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Abstract:

This paper examines empirically the predictability of operating profitability and whether any observed predictability stems from the asset or debt management policies of a portfolio of REITs. Return on assets (ROA), return on equity (ROE), Change in ROA and Change in ROE are the profitability measures of the sample portfolio, which covers, on average, about 84% of U.S. REITs included in the *FTSE NAREIT All Equity Index* between 1989 and 2015. While the asset management policies of sample REITs engenders ROA and Change in ROA, their asset and debt management policies jointly engender the ROE and Change in ROE. Our empirical work focuses on the coefficient estimates of (i) the own lags of each of these four profitability measures, and (ii) the lags of the "between," "within," "entry," and "exit" effects, obtained from the first-ever application of the Bennet (1920) dynamic decomposition to the temporal changes - between (t) and (t-1) - in the ROA and ROE of the sample portfolio. A comparison of the estimates -- between the ROA and ROE as well as between the Change in ROA and Change in ROE estimations -- in (i) and (ii) provides evidence about the root of the predictability. Our work repeats all the estimations above under the funds from operations (FFO) and net income (NI) metrics, which are used in computing the ROA and ROE measures and also their temporal changes. A comparison of the FFO- and NI-based results at the portfolio level is important since there is a growing literature and debate on whether the information content of FFO differs incrementally from that of NI. We find that (i) the predictability of profitability of the sample portfolio of REITs is highly visible and statistically strong; (ii) the estimates of the first own lags of the dependent variables or the first and second lags of some of the Bennet (1920) dynamic decomposition effects - especially the "within" effect - provide strong evidence of predictability; and (iii) the use of FFO unearths evidence that the sample REITs' asset management policies, as embodied in ROA and Change in ROA, have more to do with predictability than a combination of their asset and debt management policies, as embodied in ROE and Change in ROE, does. These findings should be useful to the investors and REIT managers and the REIT literature.

The Bennet Decomposition and Predictability of the U.S. REITs' Profitability

1. Introduction

The U.S. Real Estate Investment Trust (REIT) industry provides fertile ground for cultivating research on industry dynamics. The industry has experienced immense growth, expansion, and some consolidation, especially since accomplishing its first-ever listing on the S&P500 Index in October 2001 and weathering the Global Financial Crisis (GFC) of 2007-2008. An examination of the National Association of Real Estate Investment Trusts (NAREIT) webpage yields the following observations. At the end of 1971, only 34 REITs existed, of which 12 were Equity REITs, 12 were Mortgage REITs, and the remaining 10 were Hybrid REITs, with market capitalizations in the neighborhood of $332, $571, and $592 million, respectively. At the end of 2018, 226 REITs existed, of which 186 were Equity REITs and 40 were Mortgage REITs, with market capitalizations in the neighborhood of $980 billion and $67 billion, respectively (see https://www.reit.com/data-research/reit-market-data/us-reit-industry-equity-market-cap).

The historical development of U.S. institutions, with a strong aversion to concentration of power and with significant regulation in the REIT sector[1] since the early 1960s, has transformed illiquid income-producing real estate assets into liquid and tradable assets. These developments have generated a competitive, highly successful, transparent, and innovative industry that has significantly surpassed its counterparts in the rest of the world. In fact, the U.S. model and experience have proved the main motivation for the formal development of the REIT industry in several countries, including Australia, Japan, France, and the United Kingdom since the early 2000s.

This paper makes three contributions to the literature by constructing a value-weighted portfolio of a large sample of listed U.S. REITs and using annually defined data between 1989 to 2015. First, a long-standing interest exists on the question of predictability of financial data. Our first empirical examination centers on whether the own lagged values of (i) ROA, (ii) ROE, (iii) temporal *Change in ROA*, or (iv) temporal *Change in ROE* predict the current values of these profitability measures defined at the portfolio level.

Predictability, especially in the context of asset returns, relates to the well-known efficient markets hypothesis (EMH) with an ever-burgeoning literature. If predictability exists, examination separately of the relation between the current and lagged values across each of these four portfolio-level

[1] Legislation was enacted to offer firms tax-exemption if they fulfill legally specified dividend payment and other requirements.

profitability measures could reveal whether the observed predictability at root relates to asset or debt management policies or both. Predictability in ROA and/or the temporal *Change in ROA* without predictability in ROE or the temporal *Change in ROE* establishes asset management as the source of predictability. The reversal of this sequence will identify the sample REITs' debt management policies as the source of predictability since a firm's asset and debt management policies jointly influence its ROE. We note that only examining the levered stock returns, as countless numbers of event studies do, proves insufficient to shed any light on whether sample firms' asset or debt management policies may trigger the response of these returns to the arrival of a specific type of pertinent news.

Second, applying the novel Bennet (1920) dynamic decomposition to a temporal change between (t) and (t-1) of a portfolio's profitability captures four effects (or components): (i) improved profitability of individual REITs or the contribution of surviving firms to the portfolio's overall profitability (the "within" effect), (ii) shifts of resources from less to more profitable REITs or the contribution of changing market share of surviving firms to the portfolio profitability (the "between or reallocation" effect), (iii) entries of more profitable REITs (the "entry" effect), and (iv) exits and conversions of less profitable REITs (the "exit and conversion" effect), respectively.[2] The sum of these four effects add up to the temporal change in the portfolio's profitability. We apply separately this decomposition to the annual changes in the sample portfolio's ROA and ROE and also define each profitability measure by either annual net income (NI) or annual funds from operations (FFO).

Our second empirical examination centers on the following question: Do the lagged values of the "within," "between," "entry," and "exit and conversion" effects, as obtained from the Bennet (1920) dynamic decomposition, predict the current values of the temporal change in the sample portfolio's profitability measures? That is, if our work for the first question above detects predictability, then this second question will consider the underlying source(s) of this observed predictability. But, if our work for the first question does not detect predictability, observing predictability between the lagged values of these Bennet decomposition effects and the current values of the temporal change in either ROA or ROE will reveal that some significant underlying relations stay invisible or wash out in the predictability analyses involving the aggregated profitability measures. Further, whether the use of NI or FFO affects these effect-level results will also prove immediately pertinent to our work. To our knowledge, focusing on the predictability of financial data by focusing on the effects that make up the temporal change in a profitability measure between (t) and (t-1) is new in the literature.

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[2] Note that the reverse effect could occur. That is, we could see worsened profitability of individual REITs ("within" effect), shifts of resources from more to less profitable REITs ("between" effect), entries of less profitable REITs ("entry" effect), and exits of more profitable REITs ("exit and conversion" effect) between 1980 and 2015.

Third, the funds from operations (FFO) measure has received increasing research attention (Bhattacharya et al. 2003; Lougee and Marquardt, 2004; Ben-Shahar et al. 2011). Further, a *National Association of Real Estate Investment Trusts* (NAREIT) (2018) report points out that "FFO has gained wide acceptance by REITs and investors." Thus, our third empirical examination centers on the following question: Does measuring ROA or ROE in terms of FFO instead of the conventional measure of net income (NI) affect the predictability in profitability, as posed in the first two questions?

NAREIT has championed the use of the FFO metric since the 1990s so as to provide a more informative measurement of REITs' operating performance. Earlier studies find evidence that analysts and investors value FFO information (e.g., Ben-Shahar et al., 2011; Fields et al., 1998; Vincent 1999). More recent literature shows that the FFO metric provides more information than the NI metric for *firm-level analyses*. To our knowledge, whether FFO does so at an aggregated level (i.e., portfolio- or industry-level) and in the context of predictability of ROA, ROE, *Change in ROA*, and *Change in ROE* analyses remains an open question.

Some compromises, arising from data limitations, have not only shaped the construction of the sample portfolio but also defined the choice of the sample period. The first restriction originates from the availability of the FFO data. While the variables and data on the NI-based profitability measures exist for a considerable majority of the listed U.S. REITs since the early 1980s, an increasing number of REITs began to produce publicly and consistently their FFO data after 1988. To compare the results across the NI and FFO measures, the sample portfolio follows from the availability of FFO data. The yearly ratios of the number of FFO reporting REITs to the total number of listed REITs exceed 93 percent since 2007, averaging about 84 percent for the sample period.

The second restriction has its roots in the lack of data on sample REITs that exit from the sample at some point during the sample period. Finding (reliable) data and information, such as whether they were in fact conversions or bankrupt entities, on several exits has not been possible. Thus, it will be prudent to interpret with caution the reported empirical results on the "exit" effects from the Bennet (1920) dynamic decomposition.

The third restriction pertains to the data frequency, which is annual since publicly available data sources do not provide some of the essential variables pertinent to this study at higher frequencies. Studying annual data raises degrees of freedom concerns, pre-empts the pursuit of our research questions, and also puts a lid on some of our other research questions. Nonetheless, we still produce a rich set of results and brand-new evidence on U.S. REITs. To the extent that our Equity REIT sample proxies for the *FTSE NAREIT All Equity Index*, our conclusions also relate to this index's profitability and its predictability between 1989 and 2015.

In summary, the predictability of profitability of sample portfolio of REITs is highly visible and statistically strong. The estimates of the first own lags of the dependent variables or the first and second lags of some of the Bennet (1920) dynamic decomposition effects - especially the "within" effect - offer strong evidence of predictability. Differentiation of whether predictability originates from the sample REITs' asset management or a combination of asset and debt management policies, however, requires considerable detailed and systematically documented empirical work since both ROA and ROE or both *Change in ROA* and *Change in ROE* exhibit predictability vis-à-vis the same right-hand side variables. Ultimately, our evidence shows that the sample REITs' asset management policies, as embodied in ROA and *Change in ROA*, have more to do with predictability than a combination of their asset and debt management policies, as embodied in ROE and *Change in ROE*, does. This differentiation result depends mainly on whether an analyst uses FFO or NI in defining ROA and ROE. On the one hand, the NI-based analyses offer strong predictability across all four measures of profitability and hence lead to a pooling of all empirical results. On the other hand, the FFO-based analyses yield estimates that separate the sample REITs' asset management policies from a combination of their asset and debt management policies. This last result contributes, from a new research angle under a portfolio approach, to the recent debate about whether information content of FFO is more than that of NI. NAREIT in the USA for a long time and REALPAC in Canada in recent years have been proponents of the use of FFO. Our results appear to lend support to both institution's position on the use of FFO.

This paper unfolds as follows. Section 2 discusses the data, sample, and sub-periods unique to the REITs, known as REIT eras. Section 3 briefly introduces the Bennet dynamic decomposition, leaving the details of derivations to Appendix 1 and annual estimates of the Bennet decomposition effects to Appendix 2. Section 4 lays out our empirical work while Section 5 covers empirical results. Section 6 concludes the paper and offers ideas on how to apply the Bennet (1920) decomposition to some other financial data.

2. Data, Sample and REIT Eras

We build our database by merging distinct variables with annual frequency available in the COMPUSTAT, supplemented to the extent possible, by CRSP/ZIMAN databases and as compiled and kindly provided to us by NAREIT.[3] When a variable does not appear in these sources or contains missing values, data collected from either Internet searches or the EDGAR database enter into our own database.

[3] We thank Brad Case for kindly providing us with data from NAREIT's resources, Erkan Yonder for helping us in identifying and collecting some of our data from various sources, and Steve Cauley for his comments that guided us in cross checking our data vis-a-vis the CRSP/ZIMAN database.

