Stock Market Mis-valuation and REITs: Evidence from a Decomposition of the Market-to-Book Ratio

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ABSTRACT

Using a method in existing literature to decompose stock market mis-valuation into short-run firm specific mispricing, short-run sector-wide error, and long-run value-to-book -, this study investigates the characteristics of the mis-valuation components of REITs. It's found that short-run mis-valuation of REITs is dominated by sector-wide mispricing. The size of firm-specific mis-valuation is relatively small with a mean (median) of only one percent (seven percent) over the 17-year sample period. Long-run value mis-valuation exceeds fifty percent of the annual total mis-valuation and investors persistently overvalue the component. Regarding the factors affecting REIT mis-valuation, it's found that firm-specific and sector-wide mis-pricings are not explainable by asymmetric information arguments. Instead, the results suggest that the short-run mis-valuation components of REITs are related to irrational behavior and extrapolation errors of investors. In sharp contrast, the long-run value mis-valuation component is explainable by asymmetric information arguments but unrelated to irrational investor behavior.

Keywords: Mis-valuation, Decomposition of M/B, Irrational investor behavior, Asymmetric Information, Investor sentiment

INTRODUCTION

Stock-price mis-valuation is a common phenomenon in the stock market. Sometimes, the mispricing of common stocks is so widespread and severe that regulators have to voice their concerns. For example, concerns about a significant market mis-valuation were expressed by Alan Greenspan, in his December 5, 1996 speech when he raised the possibility that the stock market was displaying "irrational exuberance". Stock market mis-valuation is a major concern to regulators and investors because of the potential contagion effect once a bubble implodes. Researchers are also concerned because stock mis-valuation could have significant impacts on corporate behavior. Jensen (2005) suggests that overvalued equity could lead to dysfunctional managerial behavior. Lehn and Poulsen (1989) find that undervalued firms choose to go private and remove corporate resources from public scrutiny. Evidence has also been found that stock market mis-valuation frequently occurs in waves that are associated with clustered financing and takeover activities.

Researchers have posited that the mis-valuation of common equities is consisted of components reflecting short-run irrational mispricing and the effects of adverse selection and growth options (Martin 1996; Rhodes-Kropf and Viswanathan 2004; Rhodes-Kropf, Robinson, and Viswanathan (RKRV) 2005; Elliott et al. 2008; Baker and Wurgler 2003). Some researchers have also reported that the various components of market mis-valuation could be used to infer motives for equity offerings and mergers and acquisitions (Hertzel and Li 2010; RKRV 2005). Surprisingly, studying the characteristics of the components of stock mis-valuation has received scant attention in the literature. RKRV (2005) and Elliott et al. (2008) are the only published research on this topic and they investigate general equities in their studies.

In this study, the components of stock market mis-valuation of the common stocks of Real Estate Investment Trusts (REITs) are examined. It's motivational to perform this investigation because many researchers have voiced concerns about difficulties in valuing REITs (Roulac 1988; Scott 1990; Ling and Ryngaert 1997; Chui et al. 2003). From a practical viewpoint, understanding the mis-valuation of REITs is also important as REITs have become more and more important in today's investment arena. According to the statistics of the National Association of Real Estate Investment Trusts, the industry has grown from 119 REITs (58 Equity REITs) with a market capitalization of $8.7 ($5.6) billion in 1990, to 153 REITs (120 Equity REITs) with a capitalization of $389 ($358.9) billion by the end of 2010, a 29% (107%) increase in the number of REITs (Equity REITs) and a stunning 4371% (6309%) increase in capitalization. Since 1993, the mean institutional ownership of all REIT equities has exceeded that of all common stocks and the average institutional ownership of REIT stocks surpassed 40% in 1996 (Chan et al. 2003).

For the investigation, a methodology developed in RKRV (2005) to examine the mis-valuation of REITs is utilized. The focus has been placed on the market-to-book ratio given that the ratio is frequently by researchers to explain REIT returns and firm characteristics. According to RKRV, the market-to-book ratio can be decomposed into three mis-valuation components: short-run firm-specific mispricing, time-series sector error, and long-run value-to-book. The first component represents short-run firm-specific irrational mispricing, the second is short-run sector-wide mispricing, and the last component measures the mis-valuation of growth options.

The results show a number of interesting findings. First, the results show that the short-run mis-valuation of REITs is primarily dominated by sector-wide errors. Sector-wide mis-valuation fluctuates considerably over time as if it were tied to the cyclical nature of the real

estate industry. On average, firm-specific mis-valuation is small with a mean (median) of one percent (seven percent) over a 17-year sample period. The long-run value mis-valuation component of REITs has an annual amount that frequently exceeds 50% of the total mis-valuation and investors persistently overvalue the component. Second, it's found that firm-specific and sector-wide mis-valuations of REITs are not explainable by asymmetric information arguments. Instead, the two short-run mispricing components are related to firm-specific characteristics that may enhance irrational behavior and extrapolation errors of investors. Third, asymmetric information arguments work in explaining the mis-valuation of long-run growth options of REITs. The mis-valuation of the long-run value-to-book of REITs is found to be negatively related to the amount of information available but unrelated to irrational behavior and extrapolation errors of investors in cross-sectional regressions. Fourth, in identifying the factors affecting irrational behavior and extrapolation errors of investors as coming from three sources of investor sentiment: firm-specific, industry-specific, and the general stock market; the results show that the short-run mis-valuation of REITs is dominated by investor sentiments that come from the industry and/or the general stock market. However, the mis-valuation of the long-run value of REITs is unaffected by investor sentiment. Finally, the mis-valuation of value REITs is found to be more related to irrational behavior and extrapolation errors of investors than the mis-valuation of growth REITs.

The study contributes to the real estate literature in several ways. First, the study is the first to present a detailed analysis of the characteristics of the mis-valuation of REITs. By showing that the short-run mis-valuation of REITs is dominated by sector-wide mispricing instead of firm-specific mispricing and that investors persistently overvalue long-term growth options, the findings have important implications for formulating REIT investment strategies. Second, the analysis of the characteristics of the three mis-valuation components of REITs provides information to address concerns raised by researchers regarding difficulties in valuing REITs. Third, the results show that the theories of behavioral finance represent an important part in the understanding of REIT valuation. The findings supplement the results of Ooi et al. (2007) and Lin, Rahman, and Yung (2009) that extrapolation errors and investor sentiment are important in the valuation of REITs. Finally, the investigation is also related to studies that examine the cross-sectional determinants of REIT stock returns (Karolyi and Sanders 1998; Liu and Mei 1992; Peterson and Hsieh 1997; Chui, Titman and Wei 2003; Wang et al., 1995).
The remainder of the paper is organized as follows: Section II offers explanations why REITs are chosen for studying the components of stock price mis-valuation. Section III discusses the methodology and formulates the models. Section IV describes the sample and gives the descriptive statistics. Section V reports the results and Section VI concludes.

