The evidence of beta anomaly in European REITs

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This paper finds empirical evidence of the beta anomaly in the European REIT market in the period 2012 – 2021. The alpha of a low minus high beta strategy is positive and statistically significant which can interpret that the low beta REITs have a higher risk-adjusted return than high beta REITs. To examine the explanation behind the beta anomaly, the controlling variables which may cause the beta anomaly including the lottery-like stock return factor, the skewness factor, and the institutional ownership factor are added into the Fama-French 3-factor model. For the result, only the institutional ownership factor which refers to the leverage constraint hypothesis shows a significant relation with REIT returns. To examine that the beta anomaly is a demonstration of the leverage constraint hypothesis, the result of pooled OLS regression shows a significant relationship between REIT betas and institutional ownership.

Field of Study:	Finance	Student's Signature .....
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Introduction

The beta anomaly refers to the tendency of high beta stocks to underperform low beta stocks. This anomaly challenges the efficacy of the Capital Asset Pricing Model (CAPM) (Sharpe, 1964; Lintner, 1965; Mossin, 1966) which states that higher risk is technically compensated with a higher expected return.

The primary empirical evidence of the beta anomaly can be referred to Black, Jensen, and Scholes (1972), who observe that the relation between beta and an average return on an investment asset was flatter than the CAPM predicts. More recently, Blitz and van Vliet (2007) provide empirical evidence that a low beta equity portfolio earns a positive alpha relative to a high beta equity portfolio after controlling for size and book to market factors. According to the leverage constraint hypothesis, Frazzini and Pedersen (2014) find empirical evidence that low beta equities provide positive alpha relative to high beta equities in 20 international equity markets including the European region.

Many studies observe the evidence of the beta anomaly in the equity markets, however, there have been few papers that observe whether the REIT market has the evidence of the beta anomaly according to the hybrid characteristic of bonds and equities. In the pre-1990 period,

investors mainly considered them as the passive income instrument (Ling and Ryngaert, 1997) according to their predictable and stable income characteristics. However, after the Tax Reform Act of 1986 and 1993 in the US, REITs experienced structural changes (Glascock, Lu and So, 2000). REITs are more actively managed as the REITs could take responsibility for the management process internally and the interest of management and shareholder has a greater alignment (Chan, Erickson, and Wang, 2003). This circumstance changed the perception of investors in REIT characteristics as REITs are got under increasing pressure to pursue growth and the valuation is more difficult to evaluate. Additionally, there are papers observe the correlation between REIT returns and Stock returns e.g., Glascock, Lu and So (2000) who find empirical evidence that REITs are cointegrated with the stock market after the 1990s. Consequently, the integration of REITs with the stock market provides a good condition to observe whether the REIT market has evidence of the beta anomaly.

In this paper, I find empirical evidence of the beta anomaly in the European REIT market between February 2012 and November 2021. The results of analyses suggest that the beta anomaly is a demonstration

of the leverage constraint hypothesis as institutional ownership shows a significant relationship with REIT betas.

Literature review

The literature review has two main sections. Section 1 reviews the empirical evidence of the beta anomaly in Equity markets and the explanations behind the beta anomaly. Section 2 introduces Real Estate Literature including the development of the REIT market and asset prices of REITs.

1. Empirical evidence of the beta anomaly in Equity markets

The assumption of an efficient market in the Capital Asset Pricing Model (CAPM) (Sharpe, 1964; Lintner, 1965; Mossin, 1966) states that the investors need to invest in stocks with higher risk to compensate for higher return, on the other hands, the stocks with higher beta always provide a higher return than low beta stocks. However, there is empirical evidence in the stock markets that challenges the efficient market theory of CAPM. This phenomenon is currently acknowledged as the beta anomaly.

