Did real estate professionals anticipate the 2007-2008 financial crisis? Evidence from insider trading in the REITs

Accepted by The Journal of Real Estate Finance & Economics

Jianfu Shen*

Email: jeff.jf.shen@polyu.edu.hk

Department of Building and Real Estate

The Hong Kong Polytechnic University

Hum Hong, Hong Kong

Eddie C.M. Hui

Email: bscmhui@polyu.edu.hk

Department of Building and Real Estate

The Hong Kong Polytechnic University

Hum Hong, Hong Kong

Kwokyuen Fan

Email: kwokyuen.fan@polyu.edu.hk

Department of Building and Real Estate

The Hong Kong Polytechnic University

Hum Hong, Hong Kong

*Corresponding author

Shen acknowledges a research grant (P0030199) from the Hong Kong Polytechnic University. The authors thank the editor, Professor John Glascock, and a referee for their insightful comments and Professor Michael Anson for his editorial work.

Did real estate professionals anticipate the 2007-2008 financial crisis? Evidence from insider trading in the REITs

Abstract:

This research examines whether real estate professionals detected the property bubble and foresaw the consequent financial crisis of 2007-2008. By analysing the insider trading activities within REITs from 1996 to 2010, we find that REIT insiders reduced their holdings significantly during the real estate boom period as early as 2004, before the financial crisis. Difference-in-difference analysis reveals that REIT insiders cashed out their positions more aggressively than insiders in real estate and construction firms. The findings support the informed trader hypothesis that managers and employees in REITs anticipated the burst of the real estate bubble and the imminent financial crisis, and shifted their wealth away from the real estate market to avoid potential losses. We find no evidence to support the biased belief hypothesis (Cheng et al., 2014) that REIT insiders were over-optimistic during the real estate boom period or that their inside trading behaviour was affected by local market performance.

Keywords: insider trading; real estate bubble; informed trader; biased belief

Did real estate professionals anticipate the 2007-2008 financial crisis? Evidence from insider trading in the REITs

Introduction

The financial crisis of 2007-2008 caused huge losses to the US and global markets. The collapse of the real estate bubble was a key cause of the financial crisis. Although many professionals and public officials claimed that they could not anticipate the bursting of the real estate bubble, some knowledgeable executives in financial institutions such as PIMCO were aware of an imminent crisis and managed their risk exposure positions to avoid potential loss (Financial Crisis Inquiry Commission, 2011). The evidence is mixed in the literature, as to whether professionals in the finance industry, such as bankers, detected the real estate bubble and foresaw its collapse (e.g., Cheng et al., 2014; Cziraki, 2018). Yet no studies have explored whether professionals in the real estate industry, who were arguably in a better position than Wall Street employees and bankers to detect the bubble, were aware of problems in the real estate market. Our study adds to that research.

We examine the insider trading patterns of executives and employees in Real Estate Investment Trusts (REITs) during the real estate boom period 2004-2006 and the period 2007 - 2008 immediately before the onset of the financial crisis.[1] Managers and employees in REITs, in general, are involved in the active operational management of properties and have long-term experience of real estate markets (Ambrose and Linneman, 1998, 2001; Glascock et al., 2000; Deloitte, 2019).[2] With their superior knowledge of real estate markets, REIT insiders may be able to detect a property bubble and act on this knowledge by revising their stock holdings.

The competing 'informed trader' and 'biased belief' hypotheses, relating to whether real estate professionals detected the property bubble were both tested. The Informed trader hypothesis suggests that REIT insiders are real estate experts and possessed information on the development of the property bubble. Given their specialized knowledge of the real estate market, these managers and employees may choose to rebalance their portfolios if they perceive that the overall riskiness of real estate investment has increased. We would expect them to sell some of their shares given this information. In contrast, the biased belief

[1] Following previous studies in the literature of insider trading (e.g., Seyhun, 1986; Rozeff and Zaman, 1988), we take the trades by directors, managers and employees within their own firms as insider trading. The trades by the insiders are not necessarily illegal practice as would be trades based on non-public and material information.

[2] Because of active management skills and experience in real estate valuation, REIT insiders could be more informed about the market than some real estate professionals such as agents and operators. We take REIT insiders as sophisticated real estate professionals who have superior knowledge of the property market and systemic risk in that market. They also have significant personal wealth in the form of equity holdings in their managed REITs.

hypothesis suggests that REIT managers could become over-optimistic in boom market conditions with unrealistic expectations of future property price appreciation (Smith and Smith, 2006; Shiller, 2006). Over-optimistic insiders, rather than reduce, may even increase their ownership in REITs (Cheng et al., 2014).

We tested the above opposite hypotheses using a large sample of REIT insider trading activity in the US market from 1996 to 2010. Our main finding is that REIT insiders were well informed and tended to cash out their positions as early as 2004, before the financial crisis. Compared with other periods, insiders sold 17.96% more shares during the real estate boom period (January 2004 to March 2006) and 14.80% more in the pre-crisis period (April 2006 to June 2007). The proportion of sellers, amongst all inside traders, increased by 5.24% and 6.93% in the boom and pre-crisis periods respectively. The trading patterns are similar for the top executives (e.g., CEO, CFO, directors, etc.) and non-executive employees.

A difference-in-difference analysis revealed that insiders in REITs sold significantly more shares than insiders in other real estate firms just before the financial crisis. Specifically, net sales by REIT insiders were 7.77% and 4.54% more than those by insiders in other real estate firms, in the boom and pre-crisis periods respectively. The percentage of sellers among all inside traders were 5.25% and 4.80% more within REITs. The results indicate that REIT insiders were better informed about the real estate bubble and reduced stock holdings significantly more than their peers in the real estate industry.

Finally, we explored whether the beliefs of REIT insiders are likely to be distorted more if they are involved in a local market in which housing was performing strongly during the boom period. Our results indicate that insider sales are not significantly different between REITs involved with the leading markets and those with relatively weak markets, indicating that real estate professionals in the leading markets were not, in fact, over-optimistic and not misled by biased expectations of increasing property prices. In sum, we find no evidence to support the biased belief hypothesis.

The study contributes to the literature in exploring whether professionals in the financial industries were able to detect the real estate bubble and foresee the 2007-2008 financial crisis (Bebchuk et al. 2010; Fahlenbrach and Stulz, 2011; Bhagat and Bolton, 2014; Adebambo et al. 2015; Cheng et al., 2014; Cziraki, 2018). This is the first study to explore the behaviour of real estate professionals in relation to the property bubble and its bursting. The study is also the first to test whether the beliefs of REIT insiders are distorted by a 'hot' property market (Cheng et al., 2014). This research also contributes to the insider trading literature especially in the field of REITs (Damodaran and Liu, 1993; Cline et al. 2014).

Literature Review and Hypotheses Development

The finance literature has investigated whether professionals involved in financial markets were aware, in advance, of the real estate bubble and its collapse in 2007-2008. Some studies have shown that researchers and some market participants had been aware of the real estate bubble.[3] Homebuyers were well informed about the trend of local property prices and anticipated that property prices might stay flat or fall when the local market was at, or after, its peak in 2006 (Case et al., 2012). Insiders in some large financial institutions, e.g., top executives of Bear Stearns and Lehman Brothers, cashed out a large amount of their holdings between 2000 and 2008 (Bebchuk et al., 2010; Bhagat and Bolton, 2014; Cziraki, 2018).

On the other hand, many studies found that professionals in financial firms might not have been fully aware of the impending financial crisis. For instance, Cheng et al. (2014) show that the professionals in the securitization industry were not aware of the real estate bubbles and even bought second houses or moved into more expensive houses during the boom period. Bank CEOs did not reduce their equity holdings before and during the financial crisis, and hence suffered large losses in personal wealth (Fahlenbrach and Stulz, 2011). Equity analysts and institutional investors had some awareness of the imminent crisis; but insiders in financial firms were completely unaware of the impending crisis and even purchased more stocks (Adebambo et al., 2015). Some studies in the field of behavioural finance show that the lack of awareness among professionals of the real estate bubble might be attributable to over-optimism and distorted beliefs about the real estate market (Barberis, 2013; Cheng et al., 2014).

