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REITs: Dual Asset Markets and “Arbitrage”

Dongshin Kim

REITS: DUAL ASSET MARKETS AND "ARBITRAGE"

BY

DONGSHIN KIM

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ACCEPTANCE

This dissertation was prepared under the direction of the Dongshin Kim's Dissertation Committee. It has been approved and accepted by all members of that committee, and it has been accepted in partial fulfillment of the requirements for the degree of Doctor of Philosophy in Business Administration in the J. Mack Robinson College of Business of Georgia State University.

Richard Phillips, Dean

DISSERTATION COMMITTEE

Dr. Jonathan A. Wiley, *Chair*
Dr. Karen M. Gibler
Dr. Alan J. Ziobrowski
Dr. Gerald D. Gay

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I dedicate this dissertation to my wife, Jookyung Lim, who made everything possible for me with love. Sean, my son, is my love and joy. I thank our parents and family in Korea.

I thank God for His unfailing love for me in every step of my journey.

ABSTRACT

REITS: DUAL ASSET MARKETS AND "ARBITRAGE"

BY

DONGSHIN KIM

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Committee Chair: Dr. Jonathan A. Wiley

Major Academic Unit: Department of Real Estate

Dual asset markets are unique to real estate. When the assets are held by a real estate investment trust (REIT), properties trade in property markets while claims on cash flows from these assets trade in a public equity market. If the two parallel markets are in disagreement regarding the total market value of underlying assets, then REIT managers are faced with inter-market arbitrage opportunities. If a REIT's shares trade at premium in the stock market relative to the net asset value (NAV) of the underlying assets, the arbitrage opportunity can be exploited by issuing new equity in the stock market and purchasing assets in the property market with the proceeds from new equity. If a REIT's shares trade at a discount to NAV, the arbitrage opportunity is achieved by selling assets in the local property market and repurchasing shares of common equity. In this dissertation, I investigate whether REIT managers attempt to exploit such opportunities. Specifically, I identify whether share price premiums or discounts to NAV influence the propensity

of REIT managers to purchase versus sell assets in the property market. In addition, I investigate whether the market-wide premiums to NAV influence the relative transaction prices paid for the property while carefully controlling for the sample selection issue in the analyses. Further, since this information is feasible to evaluate by analysts, I investigate how investors in the stock market react when REIT managers issue new equity during periods of premiums to NAV. The analyses use property level transaction data for commercial real estate asset values and stock price data for REITs.

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CHAPTER ONE – INTRODUCTION

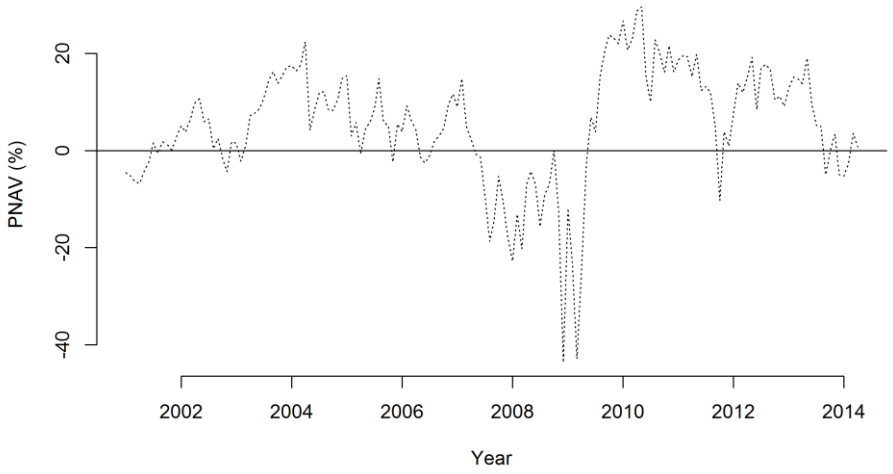
1.1 Background

Real estate assets are potentially traded in two parallel markets. In the local property market, individual assets are traded directly among private parties. At the same time, in the public equity market, claims on cash flows from these assets are traded as equity shares in real estate investment trust (REIT) stock ownership. Unlike most other industries, here property market transaction information is available, and analysts are effectively able to mark the underlying asset to market value to estimate the net asset value (NAV) of a REIT (market value of underlying assets minus outstanding liabilities).

Often times, asset valuations differ across the two parallel markets. Industry data is readily available to confirm the extent of disagreement between the dual asset markets (Figure *1*). The inter-market pricing differential is usually measured by the premium/discount to NAV (PNAV), which is the share price to NAV ratio minus one. During most periods, the two markets are inconsistent in their valuation of the underlying assets. When the PNAV is positive (i.e., premium to NAV), the public equity market values the underlying assets higher than the property markets. On the other hand, when the PNAV is negative (i.e., discount to NAV)[1], the public equity market places a lower value on the underlying assets than property markets.

[1] In this paper, premium/discount to NAV (PNAV) refers "price/NAV – 1" which can range from negative to positive values. Positive PNAV is distinguished by the term "premium to NAV"; negative PNAV is distinguished by "discount to NAV".

Figure 1 ■ Market-wide Average Premium to NAV.



Source: Green Street Advisors.

Note: This figure displays the monthly average REIT share price premium/discount to NAV (PNAV) for all REITs. PNAV is defined as *price/NAV-1*.

Previous research has considered the existence of dual asset markets and the pricing differentials in the context of causes of the pricing differentials (e.g., Capozza and Lee 1995; Barkham and Ward 1999; Gentry, Kemsley and Mayer 2003; Brounen, Ling and Prado 2013), while others have focused on consequence of pricing differentials for capital structure decisions of REIT managers (Boudry, Kallberg and Liu 2010).

However, the dual asset market characteristic of real estate brings up another interesting question that is yet to be explored: *Is inter-market arbitrage viable?* The arbitrage strategy is explained in Geltner, Miller, Clayton and Eichholtz (2014). Theoretically, when the public equity market favors the real estate securities with a premium to NAV, REIT managers can take advantage of "arbitrage" opportunities by issuing new equity shares in the stock market and purchasing assets in the property market. On the other hand, when the stock market is unfavorable to real estate securities and shares trade at a discount to NAV, REIT managers can exploit

"arbitrage" by selling assets in the property market and using the proceeds from asset sales to repurchase outstanding equity shares. In addition, managers may elect to take action at the firm level instead of transacting individual properties in order to exploit the mispricing between the two asset markets. If higher share prices are expected relative to NAV, a private real estate firm can go public, effectively selling the entire portfolio in the public market at a higher price. On the other hand, if a publicly-listed REIT has shares trading at discount to NAV, the firm may become a desirable merger and acquisition (M&A) target with the sum of the individual assets being collectively worth more than the sum of the equity and debt claims. Such outcomes would only be true arbitrage opportunities in a world without uncertainty and transactions costs. The word "arbitrage" is used loosely here, since commercial real estate transactions are inherently risky. The pricing differential is only an approximation of the true value. Also, real estate transactions tend to be very illiquid and are associated with relatively high search and transaction costs which make immediate arbitrage execution difficult.

Nevertheless, if REIT managers follow this decision rule and attempt to exploit the inter-market arbitrage opportunities, REITs should become active buyers or sellers in the property market depending on whether the share trades at a premium or discount to NAV. In addition, the overall magnitude of the PNAV should have a deterministic impact on managerial decisions to execute initial public offerings (IPO) or on M&A decision within the REIT sector. This dissertation investigates whether the frequency of transactions on either side is impacted by PNAV and whether PNAV has an impact on IPO and M&A decisions.

When premium to NAV occurs for the REIT sector in aggregate, it is possible that numerous REIT managers are attempting to exploit inter-market arbitrage opportunities, and prices for individual assets may be bid upwards due to competition for acquisitions from other REITs.

Thus, REIT industry-wide premiums to NAV are expected to put upward pressure on property prices for assets targeted for investment by REIT managers. Existing studies note that REITs tend to pay significantly higher prices in property market acquisitions (Hardin and Wolverton 1999; Lambson, McQueen and Slade 2004; Ling and Petrova 2009; Akin et al. 2013). This dissertation examines whether REITs' property acquisitions that are motivated by share premiums to NAV cause REITs to pay relatively higher prices for similar assets when compared to other investors.

The investigation of purchase price paid by REIT requires careful sample selection process as a preliminary step. Akin et al. (2013) find that REITs typically purchase different types of properties (e.g. larger and newer properties) compared to non-REIT buyers (e.g. individuals, partnerships, limited liability companies, etc.). They also argue that REITs buy properties with higher-quality characteristics which are unobservable. To address potential sample selection bias according to the buyer clienteles, I limit buyer types only to institutional investors including *Listed REIT, Non-listed REIT, Private REIT, Equity Fund, Insurance, Investment Manager and Pension Fund*. In addition, due to heterogeneous nature of commercial properties, classical hedonic pricing model (Rosen 1974) does not guarantee "apples-to-apples" comparison. To achieve a more direct comparison set, I apply a property matching technique to address sample selection issue (e.g. Eichholtz, Kok and Quigley 2010; Wiley 2012). Previous studies report that REITs pay significant premium in property purchases compared to other buyer types (Hardin and Wolverton 1999; Lambson, McQueen and Slade 2004; Ling and Petrova 2009; Akin et al. 2013). I investigate whether this premium paid by REITs persists after the matching process, and whether it is influenced by NAV premiums/discounts.

Furthermore, if REIT stock investors are aware of management's opportunity to exploit inter-market arbitrage opportunities, then investors may respond favorably to activities that are

consistent with the arbitrage strategy. Boudry, Kallberg and Liu (2010) show that REITs are more likely to issue equity when the premium to NAV is high. This may indirectly suggest that REITs are issuing this equity because they desire to use the proceeds to purchase properties (although not directly examined in their study). Thus, new equity issuance when shares trade at a premium to NAV may signal to the stock market that REIT management is maneuvering to exploit the current arbitrage opportunity. In the finance literature, seasoned equity offerings (SEO) are often responded to negatively by investors because they are believed to signal that the stock is overvalued (Myers 1984; Myers and Majluf 1984). Yet, for REITs, the negative abnormal stock returns followed by SEO announcements are mitigated relative to non-REIT firms (Howe and Shilling 1988; Francis, Lys and Vincent 2004; Ong, Ooi and Kawaguichi 2011). Francis, Lys and Vincent (2004) argue that REIT share offerings may convey positive information about new investment opportunities because REITs are cash-constrained due to the dividend payout requirement and must tap the capital market for new investments. In this dissertation, the stock price reaction to SEO announcements is differentiated for REITs issuing equity when shares trade at a premium or discount to NAV, and the magnitude of the premium or discount to NAV is interacted with the stock price reaction. This distinction allows for an important insight into the observed diminished negative stock price reaction for REITs following SEOs: perhaps share prices are not severely penalized because REIT managers are more likely to issue SEOs opportunistically, when there are premiums to NAV.

Figure *1* shows that the pricing differential is persistent for long periods of time before returning to the no-arbitrage condition. Several of the unique characteristics of commercial real estate market may contribute to this persistence. First, unlike stock markets, real estate dual asset market arbitrages are difficult to implement for individual investors because they are lack of ability

to long or short the bulky, indivisible assets. Only REIT managers are positioned to execute the inter-market arbitrage strategy. There are several factors that may hinder REIT managers from executing arbitrage strategy efficiently. Commercial real estate transactions involve significant frictions. Property search and deal closings require significant time and expense, including management search along with brokerage and third-party fees. Furthermore, NAV is an estimate or opinion of value, rather than a precise value. By the time REIT management has identified a property for acquisition (disposition), the premium (discount) to NAV may have shifted. These factors contribute to prolonged periods of the pricing differential across the dual asset markets.

REITs represent a nontrivial component of investment-grade commercial property transactions. Among transactions by institutional investors in the major markets, around 17-51% were executed by listed REITs (shown in Table *1*). Considering the scale of REIT activity in the property market, it is important to understand the extent to which REIT property investment strategies are affected by inter-market pricing differentials. REITs tend to generate returns primarily through income yields rather than capital gains. However, inter-market pricing differentials can make REITs change their colors from an income stock to a growth stock which may be perceived as a source of risk for REIT investors (Geltner et al. 2014). This paper offers insights into factors that influence the color-changing timing of REIT stocks.

Table 1 ■ Commercial real estate transactions by investor types.

	Retail		Office		Multifamily	
Investor Types	Volume ($ billion)	Share (%)	Volume ($ billion)	Share (%)	Volume ($ billion)	Share (%)
Equity Funds	1.17	4.15	16.78	8.19	9.51	9.92
Insurance	0.43	1.51	12.02	5.86	2.38	2.49
Investment Manager	6.93	24.59	94.05	45.87	52.48	54.77
Listed REIT	14.35	50.87	44.10	21.51	16.26	16.97
Non-listed REIT	2.59	9.18	11.73	5.72	7.90	8.24
Pension Fund	1.05	3.73	13.32	6.50	5.55	5.79

Private REIT	1.68	5.96	13.03	6.35	1.74	1.81
Total	28.20	100	205.03	100	95.81	100

Notes: This table reports the commercial real estate transaction volume ($ billion) during 2001-2014 by investor types. *Listed REIT* indicates publicly-traded REITs. Data is composed from CoStar. Data is limited to transactions with sale price of at least $50,000 and building size of at least 10,000 square feet (SF). Data includes only transactions that occurred in submarkets which have at least 100 transactions during the sample period.

This dissertation investigates whether REIT managers exploit the arbitrage opportunities between the two parallel markets. Using SNL data for the entire asset holdings of each REIT in the sample, the frequency of net purchases versus net divestiture that occur in the property market is evaluated in light of PNAV. In addition, firm level decisions of IPO and M&A are related to PNAV. Using CoStar property market transactions data for individual assets, the property purchase premiums paid by REIT managers are compared to asset prices paid by other investors and this property purchase premium is related to PNAVs. In this analysis, the dataset is constructed using a property matching procedure to address potential sample selection bias. Finally, utilizing CRSP daily stock return and CRSP/Ziman REIT index return data, abnormal stock return around the equity issuance announcement date is analyzed in relation to PNAVs. The evidence provided in this dissertation offers valuable insights into the consequences of mispricings and arbitrage opportunities in the dual asset markets.

1.2 Objectives of the Dissertation

The broad objective of this dissertation is to extend the body of knowledge regarding the dual nature of real estate markets by investigating the behavior of REIT management when faced with premiums or discounts to NAV, and the response of shareholders. Toward this end, the dissertation addresses the following specific questions.

1. When shares trade at premiums (discounts) to NAV, do REIT managers become more active as buyers (sellers) in the property market?
2. Do private real estate funds have an increased propensity to go public when there is a market-wide REIT share premium? On the other hand, do public firms become M&A targets when their shares trade at discount?
3. In property acquisitions, do REIT managers pay a higher (lower) price relative to other investors when the REIT shares experience market-wide premiums (discounts) to NAV?
4. Does the property purchase premium paid by REITs reported in the previous research persist after conditioning the dataset with the matching procedure methodology?
5. When shares trade at a premium to NAV, are new equity issues by REITs met with smaller negative abnormal stock returns?

1.3 Contribution of the Dissertation

Existence of dual assets markets is somewhat unique to real estate, and the mispricing of claims on the underlying assets across the two markets appears quite common. An improved understanding of the consequences from related arbitrage opportunities should be useful to both property market and stock market participants who seek to make optimal investment decisions. This dissertation investigates the responsiveness of REIT managers in the property market and REIT equity investors in the stock market surrounding inter-market pricing differentials. Specific contributions are summarized for two specific areas below.

First, this dissertation investigates property market transactions. The focus of previous research on the premium to NAV has been limited to issues in the stock market. One line of research aims to explain the drivers of premium to NAV in the stock market (Capozza and Lee

1995; Barkham and Ward 1999; Gentry, Kemsley and Mayer 2003; Brounen, Ling and Prado 2013). Other research investigates how the premium to NAV affects security issuances by REITs (Boudry, Kallberg and Liu 2010). This dissertation directs the research attention to the property market. Specifically, the dissertation investigates whether REIT managers attempt to exploit the inter-market pricing differential in the property market. At the property level, REIT managers can change their investment strategy to become net buyers (sellers) when there are premiums (discounts) to NAV. At the entity level, private firms may go public when management expects premium valuations by the stock market, while public firms may become M&A targets when their shares trade at a discount. REIT managers may pay a higher price for individual assets during periods of premium to NAV to secure a deal from other competitors. By adopting a matching technique to the transactions data, this dissertation offers an enhanced understanding for the property purchase premium paid by REITs that has been reported in previous research.

Second, this dissertation examines REIT shareholders' reaction surrounding premiums to NAV. It ought to be favorable information that REIT management intends to exploit the temporal arbitrage opportunity. New equity issuances that occur when shares trade at a premium to NAV might signal that management aims to acquire new assets using proceeds from the equity issue. Consequently, investors may respond favorably to such value-enhancing actions, resulting in diminished negative abnormal returns for SEOs when REIT shares trade at a premium to NAV.

1.4 Organization of the Dissertation

The plan for this dissertation is as follows: Chapter two provides the conceptual background of the dissertation by reviewing the previous literature on REIT property transactions and REIT share prices. Next, the hypotheses are developed. Chapter three presents the data, methodology and the

model. Chapter four discusses the empirical results. Chapter five concludes the dissertation with final remarks and implications.

CHAPTER TWO – LITERATURE REVIEW

2.1 Inter-market Arbitrage

The arbitrage opportunity between public and property markets is well described in Geltner et al. (2014). In the property market, properties are traded at market value (MV_p). For each property, REIT investors have their own investment value (IV_R). The inter-market arbitrage opportunity arises when the investment value for REIT investors diverges from the property market value, $IV_R \neq MV_P$. When the stock market values the portfolio of a REIT's properties greater than the property market does, REIT managers face a positive net present value (NPV) arbitrage opportunity such that $NPV_R = IV_R - MV_P > 0$. Under this scenario, REIT managers achieve the positive NPV by issuing new equity in the stock market and using the proceeds to acquire new assets in the property market. Alternatively, if the portfolio of REIT assets is undervalued by the stock market, $NPV_R = MV_P - IV_R > 0$, REIT management can take advantage of these conditions by divesting of assets in the property market and using the proceeds to repurchase shares or pay special dividends. These activities have consequences for shifting share prices and asset values in the property market in a direction that should diminish the arbitrage opportunity over time.

The literature review in this section provides the theoretical framework for the dissertation. The first section of the literature review begins with coverage of research that is related to the inter-market pricing differential. PNAV may have influences both in the property market and the public equity market. The second section focuses on the property market, reviewing investment activities and relative transaction prices of REIT managers. Shifting focus to the stock market, the third section provides a review of studies for REIT security issuance events. For methodological

development, the fourth section covers transaction matching techniques used in hedonic pricing applications.

2.2 Inter-market Pricing Differential

Deviations of share prices from NAV have been studied for REITs in the stock market context. One stream of research seeks to explain the underlying cause of such pricing deviations. Capozza and Lee (1995) investigate the sources and outcomes of PNAV. They document that retail REITs trade at significant premiums while warehouse/industrial REITs trade at discounts. Also, large REITs enjoy premiums while small REITs experience discounts. However, PNAV has no impact on funds from operations (FFO). REIT shares that trade at a discount to NAV, such as small-cap and warehouse/industrial REITs, tend to have higher than average expense ratio. Large REITs typically use higher than average financial leverage. Ling and Ryngaert (1997) analyze the underpricing in REIT IPOs in the 1990s. They report that IPO underpricing for REITs is related to underwriter reputation, participation by institutional investors, financial leverage and active management. Utilizing the special characteristics of REITs, Gentry, Kemsley and Mayer (2003) investigate the impact of shareholder-level tax benefits on share prices. The nature of REIT assets offers tax shields from depreciation and REITs are tax-exempt at the corporate level. They find that the tax advantages of REITs are capitalized into share prices. In a parallel market study using U.K. REITs, Barkham and Ward (1999) find that the market capitalization is commonly lower than NAV. They hypothesize that the discount to NAV results from agency costs, possible capital gain taxes and several firm-specific characteristics. They find that the capital gain tax and company-specific factors (e.g., size, trading stocks) have an impact on the individual stock discounts, but the broader sentiment for the sector is also an important factor. Brounen, Ling and

Prado (2013) study the impact of short-sale restrictions on REIT PNAV. They find that short-sale activity explains one-third of the PNAV variations. Contrary to Barkham and Ward (1999), the effect of short-sale constraints seems to overwhelm the investor sentiment effect. Short sale constraints lead to greater fluctuations in PNAV over the short-run and cause overvaluation when demand for short positions is strong but supply is limited. Utilizing short sales, dual asset market mispricings are only corrected when REIT share trade at a premium to NAV.

The mean-reversion properties of the price/NAV ratio has also been investigated. In the U.K., Barkham and Ward (1999) investigate the long-term relationship between property company stock prices and NAV and find a stable equilibrium relationship. In another U.K. study, Patel, Pereira and Zavodov (2009) show that the discount to NAV has a mean-reverting tendency to the long-term mean of 20%. For Singapore property companies, Liow (2003) finds some evidence that the stock prices revert towards the company's NAV and suggests that the stock prices and NAV are nonlinearly linked.

The reaction of stock market investors to pricing differentials has received relatively less attention. Boudry, Kallberg and Liu (2010) investigate the determinants of REIT security issuance. They find that REITs are more likely to issue equity when price/NAV ratio is high. They suggest that REITs attempt to enjoy the valuation differential between public and property markets. In other words, REITs tend to issue equity when the cost of capital is relatively cheaper in the stock market. Yet, the actions that REIT managers take in response to PNAVs have not yet been investigated for transactions in the property market.

2.3 REIT Property Transactions

The investment decision of REIT managers in the property market has been studied in the extant literature. Riddiough and Wu (2009) investigate investment and liquidity management of REITs which are cash-constrained due to the dividend payout requirements. They document that REITs increase investment when they have greater bank line of credit capacity and cash stock. Eichholtz and Yönder (2014) analyze the influence of CEO overconfidence on REIT investment activity. They find that REITs invest more when the CEO is overconfident. REITs that have an overconfident CEO buy more property and sell less frequently when compared to REITs that do not have an overconfident CEO. They also find that the REITs led by overconfident CEOs exhibit weak performance in net operating income and revenue growth. Both Riddiough and Wu (2009) and Eichholtz and Yönder (2014) control investment opportunity using Tobin's q (Brainard and Tobin 1968; Tobin 1969) based on book values. Overall, REITs invest more when there is greater investment opportunity, as measured by Tobin's q. Unlike other firms, REITs offer a more accurate measure for Tobin's q since the assets are largely tangible and held in real estate. Thus, Tobin's q for REITs can be more accurately measured using NAV rather than book values for assets (Hartzell, Sun and Titman 2006).

REITs are constrained in their ability to sell property due to REIT regulation. Mühlhofer (2013) examines the impact of the dealer rule on REIT returns. The dealer rule refers the selling constraints imposed on REITs: REITs should hold each property at least four years and they are allowed to sell only 10% of their total portfolio in a given year. The minimum holding period requirement was reduced to two years on July 30, 2008. Mühlhofer shows that REIT returns do not reflect capital gains in the short-run due to the dealer rule constraint. However, umbrella partnership REITs (UPREITs) are relatively free from the dealer rule because the contributing

partner's holding period counts toward REIT's holding period. In a related study, Mühlhofer (2014) shows that the dealer rule is costly to investors.