Black, Jensen, and Scholes (1972) is the primary paper that finds the empirical evidence of the beta anomaly in the period 1926 – 1966 and

the empirical evidence that the security market line is flatter than the CAPM. Later, there are several papers observed the beta anomaly. Fama and French (1992) show that beta can't use as a measurement to predict stock return. Blitz and van Vliet (2007) show that high volatile stocks provide lower risk-adjusted return than low volatile stocks after size, value, and momentum effects are controlled. Baker, Bradley, and Wurgler (2011) sort equity based on ordering beta into quintiles and find empirical evidence that low volatility stocks provide abnormal return relative to high volatility stocks. According to the leverage constraint hypothesis, Frazzini and Pedersen (2014) show empirical evidence of the beta anomaly in 20 international equity markets including the European region.

Whilst the presence of the beta anomaly in the equity market is unquestionable, the explanations behind the beta anomaly in equity markets fall into two different views which are the preference for lottery-like stock and the leverage constraint hypothesis. The discussion below provides empirical evidence on how the beta anomaly occurs.

1.1 The preference for lottery-like stock

The efficient market hypothesis suggests that investors are risk aversion. They have the objective to maximize the expected return from

investment. However, Kahneman and Tversky [1979] prove that investors are also loss-aversion. For example, a comparison of the gambling game as detailed below,

1. The gamble game with a 50% chance to win $110 and a 50% chance to lose $100

2. The gamble game with a 0.12% chance to win $5000 and 99.82% to lose $1.

Although the expected payoff of both games is $5. Most people prefer to play the gamble in the second choice. This phenomenon can explain through the positive skewness definition as people prefer to receive a large positive payoff although the possibility of losing the principle is very high.

In term of equity markets, Kumar (2009) shows empirical evidence that lottery-like stocks have the characteristic of low price, high volatility, and high positive skewness. Mitton and Vorkink (2007) mention that buying stocks that have the characteristics of high volatility and low-priced is similar to buying a lottery ticket. Additionally, Bali et al. (2011) state that lottery investors prefer stocks that price dramatically rises in the short term and expect the momentum will continue. However, excessive

demand for lottery-like stock overcharges the stock price and their beta and consequently decreases the future return.

1.2 The Leverage constraint hypothesis

The leverage constraints hypothesis (Black, Jensen, and Scholes, 1972) argues that investors with borrowing and leveraging restrictions have no choice other than investing in stocks with high beta to increase the level of risk premium. This hypothesis is used to explain the evidence of a flatter efficient frontier.

According to benchmarking, fund managers with an active management policy need to outperform the benchmark to both achieve the obligation and increase their incentive. To beat the benchmark, managers need to increase the weight of investment assets tilt toward high beta stocks, leading to higher demand. Consequently, the excess demand of high beta stocks overcharges the stock price and sequentially provides a lower return in the next period relative to low beta stocks (Blitz, Frankenstein, and Van Vliet, 2014).

2. Real Estate Literature

2.1 The development of the REIT market

To provide the opportunity for individuals to invest in real estate assets and provide the benefit to investors in the same way as investing in investment trusts (Chan, Erickson, and Wang, 2003), in 1960, US Congress established the Real Estate Investment Trust Act which state that REITs are excluded from the federal tax if comply with the Internal Revenue Code including (1) must be established as a corporation, trust, or an association taxable as a corporation (2) The minimum of gross real estate-related income is 75% (3) The minimum of gross real estate assets is 75% (4) the minimum of taxable income must be distributed 90%. In the pre-1990 period, many REITs were finite-horizon and obligated to liquidate at some due date. They were categorized as passive vehicles (Ross and Klein, 1994) which provided stable and predictable income with less potential growth.

However, the REIT market experienced a dramatic structural change according to the Tax Reform Act of 1986. This act permitted REITs to provide management and leasing service internally instead of hiring an external advisor. Consequently, the interest of management and shareholder has a greater alignment which dominates REIT to be

categorized as “management play” instead of a “passive vehicle” (Chan, Erickson, and Wang, 2003). Consequently, the Post-1990 REITs are got under increasing pressure to pursue growth and the valuation is more difficult to evaluate.

