The Effect of Industry Business Cycles on the Information in Pro-forma Earnings: Evidence from U.S. REITs

Joy Begley*
Sandra Chamberlain*
Jeong Hwan Joo†

June 22, 2016

ABSTRACT: This paper investigates whether the valuation of the cash flow and depreciation components of net income vary over time for Real Estate Investment Trusts (REITs). The estimated model derives from the Feltham and Ohlson [1996] (FO96) framework, reinterpreted for the REIT sector. We show how the interaction of model coefficients with a continuous measure of demand for real estate reveals time-varying persistence in cash flows from operations and investing (economic fundamentals), versus time-varying depreciation accounting bias (an accounting fundamental). Our empirical application of the model suggests, as expected, that the persistence of the cash flow component of earnings is pro-cyclical, while the depreciation bias component is counter-cyclical. This result is new to the literature. An implication of this finding is that changing valuation weights on depreciation expense leads to variability in the ability of summary measures, such as net income or funds from operations, to explain firm value. This implication is true whether an investor focuses on GAAP net income, or a pro-forma measure such as Funds From Operations (FFO).

JEL Classification: G12, G29, L85, M41

Keywords: Funds from operations (FFO); Accounting depreciation bias; Real estate cycles; Feltham and Ohlson (1996)

Data Availability: All data used in the study are available from public sources.

* Sauder School of Business, University of British Columbia
† Faculty of Business and Economics, The University of Hong Kong

This paper is based on Prof. Jeong Hwan Joo's dissertation completed at the University of British Columbia. The paper has benefitted from audience contributions at The University of Hong Kong, and at presentations at the CAAA and FARs sectional meeting of the AAA. Individual comments from Rick Morton, Steve Matsunaga, David Guenther, and Nicole Johnson have been especially helpful.

1. Introduction

This paper links accounting valuation of Real Estate Investment Trusts (REITs) to time-series variation in the companion concepts of cash flow persistence and depreciation bias. By doing this, we add to a prior literature that documents how accounting valuations have changed over time. Using large samples, this research has found that variation in valuation weights can be related to firm fundamentals such as earnings persistence, growth, and (or) discount rates (e.g., Collins and Kothari [1989], Johnson [1999], or Kothari and Shanken [2003]). Yet, the possibility that instability in valuation weights is caused not just by variation in fundamentals, but also by variation in accounting quality, by sector or over time is relatively unexplored in this prior research (e.g., Collins, Maydew and Weiss [1997], Francis and Schipper [1999], Lev and Zarowin [1999], Jenkins, Kane, and Velury [2009]).[1] Despite the interest in understanding how accounting quality has impacted valuations over time, identifying research strategies that can disentangle the valuation effects of fundamentals (such as cash flows and discount rates) from the informativeness of accounting accruals is a challenge.

This paper uses the Feltham and Ohlson [1996] (FO96) model to identify these effects for firms, particularly REITs, with large depreciation charges. The FO96 framework identifies parameters associated with the valuation effects due to growth in cash flows and investing, and due to depreciation bias. We apply this framework to REITs and fixed-asset intensive non-REIT firms. The model is a price-levels regression that allows for different weights on depreciation expense versus the weight on non-depreciation component of income and allows these weights to vary over time.[2] Depreciation bias in this framework can be detected if the valuation weight on depreciation is different from the valuation weight on other income components. We demonstrate that time series variation in valuation weights is expected

[1] For example, in their study of changing valuation weights over time, Collins et al. [1997] comment: "The analysis in this paper raises a number of questions for future research. First, it is not clear whether the changes in value-relevance we document are due to changes in GAAP or due to 'real' economic changes. Second, the effects of variation in the value-relevance of earnings and book values across industries and changes in industry composition across time have not been fully explored."

[2] While FO96 doesn't explicitly include depreciation expense as a separate variable in their valuation model, they include a linear transfromation of depreciation expense, lagged property plant and equipment, that can capture the effect of a differential coefficent on depreciation relatvie to the coefficient on other components of net income.

if cash-flow persistence increases during booms and decreases during bust periods. If so, and if depreciation is unresponsive to booms and busts (consistent with REITs depreciating buildings on a straight-line basis over 40 years), then the valuation weight on depreciation expense is counter-cyclical (i.e., it is greater during bust periods and less during booms). The model demonstrates that net income receives a greater valuation weight during booms than during busts and the correction for depreciation bias will be larger during boom times. Consistent with these underlying assumptions, our empirical application of FO96 model to REITs suggests that cash flow valuation is pro-cyclical while depreciation valuation is counter-cyclical. This is a result that is new to our paper.

To cross-validate and to expand on this result, we explore whether this cyclicality also holds for a comparable sample of fixed-asset-intensive non-REITs. We borrow this strategy from Kang and Zhao [2010]. To the extent that the underlying assumptions of the FO96 model are true for both REITs and non-REITs, we expect to find similar depreciation bias levels and cyclicality. However, counter to this expectation, we find depreciation bias is lower for non-REITs than it is for REITs, and that valuation weights do not display cyclicality. These results are similar to those of Kang and Zhao who present evidence suggesting that depreciation is unbiased for fixed-asset intensive non-REITS. This prior paper attributes the differences between the REIT and non-REIT sample to the fact that REIT assets are held for sale in a liquid market, whereas the assets of non-REIT's are held for use and may be difficult to sell (page 232). We add to Kang and Zhao by expanding on this explanation. We contend that the lower depreciation bias in the non-REIT sample is likely attributable to differences in depreciation methods within the sample of non-REIT firms. In particular, some sectors within the non-REIT sample use asset allocation methods that are linked to asset usage and the resultant decline in the asset's future ability to generate cash. For example in the extractive sector, asset use is matched to revenues using depletion, while in the REIT sector, asset use is matched to revenues using straight-line depreciation. In general straight linedepreciation is insensitive to year to year changes in the assets future earnings potential that deviate from the long-term expect decline in the asset's resale value over its useful life. . Depreciation biases are higher on average in the REIT sector than they are in the extractive sector, this is potentially due to the extractive sector's more direct link between resource consumption and depreciation expense.

The paper begins with a review of the FO96 framework, where accounting bias is defined as a perpetual difference between market and book values. This theoretical framework pinpoints the meaning of the sign and magnitude of the estimated valuation coefficients on depreciation and non-depreciation components of net income.

In preliminary analysis, we estimate alternative valuation relations using both net income and funds from operation (FFO)--the premier valuation metric in the REIT industry. The definition of FFO is subject to quasi-regulation by the National Association of Real Estate Investment Trusts or NAREIT, the trade association for REITs. FFO intends to circumvent depreciation bias; it is measured roughly as earnings before depreciation expense and before gains and losses on the sale of property. The FO96 framework shows how these two measures of performance can explain stock prices equally well. Consistent with prior research, we find the explanatory power of the net income and FFO models are indistinguishable in the pre-2000 sub-period, but that the FFO valuation model dominates the net income model after 2000. Strictly speaking, this latter result is a puzzle, and it could be interpreted as a rejection of FO96 because, as mentioned already, when correctly specified, the two valuation approaches should be equivalent.

Of course, these preliminary tests assume stationarity of model parameters, and a rejection of the stationary model could alternatively be due to the applicability of this assumption. To address our main research question regarding macro-induced cyclicality in valuation arising from depreciation bias, we relax the stationarity assumption. We show that time series variation in valuation coefficients can occur if the persistence of cash flows is impacted by supply and demand shocks to real estate. We apply this time-varying coefficient model to data for 157 REITs, and, in supplemental tests that follow Kang and Zhao [2010], we also estimate the model for a matched sample of non-REIT firms. The empirical tests of the non-stationary FO96 framework lead to the aforementioned conclusions regarding the relative depreciation bias in REITs and in non-REITs.

This paper contributes to the literature in accounting along two main dimensions. First, we provide new insights to prior research on the valuation of REIT firms. These studies often attempt to understand the valuation characteristics of FFO versus net income. For example, Baik et al. [2008] propose that the different conclusions regarding the usefulness of net income versus FFO in the post-2000 period can be traced to new regulation from NAREIT that sharpened the measurement and disclosure of FFO. (Appendix A shows the evolution of NAREIT-defined FFO during our sample period.) Nevertheless, increased valuation cyclicality in the REIT setting in the post 2000 period coincides with this regulatory change and creates the potential for spurious conclusions. Our time-varying adaptation of FO96 in combination with our use of data from both decades allows us to formally test, whether differences in findings between the pre- and post-2000 periods are partially or wholly due to cyclicality in depreciation bias. Our tests comparing the pre- and post-2000 periods show both a discrete shift in the valuation weight applied to FFO (consistent with the prior evidence in Baik et al.) and cyclicality in cash flow and depreciation valuation weights.

In focusing on the role of depreciation bias, our conclusions also reflect back to the work of Gore and Stott [1998] (who use data from 1991-1996) and Kang and Zhao [2010] (who use data from 2000-2005). Yearly regressions using annual returns in Gore and Stott [1998] show varying signs and significance on depreciation expense (Table 5); this prior paper concludes the average value relevance of depreciation is zero. Kang and Zhao reach the opposite conclusion using a price levels regression. Because accounting depreciation bias in REITs varies with macro-economic conditions, we believe that focusing on a narrow time period, as prior papers have typically done, can lead to results that do not generalize.

Our papermakes a second contribution, contributing to the more general literature that examines the reasons that valuation parameters change with macro-economic factors. Our application of the adapted FO96 model (i.e., with time-varying coefficients) to REITS and non-REITs allows for well-reasoned interpretations of the changing valuation weights on specific earnings components. In particular we identify the role of fundamental drivers of value, meaning cash flows, versus, the quality of depreciation expense. Prior studies such as Bernard and Stober (1989), or Johnson (1999) use relatively large and heterogeneous samples to investigate the impact of business cycles on the information content of earnings or earnings components for stock returns. Others such as Francis and Shipper [1999], Collins, Maydew and Weiss [1997] or Core, Guay and Buskirk [2003] (along with the commentary by Kothari and Shanken [2003]) examine time-variation in valuation weights in a price levels regression. Similar to us, Kothari and Shanken's study directly links valuation weights in a price-levels formulation to macro variables as a means to shed light on the importance of time-varying accounting quality in value relevance studies.[3] However, like other prior studies, Kothari and Shanken do not separate accounting quality from real economic sources of variation in valuation. Our paper emphasizes the analytical benefits of considering sector-specific operating and accounting characteristics to develop models and tests that can discern among the differing and time-varying components of valuation. Primarily, the insights are sharpest for REITs, but, we use these insights to comment on valuation cyclicality in other sectors.

The remainder of this study is organized as follows. Section 2 provides background information on the REIT sector, including a brief review of real estate cycle theories. Section 3 presents the theoretical valuation model and hypotheses. Section 4 outlines key research design choices and explains our sample selection. Section 5 provides tests of our hypotheses, and Section 6 concludes the study.

2. The REIT setting and the REIT Valuation Literature

2.1 Background on Valuation Research for REITS

REITs are publicly-traded, flow-through entities which avoid corporate taxation by passing earnings to shareholders through dividends. To qualify for this tax shield, a REIT must invest most of its

---

[3] Also pertinent to our paper is Jenkins, Kane and Velury [2009]. Jenkins et al. relate business cycles to "conditional" conservatism using a reverse regression of earnings on returns as done by Basu [1997]. Using a large and sector-diverse sample, they document more conditionally-conservative reporting (meaning, a larger weight translating bad news to earnings) in contractions, and weaker value relevance of earnings for returns in expansions. For REITs, using a price-levels approach, the FO96 model shows more *unconditional* conservatism during booms (e.g., because depreciation is more understated during booms) and, *less* conservative accounting in busts. Hence, the prediction for unconditional conservatism is opposite to that proposed in Jenkins et al. [2009] for conditional conservatism. However, we would expect prices to be more positively related to net income during busts and less so during booms, consistent with the predictions in Jenkins et al., who use a different research method and focus on a different aspect of conservatism.

assets in real estate and earn the majority of its income from rentals (Matheson 2008). Because of the large holdings of developed property, REIT's depreciation expense is a dominate accrual. Hence, the setting is a good one for examining the valuation properties of depreciation expense.

REIT managers have argued that depreciation expense frequently exceeds the real depreciation of their developed property, thereby making net income understate firm performance. To overcome this shortcoming to net income, NAREIT (1991) developed a non-GAAP performance measure, FFO, which is based on net income measured before depreciation expense and before gains and losses on real property.[4] Since its introduction, most REITs have reported FFO in addition to net income in their annual reports. NAREIT member companies claim that FFO reflects firm performance more accurately than net income (NAREIT 1996), and analysts and the financial media have largely accepted FFO as a standard industry earnings measure, despite early criticisms from some analysts (e.g., Martinez [1998] and Smith [2001].)

The debates over the usefulness of FFO among market participants led to research examining how effective FFO and net income are in providing valuation relevant information for investors. These studies (e.g., Vincent 1998 or Fields et al. 1997) compare the two earnings measures based on their ability to explain levels of, or changes in, publicly traded equity values. However, the results of this research are mixed. For the most part, studies that estimate models in the 1990's are unable to differentiate the explanatory power of models that anchor on FFO versus net income. Research that uses data after the year 2000 when NAREIT imposed more structure on the disclosure and measurement of FFO, tends to conclude that FFO is more relevant (Baik et al. [2008] and Kang and Zhao [2010]). Note however the post-2000 research methods are not always comparable to the methods used on earlier sample periods.

The evidence in prior studies that relies on three- to six-year sample periods does not capture the impact of longer-term real estate cycles on FFO and net income valuation weights. While the market value of real property fluctuates with booms and busts, the book value of land is held constant and the

[4] Gains or losses on the sale of real property are in part a reflection of past over- (or under-) depreciation of real property. Therefore, FFO removes from net income both depreciation expense and gains or losses on the sale of real property.

non-land component of real property is systematically reduced through depreciation expense over time. Intuitively, depreciation expense can measure the declining cash generating potential of real property as demand falls or the structure wears out, but it will fail to capture increases in asset values when demand is high. This idea is not new and is the stated reason for developing FFO measures in the first place. In fact, Fields et al. [1998] appeal to a real estate downturn in the early 1990's to explain the negative coefficient they estimate on depreciation expense in their Table 3.[5] We conjecture that valuation models in the REIT setting can be improved by allowing for continuous variation in parameters with macro-measures of the supply and demand for real estate. We test this conjecture by allowing the valuation coefficients on income components including on depreciation expense to vary with supply and demand shocks in the real estate sector.

2.2 What causes real estate cycles?

Our empirical tests link measures of real estate supply and demand shocks to changing persistence of cash flows for REITs. Given this, a brief review of the nature of real estate cycles seems warranted. The idea that real estate fundamentals exhibit cyclical behavior is well-accepted, but economists have puzzled over the reasons for this cyclicality. To get a sense of what is meant by cyclicality, the plot of total returns for commercial real estate in Figure 1 Panel A is instructive. It shows two distinct peaks and one trough in a process that appears to move relatively smoothly between these local maxima and minima. This cyclicality can occur due to the responses of real estate participants (e.g., buyers, sellers and builders) to unobserved, cyclical shocks to underlying, macro-fundamentals such as unemployment or credit availability.

Alternatively cyclicality possibly originates from institutional frictions that lead to delayed responses of real estate prices to single shocks. Wheaton [1999]) explores this idea using a *stock-flow* durable goods framework. In his model, a single stochastic shock leads to a deviation in construction starts and rental prices from equilibrium levels. This misalignment lasts for more than one period due to

---

[5] This Table contains a regression of REIT market capitalizations on FFO, book value of equity, dividends and depreciation expense.

construction lags (i.e., it takes time to build new structures). Another contributing factor to the misalignment is the use of long-term lease arrangements which prevent rental revenues from immediately responding to changes in demand. Or, borrowing for construction projects requires collateral whose valuation depends on price estimates made before the new space is delivered. These explanations suggest reasons that investment and debt financing decisions might depend on current rather than future prices.[6]

3. Model Development and Hypotheses

3.1 Overview of FO 96

Although our primary focus is on time-variation in REIT valuation weights, the basic intuition for the interpretation of our model parameters derives from an off-the-shelf, stationary valuation model due to FO96. We start by describing the features of this model and then introduce time-varying weights. The FO96 model defines a permanent difference between market values and accounting book values as *accounting bias*. Bias can arise from fundamentals (such as value created by investing which is reflected in market value, but not in book value) and from accounting policies—in our case, depreciation schedules.

