The Information Content of Analysts' Net Asset Value Estimates: The Case of Real Estate Investment Trusts (REITs)

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ABSTRACT

In this study, we examine the release of analysts' net asset value estimates of firms and ask whether they transmit new information to security markets. We find that net asset value estimates do contain new information as measured both by abnormal returns and by abnormal share turnover. Our findings remain significant after controlling for concurrent analyst FFO forecasts, buy/sell recommendations, and price targets. Consistent with efficient information transmission, the information is absorbed quickly and permanently by market participants. Analysts of most companies seldom release definite net asset value estimates. The exception is real estate investment trusts (REITs), whose analysts regularly issue estimates of net asset values (NAV) based on the value of their underlying real estate portfolio. We are the first to our knowledge to examine whether analyst estimates of REIT NAVs transmit new information to securities markets.

1. Introduction

The information contained in analysts' forecasts and estimates has long been a topic in interest in financial and accounting research. Prior research concentrates on the reaction of stock prices to the release of three types of forecasts or estimates by analysts: (1) Earnings forecasts, (2) Buy/Sell Recommendations, and (3) Price Targets.[1] The consensus of the literature is that stock prices react to the release of this information and that all three types of forecast make their own incremental contribution.[2] The purpose of this paper is to examine the market reaction to another set of analyst estimates, those of the net value of the firm's assets.

Research on the effects of analysts' net asset value estimates has been limited because of the lack of availability of the release of these numbers for most firms. The closest that researchers have come to examining the issue is by using analyst's estimates of the future price of a stock, or "price target." Analysts' estimates for a price target represents their forecast of the stock's price at a time in the future, typically one year. However, price targets may not represent good estimates of the present value of a firm. They tend to exhibit an optimistic bias, which in turn introduces bias into their information signal. Gleason, Johnson, and Li (2013) found a mean ratio of price-targets to price equal to 1.32 for a large sample of stocks. Brav and Lehavy (2003) reported an average of 1.33. These premiums for one-year ahead stock prices imply an expected one-year average stock return of about 32-33 percent, a hurdle reached by the S&P 500 Index only twice in the 50 years prior to 2016. Bradshaw and Brown (2013) find that returns implied by target prices exceed

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[1] Griffin (1976); Givoly and Lakonishok (1979); Elton, Gruber, and Gultekin (1981); Imhoff and Lobo (1984); Cornell and Landsman (1989); Stickel (1991); Peterson and Peterson (1998); Beaver, Cornell, Landsman, and Stubben (2008); Brav and Lehavy (2003); Green et al (2014); Loh and Stulz (2011); Francis and Soffer (1997); Womack (1996). among many others.

[2] An exception is the work done by Antinkilic and Hansen (2009) and Altinkilic, Balashov, and Hansen (2013) which will be addressed further in the paper.

realized returns by 15 percent. Analyst price targets are flawed; a better approach may be to measure their expectations via estimates of current firm's net asset value. Unfortunately, analysts (or their employers) have shown reluctance to release specific point estimates of a firm's present value. The reasons behind this are subject to speculation,[3] but the fact remains that little data exist on which to base research except for one type of firm, the real estate investment trust (REIT).[4]

In this paper, we examine the market reaction to analyst revisions of NAVs for a sample of Equity REITs from 2001-2015. Unlike mutual funds that hold portfolios of traded securities, Equity REITs hold portfolios of properties that have no traded market price. The NAV is an estimate of the market value of the portfolio of properties the REIT holds, net of liabilities. While individual REIT NAVs vary from their stock prices, and at times all REITs on average may sell for a premium or discount from the average NAV, NAVs do tend to be unbiased estimates of REIT prices over the long run (see, for example, Capozza and Lee (1995), Patel, Pereira, and Zavodov (2009), and French and Price (2016)). Over our entire sample period, the average REIT price-to-NAV ratio is almost exactly one.[5]

If NAV estimate revisions contain information after controlling for concurrent revisions of other analyst-estimate variables previously documented in the literature (price targets, recommendations, and FFO forecasts), then there must be unique information contained in these NAVs that is absent from the other variables. Why might NAV estimates contain unique information? Analysts calculate NAV generally by forecasting the future earnings of the property

[3] A possible explanation is that the net market value of a firms assets can be very challenging to calculate and asset-level data is not easily obtainable. These calculations are more attainable for REITs because of well-developed appraisal methods and readily available property-level data.
[4] Mutual Funds also have NAVs. The key difference is that the mutual fund holds a portfolio of traded securities for which we can observe a market price. Thus, the NAV is simply the weighted average of the portfolio assets' observed market values. REITs, however, hold a portfolio of illiquid property that has no observable market price. Therefore, it is the task of the analyst to appraise the underlying portfolio of properties.
[5] Price-NAV premiums do vary by sector as can be seen in Table I.

(Net Operating Income, or NOI), estimating a “capitalization rate” (cap rate), then applying the cap rate formula to back out a property value for each property in the portfolio. The cap rate is the ratio of NOI to property value. Economically, the cap rate is the rate of return an investor expects to earn from an all cash transaction[6]. To estimate a cap rates for a property, the analyst will typically examine recent “market comparables” or consult industry experts on the appropriate rate for a particular market. After estimating the market value of the properties, the analyst will net out the market value of liabilities and arrive at a NAV, expressed on a per share basis.[7]

An analyst NAV revision should therefore contain information about both future earnings and cap rates.[8] Therefore, by definition, NAV revisions should contain information beyond the information contained in earnings forecast revisions. Price targets should contain information about future earnings and cap rates; however, they differ from NAV estimates in that they are notoriously optimistic, which introduces noise into their information signal. Analyst recommendations are in some sense a current estimate of value, but a point estimate is far more precise. The NAV for a given REIT is expressed on a per share basis and is comparable to stock price, whereas the recommendations are confined to less precise buckets (e.g. buy, strong buy, strong sell, etc). Francis and Soffer (1997) make a similar argument about the relative value of earnings forecasts and recommendations. We hypothesize that analyst NAV estimates provide information incremental to the information conveyed by the other types of estimates or forecasts that analysts issue.

[6] For example, if a property generating $100,000 in annual Net Operating Income (NOI) is bought at a cap rate of 5%, the property was sold for $2,000,000. If an investor bought the property with cash for $2,000,000, his return on investment in the first year would be 5%.
[7] REITs hold other assets (i.e. cash) that are not properties which are factored into the market value of asset calculation. However, the property valuations are the key component of the calculation.
[8] Typically, the market value of liabilities is well approximated by the book value, so it is unlikely NAV estimates contain significant new information about liabilities.

To address our research question, we use two measures to test for information content: abnormal returns and abnormal turnover. Abnormal returns are the traditional method of testing for information content. If one assumes prices reflect all available information, and prices change following an analyst revision, it must be that the analyst revision contains new information.[9] Abnormal turnover provides another way to measure new information flow by indicating whether an analyst revision induces investors to trade. We examine these measures around revisions of analysts' estimates of NAV to determine whether they contain information.

Our results show a significant market reaction to revisions of NAV estimates in terms of both abnormal returns and abnormal turnover. Mean cumulative abnormal returns (CARs) and abnormal turnover are significantly different from zero in the [0,+1] window surrounding revisions. With and without the inclusion of a robust set of controls and fixed effects, we consistently find that analyst NAV revisions are positively associated with both CARs and abnormal turnover. These findings continue to hold through a battery of robustness checks. Importantly, both the CARs and the abnormal turnover measures remain significant after controlling for concurrent analyst FFO forecasts, buy/sell recommendations, and price targets. We also examine the market reaction over a longer window surrounding revisions. If the analyst revisions of NAV contain new information, we would expect to find a quick and permanent shock to stock prices. A CAR reversal might suggest that investors mistakenly believe the analyst revisions contain value when they do not. Consistent with our hypothesis, we find that the information is quickly and permanently impounded in the REITs stock price. Overall, we conclude that analysts' NAV estimates contain unique and significant information to the market.

[9] We relax the assumption of market efficiency in later tests (see Table VI)

There are two critiques from two strands of literature that may be levied against our story. In the accounting literature, recent arguments have suggested that analysts "piggy-back" on corporate news events (Antinkilic and Hansen, 2009 and Altinkilic, Balashov, and Hansen, 2013). According to this argument, analysts do not add additional information, but simply update their estimates following corporate news. Researchers naively attribute a significant market reaction during these windows to the analyst estimate instead of the news event. The second critique comes from the real estate literature. Yavas and Yildirim (2011) find that price discovery generally takes place in the securitized public market. Effectively, they are arguing that when the stock price changes, the valuation of the underlying assets follow (i.e. the NAV). While the argumentation from each strand of literature is different, both critiques assert that prices are changing first and NAVs are changing second. Given than both critiques have a similar empirical consequence in our setting, we address them simultaneously. In the spirit of Loh and Stulz (2011), we apply strict filters to revisions to remove observations that might be plagued by analyst piggy-backing. We also restrict our CAR and abnormal turnover windows to [0,+1] trading days to remove the effect of any price movements on day *t-1*. Our results are robust to these filters and trading day windows.

Our paper contributes primarily to two streams of ongoing research. First, our study adds to the large body of research on the information content of analyst forecasts and estimates. We are the first to our knowledge to examine the information content of analyst NAV estimates. While they are only available for a subset of firms, these unique analyst estimates require extreme precision and do not appear to suffer from optimistic biases. Second, our study contributes to the REIT literature. While the REIT literature typically uses analyst NAV estimates as a proxy for the unobserved market value of assets, we are the first to our knowledge to examine NAVs as analyst estimates, compare them to other analyst estimates and forecasts, and evaluate their information content.