Moreover, the restriction according to the 5/50 rule which states that the REITs can’t be both directly and indirectly owned over 50% by a maximum of five individuals was canceled in the 1993 Revenue Reconciliation Act. This act encourages the flow of funds into the market as institutional investors especially pension funds have been allowed to invest in REITs (Cakici, Erol, and Tirtiroglu, 2014).

In term of the European REIT regime, there is no internal market for REITs. Each country needs to establish its own fund structures and its own legislation. Basically, all of them applied investment structures based on US models. The Netherlands is the first country in Europe to establish a REIT regime in 1969 followed by France in 2003 and both UK and Germany in 2007. In 2021, 15 countries in Europe establish the form of a transparent collective scheme for REITs according to EPRA Global REIT Survey.

2.2 Asset prices of REITs

As the main objective of this paper is to examine the beta anomaly in the REIT market, the asset prices of REITs are remarkable to study. This section firstly observes the integration of REITs with stock market and stock returns and then reviews the asset prices of REITs.

According to the evolution of REITs in the 1990s, REITs are got under increasing pressure to pursue growth to meet the expectation by the shareholder in the same way as equities. Consequently, there are papers observe the correlation between REIT returns and equity returns. Glascock, Lu and So (2000) examine the cointegration of REIT returns and stock returns with autoregressive models. The result shows that REITs are cointegrated with the stock market after the 1990s. Furthermore, Clayton and MacKinnon (2003) examine the REIT performance using the multi-factor model of large cap stock, small cap stock, bond, and real estate factors and bring to the conclusion that REITs behaved like small-cap stocks in the post 1990s according to a significant relationship between REIT returns and small cap stock returns.

To examine the asset prices between REIT returns and stock market factors, Peterson and Hsieh (1997) examine the REIT performance using the five-factor model of Fama and French (1993). The

evidence shows that the risk premiums of REITs are statistically significant related to three stock market factors including market risk factor (MRP), size factor (SMB), and book-to-market factor (HML) from 1976 to 1992.

In summary, there is empirical evidence that REIT returns have a significant relationship with stock returns, and the evidence that REITs integrate with the stock market provides a good condition to observe whether the REIT market has the evidence of the beta anomaly.

To achieve the objective of the research, this paper applies explanations behind the beta anomaly in the equity markets including the Preference for lottery-like stock and the Leverage constraint Hypothesis which introduce in literature review section 1 to examine whether the European REIT market has evidence of the beta anomaly following the assumptions below,

Research Question: Does beta anomaly exist in the European REIT market?

Research Objective: To examine the characteristic factors that dominate the beta anomaly in the European REIT market.

Contribution

The motivation of this paper is to examine whether European REIT market has evidence of the beta anomaly which doesn't have any paper observing the beta anomaly before. This paper contributes two new findings to the literature in the area of the asset prices of REITs.

First, this study finds empirical evidence of the beta anomaly in the European market between 2012 and 2021. The result shows the tendency of high beta REITs underperforming low beta REITs.

Secondly, this paper finds a significant relationship between REIT betas and institutional ownership in the European REIT market. This can interpret that the leverage constraint hypothesis is the explanation behind the beta anomaly according to benchmarking which clarifies that the institutional investors need to tilt the portfolios toward high beta assets to acquire a higher expected return.

Hypothesis Development

Hypothesis 1: **European REIT market has evidence of the beta anomaly.**

The first hypothesis is to examine the beta anomaly. The beta anomaly is estimated from the abnormal return (alpha) on a long/short investment strategy by taking a long position on 25% of the lowest beta REITs and short 25% of the highest beta REITs. I can conclude that REITs have evidence of the beta anomaly if the coefficients of alpha are far away from 0 and statistically significant positive.

Hypothesis 2: **The beta anomaly in the European REIT market can be explained by the specific characteristic factors**

To examine the explanation behind the beta anomaly, I add the controlling factors based on hypotheses 2A to 2C into the Fama-French 3-factor model. Theoretically, hypotheses 2A and 2B refer to the evidence of Preference for lottery-like stock, and hypothesis 2C refers to the leverage constraint hypothesis. For the result, I expect to see the coefficient of controlling variables in long/short portfolio is statistically different from 0 leading to the conclusion of which factor can explain the beta anomaly in European REITs.

