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Review Article

Hotel REITs: Market Risks, Book Value, Market Capitalization and Time in Market

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ABSTRACT

This study applied the Fama-French three-factor model to examine the relationship between market risks, book value, market capitalization and time in market for hotel REITs. Findings suggest that hotel REITs that were significantly correlated with all three factors had the highest number of years on the market and highest mean market capitalization. Conversely, those that were not significantly correlated with the three factors had shorter time frames in the market and had the lowest mean market capitalization. Findings also indicated that the higher the market capitalizations, and the longer they existed in the market, the more risk exposure they faced. This could explain the trend of hotel REITs to change their ownership structure and or convert their business format after a few years in the market.

Keywords: Hotel REITs; Three-factor model; Book value; Time in market and performance

INTRODUCTION

Empirical research assessing portfolio performance have historically accomplish such tasks on a risk adjusted basis, using the either the Sharp Index, the Treynor Index [1], or the Jensen Index [2]. The commonality among these three tools is they assume that the Capital Asset Pricing Model (CAPM) theory holds, and thus, CAPM is applied to ascertain the relationship between risk and return. This is the case for REIT portfolios such as hotel REITs, which have also utilized these tools to assess performance.

More recently, the CAPM has been criticized for its poor performance in explaining realized returns [3], since it uses only one risk factor, excess market portfolio returns to assess performance. Hence, the model's explanatory and predictive powers are suspect, especially as it relates to explaining realized returns. Furthermore, evidence suggests that asset pricing anomalies are excluded from the model. These includes factors germane to companies such as size effect [4,5] and value effect [6-8], which are not captured by beta (the systematic risk), a key component of the CAPM. To address these concerns, Fama, et al. [9,10], expanded extended the one factor CAPM to a three-factor model that included the conventional market (beta) factor, and two additional firm specific risk factors related to size, book equity to market equity. Hence, the three-factor model comprises the original CAPM based market factor and two additional risk factors, company size (measured by market capitalization) and value (measured by book equity to market equity/book to market). As such, the two additional factors address size risks (SMB or Small minus big) and HML (High minus low) to address value risks [9,10]. In summary, the model's three factors are: market risk; the outperformance of small versus large companies, and the outperformance of high book/market versus low book/market firms.

Hotel REIT related research have typically used CAPM derived models and have examined performance for periods of less than twenty years [11-19]. The current article provides a brief review and summary of a research that departed from this pattern and applied the Fama-French three factor model to examine the relationships between hotel REITs' market risks, book value, market capitalization and time in market [12].

ANALYTICAL DISCUSSION

Data source and analysis

The study utilized monthly U.S. hotel REIT returns retrieved from the CRSP Ziman database. The initial sample comprised thirty-three publicly traded hotel REITs, for the period, January 1993 to June 2013. Data were analyzed *via* a two-step approach. In the first step, the three-factor model was applied to examine the impact of risks on each REIT return, as measured by beta coefficients. The model is represented as:

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$$r - R_f = \beta_0 + \beta_1(K_m - R_f) + \beta_2 \cdot SMB + \beta_3 \cdot HML + \varepsilon$$

Where R_f is the risk-free return rate, r is the hotel REIT return in our case and ε is the Gaussian noise in the model. Each REIT was regressed on the three factors. To compute β_i, matrix representation was used to reformulate the three-factor model. The next step was to calculate the β_i as follows: let $\vec{y}^i$ be a n dimensional vector that contains the excess return $(r - R_f)$ for hotel REIT i, where n is the number of months in consideration for REIT i; let $\vec{X}$ be an n by 4 matrix that contains the constant term and three factors for the corresponding n months as in $\vec{y}^i$; let $\vec{\beta}^i$ be the four dimensional regression coefficient vector $[\beta_0, \beta_1, \beta_2, \beta_3]^T$ for the hotel REIT i. Then the $\vec{\beta}^i$ can be computed as follows:

$$\vec{\beta}^i = (\vec{X}^T \vec{X})^{-1} \vec{X}^T \vec{y}^i$$

The second step analyzed the correlation between the REIT returns and the three factors, i.e., $\vec{\beta}$, computed in the first step. In this step, commonalities amongst each REIT were searched for and grouped accordingly. The impact of the three factors on each group was then analyzed. This was accomplished by first using K-mean algorithm [20], to cluster the $\vec{\beta}$ s of the hotel REITs into K sets of categories: $S_1, S_2, \ldots, S_K$. Therefore, each REIT was developed based on similarities in correlations to the three factors. The K-mean algorithm attempts to minimize the within-cluster sum of square and is computed as follows:

$$\arg\min_S \sum_{j=1}^{K} \sum_{\vec{\beta}^i \in S_j} \|\vec{\beta}^i - \mu_j\|^2$$

Where μ_j is the center for category j. The K-mean algorithm is represented as follows:

1. Randomly initialize $\mu_j^{(1)}, j = 1,2 \ldots K$.
2. For t = 1 to maximum number of iteration

Table 1: Three-factor model results on each hotel REIT.

