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

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Abstract

We ask three interrelated questions about the operating profitability of a portfolio of listed Equity REITs between 1989 and 2015. First, we consider whether asset or debt management policies affect the predictability of profitability. That is, 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? Second, we consider whether the changing structure of the industry affects profit predictability. That is, do the lagged values of the 'within,' 'between,' 'entry,' and 'exit' effects, as obtained from the Bennet (1920) dynamic decomposition, predict the current values of profitability measures? Third, we consider whether the information content of funds from operation (FFO) exceeds that of net income (NI) in the context of a portfolio rather than the firm level. That is, does measuring portfolio *ROA* or *ROE* in terms of funds from operations (FFO), instead of net income (NI), affect profit predictability? We find that (i) the sample Equity REITs' asset management policies ultimately influence profit predictability than either debt management in isolation or asset and debt management together, (ii) the "within" effect provides the dominant Bennet decomposition effect in profit predictability, and (iii) the FFO measure, along with the "within" effect, helps to identify asset management's more pronounced role in profit predictability and the results differ from their NI measure counterparts even at the portfolio level. These findings should provide useful information to investors, REIT managers, regulators, and the REIT literature.

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1. Introduction

This paper studies the predictability of operating profitability of a value-weighted portfolio of a large sample of listed U.S. Equity REITs, constructed annually between 1989 to 2015. We ask three interrelated questions. First, we consider whether the own lagged values of (i) return on assets (*ROA*), (ii) return on equity (*ROE*), (iii) the annual change in *ROA*, or (iv) the annual change in *ROE* predict the current values of these profitability measures defined at the portfolio level. Second, we obtain the "within," "between," "entry," and "exit" components of the *change in ROA* or *ROE* between time (t-1) and (t), as per Bennet's (1920) dynamic decomposition method, and consider whether the lagged values of these components predict the change in *ROA* or *ROE*. The "within" and "between or reallocation" effects refer to the contributions of surviving firms' operations and market shares, respectively, to the portfolio profitability. This examination aims to provide depth and refined understanding of the source(s) of predictability. Finally, we also consider two metrics of income to measure *ROA* or *ROE* - annual net income (NI) or annual funds from operations (FFO) - and study their differential effects on our first two questions.

If predictability exists, examination separately of the relation between the current and lagged values across each of these four portfolio-level profitability measures could reveal whether the observed predictability at root relates to sample firms' asset or debt management policies or both. Predictability in *ROA* and/or its annual change without predictability in *ROE* or its annual change establishes asset management as the source of predictability. The reversal of this sequence will identify the sample Equity REITs' debt management policies as the source of predictability, since a firm's asset and debt management policies jointly influence its ROE. Finally, the predictability of *ROA*, *ROE* and their changes implicates both the asset and debt management polices as the sources of predictability.

REITs are, at least in theory, a pass-through investment vehicle that routinely use a lot of long-term leverage. These characteristics, combined with reliable data availability, uniquely permit the separation of the asset- and debt-management functions. In our view, no other pass-through investment vehicle can offer an insight into this separation. Mutual funds offer rich data, but they do not use significant leverage. Hedge funds, some private equity funds, some CDOs, and some CDSs use leverage, but they offer little or no public data. Further, 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. Thus, studying REITs uniquely permits us to address a fundamental finance question and contribute not only to the real estate literature, but also to the finance literature.[1]

We also supplement our initial analyses on own lags by considering whether the lagged values of the Bennet effects predict the current values of the temporal change in the sample portfolio's ROA or ROE. If our initial set of analyses detects predictability, then this supplementary extension can reveal which Bennet effect(s) may be the source(s) of the initially observed predictability in the own lags. If our initial set of analyses does not detect predictability while the supplementary analyses do, then we infer that some significant underlying relations either stay invisible or wash out in the predictability analyses involving the aggregated profitability measures. To our knowledge, examining the predictability of financial data, by focusing on the Bennet effects that make up the temporal change in a profitability measure is new in the literature. An understanding of the source(s) of predictability should 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.

Our findings show that the sample Equity REITs' asset-management policies ultimately exert more influence on predictability than debt-management policies alone or a combination of asset- and debt-management policies together. Further, the Bennet "within" effect dominates other Bennet effects in the predictability analyses. The use of the FFO measure, along with the "within" effect, helps to identify asset management's more pronounced role in the predictability of portfolio's profits. The FFO results differ from their NI measure counterparts even at the portfolio level. *The National Association of Real Estate Investment Trusts* (NAREIT) in the United States for a long time and REALPAC in Canada in recent years have promoted the use of FFO. Our results appear to lend support to both institutions' position.

This paper unfolds as follows. Section 2 provides a literature review of profit predictability. Section 3 briefly introduces the Bennet dynamic decomposition, leaving the details of derivations to Appendix 1 and annual estimates of the Bennet decomposition effects

[1] We are grateful to a referee for this very insightful point.

to Appendix 2. Section 4 discusses the data and the sample. Section 5 specifies the empirical models and reports the findings. Section 6 concludes the paper and offers ideas on how to apply the Bennet decomposition to some other financial data.