Not all accounting valuation models incorporate bias. The Ohlson [1995] model assumes that market and book values are equal over time; this occurs if the underlying times-series process of residual income (net income minus a capital charge) is auto-regressive. When residual income is autoregressive, it is straightforward to show that the market value of common equity (cum-dividend) is equal to the linear combination of two explanatory variables--net income and book value of equity.

FO96 augment the Ohlson [1995] model by adding the book value of property, plant and equipment, and investing outflows to better capture "real-world" accounting practices that could create persistent differences between market and book values. In FO96 valuation, the inclusion (beyond net income and book value of equity) of lagged book value of property plant and equipment allows for the

[6] Other sources of a lagged response to a supply or demand shift are offered by Rajan (1994), who links cycles in real estate to career concerns by bank managers; Herring and Wachter (1999) who propose myopia on the part of bank managers with respect to the likelihood of losses; and Pavlov and Wachter (2004) who tie real estate cycles to under-pricing of non-recourse real estate loans.

incorporation of depreciation bias in valuation. In addition, the FO96 valuation model incorporates book value bias due to unrecorded growth prospects (i.e., positive net present value investing) by incorporating investing cash flows as an information variable. These two modelled sources of bias are likely to be present in firms with large depreciation charges such as REITs.

With regard to depreciation bias, the FO96 model contains two key parameters to correct for this bias -- ω_{rr}, which captures the persistence of cash flows and is a "fundamental" driver of firm market value, and δ_{pe} which captures the depreciation policy of a REIT. In FO96 bias in depreciation occurs when ω_{rr} and δ_{pe} are different. When these parameters differ, a summary measure such as net income combines two components, cash flows and depreciation expense that will be valued by the market using different multipliers. Hence, if depreciation is biased, accuracy in valuation requires that the summary measure (net income) be broken into its components, cash flows and depreciation expense.

We model REIT free cash flows –operating cash flows net of investing cash flows—using the same cash flow dynamics as in FO96, but we interpret the parameters as well as the information variable, v_{ct}, as they apply to the REIT business model. Letting *cr* refer to operating cash flows and *ci* refer to investing cash flows, we assume the following dynamic relations over time (CFD1):

$$\begin{aligned} cr_{t+1} &= \omega_{rr}cr_t + \omega_{ri}ci_t + \omega_{rc}v_{ct} + \varepsilon_{1,t+1} \\ ci_{t+1} &= \omega_{ii}ci_t + \omega_{ic}v_{ct} + \varepsilon_{2,t+1} \\ v_{c,t+1} &= \omega_{cc}v_{ct} + \varepsilon_{3,t+1} \end{aligned} \qquad \text{CFD1}$$

We interpret the third equation, v_{ct}, as reflecting supply and demand shocks to real estate.

As mentioned above, the parameter ω_{rr} is the persistence of net operating cash receipts ($0 \leq \omega_{rr} < R$) and *R* is one plus the risk free rate of interest (*r*). For REITs, ω_{rr} captures repeated, but deteriorating (or growing) rental flows net of variable costs, as stipulated in long-term rental contracts. If ω_{rr} is less than 1, then each future rent is less than the previous rent, but, if $\omega_{rr} > 1$, then rents are growing over time. Beyond ω_{rr}, there are three model variables which stimulate next period's net operating receipts; these are capital investments, (*ci*), supply and demand shocks to real estate (v_{ct}) and random shocks, (e.g.,$\varepsilon_{1,t+1}$).

Capital investments (ci) represent construction of buildings or acquisitions of property, and are undertaken to generate new rents one period hence, equal to ω_{ri}. This growth in rents which is stimulated by supply and demand shifts (v_{ct}), is further magnified if investing, once stimulated, continues to persist at the rate, ω_{ii} ($0 \leq \omega_{ii} < R$).[8] One can interpret such persistence as the serial correlation in construction costs over several years as real estate projects are developed. These information dynamics allow investing to generate rents.

Cyclical supply or demand shocks, v_{ct} can influence either cash receipts directly through ω_{rc}, or they can influence them indirectly by stimulating investment. Similar to the implied assumptions about cash receipts and capital investment, these supply and demand shocks potentially exhibit persistence (i.e., through the parameter ω_{cc} which may be equal to zero and can be as large as R).

If supply and demand shocks (v_{ct}) are all zero, our information dynamics are exactly the same as FO96 page 212. To keep it simple, we assume, for now, that v_{ct} are zero. Given these cash flow dynamics, we can value a REIT using the cash flow variables, ci and cr, at time t.[9] However our aim is to incorporate valuation in terms of accounting numbers.[10] Therefore we convert the cash flow fundamentals to accounting numbers via the accounting relation (AR) identities in FO96:

$$bv_t = pe_t + fa_t \quad \text{(AR1)}$$
$$pe_t = pe_{t-1} + ci_t + depr_t \quad \text{(AR2)}$$
$$depr_t = pe_t - pe_{t-1} - ci_t = -(1-\delta_{pe})pe_{t-1} \quad \text{(AR3)}$$
$$ni_t = cr_t + depr_t + (R-1)fa_{t-1} \quad \text{(AR4).}$$

---

[8] If $\omega_{ii} = 0$ then there is zero persistence in capital investment. The valuation consequence of investments depends on whether investing is positive net present value (NPV), as discussed later.

[9] Defining *fa as* the fair value of financial assets and applying a discounted free cash flow valuation framework (using CFD1) yields the following, contemporaneous free cash flow valuation equation (FO96, page 213):
$V_t = fa_t + vo_t = fa_t + \beta_{cr} cr_t + \beta_{ci} ci_t$, where,
$\beta_{cr} = \Phi_r \omega_{rr}$ $\quad \beta_{ci} = 1 + R\Phi_i \eta$
$\Phi_r = (R - \omega_{rr})^{-1}$ $\quad \Phi_i = (R - \omega_{ii})^{-1}$ $\quad \eta = \Phi_r \omega_{ri} - 1$.
Intuitively, the coefficient on current cash receipts denotes the capitalizing of a smoothly growing or declining stream of rental income. The coefficient on investment is positive if the discounted cash flows generated by a dollar of investment, $\Phi_r \omega_{ri}$, exceeds the one dollar cost of the investment, which would implies investments are positive NPV.

[10] This allows for the possibility that in an empirical setting, current earnings and book values could provide superior forecasts of future cash flows than that provided by current period cash flows.

AR1 separates all assets into two categories; real property, *pe* which generates rents and potentially creates value for REITs, and financial assets, *fa* which provides a value-neutral return, *r*. AR2 is the t-account expression for net property plant and equipment, while AR3 formalizes our definition of depreciation expense. AR4 defines net income for a hypothetical REIT as net rental receipts minus depreciation expense and interest.

This model defines depreciation, AR3 to be a constant fraction 1- δ_{pe}, of beginning of period net developed property, similar to the declining balance method.[11] If *ppe* refers to property, plant and equipment, depreciation is -$(1-\delta_{pe})ppe_{t-1}$. FO96 assume firms choose δ_{pe} and the larger its magnitude, the smaller is annual depreciation expense. Consistent with actual practice, this parameter can't be greater than 1, i.e., $0 < \delta_{pe} < 1$. If $(1-\delta_{pe})$ records the fraction of assets that are expensed each period for depreciation, then, it follows that δ_{pe} measures the persistence of capitalized assets. The larger is δ_{pe}, the more gradual is the assumed decline in the earnings potential of assets.

Consistent with FO96, valuation Equation (1), expresses REIT value as a linear combination of net income, ni_t, dividends, d_t, historical book value of equity, bv_t, book value of real property, pe_{t-1} and investment, ci_t.[12]

$$V_t = \gamma_{ni} ni_t + \gamma_d d_t + \gamma_{bv} bv_t + \gamma_{pe} pe_{t-1} + \gamma_{ci} ci_t \quad (1)$$

The valuation weights depend on the parameters of the cash flow dynamics and accounting rules:

$\gamma_{ni} = R\Phi_r\omega_{rr}$ $\qquad$ $\gamma_d = -\Phi_r\omega_{rr} r$ $\qquad$ $\gamma_{bv} = 1 - \Phi_r\omega_{rr} r$

[11] The "declining balance" depreciation accounting policy parameter, δ_{pe}, is analytically convenient because it causes the asset associated with depreciation to persist in a linear fashion. FO96 show how the main intuition from their model holds with more realistic assumptions, such as straight-line depreciation.

[12] This model derives from a residual income valuation, employing both CFD1 and the accounting rules implied by AR1-AR4. A residual income model sums current book value of equity (bv_t) with the discounted stream of expected future residual income ($ni^a_{t+\tau}$).

$$V_t = bv_t + \sum_{\tau=1}^{\infty} R^{-\tau} E_t(ni^a_{t+\tau}) \quad \text{(RIV)}$$

Residual income for year *t*, is measured as net income minus a capital charge on the beginning-of-period book value of equity ($ni_t - r bv_{t-1}$). This valuation relation requires that accounting rules comply with the clean surplus relation (CSR), $bv_t = bv_{t-1} + ni_t - d_t$ (e.g. Ohlson [1995]).

$\gamma_{pe} = R\Phi_r(\omega_{rr} - \delta_{pe})$ $\qquad$ $\gamma_{ci} = R\Phi_i\eta$

$\Phi_r = (R - \omega_{rr})^{-1}$ $\qquad$ $\Phi_i = (R - \omega_{ii})^{-1}$ $\qquad$ $\eta = \Phi_r\omega_{ri} - 1$

Note that the coefficient on net income, γ_{ni} depends on the persistence of cash flows (ω_{rr}). The coefficient on lagged real property, γ_{pe} reflects the difference between the persistence of cash flows (ω_{rr}) which can also be thought of as "economic depreciation," and, the accounting measure of asset persistence implied by the choice of depreciation policy (δ_{pe}). The weight on lagged *pe*, γ_{pe}, is zero if the depreciation policy is unbiased so that $\delta_{pe} = \omega_{rr}$. Stated differently, under unbiased accounting there is no weight on depreciation expense, as captured by $pe_{t-1,}$ beyond that which is already reflected in net income.[13] Looking at AR3, depreciation expense is a linear function of pe_{t-1}. Therefore it is possible to specify the equation using either depreciation expense or the book value of real property.

Another form of accounting bias is captured in the coefficient on new investments, γ_{ci}. A positive coefficient on investing will occur if the term η, is positive. This term indicates if projects are positive net present value (FO96); this occurs, when the present value of the stream of cash flows on a dollar of new investments, $\Phi_r\omega_{ri}$, is greater than the dollar invested (i.e., the -1 in η). This is a form of accounting bias because GAAP prevent a REIT from recognizing immediately the future rents associated with new investment. Increased rents from positive net present value investment are reflected in market value immediately, but appear in the accounting records when recognized in future periods. The weight on new investment is zero if a REIT engages in zero NPV projects and it is negative if new projects are negative NPV.

Equation 1 provides a relatively parsimonious valuation model for a REIT, however, NAREIT has promoted the use of the alternative summary measure, FFO, since the early 1990's. It is straightforward to restate the above model in terms of FFO. Recall that FFO is roughly net income before

---

[13] REITs use the straight-line method to depreciate assets, typically over the maximum allowable life under GAAP (40 years). By choosing a small 1- δ_{pe}, firms are accommodating a relatively high cash flow persistence, ω_{rr}. For example 1- δ_{pe} equal to 1/40 = .025 would be unbiased if ω_{rr} is equal to 0.975, implying unbiased accounting if there are highly persistent rental flows..

depreciation and before gains and losses on real estate transactions.[14] Since the residual income valuation model applies to any accounting model that is consistent with the clean surplus relation, it also works with FFO as a measure of income, provided that book value is also measured before accumulated depreciation. This leads to the following alternative formulation of the accounting valuation model.

$$\mathrm{V_t} = \gamma_{\mathrm{ffo}}\mathrm{ffo_t} + \gamma_{\mathrm{d,ffo}}\mathrm{d_t} + \gamma_{\mathrm{bv,ffo}}\mathrm{bv_t^{ffo}} + \gamma_{\mathrm{pe,ffo}}\mathrm{pe_{t-1}^{ffo}} + \gamma_{\mathrm{ci,ffo}}\mathrm{ci_t}\,, \tag{2}$$

The valuation weights are as follows:

$\gamma_{\mathrm{ffo}} = \mathrm{R}\Phi_{\mathrm{r}}\omega_{\mathrm{rr}} = \gamma_{\mathrm{ni}}$ $\gamma_{\mathrm{d,ffo}} = -\Phi_{\mathrm{r}}\omega_{\mathrm{rr}}\mathrm{r} = \gamma_{\mathrm{d}}$ $\gamma_{\mathrm{bv,ffo}} = 1 - \Phi_{\mathrm{r}}\omega_{\mathrm{rr}}\mathrm{r} = \gamma_{\mathrm{bv}}$

$\gamma_{\mathrm{pe,ffo}} = \mathrm{R}\Phi_{\mathrm{r}}(\omega_{\mathrm{rr}} - 1)$ $\gamma_{\mathrm{ci,ffo}} = \mathrm{R}\Phi_{\mathrm{i}}\eta = \gamma_{\mathrm{ci}}$

In this equation, $pe_t^{ffo} = pe_{t-1}^{ffo} + ci_t$ is the gross book value of real property and bv_t^{ffo} is the book value of equity adding back accumulated depreciation. Notably, all of the coefficients in equation (2) are the same as their counterparts in equation (1), except for the coefficient on real property. This coefficient differs between Equation (1) and (2) because depreciation expense does not exist in an FFO valuation formulation (i.e., $\delta_{pe} = 1$).[15]

Under our assumptions, models (1) and (2) are just different representations of the same information, so in theory they explain value equally well. Each can be seen as a baseline model that relies on either net income or FFO; however, each contains bias-correcting terms for positive net present value investing and for depreciation bias. They form the basis for our first hypothesis.

> **Hypothesis 1**: The net income (Equation 1) and FFO (Equation 2) stationary models of REIT valuation including bias correcting terms have equal explanatory power.

This hypothesis is based on a stationary valuation model. We test this hypothesis in order to tie our results back to early studies on REIT valuations. However, our main interest is in a valuation model that

---

[14] While the NAREIT recommended definition of FFO has varied over time (see Appendix A), throughout our sample period it has always been measured before depreciation of real property, and before gains and losses on the sale of real property and extraordinary items. We measure net income before gains and losses on the sale of property, and we assume these are transitory. Hence, our theoretical model essentially ignores them.

[15] It is relatively easy to show that the valuation coefficients on pe_{t-1}^{ffo} and bv_{t-1}^{ffo} are both equal to zero if cash receipts have persistence equal to 1 (i.e., if $\omega_{rr=}$ 1). In this case, assets do not grow or decline in value implying economic depreciation is zero,, and *ffo* along with investing cash flows are sufficient to explain value.

allows for time variation in model parameters. Tests of hypothesis 1 provide baseline results to help judge the benefits of using a more complex valuation model with time variation in parameters.

3.2 FO96 with Time Varying Parameters

A key idea explored in this paper is that bias in depreciation expense, reflected in the difference between ω_{rr} and δ_{pe}, can vary with real estate cycles. For example, not all rental contracts renew in the same year, so the effect of a supply or demand shock to cash receipts can imply a change in the persistence parameter.[16] Time variation in the persistence of cash receipts (ω_{rr}), will cause valuation coefficients containing ω_{rr}, most notably the coefficients on *ni*, *ffo*, and lagged *pe*, to increase (in absolute value) as real estate markets expand.

