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Analyst Forecasting Errors in REITs

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We find that the 3-day window around funds from operations (FFO) announcements drives the momentum profits found in the literature, which deliver an average excess monthly return of 1.22% over the period of 1990-2008 and 1.59% during the post-2000 period. Excluding this announcement window, a momentum strategy does not generate any significant returns. The FFO-surprised-based portfolio formation method produces higher momentum profits than the return-based formation method. There is a significant positive serial correlation between the unexpected FFO for the next two quarters. We contribute to the current literature by documenting that the persistence of momentum profits is due to the underreaction by analysts on public information, the FFO announcement.

Keywords:
REITs, Analyst Forecasting, Momentum Strategy, Real Estate Investment

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1. Introduction

One of the most extensively researched topics in investment during the 1990s was the phenomenon of price momentum and momentum profits. Even with extensive research on strategies which exploited momentum, Jegadeesh and Titman (2001) find that momentum profits remain profitable over the subsequent period between 1993 and 2001, 8 years after their first study. These momentum profits also exist in real estate investment trusts (REITs) as well. For example, Chui, Titman, and Wei (2003a) find that momentum strategies in REITs yield almost 3 times more profits than those with common stocks in the period of 1990-1999. They document an average monthly momentum return of 1.02% during this period. Similarly, Hung and Glascock (2008) show an average monthly momentum return of 0.87% over the period of 1993-2000.

Given the extensive research on this topic, there is ample publicity to ensure an acute awareness of momentum profits among practitioners in the investment field. REITs are more transparent than stocks in that the cash flows are also more predictable than those in other firms.[2] Due to its increased quality of information disclosure by firms, and increased coverage by analysts, one would expect that the REIT market would be more informational efficient and thus experience a decrease in momentum profits in the post-millennia period. Therefore, it is a puzzle as to why high momentum profits still exist in REITs.

Chan, Jegadeesh, and Lakonishok (1996) show that stock price momentum is positively related to earnings surprise. Obviously, such a drift may explain some of the momentum profits. Financial analysts serve the role of informational gate-keeper for investors. Analysts monitor the performance of the firms under their coverage, forecast earnings, and provide recommendations to investors. Johnson (2004) presents a model that shows why firms with higher uncertainty as measured by the dispersion of analyst forecast have a lower expected return. Can forecasting errors by analysts explain the persistence of momentum profits in REITs? Or are momentum profits simply a result of the delayed reaction of investors – ignoring the correct forecasts by analysts?

In this study, we examine the effects of analyst forecasting errors in REITs with linkage to momentum profits. We aim to shed light on the continued profitability of the momentum strategy in REITs. The purpose of this paper is to examine the effect of FFO forecast errors by analysts on the price reaction of REITs. We examine the effect of the 3-day window around FFO

[2] Baik, Billings, and Morton (2008) find a steady increase in funds from operations (FFO). Quality as well as the quality perceived by investors in the REIT industry after the REIT industry reformed the disclosure practices of FFO.

announcements to find abnormal returns. We further extend our analysis to test a hypothesis in that FFO forecast errors by analysts explain the momentum profits. As a theoretical linkage of this phenomenon, Daniel, Hirshleifer, and Subrahmanyam (1998) suggest that the behavior of overconfident investors tend to under-react to public information. We refer forecasting errors as public information obtained from the FFO announcement by analysts. We provide an alternative strategy for momentum portfolio formation by using the forecasting errors and unexpected positive and negative FFO surprises as the selection criterion guided by Chan, Jegadeesh, and Lakonishok (1996). We find that the FFO surprised based arbitrage portfolio demonstrates greater returns than the returns portfolios. By examining the 3-day window period that surrounds the FFO announcement, we find that the returns are concentrated in the announcement period. We document a strong serial correlation in the FFO surprise which may drive the momentum profits. We contribute to the literature by documenting that the momentum profits in REITs are driven by the underreaction of analysts to the release of public information.

The organization of the paper is as follows. Section 2 reviews the related literature and discusses the motivation of the study. Section 3 outlines the data. Section 4 presents the empirical results. Section 5 summarizes the results and concludes.

2. Literature Review

The persistence of momentum profits and the continuous viability of momentum strategies post a challenge to economic intuition. Given the extensive research on this topic and evidence of abnormal momentum profits, there is ample publicity to ensure an acute awareness among practitioners in the investment field. Intuitively, as more investors follow momentum strategies, momentum profits ought to decline and eventually disappear. Yet, researchers have consistently shown lucrative risk-adjusted momentum returns in the REIT market. For example, Chui, Titman, and Wei (2003a) find that momentum strategies with REIT stocks yield almost 3 times more profits than those with common stocks in the period of 1990-1999. They document an average monthly return of 0.89% for the arbitrage portfolio during this period. Similarly, Hung and Glascock (2008) show an average monthly momentum return of 0.87% for the arbitrage portfolio over the period of 1993-2000. Thus our research attempts to identify the magnitude of momentum profits previously proven.

There are several models that explain the negative relation between information efficiency and momentum profits. For example, Daniel, Hirshleifer, and Subrahmanyam (1998) present a model in which momentum profits are a result of the behavior of overconfident investors who under-react

to new public information, which is reflected in delayed price movements. Hong and Stein (1999) theorize that information follows a pattern of gradual diffusion in the marketplace, which explains the sources of momentum profits. Johnson (2004) presents a model that shows why firms with higher earnings uncertainty as measured by the dispersion of analyst forecasts have lower expected returns.