Our sample covers the listed U.S. Equity REITs that report (i) ROA and ROE between -100% to 100% so as to avoid the distortions due to outliers and (ii) FFO between 1989 and 2015. Feng et al.'s (2011) classification of REITs, especially between 1993 and 2015, guides us in identifying the sample firms. Computations of ROA and ROE use both NI and FFO to elicit evidence on whether the latter offers any incremental information over the former. Data on FFO do not exist for each of the listed sample REIT and do exist only between 1989 and 2015, while data on their NI do exist for a larger number of REITs and over a longer period of time. This FFO data limitation defines the selection of our sample and sample period. The average of the yearly ratio of the number of FFO reporting listed REITs to the total number of listed REITs is about 84 percent. This ratio is greater than 92 percent after 2006. Despite our efforts to build a comprehensive database, missing data remain an obstacle, reduce somewhat our sample size and sample period, and keep the data at an annual frequency.

Panels A and B of Table 1 tabulate the descriptive statistics for our key variables of NI, FFO, TA, TE, ROE (NI-based) = NI/TE; ROE (FFO-based) = FFO/TE; and ROA (NI-based) = NI/TA; ROA (FFO-based) = FFO/TA by sample year and for the entire sample period.

[- insert Table 1 here -]

To calculate the dynamic decomposition between two years, say 1999 and 2000, we need to identify and separate entrants (REITs that entered the industry), exits (REITs that exited the industry or converted to private ownership), and stays (REITs that stayed in the industry). To do so, we matched REIT ID numbers and tickers in our merged database. If a REIT ID number or ticker exists in both 1999 and 2000, then the REIT stays in the industry. If a REIT ID number or ticker exists in 1999, but not in 2000, then the REIT exits. If a REIT ID number or ticker exists in 2000, but not in 1999, then the REIT enters. Table 2 provides the number of REITs for each category for the (i) full NAREIT sample in the industry and (ii) our sample of REITs.

[- insert Table 2 here -]

Panels A and B of Figure 1 provide the evolution, between 1971 and 2017, of the *FTSE NAREIT All Equity REIT* series' (i) annual number of REITs and their year-end market values and (ii) the total return and price return series (see https://www.reit.com).

[- insert Figure 1 here -]

It is clear from Panel A of Figure 1 that there has been a dynamic increase both in the number of listed U.S. REITs and their market valuations since late 1980s or early 1990s. The period of these increases also corresponds to our sample period. The U.S. REIT industry has evolved over time and experienced different episodes of development and growth, now known as the Vintage Era (1960-1990 or 1991), the New REIT Era (1991 or 1992-2001), and, following Cakici et al. (2014), the REIT Maturity

Era (2002-present time), the latter which includes the Global Financial Crisis (GFC). The New REIT Era captures a quick increase in the number of Equity REITs, which then tends to stabilize around 150 institutions, and modest growth in capitalization. The REIT Maturity Era witnesses reasonably constant numbers of Equity REITs and rapid growth in their capitalization. We also note that the number of Equity REITs as well as their capitalization fell before the GFC of 2008-2009. The fall in these returns before the GFC was just over 70 percentage points.

3. Portfolio Profitability Metrics and the Bennet Dynamic Decomposition

Since we apply the Bennet dynamic decomposition to a sample portfolio of U.S. REITs, our derivation of the various dynamic decompositions employs the sample portfolio's ROE as an illustration. At time t, the ROE (R_t) equals net income (NI_t) divided by total equity (E_t). That is,

$$R_t = \frac{NI_t}{E_t} \tag{1}$$

where $NI_t = \sum_{i=1}^{n_t} NI_{i,t}$, $E_t = \sum_{i=1}^{n_t} E_{i,t}$, and n_t is the number of REITs in the portfolio. After substitution and rearrangement, we get

$$R_t = \sum_{i=1}^{n_t} r_{i,t}\theta_{i,t} , \tag{2}$$

where $r_{i,t}$ equals the ratio of net income to equity for REIT i in period t and $\theta_{i.t}$ equals the i-th REIT's share of equity in the portfolio. We want to decompose the change in the portfolio ROE into the "within," "between," "entry," and "exit and conversion ('exit' for short from now on)" effects. The change in the portfolio ROE, R_t, equals the following:

$$\Delta R_t = R_t - R_{t-1} = \sum_{i=1}^{n_t} r_{i,t}\theta_{i,t} - \sum_{i=1}^{n_{t-1}} r_{i,t-1}\theta_{i,t-1} . \tag{3}$$

Appendix 1 provides the details of the derivation that leads to the four components of the Bennet dynamic decomposition:

$$\Delta R_t = \underbrace{\sum_{i=1}^{n_{t/t-1}^{stay}} r_{i,\Delta t}\,\bar{\theta}_i}_{\text{"within effect"}} + \underbrace{\sum_{i=1}^{n_{t/t-1}^{stay}} (\bar{r}_i - \bar{R})\theta_{i,\Delta t}}_{\text{"between effect"}} + \underbrace{\sum_{i=1}^{n_t^{enter}} (r_{i,t} - \bar{R})\theta_{i,t}}_{\text{"entry effect"}}$$

$$- \underbrace{\sum_{i=1}^{n_{t-1}^{exit}} (r_{i,t-1} - \bar{R})\theta_{i,t-1}}_{\text{"exit effect"}} . \tag{4}$$

where $\bar{\theta}_i = (\theta_{i,t} + \theta_{i,t-1})/2;\quad \bar{r}_i = (r_{i,t} + r_{i,t-1})/2;\quad \bar{R} = (R_t + R_{t-1})/2.$

The "within" effect equals the summation of each REIT's change in ROE weighted by its average share of portfolio's total equity between period t-1 and period t. The "between (reallocation)" effect equals the summation of the difference between each REIT's ROE and the average portfolio ROE between period *t* and period *t-1*, multiplied by the change in that REIT's share of equity in the portfolio. The "entry" effect equals the summation of the difference between each entry REIT's ROE in period *t* and the average portfolio ROE between period *t-1* and period *t* times the entry REIT's share of equity in the portfolio in period *t*. Finally, the "exit and conversion" effect equals the summation of the difference between each exit REIT's ROE in period *t-1* and the average portfolio ROE between period *t-1* and period *t*, multiplied by the exit REITs' share of equity in the portfolio in period *t-1*.

Appendix 1 shows that some other portfolio or industry performance decomposition methods (see Bailey et al., 1992; Haltiwanger, 1997) are special cases of the Bennet (1920) decomposition and that all of these decomposition methods closely relate to the literature on price indexes, such as the Laspeyres (Laspeyres, 1871) and Paasche (Paasche, 1974) indexes. The dynamic decomposition of such industry performance requires micro-level information on firms - REITs in our paper - within an industry.[4] We can apply the same steps above and as detailed in Appendix 1 to other portfolio performance metrics. We apply them to ROA for our sample portfolio. Appendix 2 tabulates the year-by-year results for each of the four Bennet decomposition effects for *Change in ROA* and *Change in ROE*, respectively, for our sample portfolio.

4. Predictability Models, Expected Empirical Relations, and Some Thoughts on the Bennet Effects

4.a) Predictability with respect to own-lags:

We build the following simple estimation models:

$$DepVar_t = a + b * (DepVar_{(t-1)} \ or \ DepVar_{(t-2)}) + \varepsilon_t \qquad (5.a)$$

where $DepVar_t$ is either ROA_t, ROE_t, *Change in* $ROA_{t,(t-1)}$ or *Change in* $ROE_{t,(t-1)}$, respectively, of our sample portfolio. We run various OLS specifications of eq. (5.a) under the NI and FFO metrics.

A few reminders should be useful at this time. Limitations in the availability of the FFO data for the sample REITs also restrict the sample period to the annual data between 1989 and 2015 period. *Change in* $ROA_{t,(t-1)}$ (*Change in* $ROE_{t,(t-1)}$) and its first own lag, *Change in* $ROA_{(t-1),(t-2)}$ (*Change in* $ROE_{(t-1),(t-2)}$), share $ROA_{(t-1)}$ ($ROE_{(t-1)}$), respectively, in eq. (5.a). This sharing should lead to spurious results. It is in this connection that the second own lags become an alternative variable in estimating eq. (5.a). The

[4] The availability of micro-level (i.e., establishment-level) data for manufacturing industries spawned a series of such applied microeconomic research. McGuckin (1995) describes the Longitudinal Research Database (LRD) at the U.S. Bureau of the Census upon which this research relies. For banking data at the individual bank level, see the Federal Reserve Bank of Chicago at https://www.chicagofed.org/banking/financial-institution-reports/commercial-bank-data. In sum, aggregate industry data contain important firm- and plant-level dynamics that collectively determine overall industry dynamics.

Change in ROA or *ROE* variables constitute flow variables and will be instrumental in extending eq. (5.a) in the next section to the four effects of the Bennet (1920) dynamic decomposition.

The spirit of eq. (5.a) follows from the weak-form market efficiency tests, as reported in the rich and ever-burgeoning literature on this hypothesis. On the one hand, the EMH predicts no predictability, indicating that the estimates of coefficient *b* should not be statistically different from 0. No predictability conjecture under the EMH relies on excess returns, which takes the so-called "normal or risk-adjusted returns" from the returns of a well-diversified portfolio which proxies the so-called market portfolio. Since our sample portfolio is constructed to closely follow the *FTSE NAREIT All Equity Index*, which is a suitable proxy for the market portfolio for the REITs, we choose to work with the raw $DepVar_t$ measures. On the other hand, any statistically significant estimate of the coefficient *b* from various OLS model specifications of eq. (5.a) will suggest the predictability of profitability for our sample portfolio. Given the persistent patterns of increase in the number of REITs and their market valuations, as portrayed in Panel A of Figure 1, it is not unreasonable to expect that this persistence may spill over to the profitability measures in eq. (5.a) and generate predictability of profitability.

Holding either NI or FFO constant, portfolio level ROA or *Change in ROA* measure how well the sample firms manage their assets, independent of their debt policies, in their balance sheets. Meanwhile, holding either NI or FFO constant, portfolio level ROE or *Change in ROE* measure how well sample firms manage their assets and debts. In the presence of predictability, examining separately and comparatively the relation between the current and the lagged values across each of these four portfolio-level profitability metrics could reveal whether the observed predictability has its roots in the sample firms' asset or debt management policies or both. Predictability in ROA and/or *Change in ROA* without predictability in ROE or *Change in ROE* establishes asset management as the source of predictability. The reversal of this sequence will identify debt policy as the source of predictability. Predictability in ROA and/or *Change in ROA* with predictability in ROE or *Change in ROE* establishes both asset and debt management policies as the sources of predictability. We note that just studying the levered stock returns, as is done in countless numbers of event studies, is insufficient to shed any light on whether sample firms' asset or alternatively debt management policy may trigger the response of these returns to the arrival of a specific type of pertinent news.

Finally, holding ROA or ROE constant, examining separately and comparatively the predictability under each of the NI and FFO metrics can offer evidence on the differential information content of each. Industry participants, in particular NAREIT in the USA and REALPAC in Canada, have been advocating the adoption of FFO as they view it to be a more informative performance metric than NI and that REIT managers claim that NI does not accurately reflect the profitability and operating performance of REITs due to the mandatory inclusion of some non-cash items such as depreciation, amortization, and several one-time, non-recurring, non-cash revenues and expenses that provide little incremental information for evaluating REIT performance and profitability (see Ben-Shahar et al., 2011).