2. Literature Review of Profit Predictability

Financial institutions produce their profit by managing their portfolio of assets and liabilities. Financial institutions also hire labor and rent (own) capital to run their operations in addition to selling services, which also appear in their income statements along with the income and expenses from managing their portfolio. Nonetheless, asset and debt management policies provide an important component of a financial institution's profitability.

While a literature search reveals a number of published papers on the predictability of REITs' stock returns, it does not generate any published papers on predictability of their operating profits or on how asset- or debt-management policies may affect either stock returns or operating profitability. A few papers consider REITs' firm-level operating performance. Harrison et al. (2011) report that enhanced liquidity strongly associates with better firm-level operating performance. Ghosh et al. (2013) find improvements in industry-adjusted operating performance prior to a seasoned equity offering and declines in operating cash-flow measures after the offering. They attribute this mean reverting behavior to asymmetric information. Huang et al. (2009) find that operating performance of REITs peak at the announcement year and decline in the years that follow the announcement and that post-buyback operating performance is stronger than its pre-buyback counterpart. Xu and Ooi (2018) consider whether the growth of REITs over the last two decades relates to the existence of scale economies. They find that large REITs with more free cash flows have a higher propensity to engage in bad growth activities.

Focusing on studies of banks, researchers frequently measure bank profitability by *ROA* or *ROE*, where a measure of net income captures the profit from the income statement and total assets or equity comes from the balance sheet. Using Consolidated Report of Condition and Income (Call Report) data, researchers focus on the determinants of individual bank profitability, which typically include bank-specific variables (internal factors) and macroeconomic variables (external factors). The predictability of bank profitability depends on the explanatory power of these bank-specific variables that measure asset (lending and investment), management (e.g., total loans to total assets), liability (funding) management (e.g., total deposits to total assets), productivity and efficiency (e.g., total non-interest income to total income), and asset quality (e.g., provisions for loans losses to total loans). Macroeconomic variables affect bank profitability by their changes over time. Thus, studies of bank profitability that include both bank-specific variables as well as macroeconomic variables generally employ time fixed effects in a panel data setting to control for macroeconomic variables.

For example, Kwast and Rose (1982), Wall (1985), Gup and Walter (1989), and Miller and Noulas (1997) report a portfolio of findings on U.S. bank performance with various sized samples of banks and various sample periods. A few consistent explanations of good bank performance exist. For example, high-performance banks generally face low non-interest expense and quality management.

The literature on REITs debates the use of NI versus FFO. The FFO measure has received increasing research attention (Bhattacharya et al. 2003; Lougee and Marquardt, 2004; Ben-Shahar et al. 2011). Further, a NAREIT (2018) report points out that "FFO has gained wide acceptance by REITs and investors." 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). Feng et al. (2020) provide evidence that both NI and FFO contain valuable information for investors and that a possible intentional inclusion and/or omission of, "good" vs. "bad" news, respectively, in FFO may occur and that FFO adjustments relate to CEOs' involvement in hiding subpar performance. So, there appears to exist a growing consensus in the recent literature 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.

Counterarguments also exist 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.

Previous research also reports mixed and conflicting 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. Meanwhile, Ben-Shahar et al. (2011) report counter evidence that FFO explains better REITs' dividend policy than NI. Sahin (2020) reports that FFO does not produce better predictions of future REIT returns than other cash-flow measures. Vincent (1999) reports that all four measures - FFO, earnings-per-share (EPS), CFO, and earnings-before-interest-tax-depreciation-and-amortization (EBITDA) - are associated with stock returns, but their statistical significance depends on the model specifications.

Given this discussion, studying whether measuring profitability in terms of FFO, instead of the conventional NI measure, affects the predictability in profitability, as posed in the first two questions in the Introduction, constitutes another contribution of our paper. Further, we address carefully the selection bias in the data.

3. Portfolio Profitability Metrics and the Bennet Dynamic Decomposition

Applying Bennet's (1920) dynamic decomposition to the annual change of a portfolio's profitability captures four effects (or components): (i) improved profitability of individual REITs (the "within" effect), (ii) shifts of resources from less to more profitable REITs (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).[2] The sum of these effects equals the annual 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 measure by either annual net income (NI) or annual funds from operations (FFO).

Since we apply the Bennet dynamic decomposition to a sample portfolio of U.S. Equity REITs, our derivation of the various dynamic decompositions employs the sample portfolio's

[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 1989 and 2015.

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

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" 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*.

