Is There a Disposition Effect in Corporate Investment Decisions? Evidence from Real Estate Investment Trusts*

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Abstract

While several studies have documented behavioral biases in the behavior of individual investors, very little is known about the existence of such biases in corporations. We utilize the unique nature of Real Estate Investment Trusts (REITs) to test for the presence of one of the most widely discussed biases, the disposition effect. Using property level REIT data, we find strong statistical evidence that REITs tend to sell winners and hold losers, where winners and losers are defined using changes in properties' prices since they were acquired. In addition, we find evidence that this behavior is consistent with the disposition effect. REITs are significantly less likely to sell properties that have a loss relative to a reference point based on inflation or historical average returns, controlling for the properties' recent returns. Our results also indicate that companies that show greater tendencies toward disposition effect behavior tend to sell winner properties at lower prices, all else equal. We find no support for three alternative explanations, optimal tax timing, mean reverting property-level returns, and asymmetric information. Finally, we find that the effect is stronger for smaller properties and that firms showing the strongest evidence of the disposition effect tend to be smaller firms with lower insider ownership.

Keywords: Disposition effect, Behavioral corporate finance, REITs

1 Introduction

Recent evidence indicates that individual investors suffer from behavioral biases, including insufficient or naive diversification, excessive trading, and patterns in buying and selling decisions.[1] We explore whether corporate managers suffer from similar biases. If they do, it could help explain corporate decisions and have important implications for shareholder wealth and agency considerations, such as corporate governance design. But, the answer is not obvious. On the one hand, if these are intrinsic human traits, one might expect mangers to behave no differently than other individuals. On the other hand, if such behavior is detrimental to shareholders, then highly compensated professionals may be provided with the appropriate training or incentives to overcome such biases. Alternatively, at the top of the organization, the managers who survive the tournament to lead the firm may be those for whom these biases are less severe. The corporate structure may also provide a monitoring device to mitigate the effects of such biases, for example by forcing managers to make decisions as part of a team.

In spite of the importance of this issue, there is very little empirical evidence on behavioral biases in corporate finance.[2] This is perhaps not surprising; testing these hypotheses using a sample of ordinary corporations is difficult because, unlike many investors' stock trades, managers' project-level decisions are typically not observable. To get around this problem, we examine behavioral biases in the context of the investment behavior of a particular type of corporation, real estate investment trusts (REITs). REITs provide an ideal opportunity to study professional managers' behavioral biases because one can observe specific corporate investment choices – the decisions to buy and sell properties.

Using a sample of individual properties held by large, publicly-traded REITs over a 10-year period, we test whether managers are prone to selling winners and holding losers. For each purchased property, we estimate the quarterly change in value using indices based on property type and location, and then test whether the propensity to sell the asset is related to its unrealized appreciation. By

[1] These biases can be the result of preferences or beliefs. For a review of this literature, see Barberis and Thaler (2002).

[2] Malmendier and Tate (2005) is a notable exception. They look specifically at overconfidence in CEOs, not the disposition effect that we focus on here.

using market-level indices, we are able to measure changes in value driven by market fundamentals rather than property-level improvements and avoid the problem of confusing the tendency to sell winning properties with a strategy of buying, improving, and then disposing of distressed or under-performing assets.

Our results indicate that managers are significantly more likely to sell properties that have performed better compared to those that have not performed as well, controlling for property type and size, market volume, and the size and performance of the REIT itself. This result is both statistically and economically significant. In our typical specifications, a one standard deviation increase in a property's appreciation is associated with a 20 percent higher hazard rate (the probability that the property is sold at a given point in time, given that it has not yet been sold).

Having established this main result, we then investigate whether it appears to be driven by the "disposition effect," a term coined by Shefrin and Statman (1985) which they attribute to four psychological factors including preferences based on prospect theory (Kahneman and Tversky, 1979), mental accounting (Thaler, 1985), regret, and self control (Thaler and Shefrin, 1981). This explanation proposes a departure from the standard expected utility maximization framework in that investors face an S-shaped value function centered around some reference point on a given trading position, but in contrast to traditional utility functions, the value function is defined over trading gains and losses rather than wealth.[3] The S-shape implies that it is concave in the region of profits relative to the reference point and convex in the region of losses. For example, consider an asset (in our context, a project or building) purchased for \$10, with a price that has since risen to \$15. Assume that the price will rise or fall next period with equal probability and that the relevant reference point is the original purchase price. For a trader with that position who has such a value function, the value from selling the asset now is greater than the expected value of the sale next period (due to the concave function in that region). In contrast, if the price has fallen to \$5, then the expected value from holding the asset is greater than the certain loss (due to the convex

[3]In a recent paper, Barberis and Xiong (2007) suggest that this traditional view of the cause of the disposition effect may not be complete. They show for certain parameters of expected return and the number of trading periods, traditional prospect theory predicts results opposite of the disposition effect. They suggest that prospect theory defined over *realized* rather than paper gains and losses may be a more appropriate theoretical basis for this effect.

function in that region). This predicts that traders will tend to sell winners and hold losers.[4]

We find two results that provide further support for the disposition effect. First, REITs are significantly less likely to sell properties that have a loss relative to a reference point that evolves over time based on two plausible benchmarks for returns: the rate of inflation and typical price returns on similar properties. Second, we find evidence that the firms that appear to have investment decisions that are most subject to the disposition effect tend to realize lower prices when they sell their winners. This is consistent with CEOs accepting lower prices when selling profitable investments, either in their haste to recognize the gains, or due to their satisfaction over the realizations.

Three alternative explanations for selling winners and holding losers are optimal tax timing, mean reverting property-level returns, and asymmetric information. We find little support for these explanations. First, we argue that from a tax perspective, disposition effect selling tends to hurt REIT shareholders because gains are accelerated and losses are postponed.[5] Second, we examine ex post returns in property markets after dividing properties into winners or losers and by whether they were held or sold. We find no evidence that following a disposition effect strategy (i.e., selling winners and holding losers) results in greater property appreciation ex post; in fact, the estimated effect goes in the opposite direction. Thus, profitably betting on mean reversion in the property markets does not offer an alternative motive for the observed selling winners/holding losers effect. Third, we find that the tendency to sell winners is stronger in firms that are more heavily followed by analysts, casting doubt on an explanation based on managers selling their most profitable projects in order to provide a signal about performance or value.

We conclude the study by investigating whether some firms or properties are more likely to exhibit the disposition effect. We find that smaller properties are more likely to be sold early as winners or held as losers, consistent with CEOs being more susceptible to behavioral biases when less money

[4]The example presented here and much of the empirical work related to the disposition effect uses the purchase price as the relevant reference point. As pointed out by Kahneman and Tversky (1979), "there are situations in which gains and losses are coded relative to an expectation or aspiration level that differs from the status quo" (page 286). In the case of corporate managers, one might expect that if reference points exists, they may take into account an expected or minimum return.

[5]As we discuss later, REITs generally do not pay taxes at the corporate level, so the importance of taxes is due to the effect of managers' decisions on investors' taxes.

is at stake. We also find evidence that smaller REITs, and those with lower insider ownership more commonly make trading decisions that are consistent with the disposition effect.

This study provides a corporate analogue to previous evidence of the disposition effect in the behavior of individual investors. Thus, it is related to the work of Shefrin and Statman (1985), who review evidence of selected investors' trades and find it supportive of the disposition effect.[6] Odean (1998) documents more recent evidence consistent with the disposition effect in the stock trading of individual customers of a discount brokerage house. While these papers use financial assets as a test, Genesove and Mayer (2001) utilize real estate assets in their study of individuals' behavior. They also find evidence in support of the disposition effect (on the loss aversion side of the function). Sellers with nominal losses tend to have higher asking prices for their condominiums, have a lower hazard rate of selling, but conditional upon selling, they receive higher prices.

In addition to this evidence on individuals' behavior, several recent studies have examined the disposition effect in trades made by professionals, using data in a variety of settings: Shapira and Venezia (2001) in Israel, Grinblatt and Keloharju (2001) in Finland, Locke and Mann (2005) and Coval and Shumway (2005) in the futures and commodities markets, Frazzini (2006) in mutual funds, and Garvey and Murphy (2004) in a proprietary stock-trading team. For a comprehensive survey of this literature, see Shefrin (2007). These papers find results consistent with the disposition effect in professionals' trading behavior, but none focus on corporate managers. Corporations provide a different setting; they are more complex organizations, with individuals at various levels involved in the decision making (in contrast to an individual investor or money manager, for example), and a different array of monitoring and incentive mechanisms in place. Shefrin (2001, 2006) discusses the implications of a variety of behavioral biases on corporate decisions, including project investment.[7] Additionally, Statman and Caldwell (1987) discuss the experimental evidence of behavioral biases in relation to the disposition effect and its effect on capital budgeting and project terminations. However, to our knowledge, this study presents the first empirical evidence

[6] While Shefrin and Statman (1985) take care to compare and contrast the predictions of tax-motivated trading to the disposition effect, Ivkovic, Poterba, and Weisbenner (2005) present recent evidence that tax motives may be stronger than disposition effects over some horizons.

[7] One example discussed is the behavior known as escalation of commitment, which is attributed to the overconfidence and loss aversion of the manager. This behavior can result in the continued funding of and failure to terminate poor performing projects.

of the disposition effect in corporate decision making, and along with the evidence of Malmendier and Tate (2005), some of the only evidence of behavioral biases among managers.[8]

The remainder of the paper is organized as follows. Section 2 discusses the institutional features of REITs. The next two sections describe our data and methodology. Section 5 presents our empirical results, and the final section concludes.

2 Real Estate Investment Trusts

Our question is whether corporations tend to sell winners and hold losers, which would be consistent with the disposition effect manifesting itself in corporate investment decisions. Such a question is very difficult to test in normal ("C") corporations for several reasons. First, typically one can only observe the largest investment decisions, such as a merger or acquisition. Even when a new product is unveiled with great fanfare, an outside observer cannot tell how much the firm spent in "acquiring" the project, making it impossible to measure a proper starting point for future gains and losses. Second, even if one could observe the purchase price, it is usually impossible to mark the value of the project to market on a periodic basis. As a result, one cannot infer nominal losses or gains from period to period. Third, it is also rare to be able to observe the final value of a project upon its sale – such observations typically only occur in extreme cases, such as spin-offs or divestitures.

These difficulties likely explain the lack of evidence of behavioral biases in corporations.[9] To overcome them, we utilize REITs. Created in the 1960s as passive real estate investment vehicles, REITs do not pay corporate taxes to the extent that their income is distributed to shareholders, as long as they meet a set of requirements. Designed to ensure that REITs fit certain original government objectives, these requirements state that REITs must primarily invest in real estate,

[8] Malmendier and Tate (2005) focus on overconfidence rather than the disposition effect. They utilize differences in firms' cash flow-investment sensitivities to test for effects of overconfidence on corporate investment. Consistent with their hypothesis, they find that the investment decisions of overconfident CEOs are more responsive to cash flow. For theoretical discussions of the role of overconfidence in investment, see Roll (1986) and Heaton (2002).