There are also counterarguments against the adoption of FFO. The FFO measure is not audited, is voluntarily reported, and is not prepared according to the *Generally Accepted Accounting Principles* (GAAP) (see, Vincent, 1999). Thus, self-selection bias may be present in FFO since managers may engage in cherry-picking of financial items in calculating and reporting FFO and making accounting assumptions in estimating some of the recurring, non-cash revenues and expenses. Measurement errors of these items raise concerns about likely enhancements in the levels of noise in the FFO measure.[5]

To our knowledge, there is no evidence on the differential informativeness between NI and FFO at the level of REIT portfolios and in the context of ROA, ROE, *Change in ROA* and *Change in ROE*. One of our aims is to fill this gap in the literature.

4.b) Predictability with respect to the lagged Bennet effects

We build the following estimation models:

$$DepVar_t = a + \sum_{i=1}^{4} (b_i * Bennet\ Effects_{i,(t-1)}) \ or \ \sum_{i=1}^{4} (b_i * Bennet\ Effects_{i,(t-2)}) + \varepsilon_t \quad (5.b)$$

where $DepVar_t$ is either ROA_t, ROE_t, *Change in* $ROA_{t,(t-1)}$, or *Change in* $ROE_{t,(t-1)}$, respectively, and the Bennet $Effects_{i,(t-1 \text{ or } t-2)}$ are the “within”, “between,” “entry,” and “exit,” effects, respectively. We run various OLS specifications of eq. (5.b) under the NI and FFO metrics, respectively. Any statistically significant estimate of coefficients b_i will mean predictability.

Our work in this section follows directly from section 4.a above and mainly substitutes predictability variables from own lags of $DepVar_t$ to the lags of the four effects of the Bennet (1920) dynamic decomposition approach. Our arguments for the role of asset versus debt management as well as the information content of FFO versus NI remain the same, as extended to the new right-hand side variables, in this section.

The substitution of the right-hand variables in eq. (5.b) allows for an investigation of the underlying sources, i.e., the Bennet (1920) dynamic decomposition effects, of the relations discussed in section 4.a. On the one hand, if we detect predictability vis-a-vis eq. (5.a) estimations, an understanding

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[5] Previous research reports mixed evidence. For example, Graham and Knight (2000) find evidence that FFO has higher incremental information content than NI. Fields et al. (1998) find that, while FFO is better in predicting one-year-ahead FFO and cash flows from operations (CFO), NI is better in predicting contemporaneous stock prices and one-year-ahead NI. Gore and Stott (1998) find that FFO is, in fact, more closely associated with stock returns than NI and that NI predicts dividends better than FFO does. Vincent (1999) reports that all four measures - FFO, earnings-per-share (EPS), cash flows from operations (CFO), and earnings-before-interest-tax-depreciation-and-amortization (EBITDA) - are associated with stock returns, but their statistical significance depends on the model specifications. Ben-Shahar et al. (2011) report evidence that FFO explains better REITs’ dividend policy than NI beyond REITs’ operating cash flows.

of whether this observed predictability originates from (i) improved profitability of individual REITs (the "within" effect) or (ii) shifts of resources from less to more profitable REITs (the "between or reallocation" effect) or (iii) entries of more profitable REITs (the "entry" effect), or (iv) exits and conversions of less profitable REITs (the "exit and conversion" effect) or a combination of these effects will be highly useful to the REITs, investors and policymakers. On the other hand, if we do not detect predictability vis-a-vis eq. (5.a) estimations, observing predictability between the lagged values of these Bennet effects and the current values of the temporal change in either ROA or ROE will reveal that some significant underlying relations stay invisible or wash out in the predictability analyses involving the aggregated profitability measures. Further, how the use of NI or of FFO affects these results from the Bennet dynamic decompositions is also immediately useful to judge the information content of FFO vis-a-vis NI. To our knowledge, focusing on the predictability of financial data by focusing on the effects that make up the temporal change in a profitability measure between (t) and (t-1) is new in the literature.

5. Results

This section reports the OLS results obtained from estimating various specifications of equations (5.a) and (5.b) and offers discussions on them. The reported results on the "exit" component need to be interpreted with more caution and care than others as lack of data on sample REITs' exits and conversions in some of the sample years has been one of the constraining factors in undertaking this study.

5.a) Own-lags and predictability of ROA, ROE, *Change in ROA* and *Change in ROE*

Results in Table 3 reveal that, irrespective of the use of NI or FFO metric in defining the sample portfolio of Equity REITs' on *ROA* and *ROE*, the values of the first lags of *ROA* and *ROE*, *L1-ROA* and *L1-ROE*, predict strongly the current values of on *ROA* and *ROE*. The coefficient estimates for *L1-ROA* and *L1-ROE* under the NI metric (FFO metric) are positive and significant at the 1% level (1% and 5% levels), respectively. Of the four estimates of the second lags of *ROA* and *ROE*, *L2-ROA* and *L2-ROE*, only the FFO-based *L2-ROA* is significant, at the 5% level, and positive. So, evidence on the predictability of *ROA* and *ROE* from the second lags is mixed. Results provide the first differential effect of FFO from NI and support the hypothesis that the lags of the portfolio level *ROA* and *ROE* measures, especially the first, predict the current values of both measures.

[- insert Table 3 here -]

The NI-based first lags of and the FFO-based second lags of *Change in ROA* and *Change in ROE* -- *L1-Chg in ROA, L1-Chg in ROE, L2-Chg in ROA and L2-Chg in ROE* -- predict the current values of *Change in ROA* and *Change in ROE*, respectively. However, the signs of the estimates of the NI-based first lags (FFO-based second lags) are positive (negative), respectively. Both FFO-based estimates of the second lags attain significance at the 5% level. The estimates of the NI-based *L1-Chg in ROA, L1-Chg* *in ROE* are significant at the 5% and 10% levels, respectively. We remind that the NI- and FFO-based estimates of *L1-Chg in ROA and L1-Chg in ROE* are likely to be spurious due to the shared ROA(t-1) or ROE(t-1) between the dependent variable, either *Change in ROA* and *Change in ROE*, and its first lag, *L1-Chg in ROA or L1-Chg in ROE*. Overall, these results in Table 3 support the predictability, at the Equity REIT portfolio level, of *ROA* and *ROE* measures and demonstrate, consistent with the extant literature, some amount of difference in the information content of NI and FFO metrics.

5.b) The NI-based lags of the four Bennet decomposition effects and predictability of ROA, ROE, *Change in ROA* and *Change in ROE*

Panel A (Panel B) of Table 4 tabulates the NI-based results on *ROA* and *ROE* (*Change in ROA* and *Change in ROE*), respectively. In Panel A, the estimates of the first lags of the "within" effect, (i.e., the contribution of surviving firms to the portfolio's overall profitability), predict positively and strongly, at the 1% significance level, the current levels of on *ROA* and *ROE*. The estimates of the lags of the remaining three Bennet effects do not attain any statistical significance.

[- insert Table 4 here -]

The results in Panel B demonstrate that the first lags of the "within" effect, *L1-within*, and the "entry" effect, *L1-entry*, predict consistently both *Change in ROA* and *Change in ROE*. While all the estimates of *L1-within* are positive and significant mainly at the 5% level, all the estimates of *L1-entry* are negative and also significant mainly at the 5% level. There is some weak evidence that the first lag of the "exit" effect also exerts a negative effect on both dependent variables. A positive and significant estimate on the coefficient of any first lag variable, such as that of *L1-within* here, indicates that an increase (decrease) in the first lag variable at (t-1) corresponds to an increase in, for example, *Change in ROE (t)*, and, hence, a dominance of ROE (t) over ROE (t-1) and vice versa. So, any positive (negative) first lag Bennet effect at (t-1) associates with a positive (negative) effect on ROE (t), respectively. This is consistent with the economic logic of the Bennet (1920) dynamic decomposition, as laid out in detail in Appendix 1.

Overall, the NI-based results offer evidence that the first lags of both *ROA* and *ROE* predict the current values of both variables and that this predictability originates mainly from the first lags of (i) positive profitability contributions of the surviving REITs (i.e., the "within" effect under the Bennet (1920) decomposition) and (ii) negative contributions of the entry of either less or unprofitable REITs to the sample portfolio's overall profitability (i.e., the "entry" effect under the Bennet (1920) decomposition).

While observing a negative estimate for the coefficient of the first lag of the "entry" effect may appear to be unexpected, the economic logic of the Bennet (1920) dynamic decomposition, as laid out in detail in Appendix 1, suggests a negative estimate. That is, an increase in the first lag "entry" effect at (t-1) corresponds to a decline in, for example, *Change in ROE (t,)* and, hence, a dominance of ROE (t-1) over ROE (t) and vice versa. So, a positive (negative) first lag "entry" effect at (t-1) associates with a positive (negative) contemporaneous effect on ROE (t-1), respectively.

5.c) The FFO-based lags of the four Bennet dynamic decomposition effects and predictability of ROA, ROE, *Change in ROA* and *Change in ROE*

Panel A (Panel B) of Table 5 tabulates the FFO-based results on *ROA* and *ROE* (*Change in ROA* and *Change in ROE*), respectively. In Panel A, the estimates of the first lags of the "within" effect, (i.e., the contribution of surviving firms to the portfolio's overall profitability), predict positively, at the 1%, 5% and 10% significance levels across different specifications, the current levels of *ROA* and *ROE*. The estimates of the lags of the remaining three Bennet effects do not attain any statistical significance for the *ROA* estimations. Some of the estimates of the two out of three remaining Bennet (1920) decomposition effects for the *ROE* estimations are significant, differing from their NI-based counterparts in Panel A of Table 4. The estimate of the first lag of the "between" effect (i.e., the contribution of changing market share of surviving REITs to the sample portfolio's profitability), *L1-between*, is negative and significant in one model specification and the estimate of the first lag of the "exit" effect, *L1-exit*, is negative and significant in another model specification. While the significance of both lagged variables disappears in the model specification that combines all four Bennet (1920) decomposition effects, the difference of some of the FFO-based results from their NI-counterparts adds more evidence to the literature on the differential information content of FFO vis-a-vis NI.

[- insert Table 5 here -]

Panel B exhibits the estimates of the coefficients for the first and second lags of the four Bennet (1920) decomposition effects with respect to the *Change in ROA* and *Change in ROE* model specifications. Results unearth further, diverse and stronger evidence of the difference(s) in predictability between *Change in ROA* and *Change in ROE*, as per our first question, and also the difference(s) in the information contents of NI and FFO, as per our second research question. The FFO-based results in Panel B of Table 5 differ considerably in comparison to the NI-based results for the *Change in ROA* and *Change in ROE* estimations in Panel B of Table 4. The coefficient estimate of *L2-within* is the only one commonly significant in all *Change in ROA* and *Change in ROE* estimations in Panel B of Table 5.

While the estimates of *L1-within* are positive and significant, at the 5% and 10% levels, in model specifications of *Change in ROA*, none of the estimates of *L1-within* for the *Change in ROE* specifications are significant. Coupled with the positive and highly significant estimates of *L1-within* across all *Change in ROE* model specifications in Panel B of Table 4, lack of significance in any of the coefficient estimates of *L1-within* under the *Change in ROE* specifications in Panel B of Table 5 is a telling piece of evidence for our research questions.

It is noteworthy that all significant coefficient estimates of the second lag variables with respect to the *Change in ROA* specifications are negative. *L2-entry* is the most dominant variable with significant coefficient estimates, at the 5% and 10% levels, across its model specifications. The coefficient estimates of *L2-within* and *L2-exit* are significant, at the 5% level, once in two different model specifications.