To adjust the theoretical framework for time-varying weights, we use Equation (1), and decompose net income into two components, *ffo* and depreciation expense, $ni_t = ffo_t + depr_t$. This allows depreciation expense to replace lagged pe_t in Equation (1), through AR3. We also relax the assumption that real estate supply and demand shocks, v_{ct}, in CFD1 are equal to zero. These steps lead to a restated and expanded version of Equation (1), labelled Equation (1a),

$$V_t = \lambda_{ffo} ffo + \lambda_{depr} depr + \lambda_d d + \lambda_{bv} bv + \lambda_{ci} ci + \lambda_{vc} v_c \qquad \text{(1a).}$$

This contains new parameters, $\lambda_{vc} = \Phi_r \omega_{rc} + \Phi_i \eta \omega_{ic}$ and $\lambda_{depr} = \lambda_{ffo} - R\Phi_r (1 - \delta_{pe})^{-1} (\omega_{rr} - \delta_{pe})$; the other parameters are the same as in Equation 1. The weighting on the real estate cycle measure, v_{ct} reflects both ω_{rc}, which measures its role in generating new rents, as well as ω_{ic}, its role in generating investing.

The magnitude of the coefficient on depreciation expense λ_{depr} is the same as the coefficient on *ffo* if depreciation expense is unbiased (i.e., $\omega_{rr} = \delta_{pe}$) implying that the two components could be combined into one measure, net income. However, the valuation weight on depreciation expense is less than the weight on *ffo* if accounting depreciation overstates economic depreciation (i.e., $\omega_{rr} > \delta_{pe}$). In fact, if $\omega_{rr} > 1$, and $\delta_{pe} < 1$ the weight on depreciation expense is negative, indicating each dollar of

[16] Long-term rentals can take up to ten years to fully adjust to a change in demand.

depreciation actually translates into a higher market value. This occurs when REIT fundamentals are consistent with growing cash flows from the asset, while accounting rules require a depreciation charge that reduces the asset's book value. In such cases economic depreciation is positive, but accounting depreciation is negative. The market must undo the bias by placing a positive weight on depreciation expense.

So far, the model is stationary although, Equation 1a allows for a real estate shock to be observed by the market and incorporated into valuations. To obtain time varying valuation weights, we assume the parameters in CFD1 (e.g., ω_{rr}) are subscripted with time *t* and vary with the real estate cycle as follows:

$$\omega_{h,t} = \omega_{h,E} + \varphi_h \times cycle_t \qquad \text{(CFD2)}$$

In CFD2, $\omega_{h,t}$ are time-varying parameters (where h = rr, ii, allowing for possible cyclicality in persistence of cash receipts and investing); $cycle_t$ is a state variable for the period *t* phase of the real estate cycle, which fluctuates around a mean of zero; $\omega_{h,E}$ is a parameter measuring the long-term equilibrium of the real estate market (where $cycle_t = 0$); and φ_h is the sensitivity of $\omega_{h,t}$ to cycle at date *t*. With CFD2, the coefficients in Equation 1a take on an additional time subscript (e.g., $\lambda_{ffo,t}$). Unfortunately, this modification to the original cash flow dynamics leads to valuation coefficients which are *not* linear in *cycle* (Appendix B). Equation 3 below provides a linear approximation (achieved through the use of second order Taylor series approximations) to the valuation model that this modification yields.

$$\begin{aligned} V_t = &(\lambda_{ffo,E} + \lambda_{ffo,C} cycle_t)\, ffo_t + (\lambda_{depr,E} + \lambda_{depr,C} cycle_t) depr_t + (\lambda_{d,E} + \lambda_{d,C} cycle_t) d_t \\ &+ (\lambda_{bv,E} + \lambda_{bv,C} cycle_t) bv_t + (\lambda_{ci,E} + \lambda_{ci,C} cycle_t) ci_t + (\lambda_{vc,E} + \lambda_{vc,C} cycle_t) v_{ct} \end{aligned} \qquad (3)$$

Note this is just Equation 1a, modified so that the valuation weight on each explanatory variable can vary with cycle.[17] We are interested in the coefficients on *ffo* and on *depr* repeated here from Appendix B for convenience. (Again, the subscript *E* represents a long term equilibrium coefficient while the subscript *C* indicates the portion of the valuation coefficient which changes with cycles):

[17] This will be captured empirically through interactions between a proxy for "cycle" and the other independent variables in Equation 1a.

$$\lambda_{\text{ffo,E}} = R\Phi_{\text{r,E}}\omega_{\text{rr,E}} \qquad \lambda_{\text{depr,pe,E}} = \lambda_{\text{ffo,E}} - R\Phi_{\text{r,E}}(1-\delta_{\text{pe}})^{-1}(\omega_{\text{rr,E}} - \delta_{\text{pe}})$$

$$\lambda_{\text{ffo,C}} = R^2\Phi^2_{\text{r,E}}\varphi_{\text{rr}} \qquad \lambda_{\text{depr,pe,C}} = -\lambda_{\text{ffo,C}}(r/R)\delta_{\text{pe}}(1-\delta_{\text{pe}})^{-1}$$

where $\Phi_{\text{r,E}} = (R - \omega_{\text{rr,E}})^{-1}$.

The long term equilibrium valuation weight on ffo_t, $\lambda_{\text{ffo, E}}$, is very nearly the same as the valuation weight on net income, ni_t, in the stationary model (Equations 1 and 1a). The main difference is that $\omega_{\text{rr,E}}$, the equilibrium persistence of cash receipts now replaces ω_{rr}. The long term equilibrium weight on $depr_t$, $\lambda_{depr, E}$, deviates from the weight on depreciation expense in Equation 1a for this same reason.

The time-varying portion of the valuation weight on ffo_t, $\lambda_{ffo,C}$, increases in the sensitivity of the persistence of operating cash receipts to cycle, φ_{rr} from CFD2.[18] If this sensitivity is pro-cyclical ($\varphi_{rr} > 0$) the valuation weight on ffo_t will be pro-cyclical ($\lambda_{ffo,C} > 0$). Importantly, the valuation weights on ffo_t and $depr_t$ have opposite sensitivities to $cycle_t$. Intuitively, the time-varying valuation weight on $depr_t$ is counter-cyclical because δ_{pe} represents a fixed accounting policy for REITs, invariant to changes in the real estate cycle. In contrast, ω_{rr} is now able to vary due to factors that drive real estate cycles (e.g., construction lags and delayed contract renewals). Our second two hypotheses are based on these arguments.

> **Hypothesis 2** The sensitivity of the coefficient on FFO to *cycle* (i.e., the weighting on the interaction of *cycle* and *FFO*) is positive.

> **Hypothesis 3** The sensitivity of the coefficient on depreciation expense to *cycle* (i.e., the weighting applied to the interaction of *cycle* with *depr*) is negative.

As mentioned, the negative depreciation valuation sensitivity for REITs derives from our assumption (based on actual practice) that REITs have a fixed depreciation policy for buildings; typically these are amortized using the straight line method over 40 years. Feasibly, tension in H3 is created to the extent that the depreciation policy is not fixed. For example, if depreciation expense could respond to asset use (e.g., units of production depreciation or depletion), and if this occurs when the asset is truly

---

[18] The cyclical weights, captured by the interaction of *ffo* (*depr*) with cycle, can be derived by differentiating the expression for the long term equilibrium weight on *ffo* (*depr*) with respect to cycle.

being used up, then the valuation of such depreciation expense could be positive. These are not the type of assets that dominate the operations of a REIT, but they do exist in other industries, such as the resource industry. Therefore, H3 is more likely to be rejected in such a non-REIT setting.

> **Hypothesis 4** In non-REIT settings where depreciation policies and assets are similar to those of REIT's (e.g., hotels and restaurants) depreciation valuation will be more biased than in industry settings such as the extractive sector, where asset allocation methods are responsive to revenues and the economic use of the asset.

4. Research Design Choices, Sample, and Descriptive Statistics

4.1 Adaption of the Models for Empirical Application and Variable Measurement

In order to test H1-H4 we estimate empirical versions of the models in equations (1) to (3). Intercepts and error terms are added and we scale all variables by the number of shares outstanding. These modifications control for uncorrelated omitted variables and heteroscedasticity, and facilitate comparisons to prior studies.

The variables used in the empirical versions of equations (1) and (2) are defined in Appendix C. The dependent variable, $P_{t,}$ is stock price 90 days after the end of year *t*. Funds from operations per share (FFO_t) and net income per share (NI_t) for year *t* are the earnings measures in the two models. We use two different FFO measures: reported FFO which is collected from IBES actuals[19] and FFOCOMP which is an estimate of FFO constructed as Compustat net income before extraordinary items and discontinued operations, and, before depreciation expense.[20]

The variable BV_t in equation (1) denotes the book value of common equity per share at time *t*. In equation (2) BV_t^{ffo} is the book value of common equity per share, adding back accumulated depreciation per share. Similarly, the depreciation bias correction term in equation (1) is $PE_{t-1,}$ real property (including

---

[19] Reported FFO can include items beyond CFO and working capital accruals. For example, in 1999, the NAREIT recommended to its member companies that all non-recurring items, except for gains or losses on the sale of property and extraordinary items, should be included in FFO. Possibly, analysts could restate the 10-K, NAREIT version of FFO, to exclude non-property transitory items to improve forecasting accuracy (Bhattacharya et al. 2003). Similar to Baik et al. who examine 63 REIT disclosures, we examined 21 REITs (173 firm-years) and confirm the distributions are very similar.

[20] For REITs, discontinued operations contain gains and losses on sale of properties; therefore, empirically both net income and FFO are free from the influence of transitory items associated with the sale of real property, allowing us to focus on the influence of depreciation expense.

land), net of accumulated depreciation; in equation (2) PE_{t-1}^{ffo} is measured *before* accumulated depreciation. As in prior research common dividend per share declared for fiscal year *t* (DIV_t) is used as a proxy for net dividend per share.[21] Our capital investment proxy (INV_t) is net cash flows from investing activities (from the statement of cash flows) per share multiplied by –1; hence, capital spending outflows are positive in sign.

Equation 3 is estimated using the following empirical representation, Equation (4).

$$\begin{aligned} P_t = \gamma_0 &+ (\gamma_1 + \gamma_7 \text{CYCLE}_t) \times \text{FFO}_{\text{COMP},t} + (\gamma_2 + \gamma_8 \text{CYCLE}_t) \times \text{DEPR}_t + (\gamma_3 + \gamma_9 \text{CYCLE}_t) \times \text{BV}_t \\ &+ (\gamma_4 + \gamma_{10} \text{CYCLE}_t) \times \text{DIV}_t + (\gamma_5 + \gamma_{11} \text{CYCLE}_t) \times \text{INV}_t + \gamma_6 \times \text{CYCLE}_t + \varepsilon_t \end{aligned} \tag{4}$$

Estimation of Equation 4 requires a proxy for *cycle* and the shock term in Equation 3, v_{ct}. We develop one empirical proxy to capture both constructs, labeled CYCLE. By interacting CYCLE with the other explanatory variables, the coefficients on the interactions between CYCLE and FFO (CYCLE and depreciation) in equation 4 allow us to test H2 (H3). Although equation 3 might suggest including the square of CYCLE, equation 4 omits this term.[22]

The proxy for the real estate cycle phase for fiscal year *t* ($CYCLE_t$) is a weighted sum of filtered measures of three real estate market variables, capturing common-real estate cycle information (Appendix D). These real estate market variables include the total return index for real estate, the supply-demand gap for commercial real property, and the housing starts index. Using a filtering technique developed by Hodrick and Prescott (1997), we take the twelve month moving average of the cyclical components of the time-series of these three variables. Finally a composite index is formed using principle components (Panel D, Figure 1).

4.2 Sample Selection and Descriptive Statistics

Table 1 describes the sample formation which spans the period 1995-2008. Panel A describes the sample selection procedure for testing our main hypotheses. Accounting data from COMPUSTAT is

[21] In our theoretical model net dividends (d_t) is common dividends less net capital contributions (e.g. share repurchases); however, capital contributions is frequently missing in Compustat.
[22] We exclude CYCLE squared out of concern with the extremity of the trough in 2008. Our results are qualitatively similar if we include this term in our regressions.

merged with stock price and return data from CRSP, and FFO data from the I/B/E/S summary file (SIC code = 6798–6799, REITs). Mortgage REITs and hybrid REITs are excluded because depreciation expense is not a material component of earnings for these REITs (Vincent 1999). Observations with missing values of regression variables or zero depreciation expense are also deleted resulting in a sample of 1,116. To mitigate the effects of extreme outliers, we exclude observations with variables outside the mean ±3 standard deviations. The final sample is 1064 firm years for 157 REITs.

Table 2 presents the summary statistics of the samples used to estimate the valuation models. Mean price per share is $27.22, a little less than double the book value of equity per share, of $14.88; this is the difference that FO96 captures through its model of future growth opportunities and conservative accounting. The mean FFO per share of $2.27 is greater than common dividend per share ($1.63) and net income per share ($0.94). The distribution of FFO and CFO are very similar, suggesting that changes in working capital, estimated as the difference between FFO and CFO, are relatively minor. In some tests we separate the depreciable component of real property by measuring land versus buildings. The developed component of real property (BUILD) averages $31.16 per share in comparison to just $7.22 for land.

In the final nine rows of Table 2, Panel A, we report the data profile for a matched sample of non-REIT firms. One-to-one matching on the ratio of property, plant and equipment (including land) to total assets (FIXED) locates non-REIT firms that are nearly identical in their concentration of real property to assets. However, the non-REIT firms are of smaller scale with lower cash flow per share (REIT's $2.46 versus non-REIT's $1.77), and lower book value of equity (i.e., REIT average BV $14.88, non-REIT $7.47). In addition, the non-REIT sample pays lower dividends per share, and more than half are non-dividend paying firms. Panel B shows the concentration of industries that occurs when non-REIT firms are matched to REIT firms based on fixed asset ratios. As shown, the non-REIT matched sample includes a high concentration of extractive firms, along with restaurants, hotels, transportation firms and utilities.

Panel A, Table 3 reports simple correlation coefficients between market and accounting data for REITs. Stock prices are more strongly correlated with FFO than with dividends, CFO, or net income. Dividends are more strongly correlated with FFO (0.77) than with net income (0.51). There is a negative simple correlation between stock price and depreciation expense (-0.37), implying REITs with more depreciation have higher stock prices.

Panel B, Table 3 reports the correlation between the real estate cycle proxy, macroeconomic variables, and discount rates. The real estate cycle proxy is positively correlated with GDP growth and risk-free discount rates, and it is negatively correlated with the term premium on government bonds and the default spread on corporate bonds. Hence, the real estate cycle proxies are correlated with, but are not the same as, general business cycles.

5. Empirical Results

5.1 Testing H1 FO96 model works equally well for net income versus FFO

Table 4 presents an empirical analysis of REIT valuation based on net income and IBES FFO respectively using the full sample, column (a) and two sub-sample periods which align with prior research, 1995-1999 (column (b)) and 2000-2008 (column (c)). The Vuong *z*-statistic comparing explanatory power across the two models provides a formal test of H1 and is reported at the bottom of the Table. Based on this statistic, we reject H1 for the full sample, and for the post-2000 period, but not for the pre-2000 period. Consistent with early studies (e.g., Vincent [1998] and Fields et al. [1997]), for the pre-2000 period, the net income version of FO96 is statistically indistinguishable from the FFO version. Consistent with more recent studies (e.g., Baik et al.), explanatory power shifts in favor of FFO in the post 2000 period. This table suggests that shifting conclusions regarding the value relevance of FFO and net income are not due to omissions of bias terms in prior research.

Nevertheless, Table 4 results suggest that failing to consider this bias can be important. Specifically, there is no indication of depreciation bias in the pre-2000 sub-period (the valuation weight on PE_{t-1} does not differ from zero in the pre-2000 period) in the net income formulation, while the weight is positive and statistically significant in the post-2000 period. The depreciation bias correction term in the FFO model is negative and marginally significant in each sub-period, but not in the overall sample. A negative coefficient suggests that the market favors a small depreciation charge, in the presence of the FFO measure. Of course, the post 2000 period comprises both upswings and downswings in demand for real estate, so constraining coefficients on depreciation to be inter-temporarily constant within this sub-period is likely to be inappropriate and could lead to false conclusions regarding the irrelevance of depreciation. The analysis for H2 and H3 will relax this assumption.