[9] As noted by Barberis and Thaler (2002), much of the focus in the literature has instead been on the response of a fully rational corporate manager to others' behavioral biases. For example, see Stein (1996), Shefrin (2001) and Shleifer and Vishny (2003).

distribute almost all of their income, be widely held, and derive their income from passive sources.[10]

More importantly for our purposes, the nature of REITs solves the problems inherent in trying to assess the disposition effect in corporate investment. Like a regular C corporation, REITs employ professional managers to make investment decisions on behalf of stockholders. Unlike C corporations, when a REIT undertakes a project by purchasing a new property, one can usually observe both the decision itself and the purchase price. Most REITs disclose the properties they own on an annual basis, including the carrying value on their books. In addition, because returns to commercial real estate are available by property type and location (e.g., from the National Council or Real Estate Investment Fiduciaries, or NCREIF), one can estimate each property's period-by-period return as experienced by the REIT. Finally, sales of properties are also observable, and the sales price is often disclosed. Due to this transparency in the initiation and termination of projects combined with the ability to mark assets to market, REITs provide perhaps the best means of testing for the disposition effect among corporations.

3 Data

In order to examine evidence of the disposition effect in REITs, we begin by collecting property-specific data for publicly-traded REITs over the 1996 to 2006 period, as reported by the SNL DataSource Real Estate Property database. For each property, SNL provides characteristic variables including the owner, date bought and sold, purchase and sales price, location (city, state, county, MSA, etc.), property type (apartment, retail, industrial, etc), property size, and age. Our sample includes any property reported in SNL as owned sometime between 1996 and 2006 by a

[10]Specifically, in order to qualify for the tax exemption, the conditions are: 1. 75% or more of a REIT's total assets must be real estate, mortgages, cash or U.S. government securities, 2. At least 75% of the REIT's annual gross income must be derived directly or indirectly from real property ownership, 3. Five or fewer shareholders cannot hold more than 50% of a REIT's stock, and it must have at least 100 shareholders, and 4. A REIT must not be classified as a property dealer for a given transaction – a defense against this is holding a property at least four years, and not selling more than the greater of 10% of the portfolio or seven properties in any year. For our purposes, the fourth restriction on asset turnover is potentially the most important. However, there are several reasons why it does not appear to be a problem for our tests. First, given the observed holding periods, it does not appear to be a binding constraint for the vast majority of our sample. Second, our empirical modeling strategy allows for different underlying base probabilities of selling properties conditional on how long they have been held. Third, Mühlhofer (2005) argues that the Umbrella Partnership REIT (UPREIT) structure avoids this constraint. Most of our sample REITs are UPREITs, and we control for this distinction in our empirical tests.

REIT that they cover, producing a final sample of 9,875 individual properties owned by 266 REITs.

SNL's property data coverage is not complete, but it does not appear to introduce any bias for tests of the disposition effect. REITs do not have to report their properties owned to SNL, although most do. Some REITs that never report ownership or are not covered by SNL (primarily smaller REITs) never enter our sample. In addition, SNL does not design their data to track the ownership of a particular property over time; instead, they are concerned with the most recent owner. As a result, if one REIT is acquired by another, then the target REIT's properties are only shown in the data as being owned by the acquirer, with a date of purchase equal to the merger date. Thus, we cannot include those properties prior to such a merger in our sample. Similarly, if one property is sold by a REIT to another REIT, then the database will only show the eventual owner; one cannot observe that the property was ever owned by another REIT. SNL does have an indicator variable for properties that were acquired as part of a portfolio purchase (including an acquisition of another entire REIT), and our results are robust to excluding all of these properties.

To test whether firms sell winners and hold losers, we need a proxy for the return on (or value of) each of these properties at each point in time. To construct this, we supplement the SNL property level data with the National Council of Real Estate Investment Fiduciaries (NCREIF) Property Indices. We individually match each property to the appropriate NCREIF index by property type and by location. Specifically, if there are at least 10 properties in the particular Metropolitan Statistical Area (MSA), then we use the MSA level index. If not, then, we use the Division level index (if there are at least 10 properties of that type in the Division); otherwise, we use the Regional index.[11] These indices allow us to estimate a capital return (i.e., price appreciation) and income return for each property in the quarters between the purchase and sale event; because the disposition effect hypothesis focuses on the nominal gain or loss on the investment, most of our tests focus on the capital appreciation return component.[12] While these NCREIF-based returns

[11]These Regions and Divisions are defined by NCREIF. The four Regions are West, East, MidWest, and South, which are further subdivided into eight Divisions: Mideast, EastNorthCentral, Mountain, Northeast, Pacific, Southeast, WestNorthCentral, and Southwest.

[12]There is a considerable literature on the autocorrelation and potential lag in returns in the appraisal based NCREIF indices. The potential lag with which the indices measure returns would seem to the most important issue for our tests. We find that our results are robust to correcting for this problem by lagging the indices by two quarters (see Fisher, Miles and Webb (1999) for a discussion of the duration of appraisal lag).

contain some noise, they appear to be quite accurate. The correlation between the NCREIF-based proxy for the annualized return due to price changes and the realized internal rate of return for the sample of properties where we have data on both purchase and sales price is 0.87. The final panel results in an observation for each property for every quarter from the purchase date of the property until the first of either the sale date or the second quarter of 2006 (the end of the sample period for all properties not sold).

Table 1 presents summary statistics for the properties. The mean property is held for 17 quarters, with a median of 13 quarters. (This includes properties still held at the end of the sample period, i.e., properties that we never observe being sold by the end of the sample period.) The mean acquisition price is $14.8 million, with a lower median of $7.6 million. For sold properties, the cumulative price appreciation averages 27.1 percent, with a median of 10.9 percent, which equates to an average (median) price appreciation of 0.9 percent (0.7 percent) per quarter. The table also presents the breakdown of properties by property type and region. Industrial properties are the most prevalent, but as one would expect, they also have the lowest cost. Mean prices are highest for office properties, and in the East and West regions; typical returns are also highest in these groups. Among the location/property type combinations, the single most common market in our sample is the Dallas Industrial market, with 185 properties. The Washington, DC, New York, and Philadelphia office markets are next, with 184, 166, and 148 properties, respectively.

These properties are then matched with firm characteristics, including performance and financial statement data. Specifically, we collect each firm's annual return, market capitalization (in 1996 dollars), Tobin's q ratio (defined as the market value of equity plus the book value of debt divided by total assets),[13] the fraction of the firm owned by insiders, and an indicator variable for firms that are Umbrella Partnership REITs (UPREITs). UPREITs are structures where the properties are owned by an operating partnership, which is in turn controlled and largely owned by the REIT. These are created for tax purposes, as investors can contribute properties to the partnership in return for partnership units, without recognizing a capital gain.

[13] In the context of real estate, one might argue that the book value of properties understates the true value due to book depreciation. Our results are robust to alternatively calculating q after adding back accumulated depreciation.

Table 2 presents summary statistics for these firm-level variables in our sample. The results are indicative of the very strong performance experienced by REITs over the 1996 to 2006 sample period. The average market capitalization (in 1996 dollars) grows from $383 million in the first quarter of the sample to $1.73 billion by the last quarter, and the mean (median) annual return is 17 percent (15 percent). The average (median) q ratio is 1.52 (1.23), and the mean (median) insider ownership is 14.9 percent (18.5 percent). Most of the REITs in the sample are UPREITs; the mean of this indicator variable is 0.60.

Table 3 details the evolution of our dataset over the sample time period. As the table shows, the REIT sector experienced dramatic growth over this time period, both in terms of the number of REITs and the number of properties held. While in 1996 we have 125 REITs that own 1,739 properties in our sample (37 of which were sold), this grows to 176 REITs that own 4,612 properties five years later in 2001, and to 228 REITs that own 7,824 properties in the final year of the sample. Property sales are most prevalent in the middle of the sample, peaking at 243 sales in 2001, compared to only 37 sales in 1996 and 2005. In our tests below, we control for time effects and overall sales volume.

4 Methodology

To determine if the REIT managers are more likely to sell properties that have performed better (as defined by a cumulative return measured using both the property data and the NCREIF matched index), we use a hazard model to determine if the length of time a property is held is affected by the unrealized return of that property. This model is appropriate due to the conditional nature of the sale decision for each firm (e.g., see Kiefer, 1988), and is commonly used with real estate data to model time on the market (e.g., Genesove and Mayer, 2001). The probability of selling a given property in each quarter, given that it was not yet sold, is denoted by the hazard function, $h(t, x_{j,t}) = h_0(t) \exp(x_{j,t}\beta)$, where t is the time since the property was acquired, $h_0(t)$ is the baseline hazard rate, and $x_{j,t}$ is a vector of covariates that are allowed to affect the probability a property is sold (including our variable of interest, the return to date on the property since it was acquired).

We estimate two types of proportional hazard models – semiparametric Cox models and parametric Weibull models. In the Cox proportional hazard models, the baseline hazard function is not estimated, but is allowed to be an arbitrary function of time (the model is estimated via maximum partial likelihood). This approach has the advantage of allowing the probability that a property is sold (conditional on it not having been sold yet) to vary arbitrarily as holding time increases, but at the expense of not estimating those underlying probabilities. Because of the milder assumptions, we present most of our results using Cox models. In the Weibull models, the baseline hazard rate is estimated as $h_0(t) = pt^{(p-1)}$, where p is a shape parameter that allow for the hazard rate to be monotonically increasing ($p > 1$) or decreasing ($p < 1$). It nests the exponential distribution (where the hazard rate is constant, or $p = 1$) and has the advantage of being able to produce predicted probabilities that a property is sold.

Both classes of models allows for time-varying baseline probabilities of a property being bought or sold, and the covariates act as multipliers on the baseline rate (via the $\exp(x_{j,t}\beta)$ term in the hazard function).[14] In both types of models, our interest is in the coefficient vector, β, and in particular, the coefficient on the cumulative capital return on a property. The disposition effect predicts that REITs would be prone to selling winners and holding losers. In our hazard model estimates, this would manifest itself as a significantly positive coefficient on the property's price appreciation. In addition, we also investigate the significance of indicator variables for losses relative to alternative reference points as alternatives to using the continuous appreciation variable.