A negative and significant estimate on the coefficient of any second lag variable, such as that of *L2-within* here, indicates that an increase (decrease) in the second lag variable at (t-2) corresponds to an increase in, for example, *Change in ROE (t),* and, hence, a dominance of ROE (t) over ROE (t-1) and vice versa. So, any negative (positive) second lag Bennet effect at (t-2) associates with a positive (negative) effect on ROE (t), respectively. This is consistent with observing a positive estimate on the same variable's first lag and also with the economic logic of the Bennet (1920) dynamic decomposition, as laid out in detail in Appendix 1.

An eyeballing of the results in Panel B, from the *Change in ROE* estimations, reveals considerable deviations in significance and signs from the results in Panel B, from the *Change in ROA* estimations. The coefficient estimate of *L2-within* is negative and significant, at the 1% level, in one of the model specifications. In contrast to the results from the *Change in ROA* estimations, the coefficient estimate of *L2-exit* is *positive* and significant at the 10% level in one of the model specifications. The coefficient estimate of *L1-between*, in one of the *Change in ROE* model specifications, is negative and the only significant estimate, at the 5% level, of the first lag variables in Panel B.

Overall, the FFO-based results differ considerably and divergently from their NI-based counterparts in Table 4. The FFO-based results support the views that the sources of predictability of both ROA and the *Change in ROA* at the portfolio level differ from those of predictability of ROE and the *Change in ROE* and that the incremental information content in the FFO metric leads to many more (less) statistically significant relations and changes in significance levels. Further, FFO contributes sign reversals between some of the second lags of the Bennet (1920) dynamic decomposition effects and the current values of *Change in ROA* (*Change in ROE*), respectively.

6. Conclusions and ideas for possible extensions of the Bennet (1920) dynamic decomposition approach

In this paper, we ask three interrelated research questions for a portfolio of listed Equity REITs, which covers approximately, on average, 84 percent of the REITs that make up the *FTSE NAREIT All Equity Index*, during the sample period of 1989-2015:

First, do the own lagged values of (i) ROA, (ii) ROE, (iii) temporal *Change in ROA* or (iv) temporal *Change in ROE* predict the current values of these profitability measures? This question focuses on whether the source of predictability in the sample of firms' operating profitability lies with their asset or debt management policies or both. An understanding of the source(s) will prove important to the (i) REIT managers in managing their assets and debts, (ii) investors in extending the source(s) of predictability of operating profitability to their investment decisions, and (iii) policy-makers in dispensing their oversight duties of this sufficiently regulated sector.

Second, do the lagged values of the "within," "between," "entry," and "exit and conversion" effects, as obtained from the Bennet (1920) dynamic decomposition approach, predict the current values of the sample portfolio's four profitability measures, as put forth in the first question? This question extends the analyses of the first question to the Bennet (1920) dynamic decomposition effects. Evidence on this question will provide considerable depth and refined understanding about the source(s) of predictability and will prove useful and important to the three parties, highlighted above under the first question, pretty much for the same reasons.

Third, does measuring ROA or ROE in terms of FFO, instead of the conventional measure of net income (NI), affect the predictability in profitability, as posed in the two questions above? Whether the information content of FFO exceeds that of NI has received considerable research interest for some time. While NAREIT in the USA and REALPAC in Canada have been the main proponents of FFO, regulators and other REIT market participants have been concerned about REIT managers' incentives to cherry-pick items to be included and excluded in this unaudited and voluntarily disclosed non-GAAP FFO metric (see for example, Dow Jones Newswire, June 19, 2001). In other words, self-selection bias may be a big deal inherent in REITs' reported FFO numbers. Anecdotal evidence confirms this alleged manipulation. Usvyatsky (2015) points out that, in the first eight months of 2015, the Securities and Exchange Commission sent comment letters to 110 REITs, of which more than 40% related to the non-GAAP figures. Documented evidence is mixed on the information content of FFO, but favors FFO over NI.

Our findings lead to three main and novel conclusions. First, own-lags of the sample portfolio's operating profit measures strongly predict the current values of operating profit measures irrespective of the NI or FFO metric. These results in Table 3, however, offer little guidance to isolate sample REITs' asset from debt management policies (or vice versa) as the main underlying factor of the observed predictability. Although both policies appear fundamentally to respond in the same manner to our predictability analyses, some of the FFO-based estimates provide additional predictive results for the *ROE* and *Change in ROE* measures. Below, we cover further evidence on the FFO metric's additional contributions in the predictability of the *ROE* and *Change in ROE* measures.

Second, under the NI metric, the first lag of the contribution of surviving REITs to the sample portfolio's overall profitability, that is, the "within" effect from the Bennet (1920) dynamic decomposition approach, proves the main and dominant source of predictability across all operating profit measures in Table 4. An increase in the "within" effect at (t-1) under a positive sign means an increase, for example, in *Change in ROE* and, hence, a dominance of ROE (t) over ROE (t-1) and vice versa. So, a positive "within" effect at (t-1) associates with an increase in ROE (t). Under the same metric, the first lag of the contribution of entering REITs to the sample portfolio's profitability, that is, the "entry" effect from the Bennet (1920) dynamic decomposition approach, also predicts, with negative signs, the *Change in ROA* and *Change in ROE* measures.

The NI-based estimates do not reveal anything new about the differential responsiveness of asset and debt management policies of the sample REITs. While the NI-based results showcase the "within" effect as the underlying source of predictability, they reveal nothing further to isolate sample REITs' asset from debt management policies (or vice versa).

Third, under the FFO metric, results on the *ROA* and *Change in ROA* measures in Table 5 differ visibly from those on the *ROE* and *Change in ROE* measures in the same table as well as those in Table 4. This provides further and richer evidence that the information content of FFO differs from that of NI even at the portfolio level and across various operating profitability measures. Further, the FFO results suggest that predictability of operating performance at the portfolio level has its roots more in the sample REITs' asset than debt management policies. Since ROE is constructed as an amalgam of a firm's asset and debt management policies, either sample REITs' debt policies do not respond to predictability or alternatively, sample REITs' debt and asset management policies respond in opposite directions to predictability, leading to a wash out in the estimates. Importantly, the FFO results help to isolate, to some degree, the influences of the sample REITs' asset from debt management policies. Our findings support the position that has been adopted by NAREIT in the United States and REALPAC in Canada about reporting and monitoring regularly REITs' FFO metric.

The first lag of the "within" effect is, once again, the main and dominant source of predictability for *ROA, ROE* and *Change in ROA* but, unlike the earlier results in Tables 3 and 4, not for *Change in ROE* anymore. Further, the first lags of the "between" and "exit" effects predict partially and with a negative sign *ROE* (but not *ROA*). While the second lags of the "within," "entry" and "exit" effects predict with a negative sign *Change in ROA*, the second lag of the "within" and exit effects partially predict with a negative and positive sign *Change in ROE*. While the model specification that combines the second lags of all four Bennet (1920) dynamic decomposition effects has three significant estimates with negative sign on *Change in ROA*, the same specification yields no statistically significant estimates on *Change in ROE*.

Finally, to our knowledge, this paper applies the Bennet (1920) dynamic decomposition approach for the very first time to the REIT sector. This decomposition method and its cousins share a strong connection to the literature on prices indexes, such as the Laspeyres or Paasche indexes, offer new avenues of research either in a portfolio or industry content. We believe that these decomposition methods will push the literature in several interesting directions. For example, REITs exhibited diseconomies of scale in the late 1990s and early 2000s in the background of an ongoing consolidation of the industry (see Anderson et al. 2002; Miller et al., 2006). We fail to locate any new evidence on scale (dis)economies or similar measures of economic (in)efficiency of the REIT industry, despite the immense industry growth, since then. It may be time to renew research efforts on these metrics, especially given the sector's long-standing, relentless, dynamic and breath-taking growth patterns, by applying these decomposition techniques for more meticulously produced evidence.

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Table 1: Annual means and standard deviations of sample REITs' net income, funds from operations, total assets, total equity, ROA and ROE, during the sample period of 1989-2015.

We construct our sample mainly from COMPUSTAT data, supplemented by the CRSP/Ziman and EDGAR databases and various internet searches. We restrict each REIT's ROE to fall between -100% to 100% where ROA = NI/TA or ROA = FFO/TA (ROE = NI/TE or ROE = FFO/TE) by each sample year. To calculate the Bennet dynamic decomposition between two years, say 1999 and 2000, we need to identify and separate entrants (REITs that entered the industry), exits (REITs that exited the industry or converted to private ownership), and stays (REITs that stayed in the industry). To do so, we matched REIT ID numbers and tickers in our merged database. If a REIT ID number or ticker exists in both 1999 and 2000, then the REIT stays in the industry. If a REIT ID number or ticker exists in 1999, but not in 2000, then the REIT exits. If a REIT ID number or ticker exists in 2000, but not in 1999, then the REIT enters. Panel A reports for the sample of REITs year-by-year summary statistics on NI, FFO, Total Assets and Total Equity. In Panel B, EW, TATW and TEQW indicate equally weighted, total assets weighted, and total equity weighted, respectively. The EW- and TATW-weighted (TEQW-weighted) ROA (ROE) values follow from equation 2 and refer to the sample portfolio level ROA or ROE (e.g., for NI-based portfolio ROA in a given sample year = Sum of net income across all sample REITs / Sum of their total assets).

Panel A: Net income, funds from operations, total assets and total equity.

Year	No. of REITs	Net Income ($Million)		Fund from Operations ($Millions)		Total Assets ($Million)		Total Equity ($Million)	
		Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
1989	19	5.941	6.995	11.111	8.298	170.061	119.862	95.238	54.186
1990	20	6.007	9.125	11.505	9.664	172.204	118.104	88.859	54.629
1991	41	4.547	8.083	9.888	11.352	152.128	142.479	88.695	75.098
1992	51	4.148	9.049	10.560	11.574	167.703	153.607	97.683	84.887
1993	90	6.818	13.031	14.845	15.075	264.702	218.855	154.763	138.041
1994	134	10.602	12.520	20.870	19.409	336.906	325.312	172.922	163.849
1995	144	14.818	17.986	29.043	28.628	440.500	426.909	225.101	242.804
1996	137	22.678	26.737	40.546	41.294	648.893	695.515	342.402	369.735
1997	151	30.662	32.713	57.262	62.121	1083.200	1387.650	581.840	789.169
1998	152	51.410	113.290	90.571	117.005	1705.280	2398.110	800.305	1091.160
1999	143	59.434	73.176	106.864	125.877	1766.710	2221.190	846.614	1105.680
2000	131	68.784	90.984	119.197	149.362	1909.670	2567.950	890.482	1238.790
2001	124	59.181	93.838	118.744	163.664	2080.870	3109.720	954.801	1511.010
2002	116	68.116	117.091	129.722	194.187	2360.960	3293.610	1037.940	1538.740
2003	119	77.534	134.025	129.241	191.007	2469.210	3222.030	1069.760	1477.690
2004	126	75.956	112.325	129.841	181.839	2547.450	3517.070	1071.490	1471.220
2005	128	85.045	145.539	130.104	190.651	2772.930	3624.970	1102.430	1455.210
2006	112	122.030	195.269	173.453	243.306	3616.790	4756.820	1368.920	1740.310
2007	108	135.953	224.894	202.652	285.796	3944.430	4968.590	1396.320	1658.270
2008	105	86.578	169.266	184.293	264.255	4092.660	4990.860	1455.190	1618.570
2009	104	29.000	134.271	146.635	241.555	3766.180	4309.640	1568.280	1803.780
2010	113	19.831	228.571	152.056	279.079	3973.670	4989.170	1708.440	2019.380
2011	116	71.163	190.783	200.076	317.337	4219.220	5556.350	1858.750	2427.400
2012	125	90.840	215.478	229.032	359.821	4550.880	5831.170	1994.680	2501.970
2013	146	110.092	244.930	234.738	371.928	4550.190	5873.750	2036.150	2585.790
2014	157	138.968	271.514	270.122	399.221	4942.780	6009.190	2212.020	2715.390
2015	152	151.623	307.217	298.064	431.225	5279.840	6270.770	2345.970	2900.260
All	3064	66.699	164.792	134.058	246.527	2611.870	4208.250	1131.250	1799.040

Table 1: Annual means and standard deviations of sample REITs' net income, funds from operations, total assets, total equity, ROA and ROE, during the sample period of 1989-2015. (cont'd)

Panel B: NI- and FFO-based ROA and ROE.

