The Influence of Seasonal Depression on Equity Returns: Further Evidence from Real Estate Investment Trusts

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Previous studies have identified a specific behavioral effect on stock market returns worldwide that they attribute to seasonal depression among a significant subset of investors. We reexamine this notion in a unique arena, Real Estate Investment Trusts (REITs), and find further evidence of such an influence. Specifically, we find an asymmetric return pattern throughout the fall and winter months that is similar to that previously documented in traditional equities. This result is primarily driven by the smallest REITs, however, which may reflect their similarity to traditional equities. Further, we find the influence of seasonal depression remains following the Omnibus Reconciliation Act of 1993, when a large portion of REIT investors were institutional. Our results provide further evidence of a distinct psychologically driven influence in stock market returns.

Introduction

Recently, there has been a significant body of research examining non-financial influences on market values. Behavioral finance has become a highly respected branch of the discipline, as numerous works have established a significant link between behavioral influences and financial matters. This work falls within this broad arena by examining a behavioral effect on a segment of the market, Real Estate Investment Trusts (REITS).

Specifically, we examine the influence of seasonal depression on price movements of publicly traded REITs. Seasonal affective disorder (SAD) is a well-documented psychological condition that creates an increased level of overall pessimism during periods of the year where the amount of sunlight is lowest.[1] SAD has been documented (Rosenthal, 1998) to affect in excess of ten million Americans,

[1]See Molin et al. (1996), Young et al. (1997), and Carton et al. (1995).

1939-8123/09/1300-0063 $0.250

with as many as 15 million more suffering from milder versions, commonly known as "winter blues." There is the potential that SAD or winter blues could influence markets whose values are determined, at least in part, by activities of afflicted individuals. There are numerous examples in the psychology literature of mood influencing risk taking in clinical studies. For example, Yuen and Lee (2003) find induced depression creates significantly more conservative risk-taking behavior. The increased level of risk aversion, in turn, could decrease (increase) the demand to buy (sell) riskier market assets and replace those market positions with safer investments.

The first research to directly examine this notion was Kamstra, Kramer, and Levi (2003), who find strong evidence of a SAD effect in worldwide financial markets. Specifically, they find significantly lower returns as the amount of sunlight decreases during the fall months. As the days begin to lengthen during winter months (after the winter solstice), however, they find abnormally large returns as investors begin to see the end of seasonal depression and shift resources to riskier investments. The current study is unique in that it examines a subset of the market (rather than the entire market) where a rational motive can be developed for a resource shift based upon the psychological effects of seasonal depression. Also, while the study of seasonality in REIT pricing is not new, this is the first, to our knowledge, that examines a seasonal component that is completely based upon psychological influences.

REITs represent a relatively unique financial asset. Generally speaking, REIT returns are more predictable than other securities, due in no small part to the relative ease of identification and valuation of underlying assets, along with the abnormally high level of dividend payments. Because the returns (and the resulting wealth benefits) of REITs are, presumably, more predicable than other security types, it is possible the increased risk aversion brought about by SAD would drive investors away from riskier security types and to safer REITs as investment vehicles.

We generally find no support for this notion, however, as returns for our sample of REIT securities experience the same asymmetric pattern as that documented by Kamstra, Kramer, and Levi (2003). We do find interesting subsample results when segmenting based upon size. Specifically, we find the primary results to be driven by only the smallest two quintiles of REITs. Kamstra, Kramer, and Levi (2008) examine the influence of SAD on the Treasury bond market and find strong evidence of an opposite seasonal effect; higher returns in fall and lower returns in winter. This is most likely attributable to the safer nature of these securities as SAD-afflicted investors shift resources away from risky equities and toward the safer debt securities during the fall, thus driving up the returns on the latter group. This pattern is again reversed in the winter as the symptoms associated with SAD begin to alleviate. Thus, our results can be potentially explained by a similar argument based upon the relative riskier nature of small REITs (similar to traditional equities) and the relative safer nature of large REITs (more like bonds).

The SAD effect also remains following the Omnibus Reconciliation Act of 1993. Therefore, our results are particularly interesting as a large percentage of REIT investors during this time were institutional. In sum, our results are consistent with previous studies that identify a unique psychologically-driven influence on equity returns.

Seasonal Affective Disorder

Seasonal affective disorder, or SAD, is a subtype of depression that is characterized by a lack of energy, hypersomnia, overeating, weight gain, and, perhaps most notably, depressed mood. Molin et al. (1996) and Young et al. (1997) document that seasonal depression is explicitly linked to the number of hours of daylight, with declining hours of daylight contributing to increased levels of depression.

Sullivan and Payne (2007) compare seasonal and nonseasonal depression in a sample of college students and find SAD is much more prevalent than other major nonseasonal depressive disorders. They find both types of disorders are associated with higher reports of cognitive failures relative to those individuals who have no depressive symptoms, which suggests both seasonal and nonseasonal disorders have similar effects on impaired individuals. Conversely, Bagby et al. (1996) examine seasonal depression relative to other forms of psychological depression and find SAD patients may be a distinct subgroup of depressed patients who are more imaginative, emotionally sensitive, and likely to entertain unconventional ideas. This suggests persons influenced by SAD are not in the same category as many depressed individuals, who are likely to avoid any form of optional risk-taking, which would include stock market participation.