WHY REITS

Various researchers have used REITs as a natural laboratory to test financial theories because of their unique regulatory environment. Similarly, REITs constitute an excellent target for investigating the components of stock market mis-valuation because of their industry-specific characteristics.

There are two major types of REITs: an equity REIT invests in income-producing real estate assets; a mortgage REIT invests in mortgage debt used to finance real property. The relatively stable nature of the investment return may make mis-valuation problems related to asymmetric information less severe among REITs (Boudry, Kallberg, and Liu 2010). In addition,

a major advantage using REITs for analyzing the components of REIT mis-valuation is the transparency of the underlying real asset market since the underlying assets are traded in an active primary market. Moreover, REITs are a relatively large and homogeneous industry group. By holding the asset class constant, the superfluous factors affecting REIT misevaluation can be eliminated.

The second reason for using REITs to study mis-valuation components is the likelihood of a significantly smaller amount of free cash flow related problems. REITs are required to pay out at least 90% of the taxable income as dividends. The required dividend payout helps control for the free cash flow incentives among REITs (Ghosh et al 2010 REE). Thus, stock market mis-valuation that is associated with the effect of adverse selection costs might be less significant in the REIT industry. Hartzell, Kallberg, and Liu (2005) suggest that the REIT industry is an industry where the problems of managerial self-interest and asymmetry information might be mitigated due to the transparency of the underlying real asset market and constraints on managerial discretion.

Finally, the significant growth of the REIT industry since 1990s has made the valuation of REITs more difficult. In the 1990s, the REIT industry expanded substantially as a result of the passage of the Tax Reform Act of 1986. The Act eliminated passive investor constraints and allowed REITs to manage their own properties. Along with the increased number of REITs, there were major changes in the REIT industry, which included changes in management style, changes in ownership structure, and increased flow of information and the evolution of the umbrella partnership REIT (UPREIT) structure. REITs in the post-1990 period are more actively managed, which has also likely made them more difficult to value (Chui, Titman, and Wei 2003; Ling and Ryngaert 1997). Thus, structural changes in the REIT industry since 1990s have presented good opportunities to study stock mis-valuation and at the same time have made the understanding of REIT mis-valuation more urgent.

METHODOLOGY

Measuring Stock Market Mis-valuation Components

Stock mis-valuation could be due to inadequate information (asymmetric information) for correctly estimating the cash flows or discount rate; or caused by investors' irrational pricing as they overreact or under react to corporate news (Harrison and Stein 1999; Lakonishok, Shleifer, and Vishny 1994). In addition, stock market mis-valuation has also been linked to investor sentiment in the literature of behavioral finance (Lee, Shleifer, and is ample evidence that earnings management is commonly practiced among business firms. In addition, the fact that P/E is not as strong a predictor of month-ahead stock returns as market-to-book also implies that P/E is not an accurate measure of mispricing (Fama and French, 1996).

The price to residual income (P/V) ratio has been used by several authors for measuring mis-valuation (Framkel and Lee 1998; Lee, Myers, and Swaminathan 1999; Ali, Hwang, and Trombley 2003). In contrast with the M/B ratio, the estimate of residual income value (V) contains forward-looking information such as analysts' forecasts of future earnings. As indicated by Dong et al. (2006), the P/V ratio filters out the extraneous information about growth and managerial agency problems more than the M/B ratio. Unfortunately, this makes the P/V ratio less informative for the investigation of the characteristics of the mis-valuation components of REITs.

In this study, the market-to-book (M/B) ratio is used to measure the mis-valuation of REITs. The focus has been placed on the M/B ratio to study REIT mis-valuation because the ratio has been frequently used by researchers to explain REIT returns and other REIT related firm characteristics (Friday, Sirmans, and Conover 1999; Chui, Titman, and Wei 2003; Ooi, Webb, and Zhou 2007; Ooi, Wang, and Webb 2009). In addition, the M/B ratio has been used as a mispricing proxy by many researchers in the literature of finance. For example, Barberis and Huang (2001) and Daniel, Hirshleifer, and Subrahmanyam (2001) develop psychological-based models suggesting that M/B can act as a proxy for mis-valuation. Rhodes-Kropf, Robinson, and Viswanathan (2005), Dong et al. (2006), and Ang and Cheng (2006) use M/B as a proxy for market mispricing in empirical investigations of the effect of mis-valuation on takeover activity. Baker and Wurgler (2002) use the M/B ratio as a proxy for mis-valuation in investigating the relation between market timing and financing decisions. A major drawback of using the M/B ratio to measure mis-valuation is the multiple interpretations of the ratio. Baker and Wurgler (2002) concede that their results are consistent with implications that M/B either reflects irrational market pricing or adverse selection costs. McConnell and Servaes (1995) and Stulz (1990) show that M/B could be used to measure growth options of firms.

Recognizing the problems in using M/B to measure mis-valuation, RKRV (2005) decompose the market-to-book ratio into three components. The decomposition equations are as follows:

(1) $M/B = M/V * V/B$

where B is the book value of equity, M is the market value of equity and V is the fundamental value of equity. RKRV interpret the first component (M/V) as a measure of mispricing by the market and the second component (V/B) as a measure of growth opportunities.

In logarithmic form:

(2) $Log(M/B) = Log(M/V) + Log(V/B)$

Using lowercase letters to denote values expressed in logs, the equation is written as

(3) $m - b = (m - v) + (v - b)$

According to RKRV, M/V could be further decomposed into two elements: one mispricing component that is firm-specific; and another component that is shared by all firms in a given sector or market. That is,

(4) $m - b = (m\text{-}v1) + (v1\text{-}v2) + (v2\text{-}b)$

where *m* and *b* are market and book values of shares in logarithmic forms respectively. The first component, $(m - v_1)$, is the difference between market value and the fundamental value implied by industry averages at time t. This component measures firm-specific pricing deviations from short-run industry pricing, and it exists when the firm is experiencing short-run irrational mispricing in the market. The second component, $(v_1 - v_2)$, is the difference between the firm's fundamental value implied by industry averages at time t and the firm's fundamental value implied by long-run industry averages. This sector-wide mispricing component arises when contemporaneous multiples differ from long-run multiples. The component captures the possibility that an industry could be overvalued or undervalued in short-run and firms in the industry could share a common mis-valuation component. The third mispricing component, $(v_2 - b)$, is the difference between the firm's fundamental value implied by long-run industry averages and the book value of the firm. According to RKRV, the third component captures long-run growth opportunities of the firm.