The remainder of this paper proceeds as follows: Section 2 reviews the literature, Section 3 discusses the sample, Section 4 provides the empirical methods and results, and Section 5 concludes.

2. Related literature

2.1 Earnings forecasts, Stock Recommendations, and Price Targets

A large body of financial research investigates the efficacy of forecasts by financial analysts. Beginning in the 1970s, financial research investigating the information content of analysts' forecasts of company earnings began to appear, and the amount of evidence has been substantial.[10] In general, studies find that there is new information in analysts' forecasts and the market reacts accordingly to bring stock prices to reflect the forecasts. Analysts can generally add new information to the market through two mechanisms: private information through access to management and superior processing of public information.

Regulation Fair Disclosure (Reg FD), which was established in 2000, mandates that all publicly traded companies must disclose material information to all investors at the same time. While it would appear this would remove any information content of analyst forecasts or estimates via the private information channel, Green et al (2014) provide evidence to the contrary.

[10] See, for example, work by Griffin (1976) who examines stock returns around analysts' earnings forecasts; Givoly and Lakonishok (1979) who find evidence of information impounded in analysts' earnings forecast revisions; Elton, Gruber, and Gultekin (1981) showing that stock prices quickly reflect information in analyst forecast estimates; Imhoff and Lobo (1984) who show that positive returns accompany upward earnings revisions by analysts and negative returns follow downward revisions; Cornell and Landsman (1989) examining earnings forecast revisions and forecast errors, Stickel (1991); Peterson and Peterson (1998) demonstrating evidence of information impounded in earnings forecasts related to Value Line stock ranking changes; and Beaver, Cornell, Landsman, and Stubben (2008) who identify significant information content of the error component of earnings forecasts.

Specifically, they find that broker-hosted investor conferences leads to more informative research by analysts. They interpret their findings as evidence that access to management remains a critical source of analysts informational advantage.[11]

Analysts can also add information content through superior processing of public information. This could be purely skill driven where the analyst is more skilled at interpreting public information and translating that information into a forecast of future performance. Alternatively, it could be a function of effort in gathering the full extent of public information available. As an example of all three informational advantages, Greenstreet Advisors, a leading REIT research firm, advertises that their NAV estimates are superior because of the following reasons: Deep market contacts, extensive property visits, and a better understanding of REIT balance sheets (among others).[12] Deep market contacts may generally refer to access to management or contacts that the average investor may not have access to. Extensive property visits are an example of effort in gathering the full extent of public information and a better understanding of the balance sheet refers to superior skill in interpreting public information. All of these sources are potential mechanisms through which analyst estimates or forecasts might add new information to the market.

When analysts revise an estimate or forecast, most studies find that the time that the market takes to fully reflect the new forecast information can often be sufficiently long to allow market participants to profit. In other words, there appears to be a drift to the adjustment of post-forecast-revision prices. Gleason and Lee (2003) examine the factors contributing to this post-revision drift

[11] Green et al (2014) caution not to interpret this finding as evidence Reg FD is being violated. It may simply be analysts create material information by "piecing together public information and nonmaterial information form management…Analysts could also be able to glean value-relevant information from management's body language or vocal cues (Mayew and Venkatachalam, 2012)".

[12] http://delaware.greenstreetadvisors.com/about/page/REIT_valuation_where-do-navs-come-from/

and reach several conclusions. First, they find that the market does not distinguish between forecast revisions that imply new differential information about the stock and those that simply move towards the consensus. They also conclude that the price adjustment time period tends to be shorter with forecasts issued by "celebrity analysts" and forecasts issued on stocks with a larger analyst following. Finally, they show that there is a tendency for a significant portion of the drift to occur on dates that coincide with subsequent forecast revisions by other analysts and actual earnings announcements. This implies that the market waits for supporting evidence from other analysts or for corroborating evidence from the firm's financial statements before completing the price adjustment process.

A second line of research that follows the findings of new information implied in earnings forecasts examines the information that analysts buy/sell recommendations might convey to the market.[13] These studies show a post-recommendation pattern that is similar to that of the earnings forecasts. Abnormal stock returns tend to follow analysts' recommendations. Furthermore, the time over which the price adjustments occur is sufficiently long to allow investors to realize abnormal returns based on the recommendations.

As price targets became more popular among analysts, the research on their importance followed. Some of particular importance to our study are Brav and Lehavy (2003) and Asquith et al (2005). Brav and Lehavy (2003) provide evidence of significant information content in analyst price target revisions. Asquith et al (2005), using a unique hand collected data set, identify information content of several analyst forecasts by examining them at the report level. Several

[13] See, for example, studies by Holloway (1981) finding positive returns on a portfolio of Value Line Rank-1 stocks; Elton, Gruber, and Grossman (1986) showing that stock prices changes respond to recommendations by brokerage firm analysts in the expected direction; Womack (1996) who shows that large price adjustments follow extreme changes in recommendations by analysts; Jegadeesh, Kim, Krische, and Lee, C. (2004) who examine conditions under which analyst recommendations are more predictive of returns; and Howe, Unlu, and Yan (2009) concluding that abnormal returns follow analyst recommendations even after controlling for macroeconomic variables.

papers have concluded there is significant information content in price target revisions that is incremental to earnings forecast revisions and stock recommendations.

Recently, there has been criticism of the role of analyst in providing information to the market (Altinkilic and Hansen, 2009; Altinkilic, Balashov, and Hansen, 2013). Specifically, critics argue that analysts "piggy-back" on major corporate news events and therefore the short window announcement returns are related to the corporate news event itself and not the analyst revision. In their analysis, Altinkilic and Hansen (2009) use TAQ data to identify the market reaction minutes after the revision date (rather than several day windows.) They find that the abnormal returns in these minutes fail to be significantly different than zero. In response to this criticism, Bradley et al (2014) find that I/B/E/S timestamps are systematically lagged. After cross-checking the timestamp of the announcement through alternative news sources, they find that there are significant market reactions in the short minute window following analyst revisions.

Loh and Stultz (2011, 2014) acknowledge this debate and argue that the researcher can mitigate the effect of corporate news events. They do so in three ways: i) remove revisions occurring near earnings announcement dates, ii) remove revisions occurring near management guidance releases, iii) remove revisions which occur on the same day as other analyst revisions of the same firm. The reasoning behind the first two screens is obvious. The third is based on the theory that more analysts are likely to issue revisions on the same day following a major news event. In order to address the "piggy-backing" theory, we adopt a method somewhat similar to that of Loh and Stultz that matches our research setting. We discuss this in more detail in the section three.

2.2 REIT prices and net asset values

A REIT's NAV is

$$NAV = MVA - MVL, \tag{1}$$

where *MVA* is the REITs current market value of assets and *MVL* is the current market value of liabilities, all typically stated on a per share basis. While REITs may compute their NAVs for internal purposes, they generally do not disseminate that information publicly.[14] Because the *MVA* is not a value observable from transactions (as in the mutual fund NAV), the computation of NAV is done by analysts. They do so by forecasting the net earnings (NOI) that a REIT's property portfolio should generate and adjusting that number by other cash flows such as general expenses attributable to the REIT and net income from a taxable REIT subsidiary (if applicable). They will then exclude interest expense and estimate a cap rate for the property or group of properties. Then, using the cap rate formula (Cap Rate = NOI/Value), they can back out an estimate of value for the asset. *MVL* is also an estimate but usually approximated very well with the book value of liabilities adjusted for market value of debt disclosed in the financial statement footnotes.

REIT analysts therefore have to forecast the two principal inputs of the NAV, NOI and the cap rate. In estimating the cap rate, analysts consider observed market transactions and quotes of properties similar to those in the REIT's portfolio (by property type, geographic location, property quality, etc.). In doing so, their estimates incorporate market-wide factors affecting the entire real estate market. If price discovery takes place in the REIT market so that REIT price changes lead

[14] A relatively small subset of REITs in any year reports its internal NAV estimate in one or more of the periodic (10K or 10Q) filings. These estimates are not used in this study for two reasons: (1) as internal estimates they have the potential for being biased, and (2) they are usually stale estimates when released, having been performed at some date prior to the release of the filing document.

changes in transaction prices in the physical real estate market, then REIT prices changes should lead changes in analysts NAV estimates.

Applied research verifies this anticipatory relationship. NAVs (physical real estate) closely match REIT prices (as mentioned in the previous section) and correlate closely with REITs returns.[15] Yavas and Yildirim (2011) show that REIT price changes generally Granger-cause changes in NAV estimates. Yavas and Yildirim's (2011) conclusion that the REIT market anticipates analyst NAV changes may imply at first glance that there might be no information implied in analyst NAV estimates. This, however would imply that analysts are unable to impart new information via either their earnings forecasting process for specific REITs or through their ability to forecast property-explicit cap rates to individual REIT property portfolios. In reality, it is likely both are true. It is quite possible changes in market prices of REITs have an impact on analyst property value estimates and changes in analyst property value estimates have an impact on market prices for REITs. We relegate this discussion to section four.