Several studies examine the potential impact of behavioral disorders such as SAD by examining the relationship between investor mood and the willingness to take risk, as well as the potential financial ramifications of such a relationship. For example, Carton et al. (1995) conclude depression increases the general level of pessimism, and, as a result, individuals are more reluctant to make decisions that have a greater level of risk or exhibit optimistic thinking.

Kamstra, Kramer, and Levi (2003) investigate the role of SAD in the seasonal time-variation of stock market returns. They find that returns are significantly affected by the level of daylight throughout the fall and winter months. Further, they find the effect of SAD is not symmetric. Returns tend to be lowest in fall months when the amount of daylight is declining and higher in winter, which is attributed to a reversal of emotions as days begin to lengthen. In addition, Kamstra, Kramer, and Levi find their results are robust to markets across the globe, including different

hemispheres.[2] Kamstra, Kramer, and Levi (2008) further their contribution to the literature by examining the influences of SAD on the U.S. Treasury market. They find a thoroughly robust variation in excess of 80 basis points from peak to trough in monthly returns that is opposite that found in the equity markets.

Garrett, Kamstra, and Kramer (2005) examine SAD in the context of an equilibrium pricing model to determine whether seasonality can be explained using a conditional version of the capital asset pricing model (CAPM) that allows the price of risk to vary over time. They find the revised model can capture the SAD effect completely, which is consistent with SAD leading to heightened risk aversion and thereby requiring a higher risk premium.

Dolvin and Pyles (2007) examine, also within the Kamstra, Kramer, and Levi (2003) framework, the influence of SAD on initial public offerings (IPOs) that went public between 1986 and 2000. Because IPOs represent investment in a firm that is generally smaller and less well-known than the typical public firm, it is likely these investments are associated with increased information uncertainty (i.e., higher risk). Thus, during SAD periods, it is possible that IPOs need to be priced differently than issues going public at other times during the year. Dolvin and Pyles find support for this notion, as issues going public during fall and winter are associated with higher levels of underpricing and a larger degree of offer price revisions, both of which proxy for uncertainty.

Dolvin, Pyles, and Wu (2008) again examine the influence of SAD. Rather than studying all market participants, they examine stock market analyst estimates and find evidence that they too are susceptible to the influences of SAD. Specifically, they find earnings estimates are more pessimistic during fall and winter than in spring and summer.

Real Estate Investment Trusts (REITs)

REITs originally were designed as a conservative investment device through which individual investors could invest in real estate assets on a long-term basis. Thus, as REITs were authorized by Congress in 1960, they historically have served the role of financial intermediaries that enable individual investors to invest in real estate assets, yet avoid the double taxation of traditional corporate structures by complying with strict operating requirements.[3] There are two basic types of REITs.

[2]There are also several climate-oriented studies in the literature. For example, Saunders (1993) and Hirschliefer and Shumway (2003) examine cloud cover; Cao and Wei (2005) consider temperature; and Dichev and Janes (2003) and Yuan et al. (2006) study lunar cycles. In a more broad-based study, Dowling and Lucey (2008) examine, in a statistically robust manner, several proxies for investor mood worldwide. They find the only variables that are consistently related to stock market returns worldwide are SAD and low temperature.

[3]See Jarchow (1988) and Fass, Shaff, and Zief (1996) for an explanation of REIT operating procedures.

Equity REITs are involved in the investment and operation of real physical assets, while mortgage REITs purchase mortgage obligations.[4]

Prior to the Tax Reform Act of 1986, REITs were precluded from actively managing their own portfolio. The passage of this act resulted in a dramatic change in how REITs operated. Prior to the 1990s, most REIT were managed conservatively and were well diversified. Conversely, during the 1990s REITS began to be operated by managers with significant equity positions in the company. The end result was a more fluid management style, which resulted in more uncertainty about the market value of the firm.

Another event of importance in the history of REITs occurred with the Omnibus Reconciliation Act of 1993, commonly known as OBRA 1993. Prior to this time, institutional investors were limited in the amount they could invest in REITs by what is known as *the five-or-fewer rule*, which states that no less than six shareholders (i.e., five or fewer) collectively can hold more than a 50 percent stake in a REIT. The primary result of OBRA 1993 was allowing institutional investors to count each individual investor separately, rather than lump them together. Thus, the ultimate result was a significant increase in institutional investment in the REIT market over the following decade. Downs (1998) finds the resulting increased activity had benefit through value creation and increased liquidity. Further, other studies, such as Wang et al. (1995) and Khoo, Harzell, and Hoesli (1993), find improved stock performance and reduced return volatility, respectively.

REIT Returns

Smith and Shulman (1976) and Zerbst and Cambon (1984) were among the first to examine REIT returns and found their behavior was similar to that of other traded equities. Several factors have been documented to affect both the REIT market specifically and stock markets in general.[5] A large body of literature views REITs as a mixture of stock and bonds when examining the risk/return relationship.[6] REIT returns should be related to equities because they are influenced by the same macroeconomic influences. Due to the relatively fixed nature of REIT asset cash flows and the high dividend yield offered to investors, however, REITs also have features compatible with debt securities.

