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REITs' GROWTH OPTIONS and ASSET PRICING DYNAMICS ACROSS TIME

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REITs' GROWTH OPTIONS and ASSET PRICING DYNAMICS ACROSS TIME

ABSTRACT

Our paper makes two empirical contributions on REITs' asset pricing over three sequential and mutually exclusive time periods. The first yields the beta estimates of (i) assets, (ii) growth options and (iii) assets-in-place, embedded in the valuations of REITs. We develop a new approach to estimate the latter two betas and, to our knowledge, provide the first-ever REIT evidence on them. The second investigates the evolving roles, from a capital markets viewpoint, of the four pricing factors of the Carhart model on REITs' portfolio returns. In each investigation, we clean out, when needed, the unprecedented and overwhelming effects of GFC and the Eurozone bailout crisis. Our main results show that (i) the betas of growth options are larger than those of assets-in-place, raising a question mark about the 'income stock' description of REITs, (ii) the estimates of the equity beta for REITs are always positive and very highly significant, not consistent with the reports of the 'death of beta' from the mainstream finance literature, (iii) the capital markets' one-year momentum measure does not affect REITs' portfolio returns, and (iv) REITs exhibit a lot of progress in integration into the capital markets.

REITs' GROWTH OPTIONS AND ASSET PRICING DYNAMICS ACROSS TIME

1. Introduction

Our paper undertakes two empirical investigations into the asset pricing of REITs. The first investigation yields the beta estimates of growth options embedded in the valuations of US-based REITs. To our knowledge, this is the first-ever evidence on these beta estimates for REITs. The first recognition of growth options in the finance literature is in a seminal paper by Myers (1977), who demonstrates that a firm's total value will be equal to its value of (i) assets-in-place and (ii) growth options and that a firm's asset (or unlevered) beta, β^U, will be comprised of the betas of (i) assets-in-place, β^{AIP}, and (ii) growth options, β^{GO} (see also Miles, 1986). Bernardo et al. (2007) develop recently a CAPM-based empirical approach and estimate the β^{GO}s and β^{AIP}s for 37 Fama-French industries, excluding REITs, under the assumption that all firms in a given industry have the same , β^{GO} and β^{AIP}. Their results show, as expected, that growth options contribute substantially to the total value of a firm and that they, as assets boasting high risk with substantial sensitivity to leverage, have larger betas than assets-in-place do. One of the earlier works on the role of growth options in real estate is in Titman (1985). Geltner and Miller (2001) acknowledge the benefit of growth options, especially those arising from (re)development, for REITs.

Our paper develops a new and portfolio-based empirical approach in estimating the β^{GO}s and β^{AIP}s. We build on Carhart's (1997) four-factor asset pricing model (C4 henceforth); implement the research design[1] in Fama and French (FF henceforth) (1992, 1993) to construct the *size and book-to-market* REIT portfolios; and generate their monthly portfolio returns. Unlike Bernardo et al. (2007), who can produce only a single estimate of β^{GO} and β^{AIP} per industry per sample (or sub-sample) time period, our research design has the capability to produce the estimates of β^{GO} and β^{AIP} for (i) small size REITs within the low-to-mid book-to-market (B/M henceforth) band, (ii) small size REITs within the mid-to-high B/M band, (iii) large size REITs within the low-to-mid B/M band, (iv) large size REITs within the mid-to-high B/M band, (v) low B/M REITs, (vi) mid B/M REITs, and (vii) high B/M REITs per sample (or sub-sample time) period. Further, we modify the C4 model to estimate directly β^U, needed for computing an estimate of β^{GO} and β^{AIP} for each specified *size and B/M* portfolio. This modification is known to ameliorate the long-

[1] There are two major shortcomings of any REIT sector-specific sample with respect to the samples that contain all NYSE, NASDAQ, and/or AMEX listed firms: (i) The number of sample REITs are always considerably smaller and (ii) REIT sample periods are always considerably shorter. Both limitations also affect our paper.

articulated shortcomings in estimating the betas (e.g., Black et al., 1972) and produces estimates of portfolio betas, which, consistent with the portfolio theory, are value weighted. We undertake these analyses for the full sample period as well as three sub-sample periods, explained below, unique to the REIT sector.

The second investigation provides a careful and detailed examination of the roles of the four empirical pricing factors of the C4 model[2] in explaining the cross-sectional average returns of REITs between July 1981 and December 2011 and for three distinct and sequential sub-sample periods (Cakici et al., forthcoming). The REIT sector has gone through major transformations and shown remarkable resiliency, tenacity, and an immense growth since its inception and especially since early 1990s. The capital markets recognized and crowned these strengths and achievements of the sector with the first-ever listing of a REIT in the S&P500 Index on October 04, 2001.[3] In an interesting paper, Ambrose et al. (2007) show that the REIT returns have increased substantially their co-movements with the returns of mainstream assets beyond October 04, 2001. (See also Chiang, 2010.) So, our investigation focuses fundamentally on whether, how, and when the returns data for each of the four pricing factors, generated by the *capital markets* and made publicly available at Ken French's website (http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html; last accessed in November 2012), explain the REITs' returns. *Sector-specific returns data* on the pricing factors do not enter into the estimations, as our main aim is to document empirically, via the C4 asset-pricing model, the (degree of) integration of REITs into the mainstream capital markets.[4]

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[2] FF (1992) document evidence that book-to-market has stronger explanatory power than size on security returns. FF (1995) and Chen and Zhang (1998) report that firms with high B/M generally have persistently low earnings and higher financial leverage, suggesting B/M is a proxy for a pricing factor in security returns (see also Lewellen, 1999). Pontif and Schall (1998) suggest that the B/M effect is related to future earnings. La Porta et al. (1997) cite the B/M effect as an indication of mispricing for extreme B/M securities not removed by arbitrage when arbitrage costs exceed arbitrage benefits. Ali et al. (2003) offer evidence in support of this view. Daniel and Titman (2006) propose the B/M ratio to be a proxy for intangible returns. Lakonishok et al. (1994) find returns of B/M strategies lower for firms with larger market capitalization because of higher investor information and lower arbitrage costs. Griffin and Lemmon (2002) support this evidence, but La Porta et al. (1997) disagree. Loughran (1997) reports that the B/M effect is mainly driven by a January seasonal and especially low returns of small, young, growth stocks while the B/M effect is insignificant on the realized returns of large size stocks.

[3] Cakici et al. (forthcoming) show empirically that there exists a visible difference in the relation between REITs' idiosyncratic risk and their cross-sectional average returns during this newly identified sub-period. On October 04, 2001, the Standard and Poor's announced the inclusion of the Equity Office Properties into its 500 Index and also a number of other REITs into its mid- and small-cap indexes. The REIT industry has witnessed several M&A transactions and substantial growth in firm size between mid 1990s until now (Ooi et al., 2009). The coverage by financial analysts of large REITs has become broad and intense since 1990s.

[4] Firm size is a determinant of risk and smaller firms are more risky due to (i) marketability (securities of larger firms can be more easily converted to cash than small firms, thus larger firms are less risky); (ii) probability of bankruptcy (large firms take years to grow and failing firms tend to fail in early years of operation, thus firm size as a risk factor is an indication of future performance); (iii) Diversification (large firms can better diversify operations), and (iv) higher economies of scale, indicating large firms with higher economies of scale have higher earnings and lower bankruptcy probability/risk (see Ben-Zion and Shalit, 1975). FF (1993) contend that size has a relation to

Our total sample period covers all data, made available publicly as of December 2012, on all REITs in the CRSP/Ziman database. Cakici et al. (forthcoming) depart from the extant literature and identify three - rather than two, as was identified by prior research – sequential and mutually exclusive sub-sample periods for REITs. In particular, the authors recognize the REIT sector's first-ever listing on the S&P500 Index on October 04, 2001 as an *endogenous* accomplishment, which is fundamentally different from the tax-code induced exogenous turning points of the past. They identify October 2001 as the beginning point of the *REIT Maturity Era* for the REIT sector. So, the three sub-sample periods considered are: (i) the Vintage REIT Era (July 01, 1981 - December 31, 1992), (ii) the New REIT Era (January 01, 1993 - September 30, 2001), and (iii) the REIT Maturity Era (October 01, 2001 - December 31, 2011)[5]. Exogenous and endogenous shocks represent differences in REITs' asset pricing and corporate finance performances and should be observable empirically. Finally, the last sub-sample period captures some of the unprecedented effect(s) of the Global Financial Crisis (GFC) and the Eurozone country bailout crisis (Eurozone crisis henceforth) on REIT returns.[6]

Our results indicate that, consistent with the immense growth in and of the industry, growth opportunities are an important determinant of REITs' valuation. Our exploratory study shows that β^{GO}s, as expected, are greater than β^{AIP}s (with a few exceptions) and play an important role in REITs' expected return, cost of capital and their temporal variations. Further, GFC and the Eurozone crisis have had substantial effects on the magnitudes and signs of the estimates of β^{GO} and β^{AIP}. Thus, our

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profitability, which links size as a pricing factor security returns. Banz (1981) documents the size effect without an economic explanation. Knez and Ready (1997) show, however, that size premium disappears after 1% extreme observations are removed.

[5] The Maturity REIT Era is ongoing. The availability of data until the end of December 2011 puts a cut-off point for this study. The New REIT Era is in recognition of an exogenous change, which took place in the early 1990s, driven by the US lawmakers' intervention via structural changes in the tax laws on REITs The beginning date for this period is not precise. Taubman's IPO in 1992, introducing the UPREIT structure, and the Revenue Reconciliation Act of 1993 (in August 1993) are the main events, resulting in an influx of capital into the REIT market. Given this background, we choose January 1993 as the starting point of this era and thank very much CF Sirmans for his clarifying comments on this matter.

[6] The co-movements between real estate return and other assets' returns also suggest that there are variables that systematically influence real estate returns. Ling and Naranjo (1997) examine some economic variables that may systematically affect real estate returns. Apart from examining the economic variables that Chen et al. (1986) find to be significant in stock returns, Ling and Naranjo (1997) also include the real Treasury bill rate and the growth rate of real per capita consumption. Their empirical results on four different real estate portfolio groups show that growth rate in real per capita consumption, real Treasury bill rate, term structure of interest rates, and unexpected inflation are significant systematic variables in real estate returns. Clayton and MacKinnon (2003) examine REITs' asset pricing dynamics. Karolyi and Sanders (1998) advocate employing multi-factor models for REIT asset pricing. However, Chen and Zhang (1998) find that FF's (1992) size and B/M variables explain REIT returns better than macro-economic variables as per Chen et al. (1986). Although the three factors in the FF3 model are not consistent temporal predictors of REIT returns, the own-sector momentum effect is a significant predictor of REIT returns over time (Chui et al., 2003a and 2003b).

paper raises a question mark about the often-articulated notion that REITs are income stocks, moved mainly by the dynamics of their assets-in-place.

We report two main asset-pricing findings. First, we observe a consistently strong, highly statistically significant, and positive relation between REIT portfolio returns and equity beta in all estimations. This is regardless of whether excess return on the market is the only explanatory variable or competing with the returns on (i) size (SML henceforth), (ii) B/M (HML henceforth), and/or (iii) momentum (MOM henceforth). Our estimates of equity beta differ completely from those reported in Fama and French (1992, 1993, 1995, 1996) for their samples. SML (HML) exhibits a strong (weak) effect in explaining REIT portfolio returns. Second, Chui et al. (2003a, 2003b) find strong evidence of the REIT sector's own MOM effect on REIT returns. Their findings are not surprising; REIT returns can be highly correlated with the dynamics of the REIT sector. We find, however, very little evidence of a relation between REIT returns and the equity markets' MOM during any of the sub-sample periods, except that in the sample year of 2008. The MOM effect in 2008 is very strong and consistent with the well-acknowledged notion that "During a crisis correlations all go to one." This finding of very little relation between REIT returns and capital market's MOM during the sub-sample periods could be a useful diversification strategy for investors, who may be seeking a remedy against equity markets' MOM for their investment strategies and portfolios.

Overall, these results constitute evidence that (i) the equity beta is alive, strong, and healthy for REITs, (ii) the REIT sector has been progressively on a path of integration into the capital markets, (iii) REITs' asset pricing dynamics offer potential diversification benefits on equity market's MOM and, to a lesser extent, HML, and (iv) that, in general, REITs suit investors, who seek assets with persistent and positive equity beta with a magnitude less than 1. We also observe the early signals that REITs' equity betas appear to display a regime switch, reaching estimated values of exceeding one in recent years.

Section 2 highlights the methodology and defines the variables of the asset-pricing models. Section 3 describes the data and sub-sample periods. Section 4 reports and discusses the relevant empirical results. Section 5 concludes the paper.