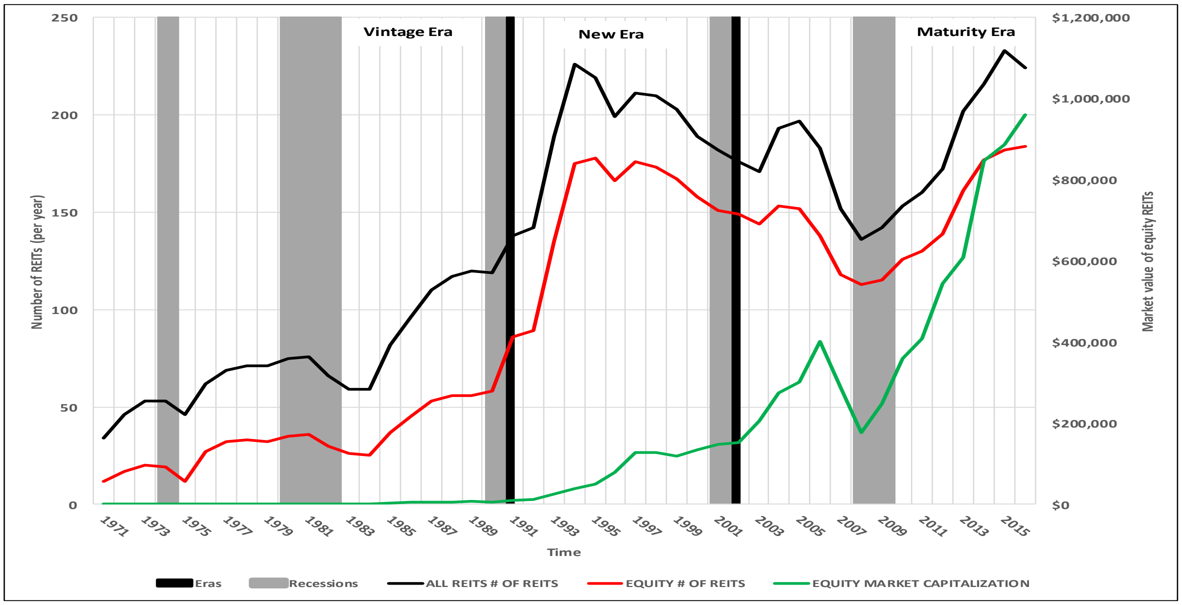
		ROA (%) – NI-based			ROA (%) – FFO Based			ROE (%) – NI-based			ROE (%) – FFO Based		
Year	No of REITs	EW-Mean	Std Dev	TATW-Mean	EW-Mean	Std Dev	TATW-Mean	EW-Mean	Std Dev	TEQW-Mean	EW-Mean	Std Dev	TEQW-Mean
1989	19	3.700	4.273	3.938	7.025	4.297	6.692	5.524	6.196	6.953	11.495	6.682	11.815
1990	20	3.600	6.534	3.717	7.092	5.167	6.970	4.969	10.950	6.915	11.804	6.824	12.967
1991	41	3.448	4.802	2.789	6.927	4.650	6.709	4.341	7.431	4.468	9.998	7.349	10.751
1992	51	2.664	5.995	2.676	6.470	4.295	6.291	2.397	10.900	4.667	9.550	5.762	10.463
1993	90	3.465	7.443	2.601	6.474	6.180	5.548	3.481	12.730	4.468	10.111	7.891	9.530
1994	134	3.719	4.916	3.196	6.622	3.409	6.217	5.549	12.510	5.983	14.542	14.535	11.648
1995	144	3.639	3.736	3.425	7.105	3.068	6.609	6.358	10.090	6.539	15.300	15.467	12.618
1996	137	3.727	2.880	3.510	6.638	2.894	6.224	7.076	5.763	6.645	13.790	8.482	11.782
1997	151	3.309	2.598	2.851	5.652	2.467	5.303	6.280	6.300	5.296	11.668	8.016	9.851
1998	152	2.968	2.394	3.020	5.673	2.152	5.353	5.352	10.098	6.429	14.939	19.981	11.396
1999	143	3.442	1.998	3.367	6.149	1.960	6.049	8.115	7.019	7.055	22.082	84.668	12.623
2000	131	3.594	3.377	3.602	6.142	2.566	6.242	8.664	11.968	7.724	15.694	15.493	13.386
2001	124	2.825	3.392	2.844	5.921	3.099	5.784	5.625	10.970	6.211	17.098	32.907	12.621
2002	116	2.738	2.769	2.885	5.520	2.872	5.535	6.058	7.590	6.563	13.561	9.536	12.581
2003	119	2.687	4.059	3.187	4.938	3.732	5.338	5.223	11.472	7.373	13.999	26.412	12.344
2004	126	3.154	4.361	2.960	4.958	3.129	5.121	7.188	10.001	7.069	11.847	14.909	12.219
2005	128	2.900	3.305	3.081	4.686	3.206	4.703	6.890	11.027	7.746	12.881	14.505	11.825
2006	112	3.532	3.478	3.561	5.045	2.595	4.899	8.125	8.833	9.030	11.956	21.591	12.423
2007	108	3.116	2.893	3.489	5.001	2.831	5.159	7.852	11.987	9.947	20.373	48.426	14.774
2008	105	2.209	3.210	2.079	4.614	3.183	4.507	6.016	9.797	5.886	14.004	13.031	12.760
2009	104	1.068	4.309	0.760	3.815	4.612	3.912	2.247	14.055	1.824	8.633	16.545	9.386
2010	113	0.762	3.752	0.499	3.785	3.930	3.845	0.970	9.520	1.161	8.827	10.597	8.975
2011	116	1.188	3.828	1.691	4.478	2.673	4.746	1.966	9.659	3.842	10.431	7.697	10.786
2012	125	1.681	2.606	2.107	4.644	2.392	5.042	3.514	7.019	4.814	11.246	8.361	11.508
2013	146	1.871	2.743	2.426	4.813	2.502	5.188	3.829	7.741	5.422	11.178	9.169	11.601
2014	157	2.054	3.662	2.913	4.724	3.163	5.482	4.428	12.123	6.537	12.352	12.794	12.309
2015	152	2.260	2.989	2.939	5.163	2.750	5.686	5.411	10.686	6.675	14.054	17.200	12.914
All	3064	2.745	3.779	2.819	5.438	3.328	5.524	5.472	10.219	6.046	13.452	25.235	11.773

Table 2: Evolution of the annual number of sample REITs for the entire.
We construct our sample mainly from COMPUSTAT data, supplemented by the CRSP/Ziman and EDGAR databases and various interest searches. We restrict each REIT's ROA and ROE to fall between -100% to 100%. To calculate the Bennet dynamic decomposition between two years, say 1999 and 2000, we need to identify and separate entrants (REITs that entered the industry), exits (REITs that exited the industry or converted to private ownership), and stays (REITs that stayed in the industry). To do so, we matched REIT ID numbers and tickers in our merged database. If a REIT ID number or ticker exists in both 1999 and 2000, then the REIT stays in the industry. If a REIT ID number or ticker exists in 1999, but not in 2000, then the REIT exits. If a REIT ID number or ticker exists in 2000, but not in 1999, then the REIT enters.

	All Publicly Traded REITs: No of REITs in each component			**Sample REITs: No of REITs in each component**		
Time period	Enter	Stay	Exit	Enter	Stay	Exit
1989-1990	1	71	1	1	19	0
1990-1991	20	71	1	16	25	0
1991-1992	4	88	3	2	49	0
1992-1993	55	88	4	36	54	0
1993-1994	47	140	3	43	91	0
1994-1995	14	180	7	8	136	0
1995-1996	8	184	10	6	131	1
1996-1997	27	173	19	25	126	0
1997-1998	23	183	17	16	136	0
1998-1999	7	184	22	4	139	3
1999-2000	5	173	18	4	127	2
2000-2001	6	165	13	5	119	2
2001-2002	7	157	14	5	111	2
2002-2003	10	157	7	7	112	0
2003-2004	21	153	14	14	112	2
2004-2005	13	160	14	11	117	2
2005-2006	4	160	13	3	109	0
2006-2007	3	145	19	3	105	2
2007-2008	2	125	23	0	105	0
2008-2009	2	120	7	2	102	3
2009-2010	12	122	0	10	103	0
2010-2011	9	133	1	9	107	1
2011-2012	11	139	3	10	115	1
2012-2013	28	148	2	23	123	0
2013-2014	18	170	6	14	143	1
2014-2015	20	186	2	16	136	0

Figure 1: Evolution of the REIT industry, 1971-2017.
This graph illustrates the evolution of the REIT industry in (i) the number of all and Equity REITs, (ii) their market valuations, and (iii) their return metrics. Data for these graphs are from the NAREIT's website (see https://www.reit.com).

Panel A: Annual number and annual total market value of REITs as covered in the FTSE-NAREIT All REIT Index.



Panel B: Annual total and price returns on the FTSE-NAREIT All Equity REIT Index.

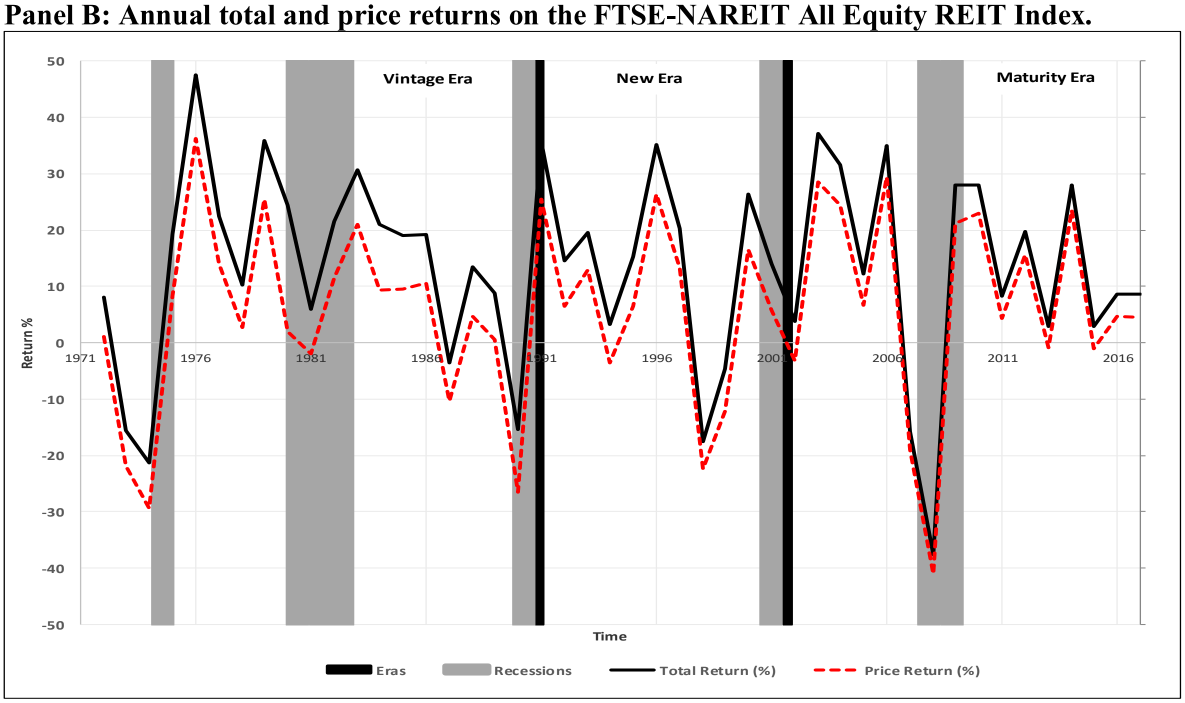


Table 3: Own-lags and predictability of ROA, ROE, *Change in ROA* and *Change in ROE*.

