Executive Summary

Investor Sentiment and Asset Pricing in Public and Private Markets

by
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Sentiment is the irrational component of investor expectations. Since sentiment-induced mispricing arises from a combination of irrational investor demand and limits to arbitrage, the degree to which private markets are affected by investor sentiment is not *ex ante* clear. To the extent that private market investors are better informed and more sophisticated, asset prices could potentially be less prone to the influence of investor sentiment in these markets. At the same time, because of the illiquidity, information asymmetries, and more limited price revelation inherent in private markets, investor sentiment may instead play a more persistent role in pushing asset prices away from their fundamental values than in public stock markets. The inability to short-sell in private markets, for example, impedes the opportunity for arbitrageurs to counteract mispricing. Thus, sentiment could lead to prolonged periods of mispricing in private markets. In contrast, price revelation occurs more rapidly in public stock markets where the ability of informed investors to short-sell exists, albeit with limits. Therefore, the reversion of prices to fundamental values should occur more quickly in public markets. Despite the potential importance of investor sentiment in the price formation process, no previous research has directly investigated the relative importance of sentiment in public and private asset markets.

We examine the relation between investor sentiment and both short- and long-horizon returns in public and private commercial real estate markets. The commercial real estate market provides an appealing testing ground for examining sentiment's pricing role for several reasons. First, private real property markets exhibit the segmentation, information asymmetries, and illiquidity that characterize other private equity markets. Second, unlike the private equity market, several representative total return indices for private commercial real estate are available, permitting us to calculate time-weighted returns that can be compared directly to corresponding returns in public real estate markets. Finally, the underlying properties held by the publicly traded real estate firms we analyze are similar to the property holdings of the institutional real estate investors whose private market returns we also track. Thus, disparities in sentiment's effects on returns in public and private real estate markets can be ascribed to differences in the characteristics of these two markets, not to fundamental differences in the types of assets owned.

Using vector autoregressive (VAR) models in which commercial real estate returns and sentiment are specified as endogenous variables in a two equation system that also includes exogenous control variables, we first seek to answer two questions: Does investor sentiment predict short-run returns? And, second, do returns predict short-run changes in sentiment?

We next examine whether a negative relation exists between investor sentiment and subsequent long-horizon returns in public and private commercial real estate markets. If excessive investor optimism (pessimism) leads to market overvaluation (undervaluation), then periods of high (low) sentiment should be followed by low (high) cumulative long-run returns since the market price should revert to its fundamental value in the long-run. Moreover, given the greater limits to arbitrage, short-sale constraints, information externalities, and delays in information transmission that characterize private real estate markets, we expect the impact of investor sentiment on market values in private real estate to be more persistent.

In our short-run VAR analysis, we find a positive relation between investor sentiment and subsequent quarter returns in both public and private real estate markets. That is, in both markets, sentiment-based investment drives prices away from fundamental value in the short-run, resulting in a short-term continuation of returns. For a given change in sentiment, the magnitude of this short-run effect is larger in the public than in the private real estate market. This result is consistent with private market investors being better informed and more sophisticated.

Using long-horizon regressions, we also provide evidence that the extent to which investors face limits to arbitrage and the degree to which price revelation is delayed play important roles in determining the time it takes for prices to revert to fundamental values. In public real estate markets, periods of sentiment-induced mispricing are quickly followed by price reversals. For example, we find that an increase in investor sentiment results in a 4 percent increase in public real estate market returns over the following year. However, this gain is subsequently reversed with significantly negative returns over the next three years. In contrast, private real estate markets are more susceptible to prolonged periods of sentiment-induced mispricing. More specifically, we find that an increase in investor sentiment results in a 5.5 percent increase in private real estate market returns over the subsequent year. However, in private real estate markets, mispricing continues to persist over long horizons due to limits to arbitrage and delays in price revelation that characterize this market.

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Abstract:

This paper examines the relation between investor sentiment and returns in public and private markets. We utilize commercial real estate as the testing ground to provide a unique side-by-side comparison of sentiment's short- and long-run impact on similar assets that are owned and traded in two distinct investment environments. Using vector autoregressive models to capture the short-run dynamics between returns and investor sentiment, we find a positive relation between investor sentiment and subsequent quarter returns in both public and private real estate markets. The magnitude of this short-run effect is larger in public markets than in private markets, which is consistent with private market investors being better informed and more sophisticated. We further find a negative relation between investor sentiment and subsequent long-horizon public market returns, consistent with prices reverting to their fundamental values over the long-run. In contrast, we find sustained periods of sentiment-induced mispricing in private real estate markets, consistent with greater limits to arbitrage, short-sale constraints, information externalities, and delays in information transmission that characterize these markets.

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I. Introduction

Efficient financial markets assume that security prices reflect available public information and that assets are fairly valued by rational investors. Temporary price deviations that occur as a result of sentiment-driven investors trading on "noisy" information are quickly offset by the actions of informed traders, helping to drive prices to their fundamental values. Although classic finance theory does not allow for the possibility that investor sentiment can have a discernible impact on security pricing, recent work in behavioral finance has addressed sentiment's influence on asset valuation. For example, the "noise trader" theory of De Long, Shleifer, Summers, and Waldmann (1990) suggests that excessive trading on noisy signals unrelated to market fundamentals can drive transaction prices away from intrinsic values. Moreover, the limits to arbitrage theory of Shleifer and Vishny (1997) posits that rational arbitrageurs face substantial risk and financing constraints that at times hinder their ability to take effective offsetting positions against irrational investors, thereby allowing prices to move further away from fundamental value over time. Emerging behavioral finance theory also suggests that this movement away from fundamentals encompasses the influences of investor sentiment on asset valuation (Baker and Wurgler, 2007). Baker and Wurgler (2007) define investor sentiment as a misguided belief about the growth in future cash flows or investment risks (or both) based on the current information set.

Building on the foundation of theoretical behavior models, a number of studies provide empirical evidence on the role of investor sentiment in asset pricing and its relation with future returns. Various measures of investor sentiment have been used to examine the effect of sentiment on public market returns over both short- and long-term horizons (Baker and Wurgler, 2007; Brown and Cliff, 2004, 2005; Neal and Wheatley, 1998), as well as the cross-sectional influence of sentiment on stock returns (Baker and Wurgler, 2006).

The empirical literature on sentiment and asset pricing in equity markets has focused on public stock markets. This focus is understandable given the difficulties associated with obtaining return information on private equity investments since private equity has historically been exempt from public disclosure requirements (Kaplan and Schoar, 2005). Nevertheless, private investment markets provide an appealing testing ground for examining sentiment's pricing role. Relative to more liquid public markets, private investment markets exhibit significant information asymmetries and illiquidity. Moreover, the market value of the private entity's assets is not generally revealed until ownership of the entity, often a limited partnership, is offered to the public in an initial public offering (IPO) or the company is sold for either cash or shares in another company through a merger or acquisition. The lack of continuous price revelation in private markets suggests that the potential impact of investor sentiment on market values may be revealed with significant lags.

Since sentiment-induced mispricing arises from a combination of irrational investor demand and limits to arbitrage, the degree to which private markets are affected by investor sentiment is not *ex ante* clear. To the extent that private market investors are better informed and more sophisticated, asset prices could potentially be less prone to the influence of investor sentiment in these markets. At the same time, because of the illiquidity, information asymmetries, and more limited price revelation inherent in private markets, investor sentiment may instead play a more persistent role in pushing asset prices away from their fundamental values in , for example, private equity markets than in public stock markets. The inability to short-sell in private markets, for example, impedes the opportunity for arbitrageurs to counteract mispricing. Thus, sentiment could lead to prolonged periods of mispricing in private markets. In contrast, price revelation occurs more rapidly in public stock markets where the ability of informed investors to short-sell exists, albeit with limits. Therefore, the reversion of prices to fundamental values should occur more quickly in public markets. Despite the potential importance of investor sentiment in the price formation process, no previous research has directly investigated the relative importance of sentiment in public and private asset markets.

In this paper, we examine the relation between investor sentiment and both short- and long-horizon returns in public and private commercial real estate markets. Recently, the commercial real estate market has become an innovative testing ground for examining behavioral biases and sentiment effects.[1] For instance, Crane and Hartzell (2009) provide evidence on corporate disposition biases using Real Estate Investment Trust (REIT) data. More in line with the current study, Clayton, Ling, and Naranjo (2009) provide some evidence suggesting that investor sentiment affects acquisition prices in the private commercial real estate market. The literature to date, however, does not address the differential effect of sentiment on asset pricing in public versus private markets. This paper contributes to the investment sentiment literature by providing a unique side-by-side comparison of sentiment's short- and long-run impact on similar assets that are owned and traded in two distinct investment environments.

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[1] Several papers have also used the sports betting market as an empirical testing ground for investigating the impact of behavioral biases on asset pricing (e.g., Avery and Chevalier, 1999; Edmans, Garcia, and Norli, 2007).

The commercial real estate market provides an appealing testing ground for examining sentiment's pricing role for several reasons. First, private real property markets exhibit the segmentation, information asymmetries, and illiquidity that characterize other private equity markets. Second, unlike the private equity market, several representative total return indices for private commercial real estate are available, permitting us to calculate time-weighted returns that can be compared directly to corresponding returns in public real estate markets. In contrast, the benchmark returns on venture capital and other private equity investments are usually dollar-weighted holding period internal-rates-of-return based on the "vintage" of the investment capital.[2] Such benchmark returns make it difficult to investigate the short-run influence of sentiment on asset pricing or how the effects of sentiment vary across time periods. Finally, the underlying properties held by the publicly traded real estate firms we analyze are similar to the property holdings of the institutional real estate investors whose private market returns we also track. Thus, disparities in sentiment's effects on returns in public and private real estate markets can be ascribed to differences in the characteristics of these two markets, not to fundamental differences in the types of assets owned.

Using vector autoregressive (VAR) models in which commercial real estate returns and sentiment are specified as endogenous variables in a two equation system that also includes exogenous control variables, we first seek to answer two questions: Does investor sentiment predict short-run returns? And, second, do returns predict short-run changes in sentiment? Daniel, Hirshleifer, and Subrahmanyam (1998) suggest that overconfident investors form optimistic expectations about the future value of an asset and tend to disregard information that contradicts these beliefs due to self-attribution bias. Welch (1992) also establishes a cascade model in which investors base their decisions on observations of previous market demand and ultimately ignore their own private information. Froot, Scharfstein, and Stein (1992) further posit that short-horizon investors may attempt to process the same information, even if it is noise, rather than focusing on long-horizon fundamentals.[3] In each case, investors act on noisy information, creating momentum that ultimately pushes prices away from fundamental value over short-horizons. Therefore, we expect to observe persistence in our measures of sentiment as the expectations of sentiment-based investors are influenced by

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[2] See, for example, the industry reports published regularly by the National Venture Capital Association.

[3] Lamont and Thaler (2003a) provide an alternative explanation in which the marginal market participant is a sentiment-induced investor. They argue that if optimists are willing to bid up the prices of some stocks and not enough investors are willing to meet that demand by selling short, the optimists will set the price.

prior periods of high or low sentiment. We also expect a positive relation between sentiment and short-run returns as irrational investor demand, accompanied by the limits to arbitrage that are inherent in both public and private real estate markets, temporarily drive prices away from fundamental value.[4]

We next examine whether a negative relation exists between investor sentiment and subsequent long-horizon returns in public and private commercial real estate markets. If excessive investor optimism (pessimism) leads to market overvaluation (undervaluation), then periods of high (low) sentiment should be followed by low (high) cumulative long-run returns since the market price should revert to its fundamental value in the long-run. Moreover, given the greater limits to arbitrage, short-sale constraints, information externalities, and delays in information transmission that characterize private real estate markets, we expect the impact of investor sentiment on market values in private real estate to be more persistent.

In our short-run analysis, we find a positive relation between investor sentiment and subsequent quarter returns in both public and private real estate markets. That is, in both markets, sentiment-based investment drives prices away from fundamental value in the short-run, resulting in a short-term continuation of returns. For a given change in sentiment, the magnitude of this short-run effect is larger in the public than in the private real estate market. This result is consistent with private market investors being better informed and more sophisticated.

Using long-horizon regressions, we also provide evidence that the extent to which investors face limits to arbitrage and the degree to which price revelation is delayed play important roles in determining the time it takes for prices to revert to fundamental values. In public real estate markets, periods of sentiment-induced mispricing are quickly followed by price reversals. For example, we find that an increase in investor sentiment results in a 4 percent increase in public real estate market returns over the following year. However, this gain is subsequently reversed with significantly negative returns over the next three years. In contrast, private real estate markets are more susceptible to prolonged periods of sentiment-induced mispricing. We find that an increase in investor sentiment results in a 5.5 percent increase in private real estate market returns over the subsequent year. However, in private

[4] Other more recent papers that examine the relation between investor sentiment and short-run returns include Antoniou, Doukas, and Subrahmanyam (2009) who show that short-run momentum profits increase when investor sentiment is optimistic, and Hengelbrock, Theissen, and Westheide (2009) who use an event study methodology to document a positive market reaction to the publication of optimistic sentiment indicators.

real estate markets, mispricing continues to persist over long horizons due to limits to arbitrage and delays in price revelation that characterize this market.

The remainder of the article proceeds as follows. The next section describes the two methods we use to construct proxies for investor sentiment in commercial real estate markets and public stock markets. Section III describes our VAR and long-horizon regression methodologies. We discuss our data and descriptive statistics in Section IV, along with the properties of our sentiment indices. Sections V-VI report our main empirical results for the short-run and long-horizon regressions. Our conclusions are presented in the final section. A detailed description of the bootstrap simulation procedure utilized to correct for estimation biases in the long-horizon regressions is provided in the Appendix.

II. Measuring Investor Sentiment

Prior research uses several approaches to quantify investor sentiment. One stream of research focuses on direct sentiment measures, such as survey-based measures developed to capture the outlook of market participants. Qiu and Welch (2005) provide a comparison of several direct survey-based measures of investor sentiment. An alternative stream of research uses multiple indirect sentiment proxies for investor sentiment. Although no single measure is a pure indicator of sentiment, each imperfect proxy is likely to contain a sentiment component. Baker and Wurgler (2006, 2007), for instance, utilize principal component analysis to develop an indirect measure of investor sentiment from multiple indirect proxies.[5] We employ both direct and indirect measures of investor sentiment in our analysis.