In our tests, we standardize all continuous variables to have a mean of zero and a standard deviation of one. In lieu of coefficients, we report hazard ratios. These are ratios of hazard rates for an observation with a unit change in the independent variable relative to a base case observation with all continuous variables at their respective means and indicator variables set to zero. Thus, the interpretation of a hazard ratio for a given continuous variable is the relative change in the likelihood that a property is sold at a given point in time, conditional on it having been held up to that point, for a one standard deviation change in that variable (holding all other variables at their

[14] It is worth noting that properties that are never sold in our sample still enter the estimation; they are "right censored." In addition, properties that were owned prior to 1996 enter the estimation only when their covariates are available, after 1996 in calendar time, but they enter with their true spell length as of that date.

means, or zero for the indicator variables). The benchmark hazard ratio is one and the t statistics are for tests of this null hypothesis; ratios greater (less) than one imply greater (lower) likelihoods of a sale. For example, assume that the baseline hazard rate for a property with every variable at its respective mean is constant at 0.08 (implying an eight percent instantaneous probability of selling the property). Then, if the estimated hazard ratio for a particular variable is 1.25, then a one standard deviation increase in that variable in a given quarter (holding all other variables constant) is associated with a hazard rate of 0.10 (implying a ten percent instantaneous probability of selling the property).

5 Empirical Results

Table 4 presents estimates of Cox proportional hazard models under a variety of specifications. Our variable of interest is the cumulative capital return on the property, which is included in all specifications. Across the columns, we vary the control variables, including the presence of property type, Division (location), year and firm fixed effects.[15] In all models, we cluster the standard errors at the firm-year level to account for within-firm correlation across properties in REITs' selling decisions for a particular year. The firm and year fixed effects serve as controls for more general REIT-level effects or time effects.

The first control is the other component of return, the lagged income return on the property. If the disposition effect that REIT managers face is due to total returns on an investment rather than just the capital appreciation, then we would expect similar hazard ratios for the price and income return variables. However, it may be that managers prefer to hold on to properties with greater income return due to their cash flow generation, in spite of the requirement that REITs have to pay out 90 percent of their taxable income (e.g., due to depreciation that provides tax shields for this income). We also include two alternative proxies for the performance of the REIT as a whole – the q ratio and lagged annual return. We control for both the size of the REIT (its lagged market capitalization) and the size of the property (its square footage). Square footage is missing

[15] Our results are also robust to the inclusion of MSA-level fixed effects.

for much of our sample, thus we present most of our specifications without it to maximize power.[16] In specifications without firm fixed effects we include an indicator of the firm's UPREIT status. Mühlhofer (2005) argues that UPREITs have increased flexibility in disposing of properties, which might manifest itself in a higher hazard ratio in our sample. In untabulated tests, we interact the UPREIT indicator with the cumulative capital return variable and find very similar results.

We add controls for two potential alternative motives for selling properties. First, we include the fraction of funds from operations paid out by the firm (*FFO Payout*); firms with higher payout ratios may feel pressure to sell properties to generate cash. Second, we include an indicator for the last quarter of the fiscal year. Firms may be more likely to sell properties at the end of the year for either tax or window-dressing motives.

Our last pair of controls is a set of alternative proxies for market liquidity in a given quarter. One would expect to see greater hazard rates during times of greater trading volumes. To measure this, we first construct *Sample Volume* as the fraction of properties in our sample sold in a given year for that property type in that location (measured by Division). Second, we use the national NCREIF sales index (labeled *NCREIF Volume*), which measures overall nation-wide sales volume on an annual basis.

The results in Table 4 across all estimated models are consistent with the disposition effect, as the likelihood that a property is sold in a given period is positively related to its price appreciation. The hazard ratios for the cumulative capital return are significantly different from one at the 0.01 level in every case. In addition, the effects are economically significant. A one standard deviation increase in the cumulative capital return is associated with a hazard ratio of about 1.22, or a 22 percent increase in the rate. The hazard ratio is even higher in the last column, but this is a much smaller sample due to missing values for many properties' square footage.

The coefficient on the income return goes in the same direction as that on the capital return. Higher income returns in the prior quarter are generally associated with higher hazard rates, but this is not significant across all models. Most of the other control variables are insignificant, with the

[16] To maximize data availability, we use the largest reported square footage for a property on SNL as the square footage for years with no reported value.

exception of the q ratio and *Sample Volume*. These hazard ratios suggest that stronger performing REITs are less likely to sell properties, and that as expected, the likelihood that a property is sold is greater in more liquid (higher volume) markets.

5.1 Alternative Specifications with Continuous Price Appreciation

One possible concern is that because real estate prices were generally trending upwards over our sample period, the cumulative capital return may be correlated with the length of the holding period and, as a result, is picking up the underlying hazard rate in the data rather than a performance effect. To provide an alternative test that does not have this problem, we replace the cumulative capital return with the average quarterly capital return on the property (from the acquisition date to the quarter of the observation). We also replace lagged income return with the average income return, which is defined similarly. The results of this regression are presented in column one of Table 5.

This results are consistent with those in Table 4. Properties that have experienced higher average capital returns are significantly more likely to be sold in a given quarter than their counterparts with typical price appreciation. The estimated hazard ratios are of similar magnitude; again, a one standard deviation increase in capital return is associated with a hazard ratio of about 1.25. The average income return is also associated with a higher hazard ratio, with estimates that are even larger, but noisier (as evidenced by the lower t statistics). Hazard ratios on the control variables are also similar to those in the previous table. Properties owned by firms with higher performance (measured by the q ratio) face lower hazard rates, an effect that goes in the opposite direction of the property-specific winner effect. Again, we see that hazard rates are higher in markets with more liquidity.

In addition to the concerns over measuring returns, two other potential issues with our previous results stem from portfolio rebalancing and leverage. One possible explanation for the greater propensity to sell winners is that firms are selling these properties in order to rebalance their portfolios. To test and control for this effect, we construct a measure, *Portfolio Weight*, defined

as the implied value of that particular property during that quarter as a percentage of the total implied value of the property portfolio of the firm. Implied values are calculated using the initial property purchase prices, and the *Cumulative Capital Return* for each property at a particular time. We then run our regressions, including this variable and its interaction with our primary variable of interest, *Cumulative Capital Return*.

While it is not immediately clear what the impact of leverage might be on sales of winners versus losers, highly levered firms may be inclined to sell properties in order to raise funds and relax some constraints. Further, if winner properties are easier to sell, then this leverage effect might be particularly strong for those properties. In order to test whether our finding is related to this capital structure choice we run our models including *Leverage*, defined as the total debt as percentage of the total firm capitalization, as well as its interaction with *Cumulative Capital Return*.

The results of these alternative specifications are presented in columns two through four in Table 5. As shown in the table, there is no significant evidence that winner properties that have larger portfolio weights are sold more quickly nor is there evidence of a significant leverage effect. More importantly, these alternative specifications produce results for our variable of interest that are very similar to those presented earlier, both economically and statistically.

We address the role of our sample selection timing in column five of Table 5. In that specification, we rerun our base regression, but we exclude any properties that were acquired prior to the start of our sample. This is to alleviate concerns over the effect on the estimates of our inability to observe the full history of our covariates for these properties that were already in place at the beginning of our sample. The results of this specification are strikingly similar to those presented before, with a hazard ratio on the cumulative capital return of 1.24. Thus, the surviving properties as of 1996 are not driving our results.

We present a final robustness check of our main results based on the type of hazard model in the last column of Table 5. We estimate a Weibull Distribution hazard model which has the advantage of letting us evaluate the shape parameter. Column six presents a similar specifications as column

five of Table 4, and shows similar results.[17] Again, the hazard ratio on the cumulative capital return is significantly greater than one, with a magnitude of 1.18.

We also investigated two more issues regarding building improvements and potential differences across REITs depending on their strategies. For the sake of brevity, we discuss the results of the investigations but do not present them in our tables. The issue with building improvements is that we may have misclassified winners and losers due to using the acquisition price as the basis for the estimated return, without controlling for property-improving capital expenditures. To test whether this affects our results, we use a sub-sample of 7,389 properties for which we have data on property book values through time. We calculate a change in book value for each of these properties by taking the difference of the first reported book value from the last reported book value. We find that this property-level proxy for capital expenditures, while statistically significant, has virtually no economic significance (the hazard ratio is almost identically one), and more importantly, we find no real change in the coefficients on the other included variables. To test whether high-growth "developer" REITs that spend money improving and developing properties behave differently than REITs that focus on acquiring existing properties, we split our sample two ways, using the median q and payout ratio, respectively. We expect that developer REITs have greater growth opportunities and higher qs, and pay out less of their available funds, in order to retain more for development.[18] We find no evidence of significant differences across either of these subsample classifications.

5.2 Hazard Rates Based on Losses Relative to Benchmarks

By using the continuous measure of price appreciation rather than indicators for capital losses or gains, we are allowing a REIT manager's reference point for the purposes of the disposition effect to be determined by the typical performance of sample properties rather than absolute gains and losses. Such a proxy for the reference point is consistent with the idea that CEOs are likely to

[17] The only difference between the specification in column six and that of column five from the previous table is the exclusion of the firm indicators. The Weibull model with firm fixed effects would not converge to a solution. An equivalent Cox model excluding the firm indicators results in estimates that are qualitatively the same.

[18] Note that a REIT can choose to retain capital gains from the sale of properties in order to finance this development. However if they do so, the gain will be taxed at the corporate level (and rate), and the shareholders will receive a credit for the taxes paid by REIT.

evaluate their various projects relative to each other (and other firms' similar projects), rather than just an absolute reference point of zero price appreciation. Given the strong performance of the real estate sector during our sample period and the relatively long holding periods involved, this appears to be a plausible assumption.

We now investigate whether the decision to sell or hold a property depends on whether the firm has experienced a paper loss relative to a particular reference point, rather than a continuous measure of price appreciation. This empirical strategy obviously requires a pre-specified reference point. Most of the literature on individual investors uses the original purchase price as the reference point. But, as noted by both Kahneman and Tversky (1979) and Odean (1998), among others, the reference point may evolve over time.

A time-varying reference point seems especially plausible in the case of corporate investments. First, the holding period is longer compared to individual investors' stock holdings and managers may not be satisfied with a zero absolute return over a longer horizon. For example, the median holding period in Odean's (1998) sample of individual investors' stock holdings is about four quarters, compared to our median holding period of about 13 quarters (which understates the eventual holding period due to the large number of properties still held at the end of the sample). Second, given their formal training, managers may be more cognizant of the opportunity cost they face by investing, and they may have in mind that their investments should keep pace with that foregone return. Further, when creating pro-forma operating budgets in the evaluation of acquisition and development projects, managers are likely to project positive growth the value of the asset. As a result, they may be evaluated on their relative performance with respect to other properties as well as the pro-forma estimates, not just whether they made an absolute profit or loss.