Following previous studies (e.g., Cheng et al. 2014; Cziraki, 2018), two competing hypotheses were examined relating to whether professionals in the real estate industry, i.e., REIT insiders, can detect a real estate bubble and manage their exposure to real estate investment risk by revising their inside holdings. The informed trader hypothesis states that REIT insiders, experts in the real estate market, have superior levels of information on the real estate market development and avoid personal wealth losses by selling their insider holdings before the financial crisis and even during the earlier real estate boom period.[4] In

[3] Some researchers had already warned the market about the existence of the real estate bubble before its collapse (e.g., Case and Shiller, 2003; Himmelberg et al., 2005; Laing, 2005; Krugman, 2005; Shiller 2006, 2007; Mayer, 2006; Smith and Smith, 2006)

[4] The literature has shown that insiders possess private information on their managed firms (Jaffe, 1974; Finnerty, 1976a, 1976b; Rozeff and Zaman, 1988). Insiders in REITs have superior information about the fundamental value of properties and act on it through informed trading (Damodaran and Liu, 1993; Cline et al., 2014). Active management within REITs requires managers to select, manage and operate properties to create

addition, it might be expected that REIT insiders are better informed than insiders of non-REIT companies in the real estate industry (e.g., real estate developers) since the former are focussed on investing in real estate assets and closely monitor real estate market trends. This first hypothesis is formally stated as:

H1: As informed traders, REIT insiders sell their holdings during the real estate boom period and the period before the financial crisis.

H1a: Insider sales within REITs are larger than insider sales in other real estate companies.

An almost opposite hypothesis is that REIT insiders may not be aware of any systemic risk in the real estate market (Adebambo et al. 2015), and might even possess unrealistic expectations on the future property price appreciation during a real estate boom period. Biased belief may be created through collective denial and wilful blindness to the real estate bubble (Benabou, 2013); and social interactions among professionals may further reinforce a distorted belief in the expected property price growth (Burnside et al., 2016). The biased belief hypothesis is that REIT insiders become over-optimistic during real estate boom periods, and increase holdings in their REIT positions (Cheng et al., 2014). If this bias belief hypothesis holds, we further expect that REIT insiders in a local market undergoing larger property price appreciation become more optimistic about the future performance of the real estate market than they would in a relatively weak market.[5] They are expected to increase exposure to the real estate market and make more insider purchases than insiders in a relatively weak market. The second hypothesis is formally stated as:

H2: Due to biased beliefs, REIT insiders increase their holdings during a real estate boom period.

H2a: Insider purchases are greater in extent, in those regions experiencing a strong local real estate market.

Data, Variables and Methodology

Data and Sample

The REIT sample used in this study derives from all available REITs in the CRSP Ziman REIT database, which includes both equity REITs and mortgage REITs traded on the NYSE, AMX and NASDAQ. The REITs data are merged with insider transaction data retrieved from the Thomson Reuters Insider Filling Feed database. The insider database

value for shareholders (Ambrose and Linneman, 1998; 2001), which brings an information advantage to REIT insiders in the evolution of the real estate market.

[5] Some cities in the US have experienced persistently large growth rates in house prices over a long period (Himmelberg et al., 2005; Gyourko et al., 2013). Buyers in these markets might form expectations of continued high growth rates in the future (Sinai and Souleles, 2005; Gyourko et al., 2013).

contains all U.S. insider activities as reported by the Securities and Exchange Commission (SEC).[6] As with previous studies, the sample of insider trading activities was restricted to open market transactions with transaction codes "P" (open market purchase) and "S" (open market sale). Inside trades from beneficial blockholders were also excluded since they may not have the same information set as executives and directors (Ali and Hirshleifer, 2017; Cziraki, 2018). Our final sample contains REITs that reported insider trading activities in the period between 1996 and 2010.[7]

To test the hypothesis that REIT insiders are better informed than insiders in other real estate companies, a sample was constructed for stocks also commonly traded in the real estate and construction industry.[8] The insider transactions data for these firms were obtained from the Thomson Reuters Insider database. Overall, there are 66,848 insider transactions for REITs and 36,679 transactions for other real estate companies during the sample period.

Firm-month observations were constructed, based on insider trading activities in each month for each firm during the sample period. In total, the REIT sample includes 272 REITs and 24,668 REIT-month observations. The common stock sample includes 159 firms and 11,723 firm-month observations. The sample contains 85.80% REITs (314 in total) and 84.57% of other real estate firms (188 in total) traded in the US market during the sample period.[9] Table 1 reports the REIT sample coverage and the average percentage of insider holdings by year. On average, the insider ownership is 4.21% of total outstanding shares per year between 1996 and 2010, which corresponds to 32.87 million USD per year. Thus, the amount of personal wealth related to insider equity holdings is significant.

[Insert Table 1]

Financial statement data were extracted from Compustat and stock price data from CRSP for the firms in our sample. The housing market returns for the aggregate US market and 20 major metropolitan areas were calculated using the Case-Shiller Indices, retrieved from Federal Reserve Economic Data. The U.S. National Index reflects the repeat-sales single-family housing price each month. It represents the level of housing prices across the

[6] The insiders are required to report their open-market trades under the Securities and Exchange Act of 1934. Insiders include officers, directors, affiliates, and beneficial owners in a firm. Thomson Reuter collects the insider trading data from SEC filings. The data are widely used in studies reported in the literature (e.g., Gao et al., 2014; Ali and Hirshleifer, 2017; Tang and Xin, 2017; Fu et al., 2019).

[7] The sample period covers the real estate boom period 2004-2006, the pre-crisis period 2006-2007 and the crisis period 2007-2008. Our results are robust to different sample periods.

[8] Following Fama-French 48 industry classifications, construction stocks are defined as the firms with SIC codes as 1500-1511, 1520-1549, 1600-1799, and real estate stocks are the firms with SIC codes as 6500, 6510, 6512-6515, 6517-6532, 6540-6541, 6550-6553, 6590-6599 and 6610-6611.

[9] The remaining firms did not have reported insider transactions during the sample period.

aggregate US market. The 20 city indices track housing prices in the 20 major metropolitan statistical areas.

Insider trading activities

Two measures were used to quantify insider trading. The first variable, net insider purchases (*NIP*), measures the directions and magnitudes of insider transactions in the given month. NIP is calculated as the aggregated number of shares insiders bought in the given month, net of the number of shares insiders sold, divided by the total number of shares insiders traded (Lakonishok and Lee, 2001; Jagolinzer et al., 2014; Adebambo et al., 2015; Gangopadhyay et al., 2018):

$$NIP_{i,t} = \frac{\sum_{j=1}^{n} \#\ Shares\ Buy_{i,j,t} - \sum_{j=1}^{n} \#\ Shares\ Sell_{i,j,t}}{\sum_{j=1}^{n} \#\ Shares\ Buy_{i,j,t} + \sum_{j=1}^{n} \#\ Shares\ Sell_{i,j,t}} \quad (1)$$

In Equation (1), $\#\ Shares\ Buy_{i,j,t}$ is the number of shares of security *i* that insider *j* buys in month *t*, and $\#\ Shares\ Sell_{i,j,t}$ is the number sold.

The second variable is Ownership Increase, which represents the proportion of inside buyers within a firm. It is calculated by the number of insiders making net purchases divided by the total number of insider trades in the month (Cziraki, 2018; Gangopadhyay et al., 2018):

$$Ownership\ Increase_{i,t} = \frac{\#\ Inside\ Buyer_{i,t}}{\#\ Inside\ Buyer_{i,t} + \#\ Inside\ Seller_{i,t}} \quad (2)$$

In Equation (2), $\#\ Inside\ Buyer_{i,t}$ is the number of insiders buying security *i* in month *t*, and $\#\ Inside\ Seller_{i,t}$ is the number of insiders selling that security in the month. If an insider trades more than once in a month, the net trading volume is calculated to identify whether the insider is a buyer or a seller. $Ownership\ Increase_{i,t}$ is assigned the value zero if a firm has no insider trading activity in that month.

To evaluate whether managers possess superior levels of information than mid-level employees and are more likely, therefore, to detect a bubble than other insiders, insiders were grouped into top executives and non-top executives (Gao et al., 2014). Top executives include the President, CEO, CFO, COO, CTO, and CIO. Non-top executive insiders included such as mid-level officers, directors, secretaries etc. The corresponding insider trading variables, NIP and Ownership Increase, were based on the trading activities of each group.