There are two other observations from Table 4 that are pertinent with respect to our framework. The positive and significant coefficient on investing cash flows suggests these are value-creating on average for REITs. Investing cash flows are included to accommodate and control for growth, a control which is necessary because accounting measures such as earnings and book value do not recognize future rents. Second, several FO96 model restrictions are violated in Table 4. The model intercepts should be zero, but this restriction is violated in the pre-2000 period for the net income model and in the post-2000 period for the FFO model.[23] In addition, the coefficient on dividends is positive and significant, but the FO96 model predicts a small negative coefficient in this specification.[24] While the FO96 model offers us a structure for tests, it is probably unrealistic to expect that all restrictions will be met. In fact, hypothesized non-stationarity of valuation weights, tested through H2 and H3, could contribute to model violations.

To summarize, Table 4 confirms Hypothesis 1 for the first sub-period from1995-1999, but not in the post 2000 period. Baik et al. [2008] propose that the shift towards an FFO valuation model is due to changes in the definition of FFO, and increased disclosures that made this number more comparable across REITs. Kang and Zhao [2010] add to this discussion highlighting the potential bias due to depreciation expense in net income. We contend that real estate cycles became more variable following 2000 (Figure 1). Hence, bias in depreciation is likely to be greater in the post-2000 period, confounding inferences on whether greater reliance on FFO in valuation changes due to the re- defining of FFO by

---

[23] Begley, Chamberlain and Li demonstrate that a non-zero intercept can imply a failure to capture all value generating activities in the cash flow dynamics.

[24] Assuming the coefficient on book value in column (a) is correct, (0.22), the coefficient on dividends should be -0.88, rather than the estimated number of 7.74. The likely reason for this violation of coefficient restrictions is that in the REIT setting dividends act as an "other information" variable that predicts future cash flows or FFO. Lo and Lys [2000] suggest this result occurs due to omitting size as an additional explanatory variable. However, including size in Table 4 does not lead to negative sign on dividends in our sample.

NAREIT (proposed by Baik et al.), or if the shift is due to cyclical biases induced by macro-economic shocks which are omitted from Table 4. We address this issue in Table 7.

5.2 Testing H2 and H3—Is depreciation bias countercyclical?

Table 5 presents our main tests of Hypotheses 2 and 3 exploring whether valuation coefficients in REITs vary with cycles. Recall we test these two hypotheses using variations on equation 1a which breaks net income into funds from operation and depreciation expense. In addition, starting with Table 5 we use a self-constructed FFO--FFO_{COMP}.[25]

Columns (a) and (b) of Table 5 begin the analysis by showing the combined effect of adding a proxy for real estate cycle to equation 1 (i.e., equation 1a), with and without the CYCLE interactive terms. In column (a) the coefficient on CYCLE is positive and statistically significant with a point estimate, 4.97. At the mean of CYCLE reported in Table 2, 0.15, this adds about $0.75 to the average price per share. A one standard deviation in CYCLE of 1.05, increases the effect to about $5.22 or about 19% of average price. The addition of CYCLE increases the adjusted r-squared of 0.44 reported in Table 4 column (a), to 0.54 in Table 5 column (a). Note that the weights on FFO and depreciation are very different from each other in this regression (see the second to last row of the Table that shows this difference is statistically significant), indicating that it is not appropriate to place a single weight on both components of net income .

In column (b), we allow all of the coefficients to interact with the cycle proxy. The base coefficients on FFO_{COMP} and DEPR are positive and statistically significant with point estimates of $5.15 and $1.29. This is similar to column (a). The significant coefficient on depreciation in this column also implies that using the summary measure funds from operations, alone, is incomplete. The positive weight on DEPR suggests the role for a small deduction for depreciation expense in the presence of FFO_{COMP}. At the average FFO_{COMP} , the impact on REIT value is $12.51 per share ($2.43 x $5.15) while the average valuation effect of depreciation expense is -$1.92 (-$1.49 x 1.29).

Turning to the question of whether the coefficients vary cyclically, the weighting on FFO_{COMP}

[25] Results of Table 5 are very similar if we continue to use FFO from IBES.

interacted with CYCLE is positive, 1.30, and statistically significant, consistent with H2. At the average FFO per share and average measure of cycle, the total effect of this interaction is small, $0.47 (0.15 x 2.43 x 1.30). However, holding means constant, a one standard deviation shift in cycle increases the effect to about $3.82 ([1.06 + .15] x 2.43 x.1.30) per share.

In contrast to the positive cyclicality on FFO, the coefficient on depreciation expense, interacted with CYCLE, is negative and statistically significant (-1.43). This is consistent with H3. At the average depreciation expense (-$1.49 per share), a one standard deviation movement in Cycle (1.06) results in a $2.57 per share add-back to the baseline average effect of -$1.92, computed above. Finally, the adjusted r-squared of 0.44 reported in the first column of Table 4 (the net income version of FO96) can be compared to the adjusted r-squared in Table 5, column (b) of 0.58. Hence, adding CYCLE to the stationary FO96 model increases the model fit by 32% ([.58-.44]/.44).

Columns (c) to (f) provide sensitivity analyses and insight to these basic results. Columns (c) and (d) pull FFO apart into its cash flow component and a proxy for changes in working capital (FFO_{COMP} - CFO).[26] In the full interactive model, column (d), the proxy for working capital accruals has a multiplier of $2.86 (versus the coefficient on CFO of $5.57).[27] An unreported statistical test reveals that these two coefficients are not equal. However, the interactive coefficient on this proxy for accruals with CYCLE does not differ from zero, and the inclusion of this has little impact on inferences regarding the cyclicality of depreciation bias.

Columns (e) and (f) separate land assets from depreciable real property. (Land values were hand collected from 10-K statements.) By allowing for a separate coefficient on land, we implicitly allow δ_{pe} to differ for land assets (not subject to accounting depreciation) versus building assets. Column (f) shows

---

[26] Given the definition of FFO_{COMP} in Appendix C, FFO_{COMP}-CFO includes both working capital accruals and long term operating accruals (other than depreciation). However for the purpose of brevity we refer to this as "working capital accruals."

[27] Christiansen and Feltham Chapter 10 pp 340-342 extend the FO 96 model to include working capital accruals. This extension to the model requires a measure of the level of working capital in the model. Accordingly we add this variable, WC_{t-1} to all regressions that include FFO-CFO. Note that empirically working capital accruals are a minor portion of accruals for REITs (see Table 2), and including them in the formal model would complicate this paper without adding much insight.

that this formulation leads CFO to have a positive but insignificant interactive coefficient with CYCLE, but that depreciation continues to exhibit counter-cyclicality in its valuation weight. In addition, the coefficient on LAND is positive and significant (0.73), as is the empirical weighting on the interaction between land and cycle (0.29). Recall from our theoretical model that depreciation expense and buildings are linearly related. Therefore we do not include buildings in this model.

Finally, as in the stationary model contained in Table 4, investment (INV) shows a positive and statistically significant coefficient in most estimations (column (c) is the exception) confirming that investment is a positive net present value undertaking in this industry. The estimated coefficient on the interaction of investment with CYCLE is negative (e.g., -0.13 in column b), but differs from zero at the 10% level, in just one of the three model specifications. Our interpretation is that the marginal return to investing cash flows is not altered with real estate demand shocks. Note also, as in Table 4, dividends exhibit large positive coefficients, and these too are unaffected by the phase of the real estate cycle.

5.3 Testing H4--Cyclicality in non-REIT firms.

Our application of the FO96 framework assumes that the major accrual for REITs is depreciation expense, and that real property is the major asset generating a REIT's value (i.e., CFD1). This section explores whether results on cyclicality of valuation weights generalize to other firms that are also likely to generate value from real property, H4. Recall from Table 2 panel C that the matched control firms are clustered in the following sectors: 44% in extractive industries (e.g., petroleum, coal etc.), 19% transportation Firms (e.g., airlines), 19% restaurants and hotels, 10% utilities, and 8% entertainment (e.g., casinos and movie theaters).

In Table 6 Panel A, we report the results of estimating equation 4 for these matched non-REIT firm-years, using the implementation of this equation from Table 5 columns (c) and (d) where net income is decomposed into cash flow from operations, an estimate of working capital accruals and depreciation expense. This specification was selected because non-REIT firms because we are unsure whether the valuation weight on working capital accruals is the same as the weighting on CFO. In addition, we have not hand-collected land values for these firms. Comparing column (a), REITS, to column (c) non-REITs, the non-REIT firm sample exhibits a lower average valuation weight on CFO (4.54) versus the REIT CFO weight (5.78) suggesting that the persistence of cash flows is lower for the non-REIT sample. However, the estimated valuation weights on depreciation differ to an even greater degree for the non-REIT versus REIT firms. For the non-REIT sample, the weight on depreciation expense is a statistically significant 3.20, in comparison to a statistically insignificant, 0.97 for REIT firms. While depreciation expense is conservatively biased for non-REITS (the difference is shown in the second to last row of column (c)). For REITs the difference is much greater (4.81 versus 1.34). In addition turning to column (d), there is no evidence of cyclicality in valuation parameters for the non-REIT firms.[28]

The conclusions we draw with regard to this analysis are both similar to, and different from, Kang and Zhao [2010]. Similar to Kang and Zhao we conclude that for non-REIT firms, the market treats depreciation expense consistent with its capturing an economic decline in the value of the asset; for REITs this is true to a lesser degree. However, we add to the former study by highlighting the role of supply and demand shocks for REIT firms. REIT firms show pro-cyclical persistence in cash flows, and also countercyclical behavior of the valuation weight on depreciation. If we were limited to the evidence in Kang and Zhao [2010] we might be tempted to conclude that reliance on FFO alone, as a valuation metric, is justified because the market undoes the coefficient on accumulated depreciation that would otherwise be blended into the book value of equity.[29] Our specification that is more directly tied to the FO96 model, shows in both Table 4 and Table 5, that the adjustment depends on the stage of the real estate cycle.

Kang and Zhao argue that the difference in valuation between the two sectors is due to REIT properties being financial assets, whereas in other industries their properties are operating assets (page 228). The FO96 framework can be used to add subtly to this explanation.

---

[28] One challenge is comparing the CYCLE-interacted columns (b) to (d) is that our measure of CYCLE is tailored to the REIT industry. This would bias the non-REIT sector interactive coefficients towards zero.
[29] Note that Kang and Zhao focus on a model containing accumulated depreciation and the book value of equity to draw this conclusion. We rely on FO96 more directly and compare depreciation expense on cash flows from operations. In untabulated results we have replicated the research design exactly as shown in Kang and Zhao. We are able to document results very similar to Table 4, using their model.

Within the FO96 framework, valuation differences for depreciation expense between non-REIT and REIT firms depend on their respective depreciation policies δ_{pe} relative to the persistence of cash flows, ω_{rr}, and the degree to which the two parameters co-vary over time. Inspection of the sectors included in our non-REIT industries suggests there are good reasons for δ_{pe} to exhibit less bias in the control sample. In the extractive industries that comprise 44% of our control sample, depreciation, (which includes depletion of properties like mines), responds to the using up of extractive assets. This naturally causes the "depreciation policy" to track the revenues of extractive firms, as assets are pulled from wells or mines and sold. A smaller percentage, 10% of the non-REIT sample, comprises regulated utilities. In this setting pricing policies are often set by regulators to "recover" all allocated expenses including depreciation. This would tend again to cause δ_{pe} and ω_{rr} to vary together. The remaining industry sectors, predominantly hotels and entertainment, are harder to explain and seem to be more like REITs.[30]

We test this hypothesis in Table 6 panel B where the non-REIT firms are split into two sub-samples: (i) Entertainment, restaurants and hotels; and (ii) Extractive including oil and gas and mining. The first subsample is meant to capture firms with high levels of fixed assets that we suppose are using similar depreciation techniques to REITs. The second subsample employs depletion which allows the historical allocation of costs to move with usage. The results support our fourth hypothesis. As shown in the second to last row under column (e), depreciation in the extractive setting receives the same valuation weight (4.19) as the coefficient on cash flows (4.20), whereas the coefficient on depreciation in the first subsample (4.72) has a different and lower coefficient than the coefficient on cash flows (6.85). Thus, these results suggest the differences between the valuation coefficients on depreciation for REITs versus non-REITs observed in panel A, are at least partially due to differences in depreciation methods.

---

[30] There is also a difference in the vocabulary in our paper versus Kang and Zhao. In the FO96 world, real property of a REIT is an "operating asset" because of its potential to generate value via positive NPV investing. Financial assets in the FO96 framework earn a value neutral return. We doubt that Kang and Zhao meant, by labelling REIT assets as financial, that they believe these assets would not be able to earn positive rents. However, we still are unclear about the specific explanation given by Kang and Zhao for differences in depreciation valuation for REITs versus non-REITS, offered in this prior paper.

5.2 Confounding effects of the NAREIT (1999) regulation and discount rates

Table 5 provides convincing evidence that the valuation mapping between accounting information and market values for REITs changes over time, with real estate cycles. Table 7 analyses the robustness of our explanation for this time variation in the face of two other confounding factors. First, as pointed out by Baik et al. [2008], regulatory changes implemented by NAREIT in the definition and reliability of FFO present a reason for the shift in the valuation model shown in Table 4. We wondered if an alternative explanation for this shift is changes in the bias due to depreciation that accompanied the more variable cycles seen in the macro economy after 2000. This is addressed in Table 7. Second, the valuation weights on performance measures and depreciation expense should vary inversely with the risk free rate (Kothari and Shanken [2003] or Johnson [1999]). Hence an alternative explanation for time-variation in valuation weights, beyond changing persistence, is changes in interest rates. This issue is addressed in Table 8.

In Table 7 and 8, we estimate the following regression model:

$$P_t = \gamma_0 + \sum_{i=1}^{9} (\gamma_{1i} + \gamma_{2i}\mathrm{CYCLE_t} + \gamma_{3i} X_{\mathrm{t}}) z_{it} + \varepsilon_t \qquad (5)$$

where z_{it} refers to CFO_t, FFO–CFO_t, $DEPR_t$, BV_t, DIV_t, $WC_{t\text{-}1}$, INV_t, and $CYCLE_t$; and X_t is either REG_t, an indicator variable equal to zero for the pre-NAREIT regulatory period (1995–1999) and one for the post-NAREIT period (2000–2008), or it is $YIELD_{TB10Y,t}$, the yield to maturity on a U.S. 10-year Treasury bond at the end of year *t*, less its mean over the sample period. For completeness we show in these Tables the effects for non-REIT firms as well.

Results in Table 7, columns (a) and (b) indicate that the real estate-cycle effect reported in Table 5 is robust to the confounding effects of NAREIT (1999) regulation. In column (b), the positive coefficient on $CFO_t \times CYCLE_t$ supports the pro-cyclicality of the valuation weight on CFO (H3). The negative coefficient on $DEPR_t \times CYCLE_t$ confirms the counter-cyclicality of the valuation weight on depreciation expense (H3). At the same time, the significantly positive coefficients on $CFO_t \times REG_t$ and suggest that the NAREIT (1999) or other post-2000 institutional changes had a significantly positive impact on the valuation weights on CFO. Consistent with conclusions drawn by Baik et al., the significantly negative coefficient on $DEPR_t \times REG_t$ suggests that NAREIT (1999) regulation coincided with market valuations that rely more on FFO and less on net income, as a valuation measure. In general the Table suggests a shift consistent with NAREIT's redefining of FFO leading to an increased valuation weight on FFO, as well as, support for our hypothesis that the valuation of depreciation changes in cycles.

The results in Table 9 provide a similar message with respect to the confounding effects of interest rates valuation weights. As expected, the coefficients on CFO, FFO-CFO and DEPR all vary negatively in interest rates. In column (b) we see that this effect does not swamp out the pro-cyclical effect of the weighting on cash flows. However, the coefficient on depreciation expense interacted with the interest rate variable, while negative, is not statistically significant. This inability to separate the interactive denominator impact of interest rates from the interactive valuation weight of depreciation expense and CYCLE could be due to the expectation of negative sign for both effects.

6. Conclusion

This study investigates whether real estate cycles affect valuations weights on components of net income and FFO in a REIT setting. We interact the coefficients of an off-the-shelf valuation model proposed by FO96 with a continuous proxy variable that reflects real estate supply and demand. The model suggests that if valuation weights on the cash flow component of net income or FFO are pro-cyclical, the weight on depreciation expense should be countercyclical, consistent with the fixed depreciation policy used by REIT firms. Our evidence consistently supports these hypotheses. Our model allows us to separate cyclicality in valuation weights due to cash flow fundamentals from biases due to depreciation policies.