2. Research Design and Empirical Methodology

Bernardo et al. (2007) show, under the assumption that all firms in the same industry have the same β_t^{GO} and β_t^{AIP} at time t, that:

$$\beta_{j,t}^{U} = \left[\beta_{j,t}^{AIP} * \left[\frac{V_{j,t}^{AIP}}{V_{j,t}^{F}}\right]\right] + \left[\beta_{j,t}^{GO} * \left[\frac{V_{j,t}^{F} - V_{j,t}^{AIP}}{V_{j,t}^{F}}\right]\right] = \beta_t^{GO} - [\beta_t^{GO} - \beta_t^{AIP}] * \left[\frac{V_{j,t}^{AIP}}{V_{j,t}^{F}}\right] \quad (1)$$

where $V_{j,t}^{AIP}$ and $V_{j,t}^{F}$ are the value of (i) assets-in-place of firm j and (ii) all assets of firm j at time t. This is a theoretical model, which follows after Myers (1977) and the following relevant literature; eventually specifies β_t^{GO} and β_t^{AIP} without a j subscript, under the assumption that they are the same for each firm in a given industry; does not require the specification of any empirical asset-pricing model; and is based on the relation that the beta of a portfolio is the weighted average of individual betas in that portfolio. Adding an error term to equ. (1) could convert it to an estimating equation with an intercept of β_t^{GO} and a slope of {- (β_t^{GO} - β_t^{AIP})}. In equ. (1), the independent variable, $\left[\frac{V_{j,t}^{AIP}}{V_{j,t}^{F}}\right]$ - in particular, firm j's $V_{j,t}^{AIP}$, is not publicly observable. Bernardo et al. (2007) try various proxies and use ultimately the ratio of book-to-market for firm j at t.[7] One must also obtain the dependent variable of the equation.

The well- and long-acknowledged problem of errors-in-variables in beta estimations and the use of proxy variables for the independent variable guide the empirical approach in Bernardo et al. (2007) and our own approach.

As highlighted in Appendix1, our methodology to estimate equ. (1) departs from that in Bernardo et al. (2007). We construct six (6) *size and B/M* portfolios, following closely FF's (1992, 1993) research design that ameliorates the errors-in-variables problem in beta estimations; use the C4 asset pricing model at the portfolio level; estimate *directly* the dependent variable, $\beta_{p,t}^{U}$, of equ. (1), for each of the six *size and B/M* portfolios, such that each of these $\beta_{p,t}^{U}$s is a value-weighted average of individual REIT's $\beta_{j,t}^{U}$s in portfolio p; and are able to produce estimates of β_t^{GO} and β^{AIP}, which are clean from the potential effects of SML, HML, and/or MOM, for seven different size ***or*** B/M portfolio combinations.

Under our approach, the first step is to form, following closely FF (1992, 1993), *size and B/M* portfolios and obtain their monthly returns. FF (1993) construct 25 size and B/M portfolios (i.e., five size portfolios times five B/M portfolios). The sample size for REITs is indeed quite limited (see footnote 1), enabling us to process the data into the following six (6) *size and B/M* portfolios: (1) Small size and Low B/M, (2) Small size and Mid B/M, (3) Small size and High B/M, (4) Large size and Low B/M, (5) Large size and Mid B/M, (6) Large size and High B/M. These six REIT portfolios are formed at June of t and subsequently reformed at June of (t+1).[8]

[7] The approach in Daniel and Titman (2006) may also be a fruitful avenue to pursue in this context.

[8] In June of each year *t* from 1981 to 2011, all available REITs are ranked on size, measured by market value of equity (ME). The median size is subsequently used to split the REITs into two equal size groups, labeled Small size and Large size. The REITs are also split separately - based on breakpoints of 30%:40%:30%, respectively - into three B/M groups, labeled Low B/M, mid B/M, and High B/M. The B/M ratio is equal to the book value of

Table 1 provides some summary statistics on these six *size and B/M* portfolios. These statistics are based on the 31-year sample period. There are some years when there are missing data for Portfolios 1 and 6. Further, the average REIT portfolio excess returns trend higher for REITs with higher B/M. This is consistent with the observation that high B/M firms tend to have high actual returns (FF, 1992; Lakonishok et al., 1994).

[insert Table 1 here]

The second step subscribes to the C4 model. Following the estimations in Black et al. (1972) to ameliorate the estimation biases in the beta estimates, FF (1992, 1993, 1995, 1996) produce strong evidence and conclusions, from their FF3 model, that empirical implementations of the CAPM face substantial challenges. Carhart's (1997)[9] work on MOM extends the FF3 model to the C4 model:

$$r^e_{p,t} = \alpha + \beta^e_{p,t} * r_{m,t} + \delta^e_{p,t} * HML_t + \theta^e_{p,t} * SML_t + \lambda^e_{p,t} * MOM_t + \varepsilon^e_{p,t} \quad (2)$$

where p=1, 2, …, 6 in our context. The dependent variable, $r^e_{p,t}$, is the monthly excess equity return (in relation to the return on one-month T-bill at time t) for portfolio p at t; $r_{m,t}$, SML_t, MOM_t, and MOM_t are the returns on the four pricing factors at t and indicate the (i) excess return on market portfolio (in relation to the return on one-month T-bill at time t), (ii) return difference between high B/M and low B/M portfolios, (iii) return difference between large size and small size portfolios, and (iv) return on the momentum factor, which captures Jegadeesh and Titman's (1993, 2001) one-year prior return (-2,-13) measure; and $\beta^e_{p,t}, \delta^e_{p,t}, \theta^e_{p,t}$, and $\lambda^e_{p,t}$ are the model parameters to be estimated. As indicated earlier, we obtain the data for these factors from Ken French's website and hence are studying fundamentally REITs' pricing within the capital markets, but not within their own sector-driven dynamics. Estimations for each individual pricing factor and combinations of them for different sub-sample periods, as discussed below, address our second research question.

To study our first research question, we modify equ. (2), such that one can estimate *directly* portfolio $\beta^U_{p,t}$s.[10] The modified version model recognizes that:

(i) the corporate tax rate, τ, for REITs is 0% (i.e., tax deductibility of interest on debt does not generate a tax shield for REITs);

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common equity, BE, divided by ME for end December *t*-1. BE is the book value of stockholders' equity plus balance-sheet deferred taxes and investment tax credit minus book value of preferred stock.

[9] For more on the MOM effect, see ???

[10] Alternatively, one can separate $\beta^e_{p,t}$ (i.e., beta of equity) into $\beta^{GO}_{p,t}$ and $\beta^{AIP}_{p,t}$ within the C4 model:

$$r^e_{p,t} = \alpha + \left[\beta^{AIP}_{p,t} * \left[\frac{V^{AIP}_{p,t}}{V^e_{p,t}}\right] * r_{m,t}\right] + \left[\beta^{GO}_{p,t} * \left[\frac{V^F_{p,t} - V^{AIP}_{p,t}}{V^e_{p,t}}\right] * r_{m,t}\right] + \delta^e_{p,t} * HML_t + \theta^e_{p,t} * SML_t + \lambda^e_{p,t} * MOM_t + \varepsilon^e_{p,t}.$$

The empirical (i.e., estimation) problem with this equation is that the weights for these betas are correlated. We could not find a way to estimate in a single step both betas under the FF3 or C4 models. Given this, our second best is to develop an alternative approach, as laid out here.

(ii) the beta of debt, $\beta_{p,t}^{D}$, is 0, which is a commonly accepted assumption, Bernardo et al. (2007) included, in the finance literature; and

(iii) $\beta_{p,t}^{U} = \left[\frac{D_{p,t}}{V_{p,t}^{F}}\right] * \beta_{p,t}^{D} + \left[\frac{E_{p,t}}{V_{p,t}^{F}}\right] * \beta_{p,t}^{e}$ (3)

where equ. (3) follows from the portfolio theory and $\left[\frac{D_{p,t}}{V_{p,t}^{F}}\right]$, $\left[\frac{E_{p,t}}{V_{p,t}^{F}}\right]$, and $\beta_{p,t}^{e}$ refer, at t, to portfolio p's ratio of debt-to-total assets value, equity-to-total assets value, and equity beta, respectively. Incorporating (i) and (ii) into (iii) yields:

$$\beta_{p,t}^{e} = \left[1 + \frac{D_{p,t}}{E_{p,t}}\right] * \beta_{p,t}^{U} \quad (4)$$

Finally, equ. (4) leads to our modified C4 estimating equation model:

$$r_{p,t}^{e} = \alpha + \beta_{p,t}^{U} * \left\{\left[1 + \frac{D_{p,t}}{E_{p,t}}\right] * r_{m,t}\right\} + \delta_{p,t}^{e} * HML_t + \theta_{p,t}^{e} * SML_t + \lambda_{p,t}^{e} * MOM_t + \varepsilon_{p,t}^{e} \quad (5)$$

Equ. (5) estimations yield the estimates of $\beta_{p,t}^{U}$, which constitute the dependent variable of equ. (1).

Third, one needs to identify a proxy for the independent variable, $\left[\frac{V_{j,t}^{AIP}}{V_{j,t}^{F}}\right]$, in equ. (1). We benefit from the evidence in Bernardo et al. (2007) that the B/M ratio, among others, is a reliable proxy for the independent variable. To move forward with the estimation of β_t^{GO} and β_t^{AIP} at t, as explained in Appendix1, the authors generate, from the $\beta_{j,t}^{U}$ estimates for individual firms in an industry, two *equally-weighted average* estimates of $\beta_{p,t}^{U}$ and their corresponding equally-weighted average B/M ratios. They end up with two unknowns and two equations of equ. (1) and obtain the industry estimates of β_t^{GO} and β_t^{AIP} for a given sample period.

Using the estimates of $\beta_{p,t}^{U}$ for our six *size and B/M* portfolios, we also construct a series of two unknowns of β_t^{GO} and β_t^{AIP} and two equations of equ. (1), solving for seven different portfolio level estimates of β_t^{GO} and β_t^{AIP} per sample period. To illustrate, we focus on the portfolios of (i) (Small Size and Low B/M), (ii) (Small Size and Mid B/M), and (iii) (Small Size and High B/M). First, we get $\beta_{p,t}^{U}$s of (i) and (ii) and obtain, following Bernardo et al. (2007), the corresponding average B/M ratio values for both portfolios pertaining to the time period under study. This gives us two equations of equ. (1) with two unknowns. Solving for β_t^{GO} and β_t^{AIP} offers an estimate of each beta for the Small-size REIT portfolio within the Low-to-Mid B/M band. Second, we focus on (ii) and (iii) and follow the same steps to estimate β_t^{GO} and β_t^{AIP} for the Small-size REIT portfolio within the Mid-to-High B/M band. Repeating the same procedure for the Large-size REIT portfolio combinations

provides the estimates of β_t^{GO} and β_t^{AIP} for the Large-size REIT portfolio within Low-to-Mid B/M band and the Large-size REIT portfolio within Mid-to-High B/M band.

Repeating further the same procedure on (Small size and Low B/M) and (Large size and Low B/M) yields the β_t^{GO} and β_t^{AIP} for the Low B/M portfolio. The estimation of Mid B/M and High B/M portfolios' β_t^{GO} and β_t^{AIP} follows the same steps.

3. Data and sample periods

We obtain all the data and relevant variables on REITs from the CRSP/Ziman database between January 01, 1980 and December 31, 2011, made publicly available as of December 2012. Similar to Chui et al. (2003a, 2003b), our sample includes all REITs in an effort to maximize the sample size. The debt-to-total equity ratio for portfolio p in equ. 5 is equal to the ratio of the sum of the (i) book value of long-term debt and (ii) market value of equity, across all REITs, j, in portfolio p at time t. The book value of long-term debt is a proxy for its market value, which is not observed publicly, and has been repeatedly and successfully used in the finance literature (e.g., see Rajan and Zingales, 1995). The market value of equity for REIT j is equal to its stock price multiplied by the number of shares outstanding at t. The momentum factor, MOM, in the C4 model requires data from previous months. Portfolios and their returns are formed at the end of June at t, pushing the beginning of our sample period to July 01, 1981. Data on the asset pricing factors for the C4 model are obtained from Ken French's website (see http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html; last accessed in November 2012). Our variable definitions follow from the extant finance literature, especially FF (1993). Data on accounting variables are from COMPUSTAT and, consistent with FF (1992), only REITs with at least two years of data in it are members of our sample.

The literature on REITs, except for Cakici et al. (forthcoming) to our knowledge, does not focus on the same three sub-periods that we do. Our paper appears to be the first to examine the performance of the C4 asset pricing model for the following three sequential and mutually exclusive REIT sector eras: (i) the Vintage REIT Era of July 01, 1981-December 31, 1992, (ii) the New REIT Era of January 01, 1993-September 30, 2001, and (iii) the REIT Maturity Era of October 01, 2001-December 31, 2011. The REIT Maturity Era begins with the crowning, by the Standard and Poor's, of the sector with its first-ever listing on the S&P500 Index (see footnote 3). In our view, this crowning represents an endogenous achievement. It was the outcome of the industry's long-standing accomplishments through sustained and substantial growth and solid performance in corporate finance. Prior periods depend on exogenous events, mainly tax-code interventions by the lawmakers.