The results in this table follow from the OLS runs of this simple estimation model, $DepVar_t = a + b * (DepVar_{(t-1)} \text{ or } DepVar_{(t-2)}) + \varepsilon_t$, where $DepVar_t$ is either ROA_t, ROE_t, *Change in* $ROA_{t,(t-1)}$ *or Change in* $ROE_{t,(t-1)}$, respectively, of our sample portfolio. We run various specifications of this model under the net income (NI) and funds from operations (FFO) metrics, respectively. Any statistically significant estimate of the coefficient b from estimations will suggest the predictability of profitability for the sample portfolio of REITs, defined annually over the 1989-2015 period. These results shed light on whether the source of predictability relates to the sample REITs' asset management policies or debt policies and also on whether the use of FFO improves predictability over the use of NI at the portfolio level. The change variables motivate the Bennet (1920) decomposition method and computing the year-by-year magnitudes of the within effect, between effect, entry effect, and the exit effect, respectively. *, ** and *** indicate statistical significance at 1%, 5% and 10% levels, respectively.

	ROA		ROE		*Change in ROA*		*Change in ROE*	
Variable	Esti/t-stat	Esti/t-stat	Esti/t-stat	Esti/t-stat	Esti/t-stat	Esti/t-stat	Esti/t-stat	Esti/t-stat
	NI-Based							
Intercept	0.0079	0.0192	0.0203	0.0515	-0.0002	-0.0002	-0.0002	0.0005
t-stat	1.95***	3.38*	2.07**	3.95*	-0.19	-0.17	-0.07	0.17
L1 - ROA or ROE	0.7049		0.6596					
t-stat	5.05*		4.22*					
L1 - Chg in ROA or ROE					0.3681		0.3355	
t-stat					1.90***		1.71***	
L2 - ROA or ROE		0.2941		0.1485				
t-stat		1.49		0.71				
L2 - Chg in ROA or ROE						-0.2815		-0.2686
t-stat						-1.43		-1.38
R-Square	0.53	0.09	0.44	0.02	0.14	0.08	0.11	0.08
Adj R-Sq	0.51	0.05	0.41	-0.02	0.10	0.04	0.07	0.04
N	25	24	25	24	25	24	25	24
	FFO-Based							
Intercept	0.0125	0.0282	0.0627	0.1387	-0.0005	-0.0011	-0.0009	-0.0006
t-stat	2.06**	3.28*	2.88**	5.67*	-0.57	-1.21	-0.34	-0.23
L1 - ROA or ROE	0.7614		0.4654					
t-stat	6.93*		2.53*					
L1 - Chg in ROA or ROE					0.2295		0.1406	
t-stat					1.14		0.69	
L2 - ROA or ROE		0.4654		-0.1800				
t-stat		2.99*		-0.87				
L2 - Chg in ROA or ROE						-0.5110		-0.4247
t-stat						-2.79*		-2.38**
R-Sq	0.68	0.29	0.22	0.03	0.05	0.26	0.02	0.21
Adj R-Sq	0.66	0.26	0.18	-0.01	0.01	0.23	-0.02	0.17
N	25	24	25	24	25	24	25	24

Table 4: Results from the NI-based predictability models with respect to the four Bennet (1920) dynamic decomposition effects.

The results in this table follow from the OLS runs of this simple estimation model, $DepVar_t = a + \sum_{i=1}^{4} (b_i * Bennet\ Effects_{i,(t-1)})\ or\ \sum_{i=1}^{4} (b_i * Bennet\ Effects_{i,(t-2)}) + \varepsilon_t$, where $DepVar_t$ is either ROA_t, ROE_t, Change in $ROA_{t,(t-1)}$, or Change in $ROE_{t,(t-1)}$, respectively, and the Bennet $Effects_{i,(t-1\ or\ t-2)}$ are the "within", "between," "entry," and "exit," effects, respectively, of our sample portfolio. We run various specifications of this model under the net income (NI) and funds from operations (FFO) metrics, respectively. Any statistically significant estimate of the coefficient b_i will suggest the predictability of profitability for the sample portfolio of REITs, defined annually over the 1989-2015 period. These results shed light on whether the source of predictability, originating from the Bennet effects, relates to the sample REITs' asset management policies or debt policies and also on whether the use of FFO improves predictability over the use of NI at the portfolio level. *, ** and *** indicate statistical significance at 1%, 5% and 10% levels, respectively.

Panel A: Results on ROA and ROE.

	NI-based ROA				
Variable	Esti / t-stat	Esti / t-stat	Esti / t-stat	Estim / t-stat	Esti / t-stat
Intercept	0.0272	0.0275	0.0267	0.0273	0.0267
t-stat	20.62*	17.03*	13.66*	16.10*	14.20*
L1-within	0.6774				0.7630
t-stat	3.49*				3.26*
L1-between		-0.8748			0.8232
t-stat		-0.79			0.72
L1-entry			-0.5802		-0.0598
t-stat			-0.59		-0.06
L1-exit				-0.7399	-1.4615
t-stat				-0.20	-0.45
R-Sq	0.35	0.03	0.01	0.00	0.37
Adj R-Sq	0.32	-0.02	-0.03	-0.04	0.24
N	25	25	25	25	25
	NI-based ROE				
Intercept	0.0590	0.0605	0.0615	0.0589	0.0596
t-stat	19.24*	14.75*	12.23*	14.46*	13.04*
L1-within	0.7508				0.7747
t-stat	3.99*				3.68*
L1-between		-1.0759			0.5337
t-stat		-0.68			0.38
L1-entry			0.7818		0.6716
t-stat			0.57		0.58
L1-exit				-4.2077	-2.6295
t-stat				-0.81	-0.61
R-Sq	0.41	0.02	0.01	0.03	0.44
Adj R-Sq	0.38	-0.02	-0.03	-0.01	0.33
N	25	25	25	25	25

Table 4: Results from the net income-based predictability models with respect to the four Bennet (1920) dynamic decomposition effects (cont'd).

Panel B: Results on the *Change in ROA* and *Change in ROE*.

	NI-based *Change in ROA*									
Variable	Esti/ t-stat	Esti / t-stat	Esti / t-stat	Esti / t-stat	Esti / t-stat	Esti / t-stat	Esti/ t-stat	Esti/ t-stat	Esti / t-stat	Esti / t-stat
Intercept	-0.0005	0.0000	-0.0003	0.0000	-0.0021	-0.0009	-0.0008	-0.0003	-0.0031	-0.0018
t-stat	-0.47	-0.01	-0.23	0	-1.54	-0.61	-0.59	-0.25	-2.22**	-1.03
L1-within	0.4023								0.4173	
t-stat	2.40**								2.39**	
L1-between			-0.5391						1.0487	
t-stat			-0.62						1.23	
L1-entry					-1.56				-1.642	
t-stat					-2.22**				-2.35**	
L1-exit							-2.893		-4.279	
t-stat							-1.00		-1.76***	
L2-within		-0.1910								-0.2748
t-stat		-1.05								-1.34
L2-between				-0.0710						-0.0472
t-stat				-0.08						-0.05
L2-entry						-0.7770				-1.2303
t-stat						-1.05				-1.46
L2-exit								-2.2973		-2.9115
t-stat								-0.81		-1.02
R-Sq	0.20	0.05	0.02	0.00	0.18	0.05	0.04	-0.25	0.42	0.18
Adj R-Sq	0.17	0.00	-0.03	-0.05	0.14	0.00	0.00	-0.81	0.31	0.01
N	25	24	25	24	25	24	25	24	25	24

Table 4: Results from the NI-based predictability models with respect to the four Bennet (1920) dynamic decomposition effects (cont'd).

Panel B: Results on the *Change in ROA* and *Change in ROE*.

	NI-based *Change in ROE*									
Variable	Esti/ t-stat	Esti/ t-stat	Esti/ t-stat	Esti / t-stat	Esti / t-stat	Esti/ t-stat	Esti/ t-stat	Esti/ t-stat	Esti / t-stat	Esti / t-stat
Intercept	-0.0007	0.0009	0.0005	-0.0001	-0.0048	-0.0009	-0.0014	0.0003	-0.0072	-0.0030
t-stat	-0.25	0.28	0.15	-0.02	-1.22	-0.21	-0.42	0.1	-1.77***	-0.60
L1-within	0.4011								0.3810	
t-stat	2.15**								2.04**	
L1-between			-1.1962						0.1466	
t-stat			-0.91						0.12	
L1-entry					-1.9610				-2.2360	
t-stat					-1.82***				-2.19**	
L1-exit							-5.0523		-6.1431	
t-stat							-1.18		-1.60	
L2-within		-0.2620								-0.2501
t-stat		-1.37								-1.18
L2-between				0.9088						0.6977
t-stat				0.66						0.46
L2-entry						-0.6943				-1.0673
t-stat						-0.63				-0.9
L2-exit								-2.0120		-3.1763
t-stat								-0.48		-0.73
R-Sq	0.17	0.08	0.03	0.02	0.13	0.02	0.06	0.01	0.37	0.13
Adj R-Sq	0.13	0.04	-0.01	-0.03	0.09	-0.03	0.02	-0.03	0.24	-0.05
N	25	24	25	24	25	24	25	24	25	24

Table 5: Results from the FFO-based predictability models with respect to the Bennet (1920) dynamic decomposition effects.

The results in this table follow from the OLS runs of this simple estimation model, $DepVar_t = a + \sum_{i=1}^{4} (b_i * Bennet\ Effects_{i,(t-1)})\ or\ \sum_{i=1}^{4} (b_i * Bennet\ Effects_{i,(t-2)}) + \varepsilon_t$, where $DepVar_t$ is either ROA_t, ROE_t, Change in $ROA_{t,(t-1)}$, or Change in $ROE_{t,(t-1)}$, respectively, and the Bennet $Effects_{i,(t-1\ or\ t-2)}$ are the “within”, “between,” “entry,” and “exit,” effects, respectively, of our sample portfolio. We run various specifications of this model under the net income (NI) and funds from operations (FFO) metrics, respectively. Any statistically significant estimate of the coefficient b_i will suggest the predictability of profitability for the sample portfolio of REITs, defined annually over the 1989-2015 period. These results shed light on whether the source of predictability, originating from the Bennet effects, relates to the sample REITs’ asset management policies or debt policies and also on whether the use of FFO improves predictability over the use of NI at the portfolio level. *, ** and *** indicate statistical significance at 1%, 5% and 10% levels, respectively.

Panel A: Results on ROA and ROE.