There is a striking lack of research of analysts in the REIT literature. Devos, Ong, and Spieler (2007) examine the value of analyst coverage in the REIT industry. One finding relevant to our study is that after the year 2000 more analysts cover REITs and forecasts are more accurate and less biased. Our study is confined to the post-2000 era where REIT analyst coverage and data availability is significant. Boudry, Kallberg, and Liu (2010) examine REIT analyst behavior and underwriter choice. They examine price targets and analyst recommendations for 161 REITs from 1996 to 2004 and show that optimistic price targets significantly increase an underwriter's

[15] For example, Toluca, Myer, and Webb (2000) show that indices of both REITs and physical real estate are cointegrated; Liow (2003) studies NAVs and REIT prices and concludes that they tend not to drift apart; Liow and Lee (2006) find a long-run cointegrating relationship between publicly traded and physical real estate in eight Asia-Pacific markets; Hoesli and Oikarinen (2012) conclude that REITs and direct real estate investment are good substitutes in the long run.

probability of attracting underwriting business. While analyst conflicts of interest are not the focus of this paper, their findings indirectly corroborate the information content of analyst price targets and recommendations in the REIT industry.

3. Sample

3.1 Data Sources

Analyst NAV estimates are obtained from the specialized database of real estate securities information from SNL Financial. Our sample ranges from 2001 to 2015. This sample period is selected because 2001 is the earliest year that SNL regularly contains daily NAV analyst estimates. We include all equity REITs in the SNL database with quarterly financial data and analyst NAV estimates. A REIT enters our sample when they appear in the SNL database and exit if they become acquired/defunct. Unlike the I/B/E/S detail file that identifies the analyst making the revision and the revision value, analyst estimates and forecasts from SNL are only a daily consensus (mean) estimate. The consensus variables in SNL are calculated as the daily average of the most recent analyst estimate or forecast for all analysts following the REIT. If an analyst has not made a revision for 120 days, that analyst estimate is dropped from the mean calculation. The FFO forecasts project FFO for the fiscal year end. NAV estimates are current values as of the date of the revision and they are not a forecast of a future value of NAV. NAV estimates are seldom reported by REITs, and NAV estimates reported by REITs are subjectively valued; therefore, there is no “forecast error” by which we can compare the analyst estimate with the actual outcome. We remove any analyst estimate of NAV that is below zero.

Price targets and recommendations are obtained from I/B/E/S. For the revisions from I/B/E/S to be consistent with the SNL data, we calculate daily consensus variables in the same fashion as

SNL from the I/B/E/S detail file. Specifically, stock price data is obtained from CRSP. Our final sample contains 202 equity REITs who have non-missing data in SNL, I/B/E/S and CRSP. The total sample consists of 328,225 total REIT-day observations and 23,101 REIT-days which have NAV revisions. Table I presents the REIT sample sector. The sample has representation of all major sectors in proportions which are consistent with the REIT industry. The average price-to-NAV ratio is also presented in Table I. The average across the full sample is very close to one. However, there is significant sector and time variation in the ratio. The highest ratio is in the Health Care sector (1.14) and the lowest is in the Lodging/Resorts sector (0.94).

One limitation of the SNL data is the lack of analyst level data. Only the consensus value is provided, so when there is a revision, we are unable to identify the analyst who has made the revision. To mitigate this challenge, we take I/B/E/S analyst characteristics and average them for all analysts covering the REIT in a given quarter. Two analyst level control variables we consider using this method are analyst experience and brokerage size. We calculate these variables for each analyst in I/B/E/S following REIT *i* in quarter *t*, then we average them by REIT (because we do not know which analyst has made the NAV revision). We have no reason to suspect this data limitation will bias the results in a direction that distorts inference.

3.2 Measures of NAV, FFO, REC, and PT information content

The measure of each analyst variable's information flow is calculated using the following equations.

$$\Delta NAV = \frac{NAV_t - NAV_{t-1}}{TA_{q-1} + D_{q-1}} \quad (2)$$

$$\Delta \text{FFO} = \frac{FFO_t - FFO_{t-1}}{TA_{q-1} + D_{q-1}} \quad (3)$$

$$\Delta PT = \frac{PT_t - PT_{t-1}}{TA_{q-1} + D_{q-1}} \quad (4)$$

$$\Delta REC = REC_t - REC_{t-1} \quad (5)$$

where *NAV* is the consensus analyst NAV estimate, time *t* and *t*-1 denote the current and the preceding trading day, *TA* is the REIT's total assets per share for the most recently reported quarter, and *D* is accumulated depreciation per share for the most recently reported quarter, *FFO* is fund from operation, *PT* is price target, and *REC* is the analyst consensus analyst recommendation forecast. Consistent with the literature, we map the analyst recommendations to a numeric scale from one to five (strong sell is equal to one and strong buy is equal to five). On days when no analysts issue new estimates or revisions, the database retains the previous day's consensus estimate. Therefore, each variable is equal to zero for all days on which no analyst issues a revision or estimate.

SNL drops an analyst from the consensus calculation if the analyst does not issue a new value for 120 days. This would result in a change in the consensus estimate when there was no actual new revision made. To remove this noise, we obtain the number of analysts following the REIT on a daily basis. If the consensus value changes and the number of analysts changes on the same day, we set the revision value to zero.[16] To remove this noise for the I/B/E/S variables, we have

[16] If the number of analysts decreases on the same day as a change in the consensus estimate, it is certain a stale estimate has been dropped. If the number of analysts increases on the same day as a change in the consensus estimate, there are two possible reasons: 1) A new analyst has issued a revision on day t, or 2) SNL added a new analyst to

the I/B/E/S detail file that tells us which dates a revision occurred and make sure that all revisions in our sample match the revision dates in the I/B/E/S detail files.

3.3 Measure of REIT reaction to information release

Two ways the literature has measured whether the market has reacted to information released in an event are the stock price reaction or the volume of trading[17]. A significant stock price reaction to an information release indicates that the information released contains new information that changes the value of the REIT. An alternate measure of information content is whether an analyst revision causes investors to trade more. To measure of the information content of analyst NAV estimates, we compute two variables: abnormal returns and abnormal turnover surrounding the revision.

Abnormal returns are market adjusted returns for REIT *i* using the CRSP/Ziman REIT Value Weighted index as the benchmark index.[18] Abnormal turnover is calculated following Llorente, Michaely, Saar, and Wang (2002): *Abturn = log turnover − average log turnover*, where *average log turnover* is the average of daily *log turnover* over the past three months, and *log turnover* = log (turnover + 0.00000255). We obtain daily turnover data from CRSP and it is calculated as the number of shares traded divided by the number of shares outstanding. We account for inter-dealer double counting of NASDAQ firms by dividing their shares traded by two.

3.4 The Piggy-Backing Hypothesis

their consensus value, but the actual revision occurred at some point in the past 120 days. After speaking with SNL, there is no clear way to differentiate between these two, so we drop them from our sample.

[17] Stulz and Loh (2011) use these abnormal returns and abnormal turnover to examine influential recommendation revisions. We follow their approach and intuition.

[18] Abnormal returns calculated using the market model with only the market factor or the Fama French (1993) three-factor model produce similar results and are found in the robustness section.

A common criticism in the information content literature is that analysts "piggy back" off corporate news events rather than produce new information. (Altinkilic and Hansen 2009, 2013). According to this hypothesis, analysts make revisions immediately following major news events, and when a [-1,+1] window for abnormal returns is used, it captures the corporate event and not the analyst revision. The primary corporate events found in previous literature which can cause this problem are earnings announcement dates (Malmendier and Shanthikumar, 2007; Loh, 2010) and management guidance dates (Chen, Francis, and Schipper, 2005). Also, Bradley, Jordan, and Ritter (2008) argue that dates on which more than one analyst revises a recommendation on the same day, it is more likely there was a significant corporate news event.

We employ several techniques consistent with the literature to mitigate this criticism. Following Stulz and Loh (2011), we remove revisions within a [-1,+1] trading day window of earnings announcement dates and management guidance dates. We cannot observe whether more than one analyst has made a revision on the same day, however, we do find that revisions tend to come in several day clusters. Therefore, we remove all revisions which have another revision within a [-1,+1] trading day window. Lastly, we use a [0,+1] day window for our tests, rather than a trading window which includes days prior to the revision date.[19] We refer to the set of revisions without these screens as *All r*evisions and the subset with these screens applied as the *Isolated* revisions. There are 23,101 *All* NAV revisions and 13,069 *Isolated* NAV revisions.

3.5 Summary Statistics

Table II contains a summary of the sample descriptive statistics. Panel A provides statistics for the analyst revision variables. While there are a fairly similar number of NAV, FFO, and Price

[19] We run all tests using a [-1,+1] trading day window and results continue to hold and are typically stronger.

Target revisions (23,101, 35,004, and 15,835, respectively), there are significantly less Recommendation revisions (7,377). This is logical as revisions are in larger buckets such as "strong sell" or "strong buy" and the other variables are in smaller numerical increments. Therefore, it is likely that recommendation revisions only occur when the analyst has significantly revised her view on the value of the REIT. Alternatively, an analyst might revise her estimate of NAV to reflect a slight change of opinion (e.g. from $33.20/share to $33.10/share).

There are generally more positive revisions than negative ones (with the exception of FFO which has slightly more negative revisions). Recommendations are mapped to a 1 to 5 scale and flipped so that a 5 is a strong buy and a 1 is a strong sell. Panel B provides firm and analyst characteristics for the REITs in the sample. All variables are defined in the appendix.

Panel C shows key revision variables and ratios by year. The number of observations and analyst revisions increase almost monotonically by year. This is likely due to SNL increasing its coverage from 2001 to 2015 as well as the significant growth of the REIT industry during the sample period. While the Price/NAV ratio is not the primary focus of this study, it has been the subject of significant research in the REIT literature (Gentry and Mayer, 2003; Gentry, Jones and Mayer, 2004). While the average ratio over our sample centers near 1.00, the ratio varies considerably by year. As would be expected, REITs trade at the largest discount to NAV in the crisis years from 2007 to 2009.