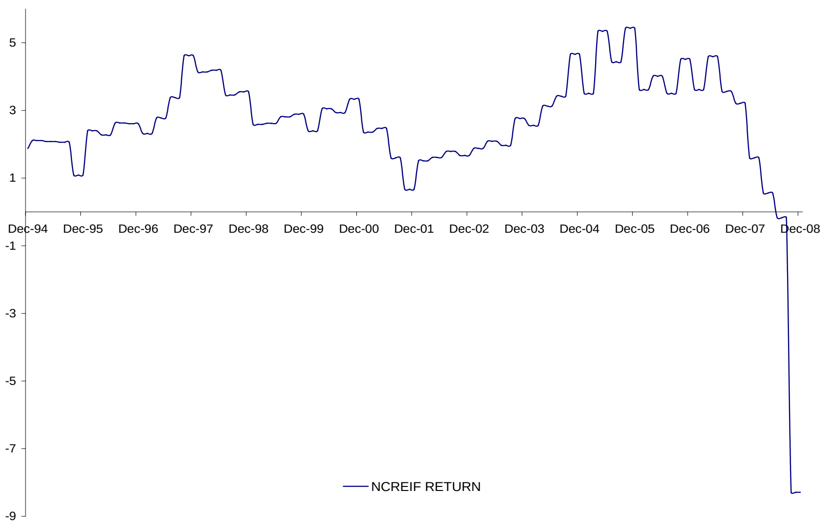
An analysis of a matched sample of non-REIT firms provides an additional benchmark for these results. High fixed asset, non-REIT firms demonstrate considerably less depreciation bias than do REIT firms.. The FO96 model should apply to both sets of firms. We supply evidence that the reason for differences in valuation weights derives from the use of an inflexible depreciation policy for REITs versus the activity-based methods used in the extractive industries that dominate the non-REIT sample.

This explanation provides new insights to prior similar results in Kang and Zhao [2010].

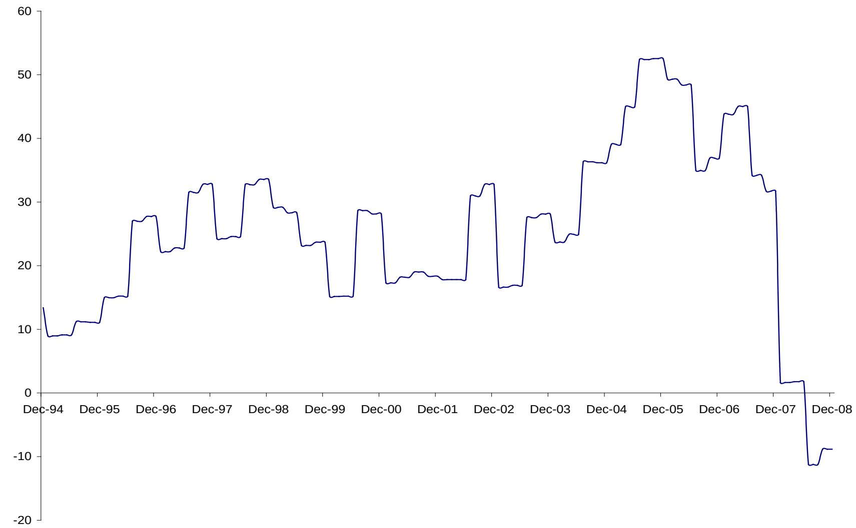
We show that depreciation bias is not static over the period 1995-2008. This expands on the analysis of REITs, not only relative to Kang and Zhao [2010] but also relative to Baik et al. [2008]. Baik et al. (2008) propose that the NAREIT (1999) regulation enhances the reliability of FFO disclosure, enabling investors to rely more on FFO in valuation. This study finds that the real estate cycles and, to the extent that the NAREIT (1999) regulation can be captured by a post-2000 dummy variable, both contribute to shifts in the relative explanatory power of FFO and net income across the sample periods used in prior studies.

Figure 1 The cyclical pattern in the real estate market variables

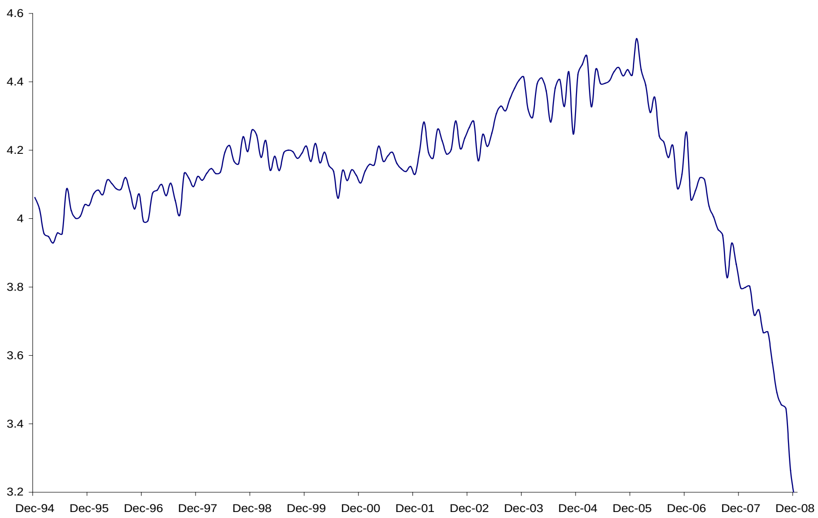
Panel A. The NCREIF total market return for commercial real estate



Panel B. The excess demand for commercial real estate



Panel C. The natural logarithm of housing starts



Panel D. The real estate cycle proxy (cycle$_t$)

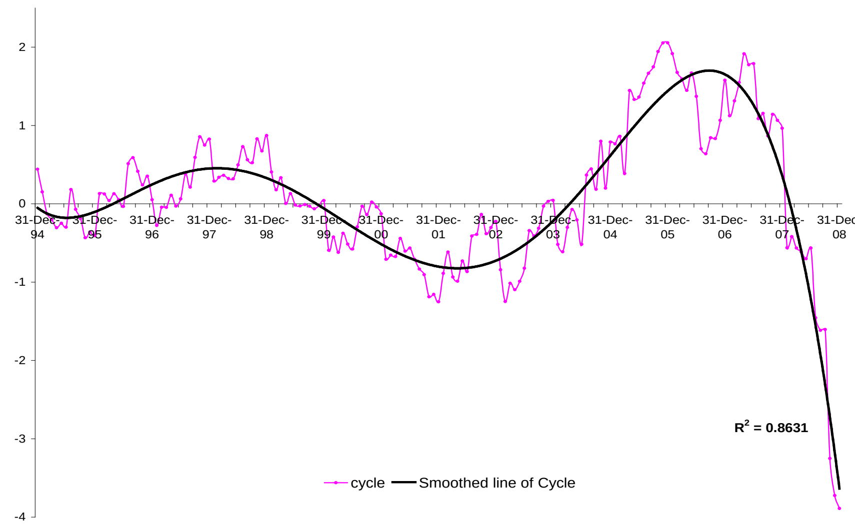


Figure 1 (Continued)

Panel E. A composite index of the (raw) real estate market variables

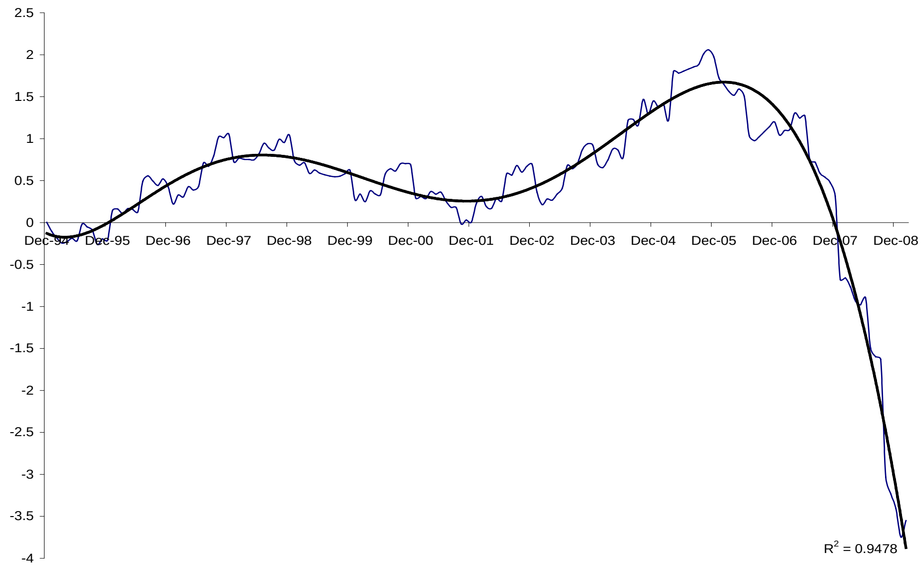


Figure 1 shows the cyclical pattern in the real estate market variables. **Panel A** shows the time series of the NCREIF total return for commercial real estate. The data is denominated in percentage points. The data is available at the NCREIF. The original data for a quarter is constant for three months within the quarter. **Panel B** shows the time series of the excess demand for commercial real estate. This variable is measured as the difference between the demand index and supply index for commercial real estate. The demand and supply indices are set at 100 as of January 1984. The original data for a quarter is constant for three months within the quarter. The data are obtained at the MIT center of real estate. **Panel C** shows the time series of the natural logarithm of housing starts. Housing starts are set at 100 as of January 1972. The data is obtained at the Federal Reserve Bank at Saint Louis. **Panel D** shows the time series of the composite index for real estate cycle ($CYCLE_t$). The red line indicates the first principal component of the cyclical components of the NCREIF total return, the excess demand for commercial real property, and housing starts. The cyclical component of each real estate market variable is extracted using the Hodrick and Prescott (1997) filter. The black thick line indicates smoothed line of $CYCLE_t$ that fits $CYCLE_t$ to a 6^{th} order polynomial with regard to time *t*. The fitted regression has R-squared of 0.863. **Panel E** shows the time series of an alternative composite index for real estate cycle ($CYCLE_{a,t}$). The red line indicates the first principal component of the NCREIF total return, the excess demand for commercial real property, and housing starts (not their cyclical components). The black thick line indicates smoothed line of $CYCLE_t$ that fits $CYCLE_t$ to a 6^{th} order polynomial with regard to time *t*. The fitted regression has R-squared of 0.948.

Appendix A. Changes in the regulatory definition of FFO

Funds from operation, generally speaking is GAAP earnings before depreciation expense, before gains and losses on the sale of real property and before extraordinary items. However, the measure is only quasi-mandated and REITs have developed idiosyncratic definitions, tailored to a particular year's events. The following table indicates whether, *relative to GAAP net income* an item was designated by NAREIT or the SEC to exclude (O) or include (X) this item. For example, depreciation expense on real property has always been excluded (O) from FFO, as has gains and losses on sales of property. In addition, the reconciliation of FFO to GAAP net income became mandated in 2002, allowing investors better information about the specific items included or excluded by particular REITs.

Items excluded from FFO	**1991–1994**	**1995–1999**	**2000–2002**	**2003–2008**
Depreciation expense on real property	O	O	O	O
Depreciation expense on company office buildings and improvements	O	X	X	X
Gains or losses on sales of property	O	O	O	O
Extraordinary items	O	O	O	O
Impairment losses	Not specified	O	O	X
Other non-recurring items	Not specified	O	X	X
Related regulations	NAREIT(1991)	NAREIT(1995)	NAREIT(1999)	NAREIT(1999) Reg. G (2002) SEC staff position (2003)

Note: The symbol O indicates that an item in the column is not included in calculation of FFO during the period indicated at the top of each column. The symbol X indicates that the opposite is true. Regulation G (2002) required a non-GAAP performance measure to be reconciled to its closest GAAP performance measure. Regulation G also required the definition of FFO to follow the definition of FFO provided by NAREIT (1999). See NAREIT (2003) for a summary of the SEC staff position about impairment losses.

Appendix B Coefficients of the time-varying valuation model[31]

With time varying coefficients (CFD2) and the expanded version of the net income model:

$$V_t = \lambda_{ffo,t} ffo_t + \lambda_{depr,pe,t} depr_t + \lambda_{d,t} d_t + \lambda_{bv,t} bv_t + \lambda_{ci,t} ci_t + \lambda_{vc,t} v_{vc,t} \quad (2a)$$

the valuation weights are:

$$\lambda_{ffo,t} = R\Phi_{r,t}\omega_{rr,t} \qquad \lambda_{depr,pe,t} = \lambda_{ffo,t} - R\Phi_{r,t}(\omega_{rr,t} - \delta_{pe})(1-\delta_{pe})^{-1}$$

$$\lambda_{d,t} = -\Phi_{r,t}\omega_{rr,t}(R-1) \qquad \lambda_{bv,t} = 1 - \Phi_{r,t}\omega_{rr,t}(R-1)$$

$$\lambda_{ci,t} = R\Phi_{i,t}\eta_t \qquad \lambda_{vc,t} = \Phi_{r,t}\omega_{rc} + \Phi_{i,t}\eta_t\omega_{ic}$$

where $\Phi_{r,t} = (R - \omega_{rr,t})^{-1} = (R - \omega_{rr,E} - \varphi_{rr}\text{cycle}_t)^{-1}$ $\quad \Phi_{i,t} = (R - \omega_{ii,t})^{-1} = (R - \omega_{ii,E} - \varphi_{ii}\text{cycle}_t)^{-1}$

As the state variable cycle_t appears in the denominator of the valuation weights in Eq. 2a they are a non-linear function of cycle_t. We use a Taylor series expansion to approximate a linear function.

Let $\lambda(\text{cycle}_t)$ be the non-linear valuation weight in Eq. 2a with regard to cycle_t. We assume that cycle_t is equal to zero when the real estate market is in long-term equilibrium and that cycle_t fluctuates around its long-term equilibrium level across valuation dates. Now, we take a first-order Taylor expansion of $\lambda(\text{cycle}_t)$ with regard to cycle_t at the point of zero (i.e., $\text{cycle}_t = 0$). Then, $\lambda(\text{cycle}_t)$ will be approximated to a linear function of cycle_t at the point of zero such that $\lambda(\text{cycle}_t) = \lambda(0) + (\partial\lambda(0)/\partial\text{cycle}_t)(\text{cycle}_t - 0)$ where $\lambda(0)$ is the long-term equilibrium valuation weight when $\text{cycle}_t = 0$, and $\partial\lambda(0)/\partial\text{cycle}_t$ is the first-order derivative of $\lambda(\text{cycle}_t)$ with regard to cycle_t at the point of zero. As a result, a valuation weight in Eq. 2a will be transformed into

$$\lambda_z(\text{cycle}_t) = \lambda_{z,E} + \lambda_{z,C}\text{cycle}_t \quad (4(a))$$

where:

z_t = A value-relevant information, where z_t is ffo_t, $depr_t$, d_t, bv_t, ci_t, v_{ct};

$\lambda_z(\text{cycle}_t)$ = The valuation weight on z_t;

$\lambda_{z,E}$ = The long-term equilibrium component of $\lambda_z(\text{cycle}_t)$ at the point of zero; and

$\lambda_{z,C}$ = The sensitivity of $\lambda_z(\text{cycle}_t)$ to cycle_t.

The *long-term equilibrium component* of a valuation weight ($\lambda_{z,E}$) can be expressed as:

$$\lambda_{ffo,E} = R\Phi_{r,E}\omega_{rr,E} \qquad \lambda_{depr,pe,E} = \lambda_{cfo,E} - R\Phi_{r,E}(1-\delta_{pe})^{-1}(\omega_{rr,E} - \delta_{pe})$$

$$\lambda_{bv,E} = 1-(r/R)\lambda_{cfo,E} \qquad \lambda_{d,E} = -(r/R)\lambda_{cfo,E}$$

$$\lambda_{ci,E} = R\Phi_{i,E}(\Phi_{r,E}\omega_{ri,E} - 1) \qquad \lambda_{vc,E} = \lambda_{ffo,E}\omega_{rr,E}^{-1}\Phi_{vc}\omega_{rc} + \lambda_{ci,E}\Phi_{vc}\omega_{ic}$$

where $\Phi_{r,E} = (R - \omega_{rr,E})^{-1}$, $\Phi_{i,E} = (R - \omega_{ii,E})^{-1}$, and $\Phi_{vc} = (R - \omega_{vc})^{-1}$.