As shown in Devos, Ong, and Spiler (2007), the REIT industry has experienced an increase in analyst coverage on FFO and a corresponding increase in forecast quality over the period of 1985-2004. We consider that the magnitude of momentum has diminished since the level of information efficiency has increased by increasing analyst coverage and improved quality of information. In addition, REITs are more transparent than stocks. By regulation, REITs have to pay out 90% of all profits. The cash flows of REITs are also more predictable than those in other firms. For example, Baik, Billings, and Morton (2008) find a steady increase in several measurements of earnings quality as well as in the quality perceived by investors in FFO in the REIT industry.

Due to its transparency, increased quality of information disclosure by firms, and increased coverage by analysts, we can hypothesize that the REIT market would be more information efficient and thus have lower momentum profits. In addition, we can hypothesize that the REIT industry is composed of almost homogeneous firms. Therefore, the momentum profits are attributable to the industry-momentum, rather than intra-industry momentum (Moskowitz and Grinblatt 1999). As a result, any change in the strength of the profitability of momentum strategies in this study would be primarily driven by the intra-industry factor and thus more robust.

Thus, our paper attempts to link a relationship between the persistence of momentum profits and analyst forecast errors. The research question also relates to how much of the profits can be explained by analyst forecasts. Thus a detailed source on the analyst forecast errors that account for momentum profits has been analyzed.

3. Data

This study includes all REITs from the National Association of Real Estate Investment Trusts (NAREIT) for the years 1990-2008. We obtain prices for REITs from the Center for Research in Security Prices (CRSP) for the period. During the sample period, REIT stocks became a mainstream staple in the investment universe not only for institutional, but also regular individual investors in their 401(k) plans. Figure 1 depicts the growth in the REIT industry, both the number of firms and average firm size. The industry went through two cycles in the past 19 years. From 1990 to 1998, there was a

steady increase in the number of REIT firms. From 1998 to 2004, there was a decrease. Not surprisingly, there was a significant reduction in the number of firms in 2008 during the financial crisis.

Figure 1 Growth of REIT Industry from 1990 to 2008

The primary vertical axis depicts the average firm size in $million. On the secondary vertical axis is the number of REIT firms.

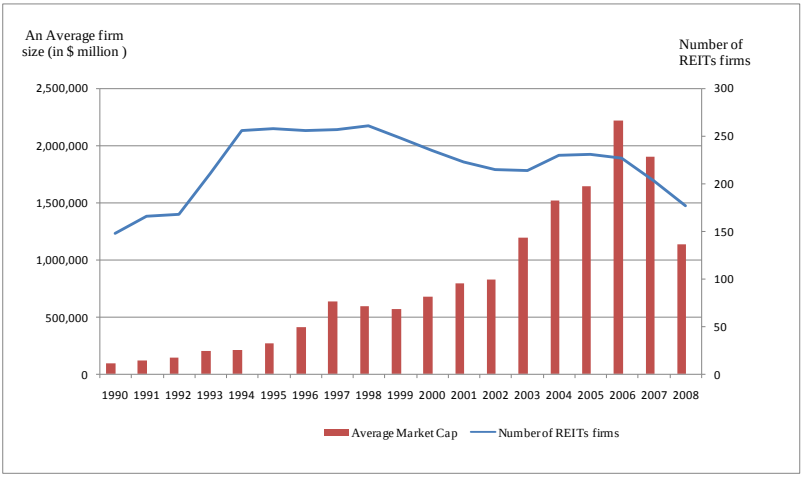


Figure 1 also shows that the average market capitalization of REIT firms had been steadily increasing from 1990 and peaked in 2006. In 2008, the average market capitalization suffered a precipitous drop of more than 50% from its peak in 2006, after the recent residential market crisis. As Panel A in Table 1 shows, the firms in our sample tend to be increasing, compared with those in Chui, Titman, and Wei (2003a). For example, the average market capitalization for the value-weighted losing/short portfolio and winning/long portfolio in Chui, Titman, and Wei (2001) are $355 million and $436 million, respectively. In comparison, our study is matched with $1,560 and $2,414, respectively.

We obtain the dates of each quarterly announcement from Compustat. We also collect current year FFO from the Institutional Broker's Estimate System (IBSE). The FFO is a widely adopted performance measure for REITs since 2001. In our study, all FFO forecasts are matched to each quarterly FFO announcement. The firms that do not contain analyst activity during some of the years are labeled as without forecasts. As shown in Figure 2, the growth in the REIT industry is also accompanied by an increase in analyst coverage. For example, the percentage of firms with analyst coverage increases from 14.0% in 1997 to 56.5% in 2008. The sample contains 442 REITs, 31 of which have continuous analyst coverage. Therefore, there are 8,365 forecasts for 1,156

REIT-years, which represent 247 different REIT observations. This result of increasing analyst coverage is consistent with that in Devos, Ong, and Spiler (2007). Since the IBSE data is limited to sell side analyst reports, Figure 2 may understate the total coverage of a firm.

Figure 2 Growth of Analyst Coverage in the REIT Industry from 1997-2008

The primary vertical axis depicts the percentage of firms with analyst coverage out of the total number of firms in the sample. The secondary vertical axis shows the number of REIT firms with analyst coverage.