	FFO-based ROA				
Variable	Esti/t-stat	Esti/t-stat	Esti/t-stat	Esti/t-stat	Esti/t-stat
Intercept	0.0536	0.0538	0.0530	0.0546	0.0529
t-stat	42.13*	35.12*	30.14*	34.98*	32.25*
L1-within	0.8848				0.9350
t-stat	3.36*				3.07*
L1-between		-1.3327			1.2313
t-stat		-1.24			0.88
L1-entry			-1.2030		-1.3649
t-stat			-1.27		-1.22
L1-exit				6.4330	3.4657
t-stat				1.02	0.62
R-Sq	0.33	0.06	0.07	0.04	0.39
Adj R-Sq	0.30	0.02	0.02	0.00	0.27
N	25	25	25	25	25
	FFO-based ROE				
Intercept	0.1158	0.1161	0.1196	0.1178	0.1181
t-stat	54.55*	45.76*	35.42*	47.16*	40.01*
L1-within	0.6354				0.4259
t-stat	4.14*				1.76***
L1-between		-1.7661			-0.767
t-stat		-2.34**			-0.94
L1-entry			1.1174		1.0113
t-stat			1.17		1.21
L1-exit				-7.0656	-2.0814
t-stat				-2.35**	-0.61
R-Squ	0.43	0.19	0.06	0.19	0.48
Adj R-Sq	0.40	0.16	0.01	0.16	0.37
N	25	25	25	25	25

Table 5: Results from the FFO-based predictability models with respect to the Bennet (1920) dynamic decomposition effects (cont'd).

Panel B: Results on the *Change in ROA* and *Change in ROE*.

	FFO-based *Change in ROA*									
Variable	Esti/ t-stat	Esti/ t-stat	Esti/ t-stat	Esti/ t-stat	Esti/ t-stat	Esti/ t-stat	Esti/ t-stat	Esti/ t-stat	Esti/ t-stat	Esti/ t-stat
Intercept	-0.0009	-0.0006	-0.0010	-0.0009	-0.0016	-0.0019	-0.0009	-0.0011	-0.0022	-0.0024
t-stat	-1.04	-0.57	-1.02	-0.89	-1.45	-1.22	-0.88	-1.14	-1.93***	-2.33**
L1-within	0.3862								0.4018	
t-stat	2.09**								1.95***	
L1-between			-0.9157						0.1981	
t-stat			-1.36						0.21	
L1-entry					-0.9139				-0.9506	
t-stat					-1.56				-1.25	
L1 -exit							-3.0093		-5.1162	
t-stat							-0.75		-1.35	
L2-within		-0.3147								-0.3992
t-stat		-1.58								-2.17**
L2-between				-0.8184						-0.5503
t-stat				-1.12						-0.58
L2- entry						-1.78				-1.2938
t-stat						-2.12**				-1.74***
L2-exit								-6.3330		-7.1692
t-stat								-1.61		-2.13**
R-Sq	0.16	0.10	0.07	0.05	0.10	0.17	0.02	0.11	0.29	0.46
Adj R-Sq	0.12	0.06	0.03	0.01	0.06	0.13	-0.02	0.06	0.15	0.35
N	25	24	25	24	25	24	25	24	25	24

Table 5: Results from the funds FFO-based predictability models with respect to the Bennet (1920) dynamic decomposition effects (cont'd).

Panel B: Results on the *Change in ROA* and *Change in ROE*.

	FFO-based *Change in ROE*									
Variable	Esti/ t-stat	Esti/ t-stat	Esti/ t-stat	Esti/ t-stat	Esti/ t-stat	Esti/ t-stat	Esti/ t-stat	Esti/ t-stat	Esti/ t-stat	Esti/ t-stat
Intercept	-0.0016	0.0006	-0.0020	0.0002	-0.0016	-0.0002	-0.0010	-0.0006	-0.0031	0.0009
t-stat	-0.57	0.26	-0.78	0.08	-0.45	-0.06	-0.35	-0.24	-0.83	0.24
L1-within	0.2376								0.1846	
t-stat	1.20								0.61	
L1-between			-1.5663						-1.3995	
t-stat			-2.01**						-1.37	
L1- entry					-0.2489				-0.2347	
t-stat					-0.25				-0.22	
L1-exit							-0.5743		3.2731	
t-stat							-0.17		0.76	
L2-within		-0.4556								-0.4197
t-stat		-2.61*								-1.46
L2-between				1.1094						-0.1106
t-stat				1.26						-0.1
L2-entry						-0.0233				0.2121
t-stat						-0.02				0.2
L2-exit								5.5924		1.4180
t-stat								1.85***		0.35
R-Sq	0.06	0.24	0.15	0.07	0.00	0.00	0.00	0.13	0.18	0.24
Adj R-Sq	0.02	0.20	0.11	0.02	-0.04	-0.05	-0.04	0.10	0.01	0.09
N	25	24	25	24	25	24	25	24	25	24

Appendix: Alternative Dynamic Decompositions[6]

At time t, the ROE (R_t) equals net income (NI_t) divided by total equity (E_t). That is,

$$R_t = \frac{NI_t}{E_t} \tag{A.1}$$

where $NI_t = \sum_{i=1}^{n_t} NI_{i,t}$, $E_t = \sum_{i=1}^{n_t} E_{i,t}$, and n_t is the number of REITs. After substitution and rearrangement, we get

$$R_t = \sum_{i=1}^{n_t} r_{i,t}\theta_{i,t}, \tag{A.2}$$

where $r_{i,t}$ equals the ratio of net income to equity for REIT i in period t and $\theta_{i,t}$ equals the i-th REIT's share of portfolio/industry equity. We want to decompose the change in portfolio/industry ROE into "within," "between," "entry," and "exit" effects. The change in portfolio/industry ROE equals the following:

$$\Delta R_t = R_t - R_{t-1} = \sum_{i=1}^{n_t} r_{i,t}\theta_{i,t} - \sum_{i=1}^{n_{t-1}} r_{i,t-1}\theta_{i,t-1}. \tag{A.3}$$

The number of REITs in period t equals the number of REITS in period *t-1* plus the number of REIT entrants minus the number of REIT exits. That is,

$$n_t = n_{t-1} + n_t^{enter} - n_{t-1}^{exit}. \tag{A.4}$$

Rearranging terms in equation (4) yields

$$n_t - n_t^{enter} = n_{t-1} - n_{t-1}^{exit} = n_{t/t-1}^{stay}; \text{ or} \tag{A.5}$$

$$n_t = n_{t/t-1}^{stay} + n_t^{enter}, \text{ and } n_{t-1} = n_{t/t-1}^{stay} + n_{t-1}^{exit}.\text{[7]} \tag{A.6}$$

Thus, equation (3) adjusts as follows:

$$\Delta R_t = \sum_{i=1}^{n_{t/t-1}^{stay}} r_{i,t}\theta_{i,t} + \sum_{i=1}^{n_t^{enter}} r_{i,t}\theta_{i,t} - \sum_{i=1}^{n_{t/t-1}^{stay}} r_{i,t-1}\theta_{i,t-1} - \sum_{i=1}^{n_{t-1}^{exit}} r_{i,t-1}\theta_{i,t-1}. \tag{A.7}$$

Case 1: Existing Dynamic Decomposition - Laspeyres Difference Index

While we already separate the "stay" terms from the "entry" and "exit" terms, we now need to decompose the "stay" terms into the "within" and "between" effects. Bailey et al. (1992) and Haltiwanger (1997) weight the "within" effect with the individual firm's portfolio/industry share of equity in the initial year.[8] That is,

[6] Jeon and Miller (2005) provide details of the derivations. These decomposition methods can be *also* applied at the industry level that includes all the firms in an industry between t and (t-1).

[7] Consider two time periods (*t-1*) and (*t*). We classify REITs as staying, if the REITs exists in both (*t-1*) and (*t*); entering, if the REIT does not exist in (*t-1*) but does in (*t*); and exiting, if the REIT exists in (*t-1*) but not in (*t*).

[8] Diewert (2005) calls this the Laspeyres (Laspeyres, 1871) difference index.

we need to add and subtract $\sum_{i=1}^{n_{t/t-1}^{stay}} r_{i,t}\theta_{i,t-1}$ from the right-hand side of equation (7). After some manipulation, we get

$$\Delta R_t = \sum_{i=1}^{n_{t/t-1}^{stay}} r_{i,t}\theta_{i,\Delta t} + \sum_{i=1}^{n_{t/t-1}^{stay}} r_{i,\Delta t}\theta_{i,t-1} + \sum_{i=1}^{n_t^{enter}} r_{i,t}\theta_{i,t} - \sum_{i=1}^{n_{t-1}^{exit}} r_{i,t-1}\theta_{i,t-1}, \tag{A.8}$$

where $\theta_{i,\Delta t} = \theta_{i,t} - \theta_{i,t-1}$ and $r_{i,\Delta t} = r_{i,t} - r_{i,t-1}$.

Then, we can rewrite equation (8) as follows:

$$\Delta R_t = \underbrace{\sum_{i=1}^{n_{t/t-1}^{stay}} r_{i,\Delta t}\theta_{i,t-1}}_{\text{"within effect"}} + \underbrace{\sum_{i=1}^{n_{t/t-1}^{stay}} (r_{i,t} - R_{t-1})\theta_{i,\Delta t}}_{\text{"between effect"}} + \underbrace{\sum_{i=1}^{n_t^{enter}} (r_{i,t} - R_{t-1})\theta_{i,t}}_{\text{"entry effect"}}$$

$$\underbrace{- \sum_{i=1}^{n_{t-1}^{exit}} (r_{i,t-1} - R_{t-1})\theta_{i,t-1}}_{\text{"exit effect"}}, \tag{A.9}$$

where we evaluate the "between," "entry," and "exit" effects relative to the lagged portfolio/industry ROE (R_{t-1}). For example, the "between" effect sums the differences between each REIT's ROE and the portfolio's/industry's ROE, multiplied by that REIT's change in equity share. In this case, we evaluate the REIT's ROE in period t and the industry's ROE in period *t-1*.

Case 2: Alternative Dynamic Decomposition - Paasche Difference Index

We decompose the change in industry ROE by weighting the "within" effect by period-*t* individual REIT's share of portfolio/industry equity.[9] In other words, we need to add and subtract $\sum_{i=1}^{n_{t/t-1}^{stay}} r_{i,t-1}\theta_{i,t}$ to equation (7). After necessary manipulations, the final form equals:

$$\Delta R_t = \underbrace{\sum_{i=1}^{n_{t/t-1}^{stay}} r_{i,\Delta t}\theta_{i,t}}_{\text{"within effect"}} + \underbrace{\sum_{i=1}^{n_{t/t-1}^{stay}} (r_{i,t-1} - R_t)\theta_{i,\Delta t}}_{\text{"between effect"}} + \underbrace{\sum_{i=1}^{n_t^{enter}} (r_{i,t} - R_t)\theta_{i,t}}_{\text{"entry effect"}}$$

$$\underbrace{- \sum_{i=1}^{n_{t-1}^{exit}} (r_{i,t-1} - R_t)\theta_{i,t-1}}_{\text{"exit effect"}}, \tag{A.10}$$

where we evaluate the "between," "entry," and "exit" effects relative to the current portfolio/industry ROE (R_t).[10]

[9] Diewert (2005) calls this the Paasche (Paasche, 1974) difference index.

[10] Note, also, that for the between effect, the lagged ROE for each REIT replaces the current ROE between equations (A.9) and (A.10).