The rapid interest in REIT investment since the early 1990s has led some research (e.g., Ziering, Winograd, and McIntosh, 1997) to conclude that REITs are beginning to behave more like real estate (and less like stock). This leads some

[4]Hybrid REITs, which could be considered a third type, invest in both physical and financial assets. These, however, make up a small fraction of the population.

[5]For example, Chan, Hendershott, and Sanders (1990) suggest changes in market risk, the term structure of interest rates, and unexpected inflation influence both markets.

[6]For example, see Ling and Naranjo (1997), Peterson and Hseih (1997), and Karolyi and Sanders (1998).

studies (e.g., Ghosh, Miles, and Sirman, 1996, and De Wit, 1997) to suggest the decrease in correlation between stock and REIT returns leads to REITs being a more viable option for risk-reducing through diversification strategies. Further, Chandrashekaran (1999) illustrates that REITs help reduce portfolio variance. Chui, Titman, and Wei (2003) examine multiple determinants of REIT returns and find in the pre-1990 period momentum, size, turnover, and analyst coverage best predict REIT returns. In the post-1990 period, they find momentum to be the dominant predictor of REIT returns.

There have been numerous studies that suggest differences between the predictability of REIT returns relative to mainstream equities. Specifically, Liu and Mei (1992) and Mei and Liu (1994) find that returns on REITs can be forecasted by the yield on one-month T-bills, the yield spread between AAA bonds and T-bills, the dividend yield on an equally weighted market portfolio, and the capitalization rate on equity REITs. Clayton and MacKinnon (2003) and Chui, Titman, and Wei (2003) find a steady increase over time in volatility of REIT returns, however, likely due to increased activity and larger number of options.[7]

As a closer examination of the notion that REITs are a safer alternative investment, we estimate the level of systematic risk of the REIT sample to be used in this paper via the traditional CAPM approach of:

$$R_{it} = \alpha_{it} + \beta * (R_{m,t} - rf_t) + \varepsilon_{i,t} \quad (1)$$

where:

R_{it} = The return on an equal or value weighted REIT index on day t;

$(R_{m,t} - rf_t)$ = The daily market risk premium obtained from Kenneth French's website and is the value-weighted return on all NYSE, AMEX, and Nasdaq stocks (from CRSP) minus the one-month Treasury bill rate (from Ibbotson Associates).

In addition, we also obtain (from Kenneth French's website) daily index returns for ten industries, which are again compiled from all stocks on the NYSE, AMEX, and Nasdaq based upon SIC codes.[8] As such, this provides a great laboratory for examining the REIT industry in relation to more traditional equity arenas. Thus, we run the same CAPM-based regression on the nine industries (excluding the "other" category) for comparison. The results are presented in Table 1.

The sample of REITs used in the paper provides a lower estimate of systematic risk than any other industry. The only reasonably comparable industry is utilities. Therefore, this is consistent with the contention that REITs are safer than traditional equities, at least in regard to their exposure to systematic risk. We are not the first to

[7]Prior to 1990 there were less than 50 publicly traded REIT investments. In contrast, the number of REITs peaked at greater than 150 in the late 1990s.

[8]Kenneth French's website can be found at:
http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/.

find this. Delcoure and Dickens (2004) examine REITs from 1997 through October 2002 and find an average beta of 0.313 over that time, which is comparable to the value we find for the longer time period we examine. Gyourko and Nelling (1996) dissect a sample of REITs over the 1988–1992 time period by property type and geographic and economic regions and find betas that range from 0.20 to 0.67 (the average is roughly 0.37).

Table 1—Estimates of Systematic Risk

Industry	Beta
REITS VW	.387
REITS EW	.371
NonDurables	.738
Durables	1.006
Manufacturing	.935
Energy	.720
High-Tech	1.453
Telecomm	.995
Shops	.991
HealthCare	.930
Utilities	.505

Note: This table presents estimates of betas from the traditional CAPM approach of:

$$R_{it} = \alpha_{it} + \beta * (R_{m,t} - rf_t) + \varepsilon_{i,t}$$

$(R_{m,t} - rf_t)$ is the daily market risk premium, calculated as the value-weight return on all NYSE, AMEX, and Nasdaq stocks (from CRSP) minus the one-month Treasury bill rate (from Ibbotson Associates). For REITs VW (REITs EW), R_{it} is the daily return on a value (equally) weighted REIT index. For all other industries, R_{it} is the daily index return for each of the nine industries, which are again compiled from all stocks on the NYSE, AMEX, and Nasdaq based upon SIC codes. REIT return data are from CRSP, while all other industry returns are obtained from Kenneth French's website. The sample period is January 1985 through December 2006

REIT securities also are known traditionally to pay a much higher dividend rate than traditional stocks. They are required to pay at least 90 percent of their net operating income as dividends. This number often is exceeded, however, with dividend payments routinely exceeding 150 percent of net operating income.[9] The higher dividend offered by REITs lends credence to the belief that this type of investment provides a more predictable return pattern than mainstream equities.

We are certainly not the first to examine a calendar-related effect in REIT returns. For example, Redman, Manakyan, and Liano (1997) and Connors et al. (2002) document a turn-of-the-month effect in REIT stocks. Further, Redman, Manakyan, and Liano (1997) find the effect is more pronounced in smaller firms. Colwell and Park (1990) and Friday and Higgins (2000) also find turn-of-the-year and day-of-the-week effects, respectively, in REITs. Particularly important to this study, Subrahmanyan (2007) finds that seasonal effects are not as pronounced in

[9]See Wang, Erickson, and Gau (1993).

