returns**

This panel reports the estimation results of the following regressions:

Baseline model:

$$Adj\_QBRet_{i,qt}=\beta_1 Sentiment_{qt}+\beta_2 Liq_{i,t-1}+\beta_3 Sentiment_{qt}*Liq_{i,t-1}+\sum\beta_{4j}RFactor+\sum\beta_{5j}Controls+\delta_j+\delta_t+\delta_q+\mu_{i,qt}$$

Test for the differential relation of the overinvestment group: (CAPXRES as the overinvestment proxy)

$$Adj\_QBRet_{i,qt}=\beta_1 Sentiment_{qt}+\beta_2 Liq_{i,t-1}+\beta_3 OverInvest_{i,qt}+\beta_4 Sentiment_{qt}*Liq_{i,t-1}+\beta_5 Liq_{i,t-1}*OverInvest_{i,qt}+\beta_6 Sentiment_{qt}*OverInvest_{i,qt}+\beta_7 Sentiment_{qt}*OverInvest_{i,qt}*Liq_{i,t-1}+\sum\beta_{8j}RFactor+\sum\beta_{9j}Controls+\delta_j+\delta_t+\mu_{i,qt}$$

Bond liquidity is measured as the autocovariance of price changes, $cov(\Delta p_t, \Delta p_{t-1})$ over the one year horizon prior to quarter *qt*, with at least 10 paired price changes available. $Liq_{i,t-1}$ takes value one if bond liquidity falls into the top tercile and zero otherwise. All other variables are defined in Appendix A. Columns (1) report the estimation results of the baseline model and columns (2) report the estimation results of the differential test. Industry, year, and quarter fixed effects are included and standard errors are clustered at firm level.

| | Baseline model (1) | | Differential test (2) | |
|---|---|---|---|---|
| | Estimate | P Value | Estimate | P Value |
| $Sentiment_{qt}$ | **-6.7999** | **<.0001** | **-6.5634** | **<.0001** |
| $Liq_{i,t-1}$ | 0.1725 | 0.0041 | 0.1749 | 0.0050 |
| $OverInvest_{i,qt}$ | | | -0.2393 | 0.0085 |
| $Sentiment_{qt}*liq_{i,t-1}$ | **0.9262** | **0.0010** | **1.1389** | **0.0002** |
| $Liq_{i,t-1}*OverInvest_{i,qt}$ | | | 0.0142 | 0.9234 |
| $Sentiment_{qt}*OverInvest_{i,qt}$ | | | **-1.4410** | **0.0004** |
| $Sentiment_{qt}*OverInvest_{i,qt}*liq_{i,t-1}$ | | | **-0.8286** | **0.2138** |
| $MKT_t$ | 0.0627 | <.0001 | 0.0618 | <.0001 |
| $SMB_t$ | -0.1139 | <.0001 | -0.1120 | <.0001 |
| $HML_t$ | 0.0287 | 0.0018 | 0.0275 | <.0001 |
| $Term_t$ | -0.4172 | 0.0050 | -0.4252 | <.0001 |
| $Def_t$ | 0.7303 | 0.0002 | 0.6873 | <.0001 |
| $Rating_{i,qt}$ | 0.1097 | <.0001 | 0.1126 | <.0001 |
| $Maturity_{i,qt}$ | 0.0261 | <.0001 | 0.0265 | <.0001 |
| $Coupon_{i,qt}$ | 0.1361 | <.0001 | 0.1354 | <.0001 |
| $Age_{i,qt}$ | -0.0592 | 0.0863 | -0.0644 | 0.0413 |
| $LogAmt_{i,qt}$ | 0.0010 | 0.9830 | -0.0023 | 0.9541 |

| | | |
|---|---|---|
| F test of $\beta_1 + \beta_3$ | <.0001 | |
| F test of $\beta_1 + \beta_4$ | | <.0001 |
| F test of $\beta_1 + \beta_6$ | | <.0001 |
| F test of $\beta_1 + \beta_4 + \beta_6 + \beta_7$ | | <.0001 |
| R-sq | 0.2421 | 0.2437 |
| # of obs | 19,443 | 19,443 |

**Panel B: Test of the impact of bond liquidity on the relation between sentiment and subsequent bond returns**

This panel reports the estimation results of the following regressions:
Baseline model:

$$Adj\_AnnBRet_{i,t+1}=\beta'_1 Sentiment_{qt}+\beta'_2 Liq_{i,t-1}+\beta'_3 Sentiment_{qt}*Liq_{i,t-1}+\sum\beta'_{4j}RFactor+\sum\beta'_{5j}Controls+\delta_j+\delta_{t+1}+\delta_q+\mu_{i,t+1}$$

Test for the differential relation of the overinvestment group: (CAPXRES as the overinvestment proxy)

$$Adj\_AnnBRet_{i,t+1}=\beta'_1 Sentiment_{qt}+\beta'_2 Liq_{i,t-1}+\beta'_3 OverInvest_{i,qt}+\beta'_4 Sentiment_{qt}*Liq_{i,t-1}+\beta'_5 Liq_{i,t-1}*OverInvest_{i,qt}+\beta'_6 Sentiment_{qt}*OverInvest_{i,qt}+\beta'_7 Sentiment_{qt}*OverInvest_{i,qt}*Liq_{i,t-1}+\sum\beta'_{8j}RFactor+\sum\beta'_{9j}Controls+\delta_j+\delta_{t+1}+\mu_{i,t+1}$$