Direct Measure of Real Estate Sentiment

The equity market sentiment literature has used various survey-based measures to capture investor sentiment. For example, Brown and Cliff (2004, 2005) use the "bull-bear" spread, defined as the percentage of stock investment newsletters deemed to be bullish minus the percentage categorized as bearish, as classified by Investors' Intelligence.[6] Brown and Cliff (2004, 2005) relate the bull-bear spread to deviations from fundamental values and examine both short- and long-run effects of sentiment on stock returns. The authors find that the bull-bear spread is highly correlated with contemporaneous stock returns but has little short-run predictive power (Brown and Cliff, 2004). However, taking a longer term perspective of two-to-

[5] Baker, Wurgler, and Yuan (2009) also utilize this methodology to create local and global sentiment indices across six major international stock markets.

[6] Other direct measures of investor sentiment include, for example, the Michigan Consumer Confidence Index and the UBS/GALLUP Index of Investor Optimism.

three years, periods of high sentiment are followed by low returns as stock prices mean revert (Brown and Cliff, 2005).

Along similar lines, we employ survey data published by the Real Estate Research Corporation (RERC) in its quarterly *Real Estate Report* as a direct measure of investor sentiment in commercial real estate markets (see www.rerc.com). RERC surveys institutional real estate investors, appraisers, lenders, and managers throughout the United States to gather information on current investment criteria, such as required rates of return on equity, expected rental growth rates, and current "investment conditions," the latter of which is of particular interest in this study. RERC survey respondents are asked to rank current investment conditions for multiple property types, both nationally and by metropolitan area, on a scale of 1 to 10, with 1 indicating "poor" investment conditions and 10 indicating "excellent" conditions for investing. This sentiment measure is similar in spirit to the bull-bear spread in that it captures movements in the proportion of participants in commercial real estate markets who are bullish relative to those less optimistic about current investment opportunities.[7]

Table 1 contains summary statistics on the property type components of our national level RERC investor sentiment index. Note that the consensus opinion of survey respondents over the 1992:Q2-2008:Q4 sample period was that apartment and industrial warehouse properties, with an average investment conditions rank of 6.3, were considered to be the most desirable, followed by neighborhood retail properties. In contrast, retail power centers, with a mean investment conditions ranking of 5.0, were deemed the least desirable investments of the eight property types over the study period. Inspection of Table 1 also reveals that RERC's investment condition rankings display significant time variation over the sample period. For example, the investment desirability of suburban office properties ranged from a low of 2.8 to a high of 7.5. It is also important to note that RERC sentiment levels display substantial positive serial correlation across quarters, with changes in aggregate sentiment displaying significant negative serial correlation.

We use principal component analysis to construct a composite index of U.S. commercial real estate sentiment from property-level RERC investment conditions. More specifically, our direct measure of sentiment (*DRES*) is constructed from the first principal component

[7] RERC also collects other investment condition variables in their survey, such as the percentage of respondents who give a buy recommendation and the percentage who give a sell recommendation. However, these variables are only available for a shorter sub-sample beginning in the latter half of the 1990's. Moreover, the correlation of RERC's buy-sell recommendation and investment conditions variables is high (0.77 for the direct measure that we use).

extracted from quarterly RERC investment condition survey responses pertaining to the eight RERC property types.[8] *DRES* is standardized to have a mean of zero and unit variance. The quarterly serial correlation of *DRES* is 0.81; the serial correlation of quarterly changes in *DRES* is -0.35.

An Indirect Index of Real Estate Sentiment

Following the framework of Baker and Wurgler (2006, 2007), we use principal component analysis to construct an indirect quarterly sentiment index based on the common variation in seven underlying proxies of investor sentiment in commercial real estate markets: (i) the average REIT stock price premium to net asset value (NAV), (ii) the percentage of properties sold each quarter from the National Council of Real Estate Investment Fiduciaries (NCREIF) Property Index (NPI), (iii) the number of REIT IPOs, (iv) the average first-day returns on REIT IPOs, (v) the share of net REIT equity issues relative to total net REIT equity and debt issues, (vi) net commercial mortgage flows as a percentage of GDP, and (vii) net capital flows to dedicated REIT mutual funds.

Lee, Shleifer, and Thaler (1991) suggest that closed-end fund discounts represent movements in stock prices away from fundamental values. Similarly, REIT price premiums relative to NAVs measure the difference between the market price of a REIT's shares and the estimated net asset values of the underlying properties that comprise the REIT. Stock price deviations from NAV may, in part, reflect the price impact of sentiment-based trading during periods of investor optimism or pessimism. Therefore, we obtain the average quarterly U.S. REIT price premium to NAV from Green Street Advisors, a prominent buy-side REIT advisory firm (see www.greenstreetadvisors.com).

Baker and Stein (2004) argue that aggregate market liquidity can serve as a sentiment proxy. In a market with short sale constraints, irrational investors will participate only when they are optimistic, and therefore liquidity will likely increase during periods of investor overconfidence. We use the percentage of properties sold from the NPI each quarter as a proxy for liquidity in the private commercial real estate market.

The market timing of IPOs and secondary equity offerings have been used to measure investor sentiment in the general stock market (e.g., Ritter, 1991; Baker and Wurgler, 2000). Similarly, the number of REIT IPOs, the average first-day returns on REIT IPOs, and the share of net REIT equity issues relative to the total capital raised by REITs may identify

[8] The correlation between an equally weighted average investment condition across the eight RERC property types and *DRES* is 0.93 over our sample period.

periods of sentiment-induced mispricing in commercial real estate markets. The number of REIT IPOs and average first-day returns are constructed using data provided by the National Association of Real Estate Investment Trusts (NAREIT). The share of REIT equity issues relative to total REIT equity and debt offerings is constructed from data obtained from the Federal Reserve Flow of Funds Accounts (see Federal Reserve of the U.S. Flow of Funds Accounts: www.federalreserve.gov).

Clayton, Ling, and Naranjo (2009) argue that net commercial mortgage flows are widely viewed by industry participants as a barometer of investment sentiment, in part because of the association between past real estate cycles and excessive mortgage flows during periods in which default risk may have been underpriced by lenders. Therefore, periods of increased commercial mortgage flows may reflect the influence of investor sentiment. Quarterly commercial mortgage flows are obtained from the Federal Reserve Flow of Funds Accounts and are scaled to be a percentage of GDP.

Finally, Brown et al. (2002) and Frazzini and Lamont (2008) suggest that flows into and out of mutual funds proxy for investor sentiment. Therefore, shifts in capital flows to dedicated REIT mutual funds may indicate periods of investor over- or under-confidence. The quarterly flow of investment capital into, and out of, dedicated REIT mutual funds is obtained from AMG Data Services.

Table 2 contains summary statistics for each of our indirect commercial real estate sentiment proxies. Similar to our direct real estate proxies, we observe substantial variation both within and across our indirect proxies. Along with this variation, however, there is also substantial persistence in the levels and changes in the indirect proxies. Utilizing quarterly data from 1992:Q2 to 2008:Q4, we generate a composite indirect sentiment index (*INDRES*) based on the first principal component of the contemporaneous levels of each of the seven sentiment proxies.[9] *INDRES* is standardized to have a mean of zero and unit variance. The quarterly serial correlation of *INDRES* is 0.73; the serial correlation of quarterly changes in *INDRES* is -0.29.

Panel A of Figure 1 plots *INDRES* against our direct measure of sentiment, *DRES,* over the sample period. Overall, the correlation between the two sentiment indices is 0.48 as shown in Table 4. During the early-to-mid 1990s, as the commercial real estate market was emerging from a downturn in the late 1980s, *INDRES* (the dashed line) was somewhat more volatile

[9] We detrend the commercial mortgage flow series using the prior 2-year rolling average before inclusion in the principal component analysis.

than *DRES* (the solid line). After peaking at a higher level than *DRES* in early 1998, *INDRES* dropped more precipitously during the subsequent slowdown that occurred in commercial real estate markets in the late 1990s and early 2000s. The private commercial real estate market began what became a prolonged bull market around 2003. It is interesting to note that our indirect measure of commercial real estate sentiment stabilized and then turned upward sooner than did our survey-based measure of sentiment. The significant and sustained run up in commercial property prices finally peaked in late 2007 in most U.S. markets. However, both measures of sentiment leveled out and then began to decline much earlier than transaction prices. That is, investor sentiment appears to have led the significant decline in property prices that occurred after the most recent peak.

An Indirect Index of Stock Market Sentiment

We again follow Baker and Wurgler's (2006, 2007) framework to construct an indirect measure of investor sentiment for the general stock market. In particular, we utilize principal component analysis to generate a quarterly sentiment index based on the common variation in six underlying proxies of investor sentiment in the stock market: (i) the closed-end fund discount, (ii) share turnover on the NYSE, (iii) the number of IPOs, (iv) the average first-day returns on IPOs, (v) the share of equity issues in total equity and debt issues, and (vi) the dividend premium.

We update Baker and Wurgler's (2007) dataset through 2008 using the following variable definitions consistent with their article. The closed-end fund discount is defined as the difference between the net asset values (NAVs) of closed-end stock fund shares and their market prices as reported in the *Wall Street Journal*.[10] Share turnover on the NYSE is defined as the total volume of NYSE Group Shares divided by shares outstanding as reported in the *NYSE Fact Book.*[11] We obtain the number of IPOs and the average first-day returns on IPOs from Professor Jay Ritter's website. The share of equity issues in total equity and debt issues is defined as gross equity issuance divided by gross equity plus gross long-term debt issuance as reported in the *Statistical Supplement to the Federal Reserve Bulletin*. The dividend premium is defined as the log difference of the average market-to-book ratios of dividend payers and non-payers (Baker and Wurgler, 2004). Table 3 contains summary statistics for

[10] We compute the value-weighted average discount on closed-end funds classified as General Equity Funds in the *Wall Street Journal*.

[11] We express our turnover measure as the natural log of the turnover ratio and detrend the time series by a 5-year moving average.

each of our indirect sentiment proxies for the general stock market. Our summary statistics are of similar magnitude to those reported in Baker and Wurgler (2007).

Utilizing data from 1965 to 2008, we generate a composite indirect stock market sentiment index (*INDSMS*) based on the first principal component of the contemporaneous levels or lags of each of the six sentiment proxies. The index is standardized to have a mean of zero and unit variance for the period 1965-2008. Table 4 contains descriptive statistics and correlations for our two real estate sentiment indices as well as our stock market sentiment index over the 1992:Q2-2008:Q4 sample period. The mean and quarterly serial correlation of *INDSMS* is 0.43 and 0.76 respectively, while the serial correlation of quarterly changes in *INDSMS* is -0.14.

Panel B of Figure 1 plots our indirect measure of general stock market sentiment, *INDSMS,* against our indirect measure of real estate sentiment, *INDRES,* over the 1992:Q2-2008:Q4 sample period. Overall, the correlation between the two indices is -0.194 (Panel B of Table 4), suggesting that investors view commercial real estate and the general stock market as distinct asset classes. Note the divergence between the two indices beginning in 1999 coincides with the internet bubble, where investor stock market sentiment was very optimistic and real estate market sentiment was more pessimistic. During this period, many investors were shifting their holdings out of value oriented investments, including commercial real estate, into high growth technology stocks. As the tech bubble burst and the Federal Reserve acted to avoid a recession in the wake of 9/11, real estate and other value investments became popular alternatives for investors seeking safer investment options. However, as the recent subprime mortgage crisis unfolded, sentiment in the commercial real estate market turned sharply downward in 2007. In contrast, stock market sentiment was slower to decline and fell less precipitously during this latter period.

III. Empirical Methodology

In this section, we discuss the short- and long-run methodologies we employ to examine the relation between investor sentiment and subsequent returns.

Short-Run Regressions

To capture the short-term dynamics between our measures of sentiment and between returns and sentiment, we employ vector autoregressive (VAR) models. In its simplest form, a VAR model is composed of a system of regressions where two or more dependent variables are expressed as linear functions of their own and each other's lagged values, and possibly some other exogenous control variables. In more technical terms, a vector autoregression model is the unconstrained reduced form of a dynamic simultaneous equations model. An unrestricted p^{th}-order Gaussian VAR model can be represented as:

$$Y_t = \mu + \Phi_1 Y_{t-1} + \Phi_2 Y_{t-2} + \ldots + \Phi_k Y_{t-p} + e_t, \qquad (1)$$

where Y_t is a vector of variables, μ is a p x 1 vector of intercepts, Φ_1, Φ_2, …, Φ_k are p x p matrices of parameters with all eigenvalues of Φ having moduli less than one so that the VAR is stationary, and e_t is a vector of uncorrelated structural shocks [~ $NID(0,\Omega)$]. In a bivariate framework consisting of only sentiment and returns as endogenous variables, the diagonal coefficients of Φ represent conditional momentum in sentiment and returns, while the off-diagonal coefficients of Φ represent conditional positive feedback trading (sentiment following returns) and conditional anticipation effects (returns following sentiment). The off-diagonal elements of Ω capture the price-impact effect of sentiment on returns.

We obtain maximum likelihood estimates of Φ and Ω using iterated least squares. The number of quarterly lags is chosen based on examination of the AIC, SBIC, and the likelihood ratio selection criteria for various choices of *p*. It is important to note that the inclusion of lagged returns in the private market return equation controls for the well-documented autoregressive nature of NCREIF returns.

We first use an unconstrained VAR system to examine the dynamic relation between our direct and indirect indices of commercial real estate sentiment over our 1992:Q2-2008:Q4 sample period. We then examine the relation between our indirect measures of real estate and stock market sentiment. Finally, we examine the relations between sentiment and real estate returns in public versus private markets. For our measures of real estate returns, we use public U.S. equity REIT and private NCREIF returns. To measure investor sentiment, we use both *DRES* and *INDRES*. To control for stock market sentiment, we utilize our indirect general stock market index (*INDSMS*). Similar to Brown and Cliff (2005), we specify our sentiment measures in both levels and changes. To control for other potential sources of variation in returns and sentiment, we also include lagged values of several control variables that have been shown to matter in the asset pricing literature (see data section below).

Long-Horizon Regressions

Following Brown and Cliff's (2005) framework, we regress future k-period quarterly returns on a vector of control variables, z_t, and a measure of investor sentiment, S_t,

$$(r_{t+1} + \ldots + r_{t+k})/k = \alpha(k) + \theta(k)\, z_t + \beta(k)\, S_t + \varepsilon_t\,, \qquad (2)$$

where r_{t+1} ... r_{t+k} are quarterly log returns, k is the number of quarters over which the investment horizon spans, and α is the intercept term. We include the same set of control variables in the long-horizon framework as we employ in our VAR framework. If periods of optimistic (pessimistic) sentiment lead initially to overvaluation (undervaluation), then periods of high (low) sentiment should be followed by low (high) cumulative long-run returns as prices revert to their fundamental values over time. Thus, a negative coefficient on S_t in our long horizon regressions is consistent with the price reversion that occurs following the initial impact of sentiment on asset prices. However, if sentiment's effect is persistent, this would result in a positive coefficient on S_t, indicating a continuation of short-term investment returns as asset prices either continue to move away from fundamental value or are slower to revert over longer horizons.