4. Empirical Methods and Results

4.1 Univariate Market Response to NAV Revisions

In our first tests for information content, we examine the market response to NAV revisions. We examine the market response to NAV revisions in two ways. First, we test whether the [0,+1] day window abnormal returns are significantly different from zero. Second, we test whether the [0,+1] day window abnormal turnover is greater than zero. Whether the revision is negative or positive, we expect abnormal turnover to be positive. The speed of diffusion information is found to be different between good news vs. bad news. The literature has shown bad news travel more slowly (Berkowitz and Depken II, 2017; Hong, Lim, and Stein, 2010). To examine whether the impact of NAV revision is asymmetric, we conduct the test for positive and negative revision separately.

Table III presents the results of these tests. In the spirit of Stulz and Loh (2011), we show the impact of removing revisions with potential confounding information. For all NAV revisions, the average two-day CAR around positive revisions is 0.1138% with a t-statistic of 8.08 (column 2 and 3 of Table III). As we remove earnings guidance dates, earnings announcement dates, and clustered revisions, the average CAR is marginally changed.[20] However, the T-statistics do decrease monotonically for both the positive and negative revisions as each filter is applied. For positive (negative) NAV revisions, the T-statistic ranges from 8.08 (-5.33) for *All* revisions to 6.55 (-3.60) for Isolated revisions.[21] The absolute value of the CARs around positive and negative revisions are very similar. For all subsample, CARs around NAV revisions are significantly different from zero at well beyond the 1% level of significance.

In columns 4 and 5 of Table III, we examine the abnormal turnover around NAV revisions. Consistent with our prediction, for both positive and negative NAV revisions, abnormal turnover is significantly positive. In both cases, the mean and significance monotonically decrease with

[20] Each screen is cumulative, so the row labeled "Remove Clustered Revisions" has no earnings guidance date revisions, not earnings announcement date revisions, and no clustered revisions.
[21] *Isolated* revisions is synonymous with the last row which has all 3 screens applied.

each screen applied. The mean abnormal turnover is not as symmetric for positive and negative revisions as the CAR results are. The response to negative NAV revision is stronger by 10%. Williams (2015) shows when the macro uncertainty (ambiguity) is high, investors react more to bad news than good news. The average abnormal turnover for *Isolated* positive revisions is 0.1012% (t-statistic of 10.47) and the average for negative revisions is 0.2018% (t-statistic of 16.44).[22] Overall, the univariate results provide strong evidence that NAV revisions illicit a market response and thus contain information.

Figures I to III provide a visual analysis of the univariate market response to analyst NAV revisions. First, we sort revision into quintiles based on the ΔNAV values. Quintile 1 contains the largest negative revision values and quintile 5 contains the largest positive revision values. We then calculate the average [0,+1] CAR within each quintile. Figure I displays the results. For both *All* NAV revisions and *Isolated* NAV revisions, the relation between revision quintile and CAR is monotonically increasing. The average CAR within quintile one for *All* and *Isolated* revisions are -0.20% and -0.16%, respectively. The average CAR for quintile five for *All* and *Isolated* revisions are 0.14% and 0.17%, respectively. Quintile two is close to zero and quintile three is greater than zero which is expected given there are more positive revisions then negative revisions and the revisions closest to zero would appear in quintile two.

Next, we examine CARs by day surrounding both *All* and *Isolated* NAV revisions. We separate positive and negative revisions and calculate the average CAR for days *t-1*, *t*, and *t+1*. Figure II displays the results. We find that for both positive and negative revisions and for *All* and *Isolated* revisions the greatest CARs are on day *t*. There appears to be a lesser but still significant CAR

[22] In untablated tests, we test whether the combined positive and negative revisions are different from zero for CARs and abnormal turnover. For the CARs, we multiply the CARs by negative one if the revision is negative. For both CARs and abnormal turnover, the combined tests are strong and significantly greater than zero.

found on day *t-1*. This result could be interpreted as evidence of the piggy backing hypothesis or public markets leading private markets. This finding highlights the importance of both our screening process and the use of [0,+1] CARs in our analysis. The success of the screening process can be identified by looking at the difference between *All* revisions and *Isolated* revisions CARs on day *t-1*. The greatest difference between the two subsamples is found on day *t-1* which suggests that the removal of earnings announcement dates, management guidance dates, and clustered revisions significant mitigates the aforementioned concerns.

Figures I and II show a significant univariate relation between NAV revisions and CARs. Next, we examine the relation between NAV revisions and abnormal turnover. For both *All* revisions and *Isolated* revisions, we calculate the average abnormal turnover value over the [0,+1] trading day window. We repeat the same for each of the other three revisions variables. Lastly, we compare this to the abnormal turnover value of all other REIT-days within our sample. We expect that for both positive and negative revisions, there will be greater trading, therefore, we do not separate them in the analysis. Figure III displays the results. NAV, FFO, and PT revisions have similar positive and significant abnormal turnover surrounding revisions. There is a noticeably greater amount of abnormal turnover around REC revisions. This is not surprising as there are much fewer REC revisions and we expect analysts to revise their recommendations following the most salient information. As expected, on all other days the abnormal turnover values are very close to zero.

At the univariate level, we consistently find results consistent with NAV revisions containing significant information content as measured by CARs and abnormal turnover. We next turn to multivariate regression analysis for a more robust analysis.

4.2 Regression analysis

In this section, we examine the information content of NAV revisions using multivariate regressions. The multivariate regression setting allows us to accomplish three objectives. First, we can quantify the relation between NAV revisions and CARs or abnormal turnover while controlling for firm and analyst characteristics. Second, we utilize sector and year fixed effects to control for any time or sector invariant omitted variables missing from our data. Third, we can test whether NAV revisions contain information while controlling for the presence of other analyst forecasts or estimates that have been found to contain information in the robust accounting and finance literature. Our regressions using CARs as the dependent variable are each a variation on the following model:

$$CAR_{i,t} = a_0 + a_1 \Delta NAV_{i,t} + \boldsymbol{a_2 X_{i,t}} + \boldsymbol{a_3 ANALYSTVAR_{i,t}} + YearFE + SectorFE + e_{i,t} \quad (6)$$

where CAR is the [0,+1] trading day window abnormal return, the vector of controls include log firm size, log book to market ratio, momentum, log analyst experience, log broker size, number of analysts, leverage, ROA, and dividend yield, the vector of *ANALYSTVAR* includes ΔFFO, ΔPT, and ΔREC, *YearFE* and *SectorFE* refer to year and sector fixed effects. All variables are defined in the Appendix. If there is information content in NAV analyst revisions, we would expect to find a positive and significant coefficient a_1.

Table IV presents results for regressions with CARs as the dependent variable.[23] Columns one and two are run on the set of *Isolated* NAV revisions without controlling for the presence of other analyst variables. With and without fixed effects, the coefficient on ΔNAV is positive and

[23] Tables IV and V are only run on *Isolated* revisions. Regressions with *All* revisions are consistently stronger.

significant at the 1% level. Specifically, without fixed effects, the coefficient is 8.540 with a t-statistic of 5.19 and the coefficient with fixed effects is 8.689 with a t-statistic of 5.15. Overall, fixed effects do not appear to significantly impact our inference. In terms of economic magnitude, a standard deviation increase in NAV corresponds to a 0.022% increase in CAR.[24]

Columns three and four present results for regressions controlling for the existence of FFO revisions. Columns five and six include controls for FFO and PT revisions, and columns seven and eight include controls for FFO, PT, and REC revisions. (something about NAV revisions holding through each column). In terms of economic significance, a standard deviation increase in NAV for the subsample with all four revision variables present corresponds to 0.017% increase in CAR.[25] The difference of economic impact between Models 2 and 8 is marginal suggesting the information content of NAV is incremental after considering other types of revisions. As a comparison, a standard deviation increase in FFO, PT and REC revisions increases CAR by 0.018%, 0.019%, and 0.070%, respectively. In summary, using CARs as a measure of information content, we consistently find results suggesting NAV revisions contain significant information content above and beyond that contained in other analyst variables.

Next, we examine whether NAV revisions contain information measured by whether investors trade more surrounding revisions. The following regression model was utilized to examine abnormal turnover:

$$ABTURN_{i,t} = a_0 + a_1 ABS\Delta NAV_{i,t} + \boldsymbol{a_2 X_{i,t}} + \boldsymbol{a_3 ABSANALYSTVAR}_{\boldsymbol{i,t}}$$
$$+ YearFE + SectorFE + e_{i,t} \tag{7}$$

[24] Calculated as the coefficient (column 2) of 8.689 multiplied by the standard deviation of ΔNAV (0.00253). 8.689*0.00253=0.0220

[25] Calculated as the coefficient (column 8) of 6.878 multiplied by the standard deviation of ΔNAV within this subsample (0.00253). 6.878*0.00253=0.017

where *ABTURN* is equal to the [0,+1] abnormal turnover, *ABS*Δ*NAV* is the absolute value of ΔNAV, the vector of controls are identical to those of model (2), *ABSANALYSTVAR* are absolute values of $\Delta FFO, \Delta PT,$ and $\Delta REC,$ and *YearFE* and *SectorFE* refer to year and sector fixed effects.