REITs as non-REIT securities. Thus, we are biased against finding a significant relation between a new seasonal effect (i.e., SAD) and REIT returns.

Lee and Lee (2003) and Wiley and Zumpano (2008) examine calendar REIT anomalies in conjunction with institutional investing, specifically examining the January effect and the turn-of-the-month effect, respectively. Lee and Lee (2003) find evidence consistent with the tax-loss selling hypothesis in REIT returns and conclude that trading strategies to garner excessive profits due to the January effect may work only in the absence of significant institutional involvement. Wily and Zumpano (2008) find a significant change in the turn-of-the-month effect following OBRA 1993 and suggest that much of the change can be attributed to the dramatic rise in institutional holdings brought by the act.[10]

Hypothesis

The premise of this study is based upon a fundamental relationship between human emotion and the human desire to take risk.[11] Given the potentially large number of people who are subject to the psychological influences of SAD, we hypothesize there may be a seasonal component to publicly traded securities. This seasonality will manifest in a significant portion of market participants shifting resources away from (i.e., selling) riskier securities and toward (i.e., buying) safer securities. Kamstra, Kramer, and Levi (2003) and others find a distinct negative return effect during the onset of seasonal depression in fall. This return pattern is then reversed during the winter, as the effects of seasonal depression fade with the lengthening of days. Further, Kamstra, Kramer, and Levi (2008) find robust evidence of an opposite effect in the safer treasury security market.

We argue that REITs, like treasury securities, are a relatively safe investment vehicle due to the predictability of their returns and the large dividend payouts. This is supported by a brief examination of the level of systematic risk. While there is evidence of increased volatility over the past fifteen years, there is still significant disparity between the risk levels of the two asset classes (i.e., REITs versus traditional equities). Thus, we hypothesize:

> *The influence of seasonal depression will result in a resource reallocation away from riskier securities and toward (safer) REITs. This reallocation will result in higher returns during periods of the year where the effects of the seasonal depression are increasing and lower returns during periods of the year where the effects are decreasing.*

[10]The level of institutional holdings averaged approximately 23 percent prior to OBRA 1993, compared to 49 percent from 1994 to 2004 (Wiley and Zumpano, 2008).

[11]See Schwarz (1990) and Loewenstein et al. (2001) for theories linking individual mood to decision making. Further, see Etzioni (1988), Romer (2000), Mehra and Sah (2002), and Olson (2006) for studies examining the effect of emotions on economic and financial decisions.

In addition, we expect the results may be different for segments of the REIT market, much as it would be for segments of the more traditional stock markets. Specifically, smaller REITs have been documented to be more prone to certain seasonal effects. Particularly relevant to the current study, this could hold true due to the riskier nature of smaller securities. On the other hand, if the motivation for investing is, at least partially, behavioral and investors are choosing safer alternatives, they likely will choose larger, more well-known investments, even within asset classes. Therefore, it is possible the influences of seasonal depression will be more dramatic in large-cap REITs than in small-cap REITs.

Another possible influence could be the rapid increase in institutional investment due to OBRA 1993. There are offsetting notions in relation to our study. On one hand, this created a much more fertile investing environment. Thus, amateur investors, including a significant number potentially afflicted by seasonal depression, are more likely to be aware of REITs as a mainstream investment vehicle. This combined with evidence that REITs have become a more viable diversification option (Ghosh, Miles, and Sirman, 1996) could indicate the influence of seasonal depression would be strongest following OBRA 1993.

On the other hand, since OBRA 1993, REIT returns have become more volatile, which is inconsistent with risk-reducing investments. In addition, since that time a much higher percentage of investors is institutional (i.e., financial professionals), and this group is presumably less prone to emotional influences than the average investor. This may not necessarily be the case in all situations (Dolvin, Pyles, and Wu, 2008).

It also has been documented that institutional investors are more likely to invest in particular ways due to the nature of their jobs. For example, numerous works, including Eakins and Sewell (1993) and Johnson and Cox (1996), have examined the influence of tax loss selling or window dressing by institutional investors on returns.[12] Either hypothesis has the same potential influence on our results and thus needs to be considered in our analyses. In general, the fact that a significant number of REIT investors are institutional biases against finding a consistent seasonal depression component to REIT returns.

[12]The concept of tax loss selling, as first proposed by Ritter (1988), is that investors attempt to sell off losers just prior to the end of the year to avoid the negative tax effects. An alternative possibility, with much the same predictions, is the window dressing hypothesis, which states that institutional investors sell losers to inflate their earnings reports artificially. As such, both hypotheses suggest both individuals and institutional investors are likely to repurchase these losers at the beginning of the next year in order to capitalize on any subsequent gains due to the potential underpriced nature of such securities. There is a debate in the literature on which of the two effects (tax loss selling or window dressing) is the primary driver of the turn-of-the-year effect. For example, Musto (1997) and Maxwell (1998) find evidence of window dressing, while Sias and Starks (1997) and Poterba and Weisbenner (2001) suggest a significant tax loss selling component to equity returns.