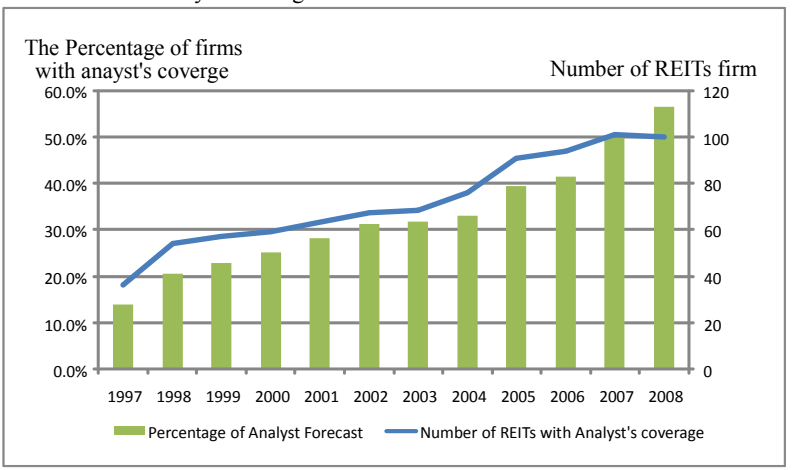


Table 1 Descriptive Statistics

Panel A depicts the number of firms in the sample period from Jan. 2000 – Dec. 2008. Panel B shows the sample with data on the FFO announcements by analysts. The (-1,1) shows the returns two days prior to the announcement and one day after the announcement. Size is the market capitalization of the REITs. The number of analysts estimates shows the number of analyst forecasts for announcements. STD shows the characteristics of the standard deviation of analyst estimates. FFO shock shows the value of the difference between actual and estimated FFO.

Panel A: Full Sample					
	Mean	**Min**	**Max**	**STD**	**N**
Monthly Returns	0.99%	-94.12%	460.00%	11.76%	49084
Size	822,819	42.344	25,946,549	1,724,904	49093
Panel B: Sample with FFO Announcements by Analysts					
	Mean	**Min**	**Max**	**STD**	**N**
Size	1,876,157	21,861	25,946,549	2,669,037	3361
# Analyst	7.4	1	20	4.14	3461
FFO Shock	-0.024	-50.49	1.18	0.873	3461
(-1,1) Return	0.03%	-50.54%	69.51%	4.47%	3361

Panel B in Table 1 shows the summary statistics on financial analyst coverage. The average number of analysts for the winning portfolio is 7.58 in our study versus 2.26 in Chui, Titman, and Wei (2003a). These increases in both market capitalization and analyst coverage over the 1990s reflect that the investors were interested in including REIT stocks in their portfolios. A comparison of Panels A and B shows that the firms with analyst coverage are much larger in size than those without analyst coverage.

Panel B also exhibits summary statistics for FFO shocks/surprises. We calculate the difference of the estimate of the forecast error as a measure of the FFO shock/surprise, between actual FFO from IBES and the forecasted FFO, denoted as the average of the recent individual forecasts.

$$FE_{iq} = FFO\_act_{iq} - FFO\_est_{iq} \tag{1}$$

where *FEiq* is the forecasting error for ith REITs in quarter *q*. The *FFO_act* is the actual FFO and *FFO_est* is the forecasted FFO. As shown in Panel B, the mean forecasting error is negative, which indicates that the actual FFO is lower on average than the estimate.

There has been literature available which indicate that stock prices exhibit post-earnings-announcement-drift and the 3-day announcement window, i.e., the announcement day plus the two surrounding days, which account for the majority of post-announcement returns.[3] In Panel B, we calculate the announcement–window returns for firms with analyst coverage. The average 3-day return is 0.032%, which corresponds to a monthly return of about 0.2%. In comparison with the average monthly return of 0.99% for the whole sample, such an equivalent monthly return is lower, which may reflect the filtering effect from the analyst coverage. That is, there is some guidance, albeit imperfect, from the analyst estimate for firms with analyst coverage. In contrast, there is a more shocking effect from the FFO announcement for firms without analyst coverage, probably due to the absence of guidance from analysts.

4. Results

4.1 Return-based Momentum Returns

By following Jegadeesh and Titman (1993), on each calendar month, we rank all REITs according to their holding period returns over the prior 6-month period. We divide all REIT stocks into ten deciles with decile 1 containing the

[3] See Ball (1992) for a discussion of the related studies.

most negative past returns (losers) and decile 10 containing stocks with the most positive past returns (winners). We form a momentum arbitrage portfolio by buying winner stocks and shorting loser stocks. We hold the arbitrage portfolio for a period of time, e.g., 1, 3, 6, 12, and 18 months. Notice that in the subsequent month, a new momentum arbitrage portfolio is formed by the same method. In essence, each month would have 6 arbitrage portfolios under this over-lapping method. We then calculate the monthly holding period returns for equal-weighted arbitrage portfolios.

4.1.1 Momentum Returns – 6-month Post-formation Holding Period

Panel A in Table 2 presents the mean monthly momentum return for the post-formation holding period of 6-months from June 1990 to December 2008.[4] We split the time period into January 2000 to December 2008 to test whether the momentum strategy still holds in the recent decade. The momentum portfolio generates a monthly raw return of 1.22%, which is statistically significant as indicated by the t-statistic. Since the arbitrage portfolio corresponds to a zero-investment strategy, such a monthly return is also economically significant. Such a return is lower than the average monthly returns of 1.33% in Chui, Titman, and Wei (2003a) for the period of 1990-1999. However, it is higher than the average monthly return of 0.87% in Huang and Glascock (2008) for the period of 1993-2000. We adjust the raw returns for risk in two ways. The first adjustment is made by subtracting the Ziman REIT equal-weighted index. The second adjustment is made by subtracting the value-weighted CRSP market index returns. As shown in Panel A, the abnormal returns are statistically significant.