Our approach can offer insights into dynamic changes in both portfolios of financial assets and industry level analyses, commonly observed in Finance or empirical Microeconomics. It is well-known that research results from portfolio level analyses are more reliable and robust than their equivalents from individual assets or firms obtained from panel data, time series, or cross-sectional explorations. Further, the dynamic decomposition methods split the surviving firms' contributions to the temporal change in the profitability metric into the "within" and "between" effects. The "between" effect sums across all sample REITs simultaneously the (i) difference in a REIT's average profitability between t and (t+1) from its industry counterpart and (ii) change in this REIT's market cap from t to (t+1). Thus, the "between" effect has a different meaning than investors' active reallocation of assets within actual REIT portfolios.[3] Tracking active portfolio reallocations poses a major data challenge for researchers.

Appendix 1 shows that some other portfolio or industry performance decomposition methods, for example, Bailey et al. (1992) and Haltiwanger (1997), are special cases of the Bennet (1920) dynamic 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. 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. Data and Sample

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

[3] We are grateful to a referee for this insightful point.

[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.

compiled and kindly provided to us by NAREIT.[5] 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.

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. In unreported work, we examine whether there is something different about the REITs for which FFO information is available.[6] All mean differences in (i) total assets, (ii) total equity, (iii) NI, (iv) ROE, and (v) ROA between the 3,855 observations for the full sample and the 3,064 observations for the FFO sample are statistically not significant. That is, our FFO sample exhibits the fundamental statistical characteristics of the full sample.

[- 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

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[5] 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.

[6] We gratefully acknowledge a referee for this point and will share these mean differences upon request.

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 compare the *ROA* and *ROE* using NI and FFO between 1989 and 2015; Panels A and B of Figure 2 compare the *Change in ROA* and *Change in ROE* using NI and FFO between 1989 and 2015. Figure 1 data come from Table 1, Panel B; Figure 2 data come from Appendix 2 Panels A and B. We note that the *NI ROA* and *FFO ROA* as well as the *NI ROE* and *FFO ROE* move together, although the FFO measures are larger than the NI measures. The changes in the two measures of *ROA* and *ROE*, however, look like they provide a much closer match, but, in fact to the levels data the correlations are nearly identical (NI-based correlation = 0.74 and the FFO based correlation = 0.87) to the levels data (NI-based correlation = 0.75 and the FFO based correlation = 0.86).

[- insert Figure 1 and 2 here -]

Some compromises, arising from data limitations, have not only shaped the construction of the sample portfolio but also defined 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. Equity REITs since the early 1980s, an increasing number of REITs have begun to produce publicly and consistently their FFO data since 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 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.

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

This section reports the OLS results obtained from estimating various specifications and offers discussions of these findings. We note, again, that we need to interpret the reported results on the "exit" component 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) Predictability with respect to own lags:

We build the following simple estimation models:

$$DV_t \; = \; a + b * (DV_{(t-1)} \;\; or \;\; DV_{(t-2)}) + \; \varepsilon_t \tag{5.a}$$

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

Remember that 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. The sharing of variables in *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) could lead to spurious results. In this connection, the second own lags become an alternative variable in estimating eq. (5.a). The *Change in ROA* or *ROE* variables constitute flow variables and will be instrumental in extending eq. (5.a) to the four effects of the Bennet dynamic decomposition.

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 temporal patterns of increase in the number of REITs and their market valuations, we can reasonably expect that this persistence can spill over to the profitability measures in eq. (5.a) and generate profit predictability.[7]

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.

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 United States and *REALPAC* in Canada, have advocated the adoption of FFO because it provides more information on performance than NI. 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).

To our knowledge, no evidence currently exists 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*. We aim to fill this gap in the literature.

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

[7] Eq. (5.a) is consistent in spirit with the weak-form market efficiency tests even though our work does not constitute a test of market efficiency. We use sample REITs' operating profits, which are not capable of reflecting immediately all publicly available information, since firms produce them under accounting principles. They are not outcomes of market-transactions. We thank a referee for bringing this matter to our attention.

Results in Table 3 reveal that, irrespective of the use of NI or FFO metric, the values of the first lags, *L1-ROA* and *L1-ROE*, predict a strong positive association with the current values of portfolio *ROA* and *ROE*. The coefficient estimates of *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 coefficient estimates of the second lags, only the FFO-based *L2-ROA* is positive significant at the 5% level. So, evidence on the predictability of *ROA* and *ROE* from the second lags is marginal or weak.

[- insert Table 3 here -]

While the signs of the coefficient estimates of the NI-based lags, *L1-Chg in ROA*, *L1-Chg in ROE*, in the *Change in ROA* and *Change in ROE* estimations are positive and significant at the 5% and 10% levels, their FFO-based second lag counterparts, *L2-Chg in ROA, and L2-Chg in ROE*, are negative and significant at the 5% level. Only these four coefficient estimates attain statistical significance.

Remember that the NI- or FFO-based coefficient estimates of *L1-Chg in ROA* or *L1-Chg in ROE* probably are spurious due to the shared ROA(t-1) or ROE(t-1) with the dependent variables, either *Change in ROA* and *Change in ROE*. Thus, we must exercise caution in interpreting the coefficient estimates of these first-lag variables.