Extensive research has been conducted on the motivation for going public (e.g. Rock 1986; Welch 1989; Chemmanur and Fulghieri 1999) and going private (e.g. Jensen 1986; Wruck 1990; North 2001) in finance. For REITs, Hartzell, Kallberg and Liu (2005) investigate the initial public offering (IPO) decision and find that IPO activity increases with strong property market conditions and high REIT share prices. Ling and Petrova (2011) explore the rationale for REITs to go private by investigating the characteristics of REITs that are targeted for M&A. They find that small and less liquid REITs which have high dividend yields are more likely to become M&A targets whereas UPREITs are less likely targets. Brau et al. (2013) also investigate the decision to go private by REITs and find that recently favorable performance and higher quality governance mechanisms negatively impact the decision to go private. In addition, they investigate the impact of private vs. public markets performance, measured as the spread between index returns of private and public markets. They report a positive but statistically insignificant coefficient for the spread.

In the property market, certain investor clienteles pay higher prices when acquiring real estate assets. Wiley (2012) estimates a 12% premium paid by corporate investors compared to non-institutional investors in the office market. Liu, Gallimore and Wiley (2015) report a 13.8% premium paid by nonlocal office investors. REITs, among the clienteles, are found to pay much higher estimated premiums for acquisitions. Hardin and Wolverton (1999) find that apartment REITs pay premiums of 27% above market value for apartment assets in Atlanta and Phoenix. They attribute this premium to agency costs. REIT management may be under pressure to expand or believe that they can achieve operational efficiencies through scale. In the Phoenix apartment market, Lambson, McQueen and Slade (2004) find similar results for REIT transaction premiums

to Hardin and Wolverton (1999). Ling and Petrova (2009) estimate premiums in the range of 14-16% in office, industrial and retail transactions.

Akin et al. (2013) estimate the premium paid by REITs to be 30% after controlling physical property characteristics. Yet, when they apply a repeat sales approach, the estimated premium reduces to 6.4%. They conclude that REITs buy properties with unobserved higher-quality characteristics. The residual premium of 6.4% is explained by two factors. First, REITs are willing to overpay due to their advantageous cost of capital relative to other investors. This explains why publicly-traded and large REITs tend to pay the higher premiums. Second, REITs are time-constrained in acquisitions on occasion due to REIT regulation. At least 75% of a REIT's assets are required to be invested in real estate, cash or government securities, and at least 75% of a REIT's gross income should be generated from real estate, including rents, mortgage interest and capital gains from asset sales. Essentially, a REIT has one year to deploy new capital into real estate holdings or REIT status is in jeopardy. REIT mangers have additional incentives to quickly deploy capital due to contractual obligations, management fees and performance evaluation. Consequently, REITs that recently obtained new capital tend to pay higher premiums for acquisitions.

Property transactions can impact a firm's stock returns. Glascock, Davidson and Sirmans (1991) investigate firm restructurings that involve real estate holdings. Surrounding the property transaction announcement day, divesting firms experience abnormal returns; acquiring firms do not. The authors attribute the abnormal returns for the divesting firm to tax shelter benefits. If a firm divests of a fully-amortized asset and replaces it with a similar asset, the firm enjoys greater depreciation benefits. In more recent research, Booth, Glascock and Sarkar (1996) apply a GARCH model and confirm the findings of Glascock, Davidson and Sirmans (1991). Focusing

exclusively on REITs, McIntosh, Ott and Liang (1995) find no abnormal returns surrounding transaction announcements. Yet, they find positive and significant abnormal returns when the asset sale is followed by an increase in dividends. Campbell, Petrova and Sirmans (2003) investigate portfolio acquisitions by REITs. In contrast to previous research, they provide evidence of a positive and significant abnormal return surrounding the purchase announcement. They attribute this finding to the wealth benefit that arises from geographical focus and the positive market signal obtained from the use of project-specific private debt and equity. Campbell, Petrova and Sirmans (2003) analyze REIT property sell-offs. Total proceeds greater than $20 million is defined as a property sell-off. They estimate abnormal returns in the magnitude of 1-3% around the announcement day, which is consistent with abnormal returns for non-REIT firms that make real estate divestitures. Since REITs are exempt from income taxes, the tax shelter benefits that accumulate to non-REIT firms (discussed in Glascock, Davidson and Sirmans 1991) fail to explain the gains to shareholders. Campbell, Petrova and Sirmans (2003) argue that the positive return stems from efficiency gains in asset reallocations. Wiley (2013) studies REIT asset sales in the context of opportunistic versus liquidation. Opportunistic (liquidation) sales occur when the firm sells real estate above (below) the fundamental value. He finds positive abnormal returns following opportunistic assets sales but no abnormal returns following liquidations.

The existing literature discusses the factors that impact REIT investment decisions including property transactions, IPO and M&A and the observed property purchase price premium paid by REITs in the property market. In addition, the stock market response surrounding the REIT investment activity announcements has been covered. However, the PNAV motive for REIT investment has not been previously been documented in the extant literature.

2.4 REIT Security Issuance

REITs are required by the Internal Revenue Service (IRS) to pay out at least 90% of taxable income as dividends. In addition, the REIT industry is capital-intensive. These conditions cause REITs to frequently access the capital markets. Ott, Riddiough and Yi (2005) report that 84% of REITs investments were financed by equity and long-term debt while only 7% were financed by retained earnings.

Capital structure issues have been examined in theoretical and empirical studies since the seminal work of Modigliani and Miller (1958). Trade-off theory claims that there is an optimal capital structure which exists at the point where the marginal benefits from additional debt, such as tax benefits and lower cost of capital, are exactly offset by the increased marginal costs of higher debt levels, including expected financial distress costs (Modigliani and Miller 1958, 1963). Pecking-order theory argues that there is no optimal capital structure due to the inherent preference of managers in selecting among alternative sources of funding. Myers and Majluf (1984) develop an equilibrium model of the issuance-investment decision. The model suggests that firms may be reluctant to issue new equity. Management may have a strong preference for financing new projects with internally-generated cash flows, then debt, and equity issuance would be the most expensive and least desirable. Finally, market timing explanations (e.g., Graham and Harvey 2001, Baker and Wurgler 2002) suggest that managers attempt to time the market based on their private beliefs about the true value of the firm.

The stock market reaction to the SEOs has an impact on the capital structure decision. In the short-horizon, a number of studies document stock return underperformance surrounding SEO announcements. Asquith and Mullins (1986) investigate the impact of SEOs on stock prices. They find abnormal announcement day returns of -2.7% and -0.9% for industrial and public utilities

firms respectively. They conclude that equity issues are viewed as a negative signal by investors, consistent with the theoretical argument in Myers and Majluf (1984). Masulis and Korwar (1986) also provide evidence of negative stock price reactions to SEOs. They attribute the negative shock to the signaling effect suggested by Leland and Pyle (1977). The Leland and Pyle (1977) model suggests that it is costly for managers to hold a large portion of the firm's stock for diversification reasons. Thus, managers will hold large portions of the firm's stock only when they expect high future cash flows relative to the current firm value. Accordingly, a stock offering that dilutes management's ownership claim can be viewed as a negative signal about the firm's perceived value by insiders. Masulis and Korwar (1986) find that the information conveyed in offerings is greater for industrial companies than for public utilities. They attribute this to the high frequency of offerings conducted by public utilities. Kalay and Shimrat (1987) test three possible hypotheses regarding the negative stock market reaction to new equity issues. The price-pressure hypothesis states that the firm is facing downward demand for its stock, thus the new issuance (increase in quantity) will reduce the price of outstanding stocks. The wealth-redistribution hypothesis argues that new equity issues are used to reduce the leverage ratio, increasing the market value of debt. The debt claim increases in value at the expense of equity shareholders. Finally, the information-release hypothesis is along the lines of Leland and Pyle (1977) and Myers and Majluf (1984). Kalay and Shimrat (1987) find empirical evidence supporting the information-release hypothesis.

Loughran and Ritter (1995) investigate the long-term impact of equity offerings on stock price returns and find that the issuing firm significantly underperforms non-issuing firms – called the new issues puzzle. During the five years following new equity issuance, firms with SEOs realized an average annual return of 7% while non-issuing counterparts realized a 15% return. Controlling for both firm size and book-to-market ratio, issuing firms experience lower returns

than the non-issuers over the long horizon. Loughran and Ritter (1995) argue that firms strategically time the market by issuing new equity when shares are overvalued. Spiess and Affleck-Graves (1995) also provide evidence of long-run underperformance by equity issuers. Returns on investment for equity-issuing firms are only 85% of the analogous returns for non-issuing firms. They suspect that mis-measurement of related risks is the cause of this underperformance and conclude that their finding is consistent with market timing theory.

Brav, Geczy and Gompers (2000) question the existence of the new issues puzzle. They find that SEO firms with small size and low book-to-market ratio underperform non-issuers. However, SEO firm returns co-vary with non-issuing firm returns, and the return pattern of issuers is no different from non-issuers. SEO firms are part of systematic price movements in the market. Eckbo, Masulis and Norli (2000) adopt a matching technique, analogous to Fama and French (1993), to construct size and book-to-market ranked portfolios. They show that issuer underperformance is a reflection of lower systematic risk by issuing firms relative to that of matched non-issuers. They conclude that the new issues puzzle is the result of a failure to appropriately control for risk in the empirical testing.

In the case of REITs, negative share price performance following SEOs are somewhat mitigated compared to non-REIT firms. Howe and Shilling (1988), investigating REITs equity offerings, find -1.9% average two-day excess return in response to the announcement compared to non-REIT firms' -3.1% average return. Francis, Lys and Vincent (2004) also find negative stock market reaction to the SEO announcements but with smaller magnitude relative to non-REIT firms, consistent with Howe and Shilling (1998). They attribute their finding to the cash-constrained nature of REIT. REITs are required to payout up to 90% of taxable income as dividends which limits the internal financing ability. Thus, REITs have to access the capital market for new

investments and the equity offering does not necessarily convey a negative signal. For Singapore and Japan REITs, Ong, Ooi and Kawaguichi (2011) find that the simultaneous announcement of property acquisition mitigates the negative share price performance following SEO announcements. They argue that the contemporaneous property acquisition announcement increases the transparency associated with the use of new equity proceeds.

The SEO offering price has also been investigated. Parsons and Raviv (1985) model the offering price of SEOs, with the prediction that the offering price will be lower than the pre-offer price. On the other hand, Loderer, Sheehan and Kadlec (1991) fail to find convincing evidence that offering prices are systematically lower than market prices. In the REIT context, Ghosh, Nag and Sirmans (2000) test competing theories of the SEO offering price. They find that REITs offer new equity issues at a lower price than both the closing price the day before and the closing price on the day of the offer, consistent with Parsons and Raviv (1985).

For REIT capital structure overall, Brown and Riddiough (2003) analyze REIT financing choice and debt structure. They find that REITs are mostly likely to use proceeds from new equity issues for investment, while proceeds from public debt offerings tend to be used for restructuring of liabilities. Firms with high level of secured debt are more likely to issue equity than public debt. Public debt issuers pursue long-run target leverage ratios in order to maintain investment-grade ratings. Boudry, Kallberg and Liu (2010) investigate the marginal capital structure choice of REITs. They find strong support for market timing theory. REITs are more likely to issue equity when the premium to NAV is high.

Overall, previous studies suggest that SEO announcements convey negative signals to the market. However, for REITs, the negative impact can be reduced if the SEO announcement simultaneously carries information about new investment opportunities. Since PNAV can be

exploited by REIT managers to achieve positive investment, PNAV may indirectly convey positive signals to the stock market at the time an SEO is announced.

2.5 Matching in Hedonic Pricing Models

Hedonic pricing theory (Rosen 1974) states that the goods are valued for their utility-producing characteristics. Adapting Rosen (1974), hedonic pricing models are widely used in residential and commercial real estate research. However, commercial properties are more heterogeneous than residential and simple application of hedonic model to commercial real estate does not guarantee an "apples-to-apples" comparison. To overcome this issue, a propensity score matching technique (Rosenbaum and Rubin 1983, 1984) has been adapted to real estate hedonic pricing models. To estimate the treatment effect, the matching technique pairs each observation in the treatment group with a counterpart observation that has similar characteristics based on nearest-neighbor propensity score matching with replacement. In commercial real estate, the propensity score matching procedure has been applied by Eichholtz, Kok and Quigley (2010), Wiley (2014), Wiley et al. (2014) and Liu, Gallimore and Wiley (2015). In residential research, McMillen (2012) suggests the matching estimator price index as an alternative to hedonic or repeat sales based indices. The hedonic model is known to suffer from possible omitted variable bias. The repeat sales approach overcomes the omitted variable problem but significantly reduces sample size and requires the assumption that property characteristics do not change over the sample period. McMillen argues that the matching approach allows for a larger sample size than the repeat sales approach while still reducing issues from omitted variable bias. Thus, the matching estimator index represents the middle ground between a classical hedonic index and the repeat sales index. The matching approach is implemented with similar but not identical homes. Repeat sales index is the

extreme case of a matching process. McMillen demonstrates that the matching approach produces an equivalent estimator to the repeat sales estimator.

Eichholtz, Kok and Quigley (2010) match each subject property to nearby properties in the same submarket. Wiley (2012) applies a similar matching process to that of Eichholtz, Kok and Quigley (2010). Wiley clusters subject properties by submarket, property class, property age, property size and transaction date. To be included in the matched control group, properties must be in the same submarket and of the same property class. Also, the properties should have age within five years of subject property and property size within 40% of subject property. Finally, transactions must have occurred within two years of the transaction date of subject property. In later research, Wiley (2013) applies ranges of 15 years property age, 50% of property size and one-year transaction period.

Akin et al. (2013) argue that REITs, compared to non-REIT investors, are typically interested in a specific subset of properties such as larger properties. Also, as will be covered in the data section, institutional investors (e.g., REITs, investment managers, equity funds) transact significantly larger assets compared to non-institutional investors (e.g., individuals, corporations, owner-occupiers). Simple application of the hedonic model using raw data will result in biased estimations. Thus, it is necessary to carefully construct the dataset using the matching procedure as a preliminary step for the empirical analyses.

2.6 Hypotheses Development

The dual asset market is unique to real estate and a REIT's PNAV can be evaluated by analysts. Consequently, REIT managers are often faced with inter-market arbitrage opportunities. The

literature review reveals that research on PNAV has primarily focused on explaining causes of the PNAV, while it has not been fully investigated whether REITs attempt to exploit the inter-market arbitrage opportunities in the property market or how REIT shareholders react to new equity issues that occur under premiums to NAV in the stock market. This dissertation investigates PNAVs in four dimensions: (i) whether PNAV causes REITs to become more active buyers (sellers) in the property market, (ii) whether PNAV affects the firm level IPO or M&A decisions, (iii) whether premium to NAV causes REIT managers to pay a higher price in property acquisitions, and (iv) whether REIT shares experience less severe negative abnormal returns when new equity is issued during periods of premiums to NAV.

Hypothesis 1: *If REIT managers attempt to exploit the inter-market arbitrage opportunity, REITs will become net buyers (sellers) in the property market when shares trade at a premium (discount) to NAV.*

When the stock market values a REIT's underlying assets greater than the property market does (premium to NAV), REIT managers are faced with positive arbitrage opportunities which can be exploited by issuing new equity in the stock market and purchasing new assets in the property market. When shares trade at a premium to NAV, REIT managers are expected to become more active buyers in the property market. On the other hand, when shares trade at a discount to NAV, REIT managers can exploit the arbitrage opportunity by selling assets in the property market and distributing the proceeds to shareholders – either through share repurchases or special dividends. Thus, REIT managers are expected to become active sellers in the property market when shares trade at a discount to NAV.

Hypothesis 2-1: *If management of a privately-held real estate fund expect share price premiums in the public market, it may positively influence their decision to go public.*

Hypothesis 2-2: *If a publicly-listed REIT's share trade at discount to NAV, management may be inclined to allow a merger and acquisition to occur.*

To accomplish positive arbitrage, managers may act at the firm level instead of trading individual properties. For instance, if management of a privately-held real estate fund expects their shares to trade at premium to NAV in the public market, they may decide to go public – effectively selling the entire portfolio of underlying assets to the public market at a higher price. Conversely, if a publicly-listed REIT has shares trading at discount to NAV, management may allow M&A which would effectively result in selling of the full portfolio at the valuation assigned by the property market.

Hypothesis 3: *If REIT managers attempt to exploit the inter-market arbitrage opportunities, REITs are more likely to pay a higher premium for property acquisitions that occur when there is a market-wide share price premium to NAV.*

Akin et al. (2013) hypothesize that REITs are willing to pay a premium in the property market because they enjoy a lower cost of capital. They use large vs. small and public vs. private REITs as proxies for advantages in cost of capital. They find that large REITs and public REITs tend to pay more compared to small REITs and private REITs respectively.

Regardless of cost of capital, REITs may not want to systematically pay higher than market values due to inefficiencies. However, when the premium to NAV is not specific to a REIT but a market-wide phenomenon, competition from other REIT managers chasing the same deals will bid up property prices. Once the capital market is tapped and new equity has already been issued, the clock is ticking on capital deployment. Under these conditions, REIT managers may bid aggressively with one another in competition for the acquisition. Thus, competition from other

bidders may cause REIT managers to pay relatively higher prices in the property market when REIT industry is experiencing market-wide share price premiums to NAV.

On the other hand, property divestitures by REIT managers may not be as competitive as acquisitions. While continuing to hold assets under management, REIT managers enjoy management fees (Graff 2001) creating incentives to preserve the portfolio size and a reluctance to liquidate. In addition, as Mühlhofer (2013, 2014) points out, the dealer rule restricts REIT management in their ability to sell for capital gains and effectively places minimum holding periods for REIT assets. Accordingly, the property sale price by REITs is not expected to be affected in a direct manner by the premium to NAV.

Hypothesis 4: *If a matched sample methodology is applied, then the estimated acquisition premium in the property market paid by REITs (relative to other investors) will be lower than that documented in previous research.*

REITs are found to pay around 14-27% premiums in property acquisitions compared to other buyer types (Hardin and Wolverton 1999; Lambson, McQueen and Slade 2004; Ling and Petrova 2009). Compared to other clienteles, the premium paid by REITs is substantial. For example, Wiley (2012) reports an estimated 12% premium paid by corporate investors and Liu, Gallimore and Wiley (2015) report an estimated 14% premium paid by nonlocal investors.

The premiums reported in the previous research may be caused by sample selection issues. Akin et al. (2013) find that REITs typically purchase different types of properties compared to non-REIT buyers and argue that REITs do not necessarily pay a significant premium but instead purchase properties with unobserved higher-quality characteristics. To address sample selection issues, Akin et al. (2013) limits the data to properties with greater than 20,000 square feet and

apply a repeat sales methodology. However, they still find 6.4% premium paid by REITs. Some studies apply matching process to overcome the sample selection issue (e.g. Eichholtz, Kok and Quigley 2010; Wiley 2012). McMillen (2012) demonstrates that the matching estimator produces equivalent results to repeat sales estimator in housing research.

REIT managers are sophisticated investors and may not want to pay more than the market value. Sample selection bias may drive the premium paid by REITs in the previous research. Thus, when each property acquired by a REIT is paired with a transaction of a similar asset purchased by non-REIT institutional investors, the estimated premium paid by REITs should be lower than estimated premiums when matching techniques are not applied.

Hypothesis 5: *If REIT stock investors are aware that managerial actions are aligned with inter-market arbitrage opportunities, an observed premium to NAV will mitigate the negative stock price shock followed by new equity issuance announcement.*

In general finance, SEOs are met with negative stock price reactions in the short-run (Asquith and Mullins 1986; Masulis and Korwar 1986; Kalay and Shimrat 1987). However, the negative stock price reaction is mitigated in REIT SEOs due to the investment opportunities linked to new equity issues which may carry positive signal (Francis, Lys and Vincent 2004; Ong, Ooi and Kawaguichi 2011).

A firm's property acquisition is not typically bad news for investors. In both REIT and non-REIT firms, most studies find that there is no abnormal return for property acquirers (Glascock, Davidson and Sirmans 1991; Booth, Glascock and Sarkar 1996; McIntosh, Ott and Liang 1995). Property acquisition can even be good news for investors. Petrova and Sirmans (2003) investigate REIT portfolio purchases and find positive abnormal returns surrounding the announcement date.

REIT equity issuance may differ from non-REIT firms, specifically if such actions occur when shares trade at a premium to NAV. In such a case, REIT managers have the opportunity to achieve positive arbitrage by acquiring assets in the property market. If REIT management attempts to capitalize on the window of opportunity, this should be good news for investors. New equity issues when there is a premium to NAV may signal actions taken by REIT managers that are consistent with the arbitrage strategy. As Brown and Riddiough (2003) show, REITs are most likely to use equity issue proceeds for new investment. Thus, if shares trade at a premium to NAV and investors are aware of the arbitrage opportunity, an equity issuance announcement should be met with diminished negative abnormal returns compared to those observed for firms announcing equity issuance during periods when their shares are trading at a discount to NAV.

CHAPTER THREE – DATA AND METHODOLOGY

3.1 Data

This dissertation investigates the PNAV effect on property market and stock market outcomes. From the SNL database, a total of 284 REITs are identified (175 active REITs and 109 historical). For each REIT, I collect PNAVs and investment activity over the period spanning from 2001 to 2014 using SNL data. The monthly PNAV is calculated using monthly share prices and NAV data. The PNAV is then annualized by taking the average for the year. There are 161 REITs that have at least one available PNAV observed during the sample period. In total, 1,190 firm-year observations are available. The SNL data for PNAV is summarized in Table *2*.

Table 2 ■ Summary of firm level PNAV data.

	N	Mean	Std.	Min.	Max
PNAV (%)	1,190	0.23	14.97	-52.17	65.45
Premium to NAV (%)	595	11.39	10.11	0.04	65.45
Discount to NAV (%)	595	-10.92	9.86	-52.17	-0.09

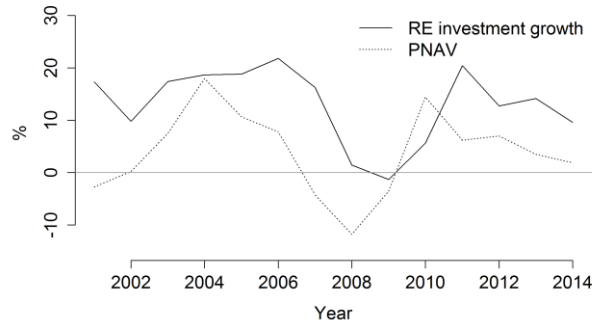
Notes: This table summarizes the firm level annual average PNAV (%) from SNL. Data runs from January 2001 to December 2014.

Real estate investment activity data for each firm-year is collected, including real estate investment growth and real estate property purchases and sales (both in count and value). Investment activities are excluded from the analysis if the REIT is no longer actively traded and the property transactions occur within two years of the exchange delisting event. It is worth noting that value-based acquisition data from SNL may underestimate the actual value of REIT acquisition activities because SNL data does not include land or development acquisitions in their reporting. In addition, there are several records with missing transactions prices.