Ultimately, this is an empirical question. We investigate three plausible benchmark returns and measure whether a property has a loss relative to a reference point equal to the original purchase price times the cumulative benchmark return that would have been experienced since the asset was acquired (i.e., this cumulative return plus one). The first benchmark return is zero, implying that the reference point is the original purchase price. The second is the inflation rate, consistent with both the idea that managers have the rate of inflation as a hurdle rate for the price appreciation of

their investments as well as with the evidence that real estate prices are correlated with inflation (e.g., see Wurtzebach et al., 1991). The third is the average return for the particular property type, consistent with the idea that managers are evaluating each investment relative to what is typical for that type. These all provide proxies for what might be a true reference point. But, as noted by Odean (1998), using a proxy for the reference point rather than the true one is likely to weaken (rather than strengthen) the statistical significance of our tests.

Our examination of continuous price appreciation and time-varying reference points is related to the work on the disposition effect of Jin and Scherbina (2006). They define winner and loser stocks based on relative performance to other stocks, rather than to the absolute reference point of zero price appreciation. Another example is Heath et al. (1999), who suggest that a reference point for the exercise of stock options is dynamic and changes relative to the underlying asset.

Table 6 presents the results of these tests. In addition to indicator variables for each potential loss relative to a reference point, we also include the most recent year's capital appreciation as a control variable (along with other controls from our previous tables). We obtain very similar results if we instead use the most recent two years' capital appreciation. Including this as a control helps identify the role of the original purchase price (plus some benchmark return) in the decision to sell, as distinct from the recent relative success of the investment. Thus, if a loss indicator variable is significant, then it implies that holding the recent performance constant, having a loss relative to the reference point is associated with a difference in the tendency to sell an asset.

As column one of Table 6 shows, we find no significant evidence that the original purchase price is a valid reference point in our sample. This could be partly due to power. As discussed earlier, the property markets performed very well during our sample. Consistent with this, only 20% of our sample had an unrealized loss relative to the purchase price at any point while it was held, while only 11% of all of the property-quarters had such an unrealized loss. Alternatively, the lack of evidence of a zero return reference point could be consistent with the disposition effect where REIT managers have a reference point that varies over time.

As tests of this, columns two and three utilize such time-varying reference points, where the infla-

tion rate and the average property appreciation rate are measured prior to the beginning of our sample. Using the 1979-1995 period, the average quarterly inflation rate was 1.27%, while property types experienced the following average quarterly appreciation: hotels, -0.69%, industrial, 0.18%, multifamily, 0.86%, office, -0.06%, and retail, 0.38%. The reference point for a particular property quarter is the original purchase price times one plus the relevant average rate raised to the power of the number of quarters it was held (as of that point).

The results of these tests, in columns two and three of Table 6, show support for these time-varying reference points. As shown in column two, a property that has a loss relative to inflation is only 32% as likely to be sold as an otherwise similar (average) property. Similarly, column three shows that a property with a loss relative to the average NCREIF benchmark has a hazard rate that is only 26% as large as an otherwise similar property that beats that benchmark. These results are consistent with loser properties (defined relative to these benchmarks) being held longer after controlling for recent returns and firm characteristics, and are significant at the 0.01 level.[19]

We extend our analysis of reference points by considering the possibility that managers use actual inflation or actual NCREIF returns over the period in the which the property was held as a benchmark (rather than a long-run average benchmark calculated over the previous time period.) Results from these tests are shown in columns four and five of Table 6. We see evidence consistent with the findings related to long run average benchmarks, however the results are slightly weaker both economically and statistically. A property that is a loser relative to actual inflation over the same period is associated with a 46% lower hazard rate, significant at the 0.05 level. Similarly, a property thats price appreciation falls below the actual NCREIF price appreciation for that property type over the same time period has a hazard rate 55% lower than a property with a return above the benchmark (significant at the 0.10 level).

[19]We also find significant coefficients using loss indicators relative to reference points based on arbitrary, small amounts of appreciation. For example, the coefficient on an indicator for a loss relative to a reference point based on 1% price appreciation per year is significant at the 0.01 level. Thus, the evidence is consistent with the disposition effect using reference points that grow quite modestly since acquisition.

5.3 Property Sales Prices

Taken together, the results are consistent with firms having the tendency to sell winners and hold losers, where winners and losers are either defined based on a continuous measure of price appreciation, or relative to a reference point consistent with plausible benchmark returns. We next ask whether managers' disposition effect tendencies appear to affect the realized prices of properties they sell – more specifically, whether managers who are selling winners receive lower (normalized) prices. One might think that due either to the haste to lock in a gain or to a lack of utility over a marginal dollar of capital gain conditional on selling a winner, one might observe a negative relation between sales price and disposition effect sales of winner properties. In a sense, our question is the flip side of that posed by Genesove and Mayer (2001), who show that loss aversion leads condominium owners to hold out for higher selling prices.[20]

To test this hypothesis, we first classify property-quarters into *Winners* and *Losers*. A property is a *Winner* in a given quarter if its cumulative capital return is above the median for all properties of that type in that quarter, and is a *Loser* otherwise. We then divide our sample of REITs into *Disposition Effect* firms and *Non-Disposition Effect* firms. After conducting our *Winner/ Loser* classification, for each firm we calculate the fraction of *Winners* sold relative to all *Winners* minus the fraction of *Losers* sold relative to all *Losers*. *Disposition Effect* firms are those firms that sell more winners and sell fewer (or hold more) losers – accordingly, we define these as firms whose difference is greater than the overall sample median, while *Non-Disposition Effect* firms have differences below the median.[21] Then, we regress sales price per square foot on an indicator variable for whether the property is a *Winner*, an interaction between the *Winner Property* indicator and the *Disposition Effect Firm* indicator, and alternate controls, including the capitalization (cap) rate in that NCREIF property type market (to control for market-specific pricing), and fixed effects for property type (to control for property type differences in price per square foot), Division (to control for locational differences in prices), and the year of the observation (to control for time differences

[20] We do not have the data required to conduct their analysis for our sample of REIT properties; we cannot observe listing prices or time on the market, for example.

[21] This measure is based on the *PGR-PLR* variable used by Odean (1998). We obtain similar results using a measure normalized by the total number of properties sold and held, respectively, as well as to using the ratio of the fractions rather than the difference, *PGR/PLR*. We also obtain similar results if we define *Disposition Effect* firms using cutoffs other than the median, such as the extreme quartiles, but we lose power by using more stringent definitions.

in prices).

The results of these tests are presented in Table 7. As the table shows, *Winner* properties tend to receive higher prices per square foot, all else equal. This is consistent with properties in markets that have historically performed well selling at a premium, but it could be the result of incomplete controls for location- and property-type-specific prices. More importantly, the interaction between the *Disposition Effect Firm* indicator and *Winner Property* is significantly negative in all specifications. Depending on the specification, the size of the interaction coefficient ranges from one-half to slightly more than the coefficient on *Winner Property*, implying that the premium price for holding a recently strong performing property drops significantly if it is being sold by a firm that tends to behave in a way that is consistent with the disposition effect. It is also important to note that since we are including *Winner Property* in the regression to control for otherwise omitted market-specific performance, the coefficient on the interaction is not simply a return effect, but is evidence consistent with the idea that the identity of the seller matters.

5.4 Explanations Other Than the Disposition Effect

We now turn to the question of whether the observed tendency to sell winners and hold losers can be explained by three alternative rational motives: optimal tax timing, mean reversion in property-level returns, and signalling due to asymmetric information. This is related to the question of whether this investment behavior has any impact on shareholders. If selling winners and holding losers appears optimal due to one of these alternative explanations, then it may be consistent with maximizing shareholder value. If not, then it suggests that the behavioral bias may be leading to suboptimal decisions.

5.4.1 Taxes

REITs are ultimately a creature of the tax code, providing a means of investing in real estate without double taxation. One could argue that because REITs do not generally pay corporate taxes and

many REIT owners are institutional investors, taxes are unimportant. As evidence counter to this argument, Gentry, Kemsley, and Mayer (2003) find that taxes on future REIT distributions are capitalized into REIT share prices.

Given that imbedded taxes appear to be priced in REIT shares, one potential avenue through which the disposition effect could impact shareholders is via after-tax returns. Unfortunately, this is difficult to assess, because we do not have enough data to tell what the firm would have paid out as capital gains distributions (or dividends) had a particular property not been sold. However, all else held constant, accelerating the sale of winners hurts taxable shareholders on an after-tax basis. For example, assume that a REIT earns a constant return of r due to price appreciation on all of its properties each year, ignore dividends, and assume that an investor's capital gains tax rate is expected to remain constant over time at T.

Consider a two-period horizon, with a \$100 initial investment. If the firm does not sell any properties in the first period, then the appreciation earned is able to grow on a tax-deferred basis. The realized appreciation after the second period would be $100(1+r)^2$, which after taxes, would yield the investor $100(1+r)^2(1-T)+100T$. If $r = 0.1$ and $T = 0.15$, then the investor would have after-tax wealth of \$117.85. Alternatively, if the REIT sells the property after the first year, then it pays the investor a capital gains distribution of \$10, on which the investor pays tax of \$1.50 and reinvests \$8.50. After the second period, the investor's stake is worth $108.5(1.1) = 119.35$, on which the investor owes taxes of $(119.35 - 108.5)(0.15) = 1.63$, for a final after-tax wealth of \$117.73, less than what he or she would have received had the gain been postponed.[22]

One important sense in which all else might not be held constant is in the case where capital gains rates are expected to rise over time. In such a scenario, it might be optimal for a REIT to recognize a larger gain immediately (or delay a loss). However, such an effect would be the same across REITs at a given point in time. The fact that our results are robust to including indicator variables for each calendar year imply that time-series variation in tax timing motives are

[22]It should be noted that by reinvesting the proceeds of sales into qualified real estate assets within 18 months, REITs can take advantage of 1031 "like kind" exchanges. This allows the REIT to defer the recognition of capital gains associated with sold property. While this may mitigate some of the tax disadvantage associated with selling winners early to the extent that recognition of gains can be deferred, it does not imply that there is a tax-driven advantage in selling the properties early.

not driving the tendency to sell winners and hold losers.

Thus, it is important to note that the observed behavior does not appear to be optimal from a tax perspective, even for a REIT. It is also important to recognize that the individual investor can offset other capital gains in their personal portfolio against the capital losses incurred by the REIT. To the extent that a REIT itself or the individual investor has a realized capital gain elsewhere in their portfolio, the REITs' failure to take an unrealized loss could exacerbate this tax effect.

5.4.2 Mean Reversion in Property-Level Returns

While taxes tend work in the opposite direction than what is required to offer a rational explanation for the observed tendency to sell winners and hold losers, a second potential rationale is a belief in mean reversion of prices. If REIT managers believe that the prices of their winners will fall in the future, while the prices of their losers will rise, then they could be following a strategy that is individually rational. We cannot test their beliefs in order to truly distinguish this explanation from the disposition effect. But, we can test whether such beliefs appeared to be rational ex post; in other words, by selling winners and holding losers, did REIT CEOs capitalize on property market mispricing? To test this, we examine property market performance following buy and sell decisions that appeared to be disposition-driven.