Overall, the results in Table 3 support the predictability of the portfolio level *ROA* and *ROE* measures and their temporal change variables and also demonstrate, consistent with the extant literature, some differences in the information content of the NI and FFO metrics.

5.c) Predictability with respect to the lagged Bennet decomposition effects

We build the following estimation models:

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

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

Our analysis in this section follows directly from section 5.a above and mainly substitutes the lags of the four Bennet decomposition effects for the own lags of DV_t. Our arguments for the role of asset- versus debt-management as well as the information content of FFO versus NI remain the same.

The new right-hand variables in eq. (5.b) capture how the Bennet decomposition effects may account for the relations discussed in section 5.a. On the one hand, if we detect predictability vis-a-vis eq. (5.a) estimations, an understanding 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" effect) or a combination of these effects will be 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 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, how the use of NI or FFO affects these results from the Bennet decompositions is also immediately useful to judge the information content of FFO vis-a-vis NI.

Note that the *Change in ROA* and the *Change in ROE* decompose into the Bennet within, between, entry, and exit effects. Thus, any increase in these effects causes the change in ROA and the change in ROE to increase. If BDE(t-2) increases then the change in ROA(t-1) and the change in ROE(t-1) both increase, implying that ROA(t-1) and ROE(t-1) both increase. These increases squeeze the change in ROA(t) and the change in ROE(t) to lower values. In sum, an increase in BDE(t-1) increases the change in ROA(t) and the change in ROE(t) whereas an increase in BDE(t-2) increases the change in ROA(t-1) and the change in ROE(t-1) and then lowers the value of the change in ROA(t) and the change in ROE(t). Thus, the coefficient on BDE(t-1) is biased toward a positive value while the coefficient on BDE(t-2) is biased toward a negative value.

To our knowledge, focusing on the predictability of financial data by focusing on the Bennet decomposition effects that make up the temporal change in a profitability measure between (t) and (t-1) is new in the literature.

5.d) 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 coefficient estimates of the first lags of the "within" effect, *L1-within*, predict positively and strongly at the 1% significance level the current levels of both *ROA* and *ROE*. The coefficient estimates of the lags of the remaining three Bennet decomposition effects do not attain any statistical significance.

[- insert Table 4 here -]

In Panel B, *L1-within* and *L1-entry* predict consistently both *Change in ROA* and *Change in ROE*. While all coefficient estimates of *L1-within* are positive and significant mainly at the 5% level, all the coefficient estimates of *L1-entry* are negative and significant mainly at the 5% level. *L1-exit* weakly and negatively affects the dependent variables.

Overall, the NI-based results offer evidence that the first own 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) 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).

5.e) The FFO-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 5 tabulates the FFO-based results on *ROA* and *ROE* (*Change in ROA* and *Change in ROE*). In Panel A, the coefficient estimates of *L1-within* are positive and significant at the 1% level for the ROA specifications and at the 1% and 10% levels for the ROE specifications. The coefficient estimates of the remaining three Bennet decomposition effects do not attain any statistical significance on the *ROA* estimations. While the coefficient estimates of *L1-between* and *L1-exit* are negative and statistically significant, at the 5% level in two different ROE specifications, their significance disappears in the ROE specification with all Bennet decomposition effects. These findings indicate that only the first-lagged values of the "within" effect predict the current values of both *ROA* and *ROE*. Further, these FFO-based results differ somewhat from their counterparts in Panel A of Table 4.

[- insert Table 5 here -]

Panel B reports the coefficient estimates of the first and second lags of the Bennet decomposition effects in specifications where either *Change in ROA* or *Change in ROE* is the dependent variable. Results unearth further, diverse, and stronger evidence of the difference(s) in (i) predictability between *Change in ROA* and *Change in ROE* and (ii) the information contents of NI and FFO. In particular, the coefficient estimates of *L1-within* in the *Change in*

ROE specifications differ *starkly* from their counterparts in not only the *Change in ROA* specifications in Panel B, but also the *Change in ROE* specifications in Panel B of Table 4. In Panel B, no coefficient estimate of *L1-within* is significant in the *Change in ROE* specifications while they are (i) positive and significant, at the 5% and 10% levels, in the *Change in ROA* specifications and (ii) once again positive and highly significant in <u>all</u> NI-based *Change in ROE* estimations in Panel B of Table 4. While no coefficient estimates of the first lags of the remaining three Bennet decomposition effects in Panel B attain significance in the *Change in ROA* estimations, the coefficient estimate of *L1-between* is positive and significant at the 5% level in one of the *Change in ROE* estimations. The significance of the coefficient estimate of *L1-between* disappears in the model specification that brings together all four Bennet decomposition effects. These stark differences reveal that (i) asset management is likely to have more to do with the predictability of a portfolio's profitability and (ii), extended to the context of a portfolio, the information content of the FFO metric differs from the NI metric and is potentially richer than that of the NI metric.