RKRV use 3 different models to estimate v1 and v2. The models differ only with respect to the accounting items that are included for the estimation. For brevity, the full model used by

RKRV is reported which includes book value (b), net income (NI), and market leverage (LEV) in the estimation.

(5) $m_{it} = \alpha_{0jt} + \alpha_{1jt}b_{it} + \alpha_{2jt}\ln(NI)^{+}_{it} + \alpha_{3jt}I_{(<0)}\ln(NI)^{+}_{it} + \alpha_{4jt}LEV_{it} + \varepsilon_{it}$

In the model, net income is expressed as an absolute value $(NI)^{+}$ because it can be negative sometimes. A dummy variable, $I_{(<0)}$, is added to indicate when net income is negative. To calculate the short-run contemporaneous industry average multiples, α_{jt}, each year all the sampled REIT firms are placed in groups and then the annual cross-sectional regressions are run by using equation 5 to generate estimated industry multiples. The industry multiples, α_{jt}, are then used to compute the short-run fundamental value (v1) of each REIT in year t. To calculate the long-run industry multiples, α_{j}, the short-run yearly estimates (α_{jt}) from the annual regressions are averaged out over the sample period. Then the long-run industry multiples are used to compute the long-run fundamental value (v2) of each REIT.

The Regression model on the relation between Mis-valuation and REIT characteristics

The relation between mis-valuation components and firm characteristics of REITs is analyzed by using the following regression model:

(6) Mis-valuation = $\alpha + \beta_1$.Firm Size + β_2.Analyst Coverage + β_3.Institutional Ownership + β_4.Share Price + β_5.Leverage + β_6.Turnover + β_7.Momentum + β_8.Alpha + β_9.Sentiment_Firm + β_{10}.Sentiment_Industry + β_{11}.Sentiment_Market + ε

where the dependent variable is the respective mis-valuation component. The independent variables in the model basically fall into two categories: one for proxies of information asymmetry; the other for factors that have been associated with irrational investor behavior. Admittedly, the three mis-valuation components could be affected by both rational and irrational factors. One of the objectives in this study is to determine whether rational or irrational factors exert a larger influence on REIT mis-valuation. An understanding of the determinants of each type of mis-valuation component may help formulate better REIT investment strategies. Among the typical proxies of information asymmetry, analyst coverage, firm size, institutional ownership, and share price are included in the model. Analyst coverage is the measured as log(1+ number of analysts). Firm size is log(Total Assets). Institutional Ownership (INST) is the percentage of common shares held by institutional investors. Share price (PRC) is measured as log(PRC). Share price has been used as a proxy capturing a stock's visibility (Chordia, Huh, and Subrahmanyam 2006; Falkenstein 1996). It has been argued that stocks with higher share prices have higher visibilities in the stock market and attract investors to seek out information about the stocks. Leverage is computed as total debt divided by total assets. A higher leverage implies higher levels of market monitoring and thus more information available. On the other hand, leverage could also be interpreted as a control variable because investors have more differences of opinions as the firm becomes riskier (Chorida et al 2006). If mis-valuation is driven by information asymmetry and adverse selection problems, it's expected that the regression coefficients on the proxies of asymmetric information be negative. That is, a lower level of mis-valuation results when more information is available.

Regarding the independent variables representing irrational investor behavior in valuation, the focus is placed on proxies of investor sentiment given that investor sentiment has frequently been associated with the over-eaction and under-reaction of investors. For the sample, it's believed that investor sentiment might come from three different sources. The first one is firm-specific characteristics that might cause investors to make irrational judgments. For this

firm level investor sentiment (Sentiment_Firm), several proxies are used including turnover, momentum, and alpha. Turnover is the ratio of the number of shares traded to the shares outstanding. The average one-month lagged turnover ratio is used in the model. A high turnover is an indication of investor overconfidence (Gervais and Odean 2001; Statman, Thorley, and Vorkink 2006). Momentum is measured by the raw return over the past six months. There is empirical evidence that investors make extrapolation errors when trading on past return patterns (Lakonishok, Shleifer, and Vishny 1994; Ooi, Webb, and Zhou 2007). Alpha is the regression intercept in the Fama-French three factors asset pricing model. The high alpha of a REIT is an indication of the superior performance of the trust manager. High alpha is thus a firm-specific characteristic that may enhance extrapolation errors as investors chase after the hot hands in the REIT industry. The second source of investor sentiment comes from the general stock market. To measure the general market investor sentiment (Sentiment_Market), the proxies available on the website of Jeffrey Wurgler are used. Keeping the same acronyms used by Baker and Wurgler (2006), the proxies that have been used alternately include SENT, SENT_OLD, NIPO, RIPO, and CEFD. For brevity purpose, the result is reported by using only SENT_OLD since all proxies produced results that are generally consistent. Finally, another source of investor sentiment could be industry specific. Three proxies are used alternately to measure REIT industry-specific investor sentiment (Sentiment_Industry), namely, the natural log of housing starts, the natural log of the Case-Shiller house price index, and the natural log of capital flows to the REIT industry (measured as the total amount invested in initial public offerings and seasoned equity offerings). Again, for brevity, only the result using the natural log of capital flows to the REIT industry is reported as all the three proxies give consistent results.

SAMPLE

The investigation focuses on equity REITs (EREITs) in this study. The sample of equity REITs is collected from the Center for Research in Security Prices (CRSP) database over the period between 1990 and 2006. All the EREITs in the sample have issued ordinary common shares as defined in CRSP. The sample was verified by using different sources of information. For the period between 1990 and 1996, the membership list published in the annual REIT Fact Book of the NAREIT Association is used. Information about EREITs after July 1997 is obtained from the website of NAREIT. The annual sample size ranges from 60 in 1990 to 173 in 2006.

RESULTS

Before presenting the empirical results, two graphs are plotted in order to get a general idea of the pattern of the mis-valuation of REITs. In Figure 1, the relationship between REIT mis-valuation, general stock market returns, REIT returns, and the general stock market investor sentiment is examined. Except for a short time period between 1999 and 2000, Figure 1 shows that in general, returns on general equities and REITs are positively related to the general stock market investor sentiment. That is, stock returns and REIT returns move up (down) when investors become optimistic (pessimistic). Figure 1 also shows that since 1992 the mis-valuation of REITs shows movements that are positively correlated with investor sentiment. However, between 2001 and 2006 the mis-valuation of REITs increased at a relatively higher speed. REIT mis-valuation reached its highest level in 2006 during the sample period.