Therefore, we provide the estimates of β_t^{GO} and β_t^{AIP} for each sub-sample period. Further, we expect empirically observable different asset pricing results among these three time periods.

GFC and Eurozone crisis have injected severe shocks to the world financial markets and economies, still causing deep pains, record budget deficits, civil unrest, considerable uncertainties for the capital markets, and even the possibility of a breakdown of the European Union (EU). We take the exit of the Lehman Brothers in September 2008 to be the starting point of GFC. An examination of the effects of GFC and Eurozone country bailout crisis on asset returns is of considerable importance. To be able to retrieve, as cleanly as possible, the effects of these crises, we study separately the October 01, 2001-December 31, 2007 sub-period, which covers the REIT Maturity Era without GFC and Eurozone crisis. (We also examine for robustness checks the October 01, 2001-June 2008 period, but do not report the results.) The October 01, 2001-December 31, 2011 period covers the REIT Maturity Era and is inclusive of both crises. A comparison of empirical results from both periods offers deductive evidence for both crises' effects on REIT returns.

Table 2 provides summary statistics and correlations for the variables of the C4 model in equ. (4). An examination of the correlation matrices for the sub-sample periods shows that all pairwise correlation estimates are positive during the REIT Maturity Era while a number of negative pairwise correlation estimates are present during the Vintage REIT Period and the New REIT Era. These results are consistent with Ambrose et al.'s (2007) and Cakici et al.'s (forthcoming) findings of increased co-movements of REIT returns with those of mainstream assets.

[insert Table 2 here]

4. Empirical results

Below, we report and discuss the empirical results on the (i) beta estimates of REITs' growth options and assets-in-place and (ii) whether, how and when the C4 asset pricing model explains REIT portfolio returns.

4.1 Beta estimates of assets, growth options, and assets-in-place

Panels A through D of Table 3 present the estimates of β^U, β^{GO}, and β^{AIP} for the full sample period; the three sub-sample periods; and the two overlapping sub-periods of the REIT Maturity Era without GFC and the Eurozone crisis. In all panels, putting aside a few exceptions, the estimates of β^{GO} are greater than those of β^{AIP}. This finding is consistent with the evidence in and views of Bernardo et al. (2007) and also the option pricing theory, as options exhibit higher risk due to their nature of being leveraged assets. Further, these results establish the role of growth

options in REITs' expected returns, cost of capital, and the observed temporal variations in both and raise a serious question mark about the "income stock" description of REITs. All estimates of β^U are positive and statistically significant at (unreported but better than) 1% level. The highest is 0.48.

[insert Table 3here]

Panel A reports the estimates for the *size portfolios* across different B/M bands. With one exception, all estimates of β^{GO} for the *Large Size* portfolios in Panel A are greater than those for the *Small Size* portfolios. Similarly, with one exception, all estimates of β^{GO} are positive. Further, there is only a single β^{AIP} estimate, 1.23, greater than 1. All these exceptions pertain to the REIT Maturity Era, which has been under the influence of GFC and the Eurozone crisis. Panel B reports the same estimates for the two sub-periods that exclude both crises. This calibration does not lead to any negative β^{GO} estimates; reduces the β^{AIP} estimate, in Panel A, of 1.23 to either -0.01 or 0.05; keeps intact the first exception above; and demonstrates the heavy influences of these crises on the empirical results.

In Panels A and B, the estimates of β^{GO} of the Vintage REIT Era are consistently greater than their counterparts. Similarly, the estimates of β^{AIP} for the Large Size portfolios within the Low- to Mid-B/M band of the REIT Maturity Era are consistently larger than their counterparts. During the New REIT Era, all estimates of β^{GO} are greater than β^{AIP}, but by a small margin. This indicates that REITs' growth options and assets-in-place contributed about the same amount to the expected return and cost of capital of a typical REIT during this period.

Panels C and D report the estimates for the *B/M portfolios*. These exhibit some similarity to those in Bernardo et al. (2007), who report their estimates based on B/M sorts. In sub-period results, we observe a number of estimates of β^{GO} and β^{AIP} with a value greater than 1; mainly positive β^{GO} estimates, which are greater than β^{AIP} estimates; and negative estimates of β^{AIP} for the Low B/M and Mid B/M portfolios, especially when the confounding effects of the crises are absent from estimations. The Low B/M portfolios should have above-average growth options. There is mixed evidence that their β^{GO} estimates are higher than those for the Mid- and High B/M portfolios. Finally, the small magnitudes of the estimates of β^{GO} for the New REIT Era indicate a tranquil time for the growth options of B/M portfolios.

4.2 Asset pricing dynamics[11] - Full sample period

Table 4 reports the estimates of the coefficients on the individual asset pricing factors of the return on the (i) market portfolio, (ii) size, (iii) book-to-market, and (iv)

[11] For robustness, we also examine samples of equity REITs and find qualitatively similar results.

momentum and also all possible combinations of these factors. Except for two insignificant ones, all estimates are positive and statistically significant, indicating that these pricing factors help explain the long-run dynamics of the REIT portfolio returns. All coefficient estimates, except for two, attain a value less than 1.

[insert Table 4]

Interestingly, the estimates of the equity beta, β^E, are persistently positive; are very highly significant; and are, consistent with defensive investments, about 0.7 and 0.8. Model estimations with β^E generate the highest R^2 values. These results depart from the findings in FF (1992, 1993, 1995, 1996) and provide evidence, from the REITs corner of the capital markets, that β^E is well, alive, and doing a better job in explaining the REIT portfolio returns than the other three pricing factors do.

HML outperforms slightly SML. MOM has the weakest link to REIT portfolio returns as indicated by the t-statistics of estimations with MOM. Further, the R^2 values for the C4 model are about the same as those for the FF3. Clearly, our findings differ from those in Chui et al. (2003a, 2003b), who report evidence of own-sector MOM (not of the general capital markets).

These results indicate that both the FF3 and C4 models and the data from the capital markets on pricing factors explain successfully and from a long run perspective the cross-sectional average REIT portfolio returns. MOM does not appear to have the strength of others while SML and HML follow, from a distance, the excess return on the market portfolio. In our view, the evolution of REITs towards a full integration into the capital markets is strong, but still work-in-progress.

4.2 Asset pricing dynamics - the vintage REIT era

Table 5 reports the results for this period, which runs from July 1981 to December 1992 in this paper. Once again, all estimates of β^E are positive and highly statistically significant. The capital market's size factor exerts a positive effect; but that is not as strong as that of the excess return on the market portfolio. Results show no influence of MOM, in disagreement with the evidence of own-sector MOM effects in Chui et al. (2003a, 2003b), and some mixed, weak, and negative influence of HML effects on REIT portfolio returns. Almost all statistically significant estimates are below 1 and those for β^E fluctuate mostly between 0.5 and 0.7. The R^2 values for the C4 model estimations are about the same as those for the FF3 model.

[insert Table 5 here]

Once again, these results from a relatively distant past, when REITs were "waiting to be discovered," lend a supporting hand to the conclusion that β^E is well, alive, and doing a better job in explaining the REIT portfolio returns than the other

three pricing factors of the C4 model do and that REITs were weakly integrated into the capital markets from the viewpoint of pricing factors of the C4 model.

4.3 Asset pricing dynamics - the new REIT era

Table 6 reports the results for this period, which runs from January 1993 to September 2001 in this paper. Once again, all estimates of β^E are positive and highly statistically significant and range mostly between 0.25 and 0.50. B/M exerts a positive effect; it is not, however, as strong as that of the excess return on the market portfolio. Results show no influence of MOM and a mixed, relatively weak, and positive influence of SML. While SML is the second most dominant factor of the previous period, HML takes over it during this period, characterized by lawmakers' tax-code intervention at its beginnings and large inflows of capital. A positive HML effect is likely related to the growth of the industry. The R^2 values for the C4 model are about the same as those for the FF3 model.

[insert Table 6 here]

These results from a recent past, when the sector was in the process of both being discovered and exhibiting a strong growth, provide further support to the conclusion that β^E is well, alive, and doing a better job in explaining the REIT portfolio returns than the other three factors do. REITs exhibit more integration into the capital markets from the viewpoint of the C4 asset-pricing model.

4.4 Asset pricing dynamics - the REIT maturity era[12] (excluding recent crises)

Table 7 reports the results for this period, which runs from October 2001 to December 2007, and excludes the effects of GFC and Eurozone crisis. To our knowledge, our paper is the first to focus explicitly and empirically on the asset pricing of REITs during this unique sub-period, whose beginning is benchmarked to the first-ever listing of a REIT on the S&P500 Index on October 04, 2001. This listing represents an endogenous and immense achievement of the sector. Beyond this date, REIT returns have begun to exhibit a higher degree of co-movements with the returns of the mainstream assets (Ambrose et al., 2007).

[insert Table 7 here]

Like before, all estimates of β^E are positive, highly statistically significant, and visibly less than 1. The coefficient estimates for SML are also all positive and highly statistically significant, and mostly greater than those of β^E but less than 1. Results also show very little positive influence of MOM (and only in the presence of β^E) and a mixed, relatively weak and positive influence of HML. When the excess return on the

[12] Cakici et al. (forthcoming) consider different sample splits and find evidence that S&P's October 04, 2001 announcement has been a reliable certification of the high quality of the REIT industry. Unreported results from the October 2001-June 2008 period offer similar conclusions to those in section 4.4.

market portfolio is combined with HML and/or MOM, its presence in these models affects visibly the contributions of the other two. SML, however, does not move the other two factors as much as the excess return on the market portfolio does. Thus, the significant role of β^E in driving REIT returns comes out even more strongly as the sector reaches a maturity status within the capital markets. MOM does not exert much influence on REIT returns even during this maturity period, either. The FF3 model does as good a job as the C4 model does.

4.5 Asset pricing dynamics - the REIT maturity era (including recent crises)

Table 8 reports the results for this period, which runs from October 2001 to December 2011 (i.e., end-of-sample period) in this paper. GFC and the Eurozone crisis have been exerting severe and unexpected adverse effects on the world financial markets. We believe that risk aversion has shifted fundamentally and globally, as exemplified by historically high recent prices of precious metals and severe and soon-not-ending turbulences in the financial markets. So, we extend the sample period of the REIT Maturity Era of section 4.4 to include the period from January 2008 to December 2011. These results are to be compared against those in Table 7 to reach deductive conclusions about the influences of GFC and the Eurozone crisis on the parameter estimates of the pricing factors.

[insert Table 8 here]

All estimates for all pricing factors, even for MOM, are positive and statistically significant and the R^2 values are visibly larger than those in previous tables. Further, many coefficient estimates for the excess return on the market portfolio, size and/or B/M factors are greater than 1. This is the first time in this paper that the estimates of β^E exceed 1 and that the momentum factor, even by itself, exhibits statistical significance in explaining REIT portfolio returns. Thus, we have deductive evidence that GFC and the Eurozone crisis have been exerting substantial influence on the asset pricing dynamics of REITs. In unreported results, we find that the statistical significance of MOM vanishes upon removing the data for 2008, demonstrating that "During a crisis, correlations all go to one." The estimates of β^E still exceed 1, suggesting the possibility that REITs' asset pricing may be under a process of a regime switch in recent years.

Once again, results from Tables 7 and 8 confirm the excellent health, survival and dominance of β^E in the REIT markets. REITs' integration into the capital markets have proceeded forward during this period. REIT returns exhibit a high and unprecedented degree of sensitivity to the pricing factors during GFC. Yet, there is room for REIT returns to offer a hedge against the momentum of the capital markets.

5. Conclusions

Our paper makes two empirical contributions on REITs' asset pricing over three sequential and mutually exclusive time periods between July 1981 and December 2011. The first contribution yields the beta estimates of (i) assets, (ii) growth options, and (ii) assets-in-place. We develop a new approach to estimate these betas and, to our knowledge, provide the first-ever evidence on them for the REIT sector. The second contribution investigates the evolving roles, *from a capital markets view*, of the four pricing factors of the C4 model on REITs' portfolio returns. In each investigation, we clean out the unprecedented and overwhelming confounding effects of the recent GFC and Eurozone crisis. We show that (i) the betas of growth options are larger than those of assets-in-place, (ii) REITs' expected returns and cost of capital change over time, raising a question mark about the 'income stock' description of REITs, (iii) the estimates of the equity beta for REITs are always positive and very highly significant, not consistent with the reports of the 'death of beta' from the mainstream finance literature, (iv) the estimates of equity betas and, to some extent, the coefficients of size and B/M factors suggest a regime switch in REITs' asset pricing in recent years, (v) the capital markets' one-year momentum measure does not move REITs' portfolio returns, indicating a possibility that REITs may be hedge security against the momentum of the capital markets, and (vi) REITs exhibit visible progress with their integration into the capital markets.