Several econometric issues arise from the use of long-horizon regressions. The first issue stems from the presence of overlapping observations in the dependent variable of the regression specification. Because the dependent variable consists of average long-horizon returns calculated over consecutive quarters, there will be a moving average process in the error term. Thus, the use of OLS will lead to standard errors that are biased downwards. Conventional corrections such as the methodology proposed by Hansen and Hodrick (1980) or a related procedure outlined by Newey and West (1987) are not appropriate in the present context because both procedures have been shown to exhibit poor finite sample properties, especially when serial correlation is high, as is the case with overlapping return observations. Moreover, a number of studies have documented a sizeable bias in the error term as the sample size decreases and autocorrelation in the error term increases.[12]

A second issue that arises within a small sample setting is the potential for finite sample bias in the coefficient estimate of a persistent independent variable. Stambaugh (1999) shows that a persistent explanatory variable will be predetermined but not strictly exogenous; thus, coefficient estimates may suffer from significant finite sample bias. Although an OLS estimate is consistent and asymptotically normally distributed under the predetermined assumption, it is not necessarily unbiased in finite samples. In empirical applications, this bias reduces to zero as the sample size approaches infinity. However, the coefficient estimate on a persistent investor sentiment measure may exhibit finite sample bias using quarterly observations that decrease in number as the length of the return horizon increases.

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[12] See Nelson and Kim (1993), Goetzmann and Jorion (1993), and Hansen and Tuypens (2004) for further discussion of the effects of small sample bias in long-horizon return regressions.

To address the econometric issues of potentially biased coefficient estimates and standard errors that arise from the use of long-horizon regressions, we use a bootstrap simulation procedure similar to Brown and Cliff (2005). See the Appendix for details.

IV. Data and Descriptive Statistics

Return Data Sources and Definitions

We use the CRSP/Ziman database for public commercial real estate returns, which is produced jointly by the Center for Research in Security Prices at the University of Chicago and UCLA's Ziman Center for Real Estate. The CRSP/Ziman database includes all REITs that have traded on the NYSE, Amex, and Nasdaq exchanges since 1980. Daily and monthly return indices are computed with both equal- and value-weighting for all U.S. REITs and for subsets defined by type of REIT (equity, mortgage, and hybrid) and by type of property. We use the value-weighted aggregate U.S. equity REIT index to construct a quarterly return series; thus, REITs that invest significantly in mortgages are excluded from our analysis.

Our return data for private real estate markets is provided by NCREIF, a not-for-profit institutional real estate industry association. Established in 1982, NCREIF serves the real estate investment industry by collecting, processing, validating, and disseminating information on the risk/return characteristics of commercial real estate assets owned by institutional, primarily pension fund, investors (see www.ncreif.com). NCREIF's flagship index, the NCREIF Property Index (NPI), tracks the quarterly total return performance of a large pool of individual commercial real estate properties acquired in the private market for investment purposes only.[13]

To be included in the NPI, the data contributing member's property must be at least 60 percent leased and be wholly owned or in a joint venture structure. Although levered properties are included in the NPI, investment performance is reported by NCREIF on an unlevered basis. The property composition of the NPI changes quarterly as data contributing NCREIF members buy and sell properties. However, all historical property-level data remain in the database and index. Each property's quarterly return is weighted by its estimated market value relative to the total market value of the properties that comprise the NPI.

The NCREIF NPI is the only source of consistently collected information on the total returns earned by investors in private U.S. commercial real estate markets and is therefore widely used as a benchmark return index. Nevertheless, the NPI has several shortcomings

[13] At the end of the second quarter of 2009, the NPI database contained 6,123 properties with an estimated market value of $254 billion.

(Geltner and Ling, 2007).[14] For example, unless the underlying property is sold during the quarter, the NPI uses changes in appraised values to calculate the appreciation component of the property's total return. The use of appraisal values may lead to "smoothing" in the index. However, we argue below that smoothing in the construction of the NPI does not affect the validity of our empirical results. Moreover, as a robustness check, we also use a variant of the NPI that is based solely on transaction prices of index properties that have been sold during the quarter and obtain similar results.

Control Variables

To control for other potential sources of variation in returns and sentiment in both our VAR and long-horizon regression specifications, we include the following macroeconomic variables that have been shown to affect asset returns: the yield on three-month U.S. Treasury securities (*TBILL*), the slope of the Treasury term structure of interest rates (*TERMSP*), the spread between yields on BAA rated and AAA rated corporate bonds (*DEFAULTSP*), and the rate of inflation (*INFLA*) (e.g., Chen, Roll, and Ross, 1986; Ferson and Harvey, 1991; Fama and French, 1993; Fama and Schwert, 1977; Sharpe, 2002). We also include the three Fama-French risk factors: *MKT*, *SMB*, *HML*, augmented by the return momentum factor, *UMD* (e.g., Fama and French 1996; Liew and Vassalou, 2000; Lettau and Ludvigson, 2001; Jegadeesh and Titman,1993; Carhart, 1997).[15]

Descriptive Statistics

Table 5 reports descriptive statistics for our two real estate return series and our control variables. As documented in the real estate literature, average total returns on publicly traded REITs typically exceed returns on similar institutional quality assets owned and managed in private markets, albeit with greater volatility. However, according to NAREIT, equity REITs produced total returns of -17.8 percent in 2007 and -37.8 percent in 2008, both of which are significantly below the comparable total returns on the NPI Index.[16] As a result, raw quarterly REIT returns averaged just 0.90 percent over our 1992:Q2-2008:Q4 sample period. The corresponding average NPI return is 2.3 percent per quarter. At 2.0 percent, the standard deviation of quarterly NPI returns is somewhat lower than the 2.8

[14] Also see Pagliari, Scherer, and Monopoli (2005) for a detailed description of the NCREIF NPI index.

[15] In a robustness test, we also include Pastor and Stambaugh's (2003) liquidity risk factor as a control variable. The magnitude of our coefficient estimates and statistical significance of our sentiment measures remain unchanged.

[16] The aggregate NAREIT equity total return index is highly correlated (ρ=0.99) with the CRSP/Ziman equity index.

percent standard deviation of REIT returns. The quarterly serial correlation of *REITRET* over our sample period is -0.043. In contrast, the quarterly serial correlation of *NPIRET* is 0.72, which is indicative of the return "smoothing" of the NPI index.

The annual yield on three-month Treasury bills averaged 3.80 percent over the sample period, ranging from a low of 0.30 percent to a high of 6.2 percent. The slope of the Treasury term structure averaged 1.6 percent on an annual basis, although *TERMSP* varied significantly over the sample period. The mean default risk premium is 0.90 percent per year, but *DEFAULTSP* ranged from a low of just 0.60 percent to a high of 3.0 percent. Average quarterly inflation is 0.60 percent, although inflation also displayed considerable time variation over our sample period.

The stock market risk premium (*MKT*) averaged just 0.40 percent per quarter and displayed significant volatility, ranging from a low of -22.3 percent to a high of 19.6 percent. *SMB*, *HML*, and *UMD* averaged 0.70 percent, 0.40 percent, and 2.7 percent per quarter, respectively, and also displayed substantial volatility over the sample period.

What about the contemporaneous correlations between sentiment and returns? In Panels A and C of Figure 2, we plot REIT total returns against *DRES* and *INDRES*, respectively, over our sample period. Sentiment is measured on the left vertical axis, while quarterly REIT returns are measured on the right. Recall that our sentiment indices are constructed to have a mean of zero and unit variance. In Panels B and D of Figure 2, we plot NPI returns against our direct and indirect measures of real estate sentiment, respectively.

Inspection of Panel A of Figure 2 does not reveal a consistent contemporaneous univariate relation between *DRES* and *REITRET*. However, there are several periods, including 2006-2008, during which our direct measure of real estate sentiment and REIT returns do appear to move together closely. This co-movement is reflected in a contemporaneous correlation of 0.34 over the full sample period. The correlation between current quarter REIT returns and lagged *DRES* is 0.13. The contemporaneous correlation between *REITRET* and *INDRES* (Panel C of Figure 2) is 0.46. The correlation between current quarter REIT returns and lagged *INDRES* is 0.12.

Panel B of Figure 2 reveals that, relative to Panel A, private real estate returns appear to better track movements in our direct measure of sentiment than do REIT returns. This is confirmed by a contemporaneous correlation between *DRES* and *NPIRET* of 0.57. Moreover, the correlation between current quarter NPI returns and lagged *DRES* is 0.52. We also observe this positive univariate relation between private market returns and lagged direct sentiment in our VAR and long-horizon regression models. NPI returns display somewhat less correlation (ρ=0.41) with contemporaneous and lagged values of indirect real estate sentiment (Panel D).

V. Short-Run Regression Results

Dynamic Relations amongst Sentiment Measures

Table 6 provides estimates of our unconstrained VAR models with two measures of investor sentiment as endogenous variables and the following exogenous control variables: *TBILL*, *TERMSP*, *DEFAULTSP*, *INFL*, *MKT*, *SMB*, *HML*, and *UMD*. The first set of VARs (reported in columns one through four) examines the relation between our direct (*DRES*) and indirect (*INDRES*) measures of commercial real estate sentiment, expressed in levels and changes, respectively, over the 1992:Q2-2008:Q4 sample period. Previously, we documented a strong positive contemporaneous correlation between *DRES* and *INDRES* (0.48). In the *DRES* and Δ*DRES* equations, we find that lagged *INDRES* does not explain variation in our direct sentiment measure regardless of whether sentiment is specified in levels or changes. However, the estimated coefficients on $DRES_{t-1}$ and $DRES_{t-2}$ are positive and statistically significant when sentiment is specified in levels, consistent with the high serial correlation of our direct sentiment index. In the *INDRES* and Δ*INDRES* equations, we find similar results; that is, lagged *DRES* does not explain current levels or changes in *INDRES*. Although not reported in Table 6, our exogenous variables do not explain the variation in either of our sentiment measures. Therefore, both our direct and indirect measures appear to effectively capture investor sentiment outside of market fundamentals.[17]

The second set of VARs (columns five through eight in Table 6) examines the dynamic relation between our indirect measures of real estate and stock market sentiment. Previously, we documented a negative correlation of -0.194 between the two sentiment indices, suggesting investors view commercial real estate and the general stock market as distinct markets. In the *INDRES* and Δ*INDRES* equations, we find that lagged stock market sentiment, $INDSMS_{t-1}$, does not explain variation in real estate sentiment, whether sentiment is specified in levels or changes. Similarly, in the *INDSMS* equation we find that our measure of real estate sentiment does not explain the variation in stock market sentiment. When sentiment is specified in changes, another interesting dichotomy emerges. Although changes in real estate sentiment

[17] More specifically, we perform F-tests for each specification to determine whether the set of exogenous control variables in our sentiment VARs is jointly insignificant. In all specifications, we fail to reject the null hypothesis.

are predictive with a one quarter lag, changes in stock market sentiment do not appear to exhibit the same degree of predictability.

Dynamic Relations between Returns and Sentiment

Tables 7 and 8 contain results from the estimation of our unrestricted VAR models with both real estate returns and sentiment as endogenous variables. The results in Table 7 are estimated using our direct measure of investor sentiment (*DRES*), while the results presented in Table 8 are estimated using our indirect measure of investor sentiment (*INDRES*). In Panel A of each table we report results from the joint estimation of public REIT returns (*REITRET*) and investor sentiment; panel B contains the results from the joint estimation of private NPI returns *(NPIRET)* and investor sentiment. We first report results from the estimation of bivariate VAR models which include only current and lagged values of our two endogenous variables: returns and sentiment. Next, we examine whether the relations between returns and sentiment uncovered in our bivariate models are robust to the addition of our exogenous control variables: *TBILL*, *TERMSP*, *DEFAULTSP*, *INFL*, *MKT*, *SMB*, *HML*, and *UMD*.

Turning first to the bivariate *REITRET* equations in Panel A of Table 7, we find that equity REIT returns are positively influenced by REIT returns in quarter t-2, but not by returns in quarter t-1. When sentiment is specified in levels (column one), the estimated coefficient on $DRES_{t-1}$ (0.013) is positive and statistically significant in the bivariate specification, suggesting that lagged sentiment, in part, predicts current quarter REIT returns. The estimated coefficient on $DRES_{t-2}$ is negative and weakly significant (p-value=0.092). The addition of our exogenous control variables (column three of Table 7) does not alter the positive association estimated between $REITRET_t$ and $REITRET_{t-2}$. However, the estimated coefficients on $DRES_{t-1}$ and $DRES_{t-2}$, are no longer significantly different from zero, although they are very similar in sign and magnitude to the bivariate model.

In addition to examining the level of sentiment, it is also important to examine the impact of changes in sentiment on short-run returns. The use of levels may capture the impact of sentiment conditional on the current state of investor beliefs (Baker and Wurgler, 2007). In other words, if the overall state of sentiment is bullish, investors may trade on noisy information consistent with prior periods of high sentiment. On the other hand, short-term investors may be more concerned with changes in sentiment as movements in asset prices reflect updates in investor expectations. For example, if investor sentiment decreases, even if the current sentiment level is high, investors may interpret this as negative information

(Brown and Cliff, 2004). Therefore, in the short-run, changes in investor sentiment could also be an important determinant of future price movements.

If lagged *DRES* is measured in quarterly changes instead of levels (columns five and seven), prior REIT returns affect current REIT returns with a two quarter lag. Moreover, changes in *DRES* over the prior quarter are again positively associated with returns in the current quarter (even after the addition of exogenous controls), indicating a continuation of short-term returns. However, the estimated coefficient on $DRES_{t\text{-}2}$ is no longer significant.

Turning to the VAR results from the joint estimation of private real estate returns and our direct measure of investor sentiment (Panel B of Table 7), we find that the estimated coefficients on both $NPIRET_{t\text{-}1}$ and $NPIRET_{t\text{-}2}$ are positive and significant in both the bivariate specification and with the addition of exogenous control variables. This result is expected given the autocorrelation in the NPI return series.

Controlling for the smoothed nature of NPI returns with lagged NPI returns, the estimated coefficient on $DRES_{t\text{-}1}$, when specified in levels, is positive and significant in the bivariate *NPIRET* equations (0.008, p-value = 0.004). The magnitude of this short-run effect is approximately half as large as the short-run public market sentiment effect observed in Panel A of Table 7. The estimated coefficient on $DRES_{t\text{-}2}$ is not statistically significant. We find similar results with the addition of the control variables.