Hypothesis 2A: **The demand for the lottery-like stock is the cause of the beta anomaly**

As discussed by Bali et al. (2011), lottery investors prefer stocks that price dramatically rises in the short term and expect the momentum will continue. However, excessive demand for lottery-like stocks overcharges the stock price and the beta and consequently decreases the future return.

According to Bali et al. (2011), MAX is the representative of the demand for lottery-like stock which is calculated by averaging the five highest daily returns.

Hypothesis 2B: **The preference of REIT which has the characteristic of high positive skewness is the cause of the beta anomaly**

According to empirical evidence from Kumar (2009), the lottery-type stock has the characteristics of high positive skewness. Lambert and Hubner (2014) stated that decreasing the skewness of the portfolio would increase the expected return of the portfolio.

To examine whether the preference of REIT which has the characteristic of high positive skewness is the explanation behind the beta anomaly, I proxy the given skewness value based on the daily returns in the previous 12 months

Hypothesis 2C: **The change in the institutional ownership is the cause of the beta anomaly**

According to the benchmarking, the fund managers need to outperform the benchmark for higher compensation Therefore, managers increase exposure of the high beta assets, and consequently, dominate the high beta assets to be overpriced (Blitz, Falkenstein, and Van Vliet, 2014).

To examine the possibility that a change in the institutional ownership is the explanation behind the beta anomaly, I proxy the change in the institutional ownership by calculating the deviation between institutional ownership in the given month (month t) and the previous month (month t-1).

DATA

I mainly collected data of European REITs via the Bloomberg database. The database provides the data of REITs including total return index, daily price, market capitalization, monthly institution ownership, etc. The observation period is from February 2012 to November 2021.

To estimate a REIT beta in the given month, I collect the daily return data from the previous 12 months to estimate the beta coefficient by regressing the excess REIT returns on excess market returns. Each regression requires a minimum of 200 daily observations.

To estimate three independent variables for the Fama-French 3-factor model include MRP (market risk factor), SMB (size factor), and HML (book to market factor), they were collected from Kenneth French's database in the category of Developed European market.

In term of three controlling variables for hypothesis 2 including the lottery-like stock factor and the institutional ownership factor (INST), I apply the forming technical pioneered by Fama and French. Technically, all REITs are monthly sorted on controlling variable value and group the top 30% REITs as the high value and the bottom 30% REITs as the low value. Independently, I sort REITS on market capitalization into two groups. Then I intersect the capitalization-based groups and the

controlling value-based group. Summarily, the equations are shown below,

1. The lottery-like stock return (MAX) factor

$$MAX = \frac{1}{2}(small\ low\ avg\ \ return + big\ low\ avg\ \ return) -$$

$$\frac{1}{2}(small\ high\ avg\ return + big\ high\ avg\ return)$$

2. Skewness (SKEW) factor

$$SKEW = \frac{1}{2}(small\ \ normal\ skewness + big\ normal\ \ skewness) -$$

$$\frac{1}{2}(small\ \ high\ postive\ skewness + big\ high\ \ positve\ skewness)$$

3. The change in institutional ownership (INST) factor

$$INST = \frac{1}{2}(small\ \ low\ change\ in\ institutional\ ownership +$$

$$big\ low\ change\ in\ institutional\ ownership) -$$

$$\frac{1}{2}(small\ \ high\ change\ in\ institutional\ ownership +$$

$$big\ high\ \ change\ in\ institutional\ ownership)$$

, where institutional ownership equals to total shares outstanding of institutional investor divided by total float share outstanding

METHODOLOGY

Hypothesis 1: European REIT market has evidence of the beta anomaly

To examine the beta anomaly, technically, I rank REITs data based on an ordering of beta and then group REITs into 4 quintiles portfolios. Then I create long/short portfolio by taking long position on 25% of the lowest beta REITs and short 25% of the highest beta REITs. Each portfolio is monthly rebalanced to compute monthly return on the value-weighted return basis. The alpha of the long/short portfolio is estimated from the Fama-French 3-factor model as stated below,

$$R_{i,t} = \alpha_{i,t} + \beta_1 MRP_{i,t} + \beta_2 SMB_{i,t} + \beta_3 HML_{i,t}$$

, where $R_{i,t}$ is the return of portfolio in month t, $MRP_{i,t}$ is the market risk factor in month t, $SMB_{i,t}$ is the size factor in month t, $HML_{i,t}$ is the book to market factor in month t.