It is worth noting that the two variables are constructed so as to measure the intensity of insider purchases. They can be easily converted to capture insider sales. A negative value in NIP means more insider shares were sold than bought. For REITs with insider transactions

occurring in a month, the value 'One minus Ownership Increase' gives the proportion of insider sale trades to overall trades.

Figure 1 gives insider trading variables trends over the sample period. NIP was generally negative during the real estate boom period in 2004-2006 and remained negative in the pre-crisis period, showing net inside sales were made before the financial crisis. Ownership increase remained at a relatively low level in the real estate boom and pre-crisis periods, indicating that there were relatively few (more) inside buyers (sellers). The results suggest that REIT insiders may have been aware of the real estate bubble and the imminent crisis, and reduced their exposure, accordingly, to real estate assets before the crisis.

[Insert Figure 1]

Real estate boom and pre-crisis periods

The real estate boom period was defined as the start of January 2004 to the end of March 2006, in keeping with previous studies (Cheng et al., 2014; Philippas et al., 2013). Case and Shiller (2003) started to warn the market of the existence of a real estate bubble in 2003, although they did not think that the bubble would burst soon. The endpoint of the real estate boom occurred in March 2006, just before Case-Shiller 20-city Composite Home Price Index exhibited its first drop in April 2006. The pre-crisis period, therefore, is defined as April 2006 to June 2007, since the literature usually takes July 2007 as the start of the financial crisis (Jagolinzer et al. 2014; Cziraki, 2018; Gangopadhyay et al., 2018).

Local real estate markets with leading performance

REIT headquarter cities were used to identify local real estate markets and measure the local housing price movements in different regions using the Case-Shiller 20 metropolitan area indices[10]. The local real estate markets are divided into leading and non-leading groups. The leading group contains the six metropolitan statistical areas experiencing the largest housing price appreciation during the boom period. The non-leading group includes the remaining 14 areas.[11] A dummy variable (*Leading*) is set equal to one for statistical areas in the leading group and zero for those in the non-leading group.

[10] The 20 major metropolitan areas include Phoenix Metropolitan Area, Greater Los Angeles, San Diego County, San Francisco, Denver-Aurora Metropolitan Area, Washington Metropolitan Area, South Florida Metropolitan Area, Tampa Bay Area, Atlanta Metropolitan Area, Chicago Metropolitan Area, Greater Boston, Metro Detroit, Minneapolis-Saint Paul, Charlotte Metropolitan Area, Las Vegas Metropolitan Area, New York Metropolitan Area, Greater Cleveland, Greater Portland, Dallas–Fort Worth Metroplex and Seattle Metropolitan Area. The index of 100 applies to January 1996. Housing index movements for the leading and non-leading groups are shown in Figure 2.

[11] The leading group includes Las Vegas Metropolitan Area, Greater Los Angeles, South Florida Metropolitan Area, Washington Metropolitan Area, Phoenix Metropolitan Area and Tampa Bay Area. The remaining 14 areas are classified among the non-leading group.

Figure 2 illustrates the trends in housing price movements in the two groups. The leading group cities significantly outperformed the non-leading group during the boom period but, after the financial crisis, housing price indices dropped to the same levels as the non-leading group.

[Insert Figure 2]

Other control variables

Firm characteristics Firm size is negatively associated with insider trading activity according to the previous studies (Seyhun, 1986; Jenter, 2005; Ravina and Sapienza, 2010). Besides, insiders tend to buy value firms, i.e. stocks with high book-to-market ratio (Jenter, 2005; Ravina and Sapienza, 2010) and sell firms with superior past performance (Lakonishok and Lee, 2001; Bonaime and Ryngaert, 2013). Insiders trade more when the firm price is volatile and purchase less when volatility decreases (Meulbroek, 1992; Jenter, 2005). We include these firm-level characteristics as control variables in the regression analysis. The book-to-market ratio is the equity book value of equity divided by the equity market value at the end of the previous fiscal year. Firm size is the natural logarithm of its total assets at the end of the previous fiscal year. To measure past performance, the cumulative returns over the past 12 months are used as a proxy. Volatility is measured as the standard deviation of daily stock returns over the past month. A change in volatility is the volatility of the past month minus the volatility of the month before that.

Insider holdings Besides trading for profit based on private information, insiders may also trade for such purposes as portfolio diversification or personal consumption (Cohen et al., 2012; Ali and Hirshleifer, 2017). Insiders with greater holdings are more likely to reduce their positions, no matter whether they have firm-specific information or information on systemic market risk. We include the variable of insider holding in the regression, which is measured by the number of shares held by all insiders over the past year divided by the total shares outstanding at the end of the year. Besides, we include the change of insider holding in the previous year as to control for the "routine" trading pattern due to the purposes such as personal consumption (Cohen et al., 2012). A change in insider holding is represented as the insider holding in the past year minus the holding in the year before.

Housing Price Past performance of the real estate market is proxied by the Case-Shiller U.S. National Index.[12] Aggregate real estate market return is calculated as the

[12] The housing returns calculated from the Case-Shiller U.S. National Index are highly related to the REIT market returns measured by the CRSP Ziman REIT Value Weighted Index. The results remain similar if we include the REIT market returns or the returns for sub-markets based on the property types in the regressions.

percentage increase in the Case-Shiller US National Index over the past 12 months. Detailed definitions of the variables are given in Appendix A.

Table 2 reports summary statistics on the variables in our REITs sample. The average NIP is negative indicating that, on average, insiders tend to sell shares rather than buy them, which is consistent with Jagolinzer et al. (2014) and Gangopadhyay et al. (2018). The mean Ownership Increase is only 15.96%, which illustrates that most insiders tend either to sell or not to trade in shares of their own firms. 15% of firm-month observations relate to the real estate boom period and 8% to the pre-crisis period. The average insider holding in the previous year is 3.85%. The average of the change in insider holdings in a year is 0.28%. Since some REITs are not located in the 20 metropolitan statistical areas covered by the Case-Shiller indices, the number of observations for the leading group dummy is smaller than for the other variables. 29% of REITs are in the six metropolitan leading housing market performance statistical areas.

[Insert Table 2]

Empirical Results

Insider trading during the real estate boom period and before the financial crisis

Our study first explores whether REIT professionals did acknowledge the existence of the real estate bubble and acted on it. A multivariate analysis approach was adopted to test the main hypothesis, which controls for heterogeneity of the characteristics of the firms, past insider holdings and past returns of the real estate market. The following equation was employed in the regression analysis (Cziraki, 2018).

$$IT_{i,t} = \alpha + \beta_1 Boom_t + \beta_2 PreCrisis_t + \beta_3 Control_{i,t} + Firm_i + Year_t + \varepsilon_{i,t} \quad (3)$$

In Equation (3), the dependent variable $IT_{i,t}$ is one of the two insider trading variables NIP or Ownership Increase in a firm *i* in a month *t*. $Boom_t$ is a dummy variable equal to one if the month is in the boom period and zero otherwise. $PreCrisis_t$ is a dummy variable equal to one for the pre-crisis period and zero otherwise. $Control_{i,t}$ represents the three set of control variables: firm characteristics, past insider holding and the past performance of the aggregate real estate market. Firm fixed effect $Firm_i$ and year fixed effect $Year_t$ are included in the regression to control for time-invariant firm factors and the aggregate time-series trend. The *t-statistics* on the coefficient estimates are reported, calculated from the robust standard errors clustered by both firm and year (Petersen, 2009).

The key independent variables are $Boom_t$ and $PreCrisis_t$. The informed trader hypothesis argues that REIT insiders have superior information about the development of real

estate markets and could avoid losses by selling holdings before the financial crisis when the market was overheated. The negative coefficients for the boom and pre-crisis dummies, which indicate insider sales in the boom and pre-crisis periods, confirm the informed trader hypothesis. The biased brief hypothesis, in contrast, suggests that insiders with distorted beliefs increase their exposure to the real estate market before its crash. In this case, the coefficients for the boom and pre-crisis period dummies would be positive.