Case 3: Bennet Dynamic Decomposition[11]

The Bennet dynamic decomposition computes the arithmetic average of *Case 1* and *Case 2* as follows:[12]

$$\Delta R_t = \sum_{i=1}^{n_{t/t-1}^{stay}} r_{i,\Delta t}\,\bar{\theta}_i + \sum_{i=1}^{n_{t/t-1}^{stay}} (\bar{r}_i - \bar{R})\theta_{i,\Delta t} + \sum_{i=1}^{n_t^{enter}} (r_{i,t} - \bar{R})\theta_{i,t}$$

"within effect" *"between effect"* *"entry effect"*

$$- \sum_{i=1}^{n_{t-1}^{exit}} (r_{i,t-1} - \bar{R})\theta_{i,t-1}\,. \qquad \text{(A.11)}$$

"exit effect"

where $\bar{\theta}_i = (\theta_{i,t} + \theta_{i,t-1})/2$, $\bar{r}_i = (r_{i,t} + r_{i,t-1})/2$, and $\bar{R} = (R_t + R_{t-1})/2$.

The Bennet dynamic decomposition includes four effects. The "within" effect equals the summation of each REIT's change in ROE weighted by its average share of portfolio/industry equity between period *t-1* and period *t*. The "between (reallocation)" effect equals the summation of the difference between each REIT's ROE and the average portfolio/industry ROE between period *t* and period *t-1*, multiplied by the change in that REIT's share of portfolio/industry equity. The "entry" effect equals the summation of the difference between each entry REIT's ROE in period t and the average portfolio/industry ROE between period *t-1* and period *t* times the entry REIT's share of portfolio/industry equity in period *t*. Finally, the "exit" effect equals the summation of the difference between each exit REIT's ROE in period *t-1* and the average portfolio/industry ROE between period *t-1* and period *t*, multiplied by the exit REIT's share of portfolio/industry equity in period *t-1*.

[11] Bailey et al. (1992) provide an algebraic decomposition of an industry's total factor productivity (TFP) growth into the "within," "between," and "net-entry" (entry minus exit) effects. Extending Bailey et al. (1992), Haltiwanger (1997) separates the effects of firm entrants into and exit from the industry. Moreover, he also divides the "between" effect into two components – the "share" and "covariance" effects. Stiroh (2000) further decomposes Haltiwanger's (1997) method by dividing firms into those that acquired other firms and those that did not. Finally, the Bennet (1920) dynamic decomposition combines Bailey et al.'s (1992) and Haltiwanger's (1997) dynamic decompositions into a simple average. Thus, the weighting of the four effects all employ simple averages of the initial (t-1) and final (t) year weights. In addition, the Bennet decomposition eliminates Haltiwanger's (1997) "covariance" effect as it emerges because of the method of decomposition.

[12] See Diewert (2005) for additional details. Jeon and Miller (2005) also provide the derivation.

Appendix 2: This appendix provides the yearly evolution of the Bennet dynamic decomposition effects, "within," "between," "entry," and "exit" effects, under the NI and FFO measures for the *Change in ROA* and *Change in ROE*, respectively, in two panels. The *Change in ROA or ROE* between any two years equals the sum of the *Within, Between*, and *Entry* effects minus the *Exit* effect. *Stay, Enter*, and *Exit* refer to the number of REITs that stay, enter, and exit for each of the two-year pairs.

Panel A: Year-by-year decomposition of NI-based *ΔROA and ΔROE.*

Years	*Within*	*Between*	*Entry*	*Exit*	*ΔROA*	*Within*	*Between*	*Entry*	*Exit*	*ΔROE*
1989-1990	-0.0018	0.0009	-0.0013	0.0000	-0.0022	-0.0017	0.0036	-0.0023	0.0000	-0.0004
1990-1991	-0.0092	0.0015	-0.0017	0.0000	-0.0094	-0.0204	0.0027	-0.0093	0.0000	-0.0270
1991-1992	-0.0074	0.0047	-0.0021	0.0000	-0.0048	-0.0074	0.0047	-0.0021	0.0000	-0.0048
1992-1993	0.0115	-0.0039	-0.0077	0.0000	-0.0002	0.0132	-0.0029	-0.0102	0.0000	0.0000
1993-1994	0.0082	-0.0007	-0.0014	0.0000	0.0061	0.0192	-0.0016	-0.0020	0.0000	0.0157
1994-1995	0.0016	0.0007	-0.0003	0.0000	0.0020	0.0057	-0.0019	-0.0009	0.0000	0.0029
1995-1996	0.0025	-0.0009	-0.0006	0.0000	0.0010	0.0039	-0.0011	-0.0017	0.0000	0.0011
1996-1997	-0.0031	-0.0015	-0.0020	0.0000	-0.0066	-0.0037	-0.0058	-0.0048	0.0000	-0.0142
1997-1998	0.0035	0.0000	-0.0020	0.0000	0.0015	0.0113	0.0027	-0.0030	0.0000	0.0110
1998-1999	0.0045	0.0004	-0.0001	-0.0016	0.0064	0.0105	0.0004	0.0000	-0.0031	0.0140
1999-2000	0.0019	0.0001	0.0000	-0.0007	0.0027	0.0060	0.0003	0.0001	-0.0015	0.0079
2000-2001	-0.0072	0.0003	0.0003	0.0001	-0.0067	-0.0146	0.0013	0.0004	0.0002	-0.0131
2001-2002	0.0008	0.0003	-0.0015	-0.0005	0.0001	0.0040	0.0011	-0.0030	-0.0011	0.0031
2002-2003	0.0020	0.0009	-0.0004	0.0000	0.0025	0.0036	0.0036	-0.0005	0.0000	0.0068
2003-2004	-0.0016	-0.0003	-0.0009	0.0000	-0.0027	-0.0044	0.0032	-0.0020	-0.0001	-0.0031
2004-2005	0.0012	0.0006	-0.0003	-0.0002	0.0018	0.0053	0.0037	-0.0011	-0.0003	0.0081
2005-2006	0.0031	0.0006	0.0002	0.0000	0.0039	0.0107	0.0003	0.0000	0.0000	0.0110
2006-2007	0.0005	0.0004	-0.0005	0.0008	-0.0004	0.0089	0.0001	-0.0016	0.0014	0.0060
2007-2008	-0.0148	0.0000	0.0000	0.0000	-0.0147	-0.0421	0.0024	0.0000	0.0000	-0.0397
2008-2009	-0.0149	0.0007	0.0001	-0.0009	-0.0132	-0.0433	0.0020	0.0002	-0.0004	-0.0406
2009-2010	-0.0005	0.0009	-0.0036	0.0000	-0.0032	-0.0003	0.0005	-0.0081	0.0000	-0.0080
2010-2011	0.0126	-0.0001	-0.0002	0.0000	0.0124	0.0281	0.0002	-0.0006	-0.0001	0.0278
2011-2012	0.0038	0.0005	-0.0002	-0.0001	0.0042	0.0079	0.0017	-0.0002	-0.0002	0.0097
2012-2013	0.0041	0.0006	-0.0015	0.0000	0.0032	0.0093	0.0003	-0.0034	0.0000	0.0062
2013-2014	0.0073	-0.0020	-0.0006	0.0000	0.0046	0.0147	-0.0037	-0.0007	0.0000	0.0103
2014-2015	0.0005	-0.0002	-0.0005	0.0000	-0.0003	0.0035	-0.0023	-0.0013	0.0000	0.0000

Panel B: Year-by-year decomposition of FFO-based *ΔROA and ΔROE.*

Years	*Within*	*Between*	*Entry*	*Exit*	*ΔROA*	*Within*	*Between*	*Entry*	*Exit*	*ΔROE*
1989-1990	0.0026	0.0018	-0.0016	0.0000	0.0028	0.0132	0.0010	-0.0027	0.0000	0.0115
1990-1991	-0.0033	0.0017	0.0014	0.0000	-0.0001	-0.0117	0.0008	-0.0111	0.0000	-0.0220
1991-1992	-0.0016	0.0002	-0.0025	0.0000	-0.0039	-0.0076	0.0020	-0.0035	0.0000	-0.0090
1992-1993	0.0033	-0.0046	-0.0064	0.0000	-0.0078	-0.0043	-0.0040	-0.0040	0.0000	-0.0123
1993-1994	0.0119	-0.0026	-0.0031	0.0000	0.0062	0.0311	-0.0057	-0.0044	0.0000	0.0211
1994-1995	0.0053	-0.0008	-0.0004	0.0000	0.0042	0.0046	0.0030	-0.0014	0.0000	0.0062
1995-1996	-0.0019	-0.0010	-0.0009	0.0000	-0.0037	-0.0101	0.0041	-0.0028	-0.0002	-0.0086
1996-1997	-0.0043	-0.0016	-0.0039	0.0000	-0.0098	-0.0058	-0.0068	-0.0090	0.0000	-0.0216
1997-1998	0.0020	-0.0010	-0.0008	0.0000	0.0002	0.0133	0.0010	0.0008	0.0000	0.0151
1998-1999	0.0058	0.0004	0.0003	-0.0007	0.0072	0.0149	-0.0006	0.0003	-0.0009	0.0155
1999-2000	0.0021	-0.0002	0.0001	0.0001	0.0018	0.0086	-0.0010	0.0003	0.0002	0.0077
2000-2001	-0.0041	-0.0005	0.0001	0.0002	-0.0046	-0.0050	-0.0016	-0.0001	0.0004	-0.0071
2001-2002	-0.0016	0.0002	-0.0014	-0.0003	-0.0026	0.0006	0.0018	-0.0027	-0.0004	0.0001
2002-2003	-0.0024	0.0007	-0.0004	0.0000	-0.0021	-0.0041	0.0017	-0.0004	0.0000	-0.0028
2003-2004	-0.0014	0.0001	-0.0011	0.0000	-0.0024	-0.0006	0.0031	-0.0025	-0.0001	0.0000
2004-2005	-0.0035	0.0002	-0.0005	-0.0002	-0.0037	-0.0023	0.0015	-0.0020	0.0001	-0.0029
2005-2006	0.0000	0.0008	-0.0002	0.0000	0.0007	0.0064	-0.0019	-0.0013	0.0000	0.0032
2006-2007	0.0021	-0.0002	-0.0007	0.0003	0.0009	0.0194	-0.0042	-0.0024	-0.0006	0.0134
2007-2008	-0.0076	-0.0001	0.0000	0.0000	-0.0076	-0.0183	-0.0003	0.0000	0.0000	-0.0186
2008-2009	-0.0080	0.0010	0.0001	-0.0009	-0.0059	-0.0346	0.0049	-0.0001	0.0039	-0.0337
2009-2010	0.0001	0.0007	-0.0015	0.0000	-0.0006	-0.0013	-0.0002	-0.0026	0.0000	-0.0042
2010-2011	0.0107	-0.0012	-0.0001	-0.0001	0.0094	0.0238	-0.0044	-0.0009	-0.0004	0.0188
2011-2012	0.0023	0.0004	0.0002	-0.0001	0.0030	0.0055	0.0000	0.0013	-0.0003	0.0070
2012-2013	0.0025	-0.0001	-0.0011	0.0000	0.0013	0.0057	-0.0022	-0.0028	0.0000	0.0007
2013-2014	0.0054	-0.0024	-0.0003	0.0000	0.0027	0.0131	-0.0079	0.0006	0.0000	0.0059
2014-2015	0.0008	-0.0003	0.0001	0.0000	0.0006	0.0047	-0.0022	0.0001	0.0000	0.0026