Panel D in Table 2, which presents the results from the period of 2000-2008 to examine the momentum strategy, still holds in the recent decade. As can be seen, the mean monthly momentum return actually increases to 1.59%, which is much higher than 1.22% during the entire sample period and the average momentum return of 1.33% found in Chui, Titman, and Wei (2003a). Notice that this period includes the real estate bubble burst in 2007. As a result, the momentum returns primarily come from the loser portfolio (-0.57%), which contrasts with that of 0.12% in the entire sample as shown in Panel A. Notice that the mean adjusted return during the more recent period is only marginally significant, which may reflect the severity of the collapse of the real estate market.

[4] Results from other holding periods are similar. As a result, we only present the 6-month holding period for brevity. The other results are available upon request.

Table 2 Momentum Profits from Return-based Arbitrage Portfolio

This table shows the average monthly returns for the post-formation holding period of six-months from a return-based momentum portfolio by using the Jegadeesh and Titman (1993) methodology. We include all REIT firms and the announcement window indicates its actual FFO announcement. The second column excludes the three day window that surrounds the FFO announcement. The third column only examines the two 3 day windows that surround the announcement windows. Panel A depicts the raw returns. Panel B depicts the returns adjusted by the CRSP value weighted returns. Panel C depicts the returns adjusted by the REIT index returns. Deciles 1-10 depict the difference between the average monthly returns for the first and tenth deciles. The t-values are in parentheses. * and ** indicate significance at the 0.05 and 0.01 levels.

Decile	Monthly Returns	REIT EW Adjusted Returns	CRSP VW Adjusted Returns
	Sample 1990-2008		
Panel A. 6-Month Holding Period Raw Returns			
1	0.12%	-1.23%	-0.57%
10	1.34%	-0.06%	0.60%
	1.22%*	1.17%*	1.17%*
10 - 1 Spread	-2.56	-2.5	-2.5
Panel B: Returns for the 3-day Announcement Windows			
1	-0.07%	-0.09%	-0.13%
10	0.17%	0.12%	0.13%
	0.24%**	0.21%**	0.26%**
10 - 1 Spread	-3.57	-3.21	-3.87
Panel C: 6-Month Returns excluding the 3-day Announcement Windows			
1	0.35%	-0.98%	-0.32%
10	1.15%	-0.24%	0.48%
	0.80%	0.74%	0.81%
10 - 1 Spread	-1.65	-1.46	-1.65
	Sample 2000-2008		
Panel D. Raw Returns			
1	-0.54%	-1.49%	-0.47%
10	1.05%	0.03%	1.07%
	1.59%*	1.52%	1.54%
10 - 1 Spread	-2	-1.93	-1.96
Panel E: Returns for the 3-day Announcement Windows			
1	-0.24%	-0.26%	-0.27%
10	0.17%	0.11%	0.16%
	0.40%**	0.36%**	0.43%**
10 - 1 Spread	-3.75	-3.43	-3.86
Panel F: 6-Month Returns excluding the 3-day Announcement Windows			
1	-0.08%	-0.98%	0.01%
10	0.88%	-0.15%	0.96%
	0.96%	0.83%	0.95%
10 - 1 Spread	-1.21	-0.99	-1.18

Overall evidence in Panels A and D confirm that momentum strategies are still viable, 15 years after their wide publicity. This raises questions on why this momentum return is not arbitraged away. Certainly, theoretical models based on psychological traits of traders such as Daniel, Hirshleifer, and Subrahmanyam (1998) or trading strategies such as Hong and Stein (1999) can be used to explain the results in Table 2. If traders symmetrically underreact to information as predicted in Daniel, Hirshleifer, and Subrahmanyam (1998), one would expect underreaction to occur during the period that surrounds the FFO announcements. Consequently, there should be a significant contribution from this announcement period to the momentum returns. We investigate this issue in the next section

4.1.2 Momentum Returns over the 3-day FFO Announcement Window

By utilizing the quarterly report date from Compustat, we determine the closest day to the announcement date. We then set the return for the day before, day of and day after to zero. We examine the returns that surround the 3-day window around the announcement period, which can be thought as the returns of the portfolios if the arbitrageur "cashed out" for the three trading days that surrounded the announcement.

As shown in Panel B of Table 2, the momentum strategy delivers significantly positive raw returns during the 3-day announcement window. For example, the mean return during this 3-day window is 0.24%, in comparison with the average monthly momentum return of 1.22%. The proportion of the 3-day window only accounts for about 20% of the monthly momentum returns. We examine the more recent period of 2000-2008 and the results are presented in Panel E of Table 2. As can be seen, the 3-day announcement window during the more recent period contributes 0.41% to the momentum returns, which is higher than the average of 0.24% during the previous period. Therefore, there is an increase in the contribution from the FFO announcement window to the momentum profits in more recent years.