Data

We obtain data from three sources. First, we identify 235 unique REITs from SNL Financial Real Estate. We then obtain closing prices from the Chicago Research in Security Prices (CRSP) database for each REIT for each trading day available from January 1, 1985 through December 31, 2006. In addition, data for other weather variables, namely temperature and precipitation, are obtained from National Climatic Data Center (NCDC). Our total sample consists of 418,701 firm-day observations.

We also must identify appropriate proxies of seasonal depression. Following Kamstra, Kramer, and Levi (2003), we first define SAD as the length of night for each day of the year. Specifically, SAD takes the form of:

$$SAD_t = H_t - 12 \text{ for trading days in the fall and winter}$$

and (2)

$$SAD_t = 0 \text{ for trading days in the spring and summer}$$

where H_t is the time from sunset to sunrise for the specific day in question. We deduct 12 (the average number of night hours over the entire year) to obtain a measure (i.e., $H_t - 12$) that reflects the length of night relative to an average day. The specification (i.e., modified binary variable) also addresses the medical evidence that suggests SAD only occurs during fall and winter months.[13,14]

Given that we are in the northern hemisphere, the total fall and winter period is defined as September 21 to March 20.[15] As discussed in a previous section, previous studies also suggest an asymmetric effect across the fall and winter periods. To address this phenomena, we also create a dummy variable, Fall, that equals one if the observation is September 21 to December 20 period, zero otherwise. This variable is designed to measure the incremental impact associated with the asymmetric effect of SAD.

A potential shortcoming of this method, as suggested by Kelly and Meschke (2007), is that the variable could be picking up cyclical factors unrelated to SAD. Because the variables SAD and Fall are indirect proxies for SAD, it is difficult to isolate the impact that is attributable to the disorder. Therefore, a better measure would be one that is directly related to seasonal affective disorder. Kamstra, Kramer, and Levi (2008) and Kamstra, Kramer, and DeGenarro (2008) create variables that measure, directly, the influence of SAD on individuals affected based upon sample

[13]For completeness, we examine an alternative specification for SAD, where SAD = ($H_t - 12$) for the entire year rather than just during the fall and winter. The results are qualitatively unchanged.

[14]See Kamstra, Kramer, and Levi (2003) for a complete explanation of the process for calculating SAD.

[15]We assume the autumnal and vernal equinoxes are September 21 and March 21, respectively, although it is possible for the actual date to vary slightly.

results of Young et al. (1997) and Lam (1998). The first, which they label Incidence, is the proportion of SAD sufferers that are afflicted during each month.[16] In addition, an additional variable, Onset/Recovery, is the monthly change in the Incidence variable. Onset/Recovery is designed to be used in circumstances where the predicted sign is the different across both fall and winter (i.e., as in Kamstra, Kramer, and Levi, 2003), whereas Incidence is designed to be used when the predicted sign is the same throughout both fall and winter.[17] Should our hypotheses be confirmed, the sign on the Onset/Recovery (henceforth labeled OR) variable should be positive. Alternatively, if the hypothesis is not supported, we may find the same negative coefficient as Kamstra, Kramer, and Levi (2003).

Summary statistics for the entire sample are presented in Table 2, along with subsamples segmented by seasons of the year. The SAD sample represents those daily returns in fall and winter, where SAD is known to be most influential. This is not an exact examination of the influence as SAD is not a pure binary variable; however, it should provide a rough view of the variables over the sample period. We also compute the traditional t-statistic for the difference in means.

Prices (Prc) and the number of shares outstanding (ShrOut) are insignificantly different between the two periods, which is not surprising. Trading activity [as measured by trading volume (Vol)], however is significantly higher during fall and winter than the remainder of the year. While this is consistent with increased demand for the safer REIT securities during this period of time, there are also other potential explanations, such as increased activity as a result of tax loss selling and/or window dressing.

The average daily return is approximately 0.06 percent throughout the entire year and a bit higher (approximately 0.07 percent) during the fall and winter months. This difference, seemingly minute, nonetheless results in a significantly different average daily return during the fall and winter months relative to the spring and summer months (at the 5 percent level). Naturally, there is an extreme difference in temperatures (Temp) between the two sample periods. There also appears to be more rainfall (Prcp) during the spring and summer than during the fall and winter.[18]

The t-statistic values discussed thus far are based upon the assumption that all observations are independent, which is erroneous given that a large number of REITs

[16]The incidence variable is calculated by cumulating, monthly, the proportion of subjects who have experienced the onset of their SAD symptoms (cumulated starting in late summer, when a small proportion of subjects are first diagnosed with onset) and then deducting the cumulative number of people who have experienced full recovery from SAD. The resulting monthly incidence variable takes values between zero percent, in summer, and close to 100 percent, in winter. Please see Kamstra, Kramer, and Levi (2008) for a complete discussion of the variable creation process.

[17]Data are available on Mark Kamstra's website at www.markkamstra.com.

[18]Data on temperature and precipitation are those recorded in New York City, NY for each day of the sample period.

trade on most given days in the observation period. Thus, the results must be interpreted with caution. In an effort to alleviate this issue, we compute daily averages for each variable (save the weather-related variables, which were already in that form). Unsurprisingly, despite the fact that the average return during SAD days increased in this analyses, the significance levels disappear, most likely due to the larger denominator value brought by the smaller number of observations. We now turn to more robust statistical techniques in an attempt to determine the true influence of seasonal depression.