Figure 2 shows the movements of the three REIT mis-valuation components. Several interesting patterns are observed. First, REIT firm-specific mis-valuation is small and relatively stable throughout the sample period. In Figure 2, it is observed that the mis-valuation of REITs is significantly related to short-run sector-wide (industry-specific) errors. In other words, investors wrongly appraise the value of the entire industry more often than the values of individual firms. The sector-wide mis-valuation component has large negative values in the early 1990s and the period between 1998 and 2001, and it has a large positive bias between 2003 and 2006. Regarding the mis-valuation of the long-run value-to-book of REITs, Figure 2 shows that investors have consistently overvalued the growth opportunities of REITs throughout the sample period. As suggested by Chui et al. (2003) and Ling and Ryngaert (1997), one of the reasons that REITs in the post-1990 period are more difficult to value is due to the growth opportunities available as REITs gain the flexibility in managing their assets.

In Table 1 , selected basic descriptive statistics of the mis-valuation components by year are reported. Firm-specific mis-valuation is small relative to the other components of mis-valuation. For the entire sample period, firm-specific mis-valuation has an overall mean (median) of only one percent (seven percent) of the total mis-valuation. On an annual basis, firm-specific mis-valuation is small in size relative to the other two mis-valuation components. On the other hand, sector-wide mis-valuation of REITs is large relative to the firm-specific mis-valuation component. The overall mean of 0.02 is almost seven times larger than that of the firm-specific mis-valuation component. Sector-wide mis-valuation fluctuates quite significantly on an annual basis. An interesting observation is that sector-wide mis-valuation shows extended periods of negative values and positive values alternately throughout the sample period. The pattern suggests that sector-wide mis-valuation of REITs might be related to the cyclical nature of the real estate industry. For example, between 2003 and 2006, sector-wide mis-valuation has increased significantly and this time period coincides with an enormous boom in the real estate industry. Another interesting result in Table 1 is that investors have consistently overvalued the long-run value-to-book (growth opportunities) mispricing component of REITs. The annual amount of the long-run value mis-valuation component is consistently positive and large. Despite Chui et al. (2003) and Ooi et al. (2007) suggest that behavioral factors such as overreaction and extrapolation errors are associated with REIT returns; the real estate literature has not yet offered a hypothesis that can explain the persistent optimism of investors' mis-valuation of the growth opportunities of REITs.

To examine the relation between REIT mis-valuation components and firm-specific characteristics, each year for each mis-valuation component, the REITs sample has been divided into quintiles by the size of the mis-valuation, the average of each selected firm-specific variable in each quintile over the sample period is then reported in Table 2. Panel A of Table 2 reports firm characteristics of REITs sorted by the firm-specific mis-valuation component. REITs with high firm-specific mis-valuation (Q5) have significantly higher levels of total assets than those with low firm-specific mis-valuation (Q1). In addition, REITs with high firm-specific mis-valuation on average have higher levels of analyst coverage, institutional ownership, leverage, and share price than REITs with low firm-specific mis-valuation component. This finding is surprising given that firm size, analyst coverage, institutional ownership, leverage, and share price are proxies of asymmetric information. The finding, however, is consistent with implications that REIT investors might respond irrationally when overwhelmed by information in the short-run. That is, short-run firm-specific mis-valuation of REITs might be more related to and explainable by irrational behavioral factors rather than asymmetric information hypotheses.

The conjecture is supported by the significantly higher values of MB, NI, momentum, and alpha among the REITs in Q5. Firms with high MB and NI are likely to have higher levels of extrapolation errors as investors react optimistically and overestimate future growth rates (Lakonishok, Shleifer, and Vishny 1994). The significantly higher stock return momentum and alpha among REITs with higher levels of firm-specific mis-valuation also suggests a higher likelihood of extrapolation errors among the REITs investors as they overreact to the past performance.

Panel B of Table 2 reports firm characteristics of REITs sorted by the sector-wide mis-valuation component. The results show that REITs in Q5 and Q1 are similar in terms of total assets, analyst coverage, institutional ownership, leverage, and share price. That is, sector-wide mis-valuation is not affected by the amount of firm-specific information available. In addition, REITs with high sector-wide mis-valuation have significantly higher median values of MB and turnover than REITs with low sector-wide mis-valuation. Thus, the result in panel B suggests that sector-wide mis-valuation of REITs is not explainable by asymmetric information arguments but affected by some factors related to irrational behavior among investors.

The relation between firm characteristics of REITs and the long-run value mis-valuation component is reported in panel C of Table 2. With the exception of leverage, REITs that have higher levels of long-run value-to-book mis-valuation (Q5) have significantly lower firm size, analyst coverage, institutional ownership, and share price. The result implies that REITs have higher levels of long-run value mispricing when less information is available. The finding is in sharp contrast to those of the firm-specific and sector-wide mis-valuation components. This observation suggests that investors are helped by more information when deciding the long-run value of a REIT. Regarding the variables related to the behavioral aspects of investors, REITs in Q5 have a higher MB, momentum, and alpha but a lower NI and turnover. The inconsistent impacts of these several variables on the mis-valuation of long-run growth opportunities of REITs suggest that REITs investors do not blindly overreact in valuing the long-run growth options of REITs.

In sum, the univariate analysis reported in Table 2 suggests that short-run firm-specific and sector-wide mis-valuations are not explainable by asymmetric information arguments. Instead, they are related to firm-specific characteristics that may enhance irrational behavior and extrapolation errors among investors. In contrast, the long-run mis-valuation component is explainable by asymmetric information arguments but is inconsistently related to firm characteristics that may enhance irrational investor behavior.

In Table 3, multivariate regression results on the relation between mis-valuation and firm characteristics are reported. Model I uses the Fama-Macbeth regression approach to account for correlations among residuals. Model II uses a two dimensional clustered standard errors approach in which the estimation is clustered by year and by firm. All the regression models have a reasonably high explanatory power with an adjusted R-squared ranging from 0.29 to 0.79.