When lagged sentiment is measured in quarterly changes instead of levels, the estimated coefficients on both $DRES_{t\text{-}1}$ and $DRES_{t\text{-}2}$, are positive and statistically significant in the bivariate specification (column five). With the addition of exogenous controls (column seven), the estimated coefficients on both $DRES_{t\text{-}1}$ and $DRES_{t\text{-}2}$, are positive, although $DRES_{t\text{-}2}$, is no longer significant. Overall, the results reported in Panel B of Table 7 suggest both levels and changes in our direct measure of investor sentiment are strongly predictive of NPI returns in the following quarter. Moreover, when expressed in changes, there is evidence that the impact of investor sentiment continues to persist beyond the short-term.

We now turn to the *DRES* equations in Table 7 estimated jointly with the real estate return equations. In both the bivariate and full model specifications, *DRES* displays no relation to lagged REIT returns (Panel A) or lagged NPI returns (Panel B). That is, our direct measure of investor sentiment does not appear to be influenced by prior quarterly returns, either in public or private real estate markets. However, $DRES_t$ is strongly positively associated with *DRES* in both quarter t-1 and t-2.

Finally, we re-estimate our VAR models using our indirect sentiment measure, *INDRES*, in place of our direct sentiment measure, *DRES*. These results are reported in Table 8. As in Table 7, we find a strong positive momentum effect in equity REIT returns with a two quarter lag (Panel A of Table 8). When NPI returns are used in place of REIT returns (Panel B of Table 8), the estimated coefficients on both $NPIRET_{t-1}$ and $NPIRET_{t-2}$ are consistently positive and significant, further supporting the existence of a strong relation between contemporaneous and lagged NPI returns.

In the joint *REITRET-INDRES* estimations (Panel A of Table 8), we find little evidence to support a relation between REIT returns and lagged indirect sentiment, regardless of whether sentiment is specified in levels or changes. However, in the joint *NPIRET-INDRES* estimations (Panel B of Table 8), we confirm the finding reported in Table 7 that lagged sentiment, measured in levels, is positively and significantly related to contemporaneous returns in the private commercial real estate market. This positive relation is somewhat smaller when lagged sentiment is measured in changes, although still statistically significant ($\rho = 0.096$). Overall, the indirect investor sentiment effects are somewhat smaller and less significant than the direct survey-based investor sentiment effects.

In examining aggregate return predictability, Baker and Wurgler (2007) suggest that returns following a period of low investor sentiment will be larger in absolute magnitude than those following a period of high investor sentiment. Though not tabulated, the inclusion of a high sentiment state indicator variable in our VAR specifications strengthens both the magnitude and significance of the sentiment coefficients using both *DRES* and *INDRES*.

Similar to the results reported in Table 7, we find no evidence that levels of indirect sentiment are driven by past returns in public or private markets. However, when measured in changes, current quarter sentiment is negatively related to NPI returns in the prior quarter (Panel B of Table 8). When sentiment is measured in levels, the estimated coefficients on $INDRES_{t-1}$ in the *INDRES* equations are uniformly positive and highly significant. However, unlike the results using *DRES* reported in Table 7, the estimated coefficient on $INDRES_{t-2}$ is not consistently significant.

Taken together, the results reported in Tables 7 and 8 suggest investor sentiment plays a significant role in private real estate market returns. Moreover, the results also suggest that sentiment plays a role in explaining short-term returns in public real estate markets, with the magnitude of the effect being greater in public markets than in private markets—particularly when using our direct measure of investor sentiment. These public market results are in contrast to Brown and Cliff (2004) who do not find evidence that sentiment predicts subsequent short-run returns in public equity markets.

As a robustness check, we also use the Transaction Based NCREIF Index (TBI) in place of the NPI. The TBI is a statistical index of price appreciation and total returns constructed using only those properties in the NCREIF database that sold during the quarter. Thus, the TBI is constructed to avoid the potential smoothing problem associated with the NPI. Though not tabulated, the use of the TBI index in place of the NPI strengthens the magnitude and significance of the sentiment coefficients using both *DRES* and *INDRES*.

Further evidence on the impact of sentiment on public and private market real estate returns is provided by the VAR generalized impulse response functions displayed in Figure 3. Panels A and B depict the response of quarterly REIT returns to a one standard deviation change in direct (Panel A) and indirect real estate sentiment (Panel B). The middle curve in each figure represents the estimated diffusion of quarterly REIT returns to the shock in sentiment. The remaining two curves represent the 95 percent confidence interval around the estimated response. Panels A and B of Figure 3 reveal an initial increase in REIT returns in response to a shock in the level of investor sentiment. With a shock to *DRES* in Panel A, the positive response in returns dissipates to zero over the next five quarters. In contrast, with a shock to *INDRES* in Panel B, price reversion appears to occur more quickly as returns diminish to zero by the second quarter.

Panels C and D display the response of NPI returns to a one standard deviation change in direct and indirect real estate sentiment, respectively. In contrast to the REIT results, the response of private market returns to an innovation in sentiment appears to persist over subsequent quarters. In addition, the magnitude of the initial increase in returns is noticeably smaller than what we observe in the public market results, consistent with private market investors being better informed and more sophisticated. The long-run impacts of sentiment on asset prices and returns are addressed in detail in our long horizon regression analysis below.

Stock Market Sentiment Effects

As displayed in Table 4, our indirect measure of general stock market sentiment is negatively correlated with our indirect measure of real estate sentiment (ρ = -0.194) and displays limited correlation with our direct measure of real estate sentiment (ρ = 0.275). These low correlations suggest commercial real estate is often viewed by investors as an asset class separate and distinct from the general stock market.

To further test this hypothesis, we estimate a set of VAR models in which real estate returns, real estate sentiment, and stock market sentiment are treated as endogenous variables in a three equation VAR model. In addition to our three endogenous variables, we retain the full set of exogenous control variables used previously. Although not reported, the inclusion of general stock market sentiment does not affect our real estate VAR results. Private market real estate returns remain positively and significantly related to lagged real estate sentiment, both direct and indirect. In addition, the relation between lagged real estate sentiment and public market real estate returns is consistent with our prior results.

In the stock market sentiment equation, the estimated coefficient on lagged stock market sentiment ($INDSMS_{t-1}$) is positive and significant, when sentiment is measured in levels. This confirms the predictability of stock market sentiment from quarter to quarter previously evidenced by its high degree of serial correlation (see Table 4). However, it is important to reiterate that real estate sentiment and stock market sentiment are not predictive of each other. These results are virtually unchanged if direct real estate sentiment is used in place of indirect real estate sentiment.

VI. Long-Horizon Regression Results

Long-run Relation between Returns and Sentiment

Shleifer and Vishny (1997) theorize that investor sentiment may have a more prolonged impact on pricing in markets with considerable limits to arbitrage, such as private markets. As the impact of sentiment on pricing deepens, precisely the time when returns to arbitrage would be the greatest, informed investors are unable to take immediate advantage of the mispricing. Consequently, prices may move further away from fundamental value. In the longer-run, sentiment should therefore be negatively related to subsequent long-horizon returns as price reversion occurs. We also posit that the lack of continuous price revelation in private markets makes it more difficult for participants to determine private market property values. This lack of price revelation is likely to cause the price effects of sentiment to be revealed more slowly and to be more persistent. Therefore, a positive relation between sentiment and returns may alternatively exist in the long-run as prices are slower to revert to fundamental value. By examining the empirical relation between investor sentiment and long-horizon returns in two markets that share similar underlying assets, we are able to shed additional light on the differential effect of investor sentiment on asset pricing in public versus private markets.

Panel A of Table 9 reports bias-adjusted coefficient estimates and bootstrap p-values for long-horizon regressions corresponding to the specification in equation (2). In our long-run regressions, sentiment is expressed in levels as we are interested in depicting patterns in subsequent returns conditional on the state of sentiment in the prior period. Focusing first on our direct measure of sentiment, the estimated coefficient on *DRES* is positive and significant in the one-year horizon *REITRET* regressions (column one). Consistent with our short-run results reported in Panel A of Table 7, there is a continuation in returns following periods of sentiment-induced mispricing. However, the positive relation between future REIT returns and levels of direct sentiment, *DRES*, is reversed after one year; the coefficient estimate on *DRES* for a two-year horizon cannot be distinguished from zero. Furthermore, the estimated coefficient on *DRES* is negative and significant for both the three- and four-year return horizons. Thus, the price reversal beginning in year one or two is substantial enough to turn the relation between sentiment and REIT returns negative for longer holding periods. With *INDRES*, we find an even quicker price reversion as the coefficient estimate on sentiment in the one-year horizon is negative and significant (column three). The estimated coefficient on *INDRES* is also negative and significant in the two-, three-, and four-year horizon *REITRET* regressions, with the magnitude and significance of the estimated coefficients decreasing as the return horizon increases beyond two years.

Consistent with Shleifer and Vishny's theory of limits to arbitrage and our hypothesis that private markets suffer from more limited price revelation, private real estate markets appear to be more susceptible to prolonged periods of sentiment-induced mispricing.[18] The results in Panel A of Table 9 document a positive and statistically significant relation between investor sentiment and long-horizon NPI returns using both measures of sentiment. That is, following periods of high (low) sentiment, private market returns increase (decrease). Moreover, due to a lack of price revelation, short selling constraints, and limits to arbitrage these sentiment induced price changes are not reversed significantly enough in subsequent years to drive sentiment's relation with long-horizon returns negative, though the coefficient estimates for sentiment decrease in magnitude as the return horizon increases. These results are consistent with Lamont and Thaler (2003b) and Scheinkman and Xiong (2003) who argue

[18] There is also a branch of literature theorizing that delays in information transmission among investors may cause prices to move away from intrinsic value. Daniel, Hirshleifer, and Subrahmanyam (1998) suggest that overreaction to private information and underreaction to public information by informed investors tend to produce short-term continuation of investment returns, but long-term reversals as public information is eventually incorporated into asset prices. Thus, investor sentiment may cause prices to diverge significantly from fundamental values before a reversion ultimately occurs.

that short sales restrictions can make arbitrage costly and lead to discrepancies in prices of economically equivalent assets. Our results are also consistent with Froot and Dabora (1999) who report differences between the prices of pairs of large companies ("Siamese twins") that trade around the world but have different trading and ownership habitats. They surmise that among other factors, country-specific sentiment shocks might affect relative prices. Finally, our results are consistent with Baker and Wurgler (2006, 2007) who find that investor sentiment has more profound price effects on stocks that are difficult to arbitrage.

Panel B of Table 9 reports the economic magnitude of a one standard deviation increase in sentiment on returns over the indicated horizon. Following Brown and Cliff (2005), we take the bias-adjusted coefficient estimates reported in Panel A of Table 9 and multiply by the number of quarters in the specified return horizon and the standard deviation of our sentiment variable. Focusing first on our public market results, a one standard deviation increase in *DRES* is associated with a 3.8 percent increase in returns over the subsequent one year period. This continuation of returns is subsequently reversed at longer horizons as a one standard deviation shock to sentiment is associated with a reduction in returns of 3.6, 9.7, and 12.3 percent over the two, three, and four year horizons respectively. Using *INDRES*, results are of similar magnitude, although returns begin to decrease by 2.9 percent over the subsequent one year period in response to an increase in sentiment.

In the private market, a one standard deviation increase in *DRES* is associated with a 5.5 percent increase in returns over the next year. Over longer horizons, returns continue to increase, although the marginal change in returns decreases over time. Using *INDRES*, the magnitude of the initial increase in returns following a standard deviation shock to sentiment is slightly smaller than is the case when using *DRES*. Over the subsequent one year period, returns increase 3.9 percent. These results are consistent with limits to arbitrage fostering persistence in sentiment-induced mispricing in private real estate markets.

In summary, the impact of investor sentiment on similar underlying assets depends in part on whether the investments are owned and managed in private or public markets. In both markets, excessive optimism (pessimism) drives prices above (below) fundamental value in the short-run. However, the degree of price revelation and liquidity, as well as the degree to which investors face restrictions in capitalizing on this mispricing, play important roles in determining the time it takes for prices to revert to intrinsic values. In public real estate markets, periods of sentiment-induced mispricing are followed by quicker price reversals. In private real estate markets, on the other hand, the initial sentiment-induced price response is more persistent as the impact of investor sentiment slowly dissipates over time.

Long-run Stock Market Sentiment Effects

As discussed previously in our VAR analysis, we find that the inclusion of stock market sentiment does not affect our short-run results. To examine if stock market sentiment impacts real estate returns in the long-run, we implement long-horizon regressions that include our indirect real estate sentiment measure, *INDRES*, as well as our indirect measure of general stock market sentiment, *INDSMS*. We retain the full set of exogenous control variables used previously. Although not tabulated, the inclusion of stock market sentiment does not affect our long-run results. Coefficient estimates and statistical significance of our real estate sentiment variable are virtually unchanged from the results reported in Table 9, while the impact of stock market sentiment is not statistically different from zero.

VII. Summary and Conclusion

Sentiment is the irrational component of investor expectations. With the emergence of the "noise trader" and limits to arbitrage theories of De Long et al. (1990) and Shleifer and Vishny (1997), a growing empirical literature has begun to focus on measuring and quantifying the effects of investor sentiment on asset pricing. Although results vary, a number of recent articles document a significant role for sentiment in the valuation of assets in public stock markets.

The focus on public markets in the existing literature is understandable given the difficulties associated with obtaining return information on investments that trade in private markets. Nevertheless, private investment markets provide an appealing testing ground for examining sentiment's pricing role. Relative to more liquid public markets, private investment markets exhibit significant information asymmetries and illiquidity. In addition, the market value of the private entity's assets is not generally revealed until ownership of the entity is sold to the public in an initial public offering (IPO) or the entity is merged or acquired by an existing company. Thus, it is more difficult for investors to determine the market value of the entity. Because of the lack of continuous price revelation, the impact of investor sentiment on market values may be revealed with significant lags in private markets.

We posit that investor sentiment plays a more persistent role in pushing asset prices away from their fundamental values in private markets because of increased illiquidity, information asymmetries, and more limited price revelation relative to public markets. The inability to short-sell in private markets, for example, impedes the opportunity for informed arbitrageurs to counteract mispricing. Thus, sentiment could lead to prolonged periods of mispricing in the private market. No previous research, however, has directly investigated the relative importance of sentiment in public and private asset markets. This paper provides a contribution to the investment sentiment literature by examining the short- and long-run relation between sentiment and the pricing of similar underlying assets that are owned and traded in two distinct investment environments.