Table 2—Summary Statistics

		Independent Observations			Daily Averaged Observations		
	Total	SAD	Non-SAD	t-stat	SAD	Non-SAD	t-stat
N	418,701	203,480	215,221		2,636	2,797	
Prc	21.20	21.17	21.24	-1.64	16.73	17.01	-1.26
Vol	141,150	142,775	139,614	2.87	98,593	95,768	.94
ShrOut	32,419	32,398	32,438	-.31	23,363	23,309	.11
Ret	.06	.07	.06	2.38[b]	.08	.06	.75
MktCap	851,241	850,504	851,938	-.30	582,322	580,865	.09
Temp	55.98	44.00	67.25	-618.48[a]	-	-	-90.83[a]
Prcp	.13	.11	.14	-20.30[a]	-	-	-2.23[b]

Note: This table presents results for the entire sample (January 1985 through December 2006), as well as subsamples segmented by SAD observations (i.e., returns during fall and winter months) and non-SAD observations (i.e., returns during the spring and summer months). Price (Prc) is the price per share of stock at the close of each observation day. Volume (Vol) is the total volume of the security traded during that day, rounded to the nearest round lot. Shares outstanding (ShrOut) is the number of shares outstanding, in thousands. Return (Ret) is the holding period return for the REIT security for each trading day. Market Capitalization (MktCap) is the market capitalization of each security for each day, calculated as Prc*ShrOut. Temperature (Temp) is the average temperature throughout each sample day, and precipitation (Prcp) is the amount of precipitation for each sample day. t-statistics are calculated assuming unequal variances. Significance at the 1 percent level is represented by a. Significance at the 5 percent level is represented by b. Significance at the 10 percent level is represented by c. Data are from SNL Real Estate, CRSP, and the National Climatic Data Center (NCDC)

Results: Total Sample

It is commonplace in financial literature for stock returns to be serially autocorrelated over time. Thus, prior to estimation, we conduct a test for autocorrelation in our panel data. The results reveal the need to control for this potentially biasing influence.[19] We therefore begin by examining the following fixed effects model with an AR(1) disturbance: [20, 21]

[19]Specifically, we implement the Wooldridge test for autocorrelation in panel data. In each instance, the significance level (rejecting no autocorrelation) is greater than the 1 percent level. See Wooldridge (2002) and Drukker (2003) for explanation.

[20]Use of this model is common in the literature. For example, see Pagan and Schwert (1990), Susmel and Engle (1994), and Park (2005).

$$Ret_{i,t} = \beta_0 + \beta_{Firm} + \beta_1 SAD_t + \beta_2 Fall + \beta_3 TYDum + \beta_4 Monday + \beta_5 Friday + \beta_6 Temp_t + \beta_7 Prcp_t + \beta_8 JanDum + \varepsilon_i \quad (2)$$

where:

$Ret_{i,t}$ = The daily holding period return for each REIT security over the 1985-2006 time period;

β_{Firm} = A vector of dummy variables to control for firm-specific effects;

TYDum = A binary variable equal to one if the observation day is one of the last ten or first ten of a calendar year and controls for the notion of tax-loss selling and/or window dressing that may occur around the ending of a calendar year;[22]

Monday and Friday = Dummy variables designed to capture day-of-the week effects, which are found to be significant in REIT returns by Friday and Higgins (2000).

In addition, we include the average temperature for each day (Temp) and the average rainfall, in inches, for each day (Prcp). Several studies have examined the influence of weather on stock markets, so it is necessary to control for the possibility that any emotional influences could be a result of a weather-related effect other than SAD. Finally, JanDum is a dummy variable equal to one if the observation is during January, zero otherwise. As the January effect has been documented numerous times in both traditional (e.g., Rozeff and Kinney, 1976; Reinganum, 1983; and Haug and Hirschey, 2006) and REIT securities (Lee and Lee, 2003), this variable is designed as a control for this potential influence.

Results are presented in Table 3 for the entire sample. We find a significantly positive (negative) relation between returns and Friday (Monday). This is consistent with a large amount of previous literature that documents these same findings in traditional stocks.[23] We also find a negative relation between temperature and REIT returns, which is consistent with Cao and Wei (2005) who find the same market-wide relation. Interestingly, the coefficient on JanDum is negative and significant. This is likely due to the inclusion of TYDum, however, as there is some overlap of the two variables.[24]

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[21]For robustness, we also examine the data using the Prais-Winstein method, which uses a generalized least squares method to examine a linear model where the errors are serially correlated. The results are qualitatively unchanged using this method.

[22]There are many ways to create this variable, based upon the number of days before and after the year-end is included in the definition. We have examined many specifications and found our results qualitatively unchanged.

[23]See Pettengill (2003) for a survey of the literature.

[24]When each is included alone, the coefficient on each is positive and significant.

To assure the model has addressed the issue of autocorrelation adequately, we also calculate the Baltagi and Wu (1999) least biased instrument (LBI) statistic for each regression. Because significant autocorrelation still exists at levels of LBI significantly lower than 2.0, it appears the AR(1) model specification has corrected for potential biases.