Bond liquidity is measured as the autocovariance of price changes, $cov(\Delta p_t, \Delta p_{t-1})$ over the one year horizon prior to quarter *qt*, with at least 10 paired price changes available. $Liq_{i,t-1}$ takes value one if bond liquidity falls into the top tercile and zero otherwise. All other variables are as defined in Appendix A. Columns (1) report the estimation results of the baseline model and columns (2) report the estimation results of the differential test. Industry, year, and quarter fixed effects are included and standard errors are clustered at firm level.

| | Baseline model | | Differential test | |
|---|---|---|---|---|
| | (1) | | (2) | |
| | Estimate | P Value | Estimate | P Value |
| $Sentiment_{qt}$ | **4.3858** | **<.0001** | **5.2539** | **<.0001** |
| $Liq_{i,t-1}$ | 0.4699 | 0.0077 | 0.5722 | 0.0017 |
| $OverInvest_{i,qt}$ | | | -0.6430 | 0.0508 |
| $Sentiment_{qt}*liq_{i,t-1}$ | **-1.3379** | **0.0435** | **-1.5898** | **0.0335** |
| $Liq_{i,t-1}*OverInvest_{i,qt}$ | | | -0.4516 | 0.2255 |
| $Sentiment_{qt}*OverInvest_{i,qt}$ | | | **-3.9941** | **0.0003** |
| $Sentiment_{qt}*OverInvest_{i,qt}*liq_{i,t-1}$ | | | **1.4405** | **0.2964** |
| $MKT_{t+1}$ | 0.0887 | 0.0007 | 0.0903 | 0.0006 |
| $SMB_{t+1}$ | -0.0880 | <.0001 | -0.0912 | <.0001 |
| $HML_{t+1}$ | -0.0553 | 0.0008 | -0.0553 | 0.0007 |
| $Term_{t+1}$ | -1.8572 | <.0001 | -1.8520 | <.0001 |
| $Def_{t+1}$ | 3.4277 | <.0001 | 3.4066 | <.0001 |
| $Rating_{i,t+1}$ | 0.2496 | <.0001 | 0.2578 | <.0001 |
| $Maturity_{i,t+1}$ | 0.0944 | <.0001 | 0.0959 | <.0001 |
| $Coupon_{i,t+1}$ | 0.2505 | 0.0033 | 0.2517 | 0.0031 |
| $Age_{i,t+1}$ | -0.4229 | 0.0248 | -0.4325 | 0.0212 |
| $LogAmt_{i,t+1}$ | 0.0673 | 0.5819 | 0.0534 | 0.6632 |

| | | |
|---|---|---|
| F test of $\beta'_1 + \beta'_3$ | 0.0024 | |
| F test of $\beta'_1 + \beta'_4$ | | 0.0004 |
| F test of $\beta'_1 + \beta'_6$ | | 0.3174 |
| F test of $\beta'_1 + \beta'_4 + \beta'_6 + \beta'_7$ | | 0.4437 |
| R-sq | 0.489 | 0.4907 |
| # of obs | 15,610 | 15,610 |

**Table 7: Financial crisis period vs. non-financial-crisis period**

**Panel A: Equity investor sentiment and contemporaneous bond returns**

Variations of the following regressions are estimated for the financial crisis period and the non-financial-crisis period:

Baseline model:

$$Adj\_QBRet_{i,qt} = \beta_1 Sentiment_{qt} + \sum \beta_{2j} RFactor + \sum \beta_{3j} Controls + \delta_j + \delta_t + \delta_q + \mu_{i,qt}$$

Test of the differential effect of the overinvestment group:

$$Adj\_QBRet_{i,qt} = \beta_1 Sentiment_{qt} + \beta_2 OverInvest_{i,qt} + \beta_3 Sentiment_{qt} * OverInvest_{i,qt} + \sum \beta_{4j} RFactor + \sum \beta_{5j} Controls + \delta_j + \delta_t + \delta_q + \mu_{i,qt}$$

The variables are described in Table 4, Panel A. Columns (1) and (2) report the estimation results of the baseline model for the financial crisis period and the non-financial-crisis period separately and columns (3) and (4) report the results of the differential effect of the overinvestment group for the financial crisis period and the non-financial-crisis period separately. Industry, year, and quarter fixed effects are included and standard errors are clustered at the firm level.