At least, three questions arise from our analyses. The first is whether β^E is indeed under a process of a regime switch. The estimated values of β^E, until the recent years, are always less than 1 and, on average, between 0.6 and 0.8. They appear to exceed 1 during recent years. This is a new level for these estimates. The second question is whether size and B/M will persist *jointly* to be significant pricing factors. They attain joint significance during the REIT Maturity Era. The third question involves the length of time until the one-year MOM will also be exhibiting persistent influence on REIT returns. Perhaps other measures, from the capital markets, of MOM, such as that with a six-month horizon, are already exerting some influence on REIT returns. These are topics of future research for us.

Table 1: Descriptive statistics for the six (6) size and B/M REIT portfolios, July 1981-December 2011.

The Size and Book-to-Market (B/M) REIT portfolios, constructed after the research design in Fama and French (1992, 1993), between July 1981 and December 2011. These portfolios are (1) Small size/Low B/M, (2) Small size/Mid B/M, (3) Small size/High B/M, (4) Large size/Low B/M, (5) Large size/Mid B/M, and (6) Large size/High B/M. Size breakpoints are 50%:50% and B/M breakpoints are 30%:40%:30%. "REIT size" in Panel A is the annual average of the value of market equity (ME) in millions US$ in June of each year. Panel B reports the annual average of the number of REITs in each REIT portfolio in June of each year. ($R_{p,t} - R_{f,t}$) in Panel C is the annual average of the REIT portfolio excess returns over the one-month T-bill in June of each year.

Panel A: REIT size (in millions US$)			
	Low B/M	Mid B/M	High B/M
Small Size	482.3	335.3	275.9
Large Size	2590.6	2095.5	2222.3

Panel B: Average number of REITs in the portfolio per year			
	Low B/M	Mid B/M	High B/M
Small Size	6	13	15
Large Size	13	19	7

Panel C: Excess portfolio returns, ($R_{p,t} - R_{f,t}$)			
	Low B/M	Mid B/M	High B/M
Small Size	-0.28	0.41	0.65
Large Size	0.85	0.89	1.12

Table 2: Summary statistics on the C4 model, July 1981 to December 2011.

($R_{p,t} - R_{f,t}$) is the realized excess return of a REIT portfolio *p* over the risk free rate at time t. The Size and Book-to-Market (B/M) REIT portfolios, constructed after the research design in Fama and French (1992, 1993), between July 1981 and December 2011. These portfolios are (1) Small size/Low B/M, (2) Small size/Mid B/M, (3) Small size/High B/M, (4) Large size/Low B/M, (5) Large size/Mid B/M, and (6) Large size/High B/M. Size breakpoints are 50%:50% and B/M breakpoints are 30%:40%:30%. ($R_{m,t} - R_{f,t}$) is the realized excess market return over the risk free rate at time *t*; SML_t is the difference between the returns of small capitalization stocks and large capitalization stocks at time *t*; HML_t is the difference between the returns of high and low B/M stocks at time *t*; and MOM_t is the market momentum factor at time *t*. Data on these four asset pricing factors pertain to the capital markets and are publicly available at Ken French's website (see references for the web address).

Full Sample Period: January 1981-December 2011										
Summary Statistics (in %)						Correlation Matrix				
Variable	Mean	Std. Dev.	Min	Max		Excess Port Ret	Excess Mark Ret	SML	HML	MOM
Excess Port Ret	0.62	6.37	-47.89	56.15		1				
Excess Mark Ret	0.56	4.64	-23.14	12.43		0.51	1			
SML	0.11	3.18	-16.62	22.06		0.27	0.23	1		
HML	0.3	3.1	-12.87	13.88		0.15	-0.31	-0.34	1	
MOM	0.62	4.74	-34.75	18.4		0.21	0.11	0.13	0.02	1

The REIT Vintage Period: January 1981-December 1992										
Summary Statistics (in %)						Correlation Matrix				
Variable	Mean	Std. Dev.	Min	Max		Excess Port Ret	Excess Mark Ret	SML	HML	MOM
Excess Port Ret	0.26	6.01	-27.58	42.6		1				
Excess Mark Ret	0.68	4.65	-23.14	12.43		0.43	1			
SML	-0.09	2.37	-8.41	8.43		0.29	0.21	1		
HML	0.37	2.48	-5.95	7.56		-0.16	-0.53	-0.28	1	
MOM	0.84	3.03	-7.92	8.3		-0.03	-0.15	0.00	0.14	1

The New REIT Era: January 1993-September 2001										
Summary Statistics (in %)						Correlation Matrix				
Variable	Mean	Std. Dev.	Min	Max		Excess Port Ret	Excess Mark Ret	SML	HML	MOM
Excess Port Ret	0.66	3.94	-10.74	16.63		1				
Excess Mark Ret	0.62	4.44	-16.21	7.99		0.26	1			
SML	-0.07	4.44	-16.62	22.06		0.14	0.18	1		
HML	0.40	4.18	-12.87	13.88		0.09	-0.61	-0.58	1	
MOM	1.07	5.48	-25.01	18.4		-0.01	0.00	0.16	-0.11	1

The REIT Maturity Era: October 2001-December 2011 (Ongoing)										
Summary Statistics (in %)						Correlation Matrix				
Variable	Mean	Std. Dev.	Min	Max		Excess Port Ret	Excess Mark. Ret	SML	HML	MOM
Excess Port Ret	0.95	8.09	-47.89	56.154		1				
Excess Mark Ret	0.40	4.78	-18.55	11.53		0.69	1			
SML	0.47	2.57	-5.16	6.83		0.44	0.38	1		
HML	0.16	2.58	-9.93	7.66		0.46	0.22	0.14	1	
MOM	0.02	5.41	-34.75	12.52		0.43	0.35	0.20	0.13	1

Table 3: Beta estimates of the growth options and assets-in-place.

Panels A and B report the beta estimates of growth options, β^{GO}, and assets-in-place, β^{AIP}, for the size-based and book-to-market (B/M) based REIT portfolios, respectively, for the full sample period of July 1981-December 2011 and three sequential and mutually exclusive sub-sample periods. Panels C and D report the results for the same estimates without the confounding effects of the crises of GFC and the Eurozone country defaults for the (i) October 2001-December 2007 and (ii) October 2001-June 2008 periods. The beta estimates for the size portfolios cover from Low B/M to Mid B/M band and from Mid B/M to High B/M band. β^{U} is the asset (or unlevered) beta from the modified Fama-French 4-factor model. β^{GO} and β^{AIP} are the two unknowns of a system of two linear equations with β^{U} and average portfolio B/M as the knowns. Our approach follows from Bernardo et al. (2007) after introducing a number of modifications to their work. All estimates of β^{U}, except that which is equal to 0, from the modified C4 asset-pricing model are highly statistically significantly different from 0. The Size and Book-to-Market (B/M) portfolios, constructed after the research design in Fama and French (1992, 1993), between July 1981 and December 2011. These portfolios are (1) Small size/Low B/M, (2) Small size/Mid B/M, (3) Small size/High B/M, (4) Large size/Low B/M, (5) Large size/Mid B/M, and (6) Large size/High B/M. Size breakpoints are 50%:50% and B/M breakpoints are 30%:40%:30%.

Panel A: Size portfolios within the B/M ratio bands							
Full sample period	Portfolio	Avg. B/M	β^{U}	β^{GO}	β^{AIP}	β^{GO}	β^{AIP}
	Low B/M	0.46	0.09				
	Mid B/M	0.80	0.30	-0.20	0.42		
Small Size	High B/M	1.42	0.20			0.41	0.27
	Low B/M	0.38	0.40				
	Mid B/M	0.59	0.40	0.41	0.39		
Large Size	High B/M	1.48	0.10			0.60	0.26
Vintage REIT Era	Portfolio	Avg. B/M	β^{U}	β^{GO}	β^{AIP}	β^{GO}	β^{AIP}
	Low B/M	0.49	0.44				
	Mid B/M	1.17	0.17	0.64	0.23		
Small Size	High B/M	2.39	0.13			0.20	0.17
	Low B/M	0.43	0.48				
	Mid B/M	0.73	0.36	0.66	0.25		
Large Size	High B/M	1.04	0.00			1.20	0.05
New REIT Era	Portfolio	Avg. B/M	β^{U}	β^{GO}	β^{AIP}	β^{GO}	β^{AIP}
	Low B/M	0.37	0.25				
	Mid B/M	0.84	0.22	0.28	0.21		
Small Size	High B/M	1.65	0.19			0.26	0.21
	Low B/M	0.44	0.29				
	Mid B/M	0.64	0.27	0.33	0.24		
Large Size	High B/M	2.41	0.22			0.29	0.26
REIT Maturity Era	Portfolio	Avg. B/M	β^{U}	β^{GO}	β^{AIP}	β^{GO}	β^{AIP}
	Low B/M	0.52	0.07				
	Mid B/M	0.63	0.33	-1.19	1.23		
Small Size	High B/M	0.90	0.21			0.60	0.17
	Low B/M	0.32	0.38				
	Mid B/M	0.50	0.42	0.32	0.51		
Large Size	High B/M	0.96	0.38			0.45	0.38

Panel B: Size portfolios within the B/M ratio bands – the REIT maturity era without the recent crises													
		October 2001-December 2007						October 2001-June2008					
Size Portfo	B/M Band	Avg. B/M	β^{U}	β^{GO}	β^{AIP}	β^{GO}	β^{AIP}	Avg. B/M	β^{U}	β^{GO}	β^{AIP}	β^{GO}	β^{AIP}
Small Size	Low B/M	0.29	0.28	0.40	-0.01			0.29	0.31	0.41	0.05		
	Mid B/M	0.49	0.19			0.12	0.27	0.51	0.23			0.15	0.30
	High B/M	0.72	0.23					0.74	0.26				
Large Size	Low B/M	0.31	0.24	0.05	0.65			0.3	0.27	0.12	0.63		
	Mid B/M	0.44	0.31			0.40	0.20	0.44	0.35			0.43	0.24
	High B/M	0.98	0.21					0.97	0.25				

Table 3 Cont'd

Panel C: The B/M ratio portfolios (avg B/M ratios are available in Panel A)									
Full sample period	Portfolio	β^{U}	β^{GO}	β^{AIP}	**New REIT Era**	Portfolio	β^{U}	β^{GO}	β^{AIP}
	Small	0.09				Small	0.25		
Low B/M	Large	0.40	1.95	-2.07	Low B/M	Large	0.29	0.07	0.56
	Small	0.30				Small	0.22		
Mid B/M	Large	0.40	0.69	0.20	Mid B/M	Large	0.27	0.43	0.18
	Small	0.20				Small	0.19		
High B/M	Large	0.10	2.97	1.03	High B/M	Large	0.22	0.12	0.16
Vintage REIT Era	Portfolio	β^{U}	β^{GO}	β^{AIP}	**REIT Maturity Era**	Portfolio	β^{U}	β^{GO}	β^{AIP}
	Small	0.44				Small	0.07		
Low B/M	Large	0.48	0.77	0.10	Low B/M	Large	0.38	0.88	-0.69
	Small	0.17				Small	0.33		
Mid B/M	Large	0.36	0.68	0.24	Mid B/M	Large	0.42	0.76	0.08
	Small	0.13				Small	0.21		
High B/M	Large	0.00	-0.09	0.00	High B/M	Large	0.38	-2.36	0.49

Panel D: The B/M ratio portfolios – the REIT maturity era without the recent crises									
		October 2001-December 2007				October 2001-June 2008			
B/M Portfolio	Size Band	Avg. B/M	β^{U}	β^{GO}	β^{AIP}	Avg. B/M	β^{U}	β^{GO}	β^{AIP}
Low B/M	Small	0.29	0.28	0.78	-0.95	0.29	0.31	1.75	-3.16
	Large	0.31	0.24			0.3	0.27		
Mid B/M	Small	0.49	0.19	1.29	-0.92	0.51	0.23	1.18	-0.69
	Large	0.44	0.31			0.44	0.35		
High B/M	Small	0.72	0.23	0.29	0.21	0.74	0.26	0.30	0.25
	Large	0.98	0.21			0.97	0.25		

Table 4: REIT portfolios formed on size and B/M breakpoints; full sample period.

For explanations about this table, see the top of the next page of this table.