Using vector autoregressive (VAR) models, we find evidence of a positive relation between investor sentiment and subsequent quarter returns in both public and private real estate markets. The magnitude of this short-run effect is larger in the public real estate market, which is consistent with private market investors being better informed and more sophisticated. Using long horizon regressions, we also provide evidence that periods of sentiment-induced mispricing are followed by quicker price reversals in public real estate markets. In contrast, private real estate markets are more susceptible to prolonged periods of sentiment-induced mispricing. These results support the hypothesis that limits to arbitrage and delays in price revelation play important roles in determining the time it takes for prices to revert to fundamental values.

Appendix

Bootstrap Simulation Procedure

Inference based on asymptotic theory can be extremely misleading with small sample sizes, where many asymptotic tests may over-reject or under-reject the null hypothesis depending on the particular sample size. Several recent studies have utilized bootstrap simulation procedures to produce more accurate coefficient estimates and more reliable measures of inference within small sample settings. Instead of imposing a restrictive shape on the sampling distribution of desired parameter estimates, the bootstrap empirically estimates the sampling distribution from the original sample by sampling repeatedly with replacement from the actual data.

We follow the framework of the bootstrap simulation procedure described in Brown and Cliff (2005), but also incorporate several additional adjustments proposed in the more recent literature.[19] First, we begin by running long-horizon regressions as specified in equation (2). The original OLS coefficient estimates on our measures of investor sentiment are saved, as they will be utilized to calculate bias-adjusted coefficient estimates. The second step in the simulation procedure is to generate a pseudo return series under the null hypothesis that sentiment does not matter. We utilize the following vector autoregressive (VAR) model as the underlying data generating process of the pseudo return series:

$$\text{VAR(1) for } y_t = [r_t\ S_t\ z_t], \qquad (3)$$

where r_t is the contemporaneous log return (i.e., the set of returns that was the basis for calculating the original future k-period return series), z_t is the set of contemporaneous control variables, and S_t is our measure of investor sentiment.[20] The beta coefficient on investor sentiment is set to zero in this case to ensure that the pseudo return series is generated under the null, and the constant in the constrained model is adjusted to restore the original mean. We save the predicted y-values and the residuals from the VAR specification.

Before proceeding, the residuals must first be adjusted to correct for a downward bias that results from the use of Least Squares in the VAR framework. Thus, each residual is multiplied by $(n/n\text{-}v)^{1/2}$, where n is the number of observations and v refers to the degrees of freedom of the VAR (MacKinnon, 2002). We then sample with replacement from these residuals to generate a new set of bootstrapped residuals.

[19] See also Menkhoff and Rebitzky (2008), Schmeling (2007), and Schmeling and Schrimpf (2008).
[20] SBIC model-selection criteria indicates that a VAR (1) specification is appropriate.

This sampling process is repeated 10,100 times, with the first 100 samples of bootstrapped residuals being discarded to avoid any startup effects. We use the remaining residual datasets to create 10,000 bootstrapped dependent variables by adding the predicted y-value from the VAR to the new residual. From this pseudo return series, we create 10,000 new sets of k-period future returns. We then run long-horizon return regressions as specified in equation (2), except in this case we use the new k-period future returns as the dependent variables. We save the beta coefficients from each of the regressions, yielding 10,000 betas for each of the return horizons. We then calculate the mean beta coefficient and the standard deviation of the estimated values of beta (bootstrap standard error) across the 10,000 simulations. These will be used to create a bias-adjusted beta coefficient and a new empirical distribution of t-statistics for inference.

MacKinnon and Smith (1998) demonstrate how bootstrap simulations can be utilized to generate more accurate beta coefficient estimates within finite sample settings. When the bias function is not known analytically, the authors hypothesize that it can be estimated through the bootstrap simulation procedure as previously discussed. Assuming the bias is constant for a particular return horizon, the estimated bias can be calculated as follows:

$$\text{Estimated Bias} = \bar{\beta} - \hat{\beta}_{OLS}\ , \tag{4}$$

where $\hat{\beta}_{OLS}$ is the original OLS beta coefficient and $\bar{\beta}$ is the sample mean of the 10,000 simulated beta coefficients. Because the simulated samples are assumed to be drawn from the same model as the original data, the estimated bias function should converge to the actual bias function as the number of simulations approaches infinity. The adjusted beta coefficient can therefore be specified as:

$$\hat{\beta}_{adj} = 2\hat{\beta}_{OLS} - \bar{\beta}. \tag{5}$$

This is the mathematical equivalent of subtracting the estimated bias from the original OLS coefficient estimate. This bias-adjusted estimator has been used extensively in the bootstrap literature and has been shown to provide more reliable coefficient estimates in numerous simulation based studies.

The bootstrap procedure's primary application has been to develop more accurate measures for hypothesis testing and more appropriate confidence intervals for inference. In fact, the bootstrap procedure was originally proposed as an alternative method to compute standard errors (Efron, 1979). Prior literature has documented that Newey-West standard errors perform poorly in finite samples with overlapping observations. In particular, research has shown that standard errors calculated in this fashion suffer from a significant downward bias in small samples (Andrews, 1991). This implies that test statistics based on these estimated error terms are likely to result in false inferences. When asymptotic standard errors are unreliable, the simplest alternative is to utilize the bootstrap standard error, which is calculated using the following specification:

$$se(\hat{\beta}) = \left(\frac{1}{B-1}\sum_{i=1}^{B}\left(\hat{\beta}_i - \bar{\beta}\right)^2\right)^{\frac{1}{2}}, \tag{6}$$

where $\hat{\beta}_i$ is the estimated beta coefficient from iteration *i* of the simulation process, $\bar{\beta}$ is the mean beta of the 10,000 simulated beta coefficients, and B is the number of simulations. In other words, se($\hat{\beta}$) is simply the standard deviation of the estimated values of beta across the 10,000 simulations. The new bias-adjusted t-statistic can be calculated as follows:

$$\hat{t}_{adj} = \frac{\hat{\beta}_{adj}}{se(\hat{\beta})} \quad , \tag{7}$$

where the numerator is the bias-adjusted beta coefficient and the denominator is the bootstrap standard error. Because t-statistics constructed in this fashion do not always follow the t-distribution in finite samples, standard critical values may not be appropriate for inference. Therefore, we utilize two alternative approaches to compute p-values based on a bootstrap distribution of t-statistics to yield a more accurate test of the null hypothesis.

The first step in both approaches is to calculate an adjusted t-statistic for each of the 10,000 simulations, thus creating a new empirical distribution of t-statistics. This test statistic is calculated as follows:

$$\hat{t}_i^* = \frac{\hat{\beta}_i - \bar{\beta}}{se(\hat{\beta})} \quad , \tag{8}$$

where $\hat{\beta}_i$ is the estimated beta coefficient for iteration *i* of the simulation procedure, $\bar{\beta}$ is the mean beta coefficient across the 10,000 simulations, and se($\hat{\beta}$) is the bootstrap standard error. An appealing aspect of this technique is that we are able to construct an empirical distribution of test statistics that adheres closely to the normal distribution, yet provides new critical values for inference.

The first approach for calculating a bootstrap p-value can be depicted as follows:

$$\hat{p}_s = \frac{1}{B}\sum_{i=1}^{B}(|\hat{t}_i^*| > |\hat{t}_{adj}|) , \tag{9}$$

where $|\hat{t}_i^*|$ is the absolute value of the simulated t-statistic of iteration *i* that is specified in equation (8), $|\hat{t}_{adj}|$ is the absolute value of the bias-adjusted t-statistic detailed in equation (7), and B is the number of simulations. This approach implicitly assumes the distribution of the test statistic is symmetric around zero.

Because the empirical distribution of test statistics may not always be entirely symmetric around zero, we compute an alternative p-value as follows:

$$\hat{p}_{ns} = 2 \min \left(\frac{1}{B} \sum_{i=1}^{B} (\hat{t}_i^* > \hat{t}_{adj}), \frac{1}{B} \sum_{i=1}^{B} (\hat{t}_i^* < \hat{t}_{adj}) \right), \qquad (10)$$

where $\hat{t}_i^*$ is the simulated t-statistic calculated in equation (8), $\hat{t}_{adj}$ is the bias-adjusted t-statistic calculated in equation (7), and B is the number of simulations. Unlike the previous specification, this technique does not assume the empirical distribution of test statistics is symmetric around zero. MacKinnon (2006) points out that these two approaches could very well lead to significantly different results if the mean value of the simulated t-statistics is vastly different from zero. However, we find that these two approaches yield essentially identical p-values, thus implying that the empirical distributions of test statistics in the present study are virtually symmetric around zero. Reported p-values are calculated based on the first specification detailed in equation (9).

Impact of Bootstrap Simulation Adjustments

Figure 4 provides a graphical illustration of the bootstrap simulation adjustment. Panel A displays the empirical distributions of unadjusted and adjusted t-statistics. The solid line represents the bootstrap-adjusted t-statistics, as depicted in equation (8), while the dashed line represents the unadjusted t-statistic, which is calculated using the OLS beta coefficient and Newey-West standard error. In this case, the unadjusted test statistic distribution has thick tails. Thus, standard inference would result in a rejection of the null hypothesis that sentiment does not affect long horizon returns more often than is actually the case. For example, the empirical distribution of the unadjusted t-statistics falls below -1.96 19.62% of the time. The adjusted t-statistics, on the other hand, more closely resemble a normal distribution. In fact, 2.45% of the empirical distribution of simulation-adjusted t-statistics falls below the critical value of -1.96 in the particular example shown.

Panel B displays the empirical distribution of unadjusted and adjusted coefficient estimates from the bootstrap simulation. The solid line represents bootstrap-adjusted coefficients, while the dashed line represents OLS coefficient estimates. The distribution of unbiased coefficient estimates, under the null hypothesis that investor sentiment does not affect long horizon returns, should be centered on zero. However, the unadjusted coefficients appear to be biased, as the empirical distribution is centered slightly to the right of zero, with a median value of 0.0005. Therefore, bias-adjusted coefficient estimates are reported and are used to calculate the adjusted test statistics.

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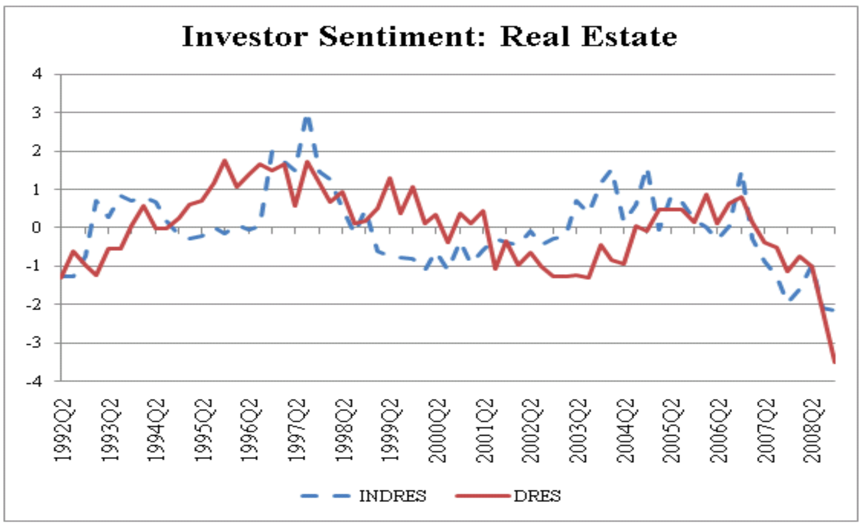
Figure 1: Investor Sentiment

This figure plots levels of investor sentiment in the commercial real estate market and stock market for the period 1992:Q2-2008:Q4. Sentiment indices are generated through the use of principal component analysis. Our direct measure of real estate sentiment, *DRES*, is the first principal component extracted from investment condition survey responses pertaining to eight property types that are published quarterly by the Real Estate Research Corporation (RERC) in the *Real Estate Report*. RERC surveys institutional investors, appraisers, lenders, and managers throughout the United States to gather information on current investment criteria. RERC survey respondents are asked to rank current investment conditions for each of eight property types, both nationally and by metropolitan area, on a scale of 1 to 10, with 1 indicating "poor" investment conditions and 10 indicating "excellent" conditions for investing. Our indirect measure of real estate sentiment, *INDRES*, is the first principal component extracted from seven underlying proxies of investor sentiment in commercial real estate markets: (i) the REIT price premium to net asset value, (ii) the percentage of properties sold from the NCREIF Property Index, (iii) the number of REIT IPOs, (iv) the average first-day returns on REIT IPOs, (v) the share of net REIT equity issues in total net REIT equity and debt issues, (vi) commercial mortgage flows as a percentage of GDP, and (vii) capital flows to dedicated REIT mutual funds. Our indirect measure of stock market sentiment, *INDSMS*, is the first principal component extracted from six underlying proxies of investor sentiment in the stock market: (i) the average difference between the net asset values of closed-end fund stock shares and their market prices, (ii) share turnover on the NYSE, (iii) the number of IPOs, (iv) the average first-day returns on IPOs, (v) the share of equity issues in total equity and debt issues, and (vi) the dividend premium. Each index is standardized to have a mean of zero and unit variance for the period over which it was generated.