| | Baseline model | | | | Differential test | | | |
|---|---|---|---|---|---|---|---|---|
| | Non-financial-crisis | | Financial crisis | | Non-financial-crisis | | Financial crisis | |
| | (1) | | (2) | | (3) | | (4) | |
| | Estimate | P Value | Estimate | P Value | Estimate | P Value | Estimate | P Value |
| $Sentiment_{qt}$ | -1.8810 | 0.0163 | -16.2279 | <.0001 | -1.7374 | 0.0243 | -15.7655 | <.0001 |
| $Overinvest_{i,qt}$ | | | | | -0.0295 | 0.7794 | -0.2990 | 0.0405 |
| $Sentiment_{qt}$*$Overinvest_{i,qt}$ | | | | | **-1.0799** | **0.0255** | **-1.9468** | **0.0328** |
| $MKT_{qt}$ | 0.1842 | <.0001 | 0.0304 | 0.0657 | 0.1824 | <.0001 | 0.0300 | 0.0714 |
| $SMB_{qt}$ | -0.2227 | <.0001 | -0.3521 | <.0001 | -0.2212 | <.0001 | -0.3539 | <.0001 |
| $HML_{qt}$ | -0.0948 | 0.0028 | 0.0839 | <.0001 | -0.0953 | 0.0029 | 0.0836 | <.0001 |
| $Term_{qt}$ | -1.5331 | <.0001 | 0.4975 | 0.0498 | -1.5351 | <.0001 | 0.4941 | 0.0452 |
| $Def_{qt}$ | 1.6412 | 0.0216 | -0.8092 | 0.0186 | 1.6506 | 0.0201 | -0.8349 | 0.0166 |
| $Rating_{i,qt}$ | 0.2833 | <.0001 | 0.3182 | <.0001 | 0.2859 | <.0001 | 0.3244 | <.0001 |
| $Maturity_{i,qt}$ | 0.0088 | 0.0229 | 0.0448 | <.0001 | 0.0088 | 0.0235 | 0.0456 | <.0001 |
| $Coupon_{i,qt}$ | 0.1113 | <.0001 | 0.1701 | <.0001 | 0.1100 | <.0001 | 0.1706 | <.0001 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| $Age_{i,qt}$ | -0.0524 | 0.2896 | -0.0895 | 0.0558 | -0.0532 | 0.2804 | -0.0924 | 0.0484 |
| $LogAmt_{i,qt}$ | 0.1846 | 0.0003 | -0.3243 | 0.0002 | 0.1821 | 0.0002 | -0.3238 | 0.0002 |
| | | | | | | | | |
| F-test of $\beta_1 + \beta_3$ | | | | | <.0001 | | <.0001 | |
| R-sq | 0.1407 | | 0.3337 | | 0.1418 | | 0.3351 | |
| # of obs | 11,522 | | 8,529 | | 11,522 | | 8,529 | |

**Panel B: Equity investor sentiment and subsequent 12-month bond returns**

Variations of the following regressions are estimated:
Baseline model:
$Adj\_AnnBRet_{i,t+1} = \beta'_1 Sentiment_{qt} + \sum\beta'_{2j} RFactor + \sum\beta'_{3j} Controls + \delta_j + \delta_{t+1} + \delta_q + \mu_{i,t+1}$
Test of the differential effect of the overinvestment group:
$Adj\_AnnBRet_{i,t+1} = \beta'_1 Sentiment_{qt} + \beta'_2 OverInvest_{i,qt} + \beta'_3 Sentiment_{qt} * OverInvest_{i,qt} + \sum\beta'_{4j} RFactor + \sum\beta'_{5j} Controls + \delta_j + \delta_{t+1} + \delta_q + \mu_{i,t+1}$
The variables are described in Table 5, Panel A. Columns (1) and (2) report the estimation results of the baseline model for the financial crisis period and the non-financial-crisis period separately and columns (3) and (4) report the results of the differential effect of the overinvestment group for the financial crisis period and the non-financial-crisis period separately. Industry, year, and quarter fixed effects are included and standard errors are clustered at the firm level.

| | Baseline model | | | | Differential test | | | |
|---|---|---|---|---|---|---|---|---|
| | Non-financial-crisis | | Financial crisis | | Non-financial-crisis | | Financial crisis | |
| | (1) | | (2) | | (3) | | (4) | |
| | Estimate | P Value | Estimate | P Value | Estimate | P Value | Estimate | P Value |
| $Sentiment_{qt}$ | 5.4755 | <.0001 | 4.5863 | 0.0080 | 5.7661 | <.0001 | 6.0935 | 0.0015 |
| $Overinvest_{i,qt}$ | | | | | -0.1250 | 0.6141 | -0.8019 | 0.0702 |
| $Sentiment_{qt}$*$Overinvest_{i,qt}$ | | | | | -1.3160 | 0.0968 | -5.5352 | 0.0060 |
| $MKT_{t+1}$ | 0.2911 | <.0001 | 0.4100 | <.0001 | 0.2916 | <.0001 | 0.4109 | <.0001 |
| $SMB_{t+1}$ | -0.2507 | <.0001 | -0.5879 | <.0001 | -0.2522 | <.0001 | -0.5848 | <.0001 |
| $HML_{t+1}$ | 0.0508 | <.0001 | -0.0480 | 0.1135 | 0.0513 | <.0001 | -0.0526 | 0.0806 |
| $Term_{t+1}$ | 2.5604 | <.0001 | 5.4923 | <.0001 | 2.5862 | <.0001 | 5.4637 | <.0001 |
| $Def_{t+1}$ | 1.5650 | 0.4704 | 9.0012 | <.0001 | 1.5605 | 0.4659 | 9.0533 | <.0001 |
| $Rating_{i,t+1}$ | 0.5370 | 0.0039 | -0.2524 | 0.4767 | 0.5387 | 0.0040 | -0.2282 | 0.5210 |
| $Maturity_{i,t+1}$ | 0.0097 | 0.4383 | 0.1313 | <.0001 | 0.0096 | 0.4425 | 0.1337 | <.0001 |
| $Coupon_{i,t+1}$ | 0.4190 | 0.0007 | 0.3614 | 0.0188 | 0.4192 | 0.0006 | 0.3616 | 0.0195 |
| $Age_{i,t+1}$ | -0.3769 | 0.1106 | -0.4004 | 0.0774 | -0.3771 | 0.1087 | -0.4088 | 0.0711 |
| $LogAmt_{i,t+1}$ | 0.1288 | 0.3127 | -0.5804 | 0.0219 | 0.1246 | 0.3300 | -0.5687 | 0.0236 |