For the firm-specific mis-valuation regressions in Table 3, the significantly positive coefficients on analyst coverage, leverage, and share price indicate that more information does not lead to a smaller amount of firm-specific mis-valuation. This observation is consistent with the result of the univariate analysis in panel A of Table 2. While the theoretical literature typically postulates a negative relation between the amount of information and the size of mis-valuation; the positive regression coefficients on analyst coverage, leverage, and share price suggest that investors overreact to information and make extrapolation errors when more information is available. The coefficients on Momentum in model I and Alpha in model II are

significantly positive; the result supports that short-run firm-specific mis-valuation of REITs is likely related to firm characteristics that may enhance irrational behavior and extrapolation errors among investors. For the sector-wide mis-valuation component, none of the coefficient is significant in model I. In model II, with the exception of firm size, the coefficients on analyst coverage, institutional ownership, leverage, and share price are all positively significant at the one percent level. That is, similar to the finding regarding firm-specific mis-valuation, the regression result suggests that short-run sector-wide mis-valuation is not explainable by asymmetric information arguments. In model II the coefficients on Momentum and Turnover are significantly positive at the one percent level; confirming that sector-wide mis-valuation is related to firm characteristics that may enhance irrational investor behavior and extrapolation errors. For the long-run value mis-valuation component, the coefficients on firm size, institutional ownership, and share price are significantly negative. This is in contrast to the findings on firm-specific and sector-wide mis-valuations; implying that investors are less likely to overvalue the growth options of REITs when more firm-specific information is available. For the long-run value mis-valuation, with the exception of the coefficient on Alpha in model II, the coefficients on all the irrational investor behavior and extrapolation errors related firm characteristics are insignificant in models I and II. The result is consistent with the implication that the long-run mis-valuation of REITs is mostly unrelated to irrational investor behavior.

The regressions reported in Table 3 have found some interesting results. The finding that more information is not associated with lower levels of short-run firm-specific and sector-wide mis-valuations suggests that asymmetric information arguments cannot effectively explain the short-run mispricing of REITs. Instead, the finding is consistent with explanations offered in behavioral finance that investors overreact when they are presented with more information (Barber and Odean, 2001). It is likely that the homogenous nature of the REIT industry makes intra-industry information transfers among REITs swift and widespread and which in turn causes investors to overreact in the short-run (Jacob and Zhang, 2008). A common form of overreaction to more information is that investors become overconfident and trade more frequently. Very often, overconfident investors tend to make mistakes in estimating asset values (Scheinkman and Xiong 2003; Statman, Thorley, and Vorlink 2006). On the other hand, the long-run mis-valuation of REITs is negatively related to the amount of information available but largely unrelated to extrapolation errors. That is, investors rely more on information and less on emotions in valuing the growth opportunities of REITs.

As stipulated earlier, the sentiment of REIT investors might come from three different sources: firm, industry, and the general stock market. The effect of firm-level investor sentiment is reported in Table 3. Table 4 reports results of cross-sectional regressions that include all the three sources of investor sentiment. For brevity, the industry-specific sentiment (Sentiment_Industry) proxy reported in Table 4 is log(capital flows to the REIT industry) and the stock market sentiment (Sentiment_Market) proxy reported is Sentiment_Old.

Similar to the regressions in Table 3, the models in Table 4 have a relatively high explanatory power with an adjusted R-squared ranging from 0.22 to 0.87. For the firm-specific mis-valuation component, only the coefficient on share price is significant and positive among all the proxies of information asymmetry. Similar to the findings in Table 3, the positive coefficient on share price suggests that more information does not necessarily result in a lower level of firm-specific mis-valuation. But unlike the findings in Table 3, the coefficients on firm-specific factors that may enhance extrapolation errors have become insignificant once the general stock market and industry-specific investor sentiment proxies are included. For the sector-wide

mis-valuation component, similar to the earlier results in Table 3, the coefficients on asymmetric information proxies such as analyst coverage, institutional ownership, and share price are positive and significant; again suggesting that asymmetric information arguments are incapable of explaining the mis-valuation component. The coefficients on firm-specific factors that may induce irrational investor behavior have also become insignificant once the general stock market and industry-specific investor sentiment proxies are included. In other words, industry related and the general stock market related investor sentiments dominate firm-specific investor sentiment. Regarding the long-run mis-valuation component, the coefficients on firm size and share price are significantly negative; implying that investors are less likely to overvalue the long-run value of a REIT when more information is available. This is consistent with the finding in Table 3. Among the firm-specific factors that are likely to enhance irrational investor behavior and extrapolation errors, only Momentum has a significant coefficient. The negative sign of the coefficient implies that REIT investors become more careful and adjust downward the mis-valuation of growth opportunities of a REIT after the shares of the REIT have enjoyed a large price run-up. The coefficients on Sentiment_Market and Sentiment_Industry are insignificant and they provide further support that investors are less likely affected by emotions when evaluating the long-run growth opportunities of REITs.

In sum, the cross-sectional regression results in Table 4 confirm that firm-specific and sector-wide mis-valuations of REITs are not explainable by asymmetric information arguments. The short-run mis-valuation components of REITs are dominated by industry-related and the general stock market related investor sentiments rather than firm-level investor-sentiment. On the other hand, the long-run value mis-valuation component is negatively related to the amount of information available and the component is unaffected by the various types of investor sentiments.

Robustness Tests: Value vs Growth

Ooi, Webb, and Zhou (2007) find that value REITs are affected by the naïve extrapolation expectations of investors whereas growth REITs are less likely affected. Thus, the sample is separated into growth REITs and value REITs to see if the earlier conclusions remain unchanged. Each year, the sample is divided into four groups by the market-to-book ratio, those in the top quartile are classified as growth REITs and those in the bottom quartile are considered value REITs. The portfolio is rebalanced each year. For brevity, only the results of the cross-sectional regressions are reported. The results of the Fama-Macbeth and clustered standard errors regressions for the two subsamples are similar and consistent.

In Table 5a, the regression results of the value REITs subsample are reported. Similar to the result of the whole sample in Table 4, firm-specific mis-valuation is not explainable by asymmetric information arguments given the positive significant coefficients on asymmetric information proxies such as institutional ownership and share price. Also similar to the result of the whole sample, the coefficients on Sentiment_Firm proxies are insignificant once Sentiment_Industry and Sentiment_Market are included as independent variables. The coefficient on Sentiment_Industry is significant at the one percent level. For the sector-wide mis-valuation component, the results are different from those of the whole sample in Table 4. The coefficients on all the asymmetric information proxies are insignificant. The results also show that the sector-wide mis-valuation of value REITs is positively and significantly related to all the three types of investor sentiment. This finding is consistent with Ooi, Webb, and Zhou (2007)

that value REITs are affected by the naïve extrapolation errors of investors. Finally, the long-run value mis-valuation component of value REITs also shows results that are slightly different from the whole sample. The coefficient on share price has turned positive and significant despite the coefficients on other asymmetric information proxies such as firm size and institutional ownership are negative and significant. Among the Sentiment_Firm proxies, Turnover has a positive and significant coefficient. The result suggests that investors sometimes behave irrationally and make mistakes regarding the long-run value of value REITs. In sum, value REITs exhibit mis-valuation characteristics that are only moderately similar to the whole sample. The major difference being that the sector-wide mis-valuation component is significantly related to all the three types of investor sentiment. Another difference is that the long-run value mis-valuation of value REITs is sometimes affected by firm-level investor sentiment. The two observations imply that value REITs are sensitive to irrational investor behavior and extrapolation errors.