Ticker symbol	Intercept	Km-Rf	SMB	HML	R-squared	Mean market capitalization (Billion $)	Year on the market
WTPR	0.2589	1.096	0.8194	0.722	0.1735	0.0276	1.3
VHT	6.6735	-1.7901	-3.5411	0.5448	0.1499	0.0032	2
EHP	1.8376	-0.0921	0.8318	-0.4691	0.0619	0.1754	2.7
WYN	-1.755	1.2810**	2.0283**	2.5124**	0.3632	1.2085	3.2
HIH	1.6373	0.2903	0.4011	-0.3851	0.0765	0.6479	3.5
HFD	-4.2092*	0.4337	-0.7392	-1.1819	0.186	0.0054	4.9
LQI	-1.2322	1.0152*	1.5340**	0.7992	0.1992	1.3169	8.1
MHX	-1.4965	1.7559**	0.8535**	1.4206**	0.3364	0.6074	9.7
RFS	-0.1303	0.9074**	0.6577**	1.1982**	0.2537	0.3409	9.8
BOY	-0.9325	0.4625*	0.9801**	1.0673**	0.1998	0.195	9.8
JAMS	-0.8335	0.6259**	0.4722*	0.7606**	0.0944	0.0651	9.9
IHT	-0.8187	0.3257	0.3047	0.3204	0.0116	0.0058	11
KPA	-0.3389	1.0924**	0.5699**	1.0652**	0.2616	0.3804	12.7
WXH	-0.224	0.8494**	0.659**	0.873**	0.243	0.1975	13
HOT	1.0756	1.1366**	0.6359*	1.0789**	0.1145	4.8958	13.2
ENN	0.1543	0.6646**	0.7642**	0.8973**	0.2198	0.4107	13.6
HT	-0.0303	1.2461**	0.5941**	1.4259**	0.4078	0.3261	14.3
HST	-0.4784	1.4679**	0.8555**	1.7061**	0.5114	6.6048	14.4
LHO	-0.0177	1.5417**	0.9587**	1.6175**	0.4687	1.0113	15.1
HPT	0.136	0.8263**	0.3305*	0.7667**	0.2942	2.1648	17.8
SPPR	-0.8712	1.0921**	0.5099*	0.939**	0.2	0.048	18.5
FCH	-1.233	2.146**	0.8637**	2.1882**	0.5304	0.8101	18.8
RHP	4.2903	-1.2219	-0.662	2.4126	0.1455	1.9826	0.6
RLJ	0.5311	1.0387**	1.0517	0.2155	0.6056	2.0142	2
INN	0.1577	0.6893	1.7435	0.3254	0.3298	0.3509	2.2
CLDT	-0.4382	0.7923	0.7507	-0.1185	0.2384	0.1998	3.1
CHSP	-0.5731	1.028**	0.4159	-0.1792	0.4281	0.5233	3.3
PEB	-0.4124	0.9737**	0.2749	-0.403	0.3662	1.0016	3.4
DRH	-0.3401	1.7949**	0.9798*	0.6658	0.6334	1.2912	8
SOHO	0.3228	1.2261**	-0.5116	2.9377**	0.2479	0.0405	8.4
SHO	-0.3829	1.7544**	1.1029**	1.7703**	0.5104	0.8437	12.8
BEE	0.2446	1.9737**	2.196**	1.0735	0.4413	0.9128	8.9
AHT	0.2998	2.1147**	0.4621	0.4579	0.3977	0.5604	9.8

Abbreviations: REIT: Real Estate Investment Trust; SMB: Small Minus Big; HML: High Minus Low.
Note: *p<0.05; **p<0.01.