To do this, we use our previous classification of property-quarters as *Winners* and *Losers*. We further categorize each property as held or sold, and use the NCREIF property market return for that property over the following four and eight quarters to see how each group of properties hypothetically would have performed after the firm's decision. It is worth noting that the NCREIF series is appraisal based, and argued to be too highly autocorrelated, which would lead to winner and loser properties both tending to persist. But, this bias should not depend on whether the property was held or sold in a given quarter.

In Table 8, we present the average ex post returns for each of the four groups (*Held Winners*, *Held Losers*, *Sold Winners* and *Sold Losers*), plus t statistics for tests of differences in means. As one

can see from the top half of the table, markets of sold properties tend to perform well over the four quarters after the sale, with capital returns of over three percent. Markets of *Loser* properties that were held perform the most poorly ex post, with returns of -3.0 percent. This is inconsistent with mean reversion as a profitable motive to hold losers. The differences in *Loser* returns across *Held* and *Sold* properties is inconsistent with an effect driven by simple persistence due to using NCREIF returns – such persistence should be independent of what firms chose to do with the properties.

We also present overall average ex post returns for two strategies. The *Disposition Strategy* is designed to mimic the exposure firms experience by selling winners and holding losers, and we calculate the returns to this strategy by going long *Held/Loser* properties and short *Sold/Winners* for four (or eight) quarters. The returns of this strategy are compared to the *Non-Disposition Strategy*, or going long *Held/Winners* and short *Sold/Losers*. The returns on these strategies are calculated in calendar time by averaging the current quarter's return with the previous three quarters (to account for the possibility of mean reversion over several quarters). The *Disposition Strategy* shows significantly lower ex post returns at both the one- and two-year horizon (although the difference in the strategies at the two-year horizon has lower statistical significance).

The profitability of these results should not be taken too literally, as there was no feasible way to short commercial properties during our sample period, and the strategies would require trading many positions in markets with high transactions costs. Still, it is informative to note that the result does not go in the direction that mean reversion would suggest, at least over these horizons. So, while we cannot rule out management's belief in mean reversion, the results suggest that such beliefs are not accompanied by private information about future property market returns. If anything, it appears as if holding on to losers results in significantly lower price appreciation in the future.

5.4.3 Selling Winners Due to Asymmetric Information

A final potential rationale for the observed tendency to sell winners and hold losers is to signal firm (and managerial) quality. This possibility could plausibly arise if there is a sufficient degree of asymmetric information with respect to the quality of a firm's portfolio of projects or properties

between the firm and the market or between the firm management and board of directors. In such a case, one might expect the manager to signal the quality of this portfolio through his or her selling decisions, as a project's value is observable upon a sale. Because of the manager's career concerns (Holmstrom, 1982) or the market's expectations (similar to Stein, 1989), the manager could attempt to influence the perception of the quality or performance of the firm (and thereby the perception of the his or her performance) by selling only the highest performing projects. In a sense, the manager would attempt to "mark to market" the balance sheet of the firm at the level of the best projects. Conversely, by retaining the poorest performers, the manager might seek to delay the market's recognition of those weaker investments. However, this attempt to"fool" board members or the market into a higher estimate of the manager's ability would only occur if the true quality of the underlying projects was not easily observable.

This argument appears less persuasive in the case of REITs, where the level of asymmetric information with respect to a firm's projects is particularly low. REITs provide detailed information with respect to their property types, property locations, and even major tenant turnover. Additionally, much of our sample is covered by industry analysts, whose reports focus on estimating the market values of the firms' properties. Plus, our definitions of winner and loser projects are based on market-level real estate returns that are easily observable, rather than the more problematic property-specific returns. In such an environment, managers would be less likely to either try to signal the firm's quality or to fool board members or the market by selling the best-performing properties of the portfolio.

To empirically examine this issue, we split our sample based on a proxy for the degree of asymmetric information between the firm and the rest of the market. This proxy uses analyst coverage for each REIT in the sample as reported in the IBES database. Table 9 shows the results of our standard hazard model specification where the sample is split based on IBES analyst coverage.[23] Column 1 shows estimates for a sub-sample in which each firm is covered by IBES for the given year, compared to column 2 that presents estimates using firms not appearing in IBES database. The results demonstrate that the hazard ratio on our variable of interest, the cumulative capital

[23]In this table, we do not include firm indicator variables, due to the lack of within-firm variation in analyst coverage.

return on the property, is actually higher for those firms that we expect to have less asymmetric information. This difference between the two samples is significant at the 5% level and suggests that the effect goes in the opposite direction of such a signalling explanation.

We further examine the subset of firms covered by IBES and categorize them into those with above or below median analyst coverage, based on the number of analysts following the firm. These results are shown in columns 3 and 4 of Table 9. We find that there is no significant difference in the hazard ratios of the cumulative capital return across these two sub-samples, further suggesting that the transparency of the firm is not driving the observed selling behavior. In untabulated results, we also conduct the analysis from Table 9 on model specifications using losses relative to benchmarks rather than continuous price appreciation. The results are consistent with the results presented and do not provide support for the signalling argument.

We also consider the question of whether the observed selling behavior of managers is related to the compensation the managers receive. If managers are attempting to realize gains in order to influence board perception of their ability we may see this reflected in the cross section of compensation. Our data include CEO compensation information for one year of our sample, 2005. Using these data, one could test whether the level of compensation is related to realized gains or losses on property sales, after controlling for other firm characteristics such as size and performance, or whether unrealized gains appear to have a different relation to compensation than realized gains. In untabulated results, we find no significant relation between cash compensation and realized gains (as a percent of the firm's total estimated portfolio value), and no difference in the relations between compensation and unrealized versus realized gains. This suggests that, even if managers are attempting to influence the board's perception of ability by recognizing gains and deferring losses, it is going unrewarded.[24] The evidence from compensation patterns, combined with the fact that we do not see an increased propensity to sell winners for firms with greater expected levels of asymmetric information, suggests that the observed behavior is not an attempt by managers to influence the perception of firms' performance or their ability.

[24]It should be noted that in a "signal jamming" equilibrium in which managers are attempting to influence perception, a rational board would recognize the incentive to sell winners, and while the behavior would continue to exist, the managers would not be rewarded for it.

5.5 Differences in Selling Behavior Across Properties and Firms

We conclude our analysis by investigating whether some firms or properties are more likely to exhibit the observed tendency to sell winners and hold losers.

We first explore whether the documented effects are more pronounced for properties of different sizes. One can imagine the effect going either way. Managers may be especially reluctant to recognize a loss (or subpar return) on a large investment if their reputations are more influenced by the performance of their biggest bets. Alternatively, if the disposition effect is suboptimal from a performance standpoint, the costs associated with it may be larger for bigger properties, leading managers to act "more rationally" when more is on the line.

To test this, we conduct our base tests from Table 4 on two subsamples of the data, divided according to property size. We classify a property as large if it is above the median square footage for all properties of that type in our sample for that quarter. The results of these tests are presented in Table 10. For the large properties, while the estimate is no longer statistically significant (due to the smaller sample size) the point estimate of the hazard ratio on the cumulative capital return variable is in line with our previous estimates, at 1.14. The lack of significance is driven by larger standard errors for this smaller subsample. For the smaller properties, the hazard ratio is significant and much higher, at 2.49, consistent with managers following the disposition effect predictions more closely when less money is at risk. Although we do not present the results, if we test for the significance of this difference by running one hazard model with every variable interacted with a small property indicator variable, the difference in the hazard ratio across property sizes is statistically significant (with a t statistic of 2.30).[25]

To this point, the analysis has focused on the relation between property-level characteristics and REIT managers' decisions whether to hold or divest a property. We now explore how these decisions differ depending on characteristics of the REITs themselves, by dividing our sample of REITs into

[25]When the size of a property is based on the weight of that property in the REITs' portfolio rather than square footage, the point estimates are very similar. The estimated hazard ratio on the cumulative capital return for large properties is 1.20, compared to 1.65 for small properties. However, because of the larger standard errors in this specification, we cannot reject the null that these coefficients are equivalent.

Disposition Effect firms and *Non-Disposition Effect* firms. In Table 11, we present the means and medians of various firm characteristics across the *Disposition Effect* and *Non-Disposition Effect* groups, plus t statistics and Wilcoxon Z statistics for differences in means and medians. The results indicate some interesting differences across the two groups. *Disposition Effect* firms tend to be smaller in terms of assets, market capitalization and revenues. We find no difference in terms of average or median annual returns. Interestingly, in spite of their larger size, we find that the *Non-Disposition Effect* firms have greater insider ownership when compared to the *Disposition Effect* firms. This is suggestive that incentives may matter in managers' propensity to exhibit such behavior.

6 Conclusion

The impact of behavioral biases has been receiving much attention in the literature. Among these biases, one of the most studied is the disposition effect, or the tendency to sell winners quickly and hold on to losers. This hypothesis builds on the seminal work on prospect theory of Kahneman and Tversky (1979), and mental accounting of Thaler (1985), and was further developed and applied to the data by Shefrin and Statman (1985). Since then, the effect has been linked to individual trader behavior (e.g., Odean, 1998), individual's behavior in selling their residences (Genesove and Mayer, 2001), and trades made by professionals (e.g., Frazzini, 2006; Coval and Shumway, 2005).

In spite of this evidence, we know very little about how the disposition effect is a part of corporate managers' decision making. In fact, other than the evidence on CEO overconfidence in Malmendier and Tate (2005), there is little evidence on whether top managers such as CEOs are subject to the same behavioral biases as individual investors or stock traders. This is an important question in helping us better understand corporate behavior, plus there may well be implications for shareholder value. In addition, if this bias is suboptimal from a performance standpoint, then it is interesting to know whether professional, sophisticated corporate managers can overcome these tendencies. From a moral hazard perspective, it may be that the incentives or organizational structures in place for CEOs are sufficient for them to do so, or from an adverse selection perspective, it may be that

CEOs who are "more rational" have survived the tournament to lead the firm.

These questions applied to the disposition effect are virtually impossible to answer using data from regular C corporations. Other than the largest investments, one cannot generally observe the firm's detailed capital budgeting decisions (when to acquire specific assets or the price paid). It is also very tough to mark these investments to market in order to ascertain gains or losses, or to see when managers sell or abandon projects. We take advantage of the transparency of real estate investment trusts (REITs) to circumvent these problems.

Using these data, we find economically and statistically significant results that are consistent with the disposition effect in this corporate setting. Across a variety of model specifications, we find that hazard rates for property sales are roughly 1.2 times higher for a one-standard deviation change in the nominal capital return (i.e., price appreciation) of the property. We also find that hazard rates are significantly lower (economically and statistically) when a property has a paper loss relative to a benchmark based on inflation or typical property returns.