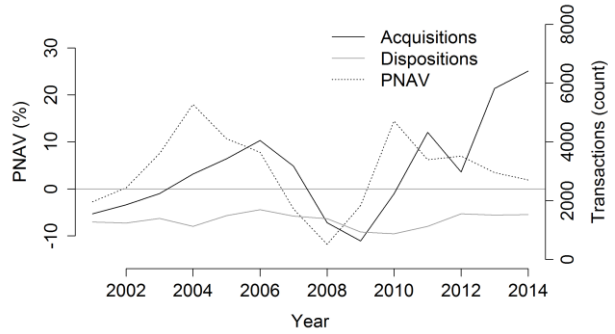
REIT investment activity and PNAVs are compared in Figure *2*. Overall, REITs actively purchase properties subsequent to NAV premiums and become less active in property acquisitions during times when shares trade at a discount to NAV. The lag between observed PNAVs and property market investment activity corresponds with the processing time required for equity issuance, property search and deal closing. In Figure *2*, Panels B and C, disposition activity appears to have a negative relation to PNAVs over the sample period.

Figure 2 ■ REIT real estate investment activities and PNAV.

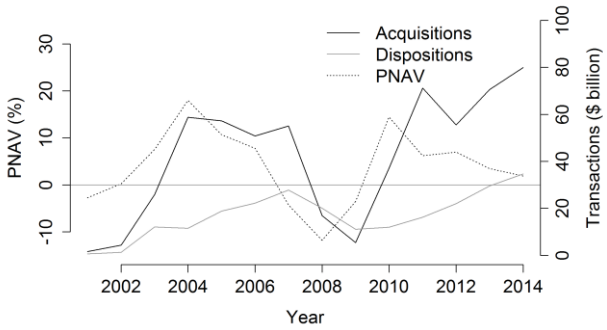
Panel A: Real estate investment growth



Panel B: Count based activity



Panel C: Value based activity

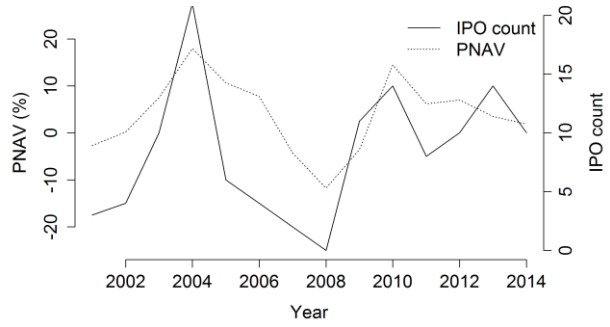


Notes: This figure displays market-wide premium/discount to NAV (PNAV) and REIT investment activities in the property market over the period 2001-2014. PNAV is the market capitalization weighted average which is collected from SNL. Panel A displays market capitalization weighted average of real estate investment growth (%) of all REITs which is collected from SNL. In Panel B, acquisition (disposition) activity is total count of purchases (sales) of all REITs. In Panel C, acquisition (disposition) activity is sum of purchase (sale) prices of all REITs in $ billion.

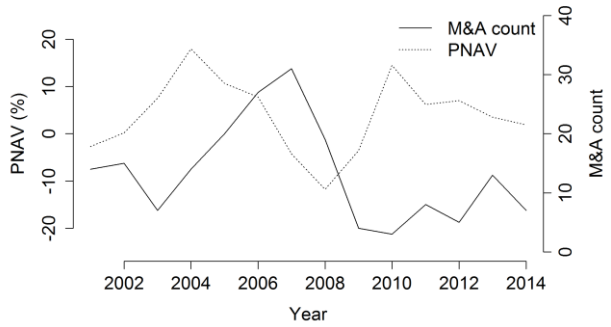
REIT IPO announcements are also collected from SNL during the 2001-2014 period. Panel A of Figure *3* shows the annual PNAV average along with the count of IPOs for the REIT sector. The annual PNAV average does not include newly listed (IPO) firms. IPO announcements appear to increase when the REIT industry encounters a period of market-wide premiums to NAV. Data for M&A announcements is collected from SNL and Securities Data Company (SDC) during the period spanning from 2001 to 2014. Panel B in Figure *3* provides the tally of M&A announcements over the sample period. Market-wide PNAV and M&A announcements display a negative relation.

Figure 3 ■ REIT IPO, M&A and PNAV.

Panel A: REIT IPO count



Panel B: REIT M&A count



Notes: This figure displays REIT initial public offerings (IPO) and merger and acquisitions (M&A) over the period of 2001-2014. IPO data is collected from SNL. M&A data is collected from SNL and SDC. Premium/discount to NAV (PNAV) represents the market capitalization weighted average of REITs' annual PNAVs (%) collected from SNL. In panel A, the annual PNAV average does not include newly listed (IPO) firms.

Two sources of data are used for REIT property purchase price analyses. The market-wide PNAV data is collected from the Green Street Advisors, LLC. Green Street provides the monthly average PNAV since February 1990. As of 2013, the reporting encompasses 87 REITs across North America. The company's coverage is summarized in Table *3*. Since the coverage is heavily biased towards, retail, office and multifamily property sector, the analysis is limited to three types of properties: retail, office and multifamily.

Table 3 ■ Green Street Advisors REIT coverage by sector.

Sector	Number of REITs		Asset ($ trillion)	
Office	18	21%	12.1	21%
Retail	21	24%	14.6	25%
Multifamily	10	11%	7.7	13%
Industrial	4	5%	3.2	5%
Health Care	7	8%	7.3	13%
Hotel	8	9%	3.3	6%
Lab Space	2	2%	1.4	2%
Manufactured Home Park	2	2%	0.5	<1%
Net Lease	4	5%	2.3	4%
Self-Storage	4	5%	1.8	3%
Student Housing	3	3%	0.8	1%
Tech	4	5%	3.4	6%
Total	87		58.4	

Notes: This table reports the REITs covered in Green Street Advisors premium to NAV estimation. The sector indicates the property type that REIT is specialized in. Asset is sum of asset value ($ trillion) of REITs by sector as of 2013.

Market-wide average annual PNAV summary is provided in Table *4*.

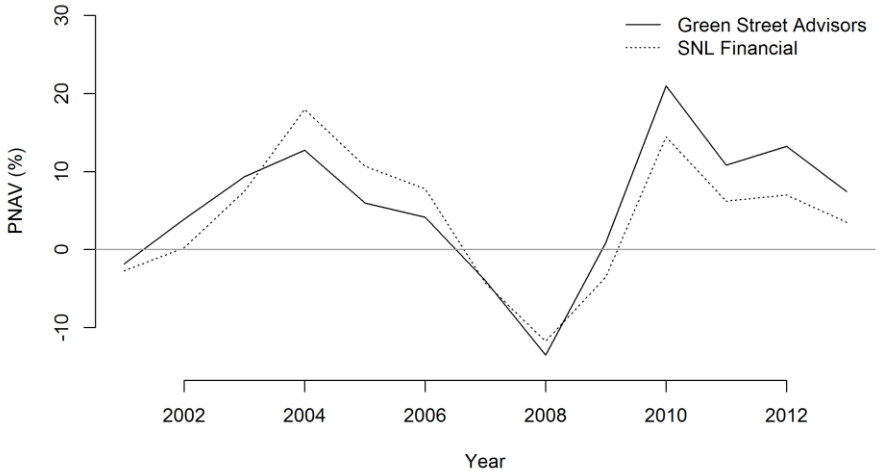
Table 4 ■ Summary of market-wide PNAV.

	N	Mean	Std.	Min.	Max
PNAV (%)	14	4.26	9.44	-13.53	20.96
Premium to NAV (%)	10	8.93	5.83	0.87	20.96
Discount to NAV (%)	4	-7.42	5.44	-13..53	-1.86

Notes: This table summarizes the market-wide annual PNAV (%) from Green Street Advisors. Data runs from 2000 to 2013.

Figure *4* compares PNAV from Green Street Advisors and SNL. SNL PNAV is market capitalization weighted average. The two series move together closely with correlation of 0.89.

Figure 4 ■ Market-wide PNAV comparison.



Notes: This figure compares annual average PNAV for all REITs. The solid line represents data from Green Street Advisors. The dashed line indicates market capitalization weighted average PNAV constructed from SNL.

Data for property market transaction is collected from CoStar property database. Property types include office, retail and multifamily buildings. In the database, buyer types are identified including individual, corporate/user, equity fund, insurance, investment manager, pension fund, private REIT and REIT. However, public REITs are not differentiated in the dataset for non-listed versus listed REITs. Thus, I match the REIT company name with SNL database to identify the firms that are exchange-listed REITs. Properties transaction dates range from January 2001 through December 2014. The dataset is restricted to include only transactions with a sale price of at least $50,000 and building size of at least 10,000 square feet (SF). The dataset is further refined to include only transactions that occur in submarkets which have at least 100 transactions during the period in order to avoid bias from thinly-traded submarkets.

Property transaction summaries are provided in Table *5* according to property type and investor type. Across all property types, individuals, corporates and users typically purchase smaller size assets when compared to other institutional investor types.

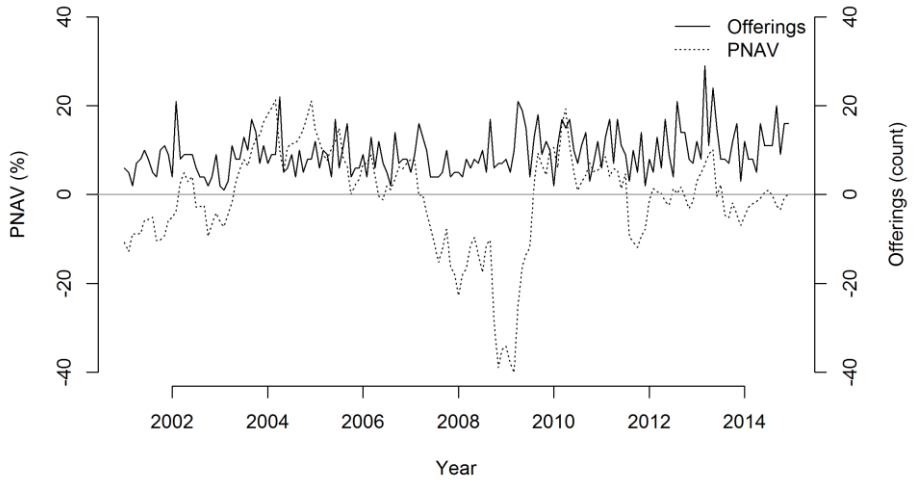
Table 5 ■ Property purchase summary by buyer types.

	Retail			Office			Multifamily		
	N	Price ($1,000)	Building Size (SF)	N	Price ($1,000)	Building Size (SF)	N	Price ($1,000)	Building Size (SF)
Individual	5,709	2,984	24,780	6,199	3,112	37,919	9,498	3,354	38,315
Corporate & User	2,539	4,299	39,421	2,746	6,779	61,166	762	5,528	59,763
Equity Fund	79	14,813	73,507	309	54,319	202,051	409	23,249	208,564
Pension Fund	38	27,704	86,602	132	100,919	290,469	79	70,267	251,925
Insurance	47	9,070	64,245	180	66,775	222,166	49	48,639	221,628
Investment Manager	488	14,209	69,803	1,755	53,592	211,670	1,735	30,248	220,057
Non-listed REIT	220	11,768	73,423	256	45,827	198,621	175	45,130	256,939
Private REIT	180	9,338	60,425	324	40,202	179,696	131	13,261	170,517
Listed REIT	775	18,510	87,319	641	68,796	228,219	331	49,113	276,972
Total	10,075			12,542			13,169		

Notes: This table reports the mean values for property purchases by buyer type. All transactions occur during the January 2001-December 2014 period. The transactions data is collected from CoStar. *Listed REIT* indicates publicly-traded REITs. The dataset is limited to include only transactions with sale prices of at least $50,000 and building size of at least 10,000 SF. Transactions from submarkets which have less than 100 transactions during the sample period are excluded.

For the analysis of stock market outcomes, data on REIT capital offerings is collected from SNL during the period January 2001 to December 2014. There are total 1,567 common equity offerings by 208 REITs. Figure 5 displays the number of common equity issuance announcements in the sector, along with the market-wide PNAV. Apart from the financial crisis during 2008-2009, the figure reveals a positive relation between PNAV and the frequency of common equity issuance. During the economic downturn, REITs may have issued common equity for reasons other than investment purposes, such as capital restructuring.

Figure 5 ■ Common equity issuance announcements and PNAV.



Notes: This figure displays REIT common equity issuance announcement count of all REITs over the period of 2001-2014, monthly. The data is collected from SNL. Multiple announcements in a same day by same REIT are counted as a single announcement. PNAV is market-wide monthly average collected from Green Street Advisors.

Finally, REIT firm level data is collected from Compustat and CRSP on a quarterly and annual basis including cash stock, total assets, long-term debt, market capitalization and firm age (summarized later).

3.2 Methodology

3.2.1 Property Investment Activity (Hypothesis 1)

For REIT i, PNAV at time t is defined as

(1) $$NAV_{i,t}^{\pi} = price_{i,t} / NAV_{i,t} - 1$$

where $price_{i,t}$ is share price and $NAV_{i,t}$ is NAV per share. Eichholtz and Yönder (2014) investigate the connection between CEO overconfidence and REIT investment activity. In their analysis, the property acquisition and disposition activities are measured as

(2) $$acq_{i,t} = \frac{purchases_{i,t}}{(PFO_{i,t-1} + PFO_{i,t})/2} \text{ and}$$

(3) $$dis_{i,t} = \frac{sales_{i,t}}{(PFO_{i,t-1} + PFO_{i,t})/2}$$

where $purchases_{i,t}$ and $sales_{i,t}$ are total number (value) of properties purchased and sold during the period t for REIT i and $PFO_{i,t}$ is the total number (value) of properties included in the REIT portfolio. Finally, the investment activity, $inv_{i,t}$, is modeled as

(4) $$inv_{i,t} = X\beta + \varepsilon_{i,t}$$

with independent variables X. For the dependent variable, they use $acq_{i,t}$, $dis_{i,t}$ and $re\_growth_{i,t}$ (real estate investment growth as reported in SNL). In this dissertation, net acquisition, defined as

(5) $$net\_acq_{i,t} = acq_{i,t} - dis_{i,t},$$

also enters the model as one of the dependent variables. Investment activity is modeled as

(6) $inv_{i,t} = X\beta + \theta\, NAV^{\pi}_{i,t-1} + \varepsilon_{i,t}$, and

(7) $inv_{i,t} = X\beta + \theta_1 NAV^{\pi+}_{i,t-1} + \theta_2 NAV^{\pi-}_{i,t-1} + \varepsilon_{i,t}$.

The absolute magnitude of the premium and discount to NAV are defined as

(8) $NAV^{\pi+}_{i,t} = \max(0,\ NAV^{\pi}_{i,t})$, and

(9) $NAV^{\pi-}_{i,t} = abs(\min(0,\ NAV^{\pi}_{i,t}))$,

respectively. Control variables, X, include *Firm Age* in years and lagged values of *Cash Ratio* (cash-to-total assets ratio), *Firm Size* (log of total assets) and *Debt Ratio* (total liabilities-to-total assets ratio). Riddiough and Wu (2009) and Eichholtz and Yönder (2014) find that higher cash holdings have a positive and significant impact on REIT investment activity. Eichholtz and Yönder (2014) document that firm age is negatively related to investment activity, while firm size and the debt ratio do not have an impact on investment.

Due to the reporting frequency of firm-level investment activities (e.g., real estate investment growth, property acquisitions and dispositions), the analysis is conducted at an annual frequency. In addition, the amount of time required to complete a commercial property acquisition or disposition is typically at least one year, including search, bargaining, financing and closing. As a result, it is expected that property transactions which respond to PNAVs should occur with a lag, following the observed pricing differential. Figure *2* shows REIT investment activity along with average PNAVs. Visually, the two series appear to support the notion of approximately one-year lag to investment in response to PNAVs.

REITs are expected to be increasingly active buyers when they experience premium to NAV. The coefficients for $NAV^{\pi}_{i,t}$ in model (6) and $NAV^{\pi+}_{i,t}$ in model (7) are expected to have a positive impact on acquisitions. Conversely, REITs are expected to become active sellers when

there is a discount to NAV. Thus, the estimated coefficient for $NAV_{i,t}^{\pi-}$ in model (7) will have a positive impact on disposition. Table *6* summarizes the expected signs of premium/discount to NAV coefficients according to the various investment activity measures.

Table 6 ■ Expected sign on premium/discount to NAV coefficients.

	Premium/discount to NAV variable		
Investment Variable	$NAV_{i,t}^{\pi}$	$NAV_{i,t}^{\pi+}$	$NAV_{i,t}^{\pi-}$
$acq_{i,t}$	positive	positive	negative
$dis_{i,t}$	negative	negative	positive
$net\_acq_{i,t}$	positive	positive	negative
$re\_growth_{i,t}$	positive	positive	negative

Notes: This table summarizes the expected impact of premium/discount to NAV on REIT investment activity. $NAV_{i,t}^{\pi}$ is premium/discount to net asset value of REIT i at time t ($price_{i,t} / NAV_{i,t} - 1$). $NAV_{i,t}^{\pi+} = \max(0,\ NAV_{i,t}^{\pi})$ and $NAV_{i,t}^{\pi-} = abs(\min(0,\ NAV_{i,t}^{\pi}))$. *Real Estate Investment Growth* ($re\_growth_{i,t}$), *Acquisition* ($acq_{i,t}$), *Disposition* ($dis_{i,t}$) and *Net Acquisition* ($net\_acq_{i,t}$) are defined as:

$re\_growth_{i,t}$ = growth rate in real estate investment reported in SNL,

$acq_{i,t} = purchases_{i,t} / [(PFO_{i,t-1} + PFO_{i,t}) / 2]$, $dis_{i,t} = sales_{i,t} / [(PFO_{i,t-1} + PFO_{i,t}) / 2]$ and $net\_acq_{i,t} = acq_{i,t} - dis_{i,t}$, where $purchases_{i,t}$ and $sales_{i,t}$ are defined as total count (value) of properties purchased and sold during year t for REIT i, and $PFO_{i,t}$ is the total count (value) of properties under REIT portfolio.

Summary statistics for REIT investment activity are provided in Table *7*. Firm characteristics are almost similar between firms experiencing premium and discount.

Table 7 ■ Summary statistics for REIT investment activity.

	N	Mean	Std. Dev.	Min	Max
Panel A: Dependent variable (Investment Activity)					
Real Estate Investment Growth (%) (Number of distinct REITs: 136)	1,016	12.03	24.27	-30.56	201.51

Transaction count based (%)					
(Number of distinct REITs: 132)					
Acquisition	988	8.50	12.93	0.00	111.11
Disposition	988	5.77	8.44	0.00	94.12
Net Acquisition	988	2.73	14.90	-91.18	111.11
Transaction value based (%)					
(Number of distinct REITs: 111)					
Acquisition	857	11.40	18.63	0.00	207.48
Disposition	857	4.34	7.51	0.00	115.57
Net Acquisition	857	7.06	17.85	-54.15	197.82

Panel B: Explanatory Variables

	Premium			Discount			Difference
	Mean	Min	Max	Mean	Min	Max	
N	523			493			
PNAV (%)	11.47	0.04	65.44	-11.52	-52.17	-0.09	22.98***
Firm Size	4,366	216	32,586	4,364	123	33,324	1.40
Cash Ratio	0.024	0.00	0.34	0.026	0.00	0.30	-0.003
Debt Ratio	0.466	0.00	0.99	0.492	0.04	1.04	-0.026***
Firm Age	16.40	2	50	16.91	2	52	-0.51

Notes: This table reports the summary statistics for REIT investment activities on an annual basis. Data runs from 2001 to 2014. Investment activities data (Panel A) is collected from SNL. *Real Estate Investment Growth* = growth rate in real estate investment reported in SNL, $Acquisition = purchases_{i,t} / [(PFO_{i,t-1} + PFO_{i,t})/2]$, $Disposition = sales_{i,t} / [(PFO_{i,t-1} + PFO_{i,t})/2]$ and $Net\ Acquisition = acq_{i,t} - dis_{i,t}$, where $purchases_{i,t}$ and $sales_{i,t}$ are defined as total count (value) of properties purchased and sold during year t for REIT i and $PFO_{i,t}$ is the total count (value) of properties under REIT portfolio. In Panel B, Premium/discount to NAV (PNAV) data is collected from SNL. Premium and discount indicate PNAV is positive and negative respectively. Firm fundamentals data is collected from Compustat and CRSP. *Firm Size* is total assets ($ million), *Cash Ratio* is cash to total assets ratio, *Debt Ratio* is debt to total assets ratio and *Firm Age* is age of the firm in years.

3.2.2 Going Public (Hypothesis 2-1)

Since share prices are not observable for the private companies, I am unable to evaluate PNAVs at the individual firm level. Consequently, the going public and PNAV relationship is investigated at the market-level by examining the total number of IPOs and market wide PNAV. A greater number of IPO announcements are expected when the REIT sector as a whole is experiencing premiums to NAV.

3.2.3 Becoming M&A Target (Hypothesis 2-2)

The probability of becoming an M&A target is modeled as follows:

$$\begin{aligned}(10)\qquad \Pr(M_{i,t}=1) = {} & \alpha + \beta_1 NAV_i^{\pi} + \beta_2 Firm\ Size_{i,t-1} + \beta_3 Debt\ Ratio_{i,t-1} \\ & + \beta_4 EBIT\ Ratio_{i,t-1} + \beta_5 Cash\ Ratio_{i,t-1} + \beta_6 Interest\ Coverage_{i,t-1} + \varepsilon_{i,t}\end{aligned}$$

using a logit model. The indicator variable $M_{i,t}$ takes one if the firm *i* becomes M&A target at year *t* and zero otherwise. NAV_i^{π} is three-month average premium/discount to NAV prior to M&A announcement. The size of discount ($NAV_i^{\pi-}$), which is $abs(\min(0, NAV_i^{\pi}))$, is tested in place of NAV_i^{π} as well. Firms with discounted share price are more likely to become an attractive M&A target and the coefficient for NAV_i^{π} is expected to be negative while the coefficient on $NAV_i^{\pi-}$ is expected to be positive.

Other lagged explanatory variables include *Firm Size* (log of total assets), *Debt Ratio* (debt-to-total assets ratio), *EBIT Ratio* (EBIT-to-total assets ratio), *Cash Ratio* (cash-to-total assets ratio) and *Interest Coverage* (EBIT-to-interest expenses ratio). Ling and Petrova (2011) find negative impacts of *Firm Size* and liquidity (*Cash Ratio*), but no significant impacts for profitability (*EBIT Ratio*) or leverage (*Debt Ratio*).

The dataset is constructed by combining M&A announcement firm-year data (as the treatment group) with non-announcing firm-year data (control group). Observations that occur two years before and after an M&A announcement are removed from the control group. To mitigate possible sample selection bias, each subject REIT is matched with control REITs which are within the ±20% range of total assets in the year preceding the announcement. After matching, there are 55 clusters, each composed of one treatment REIT and one or more matching control REITs. Summary statistics are reported in Table *8*. M&A target firms have significant discounts to NAV when compared to non-announcing firms.

Table 8 ■ Summary statistics for REIT M&A.

Panel A: Summary statistics.

	M&A			Non-M&A			Diff.	t-val.
	Mean	Min	Max	Mean	Min	Max		
N	55			372				
PNAV (NAV^{π})	-7.98	-46.33	59.58	-1.30	-67.15	83.99	-6.68 ***	-2.68
Discount ($NAV^{\pi-}$)	11.19	0.00	46.33	6.32	0.00	53.20	4.87 ***	2.90
Firm Size	3,608	389	22,084	2,669	321	17,954	939 *	1.67
Debt Ratio	0.60	0.07	1.11	0.57	0.06	1.18	0.03	1.33
Cash Ratio	0.02	0.00	0.16	0.03	0.00	0.43	0.00	-0.50
EBIT Ratio	0.04	-0.07	0.10	0.05	-0.05	0.14	-0.01	-1.35
Interest Coverage	2.17	-1.83	21.06	2.24	-12.86	95.51	-0.06	-0.11

Significance codes: * P < 0.1; ** P < 0.05; *** P < 0.01

Panel B: Pearson correlation matrix.