Table 3 gives the results of OLS regressions based on Equation (3). Columns (1)-(3) present the coefficient estimates in the regressions based on NIP and columns (4)-(6) show the result for Ownership Increase. The coefficients of the real estate boom dummy and the pre-crisis dummy are all significantly negative in the NIP regressions. Insider sales are 17.96% greater in the real estate boom period and 14.80% greater in the pre-crisis period than those in other periods. Columns (2)-(3) show that both top executives and non-executive employees significantly sold their holdings during the real estate boom and before the financial crisis periods. The results for Ownership Increase also indicate that the proportion of insider sellers decreased in the periods before the financial crisis. The results confirm the informed trader hypothesis H1 and demonstrate that REIT insiders are sophisticated professionals in the real estate market with the ability to foresee the burst of a bubble. The findings are consistent with those of Cziraki (2018), who showed that bank insiders reduced their holdings in mid-2006 when housing prices started to drop.[13] Our results indicate that both top executives and non-executive employees possess superior information about the overall real estate market and property price dynamics, probably due to their long-term experience in the market

[Insert Table 3]

The coefficient estimates for the control variables in Table 3 are generally consistent with previous studies: insiders tend to buy value stocks (Jenter, 2005; Ravina and Sapienza, 2010) and sell stocks with strong past performance (Lakonishok and Lee, 2001; Bonaime and Ryngaert, 2013). Insiders with large equity holdings tend to sell more for reasons such as diversification and personal consumption, although the negative coefficients on insider holding are generally insignificant. Furthermore, the positive coefficients applying to change in insider holding imply that insider trading follows a routine pattern, in that insiders who reduced their ownership in the past year tend to sell more shares (Cohen et al. 2012). The coefficients on stock price volatility and housing market return are not significant.

[13] Cziraki (2018) does not give evidence on abnormal insider sales observed during the real estate boom period. Our findings show that REIT insiders significantly reduced their exposure to the real estate market when the housing price was still on a rising trend.

Overall, our results support the informed trader hypothesis (H1) and provide no evidence supporting the biased belief hypothesis (H2). In the robustness test, insider trading activity is proxied by inside net trading value (Cziraki, 2018) and a similar result was found. Insiders were also divided into routine insiders and opportunistic insiders as Cohen et al. (2012). It was found that both routine and opportunistic insiders sold more of their company stocks in 2004-2007. The REIT sample was also divided into equity REITs and mortgage REITs and significant inside sales were found prior to the financial crisis for both types of REIT. The robustness test results are not reported to conserve space but are available on request.

Difference-in-difference analysis

The hypothesis H1a was tested using a difference-in-difference approach by exploring the trading activities of insiders in REITs and those in other real estate firms during the real estate boom and before the financial crisis periods. REITs and other real estate firms were combined in one sample[14] and a difference-in-difference analysis implemented by modifying our baseline multivariate regression model. The model is given as (Adebambo et al., 2015; Cziraki, 2018):

$$IT_{i,t} = \alpha + \beta_1 Boom_t + \beta_2 PreCrisis_t + \beta_3 Boom_t * REIT_i + \beta_4 PreCrisis_t * REIT_i + \beta_5 Control_{i,t} + Firm_i + Year_t + \varepsilon_{i,t} \quad (4)$$

Equation (4) includes $Boom_t$ and $PreCrisis_t$ in order to analyse insider trading activities in the boom period and the pre-crisis period. $REIT_i$ is a dummy variable equal to one if security *i* is a REIT and zero if it is a real estate firm other than a REIT. The key independent variables are the interaction terms $Boom_t * REIT_i$ and $PreCrisis_t * REIT_i$. The interaction terms in Equation (4) capture the differences in insider trading activities between REITs and other real estate firms before the crisis. As the firm fixed effect is included in the model, the variable $REIT_i$ is subsumed in the regressions. If REIT insiders do possess superior information about the property market and real estate bubble to that of insiders in other real estate firms, it is expected that they would sell more their owned REIT shares and the coefficients of the interaction terms would be negative.

Table 4 presents the Equation (4) regression results. The coefficients for the boom dummy and the pre-crisis dummy are generally negative, indicating that insiders in both REITs and real estate firms detected the real estate bubble and sold their positions in both

[14] Appendix 2 gives the sample of real estate stocks in Panel A and the summary statistics in the sample in Panel B. Panel C indicates that insiders in real estate firms also anticipated the burst of the real estate bubble and reduced the real estate exposure by selling their company stocks.

boom and pre-crisis periods. The coefficients of *Boom*REIT* are significantly negative in all the models, which indicates that REIT insiders were more likely to sell their positions than insiders in real estate firms in the real estate boom period. The net sales of REIT insiders was 7.77% greater than sales by insiders in real estate firms, and the percentage of insider sellers amongst overall inside traders was 5.25% greater. The patterns are similar for both top executives and non-executive employees. The coefficients for the interaction term *Pre crisis*REIT* are also negative, but their magnitudes are generally smaller than those relating to *Boom*REIT* and not significant in some regressions.

[Insert Table 4]

In sum, REIT insiders sold their holdings more aggressively than insiders in other real estate firms before the crisis, especially during the real estate boom period. The findings support hypothesis H1a that REIT professionals are experts on real estate investment and property valuation (Damodaran and Liu, 1993; Ambrose and Linneman, 2001) and are thus more likely to detect the bubble and reduce their exposure to the real estate market than their peers in other real estate firms.

Local real estate market and insider trading

The final investigation explored whether insider trading activity in REITs is affected by the performance of local real estate markets, as REIT insiders might become over-optimistic in a local market with strong property performance. The baseline model of Equation (3) was modified and H2b tested using the following equation.

$$IT_{i,t} = \alpha + \beta_1 Boom_t + \beta_2 PreCrisis_t + \beta_3 Boom_t * Leading_i + \beta_4 PreCrisis_t * Leading_i + \beta_5 Control_{i,t} + Firm_i + Year_t + \varepsilon_{i,t} \quad (5)$$

According to the biased belief hypothesis, REIT insiders in a local market with significant housing price appreciation during a boom period are more optimistic about the future performance of the real estate market than insiders in a relatively weak market. Thus, insiders in leading property appreciation areas tend to buy more shares (or sell fewer) than REIT insiders in other areas. Hence the coefficients of the interaction terms, i.e. *Boom*Leading* and *Pre-crisis*Leading*, should be positive. As for Equation (4), the variable *Leading* is absorbed in the regressions due to the firm fixed effect.

Table 5 reports the results from the regressions using Equation (5). Most of the coefficients on the interaction terms, i.e. *Boom*Leading* and *Pre-crisis*Leading*, are negative and insignificant. Column 4 shows that the proportion of inside sellers in the leading areas is 5.12% significantly greater than that in the non-leading areas during the real estate boom

period. The results indicate that insiders in the leading areas tend to sell more of their REIT holdings than those in non-leading areas. In sum, evidence suggests that the beliefs of REIT insiders are not distorted by the expected property price appreciation in local markets and the biased beliefs hypothesis cannot explain the insider trading behaviour in REITs.

[Insert Table 5]

In the robustness test, the local real estate markets were also divided into superstar cities and non-superstar cities, as Gyourko et al. (2013)[15]. The results show that the interaction terms between the dummies of superstar cities and the boom/pre-crisis dummies are generally negative and insignificant. There is no evidence that insiders in the superstar cities have distorted expectations and bought more of their company stocks before the financial crisis. Taken together, the results do not support the conjecture that distorted beliefs about the property market lead to a lack of awareness of real estate bubbles among real estate professionals (Cheng et al., 2014).

Conclusion

This research comprised an investigation into whether sophisticated real estate professionals detected the existence of the real estate bubble and foresaw the 2007-2008 financial crisis. By examining insider trading activities in REITs between 1996 and 2010, it was found that REIT insiders sold significantly more holdings during the real estate boom period 2004-2006 and in the period 2006-2007, just before the financial crisis. The study also showed that REIT insiders sold their holdings more aggressively than did insiders in other real estate firms, probably due to their active involvement in the management of real estate assets and their consequent superior understanding of the real estate market.