Note that all significant coefficient estimates of the second lag variables in 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. These results suggest that the "within," "entry," and "exit" effects also exert a delayed positive influence on profitability through asset management.

The second lag results in Panel B on the *Change in ROE* estimations differ considerably in significance and signs from their counterparts on the *Change in ROA* estimations. The coefficient estimate of *L2-within* (*L2-exit)* is negative (positive) and significant, at the 1% (10%) level only once. The significance of each disappears in the specification that brings together all the second lags of the Bennet decomposition effects.

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 statistically significant relations and changes in significance levels. Further, FFO contributes to sign reversals in the coefficient estimates of the second lags of the Bennet decomposition effects.

6. Summary, Conclusions and Ideas for Possible Extensions of the Bennet Dynamic Decomposition Approach

In this paper, we ask three interrelated research questions for a portfolio of listed Equity REITs, which covers, 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 examines whether the source of predictability in the portfolio of sample firms' operating profitability lies with their asset- or debt-management policies or both.

Second, "Do the lagged values of the 'within,' 'between,' 'entry,' and 'exit' 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 previous analyses of the first question to the Bennet decomposition effects. Evidence on this question will provide depth and refined understanding of the source(s) of portfolio level predictability of operating profitability.

Third, "Does measuring portfolio *ROA* or *ROE* in terms of FFO, instead of the conventional measure of NI, affect the predictability in profitability, as posed in the two questions above?" This question considers whether the information content of FFO exceeds that of NI, which has received recent research interest. While NAREIT in the United States and REALPAC in Canada have been among the main institutional 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 the 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, the 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-management policies from their debt-management policies (or vice versa) as the main underlying source 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 some additional predictive results for 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 (i.e., the "within" effect) shows up as 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 (i.e., the "entry" effect) also predicts, with negative signs, the *Change in ROA* and *Change in ROE* measures. While the NI-based results showcase the "within" effect as the underlying source of predictability, they reveal nothing further to isolate the responsiveness of the sample REITs' asset-management policies from their debt-management policies (or vice versa).

Third, under the FFO metric, results on the *Change in ROE* estimations in Table 5 differ visibly from those on (i) the *Change in ROA* estimations in the same table and (ii) the *Change in ROE* estimations in Table 4. Importantly, these FFO results suggest that predictability of operating profitability at the portfolio level has its roots *more* in the sample REITs' asset-management policies than their 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 as much 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. Additionally, we detect evidence in the delayed positive influences of the "within," "entry," and "exit" effects that supplement the conclusion that asset-management is more effective in accounting for the predictability of REITs' profits. Further, these comparative results lend support to the (i) view that the information content of FFO differs from that of NI even at the portfolio level and (ii) position, advocated by NAREIT in the United States and REALPAC in Canada, that REITs report regularly their FFO figures.

In closing, we share a few ideas for future research. Most obviously, we could perform event studies, using both levered and unlevered stock returns. This approach should reveal evidence on whether asset- or debt-management accounts for the market's reaction to a specific corporate event. We include the rich literature on de-levering asset returns as an integral part of this suggestion.

To our knowledge, this paper applies the Bennet (1920) dynamic decomposition approach for the first time to understand the temporal dynamics of the REIT sector's operational profitability. This decomposition method and its cousins share a strong connection to the literature on prices indexes, such as the Laspeyres or Paasche indexes, and offer new avenues of research either in a portfolio or industry content. We believe that these decomposition methods may push the literature in several interesting directions. For example, Xu and Ooi (2018) distinguish "bad" asset growth from "good" asset growth and find, using the Data Envelopment Analysis technique, that 44.5% of REITs' year-on-year asset growth associate with ensuing decreasing returns to scale. (i.e., events are suboptimal). Instead of using temporal change in ROE or ROA, one may introduce year-on-year asset growth into Xu and Ooi's (2018) work and examine whether the Bennet decomposition effects offer any enriched and refined set of results from a portfolio perspective.

Another example, first, obtain the periodic estimates of the Bennet decomposition effects on the stock returns of a portfolio that covers a typical announcement effect, such as the seasoned equity offerings in Ghosh et al. (2013). A second stage analysis may examine what factors, such as post-issuance operating performance metrics in Ghosh et al. (2013), explain the estimates of each of the Bennet decomposition effects.

Finally, Highfield et al. (2021) report that "we find evidence that post-recession (recovery) cost and revenue efficiencies exceed pre-recession efficiencies, perhaps due to the 'weeding-out' of inefficient enterprises during the market downturn. Limiting our analysis to REITs that were operating prior to the recession, we find modest evidence that REITs which survived the downturn market of 2007–2008 (Survivors) were larger, had higher operating revenue levels, lower operating expense levels, and lower debt-to-asset ratios." These points resonate well with the Bennet decomposition approach and suggest another research avenue in the scale economies literature.