| | | | | |
|---|---|---|---|---|
| F-test of $\beta'_1 + \beta'_3$ | | | <.0001 | 0.7733 |
| R-sq | 0.2137 | 0.4244 | 0.2143 | 0.4266 |
| # of obs | 10,185 | 7,898 | 10,185 | 7,898 |

**Table 8: Relation between equity investor sentiment and bond returns using alternative overinvestment proxy**

Column (1) and Column (2) estimate the variation of the following regressions for the contemporaneous and subsequent 12-month periods separately:
Contemporaneous returns:

$$Adj\_QBRet_{i,qt}=\beta_1 Sentiment_{qt} + \beta_2 OverInvest_{i,qt} + \beta_3 Sentiment_{qt}*OverInvest_{i,qt} + \sum\beta_{4j} RFactor + \sum\beta_{5j} Controls + \delta_j + \delta_t + \delta_q + \mu_{i,qt}$$

Subsequent 12-month returns:

$$Adj\_AnnBRet_{i,t+1}=\beta'_1 Sentiment_{qt} + \beta'_2 OverInvest_{i,qt} + \beta'_3 Sentiment_{qt}*OverInvest_{i,qt} + \sum\beta'_{4j} RFactor + \sum\beta'_{5j} Controls + \delta_j + \delta_{t+1} + \delta_q + \mu_{i,t+1}$$

$OverInvest_{i,qt}$ takes the value of one (zero) if CAPXRES2 is in the top tercile (bottom two terciles) of the sample. All other variables in Column (1) ((2)) are described in Table 4 (Table 5), Panel A. Industry, year, and quarter fixed effects are included and standard errors are clustered at the firm level.

| Contemporaneous | | | Subsequent 12-month | | |
|---|---|---|---|---|---|
| (1) | | | (2) | | |
| | Estimate | P Value | | Estimate | P Value |
| $Sentiment_{qt}$ | **-5.4387** | **<.0001** | $Sentiment_{qt}$ | **3.7605** | **0.0006** |
| $Overinvest_{i,qt}$ | -0.3232 | 0.0011 | $Overinvest_{i,qt}$ | -0.3259 | 0.1508 |
| $Sentiment_{qt}*Overinvest_{i,qt}$ | **-1.2561** | **0.0163** | $Sentiment_{qt}*Overinvest_{i,qt}$ | **-1.8304** | **0.0572** |
| $MKT_{qt}$ | 0.0708 | <.0001 | $MKT_{t+1}$ | 0.1246 | <.0001 |
| $SMB_{qt}$ | -0.1054 | <.0001 | $SMB_{t+1}$ | -0.0836 | <.0001 |
| $HML_{qt}$ | 0.0270 | 0.0036 | $HML_{t+1}$ | -0.0621 | 0.0006 |
| $Term_{qt}$ | -0.5017 | 0.0006 | $Term_{t+1}$ | -1.9869 | <.0001 |
| $Def_{qt}$ | 0.8599 | <.0001 | $Def_{t+1}$ | 3.3182 | <.0001 |
| $Rating_{i,qt}$ | 0.1279 | <.0001 | $Rating_{i,t+1}$ | 0.4651 | 0.0020 |
| $Maturity_{i,qt}$ | 0.0272 | <.0001 | $Maturity_{i,t+1}$ | 0.0751 | <.0001 |
| $Coupon_{i,qt}$ | 0.1337 | <.0001 | $Coupon_{i,t+1}$ | 0.3513 | <.0001 |
| $Age_{i,qt}$ | -0.0791 | 0.0175 | $Age_{i,t+1}$ | -0.3536 | 0.0269 |
| $LogAmt_{i,qt}$ | 0.0088 | 0.8540 | $LogAmt_{i,t+1}$ | -0.0282 | 0.8211 |
| | | | | | |
| F-test of $\beta_1+\beta_3$ | <.0001 | | F-test of $\beta'_1+\beta'_3$ | 0.1315 | |
| R-sq | 0.2949 | | R-sq | 0.5205 | |
| # of obs | 20,051 | | # of obs | 18,082 | |

**Table 9: Bond rating revision tests**

This table presents the tests of impact of equity investor sentiment on bond rating revisions.