Also examined, was whether insider trading activity in REITs is affected by the performance of a local real estate market, as managers and employees may form biased expectations of property price appreciation in leading markets. The results provide no evidence supporting the argument that REIT insiders in leading property markets became over-optimistic. In sum, our results suggest that unlike experts in financial firms (Fahlenbrach and Stulz, 2011; Cheng et al., 2014; Bhagat and Bolton, 2014), sophisticated real estate professionals did anticipate the existence of the real estate bubble and the systemic risk in the market. This research found that REIT managers and other insiders sold shares to rebalance their portfolios in recognition of the more risky nature of markets at that time.

[15] Gyourko et al. (2013) define the superstar cities as the cities in metropolitan statistical areas with a high demand for housings but inelastic and limited supply. The superstar cities have a persistently larger growth rate of home price and price-to-rent ratio than other cities.

References:

Adebambo, B., Brockman, P., & Yan, X. S. (2015). Anticipating the 2007–2008 financial crisis: Who knew what and when did they know it? *Journal of Financial and Quantitative analysis*, *50*(4), 647-669.

Ali, U., & Hirshleifer, D. (2017). Opportunism as a firm and managerial trait: Predicting insider trading profits and misconduct. *Journal of Financial Economics*, *126*(3), 490-515.

Ambrose, B. W., & Linneman, P. D. (1998). *Old REITs and New REITs*. Working paper, Real Estate Center, Wharton School of the University of Pennsylvania.

Ambrose, B., & Linneman, P. (2001). REIT organizational structure and operating characteristics. *Journal of Real Estate Research*, *21*(3), 141-162.

Barberis, N. (2013). Psychology and the Financial Crisis of 2007-2008. In M. Haliassos (Eds.), *Financial innovation: too much or too little*, 15-28. Cambridge: MIT Press.

Bebchuk, L. A., Cohen, A., & Spamann, H. (2010). The wages of failure: Executive compensation at Bear Stearns and Lehman 2000-2008. *Yale Journal on Regulation*, *27*(2), 257-282.

Benabou, R. (2013). Groupthink: Collective delusions in organizations and markets. *Review of Economic Studies*, *80*(2), 429-462.

Bhagat, S., & Bolton, B. (2014). Financial crisis and bank executive incentive compensation. *Journal of Corporate Finance*, *25*, 313-341.

Bonaime, A. A., & Ryngaert, M. D. (2013). Insider trading and share repurchases: Do insiders and firms trade in the same direction? *Journal of Corporate Finance*, *22*, 35-53.

Burnside, C., Eichenbaum, M., & Rebelo, S. (2016). Understanding booms and busts in housing markets. *Journal of Political Economy*, *124*(4), 1088-1147.

Case, K. E., & Shiller, R. J. (2003). Is there a bubble in the housing market? *Brookings Papers on Economic Activity*, *2003*(2), 299-362.

Case, K. E., Shiller, R. J., & Thompson, A. (2012). What have they been thinking? Home buyer behavior in hot and cold markets. *Brookings Papers on Economic Activity, 45*(2), 265-315.

Cheng, I. H., Raina, S., & Xiong, W. (2014). Wall Street and the housing bubble. *American Economic Review*, *104*(9), 2797-2829.

Cline, B., Fu, X., Springer, T., & Tang, T. (2014). Insider trading in REITs: Evidence from informed stock option exercise around seasoned equity offerings. *Journal of Real Estate Research*, *36*(4), 511-540.

Cohen, L., Malloy, C., & Pomorski, L. (2012). Decoding inside information. *The Journal of Finance*, *67*(3), 1009-1043.

Cziraki, P. (2018). Trading by bank insiders before and during the 2007–2008 financial crisis. *Journal of Financial Intermediation*, *33*, 58-82.

Damodaran, A., & Liu, C. H. (1993). Insider trading as a signal of private information. *The Review of Financial Studies*, *6*(1), 79-119.

Deloitte (2019). Exploring the new investment world of REIT. Deloitte Touche Tohmatsu Limited (March, 2019), available at https://www2.deloitte.com/content/dam/Deloitte/in/Documents/tax/in-tax-reit-talk-book.pdf

Fahlenbrach, R., & Stulz, R. M. (2011). Bank CEO incentives and the credit crisis. *Journal of Financial Economics*, *99*(1), 11-26.

Financial Crisis Inquiry Commission (2011). The financial crisis inquiry report. The Financial Crisis Inquiry Commission (January 2011), available at https://cybercemetery.unt.edu/archive/fcic/20110310173538/http://c0182732.cdn1.cloudfiles.rackspacecloud.com/fcic_final_report_full.pdf

Finnerty, J. E. (1976a). Insiders and market efficiency. *The Journal of Finance*, *31*(4), 1141-1148.

Finnerty, J. E. (1976b). Insiders' activity and inside information: a multivariate analysis. *Journal of Financial and Quantitative Analysis*, *11*(2), 205-215.

Fu, X., Kong, L., Tang, T., & Yan, X. (2019). Insider trading and shareholder investment horizons. *Journal of Corporate Finance*, Forthcoming.

Gangopadhyay, P., Yook, K. C., & Haley, J. D. (2019). Bank bailouts and corporate insider trading during the financial crisis of 2007–2009. *Review of Quantitative Finance and Accounting*, *52*(1), 35-83.

Gao, F., Lisic, L. L., & Zhang, I. X. (2014). Commitment to social good and insider trading. *Journal of Accounting and Economics*, *57*(2-3), 149-175.

Glascock, J. L., Lu, C., & So, R. W. (2000). Further evidence on the integration of REIT, bond, and stock returns. *The Journal of Real Estate Finance and Economics*, *20*(2), 177-194.

Gyourko, J., Mayer, C., & Sinai, T. (2013). Superstar cities. *American Economic Journal: Economic Policy*, *5*(4), 167-99.

Himmelberg, C., Mayer, C., & Sinai, T. (2005). Assessing high house prices: Bubbles, fundamentals and misperceptions. *Journal of Economic Perspectives*, *19*(4), 67-92.

Jaffe, J. F. (1974). Special information and insider trading. *The Journal of Business*, *47*(3), 410-428.

Jagolinzer, A. D., Larcker, D. F., Ormazabal, G., & Taylor, D. J. (2014). The information content of insider trades around government intervention during the financial crisis. Working paper, Stanford Graduate School of Business, Stanford University, Stanford.

Jenter, D. (2005). Market timing and managerial portfolio decisions. *The Journal of Finance*, *60*(4), 1903-1949.

Krugman, P. (2005). That hissing sound. *New York Times* (August 8, 2005), available at https://www.nytimes.com/2005/08/08/opinion/that-hissing-sound.html.

Laing, J. R. (2005). The bubble's new home. *The Wall Street Journal* (June 20, 2005), available at https://www.wsj.com/articles/SB111905372884363176

Lakonishok, J., & Lee, I. (2001). Are insider trades informative? *The Review of Financial Studies*, *14*(1), 79-111.

Mayer, C. J. (2006). Comments and discussion: Bubble, bubble, where's the housing bubble? *Brookings Papers on Economic Activity*, *2006*(1), 51-9.

Meulbroek, L. K. (1992). An empirical analysis of illegal insider trading. *The Journal of Finance*, *47*(5), 1661-1699.

Petersen, M. A. (2009). Estimating standard errors in finance panel data sets: Comparing approaches. *The Review of Financial Studies*, *22*(1), 435-480.

Philippas, N., Economou, F., Babalos, V., & Kostakis, A. (2013). Herding behavior in REITs: Novel tests and the role of financial crisis. *International Review of Financial Analysis*, *29*, 166-174.

Ravina, E., & Sapienza, P. (2010). What do independent directors know? Evidence from their trading. *The Review of Financial Studies*, *23*(3), 962-1003.

Rozeff, M. S., & Zaman, M. A. (1988). Market efficiency and insider trading: New evidence. *Journal of Business*, *61*(1), 25-44.

Seyhun, H. N. (1985). Insiders' profits, costs of trading, and market efficiency. *Journal of Financial Economics*, *16*(2), 189-212.

Shiller, R. J. (2006). Comments and discussion: Bubble, bubble, where's the housing bubble? *Brookings Papers on Economic Activity, 2006*(1), 59-67.