Regression results of the growth REITs subsample are reported in Table 5b. Among the various asymmetric information proxies, only share price is positively and significantly related to the firm-specific mis-valuation of growth REITs. Consistent with the whole sample results in Table 4 and similar to the results of value REITs, the firm-specific mis-valuation of growth REITs is negatively related to Sentiment_Industry. For the sector-wide mis-valuation component, the influence of investor sentiment on growth REITs is not as strong as the influence on value REITs given that only the coefficient on Sentiment_Industry is significant. Growth REITs are more similar to the whole sample than value REITs regarding the behavior of the long-run value mis-valuation. For growth REITs, the long-run mis-valuation component is unrelated to the three types of investor sentiment. Thus, the overall result is consistent with the finding of Ooi et al. that growth REITs are less affected by irrational behavior and extrapolation errors of naïve investors.

SUMMARY AND CONCLUSIONS

In this study, the RKRV (2005) methodology is used to decompose the stock market mis-valuation of REITs into three components: short-run firm-specific mis-valuation, short-run sector-wide mispricing, and long-run value-to-book (growth opportunities) mis-valuation. It's found that the short-term mis-valuation of REITs is dominated by sector-wide errors. On the other hand, the long-run value mis-valuation of REITs exceeds 50% of the total mis-valuation in each year over the sample period from 1990 to 2006. The results show that investors persistently overvalue the long-run value-to-book of REITs. Regarding the characteristics of the mis-valuation components of REITs, it appears that firm-specific and sector-wide mis-valuations do not decline despite the degree of information asymmetry gets smaller. That is, the short-run mis-valuation of REITs is not explainable by asymmetric information arguments. Instead, the results suggest that the short-run mis-valuation of REITs is more affected by irrational investor behavior and extrapolation errors. A plausible explanation would be due to the homogeneous nature of the REIT industry, it makes intra-industry information transmission swift and widespread, and investors overreact to the information. The results also show that the long-run value mis-valuation component is negatively related to the amount of information available and is unaffected by irrational behavior and extrapolation errors of investors in general. In addition, the results suggest that the irrational behavior of REIT investors is affected by industry-related and the general stock market related investor sentiments instead of firm-level investor sentiment.

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Table 1 Basic Descriptive Statistics of REIT Misvaluation by Year and the type of Mispricing Component

	Firm-Specific Misvaluation			Sector-wide Misvaluation			Long-run Value (growth) Misvaluation			Total Misvaluation		
	Mean	Median	S.D.	Mean	Median	S.D.	Mean	Median	S.D.	Mean	Median	S.D.
1990	-0.000	-0.126	0.90	-0.55	-0.49	0.26	0.43	0.49	0.30	-0.12	-0.13	0.96
1991	0.036	-0.131	0.82	-0.35	-0.27	0.49	0.40	0.37	0.43	0.09	-0.03	1.03
1992	-0.017	0.073	0.85	-0.24	-0.13	0.35	0.28	0.31	0.32	0.02	0.24	1.01
1993	0.003	-0.037	0.86	0.10	0.14	0.28	0.23	0.29	0.39	0.33	0.39	0.83
1994	-0.003	-0.027	0.74	-0.08	-0.06	0.18	0.35	0.38	0.32	0.26	0.29	0.77
1995	0.003	0.008	0.63	-0.04	-0.04	0.14	0.38	0.43	0.29	0.34	0.39	0.67
1996	-0.014	-0.053	0.51	0.20	0.18	0.12	0.37	0.43	0.40	0.55	0.56	0.59
1997	-0.015	-0.069	0.46	0.15	0.11	0.18	0.40	0.44	0.31	0.53	0.47	0.44
1998	-0.003	-0.049	0.49	-0.15	-0.19	0.19	0.45	0.50	0.26	0.29	0.26	0.46
1999	-0.008	-0.031	0.45	-0.37	-0.39	0.14	0.54	0.55	0.29	0.16	0.13	0.50
2000	-0.008	-0.014	0.53	-0.36	-0.34	0.09	0.55	0.59	0.29	0.18	0.24	0.63
2001	-0.012	-0.059	0.55	-0.12	-0.13	0.14	0.44	0.54	0.38	0.31	0.35	0.60
2002	0.044	0.007	0.40	-0.13	-0.15	0.20	0.42	0.54	0.38	0.33	0.40	0.46
2003	0.005	-0.022	0.51	0.16	0.12	0.17	0.49	0.54	0.45	0.66	0.64	0.42
2004	0.002	-0.018	0.57	0.36	0.30	0.24	0.43	0.53	0.43	0.79	0.81	0.42
2005	0.025	-0.039	0.58	0.29	0.23	0.21	0.41	0.51	0.40	0.73	0.70	0.47

	Firm-specific Mis-valuation Q1 (Low)	Q2	Q3	Q4	Firm-specific Mis-valuation Q5 (High)	Q5 – Q1 t-statistic (p-value)
Log(TA)	5.52 (5.59)	6.18 (6.38)	6.51 (6.66)	6.74 (6.90)	6.88 (7.04)	12.74* (<0.0001)
Log (1+ANUM)	0.25 (0.0)	0.32 (0.0)	0.38 (0.0)	0.49 (0.0)	0.51 (0.0)	3.39* (<0.0001)
INST	0.24 (0.11)	0.34 (0.31)	0.44 (0.47)	0.47 (0.51)	0.43 (0.44)	8.80* (<0.0001)
Leverage	0.52 (0.55)	0.51 (0.56)	0.52 (0.55)	0.61 (0.63)	0.71 (0.74)	13.90* (<0.0001)
Share Price	13.79 (9.97)	19.03 (16.30)	23.14 (21.92)	23.59 (20.03)	26.68 (23.00)	8.66* (<0.0001)
MB	0.79 (0.76)	1.20 (1.18)	1.49 (1.43)	1.93 (1.84)	3.50 (2.95)	5.86* (<0.0001)
Net Income	8.77 (2.85)	32.03 (14.93)	48.00 (27.84)	72.64 (33.45)	76.85 (37.79)	10.13* (<0.0001)
Turnover	0.05 (0.04)	0.06 (0.05)	0.06 (0.06)	0.06 (0.06)	0.05 (0.05)	0.97 (0.1119)
Momentum	0.09 (0.05)	0.19 (0.22)	0.22 (0.20)	0.20 (0.19)	0.27 (0.18)	5.68* (<0.0001)
Alpha-FF3	-0.03 (0.0)	0.26 (0.22)	0.40 (0.39)	0.34 (0.34)	0.49 (0.46)	4.50* (<0.0001)