	M&A	NAV^{π}	$NAV^{\pi-}$	Firm Size	Debt Ratio	Cash Ratio	EBIT Ratio
NAV^{π}	-0.13						
$NAV^{\pi-}$	0.16	-0.73					
Firm Size	0.12	-0.04	0.01				
Debt Ratio	0.06	-0.27	0.23	0.05			
Cash Ratio	-0.02	-0.09	0.05	-0.01	-0.01		
EBIT Ratio	-0.07	0.20	-0.15	0.03	-0.08	-0.08	
Interest Coverage	0.00	0.17	-0.09	0.07	-0.35	0.01	0.30

Notes: This table reports the summary statistics for REIT merger and acquisition (M&A) activities on an annual basis. Data runs from 2001 to 2014. NAV^{π} is three-month average premium/discount to NAV prior to M&A announcement. $NAV^{\pi-}$ is size of discount which is $abs(\min(0, NAV_i^{\pi}))$. *M&A* indicates the firm being a target of M&A. *Firm Size* is total assets ($ million), *Debt Ratio* is debt to total assets ratio, *Interest Coverage* is EBIT to interest expenses ratio, *EBIT Ratio* is EBIT to total assets ratio and *Cash Ratio* is cash to total assets ratio. A subject REIT is matched with control REITs which are within the ±20% range of total assets of the subject on the prior year of the announcement.

3.2.4 Property Purchase Price Premium (Hypothesis 3 & 4)

A hedonic pricing model is applied to identify REIT premiums paid in property acquisitions. However, there are potential selection bias issues if REITs tend to buy properties with distinct physical and market characteristics. Akin et al. (2013) argue that REITs acquire properties with unobserved higher-quality characteristics. To address this issue, comparison group is restricted to include only institutional investors (*Listed REIT, Non-listed REIT, Private REIT, Equity Fund, Insurance, Investment Manager and Pension Fund*). A property matching technique is applied as a preliminary step, following Wiley (2012, 2013). Based on the matching process, if the matching criteria are overly restrictive, then only a small number of matched pairs will be generated. If the criteria are too loose, the matching may not effectively resolve sample selection issues. I adopt the criteria used in Wiley (2012) where REIT-purchased properties are matched with non-REIT-purchased properties by submarket (same submarket), property class (same class), property age (within five years range), property size (within 40% range) and transaction date (within two years range). Propensity-score matching methods (Eichholtz, Kok and Quigley 2010) are also used as a robustness check.

The market-wide PNAV, NAV_t^{π}, is the annual average of individual REITs PNAV ($NAV_{i,t}^{\pi}$). The transaction price of a property is modeled as

(11) $$\ln Price = X\beta + M\kappa + \sum_t \delta_t T_t + B\theta + \theta_1 ListedREIT * NAV_{t-1}^{\pi} + \varepsilon .$$

M is a vector of indicator variables for the market and T_t is the annual indicator variables for time period t when the transaction occurred. The annual frequency of the analysis is appropriate when considering the amount of time required between initial observing PNAV deviations until the completed acquisition of new properties. The steps involved include equity issuance, property search and deal closing. Supporting the argument for a one-year lag is the observed differences shown in Figure *2* (previously discussed). *B* is a vector of indicator variables for investor types, including *Listed REIT*. *X* is a vector of physical characteristics as summarized in Table *9*. As a robustness check, PNAV enters into model (10) in the form of dummy as *Premium* (equals 1 if $NAV_t^{\pi} > 0$; 0 otherwise).

Table 9 ■ Property physical characteristics variables.

Variables		
Age	Log of building age.	
Building Size	Log of building size (SF).	
Lot Size	Log of lot size (SF).	
Stories	Number of floors.	Office
Units	Number of units.	Multifamily
Unit Size	Typical unit size (SF).	Multifamily
Building Class	Class A, B and C.	Office, Multifamily

Notes: This table summarizes the physical characteristic variables for purchase price model.

Summary statistics for property purchases, prior to the matching procedure, are reported in Table *10*. Listed REITs account for up to 8% of pre-matched transactions in the CoStar dataset.

Table 10 ■ Property purchase summary statistics (without matching).

	Mean	Std. dev.	Min	Max
Panel A: Retail (N = 10,075)				
Sale Price ($1,000)	5,573	16,637	50	766,000
$Listed\ REIT \times NAV_{t-1}^{\pi}$ (%)	8.02	7.65	-13.53	20.96
Building Size (SF)	37,960	70,782	10,000	1,981,419
Land Size (SF)	170,899	334,404	182	8,058,600
Number of Floors	1	1	1	117
Age	38	28	1	316
Exchange	0.07			
Distress	0.09			
Listed REIT	0.08			
Panel B: Office (N = 12,542)				
Sale Price ($1,000)	19,370	66,123	50	2,800,000
$Listed\ REIT \times NAV_{t-1}^{\pi}$ (%)	8.19	7.55	-13.53	20.96
Building Size (SF)	93,336	179,867	10,000	4,400,000
Land Size (SF)	146,552	691,904	139	65,514,240
Number of Floors	5	7	1	100
Age	37	28	1	224
Class A	0.19			
Class B	0.59			
Class C	0.22			
Exchange	0.05			
Distress	0.09			
Listed REIT	0.05			
Panel C: Multifamily (N = 13,169)				
Sale Price ($1,000)	10,014	24,412	50	808,800
$Listed\ REIT \times NAV_{t-1}^{\pi}$ (%)	8.25	7.48	-13.53	20.96
Building Size (SF)	80,970	136,297	10,000	3,000,000
Land Size (SF)	176,311	933,600	209	87,686,280
Number of Floors	3	3	1	76
Number of Units	85	133	0	3,221
Typical Floor Size	28,588	47,826	4	802,018
Age	51	27	1	216
Class A	0.07			
Class B	0.24			
Class C	0.69			

Exchange	0.12
Distress	0.08
Listed REIT	0.03

Notes: This table reports summary statistics before the matching procedure is applied. *Listed REIT* indicates listed REIT buyer. NAV_{t-1}^{π} is market wide annual average of PNAVs collected from Green Street Advisors. *Exchange* indicates 1031 exchange transaction. *Distress* sale includes REO, auction, short sale, bankruptcy sale and any other distressed sales. All transactions occur during the January 2001-December 2014 period. The transactions data is collected from CoStar. The dataset is limited to include only transactions with sale prices of at least $50,000 and building size of at least 10,000 SF. Transactions from submarkets which have less than 100 transactions during the sample period are excluded.

A refined dataset is then generated from the characteristic matching procedure and excluding individuals and corporate/users. An overview of the matched samples property dataset is displayed in Table *11*, which highlights the consistency among average property size for the various investor types. Summary statistics are provided in Table *12*. After the matching procedure is applied to the dataset, Listed REITs account for between 24 to 30% of the sample.

Table 11 ■ Property purchases by institutional investors (with characteristics matching).

	Retail			Office			Multifamily		
	N	Price ($1,000)	Building Size (SF)	N	Price ($1,000)	Building Size (SF)	N	Price ($1,000)	Building Size (SF)
Listed REIT	370	11,826	59,690	335	70,541	217,775	176	46,896	292,741
Equity Fund	37	5,754	41,112	88	77,180	211,830	60	34,812	220,443
Insurance	21	10,769	42,193	51	34,942	135,102	28	77,603	224,896
Investment Manager	414	9,095	45,197	561	63,323	198,723	369	48,403	295,592
Non-listed REIT	230	7,633	46,973	52	56,927	229,016	60	53,541	319,829
Pension Fund	34	13,084	43,825	44	85,838	260,209	34	105,450	259,025
Private REIT	112	8,005	41,895	91	32,278	143,673	21	32,135	265,900
Total	1,218			1,222			748		

Notes: This table reports mean values for the property purchases by investor types after characteristic matching. Transactions were completed during January 2001-December 2014. Data is collected from CoStar. All transactions occur during the January 2001-December 2014 period. The transactions data is collected from CoStar. *Listed REIT* indicates publicly-traded REITs. The dataset is limited to include only transactions with sale prices of at least $50,000 and building size of at least 10,000 SF. Transactions from submarkets which have less than 100 transactions during the sample period are excluded.

Table 12 ■ Property purchase summary statistics (with characteristics matching).

	Mean	Std. dev.	Min	Max
Panel A: Retail (N = 1,218)				
Sale Price ($1,000)	9,587	12,877	253	170,500
$Listed\ REIT \times NAV_{t-1}^{\pi}$ (%)	2.40	5.25	-13.53	20.96
Building Size (SF)	49,417	50,243	10,000	556,549
Land Size (SF)	266,274	318,559	3,005	3,812,806
Number of Floors	1	3	1	117
Age	17	11	2	100
Exchange	0.03			
Distress	0.07			
Listed REIT	0.30			
Panel B: Office (N = 1,222)				
Sale Price ($1,000)	63,342	132,991	145	2,800,000
$Listed\ REIT \times NAV_{t-1}^{\pi}$ (%)	2.29	5.47	-13.53	20.96
Building Size (SF)	201,638	237,094	10,000	2,014,062
Land Size (SF)	215,941	292,815	317	3,441,240
Number of Floors	9	9	1	54
Age	30	23	3	117
Class A	0.61			
Class B	0.37			
Class C	0.02			
Exchange	0.02			
Distress	0.05			
Listed REIT	0.27			
Panel C: Multifamily (N = 748)				
Sale Price ($1,000)	50,600	42,456	1,158	592,000
$Listed\ REIT \times NAV_{t-1}^{\pi}$ (%)	2.18	5.44	-13.53	20.96
Building Size (SF)	285,695	200,192	11,258	3,000,000
Land Size (SF)	547,235	1,670,168	827	43,516,440
Number of Floors	5	4	1	35
Number of Units	276	198	5	3,221
Typical Floor Size	79,332	58,124	1,308	456,511
Age	16	19	2	116
Class A	0.69			
Class B	0.26			
Class C	0.05			

Exchange	0.03
Distress	0.06
Listed REIT	0.24

Notes: This table reports summary statistics with characteristics matching procedure. *Listed REIT* indicates listed REIT buyer. NAV_{t-1}^{π} is market wide annual average of PNAVs collected from Green Street Advisors. *Exchange* indicates 1031 exchange transaction. *Distress* sale includes REO, auction, short sale, bankruptcy sale and any other distressed sales. All transactions occur during the January 2001-December 2014 period. The transactions data is collected from CoStar. The dataset is limited to include only transactions with sale prices of at least $50,000 and building size of at least 10,000 SF. Transactions from submarkets which have less than 100 transactions during the sample period are excluded.

When the premium to NAV is a market-wide phenomenon, REIT managers may compete for acquisitions and bid up purchase prices. The expected sign for the interaction term coefficient (θ_1) is positive (*Hypothesis 3*). On the other hand, selling strategy may be sticky due to managers' incentives to preserve large portfolio size for management fees and minimum holding period regulations resulting from the dealer rule. Thus, discount to NAV may not necessarily lead to selling competition among REIT managers. Accordingly, the discount to NAV is not expected to have an impact on sale price; θ_1 is expected to be insignificant from zero in the sale price model.

Following the property matching process, purchase premiums paid by listed REITs (coefficient for *Listed REIT*) are expected to be lower in magnitude when compared to the REIT acquisition premiums documented in previous research where the matched sampling procedure was not applied (*Hypothesis 4*).

3.2.5 Equity Issuance (Hypothesis 5)

Wiley (2013) examines stock performance following REIT asset sales. To obtain the abnormal stock return, he uses two REIT indices: (i) an all REIT index and (ii) a property type-specific REIT

index. The all REIT index is constructed by equally-weighting all securities listed under SIC code 6798 from the CRSP database. For the property type-specific REIT index (office and apartment), a value-weighted index is used. The office REIT index is constructed from the global list of office REITs reported by Bloomberg. The apartment REIT index includes REITs in the global list of apartment REITs reported by Bloomberg. He uses a companion index technique to create the indices. The abnormal stock return is measured relative to the indices surrounding the property sale announcement day.

Wiley examines abnormal stock returns over the short- and intermediate-horizon. For short-run, abnormal returns are observed for a time window ranging from five days to one day before the transaction (-5, -1) in order to investigate whether market anticipates the property sale. Another short-run window ranges from one day before to one day after the transaction (-1, +1). However, only a few transactions (less than 4%) are found to have corresponding press releases. This is the motivation for the evaluation of intermediate-horizon abnormal returns. The observation window ranges from one trading day to 25 trading days after the transaction (+1, +25).

To investigate the impact of premium to NAV on REIT stock performance surrounding the new equity issuance announcement, the methodology in Wiley (2013) is followed. For REIT market return, CRSP/Ziman REIT indices are used. The data provides daily equal- and value-weighted indices for all REITs and property types. Following Barber and Lyon (1997) abnormal returns during time from *l* to *u*, window (*l*, *u*), are estimated as cumulative abnormal return (CAR)[2]

$$(12) \qquad CAR = \sum_{t=l}^{u} (R_t - I_t) .$$

[2] Buy-and-hold abnormal returns (BHAR) is blamed for compounding expected-return model's problem, especially for long-term return (see Fama (1998) for detail). Thus, this dissertation only adopts CAR. However, in the unreported analyses, BHARs are applied and produce consistent results to CARs.

where R_t and I_t are daily stock returns and index returns respectively. Summary statistics for daily return for each index type are reported in Table *13*. I use the value-weighted property type specific index as a benchmark. Similar to Brounen and Eichholtz (2001) and Wiley (2013), I analyze short-term windows of (0, +1) and (0, +2)[3], intermediate term of (-15, -3) and (+3, +15) and long-term of (+3, +60) inclusive of intermediate-term and (+16, +60) exclusive of intermediate-term.

Table 13 ■ Daily REIT indices returns.

	Value weighted (%)		Equal weighted (%)	
Property type	Mean	Std. Dev.	Mean	Std. Dev.
All REITs	0.04	1.95	0.04	1.69
Equity REITs	0.04	2.00	0.05	1.81
Unclassified	0.04	1.89	0.04	1.48
Diversified	0.04	2.12	0.05	1.83
Health Care	0.06	1.91	0.06	1.74
Industrial/Office	0.03	2.16	0.04	2.01
Lodging/Resorts	0.05	2.60	0.06	2.32
Residential	0.04	2.05	0.04	1.70
Retail	0.06	2.10	0.06	1.92
Self Storage	0.07	1.99	0.07	1.93

Notes: This table reports CRSP/Ziman daily REITs index returns (%) in value-weighted and equal-weighted. Data runs from January 2001 to December 2014.

Upon estimating CAR, two groups of firms are compared: the firms whose shares trade at premium on the announcement date (premium firms) and the firms whose share trade at discount (discount firms). Previous research finds negative stock performance following SEO for

[3] Dann and Mikkelson (1984) investigate the convertible debt issuance and following stock price performance and find significant negative abnormal stock returns at the announcement date and issuance date. They examine issuance date because some terms are disclosed just prior to issuance such as the offering price, coupon interest rate and conversion ratio. However, in this dissertation, substantial number of data miss issuance date (1,730 out of 2,560 announcements). Also, among issuance date available data, more than 81% equities were issued within one day following the announcements which is overlapped in the short-term investigation windows. Thus, issuance date is not investigated in this dissertation.

conventional firms (Asquith and Mullins 1986; Masulis and Korwar 1986). However, when shares trade at a premium to NAV, REITs can enjoy positive inter-market arbitrage by purchasing properties using proceeds from new equity issuance. Consequently, when there is a premium to NAV, new equity issues may convey a positive signal to the equity market. Thus, less severe negative abnormal returns are expected when equity issues announcements occur during a premium to NAV versus when new equity issues are announced as shares trade at a discount to NAV (*Hypothesis 5*).

Abnormal returns are further investigated in light of capital structure theory. Abnormal returns are modeled as

$$(13) \quad CAR_{i,j} = \beta_1 OfferSize_{i,\tau} + \beta_2 DebtEquityRatio_{i,\tau} + P\beta + T\gamma + \theta\, NAV^{\pi}_{i,t-1} + \varepsilon$$

for the cumulative abnormal return of firm *i* surrounding *j*th common equity issuance ($CAR_{i,j}$). $NAV^{\pi}_{i,t}$ is PNAV at the month of announcement *t*. PNAV is lagged by one month considering one month delayed NAV estimation reports. $OfferSize_{i,\tau}$ is gross offer amount divided by pre-offer market capitalization of the firm and $DebtEquityRatio_{i,\tau}$ is pre-offer total debt divided by pre-offer market capitalization of the firm. Quarterly subscript τ indicates one quarter ahead of announcement quarter. Vector *P* and *T* include property type and year indicators, respectively. Summary statistics are provided in Table *14*. Both premium and discount firms experience short-term negative stock price reactions following the SEO announcement, CAR(0, +1) and CAR(0, +2). Discount firms have larger equity issues and higher debt ratios compared to the offerings made by firms with premium to NAV.

Table 14 ■ Common equity offerings summary statistics.

	N	Mean	Std. Dev.	Min	Max

Panel A: All offerings (135 REITs)					
CAR(0, +1)	732	-1.38	3.94	-26.28	42.75
CAR(0, +2)		-1.36	3.96	-25.72	34.43
CAR(-15, -3)		0.70	4.92	-21.30	40.36
CAR(+3, +15)		0.07	4.13	-27.58	23.44
CAR(+3, +60)		0.30	8.56	-46.72	54.37
CAR(+16, +60)		0.23	7.77	-32.81	65.35
PNAV		3.57	18.43	-64.84	61.33
Offer Size Ratio		0.15	0.24	0.00	4.68
Debt Equity Ratio		1.23	1.86	0.01	38.13
Panel B: Offerings at premium to NAV (109 REITs)					
CAR(0, +1)	456	-1.25	2.38	-11.07	11.50
CAR(0, +2)		-1.17	2.71	-12.41	13.70
CAR(-15, -3)		0.26	3.40	-14.57	16.04
CAR(+3, +15)		0.15	3.43	-13.07	23.44
CAR(+3, +60)		0.13	6.70	-22.10	50.51
CAR(+16, +60)		-0.02	6.03	-21.73	27.07
PNAV		14.02	11.75	0.10	61.33
Offer Size Ratio		0.11	0.09	0.00	0.62
Debt Equity Ratio		0.94	0.82	0.01	10.90
Panel B: Offerings at discount to NAV (112 REITs)					
CAR(0, +1)	276	-1.60	5.64	-26.28	42.75
CAR(0, +2)		-1.68	5.41	-25.72	34.43
CAR(-15, -3)		1.43	6.66	-21.30	40.36
CAR(+3, +15)		-0.06	5.10	-27.58	16.26
CAR(+3, +60)		0.59	10.97	-46.72	54.37
CAR(+16, +60)		0.65	10.01	-32.81	65.35
PNAV		-13.71	13.93	-64.84	-0.05
Offer Size Ratio		0.22	0.36	0.00	4.68
Debt Equity Ratio		1.72	2.77	0.02	38.13

Notes: This table reports common equity offerings summary statistics. Data is collected from SNL and runs from January 2001 to December 2014. CAR(l, u) indicates CAR during given time window of (l, u). *PNAV* is share price/NAV -1, *Offer Size Ratio* is gross offer amount divided by pre-offer market capitalization of the firm and *Debt Equity Ratio* is pre-offer total debt divided by pre-offer market capitalization of the firm.

By investigating capital offerings of European property companies, Brounen and Eichholtz (2001) find evidence that supports the implied cash flow change hypothesis and debt market accessibility hypothesis. The implied cash flow change hypothesis argues that additional fund raising signals to the market that current net operating income is disappointing. The larger offer size results in a more severe negative stock price reaction to the announcement. In the debt market accessibility hypothesis, accessing debt market will be less attractive for a firm with high level of debt because the firm will be regarded as being risky for lenders. In that context, raising equity instead of debt is prudent. Accordingly, the negative stock price reaction is expected to be less severe for firms issuing equity when there is a high debt to equity level. The coefficient for NAV^{π} is expected to be positive since premium to NAV may carry positive signal about possible exploration of arbitrage opportunity (*Hypothesis 5*).

3.2.6 Drivers of Pricing Differentials

One of the primary focuses of this dissertation is to examine the consequences of pricing differentials, rather than the underlying causes. However, in conducting the analysis, I am able to briefly explore a few possible determinants of pricing differentials at the firm level. One of the possible factors considered is the REITs' portfolio share in major metro markets, which may be considered to increase the quality and reduce the overall risk of the portfolio. The six major commercial real estate markets that comprise the Moody's/RCA Commercial Property Price Index includes Boston, Chicago, Los Angeles, San Francisco, New York and Washington DC. For REIT i, the major share in year t, $MajorShare_{i,t}$, equals the number properties held in major markets divided by the total number of properties in the portfolio. In addition, the operating efficiency of the underlying assets may influence property values to deviate from stock market valuations. As a

property performance measure I use the *EBIT Ratio* (earnings before interest and taxes divided by total assets). The determinants of firm-level PNAV is modeled as

$$PNAV_{i,t} = \alpha + \beta_1 Major\,Share_{i,t} + \beta_2 EBIT\ Ratio_{i,t} + \beta_3 Cash\,Ratio_{i,t} + \beta_4 Firm\,Size_{i,t} + \beta_5 Debt\ \ Ratio_{i,t} + \beta_6 Firm\,Age_{i,t} + P\rho + T\gamma + \varepsilon_{i,t}. \quad (14)$$

Other explanatory variables include *Cash Ratio* (cash-to-total assets ratio), *Firm Size* (log of total assets), *Debt Ratio* (debt-to-total assets ratio) and *Firm Age* (in years). Property type, *P*, and year, *T*, fixed effects are controlled. In addition to PNAV, I consider Relative PNAV which is defined as

$$Relative\,PNAV_{i,t} = PNAV_{i,t} - PNAV_t, \quad (15)$$

where $PNAV_t$ is market-wide annual PNAV average. In this case, year fixed effects are omitted and controlled by sector-wide changes in PNAV. Summary statistics for the measures related to firm-level PNAV are reported in Table *15*. On average, REITs hold around 26% of properties in the major markets.

Table 15 ■ Causes of PNAV summary statistics.

Panel A: Correlation matrix.

	PNAV	Relative PNAV	Major Share	EBIT Ratio	Cash Ratio	Firm Size	Debt Ratio
Rel. PNAV	0.83						
Major Share	0.01	0.00					
EBIT Ratio	0.31	0.35	-0.03				
Cash Ratio	-0.03	-0.05	0.26	-0.04			
Firm Size	0.09	0.11	0.14	-0.03	0.05		
Debt Ratio	-0.18	-0.13	-0.06	-0.09	-0.08	0.06	
Firm Age	0.03	0.01	0.03	0.14	0.13	0.24	0.01

Panel B: Explanatory Variables (155 REITs).