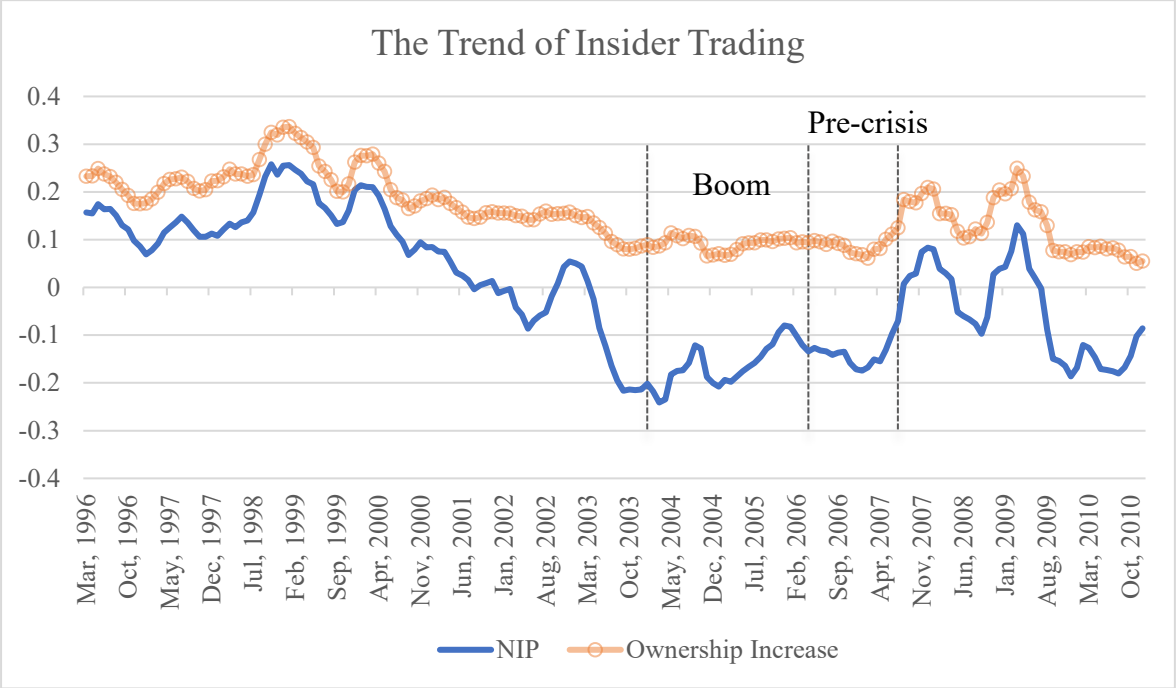
Shiller, R. J. (2007) Understanding recent trends in house prices and homeownership. *Proceedings - Economic Policy Symposium - Jackson Hole, Federal Reserve Bank of Kansas City*, 89-123.

Sinai, T., & Souleles, N. S. (2005). Owner-occupied housing as a hedge against rent risk. *The Quarterly Journal of Economics*, *120*(2), 763-789.

Smith, M. H., & Smith, G. (2006). Bubble, bubble, where's the housing bubble? *Brookings Papers on Economic Activity*, *2006*(1), 1-67.

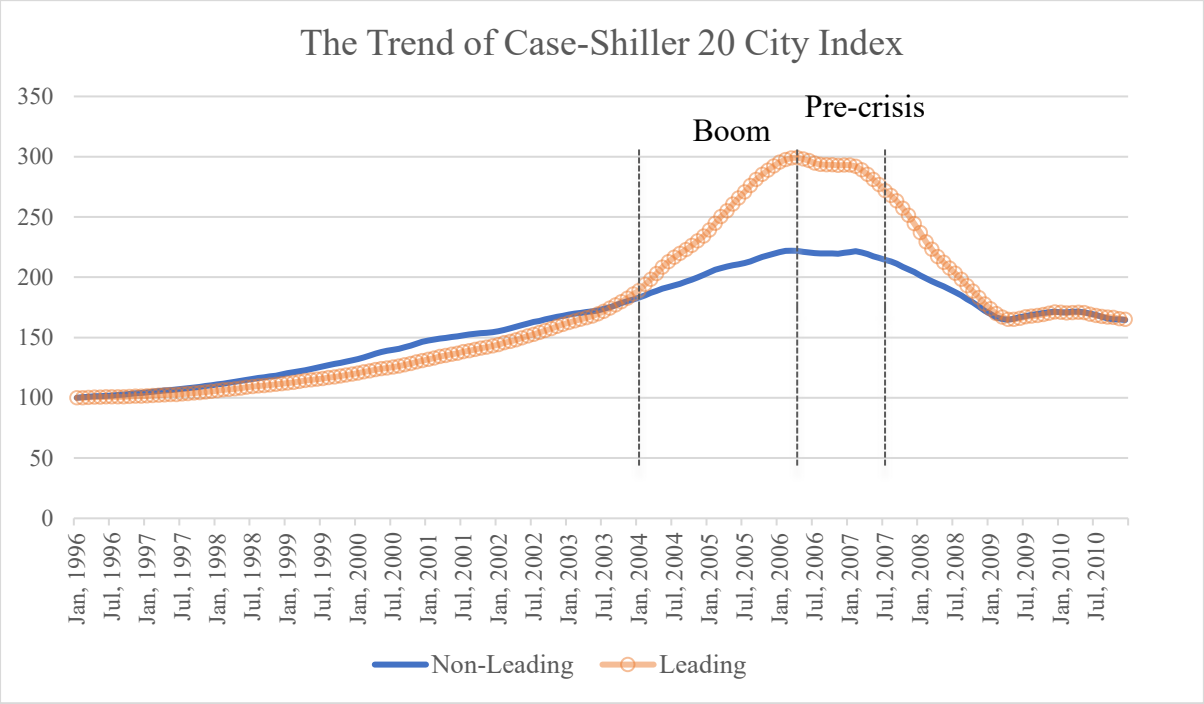
Tang, M., & Xin, H. C. (2017). Asymmetric timely loss recognition and insider trading profitability. Working paper, Stern School of Business, New York University, New York.

Figure 1. Trend of Insider Trading



Note: This figure shows the trend of insider trading activities measured by NIP and Ownership Increase for REITs from 1996 to 2010. The trend is smoothed by six month moving averages of insider trading variables.

Figure 2. The trend in local housing markets



Note: This figure shows the trend for 20 city indices from 1996 to 2010. The 20 cities are divided into two groups based on their housing returns in the boom period (from January 2004 to March 2006). The leading group, which has the highest price appreciation levels during the boom period, contains six metropolitan statistical areas. The non-leading group, the remainder, contains fourteen metropolitan statistical areas. The indexes are scaled to 100 as of January 1996.

Table 1. The number of REITs and insider holdings by year

Year	All REITs	Insider Sample	Percentages	Insider Holding
1996	221	169	76.47%	4.75%
1997	216	183	84.72%	4.78%
1998	237	208	87.76%	5.01%
1999	223	197	88.34%	5.77%
2000	214	190	88.79%	4.77%
2001	202	179	88.61%	5.39%
2002	188	166	88.30%	4.29%
2003	178	155	87.08%	4.53%
2004	188	163	86.70%	3.03%
2005	203	174	85.71%	3.35%
2006	204	171	83.82%	3.27%
2007	178	144	80.90%	3.68%
2008	157	128	81.53%	3.52%
2009	143	119	83.22%	3.73%
2010	155	127	81.94%	3.26%

Note: This table shows the number of REITs each year in our sample. All REITs shows the number of REITs that are traded in the US market each year. Insider Sample shows the number of REITs that reported their insider trading and insider holdings. Percentages reflect those REITs with insider trading. Insider Holding is the insider holdings each year as a percentage of all shares held by insiders in the total share outstanding at the end of a year.

Table 2. Summary Statistics

	Obs.	Mean	Std. dev.	Median	Min	Max
NIP	24,668	-0.06%	54.71%	0%	-100%	100%
Ownership Increase	24,668	15.96%	35.90%	0%	0%	100%
Boom	24,668	0.15	0.36	0	0	1
Pre-crisis	24,668	0.08	0.28	0	0	1
BM	24,668	0.91	0.82	0.73	0.00	14.11
Size	24,668	6.94	1.46	7.04	0.78	11.33
Momentum	24,668	0.14	0.33	0.14	-0.73	1.32
Volatility	24,668	0.02	0.02	0.01	0.00	0.44
Change in Volatility	24,668	0.00	0.01	0.00	-0.41	0.41
Insider Holding	24,668	3.85%	8.22%	1.33%	0%	53.73%
Change in Insider Holding	24,668	0.28%	7.61%	0.04%	-34.88%	39.48%
Case-Shiller Returns	24,668	0.04	0.06	0.06	-0.12	0.13
Leading	17,133	0.29	0.46	0	0	1

Note: This table is a summary of the statistics applying to the firm-month observations in the REIT sample. The variable definitions are given in Appendix A.