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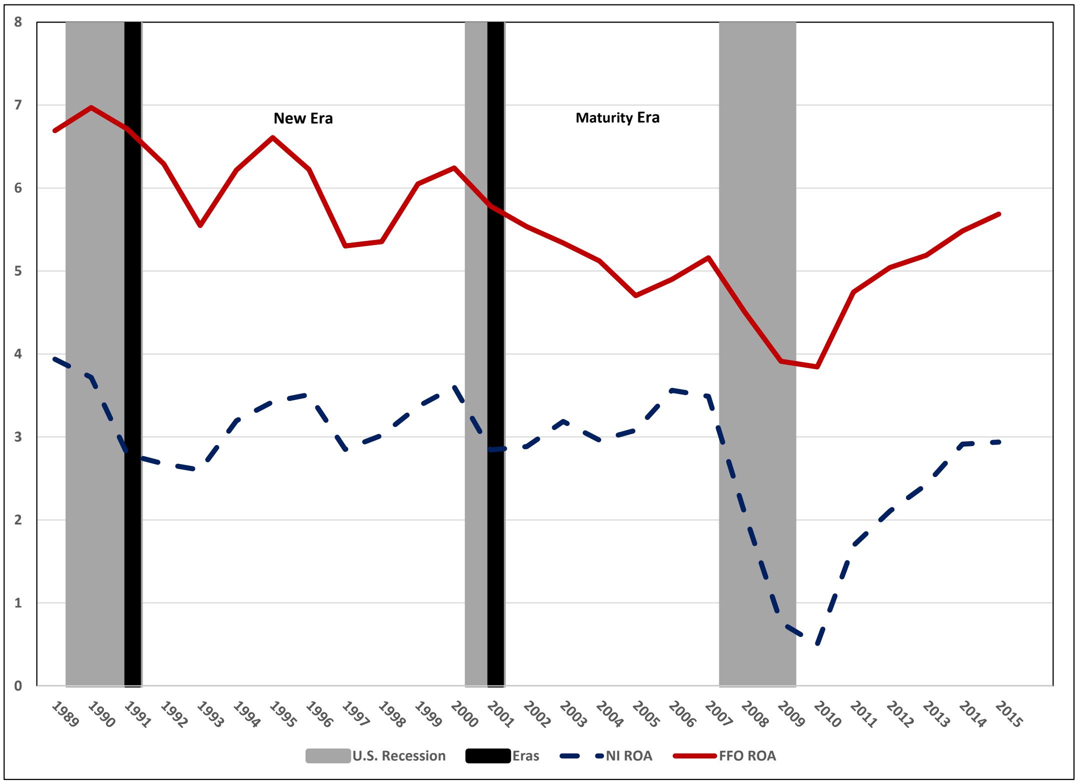
Figure 1: NI and FFO Measures of ROE and ROA.