3. Assign each $\vec{\beta}$ to the closest $\mu_j^{(t)}$, compute the K categories as follows:

$$S_j^{(t)} = \left\{ \vec{\beta}^i : \left\| \vec{\beta}^i - \mu_j^{(t)} \right\|^2 \le \left\| \vec{\beta}^i - \mu_l^{(t)} \right\|^2, \forall l, 1 \le l \le K \right\}$$

4. Calculate the $\mu_j^{(t+1)}$ as follows:

$$\mu_j^{(t+1)} = \frac{1}{\left| S_j^{(t)} \right|} \sum_{\vec{\beta}^i \in S_j^{(t)}} \vec{\beta}^i$$

where $\left| S_j^{(t)} \right|$ is the number of $\vec{\beta}^i$s in category j.

5. Stop if $\mu_j^{(t+1)}$ are all the same as $\mu_j^{(t)}$. Otherwise, go to step 2.

In practice, we initialized $\mu_j^{(1)}$ with K randomly selected $\vec{\beta}$s. After we clustered the $\vec{\beta}$s of hotel REITs into Kcategories, we then analyzed the $\vec{\beta}$ s in each category and examined the impact of the three factors on each category of hotel REITs.

Table 1 below comprises the regression results of individual REIT excess return on the three factors. The table also shows: the ticker symbols for the hotel REITs; the regression parameters of the intercept; the excess market return over the risk-free rate, SMB and HML, respectively; corresponding regression coefficient; the mean market capitalization of each REIT and the number of years on the market.

The t-test was used to check whether the $\vec{\beta}$s were significantly different from zero. The significant $\vec{\beta}$s are marked with * (significance level of 0.05) or ** (significance level of 0.01) in Table 1. The R-squared values for the REITs ranged from 0.0116 to 0.6334. The hotel REIT DRH achieved the highest regression coefficient, while IHT achieved the lowest regression coefficient. The mean regression coefficient for all the hotel REITs was approximately 0.294.

In step two, the K-mean was used to cluster the REITs. Each REIT was represented as a vector of regression coefficients of the three factors. REITs whose coefficients were insignificant were removed from further analysis since they were not correlated to the three factors. Thus, eleven REITs, whose length of time in the market ranged from .6 years to 3.5 years were removed from further analysis. After removing the 11 REITs, a K-mean algorithm was used to cluster the remaining twenty two REITs into four clusters, based on the correlation between the coefficients of the three factors.

The first cluster contained REITs whose returns were correlated with all three factors. The mean regression coefficient for the hotel REITs in this cluster was 0.31 while the mean years on the market for those hotel REITs was 13.56 years, which is much longer than the years on the market for the hotel REITs in other clusters. The mean market capitalization for the hotel REITs in this cluster was $1.26 bn. The second and third clusters contained REITs whose returns were correlated with two of the three factors, Km-Rf and SMB. These findings suggest that REITs in this cluster were likely to be exposed to the "size risk," to which small companies tend to be sensitive [21]. The returns of the hotel REITs in cluster three were correlated with Km-Rf and HML. Like the companies with high book-to-market ratios, these REITs were more likely to be exposed to a higher value risk. The mean regression coefficients for cluster 2 and 3 were 0.42 and 0.32, respectively. The mean years on the market were 8.3 years for cluster 2 and 9.1 years for cluster 3. The mean market capitalization was $1.17 bn for Cluster 2 and $300 M for Cluster 3. Overall, Clusters 2 and 3 contained the relatively younger REITs with lower market capitalization than Cluster 1. Cluster 4 contained the REITs whose returns were not significantly correlated with any of the three factors. The mean regression coefficient for Cluster 4 was only 0.10. REITs in this cluster had the fewest number of years on the market (7.95 years) and smallest market capitalization of approximately $5.6 M.

CONCLUSION

Findings suggest that hotel REITs that are significantly correlated with all three factors of the Fama-French three factor model had the greatest number of years on the market and highest mean market capitalization. Conversely, those that were not significantly correlated with any of the three factors had shorter time frames in the market and had the lowest mean market capitalization. On average, the three factors explained approximately 30 percent of the variance of the returns for the hotel REITs. Most hotel REITs that existed on the market for more than four years were statistically significantly correlated with two or three factors. Findings also indicated that the higher the market capitalization of REITs, the more risk exposure they faced in the market. Finally, results suggest that the longer hotel REITs existed in the marketplace, the greater their exposure to risk. This could explain the trend of hotel REITs to change their ownership structure and or convert their business format, to minimize risk exposure.

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