Table 3. Insider trading in REITs during the real estate boom period and before the crisis

	NIP			Ownership Increase		
	All	Top	Non-Top	All	Top	Non-Top
	(1)	(2)	(3)	(4)	(5)	(6)
Boom	-0.1796	-0.0989	-0.1401	-0.0524	-0.0477	-0.0300
	(-2.43)**	(-2.33)**	(-2.13)**	(-1.14)	(-2.16)**	(-0.74)
Pre-crisis	-0.1480	-0.0717	-0.1280	-0.0693	-0.0344	-0.0572
	(-5.78)***	(-4.85)***	(-5.77)***	(-4.22)***	(-4.52)***	(-3.92)***
BM	0.0343	0.0103	0.0274	0.0151	0.0003	0.0149
	(2.57)**	(1.46)	(2.74)***	(1.73)*	(0.07)	(2.29)**
Size	-0.0197	0.0002	-0.0177	0.0203	0.0186	0.0111
	(-1.09)	(0.02)	(-1.36)	(1.85)*	(2.21)**	(1.45)
Momentum	-0.1550	-0.0859	-0.1201	-0.0450	-0.0278	-0.0264
	(-6.19)***	(-6.24)***	(-5.72)***	(-2.48)**	(-2.97)***	(-1.71)*
Volatility	0.4972	-0.0445	0.7696	0.1081	-0.1280	0.3395
	(0.78)	(-0.13)	(1.54)	(0.23)	(-0.57)	(0.77)
Change in Volatility	-0.2351	0.0657	-0.3618	0.1056	0.2367	-0.0632
	(-0.41)	(0.25)	(-0.79)	(0.38)	(1.60)	(-0.31)
Insider Holding	-0.0513	-0.0734	-0.0232	-0.0995	-0.0931	-0.0449
	(-0.41)	(-0.86)	(-0.27)	(-1.35)	(-1.81)*	(-0.97)
Change in Insider Holding	0.1517	0.0568	0.0694	0.1611	0.0634	0.0631
	(1.59)	(1.27)	(1.16)	(2.34)**	(1.97)**	(1.63)
Case-Shiller Returns	0.0276	0.1323	-0.1665	-0.4150	-0.0444	-0.4452
	(0.04)	(0.28)	(-0.24)	(-0.86)	(-0.18)	(-1.04)
Intercept	0.1563	0.0254	0.1355	0.0437	-0.0375	0.0642
	(1.35)	(0.31)	(1.65)*	(0.61)	(-0.65)	(1.24)
Firm Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes
N of Obs.	24,668	24,668	24,668	24,668	24,668	24,668
R-squared	0.0810	0.0425	0.0656	0.0294	0.0068	0.0285

Note: This table reports the results of OLS regressions for REIT insider trading from 1996 to 2010. The dependent variables are NIP and Ownership Increase for the overall insiders, the top executives and non-executives employees. NIP is calculated as the number of shares bought by insiders minus the number of shares sold by insiders, divided by the total number of shares bought and sold by insiders. Ownership Increase is defined as the number of insiders making net purchases divided by the total number of inside traders in the given month. The key independent variables are a dummy variable indicating the real estate boom period from January 2004 to March 2006 and a dummy variable for the pre-crisis period, April 2006 to June 2007. The control variables include book-to-market value, firm size, past stock return, stock return volatility, the change in volatility, insider holdings in the previous year, the change in insider holding and the past housing market return. Firm and year fixed effects are included in the regressions. The *t-statistics* calculated by robust standard errors clustered at firm and year are reported in parentheses. ***1%, **5%, and *10%.

Table 4. Insider trading in REITs and other real estate firms

	NIP			Ownership Increase		
	All	Top	Non-Top	All	Top	Non-Top
	(1)	(2)	(3)	(4)	(5)	(6)
Boom	-0.1245	-0.0278	-0.1116	-0.0106	0.0035	-0.0073
	(-1.70)*	(-0.66)	(-1.83)*	(-0.29)	(0.18)	(-0.23)
Pre-crisis	-0.1202	-0.0277	-0.1099	-0.0332	-0.0136	-0.0277
	(-3.70)***	(-1.63)	(-3.73)***	(-2.31)**	(-1.34)	(-1.90)*
Boom*REIT	-0.0777	-0.0835	-0.0519	-0.0525	-0.0452	-0.0341
	(-2.46)**	(-3.49)***	(-1.90)*	(-3.17)***	(-2.97)***	(-1.92)*
Pre-crisis*REIT	-0.0454	-0.0601	-0.0269	-0.0480	-0.0262	-0.0383
	(-1.04)	(-2.20)**	(-0.66)	(-2.54)**	(-1.88)*	(-1.75)*
BM	0.0286	0.0107	0.0220	0.0090	-0.0006	0.0082
	(2.64)***	(1.78)*	(2.69)***	(1.54)	(-0.20)	(2.07)**
Size	-0.0279	-0.0087	-0.0241	0.0167	0.0100	0.0114
	(-1.77)*	(-0.85)	(-2.02)**	(1.64)	(1.35)	(1.43)
Momentum	-0.1429	-0.0699	-0.1197	-0.0320	-0.0174	-0.0200
	(-9.42)***	(-9.55)***	(-8.66)***	(-3.24)***	(-4.43)***	(-2.31)**
Volatility	0.0821	-0.0844	0.2495	-0.0285	-0.1447	0.1104
	(0.21)	(-0.38)	(0.86)	(-0.12)	(-1.07)	(0.51)
Change in Volatility	-0.0547	0.0216	-0.1941	0.1495	0.1658	-0.0061
	(-0.19)	(0.13)	(-0.88)	(1.09)	(1.44)	(-0.06)
Insider Holding	-0.0395	0.0064	-0.0529	-0.0489	-0.0271	-0.0555
	(-0.51)	(0.12)	(-1.16)	(-0.94)	(-0.75)	(-1.93)*
Change in Insider Holding	0.0917	0.0040	0.0538	0.1015	0.0276	0.0577
	(2.19)**	(0.13)	(1.53)	(2.47)**	(1.19)	(2.12)**
Case-Shiller Returns	0.0174	0.1386	-0.0863	-0.3285	-0.0789	-0.3309
	(0.02)	(0.30)	(-0.13)	(-0.80)	(-0.31)	(-0.96)
Intercept	0.1932	0.0694	0.1647	0.0598	0.0161	0.0591
	(1.94)*	(1.02)	(2.19)**	(0.94)	(0.33)	(1.18)
Firm Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes
N of Obs.	36,403	36,403	36,403	36,403	36,403	36,403
R-squared	0.0715	0.0363	0.0578	0.0209	0.0051	0.0194

Note: This table reports the results of OLS regressions of insider trading in REITs and real estate and construction common stocks from 1996 to 2010. The dependent variables are NIP and Ownership Increase from the overall insiders, the top executives and non-executives employees. *REIT* is a dummy variable equal to one if security firm is a REIT and zero if it is a real estate firm other than REITs. The key independent variables are the interaction terms between *REIT* dummy and dummy variables of the real estate boom period and the pre-crisis period. Control variables and firm and year fixed effects are included in the regressions. The *t-statistics* calculated by robust standard errors clustered at firm and year are reported in the parentheses. ***1%, **5%, and *10%.