A. ROA Measures



B. ROE Measures

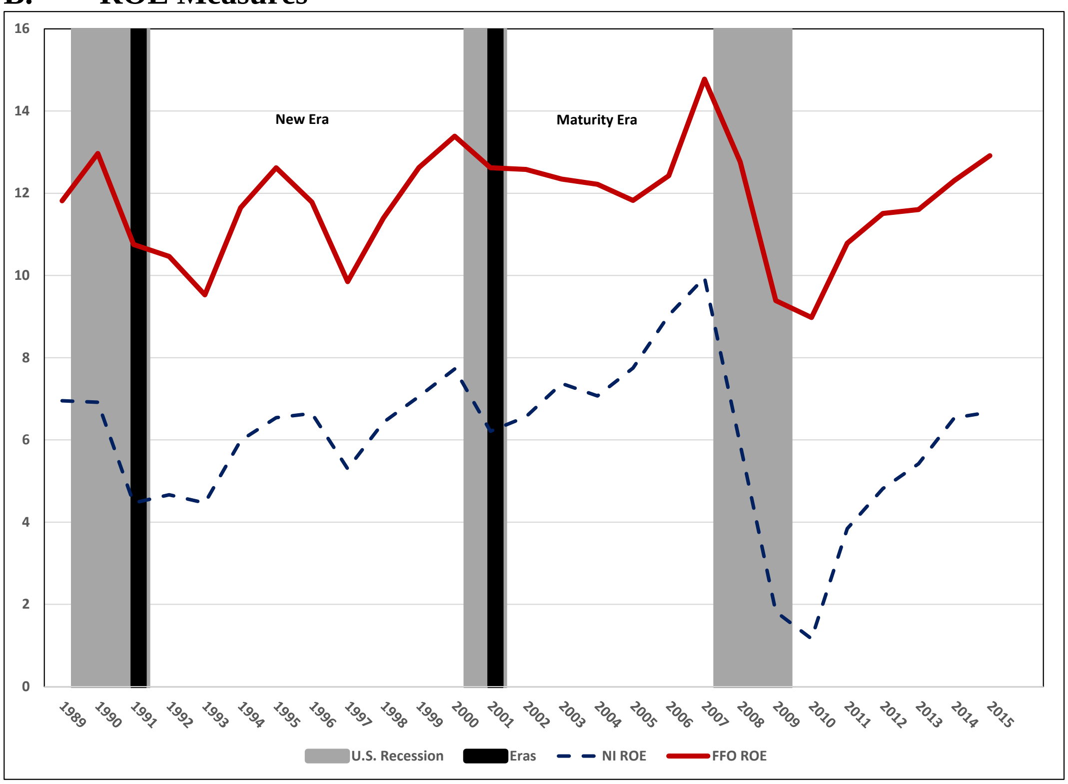
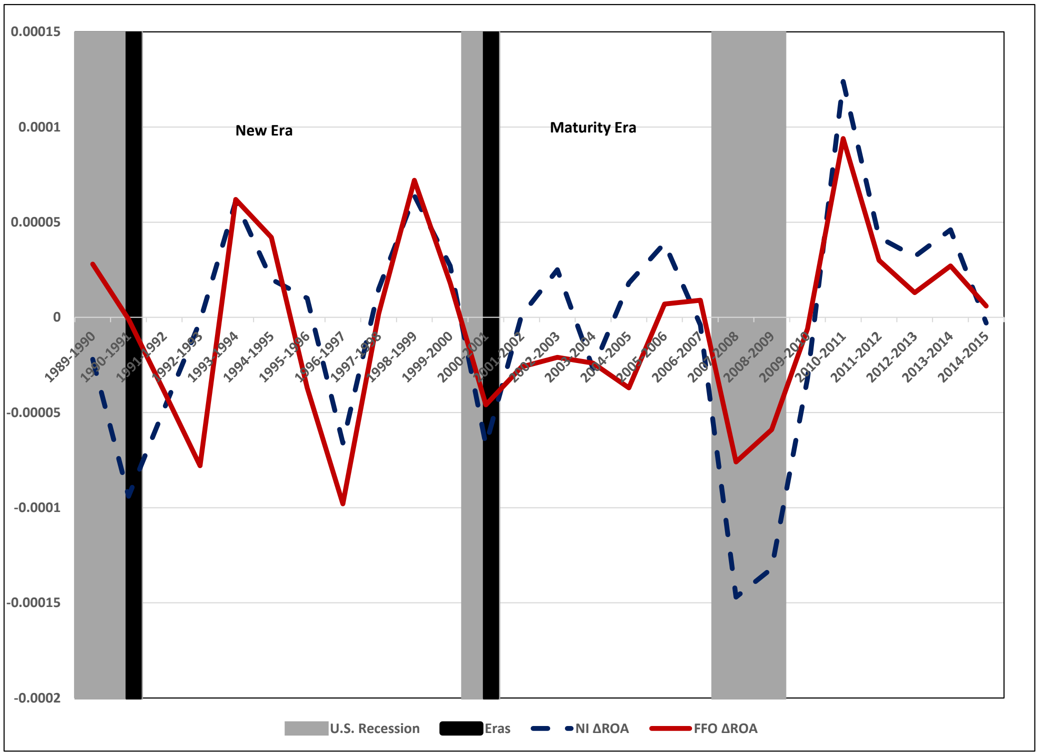