Table 2a. Firm-specific mis-valuation and REIT firm characteristics

Table 2b Sector-wide mis-valuation and REIT firm characteristics

	Sector-wide Mis-valuation Q1	Q2	Q3	Q4	Sector-wide Mis-valuation Q5	Q5 – Q1 t-statistic (p-value)
Log(TA)	6.08 (5.81)	6.38 (6.63)	6.52 (6.66)	6.51 (6.58)	6.31 (6.30)	1.56 (0.1202)
Log (1+ANUM)	0.38 (0.0)	0.39 (0.0)	0.40 (0.0)	0.36 (0.0)	0.41 (0.0)	1.25 (0.3635)
INST	0.32 (0.19)	0.37 (0.35)	0.45 (0.49)	0.43 (0.45)	0.34 (0.31)	1.05 (0.1967)
Leverage	0.59 (0.62)	0.57 (0.61)	0.56 (0.59)	0.56 (0.60)	0.58 (0.60)	1.21 (0.1508)
Share Price	20.51 (15.00)	19.96 (16.97)	22.18 (19.25)	22.20 (19.63)	19.31 (16.25)	1.12 (0.4350)
MB	1.84 (1.40)	1.60 (1.43)	1.81 (1.49)	1.68 (1.49)	1.97 (1.57)	1.07 (0.0102)**
Net Income	81.20(9.37)	34.16(19.42)	27.09(23.17)	30.50(20.37)	67.82(15.68)	1.41 (0.4185)
Turnover	0.05(0.04)	0.06(0.05)	0.07(0.06)	0.06(0.06)	0.05(0.05)	1.46 (0.0444)**
Momentum	0.22(0.14)	0.20(0.17)	0.17(0.15)	0.19(0.18)	0.20(0.17)	0.61 (0.4327)
Alpha-FF3	0.31(0.33)	0.31(0.32)	0.21(0.22)	0.28(0.33)	0.35(0.34)	0.35 (0.6424)

Table 2c. Long-run value-to-book mis-valuation and REIT firm characteristics

	Long-run Value Mis-valuation Q1	Q2	Q3	Q4	Long-run Value Mis-valuation Q5	Q5 – Q1 t-statistic (p-value)
Log(TA)	7.87 (8.05)	7.04 (7.21)	6.53 (6.67)	5.85 (6.19)	4.51 (6.66)	39.85* (<0.0001)
Log (1+ANUM)	0.65 (0.0)	0.51 (0.0)	0.40 (0.0)	0.26 (0.0)	0.14 (0.0)	5.85* (<0.0001)
INST	0.51 (0.57)	0.48 (0.51)	0.45 (0.49)	0.32 (0.30)	0.16 (0.03)	18.78* (<0.0001)
Leverage	0.55 (0.58)	0.56 (0.59)	0.57 (0.59)	0.57 (0.62)	0.63 (0.71)	4.93* (<0.0001)
Share Price	28.67 (25.13)	24.35 (22.62)	22.09 (19.29)	17.66 (14.07)	13.42 (10.05)	10.63* (<0.0001)
MB	1.75 (1.62)	1.79 (1.61)	1.80 (1.49)	1.50 (1.31)	2.06 (1.34)	2.59* (<0.0001)
Net Income	142.8 (97.87)	52.54 (45.29)	27.05 (23.05)	12.50 (8.88)	3.82 (1.63)	129.84* (<0.0001)
Turnover	0.07 (0.06)	0.07 (0.06)	0.07 (0.06)	0.06 (0.05)	0.04 (0.03)	11.76* (<0.0001)
Momentum	0.20 (0.18)	0.18 (0.17)	0.17 (0.15)	0.21 (0.17)	0.23 (0.12)	0.88 (<0.0001)
Alpha-FF3	0.21 (0.28)	0.26 (0.29)	0.21 (0.21)	0.34 (0.35)	0.44 (0.42)	2.10** (<0.0001)

Table 3 Relation between firm-specific determinants and REIT misevaluation

	Firm-specific Mis-valuation		Sector-wide Mis-valuation		Long-run Value Mis-valuation	
	I	II	I	II	I	II
Intercept	-1.57	-1.30	-0.01	-0.23	0.49	0.48
	(-11.16)*	(-16.05)*	(-0.01)	(-4.98)*	(119.20)*	(485.40)*
Ln(TA)	-0.02	-0.04	-0.01	-0.02	-0.02	-0.02
	(-1.14)	(-2.39)*	(-0.07)	(-2.98)*	(-14.40)*	(-19.81)*
Ln(1+ANUM)	0.08	-0.01	0.01	0.11	-0.01	0.01
	(3.23)*	(-0.43)	(0.79)	(11.42)*	(-0.27)	(1.23)
INST	0.29	0.03	-0.01	0.17	-0.01	-0.01
	(1.34)	(0.58)	(0.94)	(6.13)*	(-3.16)*	(-4.09)*
Leverage	1.09	0.94	0.01	0.10	0.07	0.06
	(16.85)*	(12.38)*	(0.23)	(3.06)*	(21.80)*	(57.5)*
Ln(PRC)	0.38	0.39	0.01	0.04	-0.01	-0.01
	(9.01)*	(9.28)*	(0.26)	(2.97)*	(-2.37)*	(-2.43)*
Momentum	0.57	0.01	0.01	0.49	0.01	-0.01
	(3.42)*	(0.09)	(1.72)	(10.37)*	(0.68)	(-1.04)
Turnover	-0.01	-0.02	0.01	0.01	0.01	0.01
	(1.17)	(-1.58)	(1.32)	(4.82)*	(1.61)	(1.55)
Alpha-FF3	-14.89	38.79	-0.72	-5.65	0.08	0.29
	(-0.45)	(2.62)*	(-1.66)	(-0.85)	(0.40)	(2.02)**
Adj. R^2	0.30	0.29	0.30	0.31	0.79	0.79
N	17	2110	17	2109	17	2108