Table 3—Fixed Effects Regressions with an AR(1) Disturbance

	(1)		(2)	
	Coef	t-stat	Coef	t-stat
Intercept	.081[a]	4.44	.089[a]	6.14
SAD	.027[a]	3.91		
Fall	-.061[a]	-4.79		
OR			-.073[a]	-3.53
TYDum	.138[a]	6.40	.188[a]	9.71
Monday	-.039[a]	-4.33	-.039[a]	-4.40
Friday	.067[a]	7.66	.067[a]	7.68
Temp	-.000	-1.49	-.001[b]	-2.04
Prcp	.009	.94	.008	.89
JanDum	-.087[a]	-4.68	-.041[b]	-2.49
N	417,307		417,307	
F-value	31.36 (p = .0000)		34.22 (p = .0000)	
B-W LBI	2.15		2.15	

Note: This table presents results for the following fixed effects model with an AR(1) disturbance:

$$Ret_{i,t} = \beta_0 + \beta_{Firm} + \beta_1 SAD_t + \beta_2 Fall + \beta_3 OR + \beta_4 TYDum + \beta_5 Monday + \beta_6 Friday + \beta_7 Temp_t + \beta_8 Prcp_t + \beta_9 JanDum + \varepsilon_i$$

where $Ret_{i,t}$ is the percentage holding period return for firm i on day t. β_{Firm} is a vector of dummy variables to control for firm-specific effects. SAD is calculated as [H – 12] during fall and winter, zero otherwise, where H is the number of hours of night for the given day. Fall is a dummy variable equal to one if the observation date is during fall (i.e., September 21 to December 20), zero otherwise. OR directly measures the change in the ratio of onset-to-recovery of seasonal affective disorder for each day throughout the year. TYDum is a dummy variable equal to one if the observation day is one of the last ten days of December or the first ten days of January, zero otherwise. Monday (Friday) is a dummy variable equal to one if the observation day is a Monday (Friday), zero otherwise. JanDum is a dummy variable equal to one if the observation day is in January, zero otherwise. All other variables are as defined in Table 2. t-statistics are calculated assuming unequal variance. Significance at the 1 percent level is represented by a. Significance at the 5 percent level is represented by b. Significance at the 10 percent level is represented by c. The sample period is January 1985 through December 2006

Most importantly, we find a positive relation between SAD and RET, along with a negative relation between Fall and Ret. Combined, this indicates a seasonal component to REIT returns that is similar to that found by Kamstra, Kramer, and Levi (2003) for entire markets. That is, we find returns to be lower as the hours of sunlight diminish and higher as the days begin to lengthen again. This is inconsistent with our hypothesis and suggests that REITs are susceptible to the same SAD effects as traditional equities.

Given the known issues with the traditional approach as being an indirect measure of SAD, we also examine the sample replacing SAD and Fall with the

Kamstra, Kramer, and Levi (2008) OR variable. Results are again presented in Table 3 and are consistent with those found with the original specification. The negative coefficient indicates that at times during the year where there are more onsets of SAD than recoveries, returns are lower, which is consistent with the findings in the original model specification. Given that the two methods produce similar results and that OR is a direct proxy for seasonal depression, we will focus only on the specifications including this variable for the remainder of the paper.

Results: Segmented by Size

Numerous studies have found (both seasonal and nonseasonal) influences to be more pronounced in certain size segments of the population. Thus, it may be the case that our results are driven by a segment of the sample. We examine this notion by segmenting the sample into quintiles based upon the market capitalization of each security. Results are presented in Table 4.

Table 4—Sample Segmented by Size

	Q1		Q2		Q3		Q4		Q5	
	Coef	t-stat	Coef	t-stat	Coef	t-stat	Coef	t-stat	Coef	t-stat
Intercept	.079	1.46	.038	1.36	.073[a]	3.11	.074[a]	3.50	.030	1.61
Onset	-.215[a]	-2.95	-.079[c]	-1.66	-.030	-.76	-.049	-1.39	-.040	-1.22
TYDum	.271[a]	3.93	.276[a]	6.35	.182[a]	5.07	.144[a]	4.56	.076[b]	2.55
Monday	-.091[a]	-2.78	-.047[b]	-2.56	-.041[a]	-2.65	-.017	-1.23	-.012	-.97
Friday	.120[a]	3.70	.061[a]	3.40	.065[a]	4.39	.049[a]	3.73	.041[a]	3.39
Temp	-.001	-.65	-.000	-.01	-.000	-.56	-.000	-.27	.001[c]	1.75
Prcp	-.104[a]	-2.84	.008	.37	.039[b]	2.36	.046[a]	3.27	.064[a]	5.34
JanDum	.120[b]	2.10	-.023	-.61	-.084[a]	-2.73	-.099[a]	-3.60	-.066[b]	-2.47
N	83,418		83,336		83,265		83,366		83,522	
F-value	12.29 (p = .0000)		10.05 (p = .0000)		9.84 (p = .0000)		8.27 (p = .0000)		8.01 (p =.0000)	
B-W LBI	2.27		2.03		2.04		1.99		1.91	

Note: This table presents results for the sample segmented into quintiles by MktCap. All variables are as previously defined in Tables 2 and 3. Significance at the 1 percent level is represented by a. Significance at the 5 percent level is represented by b. Significance at the 10 percent level is represented by c. The sample period is January 1985 through December 2006

Examining each of the five quartiles, we find interesting results pertaining to the OR variable. Each coefficient has the expected negative sign; however, it is only highly significant for the smallest quintile. The second smallest quintile results indicate a marginally significant coefficient, but the results for the three largest quintiles indicate insignificant relations between seasonal depression and returns.