Portf. no (no. of obs)	β	SML	HML	MOM	Adj. R^2	β	SML	HML	MOM	Adj. R^2
1	0.77				0.24	0.71	0.33			0.26
(306)	**(9.89**)**					**(9.03**)**	**(2.94**)**			
2	0.62				0.22	0.56	0.39			0.26
(366)	**(10.24**)**					**(9.17**)**	**(4.37**)**			
3	0.77				0.27	0.70	0.44			0.31
(366)	**(11.69**)**					**(10.59**)**	**(4.58**)**			
4	0.66				0.30	0.61	0.29			0.33
(366)	**(12.61**)**					**(11.58**)**	**(3.78**)**			
5	0.67				0.35	0.63	0.25			0.37
(366)	**(14.16**)**					**(13.14**)**	**(3.63**)**			
6	0.74				0.23	0.71	0.18			0.23
(324)	**(9.74**)**					**(9.13**)**	**(1.62)**			
1		0.58			0.06	0.92		0.85		0.35
(306)		**(4.65**)**				**(12.33**)**		**(7.33**)**		
2		0.58			0.09	0.78		0.76		0.36
(366)		**(6.06**)**				**(13.50**)**		**(8.81**)**		
3		0.68			0.10	0.92		0.69		0.36
(366)		**(6.37**)**				**(14.08**)**		**(7.09**)**		
4		0.50			0.08	0.79		0.62		0.41
(366)		**(5.73**)**				**(15.63**)**		**(8.22**)**		
5		0.47			0.08	0.79		0.56		0.45
(366)		**(5.70**)**				**(17.20**)**		**(8.18**)**		
6		0.42			0.03	0.90		0.75		0.32
(324)		**(3.40**)**				**(12.04**)**		**(6.87**)**		
1			0.45		0.03	0.73			0.28	0.27
(306)			**(3.32**)**			**(9.52**)**			**(3.74**)**	
2			0.39		0.04	0.60			0.22	0.25
(366)			**(3.86**)**			**(9.97**)**			**(3.67**)**	
3			0.25		0.01	0.74			0.21	0.29
(366)			**(2.18**)**			**(11.44**)**			**(3.28**)**	
4			0.24		0.02	0.64			0.14	0.31
(366)			**(2.62**)**			**(12.36**)**			**(2.68**)**	
5			0.18		0.01	0.65			0.16	0.37
(366)			**(2.08**)**			**(13.93**)**			**(3.49**)**	
6			0.34		0.02	0.71			0.20	0.24
(324)			**(2.71**)**			**(9.38**)**			**(2.80**)**	
1				0.37	0.06		0.83	0.76		0.15
(306)				**(4.40**)**			**(6.53**)**	**(5.60**)**		
2				0.28	0.04		0.81	0.67		0.19
(366)				**(4.21**)**			**(8.36**)**	**(6.80**)**		
3				0.29	0.04		0.87	0.55		0.15
(366)				**(3.88**)**			**(7.84**)**	**(4.88**)**		
4				0.21	0.03		0.66	0.47		0.14
(366)				**(3.37**)**			**(7.31**)**	**(5.12**)**		
5				0.23	0.04		0.60	0.39		0.13
(366)				**(4.03**)**			**(7.02**)**	**(4.47**)**		
6				0.29	0.04		0.61	0.56		0.08
(324)				**(3.63**)**			**(4.81**)**	**(4.33**)**		

Table 4 Cont'd

This table reports the results of 15 time-series regressions on the six REIT size and book-to-market (B/M) portfolios, constructed after the research design in Fama and French (1992, 1993), between July 1981 and December 2011. These portfolios are (1) Small size/Low B/M, (2) Small size/Mid B/M, (3) Small size/High B/M, (4) Large size/Low B/M, (5) Large size/Mid B/M, and (6) Large size/High B/M. Size breakpoints are 50%:50% and B/M breakpoints are 30%:40%:30%. The dependent variable is the monthly-realized excess return of portfolio i over the risk free rate at time t. The columns under β, SML, HML and MOM report the OLS coefficient estimates and their t-statistics for the pricing factors of excess market returns, size, B/M, and momentum. OLS estimates and their t-statistics are crosschecked with the Prais-Winsten and Cochrane-Orcutt generalized least squares regressions (parameter estimation adjusted for serial correlation), yielding similar results. ^, *, and ** reflect significance at the 90%, 95% and 99% confidence levels, respectively.

Portfo no (no. of obs)	β	SML	HML	MOM	Adj. R^2	β	SML	HML	MOM	Adj. R^2
1		0.51		0.32	0.10	0.88		0.84	0.26	0.38
(306)		**(4.15**)**		**(3.88**)**		**(11.98**)**		**(7.36**)**	**(3.80**)**	
2		0.54		0.23	0.12	0.76		0.74	0.19	0.38
(366)		**(5.66**)**		**(3.65**)**		**(13.18**)**		**(8.69**)**	**(3.43**)**	
3		0.64		0.24	0.12	0.89		0.67	0.18	0.37
(366)		**(6.00**)**		**(3.28**)**		**(13.76**)**		**(6.95**)**	**(3.01**)**	
4		0.47		0.17	0.10	0.78		0.61	0.11	0.42
(366)		**(5.39**)**		**(2.80**)**		**(15.32**)**		**(8.09**)**	**(2.36*)**	
5		0.44		0.19	0.11	0.77		0.54	0.14	0.47
(366)		**(5.31**)**		**(3.49**)**		**(16.90**)**		**(8.04**)**	**(3.23**)**	
6		0.36		0.26	0.06	0.88		0.74	0.17	0.33
(324)		**(2.96**)**		**(3.22**)**		**(11.65**)**		**(6.78**)**	**(2.61**)**	
1			0.45	0.37	0.09		0.75	0.74	0.30	0.18
(306)			**(3.44**)**	**(4.05**)**			**(6.02**)**	**(5.53**)**	**(3.78**)**	
2			0.38	0.27	0.08		0.76	0.64	0.20	0.21
(366)			**(3.82**)**	**(4.18**)**			**(7.91**)**	**(6.61**)**	**(3.34**)**	
3			0.24	0.29	0.05		0.82	0.52	0.21	0.17
(366)			**(2.11*)**	**(3.83**)**			**(7.41**)**	**(4.69**)**	**(3.00**)**	
4			0.23	0.20	0.04		0.63	0.45	0.14	0.15
(366)			**(2.55**)**	**(3.32**)**			**(6.93**)**	**(4.95**)**	**(2.50*)**	
5			0.17	0.23	0.05		0.56	0.37	0.18	0.15
(366)			**(2.01*)**	**(3.99**)**			**(6.57**)**	**(4.26**)**	**(3.23**)**	
6			0.34	0.29	0.06		0.55	0.54	0.24	0.11
(324)			**(2.73**)**	**(3.64**)**			**(4.34**)**	**(4.18**)**	**(3.03**)**	
1	0.85	0.63	1.06		0.42	0.83	0.58	1.03	0.21	0.42
(306)	**(4.15**)**	**(4.15**)**	**(3.88**)**			**(4.15**)**	**(4.15**)**	**(3.88**)**	**(3.44**)**	
2	0.72	0.65	0.96		0.46	0.71	0.63	0.94	0.14	0.46
(366)	**(5.66**)**	**(5.66**)**	**(3.65**)**			**(5.66**)**	**(5.66**)**	**(3.65**)**	**(3.31**)**	
3	0.85	0.69	0.89		0.45	0.84	0.66	0.87	0.13	0.45
(366)	**(6.00**)**	**(6.00**)**	**(3.28**)**			**(6.00**)**	**(6.00**)**	**(3.28**)**	**(2.90**)**	
4	0.74	0.50	0.77		0.48	0.73	0.49	0.76	0.07	0.48
(366)	**(5.39**)**	**(5.39**)**	**(2.80**)**			**(5.39**)**	**(5.39**)**	**(2.80**)**	**(2.34*)**	
5	0.75	0.45	0.69		0.51	0.74	0.42	0.68	0.10	0.52
(366)	**(5.31**)**	**(5.31**)**	**(3.49**)**			**(5.31**)**	**(5.31**)**	**(3.49**)**	**(3.18**)**	
6	0.86	0.45	0.90		0.35	0.84	0.42	0.87	0.14	0.36
(324)	**(11.69**)**	**(4.14**)**	**(7.98**)**			**(11.39**)**	**(3.84**)**	**(7.78**)**	**(2.11**)**	
1	0.68	0.29		0.25	0.28					
(306)	**(8.80**)**	**(2.56*)**		**(3.44**)**						
2	0.54	0.36		0.19	0.28					
(366)	**(9.00**)**	**(4.07**)**		**(3.31**)**						
3	0.68	0.41		0.18	0.32					
(366)	**(10.44**)**	**(4.31**)**		**(2.90**)**						
4	0.60	0.27		0.12	0.33					
(366)	**(11.43**)**	**(3.54**)**		**(2.34*)**						
5	0.62	0.23		0.15	0.39					
(366)	**(13.01**)**	**(3.32**)**		**(3.18**)**						
6	0.69	0.15		0.19	0.24					
(324)	**(8.89**)**	**(1.33)**		**(2.63**)**						

Table 5: REIT portfolios formed on size and B/M breakpoints; the vintage REIT era.

For explanations about this table, see the top of the next page of this table.

Port no (no. of obs)	β	SML	HML	MOM	Adj. R^2	β	SML	HML	MOM	Adj. R^2
1	0.53				0.11	0.44	0.75			0.16
(84)	**(3.33**)**					**(2.81**)**	**(2.36*)**			
2	0.34				0.12	0.28	0.54			0.20
(138)	**(4.46**)**					**(3.76**)**	**(3.75**)**			
3	0.64				0.22	0.54	0.84			0.31
(138)	**(6.23**)**					**(5.54**)**	**(4.40**)**			
4	0.65				0.35	0.58	0.60			0.42
(138)	**(8.60**)**					**(8.00**)**	**(4.25**)**			
5	0.63				0.46	0.59	0.38			0.50
(138)	**(10.81**)**					**(10.24**)**	**(3.38**)**			
6	0.58				0.08	0.58	0.04			0.08
(114)	**(3.38**)**					**(3.30**)**	**(0.11)**			
1		0.94			0.08	0.67		0.72		0.12
(84)		**(2.94**)**				**(3.71**)**		**(1.60)**		
2		0.66			0.12	0.44		0.34		0.14
(138)		**(4.45**)**				**(4.93**)**		**(2.08*)**		
3		1.07			0.16	0.68		0.14		0.21
(138)		**(5.18**)**				**(5.60**)**		**(0.65)**		
4		0.84			0.15	0.69		0.15		0.35
(138)		**(5.05**)**				**(7.77**)**		**(0.95)**		
5		0.63			0.11	0.63		-0.03		0.45
(138)		**(4.30**)**				**(8.99**)**		**(-0.22)**		
6		0.23			-0.01	0.73		0.45		0.09
(114)		**(0.65)**				**(3.51**)**		**(1.26)**		
1			-0.12		-0.01	0.51			-0.16	0.10
(84)			**(-0.30)**			**(3.18**)**			**(-0.62)**	
2			-0.09		-0.00	0.32			-0.12	0.12
(138)			**(-0.61)**			**(4.24**)**			**(-1.03)**	
3			-0.52		0.04	0.64			0.03	0.21
(138)			**(-2.51*)**			**(6.16**)**			**(0.20)**	
4			-0.52		0.06	0.67			0.23	0.36
(138)			**(-3.17**)**			**(8.89**)**			**(1.96^)**	
5			-0.64		0.13	0.65			0.14	0.46
(138)			**(-4.72**)**			**(10.98**)**			**(1.56)**	
6			-0.26		-0.00	0.60			0.23	0.08
(114)			**(-0.82)**			**(3.47**)**			**(0.98)**	
1				-0.29	0.00		1.01	0.27		0.08
(84)				**(-1.06)**			**(2.99**)**	**(0.64)**		
2				-0.20	0.01		0.68	0.08		0.12
(138)				**(-1.63)**			**(4.43**)**	**(0.57)**		
3				-0.13	-0.00		0.99	-0.27		0.16
(138)				**(-0.71)**			**(4.64**)**	**(-1.34)**		
4				0.06	-0.01		0.75	-0.33		0.17
(138)				**(0.43)**			**(4.36**)**	**(-0.27*)**		
5				-0.02	-0.01		0.48	-0.52		0.19
(138)				**(-0.15)**			**(3.31**)**	**(-3.82**)**		
6				0.13	-0.01		0.15	-0.21		-0.01
(114)				**(0.53)**			**(0.39)**	**(-0.63)**		

Table 5 Cont'd

This table reports the results of 15 time-series regressions on the six REIT size and book-to-market (B/M) portfolios, constructed after the research design in Fama and French (1992, 1993), between July 1981 and December 1992. These portfolios are (1) Small size/Low B/M, (2) Small size/Mid B/M, (3) Small size/High B/M, (4) Large size/Low B/M, (5) Large size/Mid B/M, and (6) Large size/High B/M. Size breakpoints are 50%:50% and B/M breakpoints are 30%:40%:30%. The dependent variable is the monthly-realized excess return of portfolio i over the risk free rate at time t. The columns under β, SML, HML and MOM report the OLS coefficient estimates and their t-statistics for the pricing factors of excess market returns, size, B/M, and momentum. OLS estimates and their t-statistics are crosschecked with the Prais-Winsten and Cochrane-Orcutt generalized least squares regressions (parameter estimation adjusted for serial correlation), yielding similar results. ^, *, and ** reflect significance at the 90%, 95% and 99% confidence levels, respectively.