Figure 2: NI and FFO Measures of ΔROE and ΔROA

A. ΔROA Measures



B. ΔROE Measures

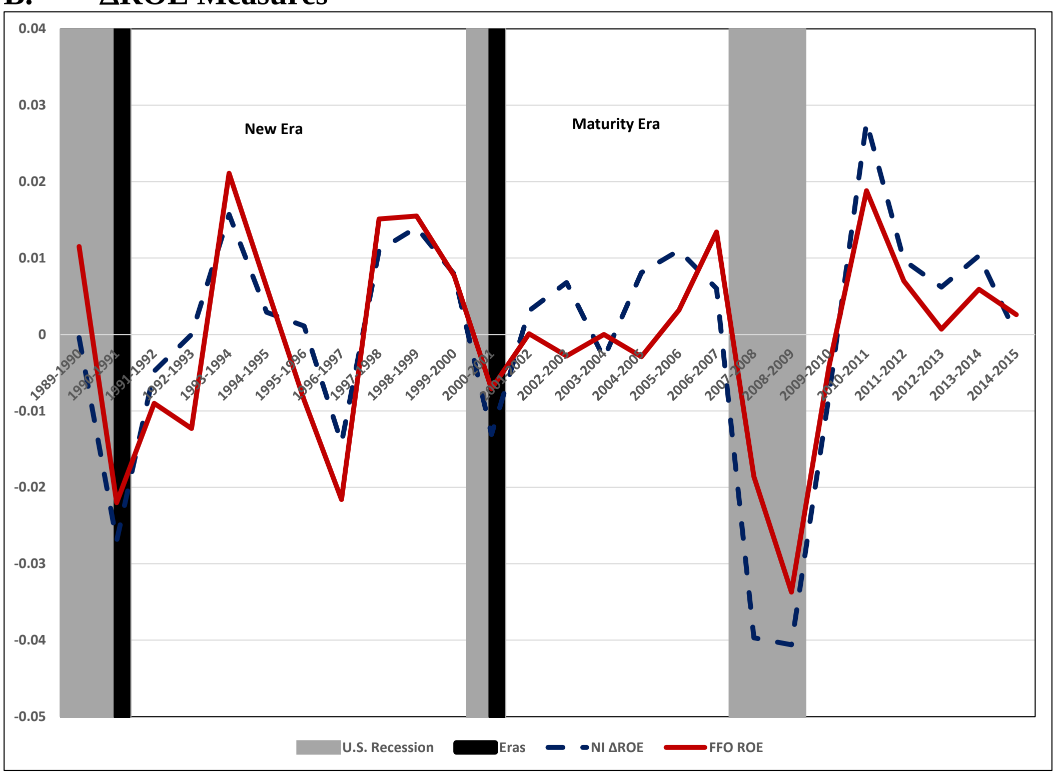


Table 1: Annual means and standard deviations of sample REITs' NI, FFO, total assets, total equity, *ROA* and *ROE*, during the sample period of 1989-2015.

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

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, $DV_t = a + b * (DV_{(t-1)} \ or \ DV_{(t-2)}) + \varepsilon_t$, where DV_t is either ROA_t, ROE_t, *Change in* $ROA_{t,(t-1)}$ *or Change in* $ROE_{t,(t-1)}$ of our sample portfolio. We run various specifications of this model under the NI and FFO metrics. 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. *, ** 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, $DV_t = a + \sum_{i=1}^{4} (b_i * BDE_{i,(t-1)}) \ or \ \sum_{i=1}^{4} (b_i * BDE_{i,(t-2)}) + \varepsilon_t$, where DV_t is either ROA_t, ROE_t, *Change in* $ROA_{t,(t-1)}$,, or *Change in* $ROE_{t,(t-1)}$ and the $BDE_{i,(t-1 \text{ or } t-2)}$ are the "within", "between," "entry," and "exit," effects of our sample portfolio. We run various specifications of this model under the net income (NI) and funds from operations (FFO) metrics. 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	**Estimate/ t-stat**	**Estimate/ t-stat**	**Estimate /t-stat**	**Estimate/ t-stat**	**Estimate/ 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	**Estimate/ t-stat**	**Estimate/ t-stat**	**Estimate/ t-stat**	**Estimate/ t-stat**	**Estimate/ t-stat**	**Estimate/ t-stat**	**Estimate/ t-stat**	**Estimate/ t-stat**	**Estimate/ t-stat**	**Estimate/ 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	**Estimate/ t-stat**	**Estimate/ t-stat**	**Estimate/ t-stat**	**Estimate/ t-stat**	**Estimate/ t-stat**	**Estimate/ t-stat**	**Estimate/ t-stat**	**Estimate/ t-stat**	**Estimate/ t-stat**	**Estimate/ 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, $DV_t = a + \sum_{i=1}^{4} (b_i * BDE_{i,(t-1)}) \ or \ \sum_{i=1}^{4} (b_i * BDE_{i,(t-2)}) + \varepsilon_t$, where DV_t is either ROA_t, ROE_t, *Change in* $ROA_{t,(t-1)}$,, or *Change in* $ROE_{t,(t-1)}$ and the $BDE_{i,(t-1 \text{ or } t-2)}$ are the "within", "between," "entry," and "exit," effects of our sample portfolio. We run various specifications of this model under the net income (NI) and funds from operations (FFO) metrics. 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 1: Alternative Dynamic Decompositions[8]

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

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

$$n_t = n_{t/t-1}^{stay} + n_t^{enter}\text{, and } n_{t-1} = n_{t/t-1}^{stay} + n_{t-1}^{exit}.\text{[9]} \tag{A.6}$$

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

[8] 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).

[9] 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*).

of equity in the initial year.[10] That is, 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.[11] 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:

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

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

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

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

where we evaluate the "between," "entry," and "exit" effects relative to the current portfolio/industry *ROE* (R_t).[12]

Case 3: Bennet Dynamic Decomposition[13]

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

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

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

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*.

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

[13] 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 and eliminates Haltiwanger's (1997) "covariance" effect as it emerges because of the method of decomposition. Thus, the weighting of the four effects all employ simple averages of the initial (t-1) and final (t) year weights. See Diewert (2005) for additional details. Jeon and Miller (2005) also provide the derivation

Appendix 2: Year-by-year Bennet (1920) decomposition effects for *ROA* and *ROE* under NI and FFO.

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* 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

Appendix 2: Year-by-year Bennet (1920) decomposition effects for *ROA* and *ROE* under NI and FFO. (cont'd)

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