Also consistent with the disposition effect, we find that those firms engaging in this behavior receive lower prices on the sale of properties. While we present evidence that winner properties receive higher valuations on a per-square-foot basis, not all sellers are equal – firms more prone to disposition effect behavior realize significantly lower sales prices per square foot, consistent with haste to sell or satisfaction with a large gain leading to a willingness to accept a lower price.

We find little support for the alternative explanations for this selling behavior. First, one can easily see that from a tax perspective, the selling of winners more quickly and holding losers longer tends to hurt rather than help REIT shareholders. Secondly, we find no evidence of ex post mean reversions in property market returns that would make selling winners and holding losers optimal. Third, while there are reasons to doubt a priori that asymmetric information is driving the observed behavior, the evidence confirms this – firms expected to have less asymmetric information appear to be just as likely to sell winners and hold losers, if not more so.

Finally, we show that the disposition effect is stronger for smaller properties, consistent with CEOs

acting in a more behavioral fashion when less money is at stake. We also find that the firms that exhibit the strongest signs of this bias tend to be smaller, with insiders who own less of the firm.

Our results suggest that there may be a role for behavioral biases in explaining corporate investment decisions. They also suggest that in addition to work on rational managers responding to irrational stakeholders, more work on behaviorally biased CEOs may be warranted.

References

[1] Barberis, N. and R. Thaler. 2002. A Survey of Behavioral Finance. In George M. Constantinides, Milton Harris, and Rene Stulz, eds: Handbook of the Economics of Finance (North-Holland Elsevier, Amsterdam).

[2] Barberis, N. and W. Xiong. 2007. What Drives the Disposition Effect? An Analysis of a Long-standing Preference-based Explanation. *forthcoming Journal of Finance*

[3] Coval, J.D. and T. Shumway. 2005. Do Behavioral Biases Affect Prices? *Journal of Finance* 60, 1-34.

[4] Fisher, J.D., M.E. Miles and R.B. Webb. 1999. How Reliable are Commercial Appraisals? Another Look. *Real Estate Finance* Fall 1999, 9-15.

[5] Frazzini, A. 2006. The Disposition Effect and Underreaction to News. *Journal of Finance* 61, 2017-2046.

[6] Garvey, R. and A. Murphy. 2004. Are Professional Traders Too Slow to Realize Their Losses? *Financial Analysts Journal* 60, 35-43.

[7] Genesove, D. and C. Mayer. 2001. Loss Aversion and Seller Behavior: Evidence from the Housing Market. *Quarterly Journal of Economics* 116, 1233-1260.

[8] Gentry, W.M., D. Kemsley and C. Mayer. 2003. Dividend Taxes and Share Prices: Evidence from Real Estate Investment Trusts. *Journal of Finance* 58, 261-282.

[9] Grinblatt, M. and M. Keloharju. 2001. What Makes Investors Trade? *Journal of Finance* 56, 589-616.

[10] Heaton, J.B. 2002. Managerial Optimism and Corporate Finance. *Financial Management* 31, 33-45.

[11] Heath, C., S. Huddart and M. Lang. 1999. Pyscholical Factors and Stock Option Exercise. *The Quarterly Journal of Economics* 114, 601-627.

[12] Holmstrom, B. 1982. Managerial Incentive Problems, a Dynamic Perspective. *in Essays in Economics and Management in Honor of Lars Wahlbeck (Helsinki: Swedish School of Economics)*

[13] Ivkovic, Z., J. Poterba and S. Weisbenner. 2005. Tax-Motivated Trading by Individual Investors. *American Economic Review* 95, 1605-1630.

[14] Jin, J. and A. Scherbina. 2006. Inheriting Losers. *Working Paper*

[15] Kahneman, D. and A. Tversky. 1979. Prospect Theory: An Analysis of Decision under Risk. *Econometrica* 47, 263-292.

[16] Kiefer, N. 1988. Economic Duration Data and Hazard Functions. *Journal of Economic Literature* 26, 646-679.

[17] Locke, P. and A. Mann. 2005. Professional Trader Discipline and Trade Disposition. *Journal of Financial Economics* 76, 401-444.

[18] Malmendier, U. and G. Tate. 2005. CEO Overconfidence and Corporate Investment. *Journal of Finance* 60, 2661-2700.

[19] Mühlhofer, T. 2005. Trading Constraints and the Investment Value of Real Estate Investment Trusts: An Empirical Examination. PhD Thesis. London School of Economics and Political Science.

[20] Odean, T. 1998. Are Investors Reluctant to Realize Their Losses? *Journal of Finance* 53, 1775-1798.

[21] Roll, R. 1986. The Hubris Hypothesis of Corporate Takeovers. *Journal of Business* 59, 197-216.

[22] Shapira, Z. and I. Venezia. 2001. Professional Trader Discipline and Trade Disposition. *Journal of Banking and Finance* 25, 1573-1587.

[23] shefrin01) Shefrin, H. 2001. Behavioral Corporate Finance. *Journal of Applied Corporate Finance* 14, 113-124

[24] Shefrin, H. 2006. Behavioral Corporate Finance. *McGraw-Hill Irwin*

[25] Shefrin, H. 2007. How the Disposition Effect and Momentum Impact Investment Professionals. *Journal of Investment Consulting* 8, 64-75

[26] Shefrin, H. and M. Statman. 1985. The Disposition to Sell Winners too Early and Ride Losers too Long. *Journal of Finance* 40, 777-790.

[27] Shleifer, A. and R.W. Vishny. 2003. Stock Market Driven Acquisitions. *Journal of Financial Economics* 70, 295-311.

[28] Statman, M. and D. Caldwell. 1987. Applying Behavioral Finance to Capital Budgeting: Project Terminations. *Financial Management* 16, 7-15.

[29] Stein, J. 1989. Efficient Capital Markets, Inefficient Firms: A Model of Myopic Corporate Behavior. *Quarterly Journal of Economics* 104, 655-665.

[30] Stein, J. 1996. Rational Capital Budgeting in an Irrational World. *Journal of Business* 69, 429-455.

[31] Thaler, R. 1985. Mental Accounting and Consumer Choice. *Marketing Science* 4, 199-214.

[32] Thaler, R. and H. Shefrin. 1981. An Economic Theory of Self Control. *Journal of Political Ecnomoy* 89, 392-406.

[33] Wurtzebach, C., G. Mueller and D. Machi. 1991. The Impact of Inflation and Vacancy on Real Estate Returns. *Journal of Real Estate Research* 6, 153-168.

Table 1: Property Level Summary Statistics

This table presents property level summary statistics for a sample of 266 REITs over the 1996 to 2006 period. Statistics are presented for the overall sample, and for each property type and region. In addition to the number of properties, the table details the mean and median quarters the property is held by the REIT, the *Acquisition Price* in thousands of 1996 dollars. For properties that were sold, the table also presents the mean and median *Cum. Capital Return*, which is the total compound price appreciation since the property was acquired, and *Ave. Capital Return*, which is the average quarterly price appreciation over that period.

						Sold Properties			
Property	Number	*Quarters Held*		*Acquisition Price*		*Cum. Capital Return*		*Ave. Capital Return*	
Description	of Properties	Mean	Median	Mean	Median	Mean	Median	Mean	Median
All	9,875	17	13	14,820.5	7,566.6	0.2707	0.1091	0.0088	0.0067
ByPropertyType									
Apartment	1,447	19	16	16,110.3	11,965.6	0.2998	0.1121	0.0132	0.0079
Hotel	706	16	14	17,745.3	10,875.3	0.0370	0.0075	0.0049	0.0008
Industrial	3,313	17	12	6,559.61	3,773.9	0.2596	0.0953	0.0149	0.0077
Office	2,249	15	12	23,811.3	10,039.8	0.3856	0.1580	0.0557	0.0126
Retail	2,160	18	12	17,119.2	9,087.3	0.2818	0.1390	0.0100	0.0086
ByRegion									
West	2,221	17	13	17,898.7	10,125.4	0.2597	0.1432	0.0302	0.0115
East	2,968	19	13	17,135.2	7,998.4	0.3798	0.1473	0.0173	0.0098
MidWest	1,621	17	13	10,811.4	5,419.1	0.2266	0.0535	0.0102	0.0043
South	2,820	16	13	11,663.5	6,654.0	0.1980	0.0559	0.0122	0.0045

Table 2: Firm Level Summary Statistics

This table presents firm level summary statistics for a sample of 266 REITs over the 1996 to 2006 period. *Market Cap* is the market capitalization of the REIT in millions of 1996 dollars, and is presented for the full sample, and the first and last quarter of the sample. *Annual Return* is the total annual return on the REIT's stock and q is the firm's Tobin's q ratio, computed as the sum of the market value of equity plus the book value of debt, divided by the book value of assets. *UPREIT* is an indicator variable for REITs structured as an Umbrella Partnership REITs. *Insider Ownership* is the fraction of the firm's equity owned by insiders, as reported by SNL.

Variable	Mean	Std. Deviation	Median	25%	75%
Market Cap	1,049.71	1541.79	546.28	198.08	1249.04
4Q2006	1,731.05	2,501.48	811.35	253.21	1,952.91
1Q1996	382.60	366.99	283.05	91.65	546.50
Annual Return	0.168	0.272	0.153	0.001	0.319
q	1.52	6.25	1.23	0.89	1.62
UPREIT	0.595	0.491	1	0	1
Insider Ownership	14.9	18.5	9.2	4.3	14.8

Table 3: Number of REITs and Properties by Year

This table presents the number of REITs, number of properties, and the number of properties sold, by year, for a sample of 266 REITs over the 1996 to 2006 period.

Year	Number of REITs	Number of Properties	Number of Properties Sold
1996	125	1,739	37
1997	151	3,013	68
1998	168	4,049	49
1999	172	4,433	173
2000	180	4,537	235
2001	176	4,612	243
2002	178	4,873	180
2003	183	5,216	217
2004	201	5,921	53
2005	213	6,954	37
2006	228	7,824	41

Table 4: Cox Proportional Hazard Models of REITs' Decisions to Sell Properties: Cumulative Returns

This table presents estimates of a series of Cox Proportional hazard models predicting property sales on a quarterly basis for a sample of REITs over the 1996 to 2006 period. Explanatory variables include *Cumulative Capital Return*, the cumulative capital return or price appreciation on each property as of the given quarter; $Income\ Return_{t-1}$, the income return for the prior quarter; $Ln(q_{t-1})$, the natural logarithm of the one-period lag of the q ratio; *Market Cap*, the current period market capitalization in 1996 dollars; *FFO Payout*, the ratio of total firm payout to funds from operations; *Fiscal Year End*, an indicator variable equal to one for the final quarter of the fiscal year; *UPREIT*, an indicator variable for REITs structured as an Umbrella Partnership REITs; *Sample Volume*, the fraction of properties sold of that property type in that location; *Square Feet*, the square footage of the property; *NCREIF Volume*, an index of national sales volume, and $Annual\ Return_{t-1}$, the total return for the REIT's stock over the previous year. Various combinations of indicator variables for *Property Type*, *Division*, *Year*, and *Firm* are included as controls for property type, location, time, and firm effects. All continuous variables have been standardized to N(0,1) variables, and in lieu of coefficients, hazard ratios are presented. These are the ratio of the hazard rate based on a one-standard deviation change in a given variable (holding all other variables at their means and indicators at zero) to the hazard rate with all variables at their means (and indicators at zero). The table also presents the number of spells (properties) and the number of completed spells (sold properties). t statistics are in brackets, and one, two, and three asterisks denote significance at the 0.1, 0.05, and 0.01 levels, respectively. Standard errors are calculated using clustering at the firm-year level.