**Panel A: Contemporaneous bond rating revisions tests**
This panel reports the estimation results of the following logistic regressions:
Baseline model:

$$Downgrade_{i,qt}=\beta_1 Sentiment_{qt} + \sum\beta_{2j}Perf + \sum\beta_{3j}BondChar + \beta_4 Def_{qt} + \delta_j + \delta_t + \delta_q + \varepsilon_{i,qt}$$

Test for the differential relation of the overinvestment group: (CAPXRES as the overinvestment proxy)

$$Downgrade_{i,qt}=\beta_1 Sentiment_{qt} + \beta_2 OverInvest_{i,qt} + \beta_3 Sentiment_{qt}*OverInvest_{i,qt} + \sum\beta_{4j}Perf + \sum\beta_{5j}BondChar + \beta_6 Def_{qt} + \delta_j + \delta_t + \varepsilon_{i,qt}$$

$Downgrade_{i,qt}$ is a dummy variable that takes the value of one if the bond rating is revised downward during the quarter *qt* and zero otherwise. *Perf* represent firm accounting performance as in Shi (2003). *DE* is the ratio of long-term debt to book-value of equity. *LogMVE* is the logarithm of market value of common stock outstanding at the end of the period. *Profit* is defined as net income to net sales. *Times* is measured as income before extraordinary items divided by interest and related expense. *BondChar* are bond characteristics including *LogAmt*, *LogMat*, and *SUB*, a dummy variable for subordinated bonds. $Def_{qt}$ is added to control time series variation of default risk. Columns (1) report the estimation results of the baseline model and columns (2) report the estimation results of the differential test. Industry, year, and quarter fixed effects are included and standard errors are clustered at firm level.

| | Baseline model (1) | | Differential test (2) | |
|---|---|---|---|---|
| | Estimate | P Value | Estimate | P Value |
| $Sentiment_{qt}$ | **0.4708** | **0.4584** | **0.5237** | **0.4058** |
| $OverInvest_{i,qt}$ | | | -0.3006 | 0.0840 |
| $Sentiment_{qt}*OverInvest_{i,qt}$ | | | **-0.1982** | **0.8055** |
| $DE_{i,qt}$ | 0.0021 | 0.9477 | 0.0000 | 0.9993 |
| $LogMVE_{i,qt}$ | -0.1295 | 0.0452 | -0.1356 | 0.0314 |
| $Profit_{i,qt}$ | 0.5468 | 0.2434 | 0.5311 | 0.2602 |
| $Times_{i,qt}$ | -0.0456 | 0.0037 | -0.0458 | 0.0035 |
| $LogAmt_{i,qt}$ | -0.1127 | 0.2388 | -0.1074 | 0.2561 |
| $Maturity_{i,qt}$ | -0.0644 | 0.3711 | -0.0603 | 0.3974 |
| $SUB_{i,qt}$ | -0.2660 | 0.2108 | -0.2638 | 0.2101 |
| $Def_{qt}$ | 0.1844 | 0.4035 | 0.1935 | 0.3788 |
| F test of $\beta_1 + \beta_3$ | | | 0.7363 | |
| Chi-sq | 522.89 | | 533.18 | |
| # of obs | 18,862 | | 18,862 | |

**Panel B: Subsequent bond rating revisions tests**

This panel reports the estimation results of the following logistic regressions:
Baseline model:

$$Downgrade_{i,t+1} = \beta'_1 Sentiment_{qt} + \sum\beta'_{2j} Perf + \sum\beta'_{3j} BondChar + \beta'_4 Def_{t+1} + \delta_j + \delta_{t+1} + \varepsilon_{i,t+1}$$

Test for the differential relation of the overinvestment group: (CAPXRES as the overinvestment proxy)

$$Downgrade_{i,t+1} = \beta'_1 Sentiment_{qt} + \beta'_2 OverInvest_{i,qt} + \beta'_3 Sentiment_{qt} * OverInvest_{i,qt} + \sum\beta'_{4j} Perf + \sum\beta'_{5j} BondChar + \beta'_6 Def_{t+1} + \delta_j + \delta_{t+1} + \varepsilon_{i,t+1}$$

$Downgrade_{i,t+1}$ is a dummy variable that takes the value of one if the bond rating is revised downward during the subsequent 12-month period following quarter *qt* and zero otherwise. All other variables are defined in Appendix A. Columns (1) report the estimation results of the baseline model and columns (2) report the estimation results of the differential test. Industry, year, and quarter fixed effects are included and standard errors are clustered at firm level.

| | Baseline model | | Differential test | |
|---|---|---|---|---|
| | (1) | | (2) | |
| | Estimate | P Value | Estimate | P Value |
| $Sentiment_{qt}$ | **0.1559** | **0.6232** | **-0.0194** | **0.9527** |
| $OverInvest_{i,qt}$ | | | 0.0129 | 0.9373 |
| $Sentiment_{qt}*OverInvest_{i,qt}$ | | | **1.0316** | **0.0385** |
| $DE_{i,qt}$ | -0.0005 | 0.8118 | 0.0004 | 0.8618 |
| $LogMVE_{i,qt}$ | -0.2001 | 0.0021 | -0.2231 | 0.0007 |
| $Profit_{i,qt}$ | 0.2007 | 0.8141 | 0.2787 | 0.7443 |
| $Times_{i,qt}$ | -0.0573 | 0.0047 | -0.0653 | 0.0022 |
| $LogAmt_{i,t+1}$ | -0.1063 | 0.3193 | -0.0031 | 0.9795 |
| $Maturity_{i,t+1}$ | -0.0457 | 0.5392 | -0.0678 | 0.4010 |
| $SUB_{i,t+1}$ | -0.4896 | 0.0141 | -0.5218 | 0.0082 |
| $Def_{t+1}$ | -0.0232 | 0.5607 | -0.0263 | 0.4996 |
| | | | | |
| F test of $\beta'_1 + \beta'_3$ | | | 0.0373 | |
| Chi-sq | 694.91 | | 872.97 | |
| # of obs | 17,371 | | 17,371 | |