How well does the momentum strategy fare during the non-announcement period? As shown in Panel C of Table 2, the mean raw return during this 3-day window is insignificant for the entire sample and the results are the same for adjusted returns. For the subsample of 2000-2008, Panel F shows that the mean return from the momentum strategy is not insignificant. Therefore, these results further reveal the significance of the FFO announcement.

In summary, momentum returns come largely from the 3-day announcement window. Holding the momentum arbitrage portfolio beyond these window periods does not generate any significantly positive abnormal returns. Our study calls for a modification of standard momentum strategies.

4.2 Earning-Surprise-based Momentum Strategy and Returns

The results in Table 2 also point to the importance of the announcement window in determining the profitability of momentum strategies. Can investors do better with a strategy based on an FFO announcement surprise than a return-based momentum strategy? Baker et al. (2007) find that a larger proportion of abnormal returns by mutual fund managers come from their skills in forecasting FFO and trading before the announcements. Therefore, we develop an FFO-surprise-based formation strategy and compare its performance with the return-based momentum strategy.

By following Jegadeesh and Titman (1993) and Chan, Jegadeesh, and Lakonishok (1996), on each calendar month, we rank all REITs according to the FFO shocks in the previous quarter, as defined in Equation 1. Those in the lower 30% are classified as most negatively-surprised stocks and those in the top 30% as most positively-surprised stocks.[5] We form a momentum arbitrage portfolio by buying the most positively-surprised stocks and shorting the most negatively-surprised stocks. We hold the arbitrage portfolio for a period of time, e.g., 1, 3, 6, 12, and 18 months. In the subsequent month, a new momentum arbitrage portfolio is formed by the same method. We then calculate the monthly holding period returns for an equal-weighted arbitrage portfolio.

The summary statistics of this FFO-surprise-based momentum portfolio are shown in Panel A of Table 3. The average size of the most negatively-surprised portfolio is smaller than that of the most positively-surprised portfolio. Not surprisingly, the mean 3-day window return is negative for the most negatively-surprised portfolio and positive for the most positively-surprised portfolio.

Table 3 Characteristics of FFO-Surprise-based Arbitrage Portfolio

This table shows the characteristics based on the number of monthly observations on firms that were grouped as either "Hi" or "Low" returns portfolios in the period from Jan. 2000 – Dec 2008. The top 30% were considered the high returns and the bottom 30% were grouped as the low returns.

	Group	Mean	Min	Max	STD	N
FFO Shock	Low	-0.07	-3.1	-0.0011	0.218	2605
	Hi	0.045	0.0044	1.18	0.061	3043
Size	Low	1,559,731	21,861	19,288,431	2,279,349	2605
	Hi	2,413,934	39,452	25,946,549	3,549,951	3043
# Analyst	Low	6.78	1	18	4	2605
	Hi	7.58	1	19	4.31	3043
(-1,1) Return	Low	-0.71%	-41.03%	69.51%	4.78%	2605
	Hi	0.84%	-35.84%	28.62%	3.66%	3043

[5] We are balancing the need for more observations in the sample against the need for more accurate selecting of shocks.

As shown in Panel A of Table 4, the raw returns for the momentum portfolio over the 6-month holding period are statistically insignificant. Therefore, the FFO-surprise based formation method fails to deliver significant abnormal returns over the 6-month period. It is the same result with adjusted returns. Notice that neither the most positively-surprised (high) portfolio nor the most negatively-surprised (low) portfolio delivers statistically significant returns.

Table 4 Momentum Profits from FFO-Surprise-based Arbitrage Portfolio

The top 30% were considered the high returns and the bottom 30% were grouped as the low returns. Equally weighted returns were calculated for each calendar time high/low portfolio. We show raw returns, returns adjusted by the equally weighted REIT index and CRSP value-weighted returns. Panel A shows the full 6-month returns. Panel B shows the returns in the two 3-day windows around the subsequent FFO announcements. Panel C shows the full 6-month return that does not include the two 3-day windows around the subsequent FFO announcements. The p-values are in parentheses. * and ** indicate significance at the 0.05 and 0.01 levels. We include a sample period from Jan. 2000 – Dec 2008.

	Raw Returns	REIT Index Adjusted	CRSP Adjusted Returns
Panel A: Full 6-Month Raw Returns			
Hi	4.00%	1.50%	2.38%
Low	3.05%	0.77%	1.47%
Diff (Hi-Low)	0.96%	0.73%	0.91%
p-value	-0.59	-0.26	-0.62
Panel B: Returns for the 3-day Announcement Windows			
Hi	0.62%	0.24%	0.41%
Low	-0.18%	-0.25%	-0.15%
Diff (Hi-Low)	0.80%**	0.49%*	0.56%**
p-value	0	-0.01	0
Panel C: 6-Month Returns excluding the 3-day Announcement Windows			
Hi	3.38%	2.10%	1.05%
Low	3.30%	1.75%	1.00%
Diff (Hi-Low)	0.08%	0.34%	0.05%
p-value	-0.97	-0.84	-0.93

4.2.1 Momentum Returns over the 3-day FFO Announcement Window

The cumulative abnormal returns of the announcement window and the post-announcement window are denoted as the difference between the buy-and-hold return of the announcing firm and that of negative earning shock and positive earning shock matching portfolio over the windows [0,1] and [2,22] in the trading days relative to the announcement date. We choose 22 trading days for the post-announcement window because most FFO surprises diminish in impact as a new FFO forecast announcement becomes available

on the market. We suspect that a momentum arbitrage portfolio fares well during the period that surrounds the FFO announcement. After all, the transparent nature of REIT stocks makes this period more likely to produce positive abnormal returns.