Note that the long-term equilibrium component of valuation weight on CFO ($\lambda_{cfo,E}$) represents the present value of expected future operating cash flows generated from existing properties that were built or acquired by past capital investments, when the real estate market is in long-term equilibrium.

[31] A full derivation of these equations appears in Joo 2013 Appendix B.

The long-term equilibrium component of valuation weight on depreciation expense ($\lambda_{depr,pe,E}$) equals the long-term equilibrium component of valuation weight on FFO less the market's correction of conservative bias in accounting depreciation. If accounting depreciation equals expected economic depreciation ($1 - \delta_{pe} = 1 - \omega_{rr,E}$), the valuation weight on unbiased depreciation expense is equal to that on FFO. If accounting depreciation exceeds expected economic depreciation ($1 - \delta_{pe} > 1 - \omega_{rr,E}$), the market places a *lower* valuation weight on depreciation expense than on FFO in order to correct the conservative bias in accounting depreciation.

The sign of $\lambda_{depr,pe,E}$ depends on whether the value of real property is expected to appreciate or depreciate over the useful life of the property, where $\lambda_{depr,pe,E}$ is rearranged to $\lambda_{depr,pe,E} = R\Phi_r(1-\omega_{rr,E})\delta_{pe}(1-\delta_{pe})^{-1}$. If property value is expected to decline over the useful life of the property ($\omega_{rr,E} < 1$), $\lambda_{depr,pe} > 0$. If property value is expected to appreciate over the useful life of the property ($\omega_{rr,E} > 1$), $\lambda_{depr,pe} < 0$. If property value is not expected to change over the useful life of the property ($\omega_{rr,E} = 1$), $\lambda_{depr,pe} = 0$.

The *sensitivity of a valuation weight to cycle$_t$* ($\lambda_{z,C}$) can be written as follows:

$$\lambda_{ffo,C} = R^2\Phi^2_{r,E}\varphi_{rr} \qquad \lambda_{d,C} = -\lambda_{cfo,C}r/R$$

$$\lambda_{depr,PE,C} = -\lambda_{ffo,C}(r/R)\delta_{pe}(1-\delta_{pe})^{-1} \qquad \lambda_{bv,C} = -\lambda_{cfo,C}r/R$$

$$\lambda_{ci,C} = R\Phi_{i,E}\left[\Phi_{r,E}\varphi_{rr} + (\Phi_{r,E}\varphi_{rr} + \Phi_{i,E}\varphi_{ii})(\Phi_{r,E}\omega_{ri,E} - 1)\right] \qquad \lambda_{ci,C} = \lambda_{cfo,C}R^{-1}\Phi_{vc}\omega_{rc} + \lambda_{ci,C}\Phi_{vc}\omega_{ic}$$

The sensitivity of the valuation weight on FFO to cycle$_t$ is related to the sensitivity of the persistence of operating cash flows to cycle$_t$. Recall that the valuation weight on FFO is an increasing function of the time-varying persistence of operating cash flows ($\omega_{rr,t} = \omega_{rr,E} + \varphi_{rr}cycle_t$). If the persistence of operating cash flows is pro-cyclical ($\varphi_{rr} > 0$), the valuation weight on FFO is also pro-cyclical ($\lambda_{ffo,C} > 0$).

The sign of the cyclical coefficient on depreciation expense is opposite to the coefficient on ffo. This is partly due to the assumption that in practice the accounting depreciation policy does not respond to cycles (i.e., the REIT continues to use the same depreciation policy no matter the state of supply and demand.)

Appendix C. Definitions of variables

Variables in Tables 4, 5, 6, 7, and 8

P_t	Closing stock prices (PRC, CRSP monthly file) at the final trading date of the third month after the end of fiscal year *t*. PRC is adjusted to remove the affect of stock splits and dividends between the end of fiscal year *t* and the valuation date.
NI_t	Net income per share, which is measured as income before extraordinary items and discontinued operation per share less preferred dividends deflated by the number of common shares outstanding at the end of year *t* (COMPUSTAT (ib – dvp)/csho).
BV_t	Book value of common equity per share at the end of year *t* (COMPUSTAT ceq /csho).
$PE_{t\text{-}1}$	The book value of real property per share at the end of year *t*–1 (COMPUSTAT ret / csho). If ret is missing, we hand collect the data from the 10–Ks.
DIV_t	Common cash dividend per share for year t (COMPUSTAT dvc / csho).
INV_t	Capital investment per share for year t, measured as (-1)×(COMPUSTAT ivncf / csho) where ivncf is cash flows from investing activities.
FFO_t	Funds from operations per share, measured as I/B/E/S actual diluted FFO per share, adjusted to a basic FFO per share measure as follows: I/B/E/S diluted FFO per share times the number of shares used to compute diluted EPS (cshfd) less the amount of dilution, and then divided by the number of common shares outstanding at the end of year *t*. The amount of dilution is measured as diluted EPS (epsfx) times the number of shares used to compute diluted EPS (cshfd) less basic EPS (epspx) times the number of shares used to compute basic EPS (cshpri).
$BV_{t,\text{ffo}}$	Gross book value of common equity per share at the end of year *t* (BV_t + accumulated depreciation per share at the end of year *t*).
$PE_{t\text{-}1,\text{ffo}}$	Gross book value of real property per share at the end of year t–1 ($PE_{t\text{-}1}$ + accumulated depreciation per share at the end of year t-1
$FFO_{\text{COMP},\, t}$	FFO per share computed using COMPSTAT numbers. For REITs, NI_t - $DEPR_t$, and for non-REIT firms, NI_t - $DEPR_t$ + Per-share gain and loss on the sale of property (-1*COMPUSTAT SPPIV/csho).
CFO_t	Cash flows from operating activities per share for year t, which are measured as CFO (COMPUSTAT oancf) less preferred dividend (dvp) and then deflated by the number of shares outstanding at the end of year t (csho).
FFO - CFO_t	Non-CFO component of FFO measured as FFO_{COMP} minus CFO.
$DEPR_t$	Depreciation expense per share. For REITs, -1*COMPUSTAT dpc/csho where dpc is depreciation expense in the statement of cash flows. If dpc is missing, depreciation expense for real estate (COMPUSTAT dpret) is used. For non-REIT firms, -1*COMPUSTAT dpc/csho.
$WC_{t\text{-}1}$	The book value of working capital per share at the end of year t–1. For REITs, we define working capital as net operating assets other than real property and measure its book value as debt plus equity less cash and real property, operationalized as: total assets

	(COMPUSTAT at) – total liabilities (COMPUSTAT tl) + total debt (COMPUSTAT dltt and dlc) – cash and cash equivalents (COMPUSTAT che) – real property (COMPUSTAT ret). If any value is missing in COMPUSTAT, it is hand collect from the company's 10-K. Similarly, for non-REIT firms, we define working capital as net operating assets other than property, plant, and equipment and measure its book value as COMPUSTAT at – tl + dltt + dlc – che – ppent.
$LAND_{t-1}$	The book value of land per share at the end of year t-1
$BUILD_{t-1}$	The book value of buildings per share at the end of year t-1 (pe_{t-1} – $land_{t-1}$)
$CYCLE_t$	A composite index for real estate cycle phase for year t (See Appendix D for estimation)
$FIXED_t$	Fixed asset ratio at the beginning of year *t*. This ratio is measured as the end-of-year net property, plant, and equipment deflated by the end-of-year total assets net of cash and short-term investment for non-REIT firms and as the end-of-year net real property deflated by the end-of-year total assets net of cash and short-term investment for REITs.

Other variables in Tables 3, 8, and 9

$YIELD_{TB10Y,\,t}$	Yield to maturity on the U.S. 10-year Treasury bond at the end of year *t* less its mean for the period 1995–2008.
REG_t	An indicator variable for the post-NAREIT (1999) period, which is equal to one for the period 2000–2008 during which the NAREIT (1999) regulation is in effects, and is equal to zero for the period 1995–1999.
GDP_t	The cyclical component of the natural logarithm of GDP during year *t*
$TERM_t$	Term premium at the end of year *t*. The difference is yield to maturity on a government bond with 10 years to maturity and yield to maturity with 1 year to maturity
$DEFAULT_t$	Default-risk spread at the end of year *t*. The difference is yield to maturity on an Aaa corporate bond and yield to maturity on a Baa corporate bond.

Note: If a single measurement for a variable is provided, the variable measurement is the same for REITS and non-REITs.

Appendix D Measurement of the real estate cycle proxy

Appendix D describes the measurement of a proxy for the real estate cycle phase during a fiscal year. Because there are no definitive or uncontroversial proxies, this study forms a composite index that reflects common variation in three real estate market variables that capture the market demand for and supply of real estate. These variables include (1) the quarterly National Council of Real Estate Investment Fiduciaries (NCREIF) total return (hereafter, the NCREIF total return), (2) the difference between the quarterly demand and supply indices for the U.S. private commercial real estate market (hereafter, the excess demand), and (3) the monthly housing starts index (hereafter, housing starts). I will introduce each of these real estate market variables and discuss how they are formed into a composite index.

The NCREIF total return represents the market-level economic income on investment in commercial real property (NCREIF 2005). The NCREIF total return is computed by aggregating the net operating income and change in the market value of all commercial real property for a quarter. The value of a property is regarded as having changed during a quarter if an independent third party appraiser externally appraises the property, or if property managers observe changes in market conditions such as occupancy rates, rental rates, or interest rates. Property value can be adjusted for capital expenditures made during the quarter. The quarterly index data are available from 1978 to 2009.

Excess demand is measured as the difference between the demand and supply indices for commercial real estate provided by the Commercial Real Estate Data Laboratory at the MIT Center for Real Estate (MIT/CRE). The MIT/CRE measures the demand and supply indices by estimating the reservation prices of suppliers and demanders (unobservable latent variables) using observed trading prices and volumes, and the attributes of traded property. Excess demand represents market liquidity that is presumably positively correlated with real estate cycles (Fisher et al. 2003). These indices are available from 1984 to 2009.

Housing starts are expected to be correlated with the performance of REITs that specialize in the residential property sector. According to Mayer and Somerville (2000), housing starts are a function of changes in housing prices and construction costs, and changes in housing prices convey information on the unanticipated growth in demand for houses. The data are available from 1978 to 2009.

Each real estate market variable is likely to contain a common business-cycle component and an idiosyncratic component. To capture the common business-cycle information embedded in these variables, this study forms a composite index of these real estate market variables. The first step is to isolate the cyclical components of the three real estate market variables by using a filtering technique developed by Hodrick and Prescott (1997). The Hodrick and Prescott (1997) filter (hereafter, the HP filter) is used to decompose a real estate market variable into the equilibrium component and the cyclical component. Specifically, the HP filter is used to find a solution to the following optimization problem:

$$\underbrace{\text{Min}}_{\{g_t\}_{t=1}^{T}}\left[\sum_{t=1}^{T} c_t^2 + \lambda \sum_{t=1}^{T}\{(g_t - g_{t-1}) - (g_{t-1} - g_{t-2})\}^2\right] \qquad \text{(HP)}$$

Subject to $y_t = g_t + c_t$ for $t = 1, 2, 3, \ldots, T$

where y_t is the natural logarithm of one of the three variables, representing the total growth of the variable;[32] g_t is the equilibrium level of y_t; and c_t is the cyclical component of y_t, oscillating around a mean of zero. The HP filter relies on the notion that the long-term equilibrium growth rate of an aggregate economic variable (i.e., $g_t - g_{t-1}$) must be smooth. A sufficiently large number for λ is used to penalize the variability of the long-term equilibrium growth rate of the variable. Following Ravn and Uhlig (2002), λ = 129,600 is used for monthly data. Quarterly real estate market variables are assumed to have the same value for all three months within a quarter.

Next, this study computes the 12-month moving average of the cyclical components so that these variables may reflect cumulative changes in market demand during the last 12 months. The moving average data are not only compatible with contemporaneous annual financial data in the regressions but also reduce the effect of idiosyncratic variation in the individual real estate market variables.

Finally, this study forms a composite index of these cyclical components and matches it to annual financial data. Principal components analysis leads to the following composite index

$$\text{CYCLE}_t = 0.381\text{c}_{1t} + 0.351\text{c}_{2t} + 0.363\text{c}_{3t} \qquad \text{(CYCLE)}$$

where c_{1t}, c_{2t}, and c_{3t} are the 12-month moving average of the cyclical components of the NCREIF total return index, the excess demand index, and the housing starts index, respectively.

To check the robustness of results to the HP filtering, this study uses principal component analysis to measure a composite index of the three real estate market variables (not their cyclical components)

$$\text{CYCLE}_{a,t} = 0.385\text{NCREIF}_t + 0.344\text{EXC}_t + 0.366\text{HSTARTS}_t \qquad \text{(CYCLE-a)}$$

where NCREIF_t, EXC_t, and HSTARTS_t are the 12-month moving averages of the NCREIF total return index, the excess demand index, and the housing starts index, respectively. This alternative proxy, $\text{CYCLE}_{a,t}$, reflects the common variations of these three real estate market variables.

The calendar year 2009 is used to compute the composite index because the composite index is based on the moving average data for the last 12 months and matched to a fiscal year. The fiscal year-end month for fiscal year 2008 is from June 2008 to May 2009. Untabulated monthly time series of the composite index shows that calendar year 2009 consists of a down period and a subsequent up period. Similarly, the calendar year 2009 data are used to identify the real estate cycle phase that includes fiscal year 2008.

[32] This study takes a log of housing starts to eliminate the growth trend of the variable. In contrast, this study does not take a log of the NCREIF total return on the excess market demand, because these variables do not include a growth trend.

Table 1 Sample selection process

		Firm-years
Panel A. Sample for Tables 4, 5, 6, 7 and 8		
a)	All REITs on COMPUSTAT 2010 (SIC = 6798, 6799) for the period 1994–2008	3,376
b)	Merge with firm-years having non-missing actual FFO from I/B/E/S summary file (2010).	(1,656)
		1,720
c)	Merge with firm-years having non-missing stock prices from CRSP monthly file (2010).	(154)
		1,566
d)	Delete observations that have missing values for cash flows from operating activities net of preferred dividend, income before extraordinary items and discontinued operation net of preferred dividend, depreciation expense, gains and losses on the sale of property, capital investment, book value of common equity, common cash dividend (per-share data).	(52)
		1,514
e)	Delete observations for hybrid REITs and mortgage REITs[1)]	(99)
		1,415
f)	Delete observations that have depreciation expense of zero.	(3)
		1,412
g)	Delete observations that have missing values for lagged accumulated depreciation, lagged book value of building, lagged book value of land, and lagged book value of working capital (per-share data).	(296)
		1,116
h)	Delete observations with values exceeding $\pm$ 3 standard deviations from the mean of each variable of stock prices, FFO, income before extraordinary items and discontinued operation, capital investment, book value of common equity, book value of common equity plus accumulated depreciation, lagged book value of building, lagged book value of building plus accumulated depreciation, and common cash dividend (per-share data).	(52)
	(Number of equity REITs of the final sample = 157)	1,064

Notes:

1) List of mortgage and hybrid REITs for the period 1999–2008 obtained at the NAREIT's website. FTSE provides U.S. Real Estate Index series that cover Equity, Mortgage, and Hybrid REITs. We delete all firm-years of all REITs that are included in the list.

2) Tables 6 and 7 use a matching sample of non-REIT firms. Each REIT firm-year observation is matched to a non-REIT firm-year observation that has the same fiscal year and a fixed asset ratio closest to that of the REIT observation and is from an industry with mean industry fixed asset ratio of 0.5 or greater. The fixed asset ratio is measured as the book value of property, plant, and equipment deflated by the difference between total assets and cash and short-term investment. Industry classification is based on the Fama and French (1997) industry classification.