The results of this model are presented in Table V. The coefficient of interest in this model is that the coefficient on a_1. If it loads significantly and positively, it would suggest investors trade more following a revision of NAV. Columns one and two present results for regressions without controlling for other revision variables, with and without fixed effects, respectively. Columns three to eight present results adding in FFO, Recommendation, and Price Target indicators variables. Consistently, the NAV indicator variable is positive and significant. The t-statistics range from 11.95 to 7.84, which are well above the 1% statistical significance level. The addition of other revision variables decreases the magnitude and statistical significance levels, but in all cases NAV revisions have a significant impact on abnormal volume at the 1% level. In summary, after controlling for a large number of control variables, fixed effects, and other analyst variables, we continue to find that investors trade more surrounding NAV revisions.

Using the two measures of information content, we present robust evidence that NAV revisions contain significant information content. We have shown that there is an immediate reaction to analyst revisions of NAV. In the next section, we examine what happens in the week following the immediate shock.

4.3 CAR [+2,+7] Analysis

Thus far, we have assumed that a significant short window stock market reaction to an analysts' NAV revision suggests that the revision contains information about the value of the REIT. This assumption is predicated on the assumption of market efficiency because it assumes that the market would only react in the presence of legitimate information about REIT value. Market efficiency would predict an immediate and permanent reaction to news about the REIT. However, if we relax the assumption of market efficiency, two alternative hypotheses may explain our results. First, a growing literature suggests that investors may overreact to salient news events beginning with DeBondt and Thaler (1985). Under this hypothesis, investors overreact to the information contained in analysts' NAV revisions because they mistakenly believe there is more information than there truly exists. Second, information may be slowly disseminating to the market, which would result in a long run drift towards the new fundamental value of the REIT. The post announcement drift is a well-documented phenomenon in the accounting literature starting with Ball and Brown (1968).

The market reaction to CARs following the [0,+1] trading day window allows us to distinguish between these alternate hypotheses. If the post [0,+1] trading day window CARs are insignificantly different from zero, this result would suggest that NAV revisions contain information and that information is quickly and permanently impounded into the REIT's stock price. Second, if the post [0,+1] trading window CARs are greater than zero, this evidence would support information slowly disseminated through the market. Lastly, if the post [0,+1] trading day window is negative, this finding would support a market overreaction to salient news that is reversed in the long run.

To conduct this analysis, we examine the [+2,+7] window CAR. We follow a parallel approach to our previous analysis by conducting univariate and multivariate analysis on the relation between analyst NAV revisions and [+2,+7] window CARs. Table VI presents our results. In Panel A, we take the quintiles sorted on ΔNAV and examine the average [+2,+7] window CARs. The first row of Panel A presents the [0,+1] CAR results for reference.[26] While there is limited evidence of a

[26] Row one of Panel A map directly to the Isolated subsample results found in figure I.

positive CAR reaction in Q5, all other quintiles (including the hedged portfolio Q5-Q1) have CARs that are indistinguishable from zero. In contrast, the [0,+1] CARs are monotonically increasing and highly significant. Additionally, there is no evidence whatsoever of a CAR reversal. We interpret this result as evidence mostly suggestive that information is quickly and permanently impounded in the stock price.

While these results are suggestive, they are not conclusive. To perform a further in depth analysis, we resort to multivariate regression analysis of the [+2,+7] window CARs using use the same specification as those in Table IV. Table VI, Panel B presents the results of this test. Columns one to four present the tests that are identical to that of Table IV. In columns five to eight, we remove from the regression all REIT-days during which ΔNAV is equal to zero. As expected, the [0,+1] window CARs continue to hold for all specifications. The [+2,+7] CARs, however, are indistinguishable from zero in all specifications. This result further corroborates the conclusion that the information in NAV revisions is quickly and permanently impounded in stock prices. In the next section, we examine the robustness of our results to various alternative measures, hypotheses, and subsample analysis.

4.4 Robustness

4.4.1 Alternative Measures

In our analysis, we use the CRSP Ziman VW Index as the benchmark index for our CAR calculations because we believe this index to be most appropriate in our setting. However, the literature is full of different measures for short window CARs. To alleviate the concern that our choice of CAR calculation affects our findings, we rerun the regressions found in Table IV using alternative CAR measurements. We recalculate CARs two ways. First, we simply use the CRSP Ziman EW Index as the benchmark return. Second, we calculate CARs using the market model with the Fama French three factor model as the benchmark model and the CRSP VW index as the market factor in the model (Fama French 1993). Table VII, Panel A, columns one to four present our results. The results are consistently robust and the significance level is strong at 1%.

Our results are also robust to a different calculation of our measure of analyst revisions. We chose to scale the NAV, FFO, and PT revisions by a measure of firm size (total assets plus accumulated depreciation per share). In columns five to eight of Table VII, Panel A, we rerun the main tests using unscaled changes. In these regressions, each revision variable is simply equal to the consensus value on day *t* minus the consensus value on day *t-1*. The loadings of NAV revision remain significant at 1%.

Lastly, it is commonplace in the examination of analyst revisions to separate positive and negative revisions. Although we have done that in the univariate analysis, we have not yet done so in the multivariate setting. Therefore, we rerun our primary regressions found in Table IV including a positive and negative ΔNAV variable labeled $\Delta NAV+$ and ΔNAV-. For $\Delta NAV+$, we set all negative revisions to zero and do the opposite for ΔNAV-. Columns one and two of Panel B present the results of this analysis. While both positive and negative revisions continue to be significant at the 1% level, there is a very slight asymmetric effect. The impact from negative revisions are about 0.75% more than positive revisions for CARs. Next, we examine the effect of positive and negative NAV revisions on abnormal turnover. We simply take the absolute value of $\Delta NAV+$ and ΔNAV- and run the regression identical to that found in Table V. The asymmetric impact of positive vs. negative NAV revision is more dramatic for abnormal turnover. This evidence is consistent with the results in Table III. The change in abnormal turnover is over 5% more from negative revision than from positive revision. Overall, the results are robust across various alternative measures of key variables.

4.4.2 Alternative Hypothesis

There are two primary critiques that can be levied against our story. The first is drawn from the accounting literature and the second from the REIT literature. From the accounting literature, several critics have argued that the piggy-backing hypothesis explains our results. The piggy-backing hypothesis is that analysts piggy back off of corporate news events by issuing a recommendation immediately following news events. Then, the researcher attributes significant market reactions to analysts' revisions when the underlying corporate news event is the true driver of the market reaction. The critique from the REIT literature is different in nature, but almost identical empirically in our setting. Yavas and Yildirim (2011) find that price discovery generally takes place in the securitized public market. Effectively, they are arguing that the stock price changes, then the valuation of the underlying assets changes (i.e. the NAV), so prices are leading NAVs. While the argumentation is different, the underlying argument of both critiques is that prices are changing first and NAV is changing second. If it is true that NAV revisions have no effect on stock price, then NAV revisions do not have significant information content. Given both the critiques have the same empirical consequence in our setting, we approach the mitigation of each obstacle in the same way.

Our strategy for ruling out these hypotheses closely follows how Stulz and Loh (2011) treat the piggy-backing hypothesis. First, we use *Isolated Revisions* for all our tests. These are revisions from which we have removed earnings guidance dates, earnings announcement dates, and clustered revisions. Second, we use a [0,+1] day window for CARs and abnormal turnover to ensure we do not pick up analyst piggy-backing off of news from the preceding days and to ensure we are not using a day *t-1* price reaction that leads the day *t* NAV revision. Last, following Stulz and Loh (2011), we rerun our primary regression analysis from Table IV and V and remove NAV revisions in which the [-2,-1] window pre-event return is greater than $1.96 \times \sqrt{2} \times \sigma_{\varepsilon}$, where σ_{ε} is the firms idiosyncratic volatility calculated as the standard deviation of residuals from a daily time-series regression of the past three-month firm returns against market returns and the Fama-French factors SMB and HML (Stulz and Loh, 2011). The intuition behind this calculation is to remove significant price movements prior to the NAV revision that could be driven by prices leading NAVs or analysts piggy-backing off of corporate news events. The results of these tests are tabulated in Table VII Panel B, columns five to eight. The results remain highly significant at 1% level.

It is important to note that neither of these alternate stories are mutually exclusive with our findings. In fact, it is likely they are all true. The finding that the CARs surrounding *Isolated* revisions is smaller than that using *All* revisions is evidence that some analysts do piggy-back off corporate news. The findings of Yavas and Yildirim (2011) are convincing that there is a component of prices that lead NAV values. These arguments can be valid and yet analyst's revisions of NAV still contain incremental information. We do not interpret our findings as a contrary result, but instead we isolate and quantify the portion of NAV revisions by analysts that do contain significant information.

5. Conclusion

We provide evidence that analyst revisions of NAV estimates contain significant information to securities market. We find that there is significant information after controlling for other analyst-estimated variables that have previously been identified in the literature (recommendations, price targets, FFO forecasts), which suggests NAV contain unique information not conveyed in those forecasts. The information in NAV revisions appears to be quickly and permanently impounded in the REIT's stock price. Our findings are withstand a battery of robustness checks.

Analysts estimate NAV for REITs and not other firms likely because of the availability of property level data and well developed appraised methods. This unique property of REITs make them an interesting subset of firms to learn about analyst valuation abilities. NAV estimates are unique because they require significant precision and do not appear to suffer from an optimistic bias. Our results suggest that market participants use information in analyst NAV estimates in their assessment of firm value.