	N	Mean	Std. dev.	Min	Max
PNAV (%)	1,153	0.16	14.94	-52.17	65.45
Rel. PNAV (%)		-5.28	13.54	-58.79	58.02

Major Share	0.26	0.25	0.00	1.00
EBIT Ratio	0.05	0.03	-0.20	0.22
Cash Ratio	0.03	0.03	0.00	0.34
Firm Size	4,439	5,125	123	33,325
Debt Ratio	0.48	0.14	0.00	1.04
Firm Age	16.60	10.19	2.00	53.00

Notes: *PNAV* = share price/NAV -1 and *Relative PNAV* = individual firm's PNAV – market wide average PNAV. *Major share* is the number of properties in the major market (Boston, Chicago, Los Angeles, San Francisco, New York and DC) relative to all property holdings. *EBIT Ratio* is EBIT to total assets ratio, *Cash Ratio* is cash to total assets ratio, *Firm Size* is total assets ($million), *Debt Ratio* is debt to total assets ratio and *Firm Age* is age of the firm in years. Data runs from 2001 to 2014. Individual REIT's premium/discount to NAV (PNAV) data and REIT property holdings are collected from SNL. Market-wide PNAV average is collected from Green Street Advisors. Firm fundamental data is collected from Compustat and CRSP database.

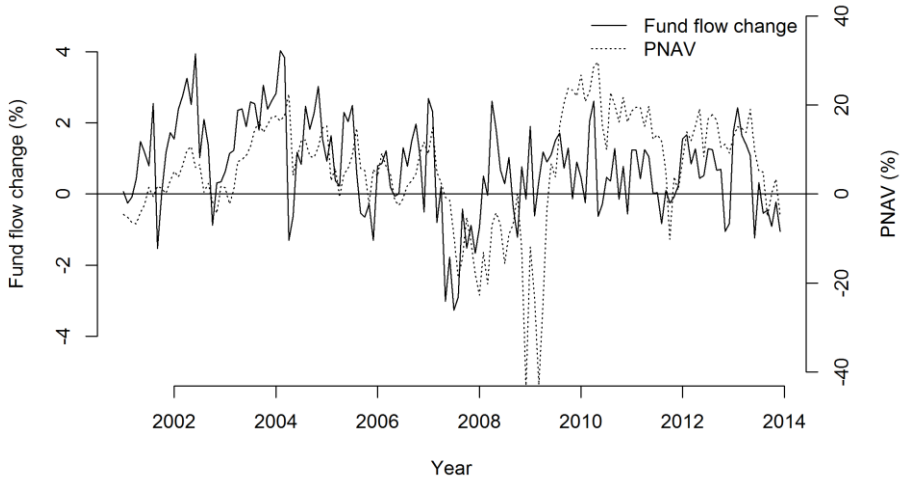
PNAV may also be affected by stock market investor sentiment which affects the numerator of PNAV. Stock market investor sentiment is proxied by fund flows into real estate mutual funds. Data for mutual fund flows is collected from CRSP during the period of 2001-2014 on a monthly basis. Real estate mutual funds are identified following Cici, Corgel and Gibson (2011) and Chou and Harding (2014) by searching fund names contain key words *Real Estate*, *Realty* and *REIT*. Then the data is restricted to actively managed domestic funds by excluding international key words *Russell, Global (Glbl), International (Intl), European and Index*. Fund flows are calculated as

$$(16) \qquad Flow_{i,t} = \frac{TNA_{i,t} - TNA_{i,t-1} \times (1 + r_{i,t})}{TNA_{i,t-1}} \times 100,$$

where $TNA_{i,t}$ is total net asset value (TNA) of mutual fund i at time t and $r_{i,t}$ is monthly mutual fund return. Mutual funds with less than 5% or greater than 95% quantile fund flows are dropped from the sample. Market-wide fund flow is the weighted average of all individual firm fund flows,

where the weights are each firm's TNA. Figure *6* displays market-wide real estate mutual fund flow vs. PNAV. Upon visual inspection, PNAV appears to lag mutual fund flow.

Figure 6 ■ Real estate mutual fund flow vs. PNAV.



Note: This figure displays monthly real estate mutual fund flow change vs. PNAV. Fund flow is total net asset value weighted average. Fund flow for firm i is calculated as $Flow_{i,t} = [TNA_{i,t} - TNA_{i,t-1} \times (1 + r_{i,t})] / TNA_{i,t-1} \times 100$ where $TNA_{i,t}$ is total net asset value of mutual fund i at time t and $r_{i,t}$ is monthly mutual fund return. Mutual funds with less than 5% or greater than 95% quantile fund flows are dropped from the data. PNAV is market wide average PNAV. Data runs from January 2001 to December 2013. Mutual fund flow is collected from CRSP and PNAV data from Green Street Advisor.

CHAPTER FOUR – EMPIRICAL RESULTS

4.1 Property Investment Activity (Hypothesis 1)

This section discusses the impacts of PNAV on REIT property investment activity. When REIT shares trade at a premium (discount) to NAV, REIT managers can achieve positive arbitrage on the property market side by purchasing (selling) assets. REIT investment activities are measured by property acquisitions and dispositions (both in count and dollar value), and also by real estate investment growth.

4.1.1 Premium to NAV and Real Estate Investment

Table *16* reports the empirical results when real estate investment growth is used as the measure for investment activity. In column (1), PNAV has a positive and significant impact on REIT investment activity with an estimated coefficient of 0.35. An increase in PNAV by one standard deviation (15%) results in 5.3% increase in investment growth in the subsequent year. Considering the average real estate investment growth of 12% during the sample period, the result is economically meaningful. Next, the PNAV is differentiated with one variable for premium to NAV (zero otherwise) and a separate variable for discount to NAV. In column (2), the magnitude of premium to NAV is evaluated. A premium to NAV is found to increase investment activity. In column (3), the magnitude of NAV discounts enters the model. Discounted share prices relative to NAV results in lower investment activity by REITs. In aggregate, during periods when REIT shares trade at a premium to NAV, investment growth is 6.2% on average – shown in column (4). REIT managers tend to increase investment when they have more cash. Larger firm size and maturity correspond with reduced investment activity.

Table 16 ■ REIT investment activity regression: real estate investment growth.

	(1)		(2)		(3)		(4)	
	Coeff.	t-value	Coeff.	t-value	Coeff.	t-value	Coeff.	t-value
Dependent variable: Real Estate Investment Growth								
Intercept	54.68***	3.78	51.53***	3.58	50.24***	3.44	47.48***	3.28
$NAV^{\pi}_{i,t-1}$	0.35***	5.27						
$NAV^{\pi+}_{i,t-1}$			0.53***	5.40				
$NAV^{\pi-}_{i,t-1}$					-0.26**	-2.50		
Premium							6.23***	3.45
Cash Ratio	115.07***	5.16	113.56***	5.10	117.21***	5.20	115.29***	5.13
Firm Size	-5.67***	-6.72	-5.28***	-6.38	-5.00***	-5.90	-4.93***	-5.94
Debt Ratio	-1.91	-0.33	-5.14	-0.88	-2.60	-0.44	-4.13	-0.70
Firm Age	-0.29***	-3.63	-0.30***	-3.81	-0.29***	-3.54	-0.29***	-3.62
Property Type	YES		YES		YES		YES	
Year	YES		YES		YES		YES	
N	1,016							
Adj. R^2	0.16		0.16		0.14		0.15	

Significance codes: * P < 0.1; ** P < 0.05; *** P < 0.01

Notes: This table reports the regression result using real estate investment growth as an investment activity dependent variable. Real estate investment growth is growth rate in real estate investment of REITs during a given year, t, collected from SNL. $NAV^{\pi}_{i,t}$ is premium/discount to net asset value of REIT i at time t ($price_{i,t} / NAV_{i,t} - 1$). $NAV^{\pi+}_{i,t} = \max(0, NAV^{\pi}_{i,t})$ and $NAV^{\pi-}_{i,t} = abs(\min(0, NAV^{\pi}_{i,t}))$. *Premium* indicates $NAV^{\pi}_{i,t-1} > 0$. *Cash Ratio* is cash to total assets ratio, *Firm Size* is log of total assets, *Debt Ratio* is debt to total assets ratio and *Firm Age* is age of the firm in years. *Property Type* and *Year* indicate the property type and year fixed effect controls.

As a measure of investment activity, real estate investment growth provides a somewhat limited measure in that it accounts for net acquisition/disposition activity, rather than total investment. To more directly quantify total acquisitions and dispositions, property transaction counts are included as a substitute for the investment growth variable. Table *17* provides the empirical results when transaction counts are considered, with acquisitions considered in Panel A. Acquisitions are measured as total acquisition count relative to the existing portfolio count. The

existing portfolio count is average of beginning- and end-of-year existing property count. The magnitude of PNAV has a positive and significant impact on the total number of acquisitions in the subsequent period. The estimated coefficient of 0.13 implies that a one standard deviation increase in the PNAV (15%) increases the number of acquisitions by 2% relative to the existing portfolio size. In column (2), NAV premiums are found to increase investment with an estimated coefficient of 0.23. A one standard deviation increase in the NAV premium leads to a 3.5% increase in acquisitions. In column (3), discount to NAV appears to have no impact on acquisition activity. In column 4, Overall, REITs increase property acquisition counts by 3.3% during periods when REIT shares trade at any premium to NAV.

Panel B of Table *17* reports the analysis for disposition activity. Dispositions are measured as total disposition count relative to the existing portfolio count. In column (1), PNAV negatively impacts disposition activity with an estimated coefficient of -0.12. A one standard deviation increase in the PNAV results in an estimated 1.8% reduction in property dispositions. In column (2), the magnitude of NAV premiums lead to reduced levels of disposition activity. In column (3), the magnitude of NAV discounts lead to increases in disposition activity. In column (4), REITs are less inclined to sell their properties during periods when shares trade at any premium to NAV.

Panel C of Table *17* reports the results for net acquisition activity, calculated as the total count of acquisitions minus the total count of dispositions divided by the existing portfolio count. The magnitude of NAV premiums is found to have a positive and significant impact on net acquisition activity; the magnitude of NAV discounts has a negative and significant impact. In column (4), net acquisition activity increases by 5.4% during periods when shares trade at any positive premium to NAV. The results in Panel C also suggest that firms with high debt ratios are less likely to participate as net buyers in the property market.

Table 17 ■ REIT investment activity regression: count based.

	(1)		(2)		(3)		(4)	
	Coeff.	t-value	Coeff.	t-value	Coeff.	t-value	Coeff.	t-value
Panel A: *Dependent variable*: Acquisition (count based)								
Intercept	26.78***	3.46	25.85***	3.36	24.57***	3.16	24.21***	3.14
$NAV^{\pi}_{i,t-1}$	0.13***	3.65						
$NAV^{\pi+}_{i,t-1}$			0.23***	4.29				
$NAV^{\pi-}_{i,t-1}$					-0.07	-1.17		
Premium							3.31***	3.40
Cash Ratio	70.56***	5.88	70.10***	5.85	71.64***	5.93	70.54***	5.87
Firm Size	-2.64***	-5.76	-2.53***	-5.66	-2.32***	-5.08	-2.43***	-5.43
Debt Ratio	-5.28	-1.61	-6.63**	-2.05	-5.92*	-1.78	-6.07*	-1.87
Firm Age	-0.18***	-4.13	-0.19***	-4.23	-0.18***	-4.00	-0.18***	-4.11
Property Type	YES		YES		YES		YES	
Year	YES		YES		YES		YES	
N	988							
Adj. R^2	0.16		0.17		0.15		0.16	
Panel B: *Dependent variable*: Disposition (count based)								
Intercept	-5.77	-1.11	-4.05	-0.78	-5.08	-0.98	-3.23	-0.62
$NAV^{\pi}_{i,t-1}$	-0.12***	-5.04						
$NAV^{\pi+}_{i,t-1}$			-0.12***	-3.39				
$NAV^{\pi-}_{i,t-1}$					0.16***	4.19		
Premium							-2.13***	-3.22
Cash Ratio	11.72	1.45	11.51	1.42	10.90	1.35	11.40	1.40
Firm Size	0.35	1.13	0.11	0.38	0.23	0.77	0.08	0.28
Debt Ratio	2.10	0.96	3.33	1.52	1.72	0.77	2.98	1.35
Firm Age	0.15***	4.88	0.15***	4.86	0.14***	4.71	0.14***	4.79
Property Type	YES		YES		YES		YES	
Year	YES		YES		YES		YES	
N	988							
Adj. R^2	0.12		0.10		0.11		0.10	

Table 17 ■ REIT investment activity regression: count based - continued.

	(1)	(2)	(3)	(4)

	Coeff.	t-value	Coeff.	t-value	Coeff.	t-value	Coeff.	t-value
Panel C: *Dependent variable*: Net Acquisition (count based)								
Intercept	32.55***	3.69	29.89***	3.40	29.65***	3.32	27.43***	3.11
$NAV^{\pi}_{i,t-1}$	0.25***	6.18						
$NAV^{\pi+}_{i,t-1}$			0.35***	5.76				
$NAV^{\pi-}_{i,t-1}$					-0.22***	-3.46		
Premium							5.44***	4.86
Cash Ratio	58.84***	4.30	58.59***	4.27	60.74***	4.38	59.15***	4.29
Firm Size	-2.99***	-5.72	-2.65***	-5.16	-2.56***	-4.87	-2.51***	-4.90
Debt Ratio	-7.37**	-1.98	-9.95***	-2.68	-7.64**	-2.01	-9.05**	-2.43
Firm Age	-0.33***	-6.50	-0.33***	-6.57	-0.32***	-6.23	-0.33***	-6.41
Property Type	YES		YES		YES		YES	
Year	YES		YES		YES		YES	
N	988							
Adj. R^2	0.18		0.18		0.16		0.17	
Significance codes: * P < 0.1; ** P < 0.05; *** P < 0.01								

Notes: This table reports the regression result using property transaction count based acquisition, disposition and net acquisition as an investment activity dependent variable. $NAV^{\pi}_{i,t}$ is premium to net asset value of REIT i at time t ($price_{i,t} / NAV_{i,t} - 1$). $NAV^{\pi+}_{i,t} = \max(0, NAV^{\pi}_{i,t})$ and $NAV^{\pi-}_{i,t} = abs(\min(0, NAV^{\pi}_{i,t}))$. *Premium* indicates $NAV^{\pi}_{i,t-1} > 0$. *Cash Ratio* is cash to total assets ratio, *Firm Size* is log of total assets, *Debt Ratio* is debt to total assets ratio and *Firm Age* is age of the firm in years. *Property Type* and *Year* indicate the property type and year fixed effect controls.

Results for acquisition and disposition activity based on total transaction values, rather than property counts, are analyzed in Table *18*. Acquisitions are measured as total acquisition value divided by existing portfolio value. The existing portfolio value is average of beginning- and end-of-year existing property value. Previously discussed, SNL data may underestimate the total value of acquisitions due to missing data for land purchases or development sites. In column (2) of Panel A, the magnitude of NAV premiums are found increase the total dollar amount of acquisition activity in the subsequent period with an estimated coefficient of 0.19. A unit standard deviation

increase in NAV premiums (15%) increases the dollar amount of subsequent acquisition activity by 2.9%. In column (4), REIT managers increase the dollar amount of acquisitions by 3.7%, on average, during periods when shares trade at a premium to NAV.

Panel B of Table *18* presents the results for disposition activity based on the total dollar value of assets sold. Dispositions are measured as the total value of dispositions divided by existing property value. NAV premiums are found to have a negative impact on the dollar amount of dispositions in the following year. In column (2), the magnitude of NAV premiums leads to lower disposition volume. In column (3), the magnitude of NAV discounts lead to an increase total dollar amount of disposition activity. In addition, the net dollar amount of transactions volume relative to the existing portfolio value is evaluated in Panel C with consistent results to those obtained using transaction counts.

Table 18 ■ REIT investment activity regression: value based.

	(1)		(2)		(3)		(4)	
	Coeff.	t-value	Coeff.	t-value	Coeff.	t-value	Coeff.	t-value
Panel A: *Dependent variable*: Acquisition (value based)								
Intercept	43.57***	6.51	43.57***	6.65	41.05***	6.14	41.80***	6.43
$NAV^{\pi}_{i,t-1}$	0.07	1.22						
$NAV^{\pi+}_{i,t-1}$			0.19**	2.22				
$NAV^{\pi-}_{i,t-1}$					0.04	0.44		
Premium							3.72**	2.41
Cash Ratio	83.00***	4.40	82.80***	4.40	84.09***	4.45	82.87***	4.40
Firm Size	-3.45***	-4.67	-3.47***	-4.84	-3.09***	-4.20	-3.48***	-4.87
Debt Ratio	-8.89*	-1.71	-9.66*	-1.87	-9.57*	-1.83	-9.02*	-1.75
Firm Age	-0.14*	-1.93	-0.15**	-2.01	-0.14**	-1.96	-0.14*	-1.93
Property Type	YES		YES		YES		YES	
Year	YES		YES		YES		YES	
N	857							
Adj. R^2	0.11		0.12		0.11		0.12	

Panel B: *Dependent variable*: Disposition (value based)								
Intercept	-0.31	-0.11	0.73	0.27	0.31	0.11	1.55	0.57
$NAV^{\pi}_{i,t-1}$	-0.07***	-2.99						
$NAV^{\pi+}_{i,t-1}$			-0.08**	-2.41				
$NAV^{\pi-}_{i,t-1}$					0.08**	2.08		
Premium							-0.76	-1.18
Cash Ratio	13.08*	1.68	12.70	1.63	12.72	1.63	12.43	1.59
Firm Size	0.57*	1.88	0.43	1.44	0.48	1.57	0.36	1.21
Debt Ratio	0.51	0.24	1.07	0.50	0.32	0.15	0.84	0.39
Firm Age	0.03	0.86	0.03	0.97	0.02	0.79	0.03	0.89
Property Type	YES		YES		YES		YES	
Year	YES		YES		YES		YES	
N	857							
Adj. R^2	0.07		0.07		0.07		0.06	

Table 18 ■ REIT investment activity regression: value based - continued.

	(1)		(2)		(3)		(4)	
	Coeff.	t-value	Coeff.	t-value	Coeff.	t-value	Coeff.	t-value
Panel C: *Dependent variable*: Net Acquisition (value based)								
Intercept	43.88***	6.91	42.84***	6.89	40.75***	6.40	40.25***	6.52
$NAV^{\pi}_{i,t-1}$	0.14***	2.58						
$NAV^{\pi+}_{i,t-1}$			0.27***	3.39				
$NAV^{\pi-}_{i,t-1}$					-0.04	-0.44		
Premium							4.47***	3.06
Cash Ratio	69.92***	3.90	70.10***	3.92	71.37***	3.97	70.44***	3.94
Firm Size	-4.02***	-5.73	-3.89***	-5.74	-3.57***	-5.09	-3.84***	-5.65
Debt Ratio	-9.40*	-1.91	-10.72**	-2.18	-9.89**	-1.99	-9.87**	-2.01
Firm Age	-0.17**	-2.40	-0.18**	-2.54	-0.17**	-2.41	-0.17**	-2.42
Property Type	YES		YES		YES		YES	
Year	YES		YES		YES		YES	
N	857							
Adj. R^2	0.13		0.13		0.12		0.13	
Significance codes: * P < 0.1; ** P < 0.05; *** P < 0.01								

Notes: This table reports the regression result using property transaction value based acquisition, disposition and net acquisition as an investment activity dependent variable. $NAV_{i,t}^{\pi}$ is premium to net asset value of REIT i at time t ($price_{i,t} / NAV_{i,t} - 1$). $NAV_{i,t}^{\pi+} = \max(0, NAV_{i,t}^{\pi})$ and $NAV_{i,t}^{\pi-} = abs(\min(0, NAV_{i,t}^{\pi}))$. *Premium* indicates $NAV_{i,t-1}^{\pi} > 0$. *Cash Ratio* is cash to total assets ratio, *Firm Size* is log of total assets, *Debt Ratio* is debt to total assets ratio and *Firm Age* is age of the firm in years. *Property Type* and *Year* indicate the property type and year fixed effect controls.

4.1.2 Threshold Premium

Due to high search and transactions costs in commercial real estate, it is possible that a minimum threshold for NAV premiums or discounts is required before REIT managers will take action in the property market. To evaluate this question, Table *19* provides results from the estimation of real estate investment growth with PNAV entering the model as a categorical variable. The results reveal that even relatively small NAV premiums (less than 5%) appear to trigger REIT managers to increase their net real estate investment activity. Discussed previously, mispricings between the property and stock market are relatively cyclical and persistent over a time-series. Even relatively small premiums are indicative of a period with favorable conditions for property acquisitions. The magnitude of the increase in real estate investment activity is considerably higher corresponding with periods of higher NAV premiums (10% or greater). By maintaining assets under management, REIT managers enjoy management fees, which creates incentives to expand the property portfolio (Graff 2001). With embedded incentives to expand, even a relatively small NAV premium can serve as rationale to the board for increasing net investment.

Table 19 ■ REIT real estate investment growth: threshold premium.

	Coefficient	t-value
Intercept	49.61 ***	3.42
PNAV [-15, -10)	-1.43	-0.44
PNAV [-10, -5)	1.95	0.63
PNAV [-5, 0)	4.16	1.36
PNAV [0, 5)	6.34 **	2.02
PNAV [5, 10)	5.95 *	1.79
PNAV [10, 15)	12.00 ***	3.25
PNAV [15, ∞)	15.59 ***	4.24
Cash Ratio	116.33 ***	5.19
Firm Size	-5.48 ***	-6.46
Debt Ratio	-3.02	-0.52
Firm Age	-0.29 ***	-3.66
Property Type	YES	
Year	YES	
N	1,016	
Adj. R^2	0.16	
Significance codes: * P < 0.1; ** P < 0.05; *** P < 0.01		

Notes: This table reports the regression result using real estate investment growth as an investment activity dependent variable. PNAV [a, b) is an indicator variable which means $a \leq NAV_{i,t-1}^{\pi} < b$. *Cash Ratio* is cash to total assets ratio, *Firm Size* is log of total assets, *Debt Ratio* is debt to total assets ratio and *Firm Age* is age of the firm in years. *Property Type* and *Year* indicate the property type and year fixed effect controls.

A factor that is expected to mitigate "arbitrage" opportunities is the high transaction costs involved in commercial real estate transactions, including brokerage commission fees. Many REITs are internally-advised, with in-house real estate transaction experts. Table *20* summarizes the distribution of acquisitions and dispositions in the CoStar data that involve a real estate broker, by investor type. Overall, REITs tend to use brokers less frequently than other investors. Brokers are also less involved in the acquisition side (for Buyers) than on the disposition side (for Sellers). Across the board as Buyers, REITs involve real estate brokers in acquisitions at the lowest

frequency of all investor types. Only 14 to 20% of REIT acquisitions involved broker representation. The ability of REITs to economize on transaction costs suggests that even small share price premiums to NAV are indicative of conditions that are favorable to increased property investment activity.

Table 20 ■ Property transactions with brokers.

	Retail			Office			Multifamily		
Buyer	All	With broker	%	All	With broker	%	All	With broker	%
Equity Funds	299	67	22.41	545	130	23.85	668	230	34.43
Insurance	107	24	22.43	339	108	31.86	76	16	21.05
Investment Manager	1,535	476	31.01	3,089	859	27.81	2,743	846	30.84
Pension Fund	84	22	26.19	183	46	25.14	106	23	21.70
Private REIT	686	153	22.30	582	110	18.90	233	70	30.04
REIT	3,410	486	14.25	1,558	259	16.62	848	176	20.75
Total	6,121	1,228		6,296	1,512		4,674	1,361	
Seller	All	With broker	%	All	With broker	%	All	With broker	%
Equity Funds	366	229	62.57	517	401	77.56	377	296	78.51
Insurance	196	150	76.53	438	359	81.96	166	144	86.75
Investment Manager	1,502	1,112	74.03	2,587	2,078	80.32	2,197	1,757	79.97
Pension Fund	80	59	73.75	205	168	81.95	97	75	77.32
Private REIT	158	114	72.15	282	229	81.21	147	111	75.51
REIT	2,076	1,361	65.56	1,026	658	64.13	1,014	695	68.54
Total	4,378	3,025		5,055	3,893		3,998	3,078	

Notes: This table reports the number of property transactions involving brokers. Transactions were executed from 2001 to 2014. Data is collected from CoStar.