Table 2 Summary statistics of a trimmed sample

Panel A: Variables used in Tables 4, 5, 6, 8 and 9 (N = 1,064)

Variable	Mean	Std. dev.	Min	P25	Median	P75	Max
REIT observations							
Tables 4, 5, 6, 8, and 9							
P_t	27.22	16.73	0.71	15.25	24.69	35.05	130.41
NI_t	0.94	0.90	-3.03	0.39	0.95	1.52	4.56
FFO_t	2.27	1.04	-1.15	1.44	2.19	2.89	6.11
DIV_t	1.63	0.68	0.00	1.12	1.65	2.06	4.06
BV_t	14.88	6.81	-3.76	9.33	15.03	19.53	36.62
PE_{t-1}	38.38	18.18	0.71	25.18	35.42	47.97	108.22
BV_t^{FFO}	21.19	8.21	3.07	14.83	20.07	26.53	52.55
PE_{t-1}^{FFO}	44.11	20.83	1.32	28.70	41.14	54.86	123.94
FFO_{COMP}	2.43	1.17	0.32	1.55	2.31	3.17	6.79
CFO_t	2.46	1.23	-1.31	1.58	2.29	3.17	7.96
$FFO\text{-}CFO_t$	-0.19	0.75	-3.40	-0.46	-0.12	0.16	3.20
$FFO_{COMP}\text{-}CFO_t$	-0.04	0.68	-3.36	-0.32	-0.03	0.22	4.10
$DEPR_t$	-1.49	0.83	-6.17	-1.88	-1.33	-0.87	-0.13
INV_t	4.37	4.97	-8.70	1.19	3.11	6.51	28.80
WC_{t-1}	0.74	4.39	-21.23	-0.89	0.36	2.18	47.70
$LAND_{t-1}$	7.22	4.13	0.13	4.10	6.65	9.55	29.90
$BUILD_{c-1}$	31.16	15.47	0.59	20.00	28.91	38.49	88.87
$CYCLE_t$	0.15	1.06	-1.90	-0.68	0.07	1.54	2.04
YTM_{TB10Y}	-0.36	0.95	-2.57	-0.82	-0.44	0.20	1.32
$FIXED_t$	0.90	0.08	0.14	0.88	0.93	0.96	1.06
Non-REIT observations							
Tables 6, 8 and 9 (Selected from extractive, utilities, transportation, entertainment, restaurant, and hotel industries)							
P_t	15.56	13.59	0.15	6.17	11.67	21.79	113.43
CFO_t	1.77	1.46	-1.75	0.72	1.56	2.55	10.58
$FFO_{COMP}\text{-}CFO_t$	-0.30	0.68	-6.33	-0.46	-0.21	-0.07	4.51
$DEPR_t$	-0.97	0.73	-5.93	-1.19	-0.84	-0.45	-0.05
BV_t	7.47	5.10	-13.52	3.80	7.29	10.55	31.09
DIV_t	0.15	0.43	0.00	0.00	0.00	0.00	2.25
INV_t	2.26	2.52	-9.97	0.68	1.59	3.04	14.72
WC_{t-1}	-4.81	6.65	-35.20	-6.83	-3.05	-0.51	11.03
$FIXED_t$	13.82	0.90	0.08	0.15	0.87	0.93	0.96

Panel C. The industry composition of the non-REIT sample

Fama-French 48 industries	Three-digit SIC code	N
Tables 6, 8 and 9		
Coal	120 - 129	2
Petroleum and Natural Gas	130 - 138, 290 - 291, 299	420
Entertainment	780 - 799	91
Precious metals	104	48
Restaurants, Hotels, Motels	589, 700 - 701, 704, 721	215
Mines	100 - 103, 105- 111, 140 - 149	6
Transportation	400 - 478	167
Utilities	490 - 494	115
Total		1,064

Note:

P25 and P75 indicate the 25th and the 75th percentiles of each variable. ***, **, and * respectively indicate two-tailed significance at the 1%, 5%, and 10% level. For variable definitions see Appendix C.

Table 3 Spearman rank correlations

Panel A: Stock prices, accounting variables, and a real estate cycle proxy (1995–2008)

	NI_t	FFO_t	DIV_t	BV_t	PE_{t-1}	$BV_{ffo,\, t}$	$PE_{ffo,\, t-1}$	CFO_t	FFO_{COMP} - CFO_t	$DEPR_t$	INV_t	WC_{t-1}	$LAND_{t-1}$	$BUILD_{t-1}$	CYCLE
P_t	0.46	0.67	0.59	0.51	0.44	0.63	0.46	0.56	0.04	-0.37	0.20	0.15	0.47	0.39	0.30
NI_t		0.61	0.51	0.48	0.13	0.36	0.09	0.52	0.27	0.08	0.15	0.17	0.22	0.09	-0.03
FFO_t			0.77	0.63	0.65	0.76	0.64	0.79	0.05	-0.55	0.11	0.18	0.55	0.61	-0.08
DIV_t				0.61	0.57	0.72	0.57	0.68	0.06	-0.50	0.05	0.10	0.48	0.54	-0.05
BV_t					0.50	0.85	0.44	0.51	0.10	-0.32	0.26	0.08	0.41	0.48	-0.02
PE_{t-1}						0.74	0.99	0.66	-0.03	-0.82	0.01	-0.05	0.72	0.98	-0.09
$BV_{ffo,\, t}$							0.75	0.71	0.02	-0.68	0.15	0.04	0.60	0.71	-0.04
$PE_{ffo,\, t-1}$								0.67	-0.05	-0.85	-0.01	-0.05	0.72	0.97	-0.09
CFO_t									-0.36	-0.62	0.14	0.10	0.54	0.63	-0.10
FFO_{COMP} - CFO_t										0.01	-0.08	0.04	-0.05	-0.02	0.10
$DEPR_t$											0.02	0.01	-0.52	-0.82	0.03
INV_t												0.03	-0.02	0.02	0.20
WC_{t-1}													0.04	-0.07	0.03
$LAND_{t-1}$														0.58	-0.06
$BUILD_{t-1}$															-0.09

Panel B: Macroeconomic variables and a real estate cycle proxy (1995–2008)

	CYCLE	GDP	TERM	DEFAULT
GDP	0.41***			
TERM	-0.56***	-0.72***		
DEFAULT	-0.44***	-0.27***	0.42***	
$YIELD_{TB10Y}$	0.02***	0.18***	-0.32***	-0.61***

Note: ***, **, and * respectively denote two-tailed significance at the 1%, 5%, and 10% levels. For variable definitions see Appendix C.

Table 4 Estimation of the Feltham and Ohlson (1996) model

The NI model: $P_t = \alpha_0 + \alpha_1 NI_t + \alpha_2 DIV_t + \alpha_3 BV_t + \alpha_4 PE_{t-1} + \alpha_5 INV_t + \varepsilon_t$

The FFO model: $P_t = \alpha_0 + \alpha_1 FFO_t + \alpha_2 DIV_t + \alpha_3 BV_t^{FFO} + \alpha_4 PE_{t-1}^{FFO} + \alpha_5 INV_t + \varepsilon_t$

	(a) Full period 1995–2008	(b) The pre-NAREIT period 1995–1999	(c) The post-NAREIT period 00–08
The NI model			
Intercept	-0.97	2.65**	-0.95
NI_t	3.97***	4.66***	4.69***
DIV_t	7.74***	4.46***	7.60***
BV_t	0.22**	0.36***	0.25*
PE_{t-1}	0.17***	-0.05	0.17***
INV_t	0.44***	0.43***	0.87***
Adj-R^2	0.440	0.459	0.492
The FFO model			
Intercept	-3.16***	0.90	-2.88**
FFO_t	6.59***	2.50**	6.87***
DIV_t	2.88***	4.10**	3.43***
$BV_{t,ffo}$	0.54***	0.51***	0.53***
$PE_{t-1,ffo}$	-0.05	-0.10*	-0.08*
INV_t	0.38***	0.44***	0.71***
Adj-R^2	0.500	0.427	0.538
N	1,064	263	801
The Vuong (1989) tests for			
H1: The above equations have equal explanatory power.			
Z-value[1)]	-4.49***	1.45	-3.04***

Note:

The pre-NAREIT (post-NAREIT) period indicates the period before (after) the NAREIT established the new definition of FFO in 1999. The coefficients of all regressions in this table estimated using Ordinary Least Squares (OLS). The standard error of the coefficient of each variable is adjusted for the correlations of error terms within firm clusters and year clusters (Peterson 2008). ***, **, and * respectively denote two-tailed significance at the 1%, 5%, and 10% levels. The statistical significance for each variable is based on a two-tailed *p*-value based on *t*-statistics for the coefficient of each explanatory variable. If a Z-value of the Vuong (1989) test is significantly different from zero, the results reject H1. If a Z-value of the Vuong (1989) test is significantly positive, the net income model outperforms the FFO model. For variable definitions see Appendix C.

Table 5 Estimation of the modified Feltham and Ohlson (1996) model for REITs (Variations in the Base-case model)

$$P_t = \delta_0 + (\delta_1 + \delta_7 \text{CYCLE}_t)\text{FFO}_{COMP,t} + (\delta_2 + \delta_8 \text{CYCLE}_t)\text{DEPR}_t + (\delta_3 + \delta_9 \text{CYCLE}_t)\text{BV}_t + (\delta_4 + \delta_{10} \text{CYCLE}_t)\text{DIV}_t + (\delta_5 + \delta_{11} \text{CYCLE}_t)\text{INV}_t + \delta_6 \text{CYCLE}_t + \varepsilon_t$$

	Base case model		Adding working capital		Adding land	
	(a)	(b)	(c)	(d)	(e)	(f)
Intercept	-1.62	0.26	-1.84	0.01	-3.05***	-0.92
$\text{FFO}_{\text{COMP}t}$	**5.19*** **	**5.15*** **				
CFO_t			**5.78*** **	**5.57*** **	**8.06*** **	**4.88*** **
FFO-CFO_t			3.25***	2.86***	7.01***	2.67***
DEPR_t	**0.64**	**1.29** **	**0.97**	**1.57*** **	**1.61*** **	**2.51*** **
BV_t	0.32**	0.29***	0.34***	0.32***	0.15*	0.25***
DIV_t	6.68***	6.50***	6.08***	6.03***	3.47***	5.78***
WC_{t-1}			0.20*	0.24**	0.09	0.24**
LAND_{t-1}					0.65***	0.73***
INV_t	0.19**	0.24***	0.13	0.16**	0.19**	0.21***
CYCLE_t	4.97***	-1.19	5.18***	-1.21	5.39***	-1.619**
$\text{FFO}_t \times \text{CYCLE}_t$		**1.30** **				
$\text{CFO}_t \times \text{CYCLE}_t$				**1.11** **		**0.49**
$(\text{FFO-CFO}_t) \times \text{CYCLE}_t$				0.23		-0.12
$\text{DEPR}_t \times \text{CYCLE}_t$		**-1.43*** **		**-1.54*** **		**-1.19** **
$\text{BV}_t \times \text{CYCLE}_t$		0.09		0.13		0.09
$\text{DIV}_t \times \text{CYCLE}_t$		-0.11		-0.19		0.10
$\text{WC}_{t-1} \times \text{CYCLE}_t$				0.24**		0.23**
$\text{LAND}_{t-1} \times \text{CYCLE}_t$						0.29***
$\text{INV}_t \times \text{CYCLE}_t$		-0.13		-0.15*		-0.10
Adjusted R2	0.543	0.578	0.554	0.594	0.612	0.621
Tests for depreciation bias						
$\text{FFO}_{\text{COMP}t}$ - DEPR_t	**4.54*** **	**3.86*** **				
$\text{FFO}_{\text{COMP}t} \times \text{CYCLE}_t$ - $\text{DEPR}_t \times \text{CYCLE}_t$		**2.73*** **				
CFO_t - DEPR_t			**4.81*** **	**4.00*** **	**6.45*** **	**2.38*** **
$\text{CFO}_t \times \text{CYCLE}_t$ - $\text{DEPR}_t \times \text{CYCLE}_t$				**2.65*** **		**1.68*** **

Note: All columns in each Panel use 1,064 observations. ***, **, and * respectively denote two-tailed significance at the 1%, 5%, and 10% levels. All coefficients are estimated using OLS. The standard errors of coefficients are adjusted for firm- and year- clustering effects (Peterson 2008). Testing depreciation bias use the Huber-White heteroscedasticity-consistent covariance matrix.

Table 6. Estimation of the modified Feltham and Ohlson (1996) model for REITs versus Non-REIT firms

Model(column d): $$P_t = \delta_0 + (\delta_1 + \delta_9 \text{CYCLE}_t)\text{CFO}_t + (\delta_2 + \delta_{10}\text{CYCLE}_t)(\text{FFO - CFO}_t) + (\delta_3 + \delta_{11}\text{CYCLE}_t)\text{DEPR}_t + (\delta_4 + \delta_{12}\text{CYCLE}_t)\text{BV}_t$$
$$+(\delta_5 + \delta_{13}\text{CYCLE}_t)\text{DIV}_t + (\delta_6 + \delta_{14}\text{CYCLE}_t)\text{WC}_{t-1} + (\delta_7 + \delta_{15}\text{CYCLE}_t)\text{INV}_t + \delta_8\text{CYCLE}_t + \varepsilon_t$$

Panel A: REITs versus Non-REIT (Non-REIT firms extracted from extractive, utilities, transportation, entertainment, restaurant, and hotel industries**)**

	REITs		**Non-REITs**		**Coefficient difference (REIT – Non-REIT)**	
	(a)	(b)	(c)	(d)	(e)	(f)
Intercept	-1.84	0.01	4.74***	4.91***	-6.58***	-4.90***
CFO_t	**5.78*****	**5.57*****	**4.54*****	**4.49*****	**1.24***	**1.08**
$FFO\text{-}CFO_t$	3.25***	2.86***	1.99***	1.88***	1.26	0.98
$DEPR_t$	**0.97**	**1.57*****	**3.20*****	**3.14*****	**-2.23****	**-1.56***
BV_t	0.34***	0.32***	0.55***	0.55***	-0.21*	-0.21*
DIV_t	6.08***	6.03***	2.03***	2.08***	4.05***	3.94***
WC_{t-1}	0.20*	0.24**	0.10*	0.09	0.103	0.15
INV_t	0.13	0.16**	0.30**	0.28**	-0.164	-0.12
$CYCLE_t$	5.18***	-1.21	2.38***	1.01**	2.79***	-2.22**
$CFO_t \times CYCLE_t$		**1.11****		**0.35**		**0.76**
$(FFO\text{-}CFO_t) \times CYCLE_t$		0.23		-0.39		0.62
$DEPR_t \times CYCLE_t$		**-1.54*****		**0.77**		**-2.30*****
$BV_t \times CYCLE_t$		0.13		0.07		0.06
$DIV_t \times CYCLE_t$		-0.19		0.33		-0.51
$WC_{t-1} \times CYCLE_t$		0.24**		-0.08		0.32***
$INV_t \times CYCLE_t$		-0.15*		0.05		-0.20
Adjusted R2	0.554	0.594	0.594	0.620		
Tests for depreciation bias						
CFO_t - $DEPR_t$	**4.81*****	**4.00*****	**1.34*****	**1.35*****	**3.46*****	**2.65*****
$CFO_t \times CYCLE_t$ - $DEPR_t \times CYCLE_t$		**2.65*****		**-0.41**		**3.06*****

Table 6 (continued)

Panel B: REITs versus Non-REIT firms (Non-REIT firms selected from two groups of industries)

Model: Same as in Panel A

	REITs		**Non-REITs selected from entertainment, restaurants, and hotel industries**		**Non-REITs selected from extractive industries**	
	(a)	(b)	(c)	(d)	(e)	(f)
Intercept	-1.84	0.01	4.70***	4.89***	3.64***	3.94***
CFO_t	**5.78*** **	**5.57*** **	**6.85*** **	**7.45*** **	**4.20*** **	**4.07*** **
FFO-CFO_t	3.25***	2.86***	2.06***	2.11***	1.71***	1.98***
$DEPR_t$	**0.97**	**1.57*** **	**4.72*** **	**5.97*** **	**4.19*** **	**4.03*** **
BV_t	0.34***	0.32***	0.16*	0.30***	1.13***	1.11***
DIV_t	6.08***	6.03***	3.35***	1.81***	1.63	1.73
WC_{t-1}	0.20*	0.24**	0.00	-0.07	-0.08	-0.08
INV_t	0.13	0.16**	0.49***	0.22	-0.08	-0.05
$CYCLE_t$	5.18***	-1.21	1.92***	1.96***	3.29***	2.19***
CFO_t ×$CYCLE_t$		**1.11** **		**0.93* **		**0.36**
(FFO-CFO_t) ×$CYCLE_t$		0.23		1.25*		0.39
$DEPR_t$ ×$CYCLE_t$		**-1.54*** **		**1.90**		**0.61**
BV_t ×$CYCLE_t$		0.13		**-0.12**		**0.15**
DIV_t ×$CYCLE_t$		-0.19		-2.34**		0.16
WC_{t-1} ×$CYCLE_t$		0.24**		-0.08		-0.13
INV_t ×$CYCLE_t$		-0.15*		0.88***		-0.04
Adjusted R2	0.554	0.594	0.516	0.547	0.652	0.705
Tests for depreciation bias						
CFO_t - $DEPR_t$	**4.81*** **	**4.00*** **	**2.13*** **	**1.48* **	**0.49**	**0.04**
CFO_t ×$CYCLE_t$ - $DEPR_t$ ×$CYCLE_t$		**2.65*** **		**-0.97**		**-0.25**

Note: Each column uses 1,064 observations. Each REIT firm-year observation is matched to a non-REIT firm-year observation with the closest fixed asset ratio and its industry average fixed asset ratio is greater than 50%. All coefficients are estimated using OLS. The standard errors of estimated coefficients are adjusted for firm- and year- clustering effects (Peterson 2008). ***, **, and * respectively denote two-tailed significance at the 1%, 5%, and 10% levels. Testing depreciation bias use the Huber-White heteroscedasticity-consistent covariance matrix.