Panel A: Real Estate Sentiment – Direct vs. Indirect



Panel B: Investor Sentiment – Real Estate vs. General Stock Market

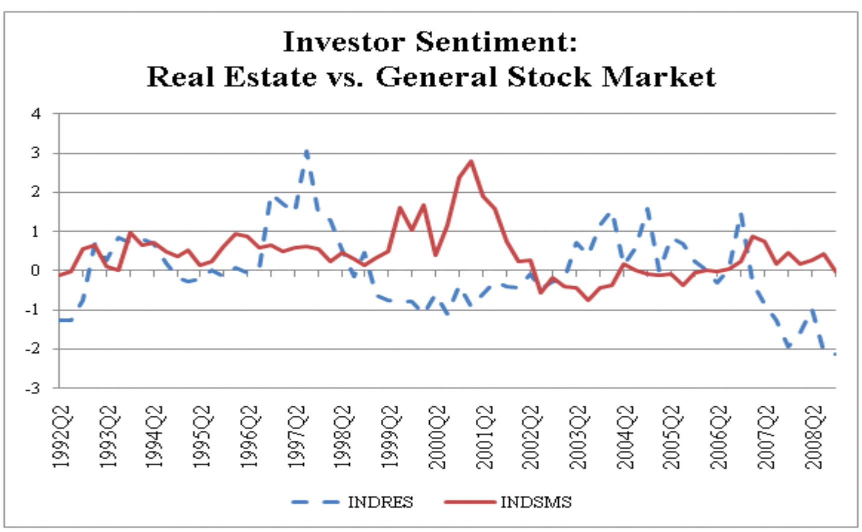
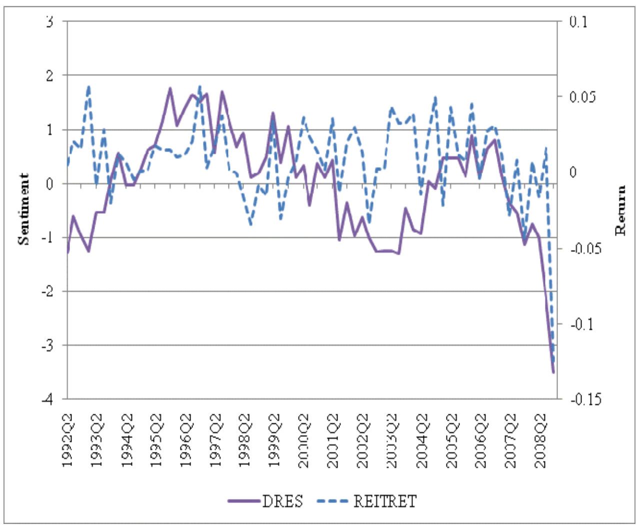


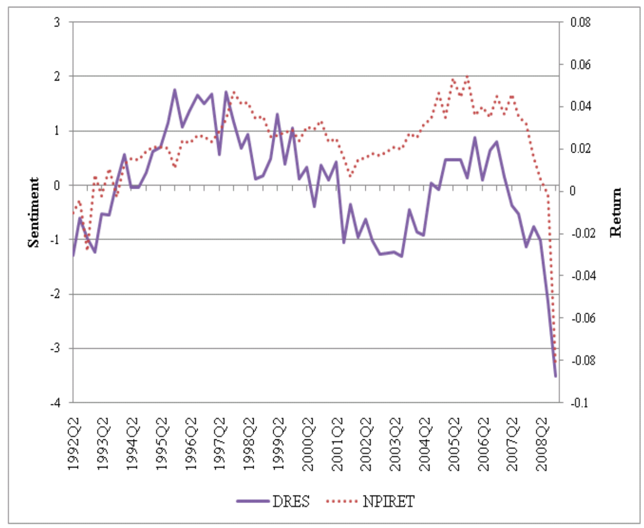
Figure 2: Investor Sentiment and Contemporaneous Returns

This figure plots levels of our real estate sentiment measures against contemporaneous returns in public and private commercial real estate markets for the time period 1992:Q2-2008:Q4. Our direct measure of real estate investor sentiment, *DRES*, is the first principal component extracted from investment condition survey responses pertaining to eight property types that are published quarterly by the Real Estate Research Corporation (RERC) in the *Real Estate Report*. Our indirect measure of sentiment, *INDRES*, is the first principal component extracted from seven underlying proxies of investor sentiment in commercial real estate markets: (i) the REIT price premium to net asset value, (ii) the percentage of properties sold from the NCREIF Property Index, (iii) the number of REIT IPOs, (iv) the average first-day returns on REIT IPOs, (v) the share of net REIT equity issues in total net REIT equity and debt issues, (vi) commercial mortgage flows as a percentage of GDP, and (vii) capital flows to dedicated REIT mutual funds. Our measure of returns in public commercial real estate markets, *REITRET,* is obtained from the CRSP/ZIMAN database. We use the value-weighted aggregate U.S. equity REIT index. Our measure of returns in private commercial real estate markets, *NPIRET*, is provided by the National Council of Real Estate Investment Fiduciaries (NCREIF). The NCREIF Property Index (NPI) tracks appraisal-based total return performance of a large pool of individual commercial real estate properties acquired in the private market for investment purposes only. Each property's quarterly return is weighted by its market value relative to the total market value of the properties that comprise the NPI Index.

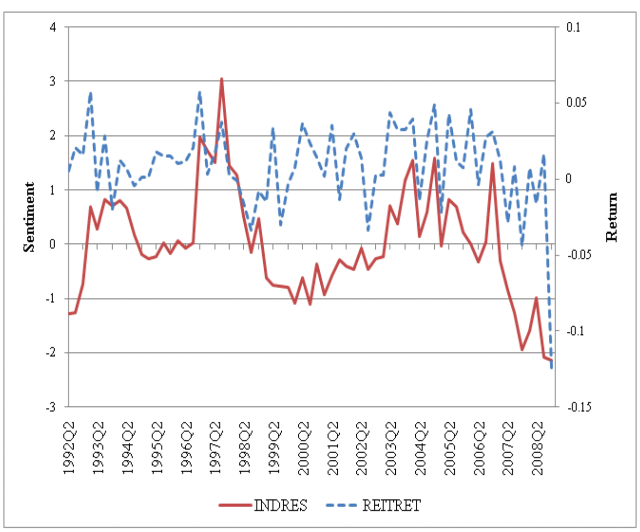
Panel A: Sentiment (Direct) and Public Market Returns



Panel B: Sentiment (Direct) and Private Market Returns



Panel C: Sentiment (Indirect) and Public Market Returns



Panel D: Sentiment (Indirect) and Private Market Returns

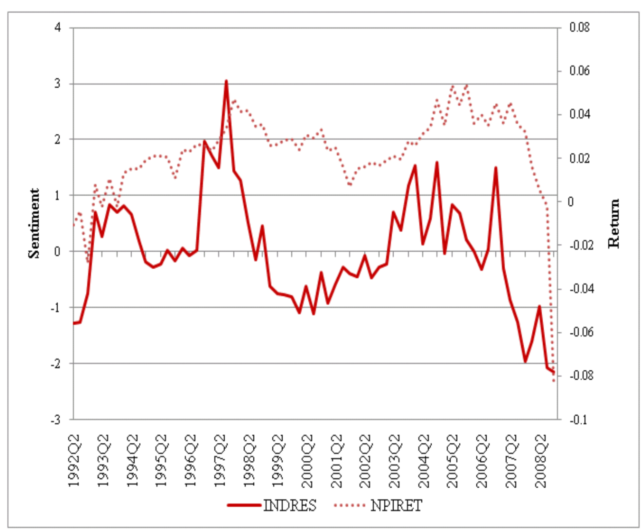
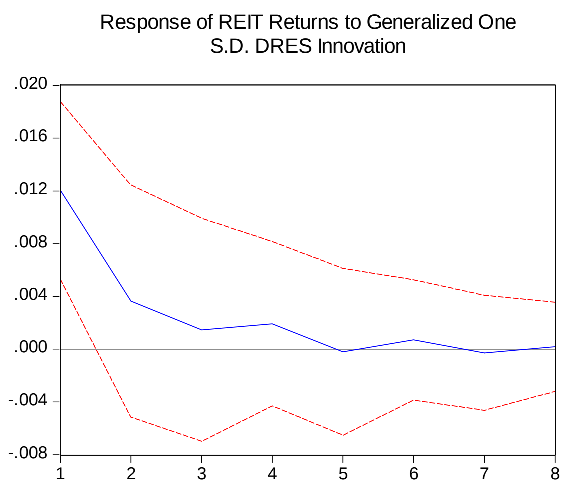


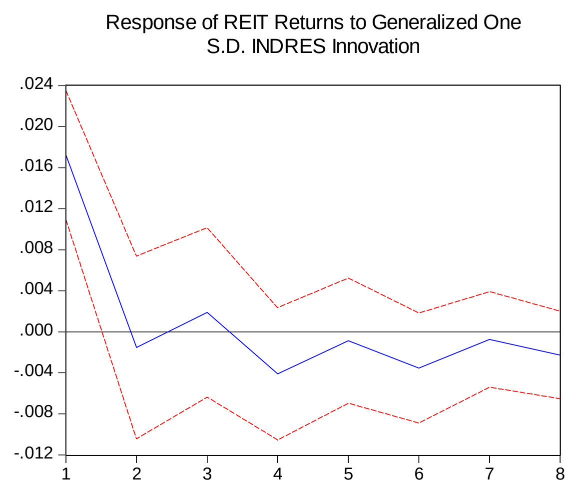
Figure 3: Impulse Response Functions

This figure plots the generalized impulse response functions corresponding to the estimated VAR models in Table 7 and Table 8 with sentiment measured in levels and including exogenous control variables. Our direct measure of real estate investor sentiment, *DRES*, is the first principal component extracted from investment condition survey responses pertaining to eight property types that are published quarterly by the Real Estate Research Corporation (RERC) in the *Real Estate Report*. Our indirect measure of real estate investor sentiment, *INDRES*, is the first principal component extracted from seven underlying proxies of investor sentiment in commercial real estate markets: (i) the REIT price premium to net asset value, (ii) the percentage of properties sold from the NCREIF Property Index, (iii) the number of REIT IPOs, (iv) the average first-day returns on REIT IPOs, (v) the share of net REIT equity issues in total net REIT equity and debt issues, (vi) commercial mortgage flows as a percentage of GDP, and (vii) capital flows to dedicated REIT mutual funds. Our measure of returns in private commercial real estate markets, *NPIRET*, is provided by the National Council of Real Estate Investment Fiduciaries (NCREIF). The NCREIF Property Index (NPI) tracks appraisal-based total return performance of a large pool of individual commercial real estate properties acquired in the private market for investment purposes only. Each property's quarterly return is weighted by its market value relative to the total market value of the properties that comprise the NPI Index. Our measure of returns in public commercial real estate markets, *REITRET*, is obtained from the CRSP/ZIMAN database. We use the value-weighted aggregate U.S. equity REIT index. The set of control variables includes the yield on the three-month Treasury bill, the slope of the Treasury term structure of interest rates, the spread between yields on BAA rated and AAA rated corporate bonds, general inflation, the three Fama-French risk factors (*MKT*, *SMB*, and *HML*) and a return momentum factor (*UMD*). The sample period spans 1992:Q2-2008:Q4.

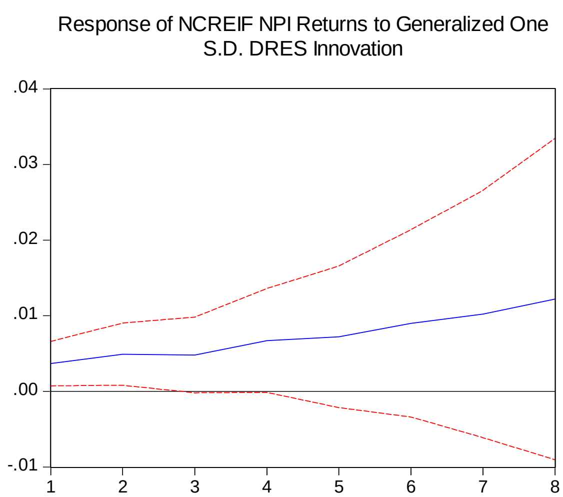
Panel A: Sentiment (Direct) and Public Market Returns



Panel B: Sentiment (Indirect) and Public Market Returns



Panel C: Sentiment (Direct) and Private Market Returns



Panel D: Sentiment (Indirect) and Private Market Returns

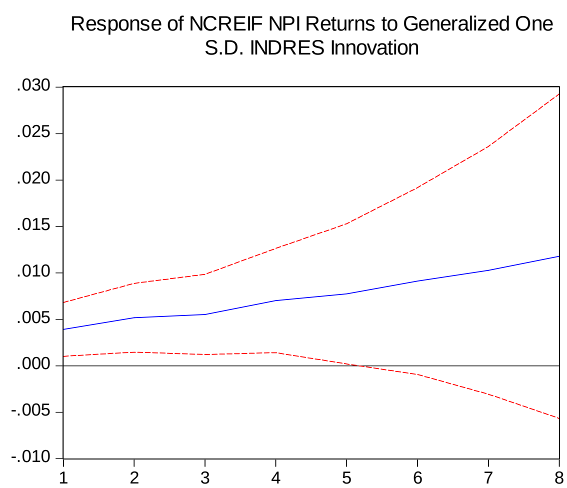
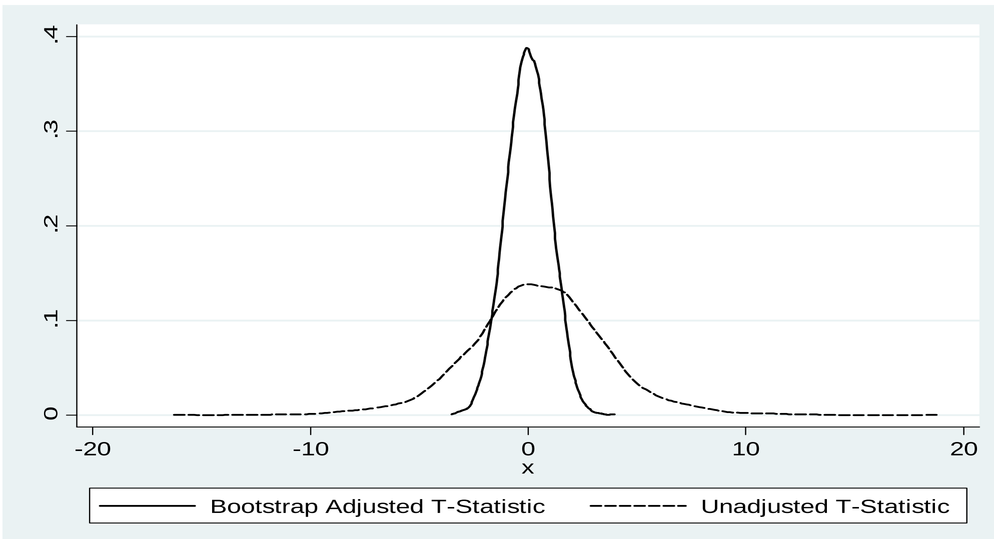


Figure 4: Empirical Distribution of T-Statistics and Coefficient Estimates

This figure provides a graphical illustration of the bootstrap simulation adjustment. Panel A displays the distributions of unadjusted and adjusted t-statistics. The solid line represents bootstrap-adjusted t-statistics, while the dashed line represents unadjusted t-statistics, which are calculated using the unadjusted OLS coefficient estimate and Newey-West standard error. Panel B displays the empirical distribution of unadjusted and adjusted coefficient estimates for our measure of investor sentiment. The solid line represents the bootstrap-adjusted coefficients, while the dashed line represents the unadjusted OLS coefficient estimates. This particular example utilizes our measure of returns in public commercial real estate markets, *REITRET,* at the four year horizon as the dependent variable and our direct measure of investor sentiment, *DRES*, as the independent variable. See Appendix for details of the bootstrap simulation adjustment.