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Figure I: Cumulative abnormal returns (CARs) around NAV revisions. CAR is measured from the announcement date (day *t*) to one day after the announcements (day *t+1*). Revisions of NAV are sorted into quintiles from the most negative (Q1) to the most positive (Q5). Average CARs within each quintile are graphed. The sample of *All* revisions and the sample of *Isolated* revisions are shown. All variables are defined in Appendix A.

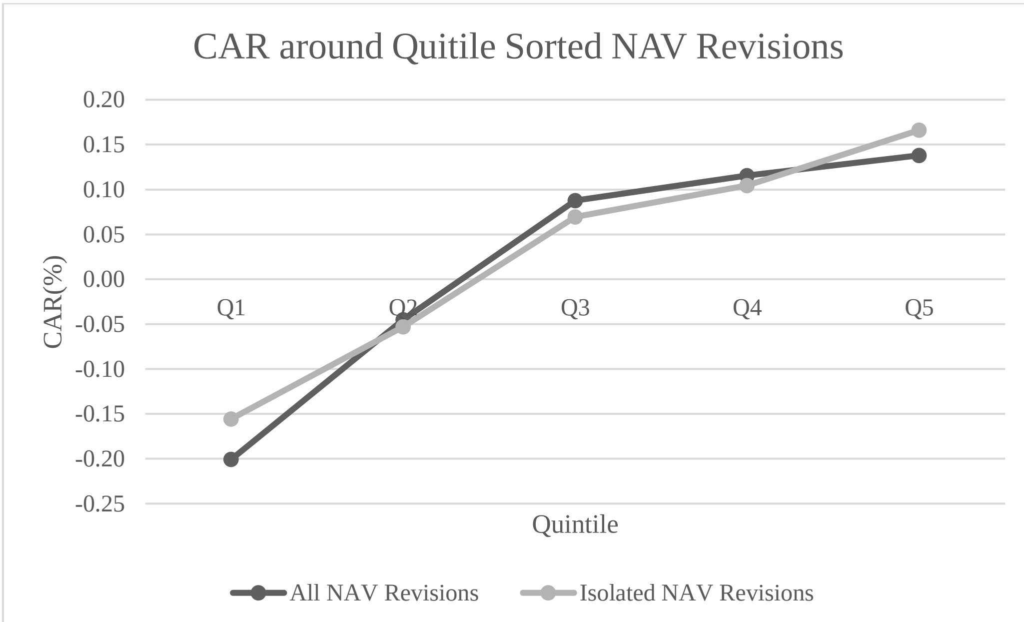

Figure II: Cumulative abnormal returns (CARs) by trading day around NAV revisions. Positive and negative revisions are examined separately. CARs are measured for various windows around revisions. Results for both *All* revisions and *Isolated* revisions are presented. All variables are defined in Appendix A.

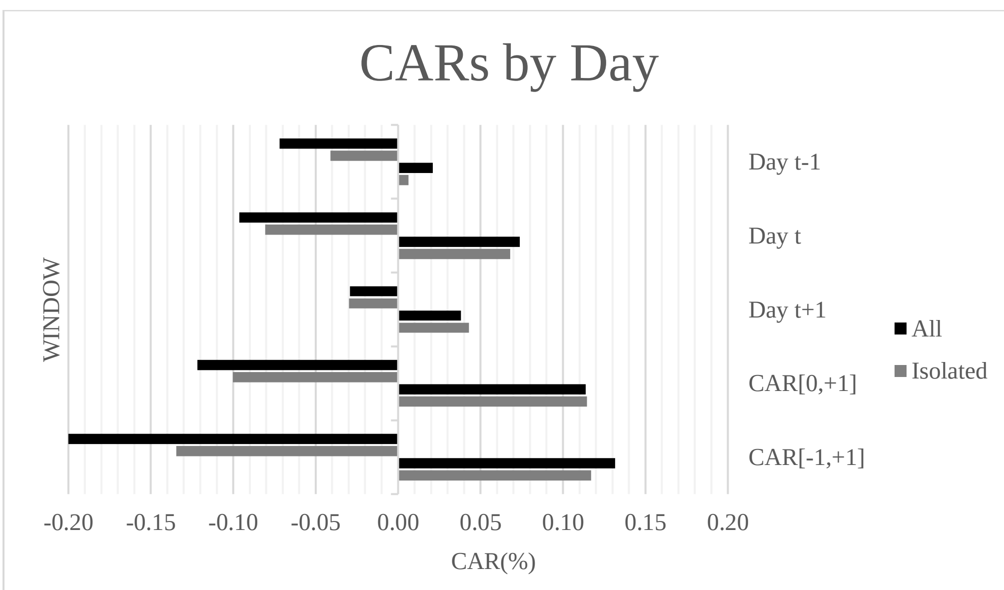

Figure III: Abnormal turnover during the [0,+1] day window of announcements of NAV, FFO, PT, REC revisions and all other days. The sample of *ALL* revisions and the sample of *Isolated* revisions are shown. All variables are defined in Appendix A.

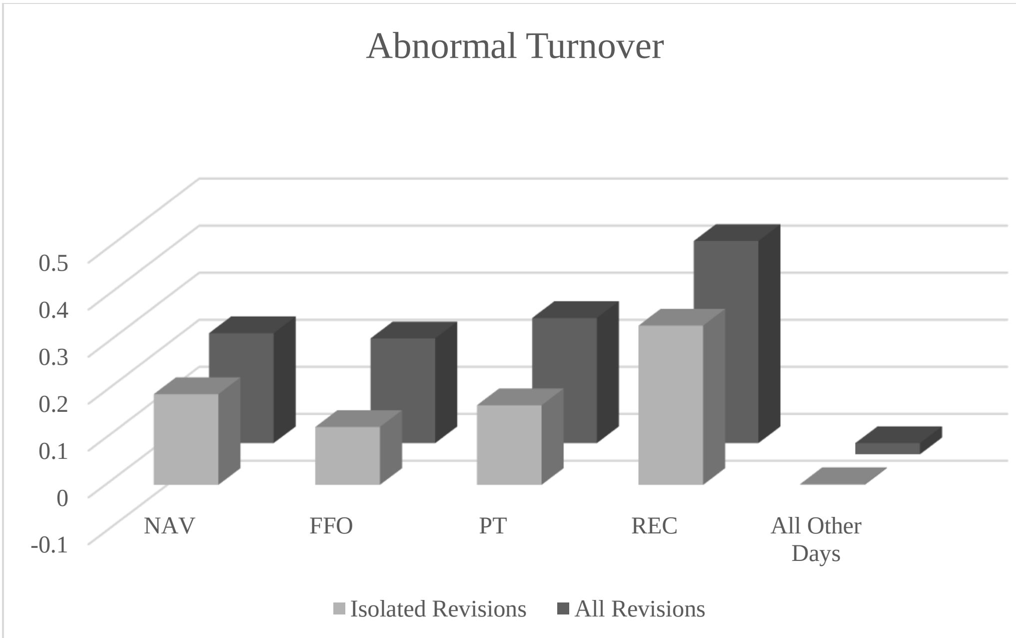

Table I
Sample Selection

Number of REITs by Sector	REITs	% of Total	Price/NAV
Retail	40	19.80%	1.01
Office	40	19.80%	0.97
Other	26	12.87%	0.96
Lodging/Resorts	24	11.88%	0.94
Multifamily	21	10.40%	0.99
Health Care	18	8.91%	1.14
Diversified	15	7.43%	0.95
Industrial	13	6.44%	1.01
Self Storage	5	2.48%	1.03
Total REITs	202	100.00%	1.00

Table 1 describes the type of Equity REITs that are within the sample by sector. The total number of REITs in the sample is 202. Price/NAV is equal to the price on day t divided by the consensus analyst NAV value on day t. Price/NAV is the mean value by sector during the 2001-2015 sample period.

Table II
Descriptive Statistics

Panel A: Revisions	NAV	FFO	PT	REC
Total Number of Estimate Revisions	23,101	35,004	26,835	7,377
Positive Revisions	13,820	16,963	16,087	3,495
Negative Revisions	9,281	18,041	10,748	3,882
Frequency of Estimate Revisions	7.04%	10.66%	8.18%	2.25%

Panel B: Firm/Analyst Characteristics	Mean	Std.	Q1	Median	Q3
Total Assets	3,875	4,421	1,294	2,480	4,479
Market Value of Equity	2,836	3,773	763	1,569	3,071
Daily Turnover x 100	0.73	0.67	0.32	0.53	0.89
Leverage	0.51	0.12	0.44	0.51	0.58
Book to Market	0.57	0.42	0.33	0.50	0.70
Return on Assets	2.71	3.37	0.92	2.48	4.24
Dividend Yield	5.38	2.31	3.86	5.24	6.73
Log(Broker Size)	1.49	0.20	1.39	1.50	1.61
Log(Analyst Experience)	2.81	0.42	2.56	2.81	3.09
Number of Analysts	5.26	2.88	3.00	5.00	7.00

Panel C: Statistics by Year	# Total Observations	# of NAV	# of FFO Revisions	# of PT Revisions	# of REC Revisions	Mean Price/NAV
2001	10,500	125	799	526	248	0.93
2002	17,920	421	1,321	948	498	0.99
2003	21,433	858	1,558	1,097	520	1.06
2004	22,341	808	1,722	1,476	504	1.15
2005	22,744	958	1,672	1,340	415	1.08
2006	21,087	1,176	1,639	1,418	515	1.05
2007	20,775	1,492	1,715	1,557	514	0.93
2008	19,723	1,758	2,127	1,910	572	0.80
2009	20,048	1,996	2,586	1,987	696	0.89
2010	20,780	1,896	2,612	1,891	560	1.08
2011	23,601	2,306	3,035	2,555	456	0.99
2012	24,939	2,388	3,305	2,278	467	1.00
2013	25,794	2,254	3,481	2,530	441	1.01
2014	27,463	2,193	3,485	2,544	414	1.01
2015	29,077	2,472	3,947	2,778	557	0.94
Total/Average	328,225	23,101	35,004	26,835	7,377	1.00

Panel A displays sample statistics for the primary variables of interest: NAV (net asset value), FFO (funds from operations), PT (price target), and REC (recommendations). The first three rows are a count of the number revisions of each variable in the sample. Frequency of revisions is the number of revisions divided by the total number of REIT-days in the sample. Panel B reports descriptive statistics of REIT firm and analyst characteristics. Panel C shows the number of observations, analyst revisions, and the Price/NAV ratio by year. Total Assets and Market Value of Equity are in millions. All variables are defined in Appendix A.