Variable	1	2	3	4	5	6	7
Cumulative Capital Return	1.17	1.21	1.22	1.22	1.22	1.22	2.72
	[13.62]***	[5.30]***	[3.85]***	[3.69]***	[3.74]***	[3.85]***	[5.13]***
$Income\ Return_{t-1}$	1.26	1.22	1.11	1.09	1.11	1.11	0.56
	[3.15]***	[1.69]*	[0.84]	[0.62]	[0.81]	[0.84]	[2.50]**
$Ln(q_{t-1})$		0.75	0.95	1.04	0.95	0.95	0.79
		[3.45]***	[0.35]	[0.30]	[0.37]	[0.35]	[0.76]
Annual Return				0.75			
				[0.36]			
Market Cap		1.03	0.99	0.77	0.96	0.99	1.21
		[0.27]	[0.02]	[0.59]	[0.10]	[0.02]	[0.30]
FFO Payout		0.98	0.92	1.01	0.94	0.92	0.98
		[0.22]	[0.47]	[0.06]	[0.41]	[0.47]	[0.08]
Fiscal Year End		0.38	1.94	1.90	1.93	1.94	2.19
		[0.95]	[0.47]	[0.45]	[0.49]	[0.47]	[0.60]
UPREIT		1.60					
		[1.46]					
Sample Volume					1.18		1.23
					[2.66]***		[2.46]**
NCREIF Volume						1.00	
						[2.54]**	
Square Feet							1.00
							[1.10]
Property Type Indicators	N	Y	Y	Y	Y	Y	Y
Division Indicators	N	Y	Y	Y	Y	Y	Y
Year Indicators	N	Y	Y	Y	Y	Y	Y
Firm Indicators	N	N	Y	Y	Y	Y	Y
Spells	8,208	5,496	5,496	5,414	5,496	5,496	3,538
Completed Spells	764	464	464	448	464	464	298

Table 5: Alternative Hazard Model Specifications With Continuous Returns

This table presents estimates of a series of hazard models predicting property sales on a quarterly basis for a set of alternative specifications. The first five columns use a Cox Proportional Hazard Model while the final column estimates the hazard using the Weibull Distribution Hazard Model. The first column includes *Average Capital Return*, the geometric average capital return or price appreciation on each property as of the given quarter and the *Average Income Return*, the geometric average income return for the prior quarter. Columns two through four include *Portfolio Weight*, the implied value of that particular property during that quarter as a percentage of the total implied value of the property portfolio of the firm; and *Leverage*, the total debt as percentage of the total firm capitalization. In the fifth column, we exclude any property acquired prior to the start of the sample, 1996. Columns six presents estimates from a Weibull Distribution Model. Various combinations of indicator variables for *Property Type*, *Division*, *Year*, and *Firm* are included as controls for property type, location, time, and firm effects. All continuous variables have been standardized to N(0,1) variables, and in lieu of coefficients, hazard ratios are presented. These are the ratio of the hazard rate based on a one-standard deviation change in a given variable (holding all other variables at their means and indicators at zero) to the hazard rate with all variables at their means (and indicators at zero). The table also presents the number of spells (properties), the number of completed spells (sold properties), and the Weibull shape parameter. t statistics are in brackets, and one, two, and three asterisks denote significance at the 0.1, 0.05, and 0.01 levels, respectively. Standard errors are calculated using clustering at the firm-year level.

Variable	1	2	3	4	5	6
Average Capital Return	1.25					
	[5.64] * **					
Average Income Return	1.28					
	[1.23]					
Cumulative Capital Return		1.21	1.21	1.2	1.24	1.18
		[3.26]***	[3.78]***	[2.66]***	[2.36]**	[5.73]***
$Income\ Return_{t-1}$		1.11	1.11	1.11	1.06	1.24
		[0.84]	[0.81]	[0.85]	[0.47]	[1.75]*
$Ln(q_{t-1})$	0.90	0.94	0.89	0.89	0.90	0.75
	[0.74]	[0.41]	[0.67]	[0.69]	[0.66]	[3.44]***
Market Cap	0.83	1.00	0.93	0.97	0.93	1.01
	[0.42]	[0.00]	[0.18]	[0.08]	[0.17]	[0.09]
FFO Payout	1.10	0.90	0.91	0.88	1.09	0.98
	[0.49]	[0.63]	[0.50]	[0.70]	[0.57]	[0.21]
Fiscal Year End	1.92	1.94	1.94	1.95	1.00	0.38
	[0.49]	[0.50]	[0.50]	[0.50]	[0.00]	[0.94]
Sample Volume	1.20	1.17	1.18	1.17	1.14	1.2
	[2.82]***	[2.46]**	[2.59]***	[2.42]**	[1.99]**	[2.76]***
Portfolio Weight		0.77		0.44		
		[2.58]***		[2.38]**		
*Port. Weight*Cum.Cap.Return*		1.04		0.96		
		[0.10]		[0.09]		
Leverage			0.84	0.85		
			[0.66]	[0.64]		
*Leverage*Cum.Cap.Return*			1.07	1.06		
			[0.29]	[0.28]		
UPREIT						1.55
						[1.34]
Property Type Indicators	Y	Y	Y	Y	Y	Y
Division Indicators	Y	Y	Y	Y	Y	Y
Year Indicators	Y	Y	Y	Y	Y	Y
Firm Indicators	Y	Y	Y	Y	Y	N
Weibull(W)/Cox(C)	C	C	C	C	C	W
Sample	Full	Full	Full	Full	Post 1996	Full
Spells	5496	5496	5468	5468	4878	5,496
Completed Spells	464	464	464	464	400	464
Weibull Parameter						0.98
						[0.14]

Table 6: Cox Proportional Hazard Models of REITs' Decisions to Sell Properties: Losses Relative to Reference Points

This table presents estimates of a series of Cox Proportional hazard models predicting property sales on a quarterly basis for a sample of REITs over the 1996 to 2006 period. Explanatory variables include a sequence of variables that are indicators whether a property has an unrealized loss relative to a particular reference point in that quarter. These indicators and their respective reference points are *Loss vs. Purchase Price*, using the purchase price as the reference point; *Loss vs. Average Inflation*, using the purchase price times (one plus the historical average inflation rate raised to the n power); *Loss vs. Average NCREIF Property Return*, using the purchase price times (one plus the historical average return on the particular property type rate raised to the n power); *Loss vs. Realized Inflation*, using the purchase price times the cumulative realized inflation since the property was acquired; and *Loss vs. Realized Average NCREIF Property Return*, using the purchase price times the cumulative realized price appreciation for all properties of that type since the property was acquired. Historical returns are measured over the 1979 to 1995 period, and n represents the number of quarters held. *Prior Year Capital Return* is the capital return on the property over the previous four quarters. *Income Return*$_{t-1}$, the income return for the prior quarter; $Ln(q_{t-1})$, the natural logarithm of the one-period lag of the q ratio; *Market Cap*, the current period market capitalization in 1996 dollars; *FFO Payout*, the ratio of total firm payout to funds from operations; *Fiscal Year End*, an indicator variable equal to one for the final quarter of the fiscal year; *Sample Volume*, the fraction of properties sold of that property type in that location; Indicator variables for *Property Type*, *Division*, *Year*, and *Firm* are included as controls for property type, location, time, and firm effects. All continuous variables have been standardized to N(0,1) variables, and in lieu of coefficients, hazard ratios are presented. These are the ratio of the hazard rate based on a one-standard deviation change in a given variable (holding all other variables at their means and indicators at zero) to the hazard rate with all variables at their means (and indicators at zero). The table also presents the number of spells (properties) and the number of completed spells (sold properties). t statistics are in brackets, and one, two, and three asterisks denote significance at the 0.1, 0.05, and 0.01 levels, respectively. Standard errors are calculated using clustering at the firm-year level.

Variable	1	2	3	4	5
Loss vs. Purchase Price	1.24				
	[0.77]				
Loss vs. Average Inflation		0.32			
		[3.05]***			
Loss vs. Average NCREIF Property Return			0.26		
			[3.16]***		
Loss vs. Realized Inflation				0.46	
				[2.44]**	
Loss vs. Realized Average NCREIF Property Return					0.55
					[1.93]*
Prior Year Capital Return	1.10	1.09	1.10	1.10	1.10
	[3.26]***	[4.04]***	[4.06]***	[3.80]***	[3.58]***
Income Return$_{t-1}$	1.00	0.99	0.97	0.98	0.99
	[0.03]	[0.10]	[0.20]	[0.13]	[0.07]
$Ln(q_{t-1})$	1.04	0.95	1.06	0.97	0.96
	[0.21]	[0.30]	[0.33]	[0.16]	[0.24]
Market Cap	0.93	0.87	0.97	0.91	0.89
	[0.14]	[0.28]	[0.07]	[0.20]	[0.24]
FFO Payout	0.87	0.83	0.85	0.88	0.87
	[0.71]	[0.89]	[0.95]	[0.74]	[0.80]
Fiscal Year End	1.94	1.97	1.92	1.93	1.86
	[0.49]	[0.50]	[0.47]	[0.49]	[0.46]
Sample Volume	1.18	1.18	1.18	1.18	1.18
	[2.56]**	[2.61]***	[2.68]***	[2.66]***	[2.64]***
Property Type Indicators	Y	Y	Y	Y	Y
Division Indicators	Y	Y	Y	Y	Y
Year Indicators	Y	Y	Y	Y	Y
Firm Indicators	Y	Y	Y	Y	Y
Spells	4672	4672	4672	4672	4672
Completed Spells	384	384	384	384	384

Table 7: Sales Prices for Winner Properties and Disposition Effect Firms

This table presents ordinary least squares regressions of sales price per square foot on explanatory variables for a sample of properties sold by REITs over the 1996 to 2006 period. The explanatory variables include *Winner Property*, an indicator for properties with cumulative capital returns that are above the median for all properties of that type in that quarter, and *Disposition Effect Firm*, an indicator for firms with an above-median value of the difference of winners sold as a fraction of all winners less losers sold as a fraction of all losers. *NCREIF Cap Rate* is the capitalization rate (net operating income divided by market price) for the property type and location as reported by NCREIF. Various combinations of indicator variables for *Property Type*, *Division* and *Year* fixed effects are included as controls for property type, location, and time effects. t statistics are in brackets, and one, two, and three asterisks denote significance at the 0.1, 0.05, and 0.01 levels, respectively. Standard errors are calculated using clustering at the firm level.