Port no (no. of obs)	β	SML	HML	MOM	Adj. R^2	β	SML	HML	MOM	Adj. R^2
1		0.96		-0.32	0.09	0.66		0.72	-0.16	0.12
(84)		**(3.00**)**		**(-1.23)**		**(3.57**)**		**(1.58)**	**(-0.60)**	
2		0.65		-0.20	0.13	0.43		0.35	-0.14	0.14
(138)		**(4.47**)**		**(-1.70^)**		**(4.79**)**		**(2.17*)**	**(-1.20)**	
3		1.06		-0.12	0.16	0.68		0.14	0.02	0.21
(138)		**(5.17**)**		**(-0.73)**		**(5.57**)**		**(0.63)**	**(0.15)**	
4		0.84		0.07	0.15	0.71		0.13	0.22	0.36
(138)		**(5.04**)**		**(0.51)**		**(7.99**)**		**(0.81)**	**(1.89^)**	
5		0.63		-0.01	0.11	0.64		-0.04	0.14	0.46
(138)		**(4.28**)**		**(-0.12)**		**(9.15**)**		**(-0.34)**	**(1.57)**	
6		0.23		0.13	-0.01	0.74		0.44	0.22	0.09
(114)		**(0.62)**		**(0.51)**		**(3.57**)**		**(1.21)**	**(0.91)**	
1			-0.10	-0.28	-0.01		1.04	0.31	-0.33	0.08
(84)			**(-0.23)**	**(-1.04)**			**(3.07**)**	**(0.73)**	**(-1.28)**	
2			-0.06	-0.20	0.01		0.69	0.12	-0.21	0.13
(138)			**(-0.37)**	**(-1.55)**			**(4.52**)**	**(0.84)**	**(-1.81^)**	
3			-0.51	-0.06	0.03		0.99	-0.25	-0.09	0.16
(138)			**(-2.42**)**	**(-0.35)**			**(4.65**)**	**(-1.24)**	**(-0.53)**	
4			-0.55	0.13	0.06		0.74	-0.35	0.11	0.17
(138)			**(-3.27**)**	**(0.92)**			**(4.33**)**	**(-2.18*)**	**(0.84)**	
5			-0.65	0.06	0.13		0.48	-0.53	0.05	0.19
(138)			**(-4.74**)**	**(0.54)**			**(3.29**)**	**(-3.83**)**	**(0.45**)**	
6			-0.28	0.16	-0.01		0.13	-0.24	0.15	-0.02
(114)			**(-0.88)**	**(0.63)**			**(0.34)**	**(-0.71)**	**(0.60)**	
1	0.63	0.92	1.03		0.20	0.61	0.94	1.03	-0.21	0.20
(84)	**(3.63**)**	**(2.91**)**	**(2.31*)**			**(3.46**)**	**(2.96**)**	**(2.31*)**	**(-0.84)**	
2	0.40	0.62	0.46		0.24	0.39	0.63	0.48	-0.16	0.25
(138)	**(4.85**)**	**(4.35**)**	**(2.99**)**			**(4.70**)**	**(4.42**)**	**(3.11**)**	**(-1.46)**	
3	0.63	0.89	0.33		0.32	0.63	0.90	0.33	-0.00	0.31
(138)	**(5.58**)**	**(4.64**)**	**(1.55)**			**(5.53**)**	**(4.62**)**	**(1.54)**	**(-0.03)**	
4	0.66	0.65	0.29		0.43	0.67	0.64	0.26	0.20	0.44
(138)	**(7.90**)**	**(4.56**)**	**(1.85^)**			**(8.11**)**	**(4.52**)**	**(1.71*)**	**(1.83*)**	
5	0.61	0.39	0.05		0.49	0.61	0.38	0.04	0.13	0.50
(138)	**(9.00**)**	**(3.39**)**	**(0.41)**			**(9.15**)**	**(3.34**)**	**(0.29)**	**(1.49)**	
6	0.73	0.19	0.51		0.08	0.74	0.16	0.49	0.21	0.08
(114)	**(3.51**)**	**(0.51)**	**(1.35)**			**(3.56**)**	**(0.44)**	**(1.28)**	**(0.87)**	
1	0.42	0.77		-0.21	0.15					
(84)	**(2.63**)**	**(2.42*)**		**(-0.82)**						
2	0.26	0.54		-0.13	0.20					
(138)	**(3.52**)**	**(3.78**)**		**(-1.18)**						
3	0.54	0.84		0.01	0.30					
(138)	**(5.46**)**	**(4.38**)**		**(0.10)**						
4	0.60	0.59		0.22	0.43					
(138)	**(8.30**)**	**(4.24**)**		**(1.96^)**						
5	0.61	0.38		0.13	0.50					
(138)	**(10.40**)**	**(3.36**)**		**(1.52)**						
6	0.60	0.02		0.23	0.08					
(114)	**(3.40**)**	**(0.06)**		**(0.97)**						

Table 6: REIT portfolios formed on size and B/M breakpoints; the new REIT era.

For explanations about this table, see the top of the next page of this table.

Port no (no. of obs)	β	SML	HML	MOM	Adj. R^2	β	SML	HML	MOM	Adj. R^2
1	0.28				0.08	0.27	0.07			0.08
(99)	**(3.12**)**					**(2.92**)**	**(0.82)**			
2	0.18				0.05	0.16	0.13			0.07
(105)	**(2.57**)**					**(2.23*)**	**(1.75^)**			
3	0.26				0.07	0.24	0.12			0.07
(105)	**(2.88**)**					**(2.61*)**	**(1.29)**			
4	0.19				0.04	0.18	0.06			0.03
(105)	**(2.24**)**					**(2.06*)**	**(0.72)**			
5	0.21				0.05	0.19	0.12			0.06
(105)	**(2.60**)**					**(2.31*)**	**(1.42)**			
6	0.27				0.08	0.27	0.01			0.07
(87)	**(2.91**)**					**(2.83**)**	**(0.07)**			
1		0.12			0.01	0.48		0.36		0.16
(99)		**(1.32)**				**(4.46**)**		**(3.09**)**		
2		0.16			0.04	0.36		0.31		0.14
(105)		**(2.15*)**				**(4.23**)**		**(3.45**)**		
3		1.16			0.02	0.42		0.29		0.11
(105)		**(1.75^)**				**(3.90**)**		**(2.56*)**		
4		0.10			0.00	0.45		0.46		0.18
(105)		**(1.10)**				**(4.54**)**		**(4.33**)**		
5		0.15			0.02	0.40		0.33		0.13
(105)		**(1.83^)**				**(4.13**)**		**(3.27**)**		
6		0.06			-0.01	0.54		0.46		0.21
(87)		**(0.58)**				**(4.84**)**		**(3.83**)**		
1			0.04		-0.01	0.28			-0.05	0.08
(99)			**(0.41)**			**(3.18**)**			**(-0.62)**	
2			0.08		-0.00	0.18			0.02	0.04
(105)			**(1.05)**			**(2.56*)**			**(0.27)**	
3			0.02		-0.01	0.26			0.02	0.06
(105)			**(0.25)**			**(2.87**)**			**(0.33)**	
4			0.17		0.02	0.19			-0.04	0.03
(105)			**(1.84^)**			**(2.23**)**			**(-0.59)**	
5			0.08		-0.00	0.21			0.02	0.04
(105)			**(0.91)**			**(2.59*)**			**(0.33)**	
6			0.10		-0.00	0.27			-0.01	0.07
(87)			**(0.91)**			**(2.89**)**			**(-0.09)**	
1				-0.05	-0.01		0.22	0.18		0.02
(99)				**(-0.69)**			**(1.93^)**	**(1.46)**		
2				0.02	-0.01		0.30	0.26		0.10
(105)				**(0.27)**			**(3.49**)**	**(2.90**)**		
3				0.02	-0.01		0.26	0.18		0.03
(105)				**(0.33)**			**(2.32*)**	**(1.54)**		
4				-0.04	-0.01		0.28	0.34		0.08
(105)				**(-0.57)**			**(2.72**)**	**(3.11**)**		
5				0.02	-0.01		0.29	0.25		0.07
(105)				**(0.33)**			**(2.95**)**	**(2.46*)**		
6				-0.01	-0.01		0.16	0.20		0.01
(87)				**(-0.07)**			**(1.38)**	**(1.55)**		

Table 6 Cont'd

This table reports the results of 15 time-series regressions on the six REIT size and book-to-market (B/M) portfolios, constructed after the research design in Fama and French (1992, 1993), between January 1993 and September 2001. These portfolios are (1) Small size/Low B/M, (2) Small size/Mid B/M, (3) Small size/High B/M, (4) Large size/Low B/M, (5) Large size/Mid B/M, and (6) Large size/High B/M. Size breakpoints are 50%:50% and B/M breakpoints are 30%:40%:30%. The dependent variable is the monthly-realized excess return of portfolio i over the risk free rate at time t. The columns under β, SML, HML and MOM report the OLS coefficient estimates and their t-statistics for the pricing factors of excess market returns, size, B/M, and momentum. OLS estimates and their t-statistics are crosschecked with the Prais-Winsten and Cochrane-Orcutt generalized least squares regressions (parameter estimation adjusted for serial correlation), yielding similar results. ^, *, and ** reflect significance at the 90%, 95% and 99% confidence levels, respectively.

Port no (no. of obs)	β	SML	HML	MOM	Adj. R^2	β	SML	HML	MOM	Adj. R^2
1		0.14		-0.07	0.01	0.48		0.36	-0.02	0.15
(99)		**(1.45)**		**(-0.92)**		**(4.40**)**		**(2.99**)**	**(-0.29)**	
2		0.16		-0.00	0.02	0.36		0.32	0.04	0.14
(105)		**(2.13*)**		**(-0.05)**		**(4.26**)**		**(3.50**)**	**(0.72)**	
3		0.16		0.01	0.01	0.43		0.30	0.05	0.11
(105)		**(1.71^)**		**(0.07)**		**(3.93**)**		**(2.61*)**	**(0.66)**	
4		0.11		-0.05	-0.00	0.45		0.46	-0.01	0.17
(105)		**(1.20)**		**(-0.75)**		**(4.50**)**		**(4.27**)**	**(-0.10)**	
5		0.15		0.00	0.01	0.40		0.34	0.05	0.13
(105)		**(1.79^)**		**(-0.05)**		**(4.17**)**		**(3.33**)**	**(0.76)**	
6		0.06		-0.01	-0.01	0.55		0.47	0.04	0.20
(87)		**(0.59)**		**(-0.17)**		**(4.85**)**		**(3.84**)**	**(0.51)**	
1			0.03	-0.05	-0.02		0.23	0.18	-0.07	0.02
(99)			**(0.33)**	**(-0.64)**			**(2.01**)**	**(1.43)**	**(-0.87)**	
2			0.08	0.02	-0.01		0.30	0.26	-0.00	0.09
(105)			**(1.08)**	**(0.38)**			**(3.45**)**	**(2.89**)**	**(-0.01)**	
3			0.03	0.03	-0.02		0.26	0.18	0.01	0.02
(105)			**(0.28)**	**(0.36)**			**(2.28*)**	**(1.53)**	**(0.09)**	
4			0.17	-0.03	0.02		0.29	0.34	-0.05	0.08
(105)			**(1.79^)**	**(-0.39)**			**(2.78**)**	**(3.10**)**	**(-0.73)**	
5			0.08	0.03	-0.01		0.29	0.25	0.01	0.06
(105)			**(0.95)**	**(0.42)**			**(2.90**)**	**(2.45*)**	**(0.09)**	
6			0.10	0.00	-0.01		0.17	0.20	-0.01	-0.00
(87)			**(0.90)**	**(0.04)**			**(1.37)**	**(1.53)**	**(-0.12)**	
1	0.59	0.37	0.66		0.25	0.58	0.38	0.66	-0.04	0.25
(99)	**(5.55**)**	**(3.63**)**	**(4.81**)**			**(3.46**)**	**(2.96**)**	**(2.31*)**	**(-0.84)**	
2	0.46	0.41	0.62		0.33	0.46	0.40	0.62	0.01	0.32
(105)	**(5.94**)**	**(5.37**)**	**(6.30**)**			**(5.92**)**	**(5.29**)**	**(6.28**)**	**(0.25)**	
3	0.52	0.38	0.59		0.21	0.52	0.38	0.59	0.02	0.20
(105)	**(4.92**)**	**(3.70**)**	**(4.37**)**			**(4.90**)**	**(3.63**)**	**(4.36**)**	**(0.32)**	
4	0.56	0.41	0.77		0.31	0.55	0.42	0.77	-0.04	0.30
(105)	**(5.90**)**	**(4.49**)**	**(6.46**)**			**(5.85**)**	**(4.51**)**	**(6.41**)**	**(-0.58)**	
5	0.50	0.41	0.64		0.28	0.50	0.40	0.64	0.02	0.27
(105)	**(5.51**)**	**(4.60**)**	**(5.60**)**			**(5.50**)**	**(4.52**)**	**(5.58**)**	**(0.35)**	
6	0.65	0.34	0.74		0.29	0.65	0.34	0.74	0.02	0.28
(87)	**(5.82**)**	**(3.22**)**	**(5.17**)**			**(5.79**)**	**(3.17**)**	**(5.14**)**	**(0.24)**	
1	0.26	0.09		-0.06	0.08					
(99)	**(2.89**)**	**(0.95)**		**(-0.87)**						
2	0.16	0.13		0.00	0.06					
(105)	**(2.22*)**	**(1.72^)**		**(0.00)**						
3	0.24	0.11		0.01	0.06					
(105)	**(2.60*)**	**(1.24)**		**(0.14)**						
4	0.18	0.07		-0.05	0.03					
(105)	**(2.04*)**	**(0.82)**		**(-0.71)**						
5	0.19	0.11		0.01	0.05					
(105)	**(2.30*)**	**(1.38)**		**(0.12)**						
6	0.27	0.01		-0.01	0.06					
(87)	**(2.81**)**	**(0.08)**		**(-0.10)**						