**Table 10: Bond rating revision test using alternative overinvestment proxy**

Column (1) and Column (2) estimate variations of the following regressions for the contemporaneous and subsequent 12-month periods separately:
Contemporaneous regression:

$$Downgrade_{i,qt}=\beta_1 Sentiment_{qt} + \beta_2 OverInvest_{i,qt} + \beta_3 Sentiment_{qt}*OverInvest_{i,qt} + \sum\beta_{4j}Perf + \sum\beta_{5j}BondChar + \beta_6 Def_{qt} + \delta_j + \delta_t + \varepsilon_{i,qt}$$

Subsequent year's regression:

$$Downgrade_{i,t+1}=\beta'_1 Sentiment_{qt} + \beta'_2 OverInvest_{i,qt} + \beta'_3 Sentiment_{qt}*OverInvest_{i,qt} + \sum\beta'_{4j}Perf + \sum\beta'_{5j}BondChar + \beta'_6 Def_{t+1} + \delta_j + \delta_{t+1} + \varepsilon_{i,t+1}$$

$OverInvest_{i,qt}$ takes the value of one (zero) if CAPXRES2 is in the top tercile (bottom two terciles) of the sample. All other variables in Column (1) ((2)) are described in Table 9, Panel A (Panel B). Industry, year, and quarter fixed effects are included and standard errors are clustered at the firm level.

| Contemporaneous (1) | | | Subsequent 12-month (2) | | |
|---|---|---|---|---|---|
| | Estimate | P Value | | Estimate | P Value |
| $Sentiment_{qt}$ | 0.4389 | 0.4935 | $Sentiment_{qt}$ | -0.0270 | 0.9361 |
| $OverInvest_{i,qt}$ | -0.4443 | 0.0122 | $OverInvest_{i,qt}$ | -0.1231 | 0.4897 |
| $Sentiment_{qt}*OverInvest_{i,qt}$ | 0.2548 | 0.7819 | $Sentiment_{qt}*OverInvest_{i,qt}$ | 1.1914 | 0.0284 |
| $DE_{i,qt}$ | -0.0015 | 0.9607 | $DE_{i,qt}$ | 0.0002 | 0.9139 |
| $LogMVE_{i,qt}$ | -0.1430 | 0.0207 | $LogMVE_{i,qt}$ | -0.2272 | 0.0005 |
| $Profit_{i,qt}$ | 0.5412 | 0.2420 | $Profit_{i,qt}$ | 0.2669 | 0.7540 |
| $Times_{i,qt}$ | -0.0463 | 0.0034 | $Times_{i,qt}$ | -0.0655 | 0.0021 |
| $LogAmt_{i,qt}$ | -0.0964 | 0.2932 | $LogAmt_{i,t+1}$ | -0.0013 | 0.9910 |
| $Maturity_{i,qt}$ | -0.0548 | 0.4413 | $Maturity_{i,t+1}$ | -0.0658 | 0.4119 |
| $SUB_{i,qt}$ | -0.2773 | 0.1918 | $SUB_{i,t+1}$ | -0.5187 | 0.0086 |
| $Def_{qt}$ | 0.1880 | 0.3931 | $Def_{t+1}$ | -0.0273 | 0.4908 |
| F-test | 0.5090 | | F-test | 0.0192 | |
| Chi-sq | 547.96 | | Chi-sq | 889.09 | |
| # of obs | 18,862 | | # of obs | 17,371 | |