4.1.3 Opportunistic Sale vs. Liquidation

An alternative explanation is that REIT property sales may be largely motivated by financial distress, which simply happens to coincide with periods that are marked by discounts to NAV. A number of REITs experienced financial distress during the most recent financial crisis. To evaluate

this shock, the sample is divided into pre-crisis (2001-2006), crisis (2007-2009) and post-crisis (2010-2014) periods. In abbreviated reporting for the investment equations, coefficients for NAV premiums only are reported in Table *21*. During all three periods, when REITs shares trade at premiums ($NAV_{i,t-1}^{\pi+}$), managers increase their investment in real estate (*Investment Growth*) and purchase a higher number of properties (*Acquisitions*). Also persistent over the three periods, REIT managers increase the number of property dispositions (*Dispositions*) when shares trade at discount to NAV ($NAV_{i,t-1}^{\pi-}$). Evidence for a linkage between NAV discounts and disposition activity that occurs outside the financial crisis suggests that the results in this dissertation are not the byproduct of an alternative financial constraint explanation.

Table 21 ■ REIT investment activity by sub-periods.

	(1) Pre-crisis (2001-2006)		(2) Crisis (2007-2009)		(3) Post-crisis (2010-2014)	
	Coeff.	t-value	Coeff.	t-value	Coeff.	t-value
Investment Growth						
$NAV_{i,t-1}^{\pi}$	0.72***	5.02	0.32**	2.48	0.23**	2.29
$NAV_{i,t-1}^{\pi+}$	0.73***	3.67	0.51*	1.71	0.44***	3.08
$NAV_{i,t-1}^{\pi-}$	-1.28***	-4.41	-0.30**	-1.99	-0.05	-0.33
Acquisitions: count based						
$NAV_{i,t-1}^{\pi}$	0.25***	3.37	0.19**	2.25	0.06	1.25
$NAV_{i,t-1}^{\pi+}$	0.20**	2.10	0.52***	2.66	0.20***	2.63
$NAV_{i,t-1}^{\pi-}$	-0.52***	-3.63	-0.13	-1.28	0.07	0.84
Dispositions: count based						
$NAV_{i,t-1}^{\pi}$	-0.05	-1.12	-0.14***	-3.07	-0.11***	-2.90
$NAV_{i,t-1}^{\pi+}$	-0.01	-0.13	-0.08	-0.81	-0.14**	-2.50
$NAV_{i,t-1}^{\pi-}$	0.17**	2.05	0.16***	3.15	0.11*	1.83

N	282	249	485

Significance codes: * P < 0.1; ** P < 0.05; *** P < 0.01

Notes: This table reports the coefficients for NAV premium/discount by sub-periods using real estate investment growth and count based acquisitions and dispositions as an investment activity dependent variable. Real estate investment growth is growth rate in real estate investment of REITs during a given year, t, collected from SNL. $NAV_{i,t}^{\pi}$ is premium/discount to net asset value of REIT i at time t ($price_{i,t} / NAV_{i,t} - 1$). $NAV_{i,t}^{\pi+} = \max(0,\ NAV_{i,t}^{\pi})$ and $NAV_{i,t}^{\pi-} = abs(\min(0,\ NAV_{i,t}^{\pi}))$.

Apart from the financial crisis, an alternative measure to financial constraints includes the EBIT Ratio (earnings before interest and tax divided by total assets). Table *22* presents results for REIT investment activity with EBIT Ratio included as a control. Firms with low EBIT are more active in both acquisitions and dispositions (columns 1 and 2). However, EBIT has no significant impact on net acquisitions or net real estate investment growth (columns 3 and 4). REITs seem to actively reposition their assets by selling and purchasing properties when they are less profitable. Although low profitability increases divestiture and investment activity, it is not related to a significant net change of investment in either direction. Importantly, NAV premiums are persistent as a significant factor in all investment metrics.

Table 22 ■ REIT investment activity and profitability.

	(1) Acquisitions		(2) Dispositions		(3) Net Acquisitions		(4) RE Growth	
	Coeff.	t-value	Coeff.	t-value	Coeff.	t-value	Coeff.	t-value
Intercept	31.47***	3.96	2.16	0.41	29.31***	3.23	53.09***	3.57
$NAV_{i,t-1}^{\pi}$	0.15***	4.12	-0.09***	-3.58	0.24***	5.68	0.34***	5.06
EBIT Ratio	-44.64**	-2.41	-75.37***	-6.17	30.73	1.46	15.25	0.46
Cash Ratio	69.70***	5.82	10.27	1.30	59.44***	4.35	115.13***	5.16
Firm Size	-2.77***	-6.02	0.13	0.43	-2.90***	-5.52	-5.62***	-6.61
Debt Ratio	-5.97*	-1.83	0.92	0.43	-6.89*	-1.85	-1.67	-0.29
Firm Age	-0.17***	-3.71	0.17***	5.88	-0.34***	-6.66	-0.30***	-3.65
Property Type	YES		YES		YES		YES	
Year	YES		YES		YES		YES	

N	988	988	988	1,016
Adj. R^2	0.17	0.15	0.18	0.16

Significance codes: * P < 0.1; ** P < 0.05; *** P < 0.01

Notes: This table reports the regression result using real estate investment growth and count based acquisitions, dispositions and net acquisitions as an investment activity dependent variable. Real estate investment growth is growth rate in real estate investment of REITs during a given year, t, collected from SNL. $NAV_{i,t}^{\pi}$ is premium/discount to net asset value of REIT i at time t ($price_{i,t} / NAV_{i,t} - 1$). *EBIT Ratio* is EBIT to total assets ratio, *Cash Ratio* is cash to total assets ratio, *Firm Size* is log of total assets, *Debt Ratio* is debt to total assets ratio and *Firm Age* is age of the firm in years. *Property Type* and *Year* indicate the property type and year fixed effect controls.

This section examines how PNAV affects REIT managers' property investment activities. The evidence is provided under a range of alternative empirical tests, and the findings consistently suggest that REIT managers purchase (sell) more properties when their shares trade at a premium (discount) to NAV. The evidence provided in this section is fully supportive of Hypothesis 1.

4.2 Going Public (Hypothesis 2-1)

To accomplish positive arbitrage, managers may act at the firm level instead of trading individual properties. If management of a privately-held real estate fund expects their shares to trade at premium to NAV in the public market, they may decide to go public – effectively selling the entire portfolio of underlying assets to the public market at a higher price. Panel A of Figure *3* (previously covered) shows the annual PNAV and count of IPOs for the REIT sector as a whole. IPO announcements appear to increase when the REIT industry encounters a period of market-wide premiums to NAV. The two series exhibit a high degree of positive correlation, with correlation coefficient 0.71. Since share prices are unobserved for private companies, I am unable to evaluate PNAVs at the individual firm level. Visually, Figure *3* and the high degree of positive correlation

are supportive of the expectation (Hypothesis 2-1) that the private real estate firms have an increased propensity to go public during periods when REIT shares trade at a premium to NAV.

4.3 Becoming M&A Target (Hypothesis 2-2)

If a publicly-listed REIT has shares trading at a discount to NAV, management may be supportive of M&A which would effectively result in selling of the entire portfolio at a price commensurate with the property market valuation. Table *23* reports the results of the logit estimation for the probability of becoming an M&A target. When PNAV enters as a continuous variable (ranging from discount to premium), the coefficient is negative and significant (model 1). Firms are more likely to become an M&A target when shares trade at a discount to NAV. In model 2, only the magnitude of discount (in absolute value) is included in the estimation. The estimated coefficient is positive and significant indicating that a greater discount in share price increases the probability of M&A. Supporting Hypothesis 2-2, listed REITs are more likely to become an M&A target when their shares trade at a discount to NAV.

Table 23 ■ REIT M&A target probability regression.

	(1)		(2)	
	Coeff.	z-value	Coeff.	z-value
Intercept	-8.19	-0.47	-8.42	-0.48
NAV_t^{π}	-0.04**	-2.18		
$NAV_t^{\pi-}$			0.06***	2.75
Firm Size	0.87	0.46	0.90	0.47
Debt Ratio	-0.14	-0.09	-0.44	-0.28
Cash Ratio	-4.96	-0.88	-4.11	-0.72
EBIT Ratio	-21.66**	-2.12	-21.08**	-2.06
Interest Coverage	0.06*	1.86	0.05	1.52
Property Type	YES		YES	
Cluster	55		55	

N	427	427
Log-lik.	-132.41	-131.03
Significance codes: * P < 0.1; ** P < 0.05; *** P < 0.01		

Notes: This table reports the logit regression results of being merger and acquisition (M&A) target. A subject REIT is matched to the control REITs which are same year with the subject REIT and in ±20% range of firm size. NAV^{π} is three-month average premium/discount to NAV prior to M&A announcement. $NAV^{\pi-}$ is size of discount which is $abs(\min(0, NAV^{\pi}))$. Followings are one year lagged variables: *Firm Size* is log of total assets, *Debt Ratio* is debt to total assets ratio, *EBIT Ratio* is EBIT to total assets ratio and *Cash Ratio* is cash to total assets ratio. *Property Type* and matching *Cluster*s are controlled.

4.4 Property Purchase Price Premium (Hypothesis 3 & 4)

This section explores how the market-wide PNAV impacts transactions prices for REIT assets in the property market. During periods when the REIT sector as a whole encounters premiums to NAV, there is competition for desirable acquisitions in order to exploit the positive arbitrage opportunity. Competition among REIT managers may act to bid up property prices, particularly when REIT comprise a sufficiently large component of the acquisitions market. The property transactions data is conditioned using a characteristics matched sampling procedure to address potential sample selection bias issues that may have affected the estimated REIT premium estimated in prior studies.

4.4.1 Property Purchase Price without Matching

As a preliminary step, Table *24* reports the estimation of property purchase prices for the three property types for the full sample (prior to applying the matching procedure). In this sample, the buyer types include *Corporate/User, Equity Fund, Individual, Insurance, Investment Manager, Pension Fund, Private REIT, Non-listed REIT* and *Listed REIT*. *Listed REIT* is the reference buyer.

Coefficients on $Listed\ REIT \times NAV_{t-1}^{\pi}$ are positive and significant for all three property types, in line with expectations that listed REITs pay higher transactions prices when there is a market-wide share price premium to NAV for the sector. Individuals and corporate/users appear to pay significantly lower price when compared to listed REITs, consistent with previous studies (Hardin and Wolverton 1999; Lambson, McQueen and Slade 2004; Ling and Petrova 2009; Akin et al. 2013). Shown in Table *5*, individuals and corporate/users select substantially smaller size buildings compared to institutional investors such as listed REITs. Thus, the property pricing differential may be driven by sample selection issues rather than REIT clientele effects.

Table 24 ■ Property purchase price regression (without matching).

Dependent	Retail		Office		Multifamily	
log(Sale Price)	Coeff.	t-value	Coeff.	t-value	Coeff.	t-value
Intercept	2.826 ***	17.24	3.181 ***	13.06	0.990 ***	6.93
$Listed\ REIT \times NAV_{t-1}^{\pi}$	0.015 ***	3.79	0.023 ***	3.97	0.013 ***	3.28
Corporate/User	-0.443 ***	-10.06	-1.365 ***	-20.12	-0.368 ***	-7.42
Equity Funds	-0.029	-0.32	-0.086	-0.97	-0.155 ***	-3.01
Individual	-0.543 ***	-12.46	-1.696 ***	-25.33	-0.384 ***	-8.27
Insurance	-0.107	-0.94	-0.256 **	-2.50	0.033	0.38
Investment Manager	0.044	0.84	-0.098	-1.44	-0.016	-0.34
Non-listed REIT	-0.029	-0.45	-0.070	-0.75	0.010	0.18
Pension Fund	0.397 ***	3.17	0.161	1.41	0.162 **	2.17
Private REIT	0.140 **	2.04	0.029	0.33	-0.111 *	-1.72
log(Building Size)	0.556 ***	37.18	0.469 ***	26.86	0.672 ***	55.51
log(Land Size)	0.084 ***	8.80	0.079 ***	8.01	0.003	0.39
Number of Floors	0.013 **	2.36	0.020 ***	8.69	0.006 ***	2.91
Number of Units					0.002 ***	21.55
Number of Units^2					0.000 ***	-15.07
Typical Floor Size					0.000	0.83
Typical Floor Size^2					0.000 ***	-4.88
Class B			-0.594 ***	-17.54	-0.268 ***	-11.18
Class C			-0.713 ***	-16.26	-0.456 ***	-17.22
log(Age)	-0.414 ***	-38.49	0.169 ***	10.65	-0.184 ***	-19.08
Exchange	0.336 ***	11.63	0.593 ***	13.05	0.113 ***	7.66
Distress	-0.595 ***	-22.75	-0.257 ***	-7.40	-0.483 ***	-26.72

Property sub-type	Yes		
Sub-market	Yes	Yes	Yes
Year	Yes	Yes	Yes
N	10,075	12,542	13,169
Adj. R^2	0.62	0.68	0.85
Significance codes: * P < 0.1; ** P < 0.05; *** P < 0.01			

Notes: This table reports property purchase price regression prior to the matching procedure. Dependent variable is log of *Sale Price*. NAV_{t-1}^{π} is one year lagged market-wide PNAV average. Buyer type includes *Corporate/User, Equity Fund, Individual, Insurance, Investment Manager, Pension Fund, Private REIT, Non-listed REIT and Listed REIT*. The reference buyer type is *Listed REIT*. *Building Size* and *Land Size* are in square feet (SF) and logged. *Number of Floors* is count. For multifamily properties, *Number of Units* (count) and *Typical Floor Size* (SF) enter with squared terms. Building classes are *Class A, Class B* and *Class C* and *Class A* is reference. *Age* is in years and logged. *Exchange* indicates 1031 Exchange transaction. *Distress* includes sales with a remark of REO, auction, short sale, bankruptcy sale and any other distressed sales. For retail properties, *Property sub-type* includes Airport Retail, Strip Center, Lifestyle Center, Neighborhood Center, Community Center, Outlet Center, Power Center, Regional Mall and Super Regional Mall. *Sub-market*s are included if there are at least 100 transactions during January 2001 - December 2014. Transaction *Year* is controlled.

4.4.2 Property Purchase Price with Matching

To address potential issues with sample selection bias, I limit the sample to include only transactions by institutional investors (*Equity Fund, Insurance, Investment Manager, Pension Fund, Private REIT, Non-listed REIT* and *Listed REIT*) and apply a characteristic matched sampling procedure. Listed REITs are distinguished from other institutional investors by a *Listed REIT* indicator variable. Table *25* presents results for the estimated impact of NAV premiums on the relative transaction prices paid by REIT investors. Estimated coefficients for the $Listed\ REIT \times NAV_{t-1}^{\pi}$ interaction term are positive and significant in samples for all three property types. During the study period, at the average market-wide PNAV, which was 4.3% as provided

in Table *4*, REITs paid premiums of 8.1%, 4.7% and 3.8% to purchase retail, office and multifamily properties, respectively. For retail properties, listed REITs pay lower prices by an estimated 14% when compared to other investors (using the baseline scenario when there is no market-wide premium to NAV). For office and multifamily, listed REITs pay acquisition prices that are statistically insignificant from prices paid by other institutional investors. These results are insightful to help explain the findings from previous studies. 27% of the listed REIT premium in the property transactions market in the previous studies is explained by either (i) sample selection issues, or (ii) "arbitrage" opportunities related directly to the sector-wide NAV premium.

Table 25 ■ Property purchase price regression (with characteristics matching, Listed REIT vs. others).

Dependent	Retail		Office		Multifamily	
log(Sale Price)	Coeff.	t-value	Coeff.	t-value	Coeff.	t-value
Intercept	2.723 **	1.97	-2.416 *	-1.69	5.427 ***	4.79
$Listed\ REIT \times NAV_{t-1}^{\pi}$	0.019 ***	3.18	0.011 **	2.01	0.009 **	2.01
Listed REIT	-0.139 **	-2.27	0.048	0.77	-0.056	-1.09
log(Building Size)	0.655 ***	5.84	1.128 ***	11.16	0.423 ***	4.74
log(Land Size)	0.013	0.40	-0.125 ***	-5.57	-0.069 ***	-3.72
Number of Floors	-0.009	-1.32	0.005	0.90	0.018 ***	3.38
Number of Units					0.006 ***	8.85
Number of Units^2					0.000 ***	-6.29
Typical Floor Size					0.000 **	-2.27
Typical Floor Size^2					0.000	1.00
log(Age)	-0.347 ***	-3.70	-0.029	-0.22	-0.216 ***	-4.13
Exchange	0.118	1.07	0.120	0.93	-0.152 *	-1.74
Distress	-0.803 ***	-10.12	-0.350 ***	-3.84	-0.354 ***	-5.61
Property sub-type	Yes					
Cluster	Yes (370 clusters)		Yes (335 clusters)		Yes (176 clusters)	
Year	Yes		Yes		Yes	

N	1,218	1,222	748
Adj. R^2	0.68	0.80	0.81

Significance codes: * P < 0.1; ** P < 0.05; *** P < 0.01

Notes: This table reports property purchase price regression with characteristics matching procedure. Dependent variable is log of *Sale Price*. NAV_{t-1}^{π} is one year lagged market-wide PNAV average. *Listed REIT* indicates listed REIT buyer. *Building Size* and *Land Size* are in square feet (SF) and logged. *Number of Floors* is count. For multifamily properties, *Number of Units* (count) and *Typical Floor Size* (SF) enter with squared terms. Building classes are *Class A, Class B* and *Class C* and *Class A* is reference. *Age* is in years and logged. *Exchange* indicates 1031 Exchange transaction. *Distress* indicates sales with a remark of REO sale, auction sale, short sale, bankruptcy sale or distress sale. For retail properties, *Property sub-type* includes Airport Retail, Strip Center, Lifestyle Center, Neighborhood Center, Community Center, Outlet Center, Power Center, Regional Mall and Super Regional Mall. *Sub-market*s are included if there are at least 100 transactions during January 2001 - December 2014. *Cluster*s are indicators for matched groups. Matching procedure requires same *Sub-market* and building *Class* and other conditions. Transaction *Year* is controlled.

In the next stage of the analysis, investor types are identified on a more granular level, including separate indicator variables for *Equity Fund, Insurance, Investment Manager, Pension Fund, Private REIT, Non-listed REIT* and *Listed REIT*. Listed REIT is used as the reference investor type. Table *26* reports the empirical results[4]. Consistent with previous results, the estimated coefficient for $Listed\ REIT \times NAV_{t-1}^{\pi}$ is positive and significant. For retail properties, listed REITs pay relatively less than other investors, with the exception of equity funds. For office, only insurance companies pay less than listed REITs. For multifamily, only equity funds pay less than the listed REITs. Taken together, apart from the strong influence from market-wide premiums

[4] In untabulated analyses, I include a vacancy variable which results in substantial data loss. After including the vacancy variable, number of available observations is reduced from 1,218 to 93 for retail, from 1,222 to 505 for office and from 748 to 416 for multifamily. In spite of sample size issues, coefficients on PNAV for all property types are positive (retail and multifamily significant, office insignificant) and never negative, even after vacancy is accounted. The adjusted R^2 for the estimation is 0.83.

to NAV, listed REITs do not appear to purchase properties at a significantly higher price when compared to other institutional investors.

Table 26 ■ Property purchase price regression (with characteristics matching, investor types).

Dependent	Retail		Office		Multifamily	
log(Sale Price)	Coeff.	t-value	Coeff.	t-value	Coeff.	t-value
Intercept	2.887 **	2.09	-2.069	-1.43	5.284 ***	4.74
$Listed\ REIT \times NAV_{t-1}^{\pi}$	0.021 ***	3.62	0.012 **	2.12	0.010 **	2.44
Equity Fund	-0.233 *	-1.91	-0.122	-1.35	-0.118 *	-1.68
Insurance	0.107	0.72	-0.199 *	-1.88	0.285 ***	3.27
Investment Manager	0.136 **	2.11	-0.045	-0.70	0.066	1.29
Non-listed REIT	0.171 **	2.33	0.016	0.15	0.063	0.94
Pension Fund	0.256 **	2.00	-0.018	-0.16	0.344 ***	4.07
Private REIT	0.292 ***	3.31	0.060	0.66	-0.083	-0.90
log(Building Size)	0.629 ***	5.62	1.097 ***	10.77	0.393 ***	4.47
log(Land Size)	0.012	0.37	-0.129 ***	-5.68	-0.048 ***	-2.63
Number of Floors	-0.008	-1.29	0.006	0.96	0.020 ***	3.78
Number of Units					0.006 ***	8.79
Number of Units^2					0.000 ***	-6.31
Typical Floor Size					0.000 **	-2.52
Typical Floor Size^2					0.000	1.21
log(Age)	-0.338 ***	-3.61	0.007	0.05	-0.190 ***	-3.73
Exchange	0.142	1.29	0.104	0.80	-0.149 *	-1.75
Distress	-0.736 ***	-9.08	-0.353 ***	-3.87	-0.365 ***	-5.93
Property sub-type	Yes					
Cluster	Yes (370 clusters)		Yes (335 clusters)		Yes (176 clusters)	
Year	Yes		Yes		Yes	
N	1,218		1,222		748	
Adj. R^2	0.69		0.80		0.82	

Significance codes: * P < 0.1; ** P < 0.05; *** P < 0.01

Notes: This table reports property purchase price regression with characteristics matching procedure. Dependent variable is log of *Sale Price*. NAV_{t-1}^{π} is one year lagged market-wide PNAV average. Investor type includes *Equity Fund, Insurance, Investment Manager, Pension Fund, Private REIT, Non-listed REIT and Listed REIT*. The reference buyer type is *Listed REIT*. *Building Size* and *Land Size* are in square feet (SF) and logged. *Number of Floors* is count. For multifamily properties, *Number of Units* (count) and *Typical Floor Size* (SF) enter with squared terms. Building classes are *Class A, Class B* and *Class C* and *Class A* is reference. *Age* is in years and logged. *Exchange* indicates 1031 Exchange transaction. *Distress* indicates sales with a remark of REO sale,

auction sale, short sale, bankruptcy sale or distress sale. For retail properties, *Property sub-type* includes Airport Retail, Strip Center, Lifestyle Center, Neighborhood Center, Community Center, Outlet Center, Power Center, Regional Mall and Super Regional Mall. *Sub-market*s are included if there are at least 100 transactions during January 2001 - December 2014. *Cluster*s are indicators for matched groups. Matching procedure requires same *Sub-market* and building *Class* and other conditions. Transaction *Year* is controlled.

The next layer of analysis evaluates the price impact by using a *Premium* indicator variable, which takes on a value of one if market-wide PNAV is positive and zero otherwise. Regression results with the *Premium* variable in place of PNAV are presented in Table *27*. For retail, the estimated coefficient on the *Listed REIT*×*Premium* interaction term is positive and significant sign, consistent to previous analyses. For office and multifamily, the coefficient is positive but insignificant. This finding suggests that the magnitude of NAV premium is important when explaining the transaction premium paid by REIT managers.