Table 7: REIT portfolios formed on size and B/M breakpoints; the REIT maturity era without the effects of recent crises.

For explanations about this table, see the top of the next page of this table.

Port no (no. of obs)	β	SML	HML	MOM	Adj. R^2	β	SML	HML	MOM	Adj. R^2
1	0.70				0.21	0.54	0.71			0.32
(75)	**(4.59**)**					**(3.65**)**	**(3.53**)**			
2	0.51				0.19	0.38	0.58			0.30
(75)	**(4.22**)**					**(3.26**)**	**(3.68**)**			
3	0.57				0.25	0.44	0.60			0.38
(75)	**(5.05**)**					**(4.08**)**	**(4.15**)**			
4	0.58				0.16	0.45	0.55			0.23
(75)	**(3.94**)**					**(3.09**)**	**(2.79**)**			
5	0.60				0.22	0.52	0.38			0.26
(75)	**(4.67**)**					**(3.93**)**	**(2.14*)**			
6	0.59				0.22	0.46	0.55			0.31
(75)	**(4.63**)**					**(3.73**)**	**(3.29**)**			
1		0.93			0.20	0.79		0.72		0.29
(75)		**(4.48**)**				**(5.33**)**		**(2.94**)**		
2		0.74			0.22	0.58		0.53		0.25
(75)		**(4.58**)**				**(4.87**)**		**(2.71**)**		
3		0.78			0.25	0.64		0.56		0.33
(75)		**(5.10**)**				**(5.87**)**		**(3.09**)**		
4		0.74			0.14	0.64		0.47		0.19
(75)		**(3.68**)**				**(4.33**)**		**(1.95^)**		
5		0.59			0.11	0.66		0.51		0.27
(75)		**(3.17**)**				**(5.24**)**		**(2.44*)**		
6		0.74			0.19	0.64		0.42		0.25
(75)		**(4.26**)**				**(5.04**)**		**(1.99^)**		
1			0.44		0.02	0.71			0.15	0.22
(75)			**(1.58)**			**(4.68**)**			**(1.21)**	
2			0.33		0.02	0.52			0.14	0.20
(75)			**(1.50)**			**(4.35**)**			**(1.45)**	
3			0.34		0.02	0.59			0.16	0.27
(75)			**(1.57)**			**(5.23**)**			**(1.74^)**	
4			0.25		-0.00	0.58			0.07	0.16
(75)			**(0.95)**			**(3.95**)**			**(0.56)**	
5			0.28		0.00	0.61			0.11	0.22
(75)			**(1.17)**			**(4.74**)**			**(1.01)**	
6			0.19		-0.00	0.60			0.18	0.24
(75)			**(0.82)**			**(4.82**)**			**(1.74^)**	
1				0.11	-0.01		0.95	0.50		0.24
(75)				**(0.76)**			**(4.66**)**	**(2.01*)**		
2				0.11	0.00		0.75	0.37		0.24
(75)				**(1.01)**			**(4.76**)**	**(1.93^)**		
3				0.12	0.00		0.80	0.38		0.29
(75)				**(1.16)**			**(5.13**)**	**(2.09*)**		
4				0.03	-0.01		0.75	0.30		0.15
(75)				**(0.24)**			**(3.74**)**	**(1.21)**		
5				0.07	-0.01		0.60	0.31		0.12
(75)				**(0.58)**			**(3.25**)**	**(1.40)**		
6				0.14	0.01		0.75	0.24		0.19
(75)				**(1.21)**			**(4.31**)**	**(1.11)**		

Table 7 Cont'd

This table reports the results of 15 time-series regressions on the six REIT size and book-to-market (B/M) portfolios, constructed after the research design in Fama and French (1992, 1993), between October 2001 and to December 2007. This table excludes GFC and beyond (see Table 7 for results with the GFC dynamics). On Oct. 04, 2001, Equity Office Properties was named the first-ever REIT to be listed on the S&P500 Index, opening a new era for the sector. This era is presently ongoing. Our last sample month was dictated on us by what was reported publicly on the CRSP/ZIman database in November 2012. These six portfolios are (1) Small size/Low B/M, (2) Small size/Mid B/M, (3) Small size/High B/M, (4) Large size/Low B/M, (5) Large size/Mid B/M, and (6) Large size/High B/M. Size breakpoints are 50%:50% and B/M breakpoints are 30%:40%:30%. The dependent variable is the monthly-realized excess return of portfolio i over the risk free rate at time t. The columns under β, SML, HML and MOM report the OLS coefficient estimates and their t-statistics for the pricing factors of excess market returns, size, B/M, and momentum. OLS estimates and their t-statistics are crosschecked with the Prais-Winsten and Cochrane-Orcutt generalized least squares regressions (parameter estimation adjusted for serial correlation), yielding similar results. ^, *, and ** reflect significance at the 90%, 95% and 99% confidence levels, respectively.

Port no (no. of obs)	β	SMB	HML	MOM	Adj. R^2	β	SMB	HML	MOM	Adj. R^2
1		0.92		0.02	0.19	0.81		0.73	0.16	0.30
(75)		**(4.37**)**		**(0.18)**		**(5.45**)**		**(2.99**)**	**(1.36)**	
2		0.73		0.04	0.20	0.59		0.54	0.15	0.27
(75)		**(4.44**)**		**(0.45)**		**(5.04**)**		**(2.79**)**	**(1.60)**	
3		0.77		0.05	0.25	0.66		0.57	0.17	0.35
(75)		**(4.94**)**		**(0.57)**		**(6.11**)**		**(3.20**)**	**(1.94^)**	
4		0.75		-0.04	0.13	0.64		0.48	0.07	0.19
(75)		**(3.66**)**		**(-0.30)**		**(4.35**)**		**(1.96^)**	**(0.63)**	
5		0.58		0.02	0.10	0.68		0.52	0.11	0.27
(75)		**(3.09**)**		**(0.14)**		**(5.32**)**		**(2.48**)**	**(1.12)**	
6		0.72		0.07	0.18	0.66		0.43	0.18	0.27
(75)		**(4.09**)**		**(0.71)**		**(5.25**)**		**(2.07*)**	**(1.85^)**	
1			0.45	0.11	0.01		0.94	0.50	0.02	0.23
(75)			**(1.59)**	**(0.79)**			**(4.55**)**	**(2.00*)**	**(0.19)**	
2			0.33	0.11	0.02		0.74	0.37	0.05	0.23
(75)			**(1.52)**	**(1.04)**			**(4.61**)**	**(1.93^)**	**(0.47)**	
3			0.34	0.12	0.02		0.78	0.38	0.05	0.28
(75)			**(1.59)**	**(1.19)**			**(5.14**)**	**(2.08*)**	**(0.59)**	
4			0.25	0.03	-0.01		0.76	0.30	-0.04	0.14
(75)			**(0.95)**	**(0.25)**			**(3.72**)**	**(1.20)**	**(-0.29)**	
5			0.28	0.07	-0.00		0.60	0.31	0.02	0.11
(75)			**(1.17)**	**(0.60)**			**(3.17**)**	**(1.39)**	**(0.15)**	
6			0.20	0.14	0.00		0.73	0.24	0.08	0.18
(75)			**(0.84)**	**(1.22)**			**(4.14**)**	**(1.11)**	**(0.71)**	
1	0.63	0.70	0.70		0.39	0.65	0.67	0.71	0.09	0.39
(75)	**(4.43**)**	**(3.68**)**	**(3.12**)**			**(4.48**)**	**(3.47**)**	**(3.14**)**	**(0.80)**	
2	0.45	0.58	0.52		0.37	0.47	0.55	0.53	0.09	0.37
(75)	**(3.95**)**	**(3.81**)**	**(2.89**)**			**(4.05**)**	**(3.56**)**	**(2.92**)**	**(1.05)**	
3	0.51	0.60	0.55		0.46	0.53	0.56	0.56	0.11	0.47
(75)	**(4.97**)**	**(4.38**)**	**(3.38**)**			**(5.14**)**	**(4.08**)**	**(3.45**)**	**(1.36)**	
4	0.51	0.55	0.46		0.27	0.52	0.54	0.46	0.02	0.25
(75)	**(3.50**)**	**(2.81**)**	**(2.00*)**			**(3.47**)**	**(2.72**)**	**(1.99^)**	**(0.15)**	
5	0.58	0.37	0.50		0.31	0.59	0.35	0.51	0.08	0.30
(75)	**(4.49**)**	**(2.17*)**	**(2.46*)**			**(4.53**)**	**(1.98^)**	**(2.48*)**	**(0.76)**	
6	0.52	0.55	0.41		0.34	0.54	0.51	0.41	0.13	0.35
(75)	**(4.15**)**	**(3.33**)**	**(2.06*)**			**(4.32**)**	**(3.04**)**	**(2.12*)**	**(1.36)**	
1	0.55	0.68		0.08	0.31					
(75)	**(3.69**)**	**(3.34**)**		**(0.66)**						
2	0.40	0.56		0.08	0.30					
(75)	**(3.34**)**	**(3.45**)**		**(0.90)**						
3	0.45	0.57		0.10	0.39					
(75)	**(4.21**)**	**(3.87**)**		**(1.16)**						
4	0.46	0.55		0.01	0.22					
(75)	**(3.06**)**	**(2.71**)**		**(0.08)**						
5	0.53	0.36		0.07	0.25					
(75)	**(3.96**)**	**(1.97^)**		**(0.66)**						
6	0.48	0.51		0.12	0.32					
(75)	**(3.87**)**	**(3.02**)**		**(1.26)**						

Table 8: REIT portfolios formed on size and B/M breakpoints; the REIT maturity era.

For explanations about this table, see the top of the next page of this table.