Panel A: T-Statistic Distribution



Panel B: Beta Coefficient Distribution

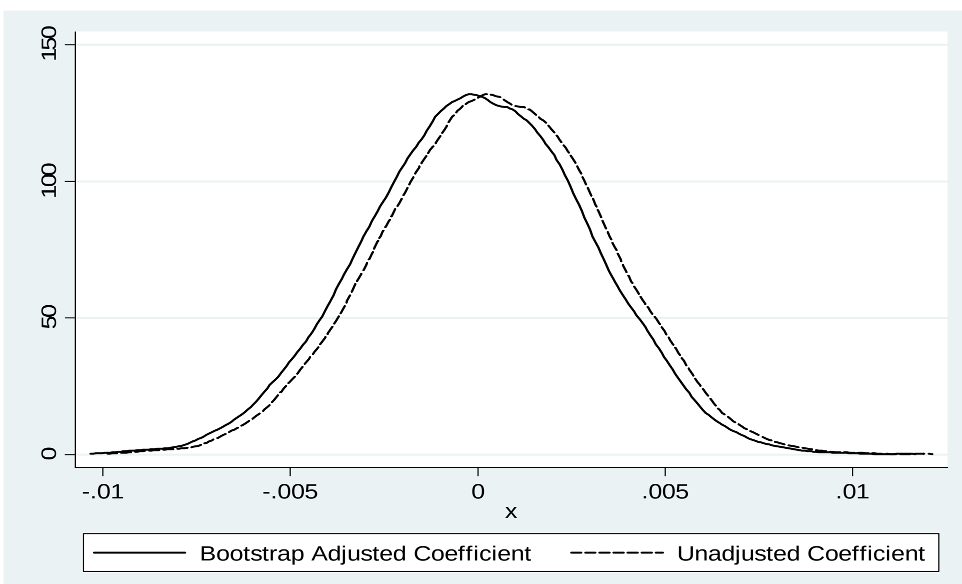


Table 1: Descriptive Statistics – Direct Real Estate Sentiment Proxies

This table reports descriptive statistics for each property-type component of our direct real estate sentiment index (*DRES*). Mean, median, standard deviation, minimum, maximum, and serial correlation of levels and changes are reported. Our direct measure of real estate investor sentiment, *DRES*, is the first principal component extracted from investment condition survey responses pertaining to eight property types that are published quarterly by the Real Estate Research Corporation (RERC) in the *Real Estate Report*. RERC surveys institutional investors, appraisers, lenders, and managers throughout the United States to gather information on current investment criteria. RERC survey respondents are asked to rank current investment conditions for each of eight property types on a scale of 1 to 10, with 1 indicating "poor" investment conditions and 10 indicating "excellent" conditions for investing. The sample period spans 1992:Q2-2008:Q4. ***, **, and * represent 1%, 5%, and 10% significance levels respectively.

						Serial Correlation	
Property Type	Mean	Median	Std Dev	Min	Max	Levels	Changes
Apartment	6.3	6.4	0.7	3.9	7.6	0.61***	-0.38***
Industrial R&D	5.1	5.1	0.8	3.0	6.7	0.80***	-0.30**
Industrial Warehouse	6.3	6.3	0.6	4.5	7.7	0.72***	-0.40***
CBD Office	5.5	5.7	1.1	2.8	7.3	0.88***	-0.19
Suburban Office	5.3	5.3	1.2	2.8	7.5	0.92***	-0.20
Neighborhood Retail	5.9	6.0	0.7	3.4	7.2	0.60***	-0.38***
Power Center	5.0	5.0	1.1	2.7	6.8	0.85***	-0.38***
Regional Malls	5.4	5.4	0.8	2.9	6.7	0.59***	-0.44***

Table 2: Descriptive Statistics – Indirect Real Estate Sentiment Proxies

This table reports descriptive statistics for each component of our indirect real estate sentiment index (*INDRES*). Mean, median, standard deviation, minimum, maximum, and serial correlation of levels and changes are reported. Our indirect measure of real estate sentiment, *INDRES*, is the first principal component extracted from seven underlying proxies of investor sentiment in commercial real estate markets: (i) the industry-wide REIT price premium to net asset value, (ii) the percentage of properties sold from the NCREIF Property Index, (iii) the number of REIT IPOs, (iv) the average first-day returns on REIT IPOs, (v) the share of net REIT equity issues in total net REIT equity and debt issues, (vi) commercial mortgage flows as a percentage of GDP, and (vii) capital flows to dedicated REIT mutual funds. Descriptive statistics are reported in decimal form and on a quarterly basis. The sample period spans 1992:Q2-2008:Q4. ***, **, and * represent 1%, 5%, and 10% significance levels respectively.

						Serial Correlation	
Sentiment Proxy	Mean	Median	Std Dev	Min	Max	Levels	Changes
Industry-Wide REIT NAV Premium	0.033	0.031	0.115	-0.244	0.302	0.81***	-0.31**
Percentage of Properties Sold from NCREIF	0.022	0.023	0.013	0.002	0.057	0.60***	-0.48***
Number of REIT IPOs	2.493	1.000	4.069	0.000	20.00	0.83***	0.06
Average First-Day Return on REIT IPOs	0.039	0.025	0.052	-0.025	0.268	0.06	-0.58***
Share of REIT Equity Issues	0.221	0.234	0.411	-2.044	1.674	-0.34***	-0.77***
Commercial Mortgage Flows as % of GDP	0.002	0.004	0.011	-0.029	0.024	0.60***	-0.41***
Capital Flows to Dedicated REIT Mutual Funds	0.304	0.160	1.295	-4.513	3.605	0.40***	-0.11

Table 3: Descriptive Statistics – Indirect Stock Market Sentiment Proxies

This table reports descriptive statistics for each component of our indirect stock market sentiment index (*INDSMS*). Mean, median, standard deviation, minimum, maximum, and serial correlation of levels and changes are reported. Similar to the measure constructed in Baker and Wurgler (2006, 2007), our indirect measure of stock market sentiment, *INDSMS*, is the first principal component extracted from six underlying proxies of investor sentiment in the stock market: (i) the average difference between the net asset values of closed-end fund stock shares and their market prices, (ii) share turnover on the NYSE, (iii) the number of IPOs, (iv) the average first-day returns on IPOs, (v) the share of equity issues in total equity and debt issues, and (vi) the dividend premium. Descriptive statistics are reported in decimal form and on a monthly basis. The sample period spans April 1992 through December 2008. ***, **, and * represent 1%, 5%, and 10% significance levels respectively.

						Serial Correlation	
Sentiment Proxy	Mean	Median	Std Dev	Min	Max	Levels	Changes
Closed-end Fund Discount	0.071	0.067	0.036	-0.013	0.191	0.92***	-0.19***
NYSE Share Turnover	0.136	0.136	0.129	-0.249	0.543	0.33***	-0.51***
Number of IPOs	29.42	23.00	23.10	0.000	106.0	0.80***	-0.27***
Average First Day Return on IPOs	0.193	0.140	0.212	-0.199	1.162	0.76***	-0.44***
Share of Equity Issues	0.118	0.102	0.073	0.015	0.539	0.61***	-0.33***
Dividend Premium	-0.147	-0.137	0.122	-0.602	0.128	0.92***	0.06

Table 4: Descriptive Statistics and Correlations – Aggregate Sentiment Measures

This table reports descriptive statistics and correlations for our aggregate sentiment indices. The sample period spans 1992:Q2-2008:Q4. Panel A reports the mean, median, standard deviation, minimum, maximum, and serial correlation of levels and changes. Panel B presents unconditional correlations between each of our sentiment indices. Our direct measure of investor sentiment, *DRES*, is the first principal component extracted from investment condition survey responses pertaining to eight property types that are published quarterly by the Real Estate Research Corporation (RERC) in the *Real Estate Report*. RERC survey respondents are asked to rank current investment conditions for each of eight property types, both nationally and by metropolitan area, on a scale of 1 to 10, with 1 indicating "poor" investment conditions and 10 indicating "excellent" conditions for investing. Our indirect measure of sentiment, *INDRES*, is the first principal component extracted from seven underlying proxies of investor sentiment in commercial real estate markets: (i) the industry-wide REIT price premium to net asset value, (ii) the percentage of properties sold from the NCREIF Property Index, (iii) the number of REIT IPOs, (iv) the average first-day returns on REIT IPOs, (v) the share of net REIT equity issues in total net REIT equity and debt issues, (vi) commercial mortgage flows as a percentage of GDP, and (vii) capital flows to dedicated REIT mutual funds. Our indirect measure of stock market sentiment, *INDSMS*, is the first principal component extracted from six underlying proxies of investor sentiment in the stock market: (i) the average difference between the net asset values of closed-end fund stock shares and their market prices, (ii) share turnover on the NYSE, (iii) the number of IPOs, (iv) the average first-day returns on IPOs, (v) the share of equity issues in total equity and debt issues, and (vi) the dividend premium. *INDSMS* is constructed using data from 1965-2008. Each index is standardized to have a mean of zero and unit variance for the period over which it was generated. Descriptive statistics are reported in decimal form and on a quarterly basis. ***, **, and * represent 1%, 5%, and 10% significance levels respectively.

Panel A: Descriptive Statistics

						Serial Correlation	
Sentiment Measure	Mean	Median	Std Dev	Min	Max	Levels	Changes
DRES	0.000	0.117	1.000	-3.508	1.762	0.81***	-0.35***
INDRES	0.000	-0.070	1.000	-2.146	3.051	0.73***	-0.29**
INDSMS	0.426	0.343	0.651	-0.758	2.799	0.76***	-0.14

Panel B: Correlations

Sentiment Measure	*DRES*	*INDRES*	*INDSMS*
DRES	1.000		
INDRES	0.478***	1.000	
INDSMS	0.275**	-0.194	1.000

Table 5: Descriptive Statistics - Return Series and Control Variables

This table reports descriptive statistics for our two quarterly return series, as well as our macroeconomic/risk control variables. Our measure of returns in private commercial real estate markets, *NPIRET*, is provided by the National Council of Real Estate Investment Fiduciaries (NCREIF). The NCREIF Property Index (NPI) tracks the total return performance of a large pool of individual commercial real estate properties acquired in the private market for investment purposes only. Each property's quarterly return is weighted by its market value relative to the total market value of the properties that comprise the NPI Index. Our measure of returns in public commercial real estate markets, *REITRET,* is obtained from the CRSP/ZIMAN database. We use the quarterly value-weighted aggregate U.S. equity REIT index. Our macroeconomic control variables include the annualized yield on three-month U.S. Treasury securities (*TBILL*), the annual slope of the Treasury term structure of interest rates (*TERMSP*), the annual spread between yields on BAA rated and AAA rated corporate bonds (*DEFAULTSP*), and quarterly inflation (*INFLA*). We also include the three Fama-French risk factors: *MKT*, *SMB*, and *HML* augmented by a return momentum factor, *UMD*. *MKT* is the total return on the value-weighted stock market portfolio, as measured by the Center for Research in Securities Pricing (CRSP), minus the corresponding quarterly return on U.S. Treasury securities from CRSP. *SMB* is defined as the total return on a portfolio of small cap stocks in excess of the return on a portfolio of large cap stocks. *HML* is the total return on stocks with high ratios of book-to-market value in excess of the returns on a portfolio of stocks with low book-to-market ratios. *UMD* is the total return on a portfolio of stocks with high prior returns in excess of stocks with low prior returns. The sample period spans 1992:Q2-2008:Q4. Descriptive statistics are reported in decimal form. ***, **, and * represent 1%, 5%, and 10% significance levels respectively.

Variable	Mean	Median	Std Dev	Min	Max	Serial Correlation
NPIRET	0.023	0.025	0.020	-0.083	0.054	0.72***
REITRET	0.009	0.012	0.028	-0.125	0.058	-0.04
TBILL	0.038	0.044	0.016	0.003	0.062	0.96***
TERMSP	0.016	0.015	0.012	-0.006	0.036	0.93***
DEFAULTSP	0.009	0.008	0.003	0.006	0.030	0.83***
INFLA	0.006	0.006	0.009	-0.039	0.025	-0.13
MKT	0.004	0.012	0.082	-0.223	0.196	-0.01
SMB	0.007	0.002	0.055	-0.108	0.191	0.01
HML	0.004	0.004	0.077	-0.320	0.206	0.16
UMD	0.027	0.019	0.080	-0.201	0.260	-0.07

Table 6: VAR Results – Dynamic Relations amongst Sentiment Measures

This table presents results obtained from estimating our unrestricted VAR models with our investor sentiment measures as endogenous variables. An unrestricted pth- order Gaussian VAR model can be represented as:

$$Y_t = \mu + \Phi_1 Y_{t-1} + \Phi_2 Y_{t-2} + \ldots + \Phi_k Y_{t-p} + e_t,$$

We estimate a bivariate model with exogenous controls. The lag-length of the VAR is chosen by looking at the AIC, SBIC, and the likelihood ratio for various choices of *p*. We find that two lags provide the best fit for comparing our real estate sentiment measures, while one lag is deemed appropriate for our comparison of real estate and stock market sentiment. Our direct measure of real estate investor sentiment, *DRES*, is the first principal component extracted from investment condition survey responses pertaining to eight property types that are published quarterly by the Real Estate Research Corporation (RERC) in the *Real Estate Report*. Our indirect measure of real estate investor sentiment, *INDRES*, is the first principal component extracted from seven underlying proxies of investor sentiment in commercial real estate markets: (i) the industry-wide REIT price premium to net asset value, (ii) the percentage of properties sold from the NCREIF Property Index, (iii) the number of REIT IPOs, (iv) the average first-day returns on REIT IPOs, (v) the share of net REIT equity issues in total net REIT equity and debt issues, (vi) commercial mortgage flows as a percentage of GDP, and (vii) capital flows to dedicated REIT mutual funds. Our indirect measure of stock market sentiment, *INDSMS*, is the first principal component extracted from six underlying proxies of investor sentiment in the stock market: (i) the average difference between the net asset values of closed-end fund stock shares and their market prices, (ii) share turnover on the NYSE, (iii) the number of IPOs, (iv) the average first-day returns on IPOs, (v) the share of equity issues in total equity and debt issues, and (vi) the dividend premium. The set of control variables includes the yield on the three-month Treasury bill, the slope of the Treasury term structure of interest rates, the spread between yields on BAA rated and AAA rated corporate bonds, inflation, the three Fama-French risk factors (MKT, SMB, and HML) and a return momentum factor (*UMD*). The sample period spans 1992:Q2-2008:Q4. P-values are reported in parentheses. ***, **, and * represent 1%, 5%, and 10% significance levels respectively.