Table 4: Cross-sectional regression on determinants of REIT Mis-valuation

	Firm-specific Mis-valuation	Sector-wide Mis-valuation	Long-run Value Mis-valuation
Intercept	-1.05	-0.14	0.51
	(-5.89)*	(-2.64)**	(16.21)*
Log(TA)	0.01	0.01	-0.02
	(0.20)	(1.33)	(-22.49)*
Log(1+ANUM)	0.07	0.08	-0.02
	(0.82)	(2.93)**	(-0.68)
INST	0.04	0.17	-0.02
	(0.24)	(2.89)**	(-0.37)
Leverage	0.19	0.05	0.01
	(3.58)*	(2.65)*	(1.61)
Log(PRC)	0.03	0.01	-0.01
	(5.55)*	(0.07)	(-1.98)**
Momentum	-0.02	-0.13	-0.01
	(1.05)	(-1.34)	(-1.93)**
Turnover	-0.02	0.01	0.00
	(-1.19)	(1.47)	(0.53)
Alpha-FF3	-81.90	-32.01	-0.01
	(-1.40)	(-1.57)	(-0.77)
Sentiment_Market	-0.55	-0.37	-0.02
	(-1.14)	(-2.76)**	(-1.49)
Sentiment_Industry	-0.01	0.01	-0.01
	(-4.34)*	(14.12)*	(-1.01)
Adj. R^2	0.26	0.47	0.86
N	241	241	241

Table 5a: Cross-sectional regression on determinants of REIT Mis-valuation (Value REITs)

	Firm-specific Mis-valuation	Sector-wide Mis-valuation	Long-run Value Mis-valuation
Intercept	-0.81	-0.24	0.49
	(-4.63)*	(-3.44)*	(63.28)*
Log(TA)	-0.04	-0.00	-0.02
	(-1.00)	(-0.28)	(-55.84)*
Log(1+ANUM)	0.14	-0.01	-0.01
	(1.09)	(-0.20)	(0.98)
INST	0.46	0.09	-0.01
	(1.80)***	(1.01)	(-3.23)*
Leverage	-0.18	0.13	0.05
	(-0.86)	(1.60)	(21.07)*
Log(PRC)	0.19	0.02	0.00
	(3.45)*	(1.38)	(3.06)*
Momentum	-0.29	-0.08	0.00
	(-0.70)	(-0.87)	(0.49)
Turnover	-0.01	0.01	0.00
	(-1.29)	(1.78)***	(2.15)*
Alpha-FF3	-10.43	3.75	-0.50
	(-0.28)	(0.28)	(-1.35)
Sentiment_Market	-0.23	0.01	0.00
	(-0.83)	(3.13)*	(0.97)
Sentiment_Industry	-0.01	0.01	-0.01
	(-3.32)*	(7.76)*	(-0.06)
Adj. R^2	0.21	0.17	0.98
N	76	76	76

Table 5b: Cross-sectional regression on determinants of REIT Mis-valuation (Growth REITs)

	Firm-specific Mis-valuation	Sector-wide Mis-valuation	Long-run Value Mis-valuation
Intercept	-0.29	0.77	0.48
	(-1.20)	(4.73)*	(138.16)*
Ln(TA)	0.04	-0.03	-0.02
	(1.25)	(-1.24)	(-43.10)*
Ln(1+ANUM)	-0.06	0.19	0.00
	(-0.91)	(4.05)*	(0.36)
INST	-0.04	0.11	-0.01
	(-0.25)	(0.99)	(0.93)
Leverage	0.68	-0.24	0.08
	(3.06)**	(-1.51)	(23.12)*
Ln(PRC)	0.09	-0.16	-0.01
	(0.176)	(-4.12)*	(-6.26)*
Momentum	-0.11	0.08	0.00
	(-0.39)	(0.27)	(1.15)
Turnover	-0.02	0.01	-0.00
	(-2.93)**	(2.33)**	(-0.64)
Alpha-FF3	20.37	-0.79	-1.53
	(0.28)	(-0.01)	(-1.23)
Sentiment_Market	-0.05	-0.07	-0.00
	(-0.24)	(-0.44)	(-0.19)
Sentiment_Industry	-0.01	0.01	-0.01
	(-4.91)*	(5.20)*	(-0.30)
Adj. R^2	0.19	0.42	0.98
N	118	118	118

Figure 1 The relationship between REITs mis-valuation, general equity returns, REIT returns, and the general stock market investor sentiment.

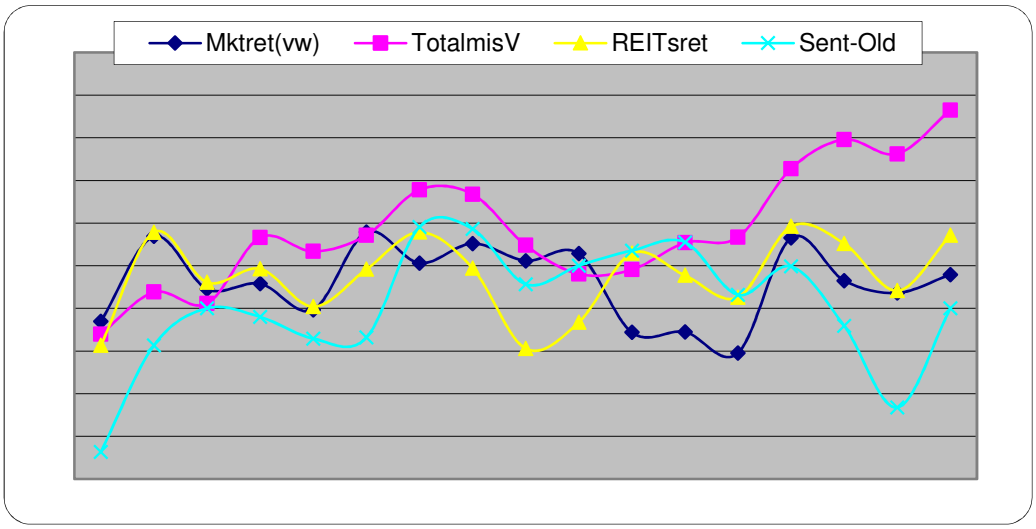

Figure 2 The movements of the three REIT mis-valuation components. Fmis is the firm-specific mis-valuation, Indmisv is the sector-wide mis-valuation and LRmis is the long-run value-to-book mis-valuation.