Table 27 ■ Property purchase price regression (with characteristics matching, premium dummy).

Dependent	Retail		Office		Multifamily	
log(Sale Price)	Coeff.	t-value	Coeff.	t-value	Coeff.	t-value
Intercept	2.890 **	2.10	-2.157	-1.49	5.241 ***	4.65
Listed REIT×Premium	0.619 ***	4.00	0.204	1.36	0.151	1.03
Equity Fund	0.146	0.83	-0.036	-0.23	-0.078	-0.53
Insurance	0.530 ***	2.62	-0.106	-0.63	0.323 **	2.05
Investment Manager	0.534 ***	3.60	0.040	0.28	0.112	0.80
Non-listed REIT	0.569 ***	3.67	0.100	0.59	0.118	0.79
Pension Fund	0.654 ***	3.51	0.068	0.40	0.378 **	2.41
Private REIT	0.685 ***	4.20	0.139	0.89	-0.022	-0.14
log(Building Size)	0.610 ***	5.46	1.098 ***	10.76	0.393 ***	4.46
log(Land Size)	0.011	0.35	-0.129 ***	-5.66	-0.047 **	-2.58
Number of Floors	-0.009	-1.35	0.006	1.02	0.020 ***	3.81
Number of Units					0.006 ***	8.65
Number of Units^2					0.000 ***	-6.16
Typical Floor Size					0.000 **	-2.51
Typical Floor Size^2					0.000	1.21
log(Age)	-0.334 ***	-3.57	-0.004	-0.03	-0.193 ***	-3.77
Exchange	0.154	1.40	0.136	1.06	-0.149 *	-1.74

Distress	-0.749 *** -9.31	-0.363 *** -3.98	-0.360 *** -5.82
Property sub-type	Yes		
Cluster	Yes (370 clusters)	Yes (335 clusters)	Yes (176 clusters)
Year	Yes	Yes	Yes
N	1,218	1,222	748
Adj. R^2	0.69	0.80	0.82

Significance codes: * P < 0.1; ** P < 0.05; *** P < 0.01

Notes: This table reports property purchase price regression with characteristics matching procedure. Dependent variable is log of *Sale Price*. *Premium* indicates that one year lagged market-wide PNAV average is positive. Investor type includes *Equity Fund, Insurance, Investment Manager, Pension Fund, Private REIT, Non-listed REIT and Listed REIT*. The reference buyer type is *Listed REIT*. *Building Size* and *Land Size* are in square feet (SF) and logged. *Number of Floors* is count. For multifamily properties, *Number of Units* (count) and *Typical Floor Size* (SF) enter with squared terms. Building classes are *Class A, Class B* and *Class C* and *Class A* is reference. *Age* is in years and logged. *Exchange* indicates 1031 Exchange transaction. *Distress* indicates sales with a remark of REO sale, auction sale, short sale, bankruptcy sale or distress sale. For retail properties, *Property sub-type* includes Airport Retail, Strip Center, Lifestyle Center, Neighborhood Center, Community Center, Outlet Center, Power Center, Regional Mall and Super Regional Mall. *Sub-market*s are included if there are at least 100 transactions during January 2001 - December 2014. *Cluster*s are indicators for matched groups. Matching procedure requires same *Sub-market* and building *Class* and other conditions. Transaction *Year* is controlled.

An alternative to characteristic matched samples is the propensity score matching methodology, which is also used widely and in previous studies (Eichholtz, Kok and Quigley 2010, Wiley 2014, Wiley et al. 2014 and Liu, Gallimore and Wiley 2015). As a robustness check, the propensity score matching method is applied in place of the characteristic matched samples. Summary statistics after matching are reported in Table *28* and Table *29*.

Table 28 ■ Property purchases by institutional investors (with propensity score matching).

	Retail			Office			Multifamily		
	N	Price ($1,000)	Building Size (SF)	N	Price ($1,000)	Building Size (SF)	N	Price ($1,000)	Building Size (SF)
Listed REIT	775	18,510	87,319	641	68,796	228,219	331	49,113	276,972
Equity Fund	57	24,548	93,510	67	96,095	234,770	56	39,672	253,382
Insurance	38	12,195	58,905	40	30,097	159,108	9	54,038	209,280
Investment Manager	341	14,591	73,143	351	62,315	212,362	213	54,157	313,553
Non-listed REIT	171	11,501	74,456	66	44,477	176,011	25	53,582	274,247
Pension Fund	23	30,993	63,099	30	87,144	342,551	12	85,189	229,369
Private REIT	145	8,984	55,325	87	33,906	156,782	16	21,841	438,688
Total	1,550			1,282			662		

Notes: This table reports mean values for the property purchases by investor types after propensity score matching. Transactions were completed during January 2001-December 2014. Data is collected from CoStar. *Listed REIT* indicates publicly trading REITs. Data is limited to transactions with sale price of at least $50,000 and building size of at least 10,000 SF. Also, data includes only transactions that occurred in submarkets which have at least 100 transactions during the period.

Table 29 ■ Property purchase summary statistics (with propensity score matching).

	Mean	Std. dev.	Min	Max
Panel A: Retail (N = 1,550)				
Sale Price ($1,000)	16,236	38,855	80	766,000
$Listed\ REIT \times NAV^{\pi}_{t-1}$ (%)	3.87	6.07	-13.53	20.96
Building Size (SF)	78,960	131,592	10,000	1,981,419
Land Size (SF)	387,730	646,262	618	7,405,200
Number of Floors	1.35	3.13	1	117
Age	26.41	21.37	2	184
Exchange	0.03			
Distress	0.05			
Listed REIT	0.50			
Panel B: Office (N = 1,282)				
Sale Price ($1,000)	64,050	140,481	105	2,800,000
$Listed\ REIT \times NAV^{\pi}_{t-1}$ (%)	3.88	6.55	-13.53	20.96
Building Size (SF)	217,203	298,448	10,000	2,652,712
Land Size (SF)	249,91	491,028	317	8,058,600
Number of Floors	8.78	10.72	1	65
Age	33.53	27.63	1	166
Class A	0.46			
Class B	0.46			
Class C	0.07			
Exchange	0.03			
Distress	0.03			
Listed REIT	0.50			
Panel C: Multifamily (N = 662)				
Sale Price ($1,000)	50,168	55,769	105	592,000
$Listed\ REIT \times NAV^{\pi}_{t-1}$ (%)	4.26	6.95	-13.53	20.96
Building Size (SF)	288,769	283,626	10,500	3,000,000
Land Size (SF)	556,560	841,430	1,873	9,070,498
Number of Floors	4.52	4.88	1	39
Number of Units	281.63	273.32	5	3,221
Typical Floor Size	84,920.69	81,241.42	7.00	802,018.00
Age	27.37	23.35	2	123
Class A	0.43			
Class B	0.42			
Class C	0.15			

Exchange	0.07
Distress	0.05
Listed REIT	0.50

Notes: This table reports summary statistics with propensity score matching procedure. *Listed REIT* indicates listed REIT buyer. NAV_{t-1}^{π} is market wide annual average of PNAVs collected from Green Street Advisors. *Exchange* indicates 1031 exchange transaction. *Distress* sale includes REO, auction, short sale, bankruptcy sale and any other distressed sales. Transactions were completed during January 2001-December 2014. Data is collected from CoStar. Data is limited to transactions with sale price of at least $50,000 and building size of at least 10,000 SF. Also, data includes only transactions that occurred in submarkets which have at least 100 transactions during the period.

Empirical results based on the propensity score matched sample are provided in Table *30*. Coefficients on market-wide PNAV ($Listed\ REIT \times NAV_{t-1}^{\pi}$) are positive and significant for office and multifamily. For retail, the coefficient is statistically insignificant but maintains positive sign. Overall, characteristics and propensity matching procedures produce similar results.

Table 30 ■ Property purchase price regression (with propensity score matching).

Dependent	Retail		Office		Multifamily	
log(Sale Price)	Coeff.	t-value	Coeff.	t-value	Coeff.	t-value
Intercept	1.365 ***	3.51	0.325	0.83	2.394 ***	4.06
$Listed\ REIT \times NAV_{t-1}^{\pi}$	0.006	1.14	0.015 ***	2.90	0.013 ***	2.68
Equity Fund	-0.159	-1.44	-0.068	-0.69	-0.110	-1.38
Insurance	-0.146	-1.12	-0.712 ***	-6.10	0.108	0.66
Investment Manager	0.044	0.69	-0.146 **	-2.36	0.001	0.01
Non-listed REIT	-0.180 **	-2.33	-0.005	-0.05	0.194 *	1.87
Pension Fund	0.634 ***	3.89	0.136	1.01	0.396 ***	2.69
Private REIT	0.105	1.25	0.095	1.08	-0.599 ***	-4.46
log(Building Size)	0.763 ***	22.88	0.949 ***	29.17	0.658 ***	13.62
log(Land Size)	0.010	0.41	-0.098 ***	-4.82	-0.040	-1.64
Number of Floors	0.007	1.24	0.004	1.23	0.024 ***	4.33
Number of Units					0.002 ***	6.14
Number of Units^2					0.000 ***	-5.77
Typical Floor Size					0.000	1.56
Typical Floor Size^2					0.000 ***	-3.37
Class B			-0.229 ***	-4.51	-0.101 **	-2.09

Class C			-0.410 ***	-4.43	-0.439 ***	-6.34
log(Age)	-0.350 ***	-12.95	-0.172 ***	-5.34	-0.152 ***	-5.25
Exchange	0.025	0.23	0.052	0.47	0.067	0.88
Distress	-0.822 ***	-8.75	-0.469 ***	-4.38	-0.350 ***	-3.92
Property sub-type	Yes					
Submarket	Yes		Yes		Yes	
Year	Yes		Yes		Yes	
N	1,550		1,282		662	
Adj. R^2	0.64		0.80		0.80	

Significance codes: * P < 0.1; ** P < 0.05; *** P < 0.01

Notes: This table reports property purchase price regression with propensity score matching procedure. Dependent variable is log of *Sale Price*. NAV_{t-1}^{π} is one year lagged market-wide PNAV average. Investor type includes *Equity Fund, Insurance, Investment Manager, Pension Fund, Private REIT, Non-listed REIT and Listed REIT*. The reference buyer type is *Listed REIT*. *Building Size* and *Land Size* are in square feet (SF) and logged. *Number of Floors* is count. For multifamily properties, *Number of Units* (count) and *Typical Floor Size* (SF) enter with squared terms. Building classes are *Class A, Class B* and *Class C* and *Class A* is reference. *Age* is in years and logged. *Exchange* indicates 1031 Exchange transaction. *Distress* indicates sales with a remark of REO sale, auction sale, short sale, bankruptcy sale or distress sale. For retail properties, *Property sub-type* includes Airport Retail, Strip Center, Lifestyle Center, Neighborhood Center, Community Center, Outlet Center, Power Center, Regional Mall and Super Regional Mall. *Sub-market*s are included if there are at least 100 transactions during January 2001 - December 2014. *Cluster*s are indicators for matched groups. Matching procedure requires same *Sub-market* and building *Class* and other conditions. Transaction *Year* is controlled.

4.4.3 Property Sale Price with Matching

Property dispositions by REIT managers may not be as competitive as property purchases due to management fee structures and the dealer rule. As a consequence, the market-wide PNAV is not expected to have a significant impact on the selling side. Property sales summary statistics for the characteristic matched samples are provided in Table *31* and Table *32*.

Table 31 ■ Property sales by institutional investors (with characteristics matching).

	Retail			Office			Multifamily		
	N	Price ($1,000)	Building Size (SF)	N	Price ($1,000)	Building Size (SF)	N	Price ($1,000)	Building Size (SF)
Listed REIT	72	6,957	68,011	72	53,715	222,578	38	54,116	327,828
Equity Fund	18	18,014	81,044	18	49,927	159,996	9	29,388	237,025
Insurance	6	5,138	39,152	7	53,927	257,570	5	81,890	297,474
Investment Manager	75	20,211	60,935	102	54,979	185,667	46	43,260	327,931
Non-listed REIT	6	10,478	51,665	4	42,181	246,921	10	55,825	356,758
Pension Fund	2	9,590	37,913	11	78,009	181,780	3	86,433	336,685
Private REIT	7	4,906	29,016	9	18,816	113,493	6	27,025	287,140
Total	186			223			117		

Notes: This table reports mean values for the property sales by investor types after characteristics matching. Transactions were completed during January 2001-December 2014. Data is collected from CoStar. *Listed REIT* indicates publicly trading REITs. Data is limited to transactions with sale price of at least $50,000 and building size of at least 10,000 SF. Also, data includes only transactions that occurred in submarkets which have at least 100 transactions during the period.

Table 32 ■ Property sales summary statistics (with characteristics matching).

	Mean	Std. dev.	Min	Max
Panel A: Retail (N = 186)				
Sale Price ($1,000)	13,377	30,349	299	241,000
$Listed\ REIT \times NAV_{t-1}^{\pi}$ (%)	3.34	6.32	-13.53	20.96
Building Size (SF)	63,169	75,072	10,017	726,674
Land Size (SF)	325,183	683,730	20,494	8,058,600
Number of Floors	1.26	0.74	1	5
Age	20.99	9.69	4	47
Exchange	0.02			
Distress	0.11			
Listed REIT	0.39			
Panel B: Office (N = 223)				
Sale Price ($1,000)	53,577	68,327	69	576,000
$Listed\ REIT \times NAV_{t-1}^{\pi}$ (%)	2.78	6.01	-13.53	20.96
Building Size (SF)	195,763	236,292	16,047	2,652,712
Land Size (SF)	237,182	268,591	1,306	1,947,132
Number of Floors	8.29	8	1	54
Age	28.87	17.17	6	112
Class A	0.57			
Class B	0.42			
Class C	0.01			
Exchange	0.04			
Distress	0.04			
Listed REIT	0.32			
Panel C: Multifamily (N = 117)				
Sale Price ($1,000)	48,717.84	42,958	1,970	262,500
$Listed\ REIT \times NAV_{t-1}^{\pi}$ (%)	2.33	6.76	-13.53	20.96
Building Size (SF)	320,200	146,171	110,707	1,078,800
Land Size (SF)	709,583	561,337	34,412	2,625,883
Number of Floors	3.63	3.39	1	33
Number of Units	324.72	143.15	112	937
Typical Floor Size	104,851	68,926	1,308	456,511
Age	22.27	11.67	3	51
Class A	0.41			
Class B	0.52			
Class C	0.07			

Exchange	0.01
Distress	0.07
Listed REIT	0.32

Notes: This table reports summary statistics with characteristics matching procedure. *Listed REIT* indicates listed REIT seller. NAV_{t-1}^{π} is market wide annual average of PNAVs collected from Green Street Advisors. *Exchange* indicates 1031 exchange transaction. *Distress* sale includes REO, auction, short sale, bankruptcy sale and any other distressed sales. Transactions were completed during January 2001-December 2014. Data is collected from CoStar. Data is limited to transactions with sale price of at least $50,000 and building size of at least 10,000 SF. Also, data includes only transactions that occurred in submarkets which have at least 100 transactions during the period.

Estimations for the property sale price are reported in Table *33*. Market-wide PNAV ($Listed\ REIT \times NAV_{t-1}^{\pi}$) has no significant impact on sale price. Sale prices attained by REIT managers in disposition are not significantly different for those attained by other institutional investors. The only exception is pension funds, which achieve higher selling price in the multifamily sector.

Table 33 ■ Property sale price regression (with characteristics matching).

Dependent	Retail		Office		Multifamily	
log(Sale Price)	Coeff.	t-value	Coeff.	t-value	Coeff.	t-value
Intercept	6.209	1.30	-1.382	-0.32	4.727	1.05
$Listed\ REIT \times NAV_{t-1}^{\pi}$	0.028	1.13	0.000	0.02	0.007	0.86
Equity Fund	0.108	0.24	-0.439	-1.63	-0.092	-0.53
Insurance	0.097	0.17	-0.554	-1.63	0.363	1.32
Investment Manager	0.349	1.17	-0.006	-0.04	-0.039	-0.32
Non-listed REIT	0.520	0.93	0.113	0.25	0.012	0.08
Pension Fund	0.939	1.07	0.252	0.90	0.430 *	1.71
Private REIT	0.921	1.62	-0.037	-0.11	-0.174	-0.94
log(Building Size)	0.563	1.25	1.098 ***	3.33	0.613	1.65
log(Land Size)	-0.027	-0.14	-0.163 **	-2.41	-0.222 ***	-2.80
Number of Floors	0.642 ***	3.39	0.000	-0.02	0.017	1.36
Number of Units					0.005 **	2.52
Number of Units^2					0.000 **	-2.21
Typical Floor Size					0.000	0.09
Typical Floor Size^2					0.000	0.45

log(Age)	-1.469 **	-2.47	0.239	0.43	-0.103	-0.36
Exchange	0.119	0.19	0.471	1.59	1.010	1.31
Distress	-0.726 **	-2.16	-0.580 **	-2.11	-0.437 **	-2.27
Property sub-type	Yes					
Cluster	Yes (72 clusters)		Yes (72 clusters)		Yes (38 clusters)	
Year	Yes		Yes		Yes	
N	186		223		117	
Adj. R^2	0.51		0.81		0.89	

Significance codes: * P < 0.1; ** P < 0.05; *** P < 0.01

Notes: This table reports property sale price regression with characteristics matching procedure. Dependent variable is log of *Sale Price*. NAV^{π}_{t-1} is one year lagged market-wide PNAV average. Seller investor type includes *Equity Fund, Insurance, Investment Manager, Pension Fund, Private REIT, Non-listed REIT and Listed REIT*. The reference seller type is *Listed REIT*. *Building Size* and *Land Size* are in square feet (SF) and logged. *Number of Floors* is count. For multifamily properties, *Number of Units* (count) and *Typical Floor Size* (SF) enter with squared terms. Building classes are *Class A, Class B* and *Class C* and *Class A* is reference. *Age* is in years and logged. *Exchange* indicates 1031 Exchange transaction. *Distress* indicates sales with a remark of REO sale, auction sale, short sale, bankruptcy sale or distress sale. For retail properties, *Property sub-type* includes Airport Retail, Strip Center, Lifestyle Center, Neighborhood Center, Community Center, Outlet Center, Power Center, Regional Mall and Super Regional Mall. *Sub-market*s are included if there are at least 100 transactions during January 2001 - December 2014. *Cluster*s are indicators for matched groups. Matching procedure requires same *Sub-market* and building *Class* and other conditions. Transaction *Year* is controlled.

This section covers the impact of market-wide PNAV on REITs property purchase prices. Hypothesis 3 is confirmed and listed REIT managers appear to pay higher price for a property when there is a market-wide premium to NAV in REIT shares. However, listed REITs do not typically pay higher price compared to other institutional investors – supporting Hypothesis 4.

4.5 Equity Issuance (Hypothesis 5)

In the general finance literature, SEO announcements are typically followed by negative stock price reactions (Asquith and Mullins 1986, for example). However, REITs are cash-constrained due to dividend payout requirement and it is necessary for REITs to access the capital markets in

order to raise capital for new investment. Consequently, the negative stock price reaction is somewhat diminished in the REIT sector (Howe and Shilling 1988, for example). SEO announcements that occur during periods when REIT share prices trade at a premium to NAV may signal favorable information to the stock market, such as opportunities for new investment. If privy to the opportunity faced by REIT managers, investors may react more favorably to SEO announcements that occur when share prices trade at a premium to NAV than when share trade at a discount to NAV.

4.5.1 Purpose of Equity Issuance

As an initial step in this line of research, I investigated the stated intended purpose of the SEO to determine whether REIT SEOs are related to new investment opportunities. One approach to do this is to analyze the stated intended purpose using regular expression search. Intended purposes are categorized as Table *34* depending on the contained expressions.

Table 34 ■ Category of intended purpose of SEOs.

Category	Contained expressions
General Purpose	general purpose, working capital
Capital Structuring	capital (re)structure, borrow, debt, credit, repayment, repurchase, reduction, pay down, pay off, retire, redemption
Property Acquisition	acquisition, purchase, buy property, buy real estate, invest property, invest real estate
Development	development
Operating Partnership	OP unit, operating partnership
Capital Expenditure	capital expenditure, capital improvement

Notes: This table categorizes the intended purpose of SEOs. Regular expression search is applied and expressions similar to contained expressions are categorized into a purpose. For example, expressions "general purpose" and "general operational purpose" are all categorized into *general purpose*. On the other hand, "repurchase" is categorized into *capital structuring* while "purchase" falls into *property acquisition*.

Table *35* summarizes the categories of stated intended purpose for REIT SEOs. In Panel A, 674 (out of 1,021) SEOs express the intended use of offering proceeds will go to property acquisitions. However, a large number of announcements mention multiple purposes and only 45 announcements were stated exclusively for property acquisitions. Panel B shows that more than 80% of announcements include two or more purposes. Thus, the depth of analysis for intended use of SEO proceeds is somewhat limited due to multiple explanations and potentially confounding implications.

Table 35 ■ SEO intended purpose.

Panel A: SEO announcements by purpose.

Purpose	Inclusive	Exclusive	Exclusive Ratio (%)
General	783	26	3.32
Capital Structure	853	99	11.61
Property Acquisition	674	45	6.68
Development	235	1	0.43
Operating Partnership	178	0	0.00
Capital Expenditure	75	0	0.00

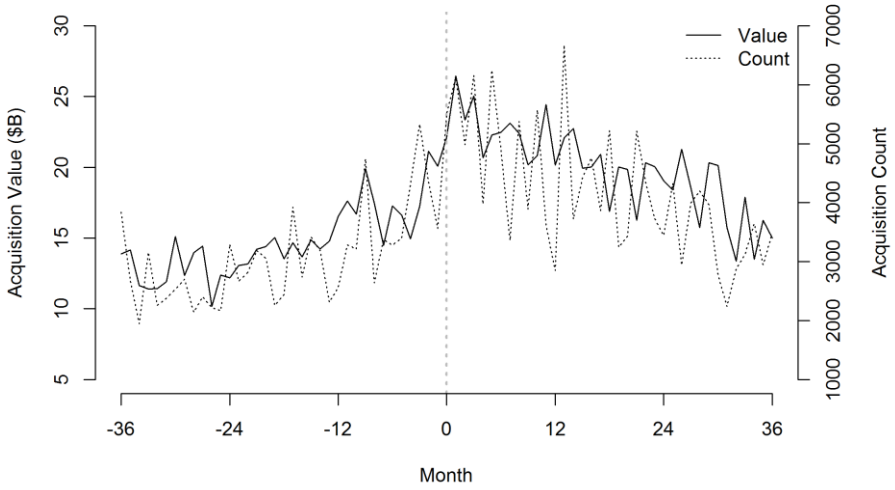
Panel B: SEO announcements by number of purposes.

Number of purposes	Count	%
1	171	16.75
2	294	28.80
3	275	26.93
4	200	19.59
5	72	7.05
6	9	0.88
Total	1,021	100

Notes: This table shows the breakdown of SEO intended purposes. SEO announcements were made during January 2001 to December 2014. *Inclusive* indicates that the SEO purpose statement includes at least one specific purpose while *Exclusive* indicates that SEO purpose statement exclusively includes only specific purpose.