Table 5. Local market performance and insider trading in the REITs

	NIP			Ownership Increase		
	All	Top	Non-Top	All	Top	Non-Top
	(1)	(2)	(3)	(4)	(5)	(6)
Boom	-0.1844	-0.1149	-0.1486	-0.0366	-0.0491	-0.0180
	(-2.43)**	(-2.35)**	(-2.25)**	(-0.93)	(-2.51)**	(-0.47)
Pre-crisis	-0.1305	-0.0630	-0.1188	-0.0567	-0.0384	-0.0456
	(-4.72)***	(-3.35)***	(-5.24)***	(-3.39)***	(-5.24)***	(-2.94)***
Boom*Leading	-0.0025	0.0067	0.0172	-0.0512	-0.0153	-0.0361
	(-0.07)	(0.27)	(0.52)	(-2.03)**	(-0.97)	(-1.67)*
Pre-crisis*Leading	-0.0297	-0.0336	0.0034	-0.0228	-0.0058	-0.0179
	(-0.68)	(-0.91)	(0.10)	(-1.01)	(-0.34)	(-0.81)
BM	0.0254	0.0038	0.0222	0.0094	-0.0028	0.0113
	(2.09)**	(0.55)	(2.28)**	(1.20)	(-0.66)	(1.87)*
Size	-0.0181	-0.0076	-0.0100	0.0229	0.0142	0.0169
	(-0.88)	(-0.49)	(-0.81)	(1.73)*	(1.43)	(1.88)*
Momentum	-0.1452	-0.0720	-0.1204	-0.0343	-0.0138	-0.0217
	(-4.81)***	(-3.95)***	(-4.74)***	(-1.86)*	(-1.23)	(-1.32)
Volatility	-0.0428	-0.0720	0.1521	-0.2242	-0.1628	-0.0205
	(-0.07)	(-0.20)	(0.31)	(-0.48)	(-0.68)	(-0.05)
Change in Volatility	0.0364	0.1214	-0.0779	0.2558	0.2904	0.0626
	(0.07)	(0.43)	(-0.18)	(0.88)	(1.56)	(0.30)
Insider Holding	-0.0409	-0.0258	-0.0262	-0.1357	-0.1474	-0.0537
	(-0.28)	(-0.17)	(-0.19)	(-1.65)*	(-1.45)	(-0.87)
Change in Insider Holding	0.1854	0.0757	0.1205	0.2095	0.1300	0.1161
	(2.05)**	(1.01)	(1.07)	(2.65)***	(2.28)**	(1.48)
Case-Shiller Returns	0.1647	0.1323	0.0430	-0.4213	-0.1199	-0.3654
	(0.20)	(0.24)	(0.06)	(-0.95)	(-0.47)	(-0.87)
Intercept	0.1494	0.0772	0.0843	0.0282	-0.0047	0.0226
	(1.06)	(0.71)	(0.98)	(0.31)	(-0.07)	(0.34)
Firm Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes
N of Obs.	17,133	17,133	17,133	17,133	17,133	17,133
R-squared	0.0774	0.0452	0.0630	0.0248	0.0045	0.0288

Note: This table reports the results of OLS regressions of REIT insider trading from 1996 to 2010. The dependent variables are NIP and Ownership Increase from the overall insiders, the top executives and non-executives employees. The variable *Leading* is a dummy variable equal to one if a REIT is located in the cities with leading local housing performance and zero otherwise. The key independent variables are the interaction terms between *Leading* dummy and dummy variables of the real estate boom period and the pre-crisis period. Control variables and firm and year fixed effects are included in the regressions. The *t-statistics* calculated by robust standard errors clustered at firm and year are reported in the parentheses. ***1%, **5%, and *10%.

Appendix A. Brief explanation of variable definition

Variable	Explanation	Data Source
NIP	Net insider purchase; the number of insider shares purchased minus the number of insider shares sold, scaled by the total number of insider shares transacted	Thomson Reuters
Ownership Increase	The number of insider buyers divided by the total number of insider traders	Thomson Reuters
Boom	Dummy variable equal to one if the month is from January 2004 to March 2006 and zero otherwise	Derived
Pre-crisis	Dummy variable equal to one if the month is in the range April 2006 to June 2007 and zero otherwise	Derived
BM	Book-to-market ratio; book value of equities divided by market value of equities at the end of the previous fiscal year	Compustat
Size	Firm size; the natural logarithm of total assets at the end of the previous fiscal year	Compustat
Momentum	Past stock returns; cumulative stock returns in the past 12 months	CRSP
Volatility	The standard deviation of daily stock returns in the past month	CRSP
Change in Volatility	The change of volatility in the past month	CRSP
Insider Holding	The number of shares held by insiders in the past year divided by the total shares outstanding at the end of the year	Thomson Reuters
Change in Insider Holding	The change in the number of shares held by insiders in the previous year divided by the total shares outstanding at the end of the year	Thomson Reuters
Case-Shiller Returns	Cumulative returns of Case-Shiller US National Index in the past 12 months	FRED
REIT	Dummy variable equal to one if the security is a REIT and zero otherwise	CRSP
Leading	Dummy variable equal to one if the REIT is located in one of six metro statistical areas with leading housing market performance during the boom period (measured by the cumulative returns of the Case-Shiller 20 City Index from January 2004 to March 2006) and zero otherwise	FRED

Appendix B. The results for real estate and construction companies

Panel A: Number of real estate and construction company common stock and insider holdings

Year	All Stocks	Insider Sample	Percentages	Insider Holding
1996	129	107	82.95%	9.75%
1997	136	119	87.50%	12.48%
1998	151	133	88.08%	11.72%
1999	137	125	91.24%	7.29%
2000	124	113	91.13%	12.17%
2001	108	98	90.74%	9.52%
2002	92	82	89.13%	9.90%
2003	82	74	90.24%	10.72%
2004	74	68	91.89%	7.35%
2005	76	69	90.79%	8.41%
2006	75	68	90.67%	5.15%
2007	79	71	89.87%	8.12%
2008	77	68	88.31%	6.28%
2009	75	65	86.67%	4.39%
2010	67	57	85.07%	4.78%

Panel B: Summary statistics of real estate and construction stocks

	Obs.	Mean	Std. dev.	Median	Min	Max
NIP	11,723	-6.10%	51.35%	0%	-100%	100%
Ownership Increase	11,723	11.21%	30.84%	0%	0%	100%
Boom	11,723	0.13	0.33	0	0	1
Pre-crisis	11,723	0.07	0.26	0	0	1
BM	11,723	0.96	0.90	0.76	0.00	27.99
Size	11,723	5.79	1.79	5.88	0.58	9.97
Momentum	11,723	0.13	0.60	0.03	-0.84	2.56
Volatility	11,723	0.04	0.03	0.03	0.00	0.75
Change in Volatility	11,723	0.00	0.02	0.00	-0.63	0.68
Insider Holding	11,723	9.43%	16.00%	2.51%	0%	89.34%
Change in Insider Holding	11,723	-0.33%	16.49%	0%	-68.83%	68.32%
Case-Shiller Returns	11,723	0.04	0.06	0.06	-0.12	0.13

.

Panel C: Insider trading in real estate and construction common stocks

	NIP			Ownership Increase		
	All	Top	Non-Top	All	Top	Non-Top
Boom	-0.1925	-0.0552	-0.1883	-0.0402	0.0192	-0.0437
	(-3.09)***	(-1.75)*	(-3.53)***	(-1.21)	(0.72)	(-1.68)*
Pre-crisis	-0.1578	-0.0564	-0.1345	-0.0566	-0.0204	-0.0491
	(-7.09)***	(-6.01)***	(-6.86)***	(-4.03)***	(-2.12)**	(-4.94)***
Control variables	Yes	Yes	Yes	Yes	Yes	Yes
Firm Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes
N of Obs.	11,723	11,723	11,723	11,723	11,723	11,723
R-squared	0.0844	0.0313	0.0727	0.0011	0.0051	0.0011

Note: This table presents the sample of real estate and construction firms in Panel A, summary statistics in Panel B and the regression results of insider trading in Panel C. The variables definitions are contained in Appendix A. Panel C reports the results of the OLS regressions for real estate and construction insider trading from 1996 to 2010. The dependent variables are NIP and Ownership Increase for the overall insiders, the top executives and non-top executives. The key independent variables are a dummy variable indicating the real estate boom period from January 2004 to March 2006 and a dummy variable for the pre-crisis period from April 2006 to June 2007. Control variables and firm and year fixed effects are included in the regressions. To conserve space, we do not report the control variables coefficients. The *t-statistics* calculated by robust standard errors clustered at firm and year, are reported in the parentheses. ***1%, **5%, and *10%.