	Direct and Indirect Real Estate Sentiment				Indirect Real Estate and Stock Market Sentiment			
	Sentiment in Levels		Sentiment in Changes		Sentiment in Levels		Sentiment in Changes	
Endog. Variables	*DRES*	*INDRES*	Δ*DRES*	Δ*INDRES*	*INDRES*	*INDSMS*	Δ*INDRES*	Δ*INDSMS*
Constant	1.098	0.447	0.957	-1.507	0.722	0.010	-1.252	-0.149
	(0.185)	(0.654)	(0.217)	(0.129)	(0.468)	(0.986)	(0.203)	(0.815)
$DRES_{t-1}$	0.447***	0.245	-0.420***	0.099	-	-	-	-
	(0.001)	(0.148)	(0.002)	(0.567)	-	-	-	-
$DRES_{t-2}$	0.303**	0.197	-0.010	0.143	-	-	-	-
	(0.032)	(0.246)	(0.945)	(0.416)	-	-	-	-
$INDRES_{t-1}$	0.058	0.372***	-0.006	-0.407***	0.625***	-0.080	-0.293**	0.045
	(0.626)	(0.010)	(0.958)	(0.003)	(0.000)	(0.224)	(0.020)	(0.583)
$INDRES_{t-2}$	-0.039	0.101	-0.087	-0.240*	-	-	-	-
	(0.710)	(0.426)	(0.389)	(0.064)	-	-	-	-
$INDSMS_{t-1}$	-	-	-	-	-0.106	0.543***	0.048	-0.179
	-	-	-	-	(0.554)	(0.000)	(0.799)	(0.144)
Adjusted R^2	0.70	0.56	0.14	0.04	0.53	0.60	0.03	-0.04

Table 7: VAR Results - Dynamic Relations between Returns and Direct Measure of Sentiment

This table presents results obtained from estimating our two unrestricted VAR models for the commercial real estate market. An unrestricted p^{th}-order Gaussian VAR model can be represented as:

$$Y_t = \mu + \Phi_1 Y_{t-1} + \Phi_2 Y_{t-2} + \ldots + \Phi_k Y_{t-p} + e_t,$$

We estimate two unrestricted VAR models: a bivariate model with and without exogenous controls. The lag-length of the VAR is chosen by looking at the AIC, SBIC, and the likelihood ratio for various choices of *p*. We find that two lags provide the best fit. Our direct measure of real estate investor sentiment, *DRES*, is the first principal component extracted from investment condition survey responses pertaining to eight property types that are published quarterly by the Real Estate Research Corporation (RERC) in the *Real Estate Report*. Our measure of returns in public commercial real estate markets, *REITRET,* is obtained from the CRSP/ZIMAN database. We use the value-weighted aggregate U.S. equity REIT index. Our measure of returns in private commercial real estate markets, *NPIRET*, is provided by the National Council of Real Estate Investment Fiduciaries (NCREIF). The NCREIF Property Index (NPI) tracks appraisal-based total return performance of a large pool of individual commercial real estate properties acquired in the private market for investment purposes only. Each property's quarterly return is weighted by its market value relative to the total market value of the properties that comprise the NPI Index. The set of control variables includes the yield on the three-month Treasury bill, the slope of the Treasury term structure of interest rates, the spread between yields on BAA rated and AAA rated corporate bonds, inflation, the three Fama-French risk factors (MKT, SMB, and HML) and a return momentum factor (*UMD*). The sample period spans 1992:Q2-2008:Q4. P-values are reported in parentheses. ***, **, and * represent 1%, 5%, and 10% significance levels respectively.

Panel A: Commercial Real Estate Returns Measured by Equity REIT Index

	Sentiment in Levels				*Sentiment in Changes*			
	Without Exogenous Control Variables		With Exogenous Control Variables		Without Exogenous Control Variables		With Exogenous Control Variables	
Endog. Variables	*REITRET*	*DRES*	*REITRET*	*DRES*	*REITRET*	*ΔDRES*	*REITRET*	*ΔDRES*
Constant	0.006	-0.077	0.020	1.005	0.007	-0.069	0.012	0.893
	(0.160)	(0.343)	(0.618)	(0.178)	(0.104)	(0.411)	(0.772)	(0.251)
$REITRET_{t-1}$	-0.129	-1.001	-0.060	-1.616	-0.164	-1.334	-0.112	-3.145
	(0.398)	(0.749)	(0.785)	(0.699)	(0.289)	(0.678)	(0.611)	(0.464)
$REITRET_{t-2}$	0.368**	4.006	0.445**	2.420	0.327**	3.454	0.416**	1.038
	(0.013)	(0.190)	(0.015)	(0.484)	(0.033)	(0.276)	(0.020)	(0.766)
$DRES_{t-1}$	0.013**	0.657***	0.008	0.485***	0.016**	-0.295**	0.013*	-0.392***
	(0.034)	(0.000)	(0.237)	(0.000)	(0.018)	(0.038)	(0.072)	(0.004)
$DRES_{t-2}$	-0.011*	0.314**	-0.009	0.280**	0.009	0.075	0.008	-0.007
	(0.092)	(0.018)	(0.213)	(0.036)	(0.203)	(0.602)	(0.268)	(0.959)
Adjusted R^2	0.08	0.68	0.02	0.71	0.09	0.09	0.04	0.14

Table 7, continued

Panel B: Commercial Real Estate Returns Measured by NCREIF NPI Index

	Sentiment in Levels				Sentiment in Changes			
	Without Exogenous Control Variables		With Exogenous Control Variables		Without Exogenous Control Variables		With Exogenous Control Variables	
Endog. Variables	*NPIRET*	*DRES*	*NPIRET*	*DRES*	*NPIRET*	*ΔDRES*	*NPIRET*	*ΔDRES*
Constant	0.000	-0.076	-0.004	0.173	0.000	-0.050	-0.004	0.768
	(0.894)	(0.599)	(0.884)	(0.876)	(0.886)	(0.730)	(0.850)	(0.505)
$NPIRET_{t-1}$	0.552***	12.572	0.498***	8.009	0.603***	11.364	0.512***	4.364
	(0.003)	(0.112)	(0.005)	(0.310)	(0.001)	(0.144)	(0.002)	(0.586)
$NPIRET_{t-2}$	0.368**	-11.389	0.735***	1.607	0.389**	-11.296	0.678***	-2.312
	(0.035)	(0.132)	(0.000)	(0.853)	(0.027)	(0.147)	(0.000)	(0.800)
$DRES_{t-1}$	0.008***	0.633***	0.006**	0.447***	0.010***	-0.315**	0.007***	-0.418***
	(0.004)	(0.000)	(0.040)	(0.001)	(0.001)	(0.018)	(0.009)	(0.002)
$DRES_{t-2}$	-0.004	0.331**	-0.004	0.265**	0.006**	0.077	0.003	-0.025
	(0.209)	(0.011)	(0.224)	(0.048)	(0.042)	(0.575)	(0.313)	(0.855)
Adjusted R^2	0.56	0.68	0.62	0.71	0.54	0.10	0.62	0.13

Table 8: VAR Results - Dynamic Relations between Returns and Indirect Measure of Sentiment

This table presents results obtained from estimating our two unrestricted VAR models for the commercial real estate market. An unrestricted p^{th}-order Gaussian VAR model can be represented as:

$$Y_t = \mu + \Phi_1 Y_{t-1} + \Phi_2 Y_{t-2} + \ldots + \Phi_k Y_{t-p} + e_t,$$

We estimate two unrestricted VAR models: a bivariate model with and without exogenous controls. The lag-length of the VAR is chosen by looking at the AIC, SBIC, and the likelihood ratio for various choices of *p*. We find that two lags provide the best fit. Our indirect measure of real estate investor sentiment, *INDRES*, is the first principal component extracted from seven underlying proxies of investor sentiment in commercial real estate markets: (i) the REIT price premium to net asset value, (ii) the percentage of properties sold from the NCREIF Property Index, (iii) the number of REIT IPOs, (iv) the average first-day returns on REIT IPOs, (v) the share of net REIT equity issues in total net REIT equity and debt issues, (vi) commercial mortgage flows as a percentage of GDP, and (vii) capital flows to dedicated REIT mutual funds. Our measure of returns in public commercial real estate markets, *REITRET*, is obtained from the CRSP/ZIMAN database. We use the value-weighted aggregate U.S. equity REIT index. Our measure of returns in private commercial real estate markets, *NPIRET*, is provided by the National Council of Real Estate Investment Fiduciaries (NCREIF). The NCREIF Property Index (NPI) tracks appraisal-based total return performance of a large pool of individual commercial real estate properties acquired in the private market for investment purposes only. Each property's quarterly return is weighted by its market value relative to the total market value of the properties that comprise the NPI Index. The set of control variables includes the yield on the three-month Treasury bill, the slope of the Treasury term structure of interest rates, the spread between yields on BAA rated and AAA rated corporate bonds, inflation, the three Fama-French risk factors (MKT, SMB, and HML) and a return momentum factor (*UMD*). The sample period spans 1992:Q2-2008:Q4. P-values are reported in parentheses. ***, **, and * represent 1%, 5%, and 10% significance levels respectively.

Panel A: Commercial Real Estate Returns Measured by Equity REIT Index

	Sentiment in Levels				Sentiment in Changes			
	Without Exogenous Control Variables		With Exogenous Control Variables		Without Exogenous Control Variables		With Exogenous Control Variables	
Endog. Variables	*REITRET*	*INDRES*	*REITRET*	*INDRES*	*REITRET*	*ΔINDRES*	*REITRET*	*ΔINDRES*
Constant	0.007	-0.070	0.058	0.130	0.005	-0.004	0.024	-1.437
	(0.111)	(0.493)	(0.157)	(0.897)	(0.230)	(0.491)	(0.537)	(0.147)
$REITRET_{t-1}$	-0.219	4.235	-0.125	6.075	0.005	2.908	-0.162	5.108
	(0.246)	(0.359)	(0.591)	(0.281)	(0.310)	(0.541)	(0.503)	(0.400)
$REITRET_{t-2}$	0.358**	2.194	0.618***	3.284	0.454**	2.021	0.554***	2.530
	(0.029)	(0.584)	(0.001)	(0.477)	(0.016)	(0.671)	(0.010)	(0.638)
$INDRES_{t-1}$	0.009	0.530***	0.005	0.430***	0.008	-0.392**	0.009	-0.448***
	(0.135)	(0.001)	(0.414)	(0.005)	(0.223)	(0.012)	(0.155)	(0.004)
$INDRES_{t-2}$	-0.008	0.230	-0.014**	0.173	-0.004	-0.189	-0.004	-0.270*
	(0.170)	(0.124)	(0.018)	(0.240)	(0.438)	(0.236)	(0.533)	(0.081)
Adjusted R^2	0.05	0.52	0.08	0.54	0.05	0.05	0.04	0.04

Table 8, continued

Panel B: Commercial Real Estate Returns Measured by NCREIF NPI Index

	Sentiment in Levels				Sentiment in Changes			
	Without Exogenous Control Variables		With Exogenous Control Variables		Without Exogenous Control Variables		With Exogenous Control Variables	
Endog. Variables	*NPIRET*	*INDRES*	*NPIRET*	*INDRES*	*NPIRET*	Δ*INDRES*	*NPIRET*	Δ*INDRES*
Constant	0.000	0.321*	-0.007	-0.354	-0.002	0.002***	-0.002	0.063
	(0.934)	(0.055)	(0.763)	(0.793)	(0.680)	(0.010)	(0.931)	(0.964)
$NPIRET_{t-1}$	0.323*	-12.985	0.377**	-10.599	0.590***	-20.325**	0.452**	-24.131**
	(0.086)	(0.193)	(0.038)	(0.292)	(0.003)	(0.030)	(0.011)	(0.018)
$NPIRET_{t-2}$	0.602***	-0.667	0.837***	15.906	0.436**	0.969	0.811***	10.607
	(0.001)	(0.945)	(0.000)	(0.163)	(0.030)	(0.920)	(0.000)	(0.363)
$INDRES_{t-1}$	0.006**	0.626***	0.005**	0.557***	0.003	-0.395***	0.004*	-0.376***
	(0.011)	(0.000)	(0.032)	(0.000)	(0.248)	(0.002)	(0.096)	(0.005)
$INDRES_{t-2}$	0.001	0.252*	-0.002	0.082	0.002	-0.253**	0.001	-0.298**
	(0.722)	(0.051)	(0.411)	(0.553)	(0.448)	(0.037)	(0.686)	(0.019)
Adjusted R^2	0.59	0.55	0.62	0.55	0.46	0.18	0.60	0.11

Table 9: Long-Horizon Regression Results

This table presents results for our long-horizon regressions. The long-horizon regression specification is as follows:

$$(r_{t+1} + \ldots + r_{t+k})/k = \alpha(k) + \theta(k)\, z_t + \beta(k)\, S_t + \varepsilon_t$$

where $r_{t+1} + \ldots + r_{t+k}$ are log returns, k is the number of quarters over which the particular horizon spans, α is the intercept term, z_t is the set of control variables, and S_t is our measure of investor sentiment in commercial real estate. The set of control variables includes the yield on the three-month Treasury bill, the slope of the Treasury term structure of interest rates, the spread between yields on BAA rated and AAA rated corporate bonds, inflation, the three Fama-French risk factors (MKT, SMB, and HML) and a return momentum factor (*UMD*). In Panel A, bias-adjusted coefficient estimates and their associated p-values utilize adjustments derived from the bootstrap simulation procedure documented in the Appendix. 10,000 bootstrap simulations were run for each long-horizon return series within each property type. Panel B reports the economic magnitude of a one standard deviation shock to sentiment using the bias-adjusted coefficient estimates reported in Panel A. The sample period spans 1992:Q2-2008:Q4. ***, **, and * represent 1%, 5%, and 10% significance levels respectively.

Panel A: Sentiment Coefficient Estimates and Statistical Significance

Sentiment Index:	*DRES*		*INDRES*	
Return Horizon	*REITRET*	*NPIRET*	*REITRET*	*NPIRET*
One-year	0.010*	0.014***	-0.007*	0.010***
	(0.096)	(0.000)	(0.067)	(0.000)
Two-year	-0.004	0.008***	-0.014***	0.003**
	(0.313)	(0.000)	(0.000)	(0.017)
Three-year	-0.008**	0.006***	-0.007***	0.004***
	(0.026)	(0.000)	(0.002)	(0.001)
Four-year	-0.008**	0.005***	-0.004**	0.003***
	(0.018)	(0.002)	(0.034)	(0.001)

Panel B: Economic Magnitude

Sentiment Index:	*DRES*		*INDRES*	
Return Horizon	*REITRET*	*NPIRET*	*REITRET*	*NPIRET*
One-year	0.038	0.055	-0.029	0.039
Two-year	-0.036	0.066	-0.111	0.027
Three-year	-0.097	0.076	-0.087	0.042
Four-year	-0.123	0.075	-0.072	0.056