Table III
Market Response to NAV Revisions

Positive NAV Revisions	# of Revisions	CARs [0,+1] Mean	CARs [0,+1] T-Statistic	Abnormal Turnover Mean	Abnormal Turnover T-Statistic
All Revisions	13,820	0.1138***	8.08	0.1956***	23.97
Remove Earnings Guidance Dates	11,675	0.1103***	7.60	0.1434***	18.24
Remove Earnings Announcement Dates	10,495	0.1063***	7.11	0.1333***	16.09
Remove Clustered Revisions	7,703	0.1145***	6.55	0.1012***	10.47
Negative NAV Revisions	# of Revisions	CARs [0,+1] Mean	CARs [0,+1] T-Statistic	Abnormal Turnover Mean	Abnormal Turnover T-Statistic
All Revisions	9,281	-0.1218***	-5.33	0.2967***	32.02
Remove Earnings Guidance Dates	7,968	-0.1039***	-4.40	0.2522***	25.13
Remove Earnings Announcement Dates	7,182	-0.1001***	-4.09	0.2449***	23.10
Remove Clustered Revisions	5,366	-0.1002***	-3.60	0.2018***	16.44

Table 3 presents cumulative abnormal returns from the two-day window around NAV revisions and abnormal turnover for the two-day window around NAV revisions. Positive and negative revisions are examined separately. The statistics are shown for the sample of all revisions and the sample after each screening criteria. The screening criteria is cumulative, so the final row has all three screens applied. The Isolated set of revisions are revisions in which the three screens are applied. CARs are presented in percentages. Mean, corresponding t-statistics and percentage of CARs and abnormal turnover greater than zero (% ABTURN>0) are shown. *, **, *** Indicate statistical significance at the 10 percent, 5 percent, and 1 percent levels, respectively.

Table IV
Regression Analysis: CAR [0,+1] for Isolated Revisions

Dep Var: CAR [0,+1]	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
ΔNAV	8.540***	8.689***	8.232***	8.382***	6.807***	6.964***	6.722***	6.878***
	(5.19)	(5.15)	(5.26)	(5.22)	(4.05)	(4.05)	(3.87)	(3.89)
Log Size	-0.007	-0.011	-0.008	-0.011	-0.008	-0.011	-0.007	-0.011
	(-1.05)	(-1.34)	(-1.06)	(-1.33)	(-1.00)	(-1.31)	(-0.91)	(-1.30)
Log BtM	0.012	0.006	0.012	0.006	0.012	0.006	0.012	0.006
	(1.21)	(0.79)	(1.14)	(0.79)	(1.12)	(0.79)	(1.15)	(0.80)
Mom	-0.032	-0.008	-0.032	-0.009	-0.036	-0.013	-0.035	-0.011
	(-1.10)	(-0.21)	(-1.12)	(-0.23)	(-1.27)	(-0.35)	(-1.22)	(-0.29)
Leverage	0.074**	0.046	0.073**	0.045	0.073**	0.044	0.072**	0.044
	(2.36)	(1.19)	(2.35)	(1.17)	(2.32)	(1.14)	(2.30)	(1.13)
ROA	0.007***	0.006***	0.007***	0.006***	0.007***	0.006***	0.007***	0.006***
	(3.18)	(3.52)	(3.07)	(3.41)	(3.12)	(3.35)	(3.08)	(3.37)
Dividend Yield	-0.005*	-0.009**	-0.005*	-0.009**	-0.005	-0.009**	-0.005	-0.009**
	(-1.69)	(-2.46)	(-1.73)	(-2.40)	(-1.51)	(-2.31)	(-1.22)	(-2.34)
Number of Analysts	0.004***	0.004**	0.004**	0.004**	0.004	0.004*	0.004**	0.004
	(2.68)	(2.21)	(1.98)	(2.21)	(1.94)*	(1.82)	(1.98)	(1.84)*
Log Broker Size	-0.001	-0.006	-0.001	-0.006	-0.001	-0.006	-0.001	-0.006
	(-0.06)	(-0.24)	(-0.05)	(-0.23)	(-0.04)	(-0.23)	(-0.04)	(-0.23)
Log Analyst Experience	-0.019*	-0.007	-0.019*	-0.007	-0.019*	-0.007	-0.018*	-0.007
	(-1.92)	(-1.07)	(-1.95)	(-0.88)	(-1.94)	(-0.82)	(-1.86)	(-0.74)
ΔFFO			218.259***	219.546***	203.231***	204.511***	197.187***	198.454***
			(4.60)	(4.68)	(4.34)	(4.43)	(4.44)	(4.52)
ΔPT					7.897***	7.905***	5.879***	5.882***
					(5.39)	(5.48)	(4.34)	(4.39)
ΔREC							1.195***	1.196***
							(11.40)	(11.33)
Observations	328,225	328,225	328,225	328,225	328,225	328,225	328,225	328,225
Adj. R-Squared	0.0004	0.0008	0.0005	0.0009	0.0008	0.0012	0.0026	0.0030
Fixed Effects	No	Year/Sector	No	Year/Sector	No	Year/Sector	No	Year/Sector

This table presents multivariate analysis of the impact of NAV revisions (ΔNAV) on cumulative abnormal returns from the announcement date to one day after the announcement (CAR [0,+1]). The dependent variable is the [0,+1] CAR. CARs are presented in percentages. The sample includes only Isolated revisions (as defined in Appendix A) for each of the analyst variables (NAV, FFO, PT, and REC). All regression standard errors are clustered by both Year-Month and Sector. *, **, and *** Indicate statistical significance at the 10, 5, and 1 percent levels, respectively. T-Statistics are presented in parentheses. All variables are defined in Appendix A.

Table V

Regression Analysis: Abnormal Turnover [0,+1] for Isolated Revisions

Dep Var: ABTURN [0,+1]	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
ABSΔNAV	10.292***	10.268***	9.181***	9.082***	6.946***	6.962***	6.672***	6.691***
	(11.57)	(11.95)	(10.60)	(10.99)	(8.67)	(8.44)	(8.01)	(7.84)
Log Size	0.004	0.006	0.004	0.007	0.004	0.007	0.004	0.006
	(0.54)	(1.07)	(0.60)	(1.12)	(0.57)	(1.08)	(0.53)	(1.04)
Log BtM	-0.022**	0.006	-0.022**	0.006	-0.022**	0.006	-0.022**	0.006
	(-2.25)	(1.05)	(-2.26)	(1.05)	(-2.23)	(1.09)	(-2.18)	(1.11)
Mom	0.047	0.114**	0.048	0.115**	0.048	0.115**	0.047	0.114**
	(0.65)	(2.05)	(0.66)	(2.06)	(0.67)	(2.05)	(0.66)	(2.05)
Leverage	0.124**	0.083**	0.127**	0.086**	0.129**	0.087**	0.128**	0.087***
	(1.97)	(2.46)	(2.03)	(2.56)	(2.06)	(2.62)	(2.05)	(2.60)
ROA	0.003	0.000	0.003	0.000	0.003	0.000	0.003	0.000
	(1.47)	(0.10)	(1.44)	(0.14)	(1.41)	(0.13)	(1.40)	(0.15)
Dividend Yield	0.004	0.007	0.004	0.007*	0.004	0.007*	0.004	0.007*
	(0.97)	(1.82)	(0.96)	(1.80)	(0.97)	(1.80)	(0.92)	(1.81)
Number of Analysts	-0.005**	-0.003	-0.005**	-0.003	-0.005**	-0.003	-0.005**	-0.003*
	(-2.06)	(-1.39)	(-2.02)	(-1.48)	(-2.07)	(-1.53)	(-2.11)	(-1.68)
Log Broker Size	0.047**	0.009	0.046**	0.008	0.046**	0.008	0.045**	0.008
	(2.08)	(0.69)	(2.05)	(0.62)	(2.01)	(0.62)	(2.01)	(0.63)
Log Analyst Experience	-0.003	0.009	-0.004	0.009	-0.003	0.009	-0.002	0.009
	(-0.17)	(1.03)	(-0.19)	(1.01)	(-0.17)	(1.01)	(-0.11)	(1.06)
ABSΔFFO			177.16***	189.57***	127.99***	142.81***	112.41***	127.27***
			(5.63)	(6.59)	(4.24)	(5.24)	(4.24)	(5.40)
ABSΔPT					9.270***	8.815***	7.622***	7.187***
					(10.79)	(12.40)	(9.06)	(10.31)
ABSΔREC							0.613***	0.607***
							(18.04)	(18.50)
Observations	328,225	328,225	328,225	328,225	328,225	328,225	328,225	328,225
Adj. R-Squared	0.0026	0.0129	0.0030	0.0134	0.0043	0.0145	0.0059	0.0161
Fixed Effects (Year/Sector)	No	Year/Sector	No	Year/Sector	No	Year/Sector	No	Year/Sector

This table presents multivariate analysis of the impact of NAV revisions (ABSΔNAV) on abnormal turnover from the announcement date to one day after the announcement (ABTURN [0,+1]). The dependent variable is the [0,+1] ABTURN. The sample includes only Isolated revisions (as defined in Appendix A) for each of the analyst variables (NAV, FFO, PT, and REC). For all revision variables, the absolute value of the revision variable is taken. All regression standard errors are clustered by both Year-Month and Sector. *, **, and *** Indicate statistical significance at the 10, 5, and 1 percent levels, respectively. T-Statistics are presented in parentheses. All variables are defined in Appendix A.