$$CAR[0,1]_{iq} = \prod_{k=t}^{t+1}(1+R_{ik}) - \prod_{k=t}^{t+1}(1+R_{pk})$$
$$CAR[2,21]_{iq} = \prod_{k=t}^{t+22}(1+R_{ik}) - \prod_{k=t}^{t+22}(1+R_{pk}) \quad (2)$$

As shown in Panel B, an FFO-surprise-based momentum strategy still produces significant returns over the short window period that surrounds the FFO announcements. During the two 3-day windows, the average momentum return of 0.80% is statistically significant, which is almost twice as high as the average 3-day return of 0.24% as shown in Table 2. Therefore, the results in Table 4 indicate that an FFO-surprised-based momentum formation strategy is best during the window that surrounds FFO announcements. The same conclusion is reached when we examine the risk-adjusted momentum returns.

As Panel C in Table 4 shows, excluding the two window periods that surround the FFO announcements, the rest of the holding period momentum returns are statistically insignificant. It is intriguing that the most negatively-surprised portfolio actually has a positive return – just as the most positively-surprised portfolio. Thus, the result does not support the post-earnings announcement drift (PEAD) hypothesis over the 6-month holding period.

In summary, the FFO-surprise-based momentum formation strategy produces a much lower return than the return-based formation strategy in Jegadeesh and Titman (1993). However, the FFO-surprise-based formation strategy produces a much higher momentum return than the return-based formation strategy during the 3-day window that surrounds the FFO announcements. Our results further provide support to the notion that mutual fund managers and investors in general play a short-term "announcement effect".

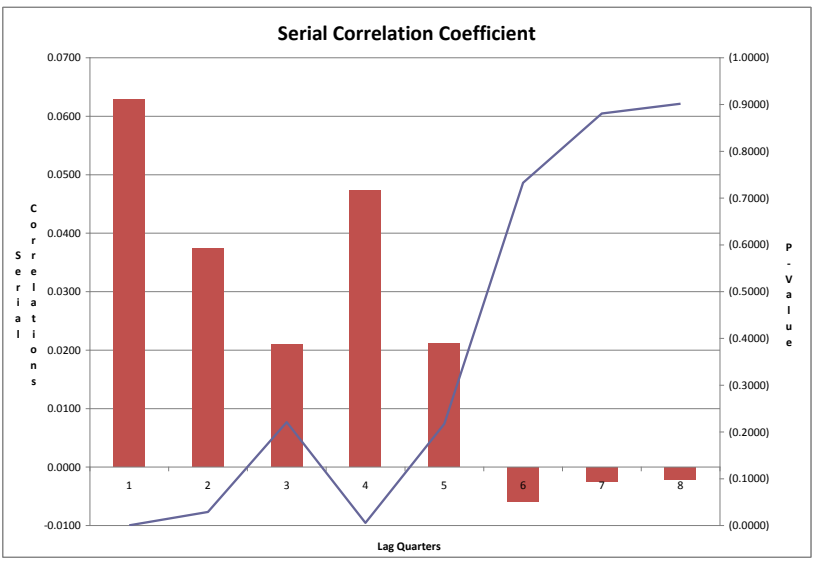
4.2.2 Analyst Coverage and Momentum Returns – A Cross-sectional Analysis

We further investigate the importance of short window periods that surround the FFO announcements in determining the momentum profits. Daniel, Hirshleifer, and Subrahmanyam (1998) show that delayed reactions of price to new information, due to overconfident investors, would lead to momentum profits. On the other hand, Hong and Stein (1999) have developed a model in which momentum traders drive a pattern of gradual price diffusion in the marketplace, which results in price continuity to generate momentum profits. Table 1 already shows a negative mean forecasting error for FFO by analysts. If analysts exhibit a positive serial correlation in their forecast errors, coupled

with their important roles as information watch dogs, it would be more likely to observe momentum profits over the window periods and subsequently over long holding periods.

Figure 3 A Serial Correlation Coefficient of FFO forecast errors by Analysts

The primary vertical axis depicts the serial correlation of forecast errors by analysts. The secondary vertical axis shows the level of p-value with a solid line. We include a sample period from Jan. 2000 – Dec 2008. We calculate the serial correlations of the forecast errors. The serial correlations of forecast errors by analysts are significant at the quarterly lags of 1, 2, and 4. Therefore, underreaction by analysts could be causing persistence in momentum profits over the short window period that surrounds the FFO announcements.