To expand on the linkage between SEOs and property acquisitions, I examine the level of REIT acquisitions surrounding the SEO announcement date in Figure *7*, tallied in dollar amount and property count. Month zero is the SEO announcement date. Acquisition activity increases substantially following SEO announcements for a sustained period beyond 12 months.

Figure 7 ■ Property acquisitions surrounding SEO announcements.



Note: This figure displays property acquisitions surrounding SEO announcements. Month zero indicates the announcement month. Property acquisition value (in $billion) and count are aggregated for all the announcing firms up to ±36 months from the announcement month.

Table *36* summarizes the SEO gross offering amounts. There are 961 announcements from 197 REITs with data available and the average offering size is $216 million.

Table 36 ■ SEO gross amount offered.

	N	Mean	Std. Dev.	Min	Max
Gross Amount Offered	961				
($ million)	(197 REITs)	216	362	0	6,300

Notes: This table reports the summary statistics of SEO gross amount offered in $ million.

Table *37* compares the property acquisitions before and after the SEO announcements. On average, during 12-month period following the SEO announcement, REIT managers increase property purchases by $48 million (36% increase) or 8.5 properties compared to the 12-month pre-announcement period. During the 24-month period following the announcement, property purchases increase by $81 million or 19.6 properties compared to 24-month period leading up to the announcement. The results suggest that REIT's equity issuances are followed by a significant increase in property acquisitions.

Table 37 ■ Property acquisitions surrounding SEOs.

	Value ($ million)				Count			
12 months		Pre	Post	Post - Pre		Pre	Post	Post - Pre
	N	521			N	1,522		
	Mean	135	183	48***	Mean	28.95	37.48	8.53**
				(3.59)				(2.02)
24 months		Pre	Post	Post - Pre		Pre	Post	Post - Pre
	N	327			N	1,522		
	Mean	216	297	81***	Mean	52.15	71.71	19.56**
				(3.06)				(2.34)

Significance codes: * P < 0.1; ** P < 0.05; *** P < 0.01

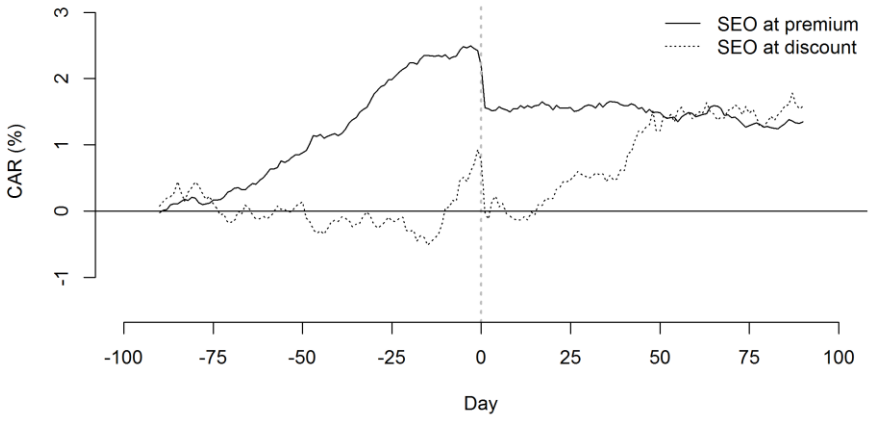
Notes: This table reports the mean property acquisitions of pre- and post-SEO announcements. Property acquisition values are in $ million and count is number of properties purchased. Pre (Post) indicates 12- or 24-month period before (after) the announcement.

4.5.2 Premium to NAV and SEO Shock

This subsection examines the stock price shock following the SEO announcements in relation to PNAV. Figure *8* displays average CAR surrounding SEO announcements for the event window of ±90 days. The solid line represents abnormal returns for firms with shares that trade at a premium on the announcement date, while the dotted line represents abnormal returns for firms with shares that trade at a discount to NAV on the announcement date. Both premium and discount firms

experience share price reductions following the SEO announcement. There are notable differences between the two groups. Premium firms announce SEO when their shares are fully appreciated and show no additional significant abnormal returns. On the other hand, discount firms announce SEO while their shares are gaining momentum. Following the announcement, premium firms experience almost no abnormal returns while discount firms regain momentum after a while. This higher abnormal return of discount firms in the long-term is similar to Gentry, Jones and Mayer (2004) who find substantial positive excess returns in the strategy of buying discount firms and shorting premium firms.

Figure 8 ■ Average cumulative abnormal returns surrounding SEO announcements.



Note: This figure displays average abnormal return surrounding seasoned equity offerings (SEO) for time window of (-90, +90). Day zero indicates the announcement date. Solid and dotted line represent the average cumulative abnormal return (CAR) of REITs which announced SEO at a share price premium and discount, respectively.

Following the SEO announcement, CARs are investigated for time windows of short-term, (0, +1) and (0, +2); intermediate-term, (-15, -3) and (+3, +15); long-term, (+3, +60) and (+16, +60). First, short-term CAR is investigated for event windows (0, +1) and (0, +2). Table *38* reports mean CAR for premium and discount firms. For the (0, +1) window, premium firms experience 0.87%

stock price drop while discount firms experience 0.95% drop on average. For the (0, +2) window, premium firms experience 0.88% negative stock price reactions while discount firms experience 1.05% negative reactions. These return differences between the two groups are statistically insignificant.

Table 38 ■ Short-term CAR.

Window		CAR(0, +1)	CAR(0, +2)
	N	Mean	Mean
All	1,238	-0.90 ***	-0.95 ***
		(-9.40)	(-9.55)
Premium	734	-0.87 ***	-0.88 ***
		(-10.88)	(-9.71)
Discount	504	-0.95 ***	-1.05 ***
		(-4.65)	(-5.11)
Difference		0.09	0.17
		(0.40)	(0.76)

Significance codes: * P < 0.1; ** P < 0.05; *** P < 0.01

Notes: This table reports the mean of CARs for the time window of (l, u). Premium and Discount indicate the firms announced SEO when their shares trade at a premium and discount, respectively. Differences test differences between premium and discount groups. t-test statistics are in parentheses. Returns are in percentage.

The short-term relationship between stock price reactions and PNAV is investigated in greater depth in the analyses reported in Table *39*. The dependent variable in the estimations is CAR(0, +1) and CAR(0, +2). PNAV has no impact on the subsequent abnormal returns following the SEO announcement. Consistent with evidence provided in Brounen and Eichholtz (2001), firms with larger offer size experience more severe negative stock price reactions, and those with higher debt ratios experience less severe negative reactions. The results in Table *38* and Table *39* suggest that, in the short-term, REIT stock investors are unaffected by information about the share premiums to NAV when reacting to the SEO announcement.

Table 39 ■ Short-term cumulative abnormal return regression.

Window	CAR(0, +1)		CAR(0, +2)	
	Coeff.	t-value	Coeff.	t-value
Intercept	-1.52	-1.47	-1.22	-1.19
$NAV^{\pi}_{i,t-1}$	-0.01	-1.25	-0.01	-0.74
Offer Size Ratio	-4.38***	-6.17	-4.54***	-6.42
Debt Equity Ratio	0.26***	2.80	0.12	1.25
Property Type	Yes		Yes	
Year	Yes		Yes	
N	732		732	
R^2	0.07		0.09	
Adj. R^2	0.04		0.06	
Significance codes: * P < 0.1; ** P < 0.05; *** P < 0.01				

Notes: This table reports abnormal return regression results. Dependent variable CAR(l, u) indicates CAR during given time window of (l, u). $NAV^{\pi}_{i,t-1}$ is PNAV one-month prior to SEO announcement month t. *Offer Size Ratio* is gross offer amount divided by pre-offer market capitalization of the firm and *Debt Equity Ratio* is pre-offer total debt divided by pre-offer market capitalization of the firm. *Property Type* and *Year* fixed effects are controlled.

In the next step, intermediate-term CARs surrounding the SEO announcement date are investigated with results presented in Table *40*. During the pre-announcement (-15, -3) window, premium firms experience 0.15% CAR which is statistically insignificant from zero. Discount firms exhibit significant share price appreciation of 1.02%. During post-announcement (+3, +15) window, both premium and discount firms have abnormal returns that are insignificant from zero. The third column in Table *40* tests the difference between pre- and post-announcement periods. Premium firms do not lose momentum while discount firm lose significant momentum of 0.96%.

Table 40 ■ Intermediate-term CAR.

Window		Pre-announcement CAR(-15, -3)	Post-announcement CAR(+3, +15)	
	N	Mean	Mean	Difference
All	1,232	0.51 ***	0.05	0.46 **
		(3.55)	(0.41)	(2.43)
Premium	731	0.15	0.05	0.11

		(1.26)	(0.36)	(0.58)
Discount	501	1.02 ***	0.06	0.96 ***
		(3.39)	(0.24)	(2.57)
Difference		-0.87 ***	-0.01	
		(-2.68)	(-0.04)	

Significance codes: * P < 0.1; ** P < 0.05; *** P < 0.01

Notes: This table reports the mean of CARs for the time window of (l, u). Premium and Discount indicate the firms announced SEO when their shares trade at a premium and discount, respectively. Premium and discount group difference is non-paired t-test, and pre- and post- announcement group difference test is paired t-test. t-statistics are in parentheses.

Intermediate-term CAR is analyzed in the results in Table *41*. During the pre-announcement period, $NAV^{\pi}_{i,t-1}$ (PNAV one-month prior to announcement) has negative impact on CAR (column 1). A high PNAV may signal overvaluation in the share price resulting in lower CAR. During the post-announcement period, $NAV^{\pi}_{i,t-1}$ has positive sign (column 2) indicating that higher PNVA firms have greater abnormal returns following the SEO announcement. In column 3, the dependent variable is momentum loss which is CAR(-15, -3) minus CAR(+3, +15). The coefficient on PNAV is negative and significant implying that lower PNAV firms lose more stock price appreciation momentum following the announcement. The results in Table *40* and Table *41* suggest that, in the intermediate-term, discount firms lose their stock return momentum following the SEO announcements.

Table 41 ■ Intermediate-term cumulative abnormal return regression.

Window	(1) CAR(-15, -3)		(2) CAR(+3, +15)		(3) (1) – (2)	
	Coeff.	t-value	Coeff.	t-value	Coeff.	t-value
Intercept	0.51	0.39	0.34	0.32	0.17	0.10
$NAV^{\pi}_{i,t-1}$	-0.03**	-2.51	0.03**	2.43	-0.06***	-3.56
Offer Size Ratio	-0.39	-0.43	1.94***	2.64	-2.33**	-2.05
Debt Equity Ratio	0.05	0.43	-0.24**	-2.53	0.30**	1.98
Property Type	Yes		Yes		Yes	
Year	Yes		Yes		Yes	

N	732	732	732
R^2	0.03	0.09	0.05
Adj. R^2	0.00	0.06	0.02
Significance codes: * P < 0.1; ** P < 0.05; *** P < 0.01			

Notes: This table reports abnormal return regression results. Dependent variable CAR(l, u) indicates CAR during given time window of (l, u). In column 3, dependent variable is CAR(-15, -3) minus CAR(+3, +15). $NAV_{i,t-1}^{\pi}$ is PNAV one-month prior to SEO announcement month t. *Offer Size Ratio* is gross offer amount divided by pre-offer market capitalization of the firm and *Debt Equity Ratio* is pre-offer total debt divided by pre-offer market capitalization of the firm. *Property Type* and *Year* fixed effects are controlled.

Finally, the long-term following the announcements are investigated for the windows of (+3, +60) and (+16, +60) which is inclusive and exclusive of intermediate-term, respectively. Table *42* reports mean CARs[5]. Discount firms experience significant positive CAR of 1.60% and 1.49% for time windows (+3, +60) and (+16, +60) respectively while premium firms do not show significant abnormal returns. Relative to premium firms, discount firms gain abnormal returns of 1.69 to 1.75%. Over the long-term, discount firms are able gain stock price momentum following SEO announcements.

Table 42 ■ Long-term CAR.

Window		CAR(+3, +60)	CAR(+16, +60)
	N		Mean
All	1,203	0.56 *	0.49 *
		(1.94)	(1.92)
Premium	716	-0.15	-0.19
		(-0.56)	(-0.81)
Discount	487	1.60 ***	1.49 ***
		(2.73)	(2.85)
Difference		1.75 ***	1.69 ***
(discount minus premium)		(2.71)	(2.94)
Significance codes: * P < 0.1; ** P < 0.05; *** P < 0.01			

[5] For long-term post-announcement CAR, regression analysis is not applied since the capital structure of the firm has been impacted as a result of SEO over the long-term period.

Notes: This table reports the mean of CARs for the time window of (l, u). Premium and Discount indicate the firms announced SEO when their shares trade at a premium and discount, respectively. Differences between discount and premium firms are reported with test t-statistics in parentheses.

This section has covered whether REIT stock investors are aware of pricing differentials when they react to SEO announcements. Following SEO announcements, both premium and discount firms experience similar magnitude negative stock price reactions in the short-term. In the intermediate-term, discount firms lose significant stock price return momentum which is regained over a longer horizon. The evidence considered in this analysis is not conclusive in its capacity to suggest that REIT investors react favorably to SEO announcements that occur when shares trade at a premium to NAV. There is insufficient evidence to support Hypothesis 5.

4.6 Drivers of Pricing Differentials

This section explores the determinants of NAV spreads at the firm level. Specifically, I investigate the concentration of property holdings in major commercial real estate markets and the role of REIT profitability. The regression results are presented in Table *43*. In models (1) and (2), the estimated coefficient for *Major Share* is positive and significant. REITs with greater allocations to the major markets are more likely to experience share price premiums to NAV – enhancing opportunities to exploit inter-market arbitrage. Estimated coefficients for *EBIT Ratio* are also positive and significant. More profitable firms experience greater share price premiums to NAV. Larger REITs tend to trade at premium, consistent with Capozza and Lee (1995). Results for leverage and firm age are insignificant.

Table 43 ■ Determinants of PNAV.

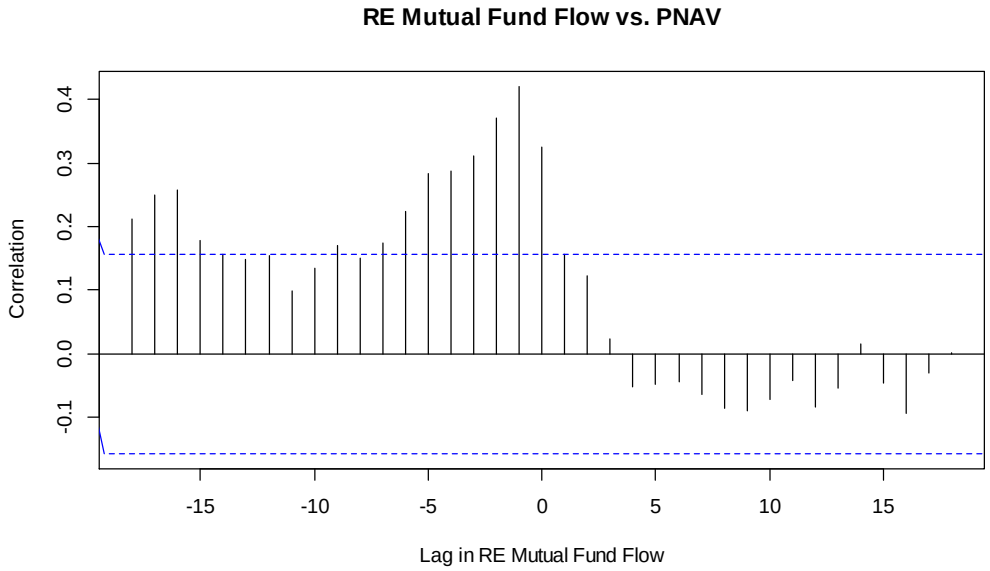
Dependent Variable	(1) PNAV	(2) Relative PNAV

	Coeff.	t-value	Coeff.	t-value
Intercept	-30.88***	-4.65	-32.43***	-9.32
Major Share	4.79***	3.43	3.43**	2.20
EBIT Ratio	91.63***	6.32	159.51***	10.92
Cash Ratio	-4.38	-0.44	-5.76	-0.52
Firm Size	2.95***	8.52	2.85***	7.35
Debt Ratio	-7.21***	-2.84	-4.16	-1.49
Firm Age	-0.02	-0.47	-0.12***	-3.15
Property Type	Yes		Yes	
Year	Yes		No	
N	1,153		1,153	
Adj. R^2	0.53		0.28	
Significance codes: * P < 0.1; ** P < 0.05; *** P < 0.01				

Notes: This table reports the regression result for causes of PNAV. *PNAV* = share price/NAV -1 and *Relative PNAV* = individual firm's PNAV - market wide average PNAV. *Major share* is the number of properties in the major market (Boston, Chicago, Los Angeles, San Francisco, New York and DC) relative to all property holdings. *EBIT Ratio* is EBIT to total assets ratio, *Cash Ratio* is cash to total assets ratio, *Firm Size* is log of total assets, *Debt Ratio* is debt to total assets ratio and *Firm Age* is age of the firm in years. *Property Type* and *Year* indicate the property type and year fixed effect controls.

Stock market investor sentiment may contribute to deviations between NAV and stock market valuations. In this dissertation, investor sentiment is proxied by real estate mutual fund flows. Figure *9* displays correlations between real estate mutual fund flow ($Flow_{t+h}$) and PNAV ($PNAV_t$) with choice of lags h . The horizontal axis represents lags in real estate mutual fund flow. The two series are characterized by significant positive correlations with up to 6 months lead in mutual fund flows. Stock market investor sentiment, proxied by real estate mutual fund flows, can create inflated stock market valuations, which appears to lead PNAV outcomes.

Figure 9 ■ Fund flow and PNAV cross correlation functions.



Note: This figure displays cross correlation functions of real estate mutual fund flows ($Flow_{t+h}$) vs. PNAV ($PNAV_t$) with different lags. Horizontal axis represents lags in real estate mutual fund flow (h). Dashed line is for ±95% confidence interval.

Granger causality between PNAV and fund flows is tested with results reported in Table *44*.

Table 44 ■ Fund flow and PNAV Granger causality test.

Lag order	1	2	4	6
PNAV → Flow	0.09	1.52	1.02	0.87
Flow → PNAV	14.84 ***	10.27 ***	5.50 ***	3.94 ***
Significance codes: * P < 0.1; ** P < 0.05; *** P < 0.01				

Notes: This table reports Granger causality test F statistics with various lag order. PNAV → Flow and Flow → PNAV indicate PNAV Granger causes real estate mutual fund flow vice versa.

The results in Table *44* suggest that real estate mutual fund flows Granger causes PNAV but the reverse is not true. Thus, PNAV is influenced by stock market investor sentiment, as proxied by mutual fund flows.

The determinants of PNAV deviations are investigated in this section. The findings suggest that greater allocations in major commercial real estate markets, enhanced firm profitability and

positive investor sentiment in the stock market are contributing factors to REIT share price trading at a premium to NAV.

CHAPTER FIVE – CONCLUSION

Public and private dual asset markets are unique to real estate. The two markets often deviate from each other in the valuation of the underlying assets. This dissertation enhances our understanding of the consequences from pricing differentials, with implications for property investors, REIT stock investors and researchers. The central idea behind the dissertation is that REIT managers are uniquely positioned to exploit positive "arbitrage" between the two markets. However, arbitrage in the dual market system involves significant risks and amount of time involved with issuing equity and participating in property transactions. The dissertation evaluates whether REIT managers attempt to exploit the inter-market arbitrages despite the risks and whether REIT stock investors are aware of potential signaling that results from related actions. Specifically, this dissertation examines three main research questions surrounding asset pricing differentials.

First, REIT managers' property investment activities are investigated. When REIT shares trade at a premium to NAV, REIT managers can realize positive arbitrage by issuing new equities in the public market, and by purchasing properties in the property markets where assets are valued relatively low by the stock market. Conversely, when REIT shares trade at discount to NAV, positive arbitrage can be achieved by selling assets in the property market (which is overvalued by the stock market) and redistributing the proceeds to shareholders. The results provided in this dissertation suggest that REIT managers tend to increase property purchases by 3-4% during periods when REIT shares trade at a premium to NAV, and they increase property dispositions by around 2% during periods when share prices are below NAV.

Inter-market arbitrages can also be accomplished at the firm level. A private real estate firm may choose to go public if they anticipate premiums to NAV in the public equity market. During 2001 to 2014, REIT IPOs were significantly more likely to occur during periods when the

sector experienced market-wide premiums to NAV. On the other hand, a listed REIT may elect to go private during periods when shares trade at discount to NAV. The results suggest that REITs are more likely to become M&A targets during periods when share prices are discounted to NAV.

Second, I investigate the property purchase price paid by REIT managers. If the REIT sector as a whole is experiencing market-wide premiums to NAV, competition among REIT managers for desirable acquisitions may bid up property values – particularly when REIT acquisitions represent a sufficiently large component of the transactions market. The evidence provided suggests that REIT managers pay higher prices for property purchases when premium to NAV is a market-wide phenomenon. Under the average market-wide premium to NAV (4.3%), REIT managers pay estimated premiums of 8.1%, 4.7% and 3.8% to acquire retail, office and multifamily assets, respectively. However, the market-wide premium to NAV has no impact on divestiture prices.

Previous studies document that REITs pay premiums of up to 27% to purchase properties when compared to other investors. To address the potential sample selection issue, this dissertation adopts data matching methodology and compares only institutional investor types. In contrast to the findings of previous studies, REIT managers are not observed to pay higher transaction prices in acquisitions – absent periods of premiums to NAV. The occasions when REIT managers appear to pay relatively higher prices than other investors coincide with market-wide premiums to NAV.

Finally, I examine whether REIT stock investors are aware of REIT managers' attempt to exploit the inter-market arbitrage. Firms generally experience negative stock price reactions following SEO announcements. However, REITs are cash-constrained in nature and SEOs are commonly utilized for new investment opportunities. If REIT managers announce SEOs during periods when shares trade at a premium to NAV, it may signal positive arbitrage opportunities to

shareholders. Consequently, SEOs that occur during periods when shares trade at a premium to NAV might be expected to receive less severe negative price reactions. To identify the differences in reactions to SEO announcements, firms announcing during premium to NAV (premium firms) are compared to firms announcing during discount (discount firms).

The findings suggest that REIT investors are indifferent to whether shares trade at a premium or discount to NAV when reacting to the SEO signal. Over the initial two days following the SEO announcement, both premium and discount firms experience negative price in similar magnitude. During the intermediate term (15-days pre- and post-announcement), discount firms lose 0.96% stock price momentum following SEOs while premium firms appear to have no abnormal returns in both pre- and post-announcement periods. In the long-term (60-day post-announcement), discount firms regain momentum around 1.5 to 1.6%, while premium firms experience no significant change. In summary, there is a lack of compelling evidence that REIT investors respond more favorably to SEO announcements that occur when share prices trade at a premium to NAV.

Taken together, this dissertation contributes to our knowledge in a small but growing area of literature on real estate inter-market pricing differentials. Specifically, this research explores the consequences of pricing differentials both in the property markets and public markets. Inter-market arbitrage opportunities have a strong theoretic foundation, yet limited investigation has been conducted on this topic. Among industry practitioners, the pricing differential metric, PNAV, is becoming increasingly visible in its application to explain REIT property investment opportunities, IPOs, SEOs, M&A activity and more. Yet, thus far, there is a lack of research to support the meaningfulness of related actions by REIT managers. This dissertation provides seminal evidence toward that end.

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