**Figure 1: Baker and Wurgler (2006) equity investor sentiment index and NBER recession periods**

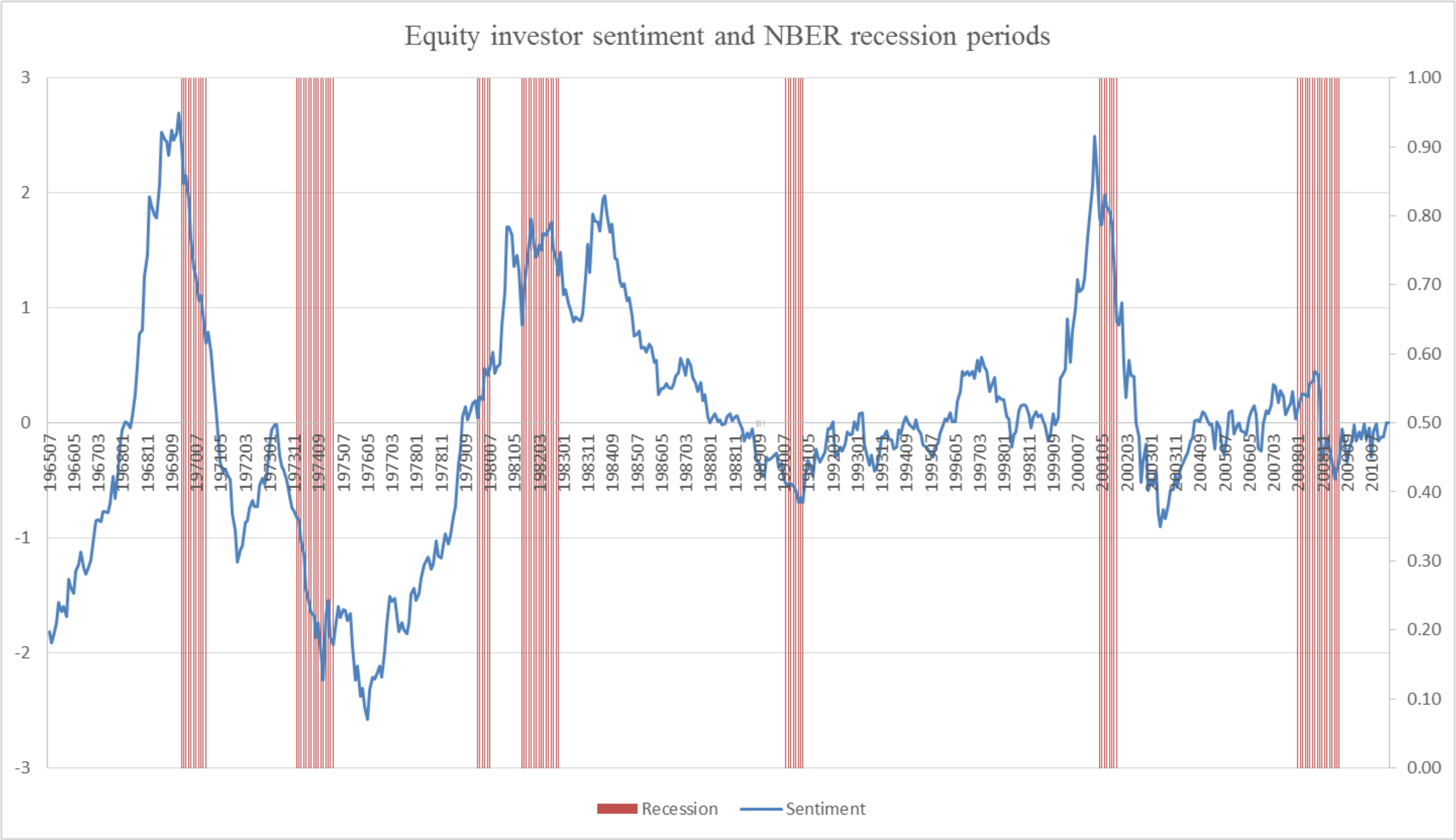
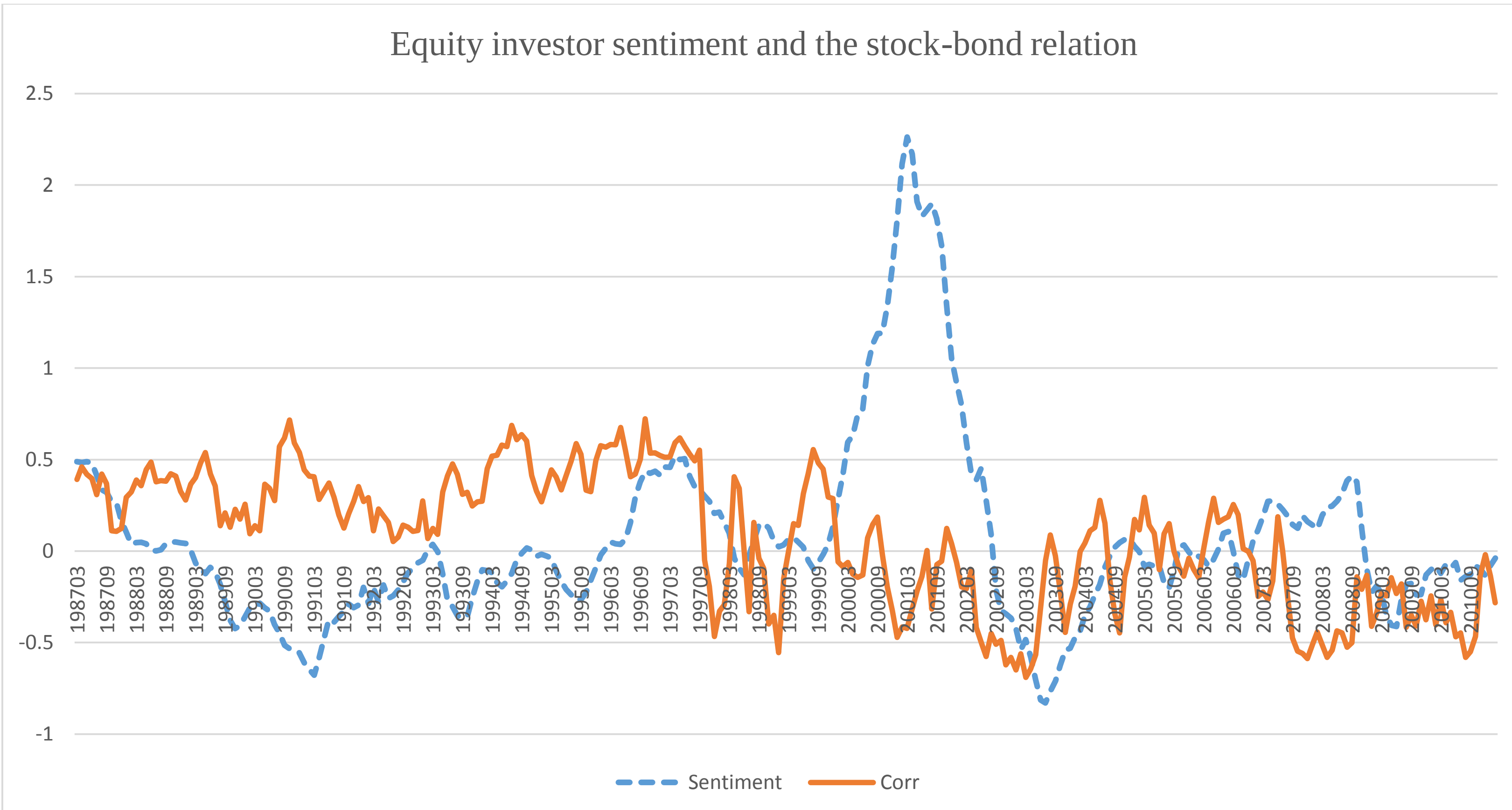