Table VI
CAR [+2,+7] Analysis

Panel A: Quintile Sorts of NAV Revisions

Window	Statistic	Q1	Q2	Q3	Q4	Q5	Q5-Q1	NAV>0	NAV<0
CAR [0,+1]	Mean	-0.16***	-0.05	0.07**	0.10***	0.17***	0.32***	0.11***	-0.10***
	T-Statistic	(-3.34)	(-1.63)	(2.47)	(3.77)	(4.92)	(5.59)	(6.55)	(-3.60)
CAR [+2,+7]	Mean	0.06	-0.00	-0.07	0.07	0.16***	0.10	0.06**	0.02
	T- Statistic	(0.87)	(-0.06)	(-1.37)	(1.53)	(3.32)	(1.08)	(2.21)	(0.49)

Panel B: Regressions of NAV Revisions

	Full Sample				Remove Zeroes			
Dependent Variable	CAR [0,+1]		CAR [+2,+7]		CAR [0,+1]		CAR [+2,+7]	
ΔNAV	8.54***	8.69***	1.65	2.12	8.53***	8.75***	2.50	2.77
	(5.19)	(5.15)	(0.68)	(0.91)	(4.37)	(4.31)	(1.21)	(1.35)
Controls	YES	YES	YES	YES	YES	YES	YES	YES
Observations	328,225	328,225	328,225	328,225	13,069	13,069	13,069	13,069
Adj R-Squared	0.0004	0.0008	0.0007	0.0019	0.0047	0.0078	0.0008	0.0015
Fixed Effects	NO	BOTH	NO	BOTH	NO	BOTH	NO	BOTH

This table presents tests for CARs for days *t+2* to *t+7* following NAV revisions (CAR[+2,+7]). Panel A presents average CARs for both the [0,+1] and [+2,+7] windows for each group of revisions sorted on ΔNAV. Q5-Q1 is the "hedged" portfolio calculated by subtracting the average CARs of Q5 by those of Q1. CARs are presented in percentages. T-Statistics are reported in parenthesis for tests of whether the CARs are different from zero. NAV>0 and NAV<0 are CARs for positive and negative revisions, respectively. Panel B presents regressions results using CAR [0,+1] and CAR [+2,+7]. The "Full Sample" regressions are identical to columns 1 and 2 of table IV using both CAR windows. The "Remove Zeroes" columns are regressions using a sample of only isolated revisions. Days in which there are no NAV revisions are omitted from the regression. All regression standard errors are clustered by both Year-Month and Sector. "BOTH" Fixed Effects refers to using both year and sector fixed effects. *, **, and *** Indicate statistical significance at the 10, 5, and 1 percent levels, respectively. T-Statistics are presented in parentheses. All variables are defined in Appendix A.

Table VII
Robustness Tests

Panel A: Alternative Measures

	EW CARs		FF3 Market Model		Unscaled Changes			
Dependent Var	EW CAR [0,+1]		FF3 CAR [0,+1]		VW CAR [0,+1]		ABTURN [0,+1]	
(ABS)ΔNAV	7.36***	7.47***	7.92***	7.52***	0.15***	0.16***	0.22***	0.21***
	(6.61)	(6.61)	(5.52)	(5.78)	(3.98)	(3.93)	(9.93)	(11.30)
Controls	YES	YES	YES	YES	YES	YES	YES	YES
Observations	328225	328225	328225	328225	328225	328225	328225	328225
Adj. R-Squared	0.0006	0.0011	0.0018	0.0054	0.0004	0.0008	0.0025	0.0128
Fixed Effects	NO	BOTH	NO	BOTH	NO	BOTH	NO	BOTH

Panel B: Separate Positive and Negative and Piggy Backing Robustness

	Positive and Negative Splits				Remove Influential [-2,-1]			
Dependent Var	VW CAR [0,+1]		ABTURN [0,+1]		VW CAR [0,+1]		ABTURN [0,+1]	
(ABS)ΔNAV					8.28***	8.43***	6.19***	6.32***
					(5.99)	(6.09)	(5.85)	(5.86)
(ABS)ΔNAV+	8.27***	8.25***	7.82***	8.18***				
	(4.80)	(5.04)	(7.97)	(8.25)				
(ABS)ΔNAV-	8.84**	9.19***	12.92***	12.50***				
	(2.77)	(2.91)	(8.14)	(8.60)				
Controls	YES	YES	YES	YES	YES	YES	YES	YES
Observations	328225	328225	328225	328225	328225	328225	328225	328225
Adj. R-Squared	0.0004	0.0008	0.0027	0.0129	0.0004	0.0008	0.0018	0.0121
Fixed Effects	NO	BOTH	NO	BOTH	NO	BOTH	NO	BOTH

This table presents a battery of robustness tests. Panel A examines the primary results of Table IV and Table V using alternative measures. For all regressions with abnormal turnover as the dependent variable, the ΔNAV and other revision variables are converted to absolute values. The first two columns use market adjusted CARs using the Zimon EW index as the base index return. The 3rd and 4th columns use the market model to calculate CARs using the Fama-French (1993) three factors. CARs are presented in percentages. The final four columns rerun the primary regressions using unscaled changes to calculate the ΔNAV variable. In these columns, ΔNAV is equal to the change in the consensus NAV estimate from day *t-1* to day *t.* Panel B presents results separating positive and negative revisions and accounting for the piggy backing hypothesis. To separate positive (negative) revisions, we set the variable equal to 0 when the revision is negative (positive). These results are presented in the first four columns. The second four columns present results with day [-2,-1] influential observations removed. We calculate whether the day [-2,-1] window around the revision is influential for CAR or ABTURN following Loh and Stulz (2011). If the [-2,-1] revision is influential, we set the revision equal to 0. *, **, and *** Indicate statistical significance at the 10, 5, and 1 percent levels, respectively. T-Statistics are presented in parentheses. All variables are defined in Appendix A.

Appendix A - Variable Definitions

Variable	Source	Definition
ΔNAV	SNL Financial	The difference between the consensus NAV estimate on day t minus the consensus NAV estimate on day t-1, scaled by the sum of Total Assets and Accumulated Depreciation of the most recently reported quarter, all on a per share basis. If the consensus NAV estimate changes on the same day the number of analyst changes, we set the variable equal to 0.
ΔFFO	I/B/E/S	The difference between the consensus one year FFO forecast on day t minus the consensus one year FFO forecast on day t-1, scaled by the sum of Total Assets and Accumulated Depreciation of the most recently reported quarter, all on a per share basis. The daily consensus FFO is calculated following the metho SNL uses to calculate the consensus NAV (see Sample section for more detail).
ΔPT	I/B/E/S	The difference between the consensus Price Target forecast on day t minus the consensus Price Target forecast on day t-1, scaled by the sum of Total Assets and Accumulated Depreciation of the most recently reported quarter, all on a per share basis. The daily consensus PT is calculated following the metho SNL uses to calculate the consensus NAV (see Sample section for more detail).
ΔREC	I/B/E/S	The difference between the consensus recommendation estimate on day t minus the consensus NAV estimate on day t-1. The consensus recommendation has been mapped to a 1 to 5 number scale in which 1 is the lowest rating and 5 is the highest rating. The daily consensus REC is calculated following the metho SNL uses to calculate the consensus NAV (see Sample section for more detail).
Size (MVE)	CRSP	Market Value of Equity as of June 30th of each year.
BTM	CRSP/ COMPUSTAT	Book to Market ratio, computed following Fama and French (2006)
MOM	CRSP	Buy and hold return for months t-12 to t-1
Turnover	CRSP	Number of shares traded divided by the number of shares outstanding. Firms from NASDAQ have their shares divided by two to adjust for inter-dealer double counting.
Leverage	SNL Financial	Total long-term debt divided by total equity
Dividend Yield	SNL Financial	Dividend Yield from most recent quarter.
ROA	SNL Financial	Return on Average Assets from most recent quarter.
Analyst Experience	I/B/E/S	Number of quarters the analyst is found in the I/B/E/S detail file, averaged by number of REITs.
Broker Size	I/B/E/S	Number of analysts associated with the broker in quarter t, averaged by number of REITs.
Number of Analysts	SNL Financial	Number of analysts included in consensus NAV calculation on day *t*.
CARs	CRSP	Stock return of REIT i on day t minus the return of the CRSP Ziman VW REIT Index. Alternative measures of CARs are used in the robustness section (Table VII)
Abnormal Turnover	CRSP	Log turnover minus the average daily log turnover over the past three months following Llorente, Michaely, Saar, and Wang (2002).