Variable	1	2	3	4	5
Winner Property	0.05	0.05	0.05	0.04	0.04
	[5.79]***	[5.78]***	[6.55]***	[5.88]***	[5.99]***
*Disposition Effect Firm*Winner Property*	−0.06	−0.06	−0.03	−0.02	−0.02
	[6.05]***	[6.04]***	[2.91]***	[2.35]**	[2.17]**
NCREIF Cap Rate		0.13	−0.05	−0.18	−0.55
		[0.18]	[0.08]	[0.26]	[0.41]
Property Type Indicators	N	N	Y	Y	Y
Division Indicators	N	N	N	Y	Y
Year Indicators	N	N	N	N	Y
Constant	0.08	0.07	0.04	0.03	0.04
	[13.04]***	[1.11]	[0.45]	[0.31]	[0.30]
Observations	493	492	492	492	492
R-squared	0.09	0.09	0.29	0.32	0.38

Table 8: Ex Post Property Market Returns by Disposition and Prior Performance

This table presents ex post property market capital appreciation returns for four and eight quarter holding periods. First, each property-quarter observation is classified according to whether the property was a *Winner* or *Loser*, then by whether it was held or sold. A property is a *Winner* in a given quarter if its cumulative capital return is above the median for all properties of that type in that quarter, and is a *Loser* otherwise. Then, cumulative price appreciation returns are calculated for the following four and eight-quarters for that property type and market, and the table presents the averages of these cumulative returns across all observations, by group. The table presents t statistics for tests of differences in means across each group. Average returns to the *Disposition Strategy* are calculated in calendar time by assuming that an investor goes long held *Loser* properties and short sold *Winner* properties for the specified time period, with an equal weight in each property market. Average returns to the *Non-Disposition Strategy* are calculated by assuming that an investor goes long held *Winner* properties and short sold *Loser* properties for the specified time period, with an equal weight in each property market. Averages for these strategies and t statistics for differences in average returns across the strategies are calculated using the time series of these quarterly returns. One, two, and three asterisks denote significance at the 0.1, 0.05, and 0.01 levels, respectively.

Average Cumulative Capital Returns, Four Quarters

	Winner	*Loser*	t statistic
Held	1.64	−3.02	−2.02*
Sold	3.10	3.44	0.17
t statistic	−0.95	−2.31**	

Non-Disposition Strategy	*Disposition Strategy*
−0.79	−5.85

t statistic = 2.04**

Average Cumulative Capital Returns, Eight Quarters

	Winner	*Loser*	t statistic
Held	2.15	−4.12	−1.90*
Sold	4.21	7.28	0.57
t statistic	−1.10	−1.89*	

Non-Disposition Strategy	*Disposition Strategy*
−0.65	−6.24

t statistic = 1.93*

Table 9: Cox Proportional Hazard Models of REITs' Decisions to Sell Properties: High and Low Analyst Coverage

This table presents estimates of a series of Cox Proportional hazard models predicting property sales on a quarterly basis for a sample of REITs over the 1996 to 2006 period where the sample is split based on measures of analyst coverage. Explanatory variables include *Cumulative Capital Return*, the cumulative capital return or price appreciation on each property as of the given quarter; $Income\,Return_{t-1}$, the income return for the prior quarter; $Ln(q_{t-1})$, the natural logarithm of the one-period lag of the q ratio; *Market Cap*, the current period market capitalization in 1996 dollars; *FFO Payout*, the ratio of total firm payout to funds from operations; *Fiscal Year End*, an indicator variable equal to one for the final quarter of the fiscal year, and *Sample Volume*, the fraction of properties sold of that property type in that location. Indicator variables for *Property Type*, *Division*, *Year*, and *Firm* are included as controls for property type, location, time, and firm effects. Columns 1 and 2 present estimates in which the sample is split based on whether the firm was covered in IBES in the given quarter. The t-statistic for the difference between the two estimates of *Cumulative Capital Return* is given. Columns 3 and 4 present estimates in which the sample is split based on whether the firm, conditional on IBES coverage, had above or below the median number of analysts covering the firm in a given quarter. The t-statistic for the difference between the two estimates of *Cumulative Capital Return* is given. All continuous variables have been standardized to N(0,1) variables, and in lieu of coefficients, hazard ratios are presented. These are the ratio of the hazard rate based on a one-standard deviation change in a given variable (holding all other variables at their means and indicators at zero) to the hazard rate with all variables at their means (and indicators at zero). The table also presents the number of spells (properties) and the number of completed spells (sold properties). t statistics are in brackets, and one, two, and three asterisks denote significance at the 0.1, 0.05, and 0.01 levels, respectively. Standard errors are calculated using clustering at the firm-year level.

Variable	*IBES Coverage*		*Above Median IBES Coverage*	
	Y	N	Y	N
Cumulative Capital Return	1.39	1.2	1.39	0.76
	[3.71]***	[4.40]***	[3.51]***	[0.40]
$Income\,Return_{t-1}$	1.06	1.45	1.31	0.67
	[0.32]	[2.78]***	[1.63]	[0.68]
Market Cap	0.97	0.94	1.14	0.61
	[0.39]	[0.53]	[1.53]	[1.34]
$Ln(q_{t-1})$	0.8	0.62	0.86	1.24
	[2.90]***	[3.00]***	[1.73]*	[0.57]
FFO Payout	0.92	0.97	0.73	0.76
	[0.43]	[0.18]	[0.98]	[1.21]
Fiscal Year End	0.53	0.58	0.6	0.75
	[0.49]	[0.43]	[0.72]	[0.50]
Sample Volume	1.38	1.36	1.36	1.15
	[5.06]***	[3.81]***	[6.14]***	[0.46]
Property Type Indicators	Y	Y	Y	Y
Division Indicators	Y	Y	Y	Y
Year Indicators	Y	Y	Y	Y
Firm Indicators	N	N	N	N
t-stat: Diff. Cum. Cap. Return	2.28**		0.46	
Spells	4350	3442	2924	1426
Completed Spells	250	214	228	22

Table 10: Cox Proportional Hazard Models of REITs' Decisions to Sell Properties: Large vs. Small Properties

This table presents estimates of a Cox Proportional hazard models predicting property sales on a quarterly basis for a sample of REITs over the 1996 to 2006 period. The first column presents results for Large Properties, which are defined as having greater than the median square footage for that property type in that quarter. The second column presents the results for Small Properties, which are defined analogously, except they are below the median square footage. Explanatory variables include *Cumulative Capital Return*, the cumulative capital return or price appreciation on each property as of the given quarter; $Income\,Return_{t-1}$, the income return for the prior quarter; $Ln(q_{t-1})$, the natural logarithm of the one-period lag of the q ratio; *Market Cap*, the current period market capitalization in 1996 dollars; *FFO Payout*, the ratio of total firm payout to funds from operations; *Fiscal Year End*, an indicator variable equal to one for the final quarter of the fiscal year; and *Sample Volume*, the fraction of properties sold of that property type in that location. Indicator variables for *Property Type* and *Division* are included as controls for property type and location effects. All continuous variables have been standardized to N(0,1) variables, and in lieu of coefficients, hazard ratios are presented. These are the ratio of the hazard rate based on a one-standard deviation change in a given variable (holding all other variables at their means and indicators at zero) to the hazard rate with all variables at their means (and indicators at zero). The table also presents the number of spells (properties) and the number of completed spells (sold properties). t statistics are in brackets, and one, two, and three asterisks denote significance at the 0.1, 0.05, and 0.01 levels, respectively. Standard errors are calculated using clustering at the firm-year level.

Variable	Large Properties	Small Properties
Cumulative Capital Return	1.14	2.49
	[1.53]	[3.26]***
$IncomeReturn_{t-1}$	1.19	0.90
	[1.30]	[0.37]
Market Cap	1.00	0.23
	[0.00]	[3.54]***
$Ln(q_{t-1})$	0.87	0.75
	[1.36]	[1.87]*
FFO Payout	0.86	0.86
	[0.69]	[0.73]
Fiscal Year End	0.58	2.19
	[0.00]	[0.72]
Sample Volume	1.26	1.67
	[3.53]***	[5.42]***
Property Type Indicators	Y	Y
Division Indicators	Y	Y
Firm Indicators	Y	Y
Spells	1,469	1,528
Completed Spells	128	100

Table 11: Characteristics of Disposition Effect Firms vs. Non-Disposition Effect Firms

This table presents mean and median firm level characteristics statistics for a sample of 266 REITs over the 1996 to 2006 period, where the sample is divided into *Non-Disposition Effect* firms and *Disposition Effect* firms. This division is accomplished by first classifying property-quarters into *Winners* and *Losers*. A property is a *Winner* in a given quarter if its cumulative capital return is above the median for all properties of that type in that quarter, and is a *Loser* otherwise. After classifying properties, for each firm, we calculate the fraction of *Winners* sold relative to all winners, minus the fraction of *Losers* sold relative to all losers. *Disposition Effect* firms are those firms that sell more winners and sell fewer losers – we define this as having the difference of these two fractions greater than the overall sample median – while *Non-Disposition Effect* firms have differences below the median. Firm characteristics include *Total Assets*, *Market Cap*, and *Total Revenue*, the book value of assets, market capitalization, and revenues of the REIT, respectively, in thousands of 1996 dollars. *Leverage* is the ratio of the firm's debt to total capitalization. *Annual Return* is the average total annual return on the REIT's stock and q is the firm's Tobin's q ratio, computed as the sum of the market value of equity plus the book value of debt, divided by the book value of assets. *Insider Ownership* is the fraction of the firm's equity owned by insiders, as reported by SNL. *UPREIT* is an indicator variable for REITs structured an as Umbrella Partnership REITs. The table also presents t statistics and Wilcoxon Z statistics for differences in means and medians across the two groups.

	Non-Disposition Effect		*Disposition Effect*			
Variable	*Mean*	*Median*	*Mean*	*Median*	t statistic	Wilcoxon Z statistic
Total Assets	2,225,731	1,209,541	1,998,761	980,691	2.62	4.66
Market Cap	1,139,103	637,870	982,852	476,241	3.15	4.52
Quarterly Revenue	83,401	39,777	69,581	35,226	3.23	3.07
Leverage	43.18	42.71	42.92	42.28	0.60	-0.37
Annual Return	0.165	0.149	0.165	0.154	0.01	-0.25
q	1.57	1.52	1.58	1.53	-0.66	-1.70
Insider Ownership	17.77	9.60	12.67	9.20	10.74	4.23
UPREIT	0.581	1	0.606	1		