**Figure 2: Baker and Wurgler (2006) equity investor sentiment index and the correlation between daily value-weighted market returns and corporate bond return index by quarter**



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**Appendix A: Variables definitions**

| Variable | Definition |
|---|---|
| Invest | Capital expenditure (Compustat item CAPXQ) deflated by beginning-of-quarter net property, plant, and equipment (Compustat item PPENTQ) |
| Q | Tobin's Q, measured as the beginning-of-quarter market value of assets to book value of assets, where market value of assets equals the book value of assets plus the market value of common stock less the sum of the book value of common stock and balance sheet deferred taxes |
| CF | Cash flow, measured as the sum of earnings before extraordinary items and depreciation over beginning-of-quarter net property, plant, and equipment |
| CPI | Aggregate quarterly Consumer Price index |
| CAPXRES | The residual from equation (1) which is estimated using the whole sample, proxy for the deviation from the optimal investment level |
| CAPXRES2 | The residual from equation (1) which is estimated annually using the most recent 5 year observations, proxy for the deviation from the optimal investment level |
| P | Last day transaction price; I use the last trading day price if available. If not, I search the 5-day window before the end of the period and use the price of the last day with trades within this window. If not available again, I then search the first 5 calendar days at the next period and use the price of the first day with trades as the last day transaction price. |
| AI | Accrued interest, estimated as coupon rate multiplied by the number of days between the date on which $P_t$ is observed and the date on which the last coupon payment is due, divided by 365 |
| Cp | Coupon rate |
| QBRet (AnnBRet) | Quarterly (annual) buy-and-hold raw bond returns, calculated as $R_t = \frac{(P_t+AI_t)+C_t-(P_{t-1}+AI_{t-1})}{P_{t-1}+AI_{t-1}}$ |
| Adj_QBRet (Adj_AnnBRet) | Adjusted quarterly (annual) bond returns as QBRet (AnnBRet) minus contemporaneous compounded U.S. T-bill return |

| | |
|---|---|
| Sentiment | Quarterly investor sentiment index calculated as the average of the monthly Baker and Wurlger (2006) sentiment index |
| MKT | The excess returns of the stock market return over the risk-free rate |
| SMB | The excess returns of small stocks over big stocks |
| HML | The excess returns of value stocks over growth stocks |
| Term | The bond yield change difference between long-term government bonds and one-month treasury bills |
| Def | Default risk premium, measured as the bond yield change difference between long-term Moody's BAA bonds and long-term government bonds |
| Rating | A numeric translation of bond ratings, see Appendix B for details |
| Maturity | The number of years until a bond matures |
| Coupon | A bond coupon payment rate in % |
| Age | The number of years since a bond is issued |
| LogAmt | Logarithm of bond offering amount in millions of dollars |
| Liq | Dummy variable for bond liquidity. The bond liquidity is measured as the autocovariance of price changes at the trade-by-trade level, $cov(\Delta price_t, \Delta price_{t+1})$, over one year horizon with at least 10 paired price changes available. It takes value of one if bond liquidity falls into the top tercile and zero otherwise. |
| Downgrade | Dummy variable that takes value of one if the bond rating is downward revised during the period and zero otherwise. A bond rating revision is counted as downgrade if the new rating is at least one notch lower than the existing rating. |
| DE | Ratio of long-term debt to book value of equity |
| LogMVE | Logarithm of market value of common stock outstanding at the end of the period |
| Profit | Net income to net sales |
| Times | Income before extraordinary items divided by interest and related expense |
| SUB | Dummy variable that takes value of one for subordinated bonds and zero otherwise |

**Appendix B: Conversion of letter credit ratings into numeric ratings**

| Moody's | Standard & Poor's | Numeric Rating |
|---|---|---|
| Aaa | AAA | 1 |
| Aa1 | AA+ | |
| Aa2 | AA | 2 |
| Aa3 | AA- | |
| A1 | A+ | |
| A2 | A | 3 |
| A3 | A- | |
| Baa1 | BBB+ | |
| Baa2 | BBB | 4 |
| Baa3 | BBB- | |
| Ba1 | BB+ | |
| Ba2 | BB | 5 |
| Ba3 | BB- | |
| B1 | B+ | |
| B2 | B | 6 |
| B3 | B- | |
| Caa1 | CCC+ | |
| Caa2 | CCC | |
| Caa3 | CCC- | 7 |
| Ca | CC | |
| C | C | |
| | D | |