Table 7 Confounding effects of NAREIT (1999) regulations on valuation weights

Dependent variable = P_t	REITs		Non-REITs		Coefficient difference (REIT – Non-REIT)	
	(a)	(b)	(c)	(d)	(e)	(f)
Intercept	4.70***	6.32***	2.21*	2.69**	2.49	3.63*
CFO_t	**3.95*** **	**3.35*** **	5.43***	5.15***	-1.49	-1.60
$FFO\text{-}CFO_t$	**2.21* **	**2.41** **	4.11**	3.81**	-1.90	-1.40
$DEPR_t$	**7.53*** **	**7.74*** **	4.29**	3.63*	3.24	4.11*
BV_t	0.38***	0.34***	0.55***	0.54***	-0.17	-0.20
DIV_t	6.05***	6.01***	6.74***	7.45***	-0.69	-1.44
WC_{t-1}	0.31**	0.25	0.17	0.19	0.14	0.06
INV_t	0.47***	0.54***	0.59***	0.34	-0.12	0.20
$CYCLE_t$	-5.84***	-11.25***	1.85	0.70	-7.70***	-11.95***
$CFO_t \times CYCLE_t$		**1.51*** **		0.88		0.63
$(FFO - CFO_t) \times CYCLE_t$		**0.08**		1.32*		-1.24
$DEPR_t \times CYCLE_t$		**-1.09** **		1.85		-2.95**
$BV_t \times CYCLE_t$		0.13*		-0.06		0.19
$DIV_t \times CYCLE_t$		-0.02		-2.66**		2.63*
$WC_{t-1} \times CYCLE_t$		0.19*		-0.10		0.29**
$INV_t \times CYCLE_t$		-0.21**		0.81***		-1.02***
REG_t	-6.23***	-5.92***	4.25***	3.39**	-10.48***	-9.31***
$CFO_t \times REG_t$	**2.84** **	**3.01** **	2.21	2.77**	0.63	0.24
$(FFO\text{-}CFO_t) \times REG_t$	**1.22**	**0.58**	-2.40	-1.74	3.63	2.32
$DEPR_t \times REG_t$	**-5.31*** **	**-4.91*** **	3.12	3.66	-8.43***	-8.57***
$BV_t \times REG_t$	-0.03	0.01	-0.37*	-0.32	0.34	0.33
$DIV_t \times REG_t$	0.08	0.02	-6.15***	-7.03***	6.24***	7.04***
$WC_{t-1} \times REG_t$	-0.21	-0.10	-0.34**	-0.38***	0.13	0.29
$INV_t \times REG_t$	-0.06	-0.07	0.06	0.06	-0.12	-0.13
$CYCLE_t \times REG_t$	11.34***	10.16***	1.10	1.23	10.24***	8.93***
Adjusted R2	0.623	0.667	0.541	0.573		
Tests for depreciation bias						
$CFO_t – DEPR_t$	**-3.58*** **	**-4.19*** **	**1.14**	**1.52**	**-4.73*** **	**-5.71*** **
$CFO_t*CYCLE_t – DEPR_t*CYCLE_t$		**2.60*** **		**-0.97**		**3.57*** **
$CFO_t*REG_t – DEPR_t*REG_t$	**8.15*** **	**7.92*** **	**-0.91**	**-0.89**	**9.06*** **	**8.81*** **

Note: All columns use 1,064 observations. Non-REIT firms are selected from extractive, utilities, transportation, entertainment, restaurant, and hotel industries. REG_t is an indicator variable for the period following the NAREIT's (1999) guidance on the definition of FFO. The other variables are as previously defined. All columns in each Panel use 1,064 observations. All coefficients are estimated using Ordinary Least Squares (OLS) with firm-year clustering effects corrected (Peterson 2008). ***, **, and * respectively denote two-tailed significance at the 1%, 5%, and 10% levels. The tests for the equations of coefficients are based on the Huber-White heteroscedasticity-consistent covariance matrix.

Table 8 Confounding effects of discount rates on valuation weights

Dependent variable = P_t	REITs		Non-REITs		Coefficient difference (REIT – Non-REIT)	
	(a)	(b)	(c)	(d)	(e)	(f)
Intercept	-2.49**	0.82	4.22***	4.64***	-6.71***	-3.83***
CFO_t	**4.58***	**4.59***	**6.89***	**6.69***	**-2.30***	**-2.10***
FFO - CFO_t	**3.01***	**2.81***	**2.85***	**2.68***	**0.17**	**0.13**
$DEPR_t$	**0.46**	**2.14***	**6.11***	**5.77***	**-5.65***	**-3.63***
BV_t	0.34***	0.32***	0.41***	0.43***	-0.07	-0.11
DIV_t	7.18***	6.89***	2.16***	2.62***	5.02***	4.28***
WC_{t-1}	0.35***	0.31***	-0.08	-0.08	0.44***	0.39***
INV_t	0.27***	0.32***	0.59***	0.17	-0.32	0.15
$CYCLE_t$	4.12***	-2.68***	2.20***	1.74**	1.92***	-4.42***
$CFO_t \times CYCLE_t$		**1.89***		**1.33**		**0.56**
(FFO - CFO_t) × $CYCLE_t$		**0.68**		**0.75**		**-0.06**
$DEPR_t \times CYCLE_t$		**-1.24**		**2.40*		**-3.64**
$BV_t \times CYCLE_t$		0.12		-0.12		0.24*
$DIV_t \times CYCLE_t$		-0.60		-2.59**		1.99
$WC_{t-1} \times CYCLE_t$		0.17		-0.09		0.26*
$INV_t \times CYCLE_t$		-0.24***		0.91***		-1.14***
$YTM_{TB10Y,\,t}$	-3.07***	-0.98	-2.93***	-1.49***	-0.14	0.51
$CFO_t \times YTM_{TB10Y,\,t}$	**-3.40***	**-3.38***	**-0.94**	**-1.76***	**-2.45***	**-1.62**
(FFO - CFO_t) × $YTM_{TB10Y,\,t}$	**-1.40***	**-1.39**	**1.51***	**0.84**	**-2.91***	**-2.23**
$DEPR_t \times YTM_{TB10Y,\,t}$	**-1.97***	**-0.70**	**-1.92*	**-2.86***	**-0.05**	**2.16*
$BV_t \times YTM_{TB10Y,\,t}$	0.05	0.02	0.22***	0.14	-0.16	-0.12
$DIV_t \times YTM_{TB10Y,\,t}$	1.98**	1.83**	1.98***	2.52***	0.00	-0.69
$WC_{t-1} \times YTM_{TB10Y,\,t}$	0.29***	0.18**	0.06	0.11	0.22**	0.06
$INV_t \times YTM_{TB10Y,\,t}$	0.32***	0.34**	-0.03	-0.10	0.35*	0.45**
$CYCLE_t \times YTM_{TB10Y,\,t}$	-1.43***	-1.85***	-1.04**	-0.14	-0.39	-1.71***
Adjusted R^2	0.594	0.637	0.569	0.539		
Tests for depreciation bias						
$CFO_t - DEPR_t$	**4.13***	**2.45***	**0.78**	**0.91**	**-4.73***	**-5.71***
CFO_t*$CYCLE_t$ – $DEPR_t$*$CYCLE_t$		**3.13***		**-1.07**		**3.57***

Note: All columns use 1,064 observations. Non-REIT firms are selected from extractive, utilities, transportation, entertainment, restaurant, and hotel industries. $YTM_{TB10Y,\,t}$ is the difference between the yield-to-maturity for the U.S. 10-year Treasury bond and its average for the 1995–2008 period. The other variables are as previously defined. All columns in each Panel use 1,064 observations. The coefficients of all regressions in this table are estimated using Ordinary Least Squares (OLS) with firm- and year-clustering effects corrected (Peterson 2008). ***, **, and * respectively denote two-tailed significance at the 1%, 5%, and 10% levels. The tests for the equations of coefficients are based on the Huber-White heteroscedasticity-consistent covariance matrix.

REFERENCES

Baik, B., B. Billings, and R. Morton. 2008. Reliability and transparency of non-GAAP disclosures by real estate investment trusts (REITs). *The Accounting Review 83*: 271–301.

Brown, S., K. Lo, and T. Lys. 1999. Use of R^2 in accounting research: measuring changes in value relevance over the last four decades. *Journal of Accounting and Economics* 28(2): 83–115.

Christensen, P., and G. Feltham. 2003. *Economics of accounting, Volume I - Information in markets*. Amsterdam: Kluwer Academic Publishers.

Collins, D. W. and S. P. Kothari. 1989. An analysis of intertemporal and cross-sectional determinants of earnings response coefficients. *Journal of Accounting and Economics* 11: 143-181.

Collins, D. W., E. L. Maydew and I. S. Weiss 1997. Changes in the value-relevance of earnings and book values over the past forty years. *Journal of Accounting and Economics*. 24: 39-67

Core, J., Guay, W., Van Buskirk, A., 2003. Market valuations in the new economy: an investigation of what has changed. *Journal of Accounting and Economics* 34, 43-67.

Fama, E. and K. French. 1989. Business conditions and expected returns on stocks and bonds. *Journal of Financial Economics* 25: 23–49.

Fama, E. and K. French. 1997. Industry costs of equity. *Journal of Financial Economics* 43(2): 153–193.

Feltham, G. A., and J. A. Ohlson. 1996. Uncertainty resolution and the theory of depreciation measurement. *Journal of Accounting Research* 34(2): 209 – 234

Fields, T., S. Rangan, and S. R. Thiagarajan. 1998. An empirical evaluation of the usefulness of non-GAAP accounting measures in the real estate investment trust industry. *Review of Accounting Studies 3*: 103-130.

Fisher, J., D. Gatzlaff, D. Geltner, and D. Haurin. 2003. Controlling for the impact of variable liquidity in commercial real estate price indices. *Real Estate Economics 31(1)*: 269-303.

Francis, J. and K. Schipper. 1999. Have financial statements lost their relevance? *Journal of Accounting Research* 37 (2): 319-352.

Gore, R. and D. M. Stott. 1998. Toward a more informative measure of operating performance in the REIT industry: net income vs. funds from operations. *Accounting Horizons* 12(4): 323-339.

Herring, R. and S. Wachter. 1999. Real estate booms and banking busts: An international perspective. Working paper. The Wharton Financial Institutions Center.

Hodrick, R., and E. Prescott. 1997. Postwar US Business cycles: an empirical investigation. *Journal of Money, Credit, and Banking* 29(1): 1–17.

Jenkins, D., G. D. Kane, and U. Velury. 2009. Earnings conservatism and value relevance across the business cycle. *Journal of Business Finance and Accounting* 36(9): 1041–1058.

Johnson, M. F. 1999. Business cycles and the relation between security returns and earnings. *Review of Accounting Studies* 4(2): 93–118.

Joo, J. H. 2013. *Effects of real estate cycles on valuation of U.S. Real Estate Investments Trusts (REITs)* (Unpublished doctoral dissertation). University of British Columbia.

Kang, S. H., and Y. Zhao. 2010. Information content and value relevance of depreciation: a cross-industry analysis. *The Accounting Review* 85(1): 227–260.

Kothari, S.P., and J. Shanken. 2003. Time-series coefficient variation in value-relevance regressions: a discussion of Core Guay, and Van Buskirk and new evidence. *Journal of*

Accounting and Economics 34: 69-87.

Lev, B. and P. Zarowin. 1999. The boundaries of financial reporting and how to extend them. *Journal of Accounting Research.* 37 (2): 353-385.

Martinez, B. 1998. REIT interest: Accounting becomes issue as pressure mounts. *Wall Street Journal* (November 18): B1.

Matheson, T. 2008. The development of taxable REIT subsidiaries, 2001-2004. *Statistics of Income Bulletin* (Spring 2008): 196 – 203.

Mayer, C., and T. Somerville. 1994. Residential construction: Using the urban growth model to estimate housing supply. *Journal of Urban Economics* 48: 85–109.

National Association of Real Estate Investment Trusts (NAREIT). 1991. *NAREIT white paper on funds from operations*. Washington, D.C.: NAREIT.

——————————. 1995. *NAREIT national policy bulletin*. Washington, D.C.

——————————. 1996. *Accounting for Depreciation of Income-Producing Property*. Discussion Paper. Washington, D.C.

——————————. 1999. *NAREIT national policy bulletin*. Washington, D.C.

——————————. 2002. *White paper on funds from operations.* Washington, DC.

——————————. 2003. *Financial Reporting Alert (October 1, 2003).* Washington, DC.

National Council of Real Estate Investment Fiduciaries (NCREIF). 2005. *Frequently asked questions about NCREIF and the NCREIF Property Index (NPI).* Chicago: NAREIF.

Ohlson, J. 1995. Earnings, book values, and dividends in equity valuation. *Contemporary Accounting Research* 11: 661 – 687.

Ohlson, J. 2009. Accounting data and value: the basic results. *Contemporary Accounting Research* 26 (1): 231 – 259.

Pavlov, A. and S. Wachter. 2004. Robbing the bank: non-recourse lending and asset prices. *Journal of Real Estate Finance and Economics* 28: 147-160.

Peterson, M. 2008. Estimating standard errors in financial panel data sets: comparing approaches. *Review of Financial Studies 22*: 435–480.

Rajan, R. G. 1994. Why bank credit policies fluctuates: A theory and some evidences. *The Quarterly Journal of Economics* 109 (2): 399-441.

Ravn, M., and H. Uhlig. 2002. On adjusting the Hodrick-Prescott filter for the frequency of observations. *The RevHow well does net income measure firm performance? A discussion of two studies*

Securities Exchange Commission (SEC). 2003. *Frequently Asked Questions Regarding the Use of Non-GAAP Financial Measures*. Washington, D.C.: SEC.

Smith, R. A. 2001. REIT wrangling: A debate over earnings puts major Wall Street analysts at odds. *Wall Street Journal* (August 29): C1.

Vincent, L. 1999. The information content of funds from operations (FFO) for real estate investment trusts (REITs). *Journal of Accounting and Economics 26*: 69–104.

Vuong, Q. H. 1989. Likelihood ratio tests for model selection and non-nested hypotheses. *Econometrica* 57(2): 307–333.

Wheaton, W. C. 1999. Real estate “cycles”: Some fundamentals. *Real Estate Economics* 27(2): 209