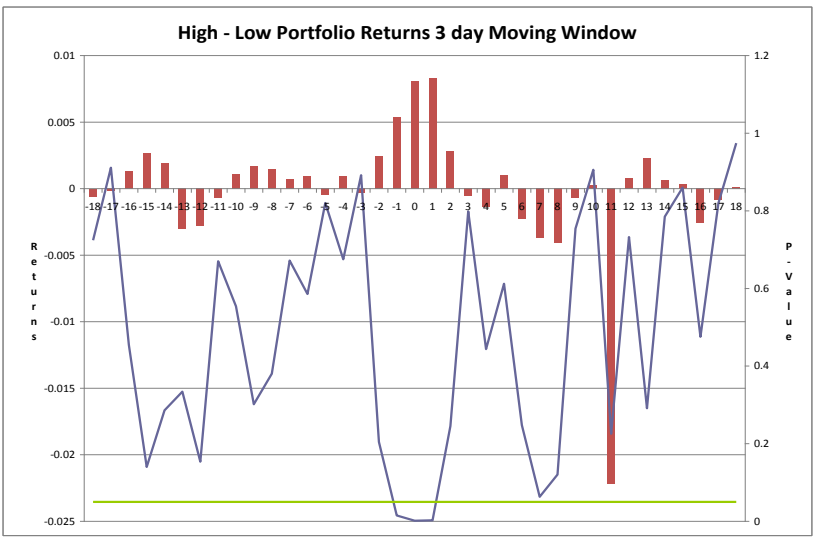
To test our conjecture, we calculate the serial correlation of the forecast errors. As exhibited in Figure 3, the serial correlations of the forecast errors by analysts are significant at the quarterly lags of 1, 2, and 4. Therefore, underreaction by analysts could cause the persistence of momentum profits over the short window period that surrounds the FFO announcements. In this aspect, our results are consistent with the empirical evidence in Konchitchki et al. (2010) and Gyamfi-Yeboah, Ziobrowski, and Lambert (2010) in that analysts systematically underestimate past good news than past bad news.

Given the results in Table 2, where the returns are much weaker for the announcement window and economically larger in Table 4 for FFO-surprise-based formation strategy, we further examine the role of FFO announcement windows. We test if the profitability based on the three day window is independent of the FFO announcement.

As Figure 4 shows, profits for the constructed portfolios are insignificantly different from zero over the windows from [-18,+18] of the FFO announcements. We find that the only significance is during the window that surrounds the FFO announcements. This strongly implies that FFO announcements play a large role in the FFO profitability of the portfolios. In Figure 3, we examine the serial correlation by quarters of FFO surprises. We find strong serial correlations in the first, second and fourth lags. This seems to indicate that analysts underreact to the release of new information. This supports the Daniel, Hirshleifer, and Subrahmanyam model of underreaction to public information. However, we find support that the price drift is not due to the underreaction of individual investors, but rather, may be related to the underreaction of more informed analysts to these public disclosures. Narayanamoorthy (2006) shows that executives tend to be more conservative in that bad news is more negatively incorporated into their assessments and good news is less positively processed. We do not have the data to test whether conservatism by executives affects analyst forecasting errors**.**

Figure 4 The Impact of FFO Announcements

We classify the sample in either "Hi" or "Low" portfolios based on FFO shocks where the top 30% were considered the high returns and the bottom 30% were grouped as the low returns. The primary vertical axis depicts a return. The secondary vertical axis shows the level of the p-value with a solid line. We include a sample period from Jan. 2000 – Dec 2008. We examined all of the three day windows from [-18,+18] of the FFO announcements. We find that all the other three day windows are not significantly different from zero. We find that the only significance is during the window that surrounds the FFO announcements. This strongly implies that FFO announcements play a large role in the FFO profitability of the portfolios.



Previous research work has shown that momentum profits are related to a set of factors. For example, Hong, Lim, and Stein (2000) show that momentum profits sharply decline with the market capitalization of a stock. By using volume as a proxy for information, Hong, Lim, and Stein (2000), and Lee and Swaminathan (2000) find that momentum is more pronounced in high-volume than low-volume firms and becomes reversed in long horizons of three to five years. Chui, Titman, and Wei (2003b) also relate momentum profits to size and trading volume. We explore the sources of the persistent momentum profits.

Table 5 Cross-Sectional Regression of FFO-Surprise-based Momentum Returns - Raw Returns

This table presents the results from the cross-sectional analysis of the 6-month post-formation momentum returns based on FFO surprise. The dependent variable in the first model is the full 6 month return. The dependent variable in the second model is the full return excluding the returns in the two - 3 day windows around the subsequent FFO announcements. The previous FFO shock is defined as Eq.1.from the previous quarter, a difference between actual FFO from IBES and the forecasted FFO. The value in the parentheses is the p-value. * and ** denote significance at 5% and 1%, respectively. We include a sample period from Jan. 2000 – Dec 2008.

	6-month Return	3-day Return	Excluding 3-day Return
Intercept	-0.0387	-0.0411	0.0014
	(0.41)	(0.36)	(0.93)
Previous FFO Shock	0.1095**	0.1004**	0.0118
	(0.00)	(0.00)	(0.25)
Number of Analysts	0.0014	0.0014	-0.0003
	(0.29)	(0.28)	(0.48)
Std Dev of Forecast	0.0442	0.0601	-0.0046
	(0.43)	(0.27)	(0.82)
Book to Market	-0.0002	-0.0003	-1.324E-05
	(0.15)	(0.09)	(0.82)
Trade Volume	-2.6E-09**	-2.55E-09**	-6.166E-11
	(0.00)	(0.00)	(0.25)
Log Size	0.0149*	0.0152*	0.0003
	(0.04)	(0.03)	(0.89)

As shown in Table 5, for raw returns over the full 6-month holding period, FFO-surprise-based momentum profits are not related to the number of analysts who are covering a firm. The uncertainty of earning as measured by the standard deviation of FFO forecasts is not significant in the regression. In addition, the coefficient for the book-to-market ratio is insignificant, which contrasts with the results in Chui, Titman, and Wei (2003b). However, consistent with previous studies, trading volume, market size, and previous FFO shocks are important determinants of momentum profits as indicated by

the significance of the corresponding coefficients in the regression. The results remain the same when we examine the momentum returns during the window period. However, none of the independent variables are significant for raw returns, excluding the window period that surrounds the FFO announcements.