Port no (no. of obs)	β	SML	HML	MOM	Adj. R^2	β	SML	HML	MOM	Adj. R^2
1	1.31				0.47	1.19	0.61			0.49
(123)	**(10.49**)**					**(9.00**)**	**(2.48*)**			
2	1.24				0.44	1.07	0.83			0.49
(123)	**(9.86**)**					**(8.25**)**	**(3.43**)**			
3	1.28				0.49	1.12	0.80			0.53
(123)	**(10.77**)**					**(9.12**)**	**(3.49**)**			
4	1.00				0.48	0.90	0.52			0.51
(123)	**(10.61**)**					**(9.05**)**	**(2.84**)**			
5	1.04				0.52	0.95	0.44			0.54
(123)	**(11.50**)**					**(9.95**)**	**(2.49*)**			
6	1.19				0.54	1.06	0.63			0.58
(123)	**(12.01**)**					**(10.33**)**	**(3.31**)**			
1		1.44			0.16	1.18		1.08		0.56
(123)		**(4.90**)**				**(10.13**)**		**(5.01**)**		
2		1.58			0.20	1.10		1.15		0.55
(123)		**(5.65**)**				**(9.52**)**		**(5.37**)**		
3		1.58			0.21	1.14		1.15		0.59
(123)		**(5.76**)**				**(10.57**)**		**(5.71**)**		
4		1.15			0.18	0.90		0.90		0.58
(123)		**(5.21**)**				**(10.36**)**		**(5.56**)**		
5		1.11			0.16	0.79		0.56		0.64
(123)		**(4.99**)**				**(11.54**)**		**(6.33**)**		
6		1.38			0.20	0.90		0.75		0.63
(123)		**(5.67**)**				**(11.86**)**		**(5.45**)**		
1			1.56		0.19	1.09			0.54	0.56
(123)			**(5.44**)**			**(8.99**)**			**(5.04**)**	
2			1.60		0.21	1.10			0.34	0.47
(123)			**(5.77**)**			**(8.48**)**			**(2.93**)**	
3			1.61		0.22	1.15			0.31	0.51
(123)			**(5.92**)**			**(9.36**)**			**(2.88**)**	
4			1.26		0.21	0.93			0.19	0.49
(123)			**(5.83**)**			**(9.31**)**			**(2.19*)**	
5			1.32		0.24	0.96			0.21	0.54
(123)			**(6.25**)**			**(10.11**)**			**(2.48*)**	
6			1.36		0.20	0.71			0.20	0.57
(123)			**(5.60**)**			**(10.55**)**			**(2.95**)**	
1				0.88	0.27		1.24	1.39		0.31
(123)				**(6.81**)**			**(4.63**)**	**(5.18**)**		
2				0.68	0.17		1.38	1.40		0.36
(123)				**(5.02**)**			**(8.36**)**	**(6.80**)**		
3				0.67	0.17		1.38	1.42		0.38
(123)				**(5.04**)**			**(7.84**)**	**(4.88**)**		
4				0.48	0.13		1.00	1.12		0.34
(123)				**(4.47**)**			**(7.31**)**	**(5.12**)**		
5				0.51	0.15		0.94	1.19		0.35
(123)				**(4.76**)**			**(4.79**)**	**(6.06**)**		
6				0.60	0.17		0.61	0.56		0.35
(123)				**(5.15**)**			**(5.49**)**	**(5.41**)**		

Table 8 Cont'd

This table reports the results of 15 time-series regressions on the six REIT size and book-to-market (B/M) portfolios, constructed after the research design in Fama and French (1992, 1993), between October 2001 and to December 2011. On Oct. 04, 2001, Equity Office Properties was named the first-ever REIT to be listed on the S&P500 Index, opening a new era for the sector. This era is presently ongoing. Our last sample month was dictated on us by what was reported publicly on the CRSP/ZIman database in November 2012. These six portfolios are (1) Small size/Low B/M, (2) Small size/Mid B/M, (3) Small size/High B/M, (4) Large size/Low B/M, (5) Large size/Mid B/M, and (6) Large size/High B/M. Size breakpoints are 50%:50% and B/M breakpoints are 30%:40%:30%. The dependent variable is the monthly-realized excess return of portfolio i over the risk free rate at time t. The columns under β, SML, HML and MOM report the OLS coefficient estimates and their t-statistics for the pricing factors of excess market returns, size, B/M, and momentum. OLS estimates and their t-statistics are crosschecked with the Prais-Winsten and Cochrane-Orcutt generalized least squares regressions (parameter estimation adjusted for serial correlation), yielding similar results. ^, *, and ** reflect significance at the 90%, 95% and 99% confidence levels, respectively.

Port (no. of obs)	β	SML	HML	MOM	Adj. R^2	β	SML	HML	MOM	Adj. R^2
1		1.12		0.78	0.36	0.98		1.03	0.51	0.64
(123)		**(4.29**)**		**(6.30**)**		**(8.79**)**		**(5.24**)**	**(5.28**)**	
2		1.35		0.55	0.31	0.98		1.12	0.31	0.57
(123)		**(5.08**)**		**(4.41**)**		**(8.26**)**		**(5.37**)**	**(2.96**)**	
3		1.35		0.55	0.31	1.04		1.12	0.28	0.62
(123)		**(5.20**)**		**(4.43**)**		**(9.29**)**		**(5.72**)**	**(2.93**)**	
4		0.99		0.39	0.26	0.83		0.88	0.17	0.59
(123)		**(4.64**)**		**(3.83**)**		**(9.19**)**		**(5.52**)**	**(2.14*)**	
5		0.94		0.42	0.26	0.86		0.93	0.18	0.65
(123)		**(4.40**)**		**(4.15**)**		**(10.27**)**		**(6.32**)**	**(2.50*)**	
6		1.17		0.49	0.31	0.99		0.89	0.24	0.65
(123)		**(5.10**)**		**(4.55**)**		**(10.53**)**		**(5.45**)**	**(2.98**)**	
1			1.35	0.80	0.41		0.97	1.23	0.72	0.48
(123)			**(5.47**)**	**(6.83**)**			**(4.09**)**	**(5.30**)**	**(6.40**)**	
2			1.44	0.59	0.33		1.19	1.30	0.49	0.44
(123)			**(5.62**)**	**(4.87**)**			**(4.99**)**	**(5.53**)**	**(4.33**)**	
3			1.45	0.59	0.34		1.20	1.32	0.48	0.46
(123)			**(5.79**)**	**(4.91**)**			**(5.13**)**	**(5.73**)**	**(4.37**)**	
4			1.15	0.41	0.31		0.87	1.05	0.14	0.41
(123)			**(5.65**)**	**(4.26**)**			**(4.49**)**	**(5.51**)**	**(3.69**)**	
5			1.20	0.43	0.35		0.80	1.11	0.36	0.43
(123)			**(6.12**)**	**(4.61**)**			**(4.26**)**	**(5.99**)**	**(4.08**)**	
6			1.21	0.53	0.33		0.55	0.54	0.24	0.44
(123)			**(5.45**)**	**(5.00**)**			**(4.99**)**	**(5.34**)**	**(4.47**)**	
1	1.08	0.54	1.05		0.58	0.90	0.46	1.00	0.50	0.65
(123)	**(8.79**)**	**(2.39*)**	**(4.94**)**			**(7.74**)**	**(2.26*)**	**(5.19**)**	**(5.19**)**	
2	0.95	0.75	1.11		0.58	0.85	0.71	1.08	0.28	0.61
(123)	**(8.05**)**	**(3.46**)**	**(5.38**)**			**(7.08**)**	**(3.35**)**	**(5.38**)**	**(2.84**)**	
3	1.00	0.72	1.10		0.63	0.91	0.68	1.08	0.26	0.65
(123)	**(9.07**)**	**(3.56**)**	**(5.75**)**			**(8.09**)**	**(3.45**)**	**(5.76**)**	**(2.81**)**	
4	0.81	0.47	0.87		0.60	0.75	0.44	0.85	0.15	0.61
(123)	**(8.95**)**	**(2.81**)**	**(5.53**)**			**(8.07**)**	**(2.70**)**	**(5.49**)**	**(2.00*)**	
5	0.86	0.38	0.92		0.65	0.79	0.36	0.91	0.17	0.66
(123)	**(10.12**)**	**(2.46*)**	**(6.29**)**			**(9.16**)**	**(2.33*)**	**(6.28**)**	**(2.37*)**	
6	0.97	0.57	0.89		0.66	0.89	0.54	0.86	0.22	0.68
(123)	**(10.34**)**	**(3.34**)**	**(5.45**)**			**(9.33**)**	**(3.22**)**	**(5.46**)**	**(2.86**)**	
1	0.99	0.53		0.52	0.58					
(123)	**(8.80**)**	**(2.56*)**		**(3.44**)**						
2	0.96	0.78		0.31	0.51					
(123)	**(7.21**)**	**(3.31**)**		**(2.80**)**						
3	1.01	0.75		0.29	0.55					
(123)	**(8.07**)**	**(3.37**)**		**(2.75**)**						
4	0.83	0.50		0.18	0.52					
(123)	**(8.10**)**	**(2.71**)**		**(2.04*)**						
5	0.88	0.41		0.19	0.55					
(123)	**(8.92**)**	**(2.36*)**		**(2.34*)**						
6	0.97	0.59		0.25	0.60					
(123)	**(9.25**)**	**(3.19**)**		**(2.81**)**						

Appendix1: The Methodology in Bernardo et al. (2007).

Here is a summary of the steps that Bernardo et al. (2007) take in estimating the industry β_t^{GO} and β_t^{AIP}:

1. Using monthly data on a 5-year rolling period (i.e., 60 data points - 5*12=60) and under the market model, estimate the individual $\beta_{j,t}^{e}$s of sample firms at time t, (t+1), (t+2), …, T. Using the market model to estimate $\beta_{j,t}^{e}$s implies that this paper takes a CAPM approach. Further, its use of rolling data implies that the estimated $\beta_{j,t}^{e}$s per firm across time might have correlations induced by the use of overlapping data. That is, it appears from reading Bernardo et al. (2007) that the $\beta_{j,t}^{e}$ at t and the $\beta_{j,t}^{e}$ at (t+1) share the same 59 observations. Similarly, there seems to be an overlap of 58 observations between t and (t+2) for the $\beta_{j,t}^{e}$ (and so on and so forth). Whether this overlap and arising serial correlation has any effect on their analyses does not have an answer in their paper and remains an open-ended question.

2. Convert the $\beta_{j,t}^{e}$s for each firm in each time period to its $\beta_{j,t}^{U}$, using the adjustment on the debt-to-equity and a constant corporate tax rate of 33% across firms and across time and assuming that $\beta_{j,t}^{D}$=0 for each firm in each time period. This step computes the dependent variable for each firm for each sample period.

3. Obtain from COMPUSTAT or a similar database the $B/M_{j,t}$ for all sample firms, j, at t.

4. Do not formally estimate equ (1) in the presence of severe errors-in-variables problems. To obtain industry estimates for β_t^{GO} and β_t^{AIP} at time ***t***, sort the entire data set by the B/M ratio (i.e., independent variable) at time ***t*** and split the data set into two sub-sets: Sub-sample of firms at time t with (i) high B/M values and (i) low B/M values.

5. For each sub-sample at t, obtain the averages across firms of the (i) $\beta_{p,t}^{U}$ and (ii) B/M values and generate two sub-samples:

a) Low B/M sub-sample: Averages of $\beta_{p=1,t}^{U}$ and B/M_1 values,
b) High B/M sub-sample: Averages of $\beta_{p=2,t}^{U}$ and B/M_2 values.

6. Since the regression line must pass through the means of the variables, Bernardo et al. (2007) has two observations (under the presumption of little errors-in-variables and no serial correlation) and two unknowns (β_t^{GO} and β_t^{AIP}). Connecting these two points in the XY-space yields an intercept (i.e., β_t^{GO}) and a slope equal to $\{\beta_t^{GO} - \beta_t^{AIP}\}$. Solving for the intercept allows us to compute, the from the slope equation, the industry β_t^{AIP}.

Main Differences of Our Methodology from Bernardo et al.'s (2007)

1. The most obvious difference is that we produce the β_t^{GO} and β_t^{AIP} for the REIT portfolios of (i) Small-size REITs, (ii) Large-size REITs, (iii) Low book-to-market REITs, (iv) Mid book-to-market REITs and (v) High book-to-market REITs. Further, for each size portfolio, our beta estimates cover a band of differences in the average B/M values of portfolios. Bernardo et al. (2007) produce only a single pair of industry estimates of β_t^{GO} and β_t^{AIP}.

2. The $\beta_{p,t}^{U}$s of any one of the six REIT size and B/M portfolios are an amalgam of the value weighted $\beta_{j,t}^{U}$ of individual REITs, j, in a given portfolio during that time. We obtain our $\beta_{p,t}^{U}$s with a single estimation. These $\beta_{p,t}^{U}$s correspond to the equally-weighted average $\beta_{p,t}^{U}$s in Bernardo et al. (2007), obtained from individual REITs' $\beta_{j,t}^{U}$s, which face potentially serial correlations from using overlapping data to estimate $\beta_{j,t}^{e}$.

3. Bernardo et al. (2007) use a CAPM (via the market model) approach. We take a modified C4 approach. The beta estimates of the C4 pricing model are free from the confounding effects of each of the remaining three factors. The beta estimates from the CAPM pricing

models, however, might be embracing the pricing effects of these three factors, inducing their effects on the estimates of β_t^{GO} and β_t^{AIP}. The C4 model offers a clean set of estimates.

4. We are estimating the equity or unlevered betas of ***portfolio returns*** rather than equity betas of individual REITs. This is also a major difference from Bernardo et al. (2007), who estimate the equity betas of individual firms with substantially overlapping data and aggregate these betas to obtain equally weighted equity betas for an individual firm. Following up on FF (1992, 1993), Carhart (1997), and the rich extant literature on beta estimations, the portfolio estimations control substantially the adverse effects of the errors-in-variables problem on beta estimates.

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