While the exact reason for this pattern cannot be determined with absolute certainty, there are logical suppositions that can be made. Historically speaking, small stocks are riskier than large, due in no small part to the lack of available information relative to their larger counterparts. Thus, in many ways it is unsurprising to find the primary result (which was consistent with a risk-reward shift by SAD-afflicted investors) appears to be driven by the subset of securities in the

sample where risk (and reward) is most prevalent. Large cap REITs, on the other hand, can be hypothesized to be safer and, to a lesser degree, behave similarly to Treasuries (as examined by Kamstra, Kramer, and Levi, 2008). The relative safety is not enough to put them into the same category as debt securities, but is likely enough to result in a significant dampening of the influence of seasonal depression (which results in an insignificant coefficient on OR).

In short, it is possible that small cap REITs are enough like traditional stocks (at least in the minds of SAD-afflicted investors) to induce the same trading reactions from SAD investors, while large cap REITs have a risk-reward tradeoff that more closely resembles debt securities. Thus, while these results still do not support our hypothesis of an opposite SAD effect, they are not inconsistent in that it appears a substantial portion of REITs have different SAD influences than traditional equities.

Results: Segmented by Time

REIT trading activity increased dramatically as a result of OBRA 1993. The increase was due primarily to increased institutional involvement. To examine this issue, we separate the sample into two subperiods: (1) 1985 to 1993 and (2) 1994 to 2006. These time periods correspond to a pre-and post-OBRA 1993 segmentation. Results for the two subsamples are presented in Table 5. We find a negative relation between OR and Ret for both time periods, which adds validity to our primary findings. In addition, the fact that the relation remains strong during the post-OBRA 1993 time period, which is associated with a higher level of institutional investment, makes this result interesting.

These results are inconsistent with the anecdotal notion that financial professionals (such as institutional investors) should be less prone to suffer from behavioral biases than typical investors. Presumably, because these investors typically trade large blocks of shares, one would expect any emotional component to be minimal. Given our findings, however, there are three possible explanations. First, it could be that there is a component of returns during the fall and winter that is driven by institutional investors and is, as yet, undefined in our model.

A second explanation is that a large percentage of the non-institutional investors are prone to seasonal depression.[25] Finally, a third explanation is that institutional managers are not immune to seasonal depression characteristics, despite their position as members of the financial profession. This is consistent with the findings of Dolvin, Pyles, and Wu (2008) who find professional financial analysts have increased biases in their earnings estimates during SAD periods. It is also possible

[25]Because institutional investing grew relatively steadily over time, if this were true, we would expect to see a diminishing significance of seasonal depression in more recent years. In unreported results, however, we examine the sample on a year-by-year basis and find that the influence of SAD actually increases over time.

the true answer is a combination of the three possibilities and could be a topic of future studies.

Table 5—Sample Segmented by Pre- and Post-OBRA 1993

	1985-1993		1994-2006	
	Coef	t-stat	Coef	t-stat
Intercept	.038	.52	.094[a]	6.57
OR	-.266[a]	-2.71	-.054[a]	-2.61
TYDum	.349[a]	3.91	.175[a]	9.00
Monday	-.193[a]	-4.37	-.024[a]	-2.69
Friday	.102[b]	2.31	.063[a]	7.36
Temp	.000	.34	-.001[b]	-2.33
Prcp	-.092[c]	-1.89	.019[b]	2.00
JanDum	.144[c]	1.82	-.053[a]	-3.23
N	36,241		381,066	
F-value	9.90 (p = .0000)		27.87 (p= .0000)	
B-W LBI	2.31		2.11	

Note: This table presents results for the sample segmented by the pre-and post-Omnibus Reconciliation Act (OBRA) of 1993. All variables are as previously defined in Tables 1 and 2. Significance at the 1 percent level is represented by a. Significance at the 5 percent level is represented by b. Significance at the 10 percent level is represented by c

Conclusion

Many studies recently have documented a strong psychological influence on market-wide equity returns. Little work has been done within the market to determine potential resource shifts among industries. In this study, we extend previous studies by examining a unique type of security, real estate investment trusts, which can be argued to have a more predictable return pattern (i.e., are safer). Our evidence is consistent with the notion of a distinct psychological seasonal effect on the REIT market. We initially find results consistent with those found in overall stock market analyses. A closer examination reveals that only the smallest 40 percent of REITs experience the same asymmetric relation as mainstream equities. Conversely, the largest 60 percent have no significant influence from seasonal depression, likely due to the safer nature of these securities.

In addition, we find the influence remains during the post-OBRA 1993 period, which adds to the interest of our findings, given that the returns are driven, in large part, by institutional investors during that time period. Our results indicate it is likely worthwhile to examine behavioral influences in specialty markets in addition to the overall market research that has been done. Specifically, the potential shift away from risky assets and toward safer assets as a result of purely psychological influences could provide many fertile research opportunities in the future. In addition, we shed light on the need to more closely examine behavioral issues, as relations may be driven by only a subset of the sample. Our work also adds to the abundant literature that examines REIT returns and offers a suggestion for a possible new influence to be considered in future works.

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