Table 6 Cross-Sectional Analysis of FFO-Surprise-based Momentum Returns – Adjusted Returns

This table shows the cross-sectional regression of the adjusted returns of the 6 month post-formation returns. The dependent variable in the first model is the full 6 month return. The dependent variable in the second model is the full return excluding the returns in the two - 3 day windows around the subsequent FFO announcements. The previous FFO shock is defined as Eq.1.from the previous quarter, the difference between the actual FFO from the IBES and the forecasted FFO. The value in the parentheses is the p-value. * and ** denote significance at 5% and 1%, respectively. We include a sample period from Jan. 2000 – Dec 2008.

	6-month Return	3-day Return	Excluding 3-day Return
Panel A. CRSP Index-adjusted Returns			
	0.036	0.0355	-0.0006
Intercept	-0.44	-0.43	-0.97
Previous FFO	0.0804*	0.0670*	0.0166
Shock	-0.01	-0.02	-0.07
	0.001	0.0011	-0.0004
Number of Analysts	-0.43	-0.39	-0.35
	0.0914	0.1019	0.0009
Std Dev of Forecast	-0.1	-0.06	-0.96
	-0.0002	-0.0003	3.39E-05
Book to Market	-0.27	-0.1	-0.51
	-8.496E-10**	-8.30226E-10**	-2.27E-11
Trade Volume	0	0	-0.63
	-0.0011	-0.0007	0.0001
Log Size	-0.87	-0.92	-0.96
Panel B. REIT Index-adjusted Returns			
	-0.05	-0.0335	-0.021
Intercept	-0.11	-0.11	-0.1
Previous FFO	0.051**	0.051*	0.016*
Shock	0	-0.01	-0.04
	-0.003**	-0.003	-0.0008*
Number of Analysts	0	0	-0.02
	0.038	0.043	0.008
Std Dev of Forecast	-0.32	-0.25	-0.59
	-0.0004	-0.0002	9.14E-05*
Book to Market	-0.72	-0.12	-0.04
	-3.84E-10**	-3.73E-10**	-2.93E-11
Trade Volume	0	0	-0.49
	0.013**	0.010*	0.0035
Log Size	0	-0.02	-0.07

For robustness, we conduct the same regression with abnormal returns. In Table 6, we analyze the adjusted returns. In Panel A, we adjust the raw returns by subtracting the value-weighted CRSP index returns from the raw returns of the momentum arbitrage portfolio. Two factors, i.e., previous FFO shocks and trading volume, are consistently important in both panels, which is similar to those in Table 5. However, it is less clear whether the number of analyst covering, uncertainty of forecasts, and book-to-market ratio are important factors of momentum profits. The results are the same when we examine the impact of the variables on momentum profits during the window periods; only previous FFO shocks and trading volume are significant and all other variables are insignificant.

We find that the 3-day window plays a vital role in determining the momentum profits and that there is a strong and positive serial correlation between the unexpected FFO for the next two quarters. A traditional approach on the rational behavior of experts in financial markets assumes that without bias, financial analysts immediately incorporate new information on forecasts of FFO so that their forecast is regarded as accurate and precise information on the earning forecasts of a firm. Studies on the behavior of financial analysts on their forecast are largely unexplored. However, if analyst forecasts are biased and do not accurately reflect all available information while markets incorporate analyst forecasts as both rational and statistically optimal, then the information generated by inefficient forecasts could have impacts on the market efficiency hypothesis. Due to the inefficiency of analyst forecasts, they fail to accurately incorporate all information and further generate suboptimal forecasts which contradict rational unbiased behavior based on the modern economic utility theory. Given that forecast errors are realized as the actual announcement is quarterly disseminated, the dissemination of this erroneous information can be financially and economically momentous. Based on the model of investor overconfidence of private information and self attribution by Daniel, Hirshleifer, and Subrahmanyam (1998), overconfident investors will place less value on publicly released information and more on their privately held information. However, we understand that the analysts might be subject to the same biases and overconfidence. Analysts, by privilege of their position, have access to greater information and may believe that they hold more private and valuable information.

5. Conclusion

We examine the effect of FFO forecast errors by analysts on the price reaction of REITs and attempt to determine that these FFO forecast errors can explain the momentum profits. We find that the momentum of momentum strategies is strong 15 years after they have been widely publicized. The arbitrage momentum portfolio delivers both economically and statistically significant excess returns even in the post-2000 period. Such persistence in momentum

profits posts a challenge to the market efficiency hypothesis, but is consistent with the behavioral models. We find that a large part of the momentum profits come from the 3-day FFO announcement window. Beyond this announcement window, momentum strategies do not generate any significant abnormal returns.

During the 3-day announcement window, a momentum portfolio formed based on earning-surprise generates higher profits than the return-based formation approach as in Jegadeesh and Titman (1993). Thus, one of the practical implications from our results is that investors should modify the momentum strategy to focus on the FFO announcement effect. Holding a momentum portfolio longer than the 3-day window is not value-enhancing.
Finally, we find a significantly positive serial correlation between the unexpected FFO for the next two quarters. A cross-sectional analysis confirms that FFO shocks and trading volume are important factors that determine the momentum returns. We attribute the persistence of momentum profits over the announcement window to underreaction by analysts.

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