For the result, I would like to see that the coefficient of alpha is positive and statistically different from 0.

Hypothesis 2: Beta anomaly in European REIT market can be explained by the specific characteristic factors

To examine the explanations behind the beta anomaly, technically, I rank REITs based on an ordering of beta from the lowest beta REITs to the highest beta REITs and then group all REITs into 4 quintiles portfolio as the same method in hypothesis 1. Then I create long/short portfolio by taking long position on REITs with 25% of the lowest betas and short

position on REIT with 25% of the highest betas. Then I created three mimicking portfolios augmented with MAX, SKEW and INST factors. Each portfolio is monthly rebalanced to compute monthly return on the value-weighted return basis. The equation to examine the cause of the beta anomaly is shown as below equation,

$$R_{i,t} = \alpha_{i,t} + \beta_1 MRP_{i,t} + \beta_2 SMB_{i,t} + \beta_3 HML_{i,t} + \beta_4 MAX_{i,t} + \beta_5 SKEW_{i,t} + \beta_6 \mathrm{INST}_{i,t}$$

, where $R_{i,t}$ is the return of portfolio in month t, $MRP_{i,t}$ is the market risk factor in month t, $SMB_{i,t}$ is the size factor in month t, $HML_{i,t}$ is the book to market factor in month t, $MAX_{i,t}$ is the lottery like stock return factor in month t, $SKEW_{i,t}$ is the skewness factor in month t, and $INST_{i,t}$ is the institutional ownership factor in month t

For the result, I would like to see the coefficients of MAX, SKEW and INST factors in long/short portfolio are negative and statistically different from 0.

DESCRIPTIVE STATISTIC

I collected lists of European REITs from the Bloomberg Terminal. The total number of REITs is 118 REITs. The observation period is from February 2012 to November 2021. The number of REITs in each year is shown in Table 1 below. The average number of REITs is 93.

Table 1 Total Number of REITs between 2012 and 2021

Year	Number of REITs	Year	Number of REITs
2012	74	2017	95
2013	73	2018	104
2014	81	2019	105
2015	89	2020	107
2016	94	2021	108
		Average	93
		Total	118

To demonstrate the clause of the beta anomaly, European REITs are grouped into 4 quintiles portfolio based on an ordering of beta (Bali et al., 2017) and monthly rebalance each portfolio to compute monthly return on the value weighted return basis. Table 2 presents statistic data of sorted Beta portfolio. The results show that the average beta is 0.414 for the lowest beta portfolio and increases to 0.919 for the highest beta portfolio. In terms of mean return, the result shows that mean return increases from 0.929% for the lowest beta portfolio to 1.475% for the middle to high beta portfolio (portfolio 3) and the highest beta portfolio has the lowest mean return of 0.858%. Conversely, an average market

capitalization increases from €13,718.12 million for the lowest beta portfolio to €99,688.3 million for the highest beta portfolio respectively. The characteristic of REIT market capitalization is consistent with the evidence in Equity market by Novy-Marx (2016) which find that the high beta stocks have larger market capitalization than low beta stocks. In term of skewness, the data indicates that the highest beta portfolio (0.034) has lower positive skewness than the lowest beta portfolio (0.235), which is inconsistent with the evidence in the equity market that skewness is negatively with the mean return (Kumar, 2009). Based on the leverage constraint hypothesis, the institutional ownership aligns with the definition of hypothesis that active fund managers have incentive to buy high beta assets to increase the level of risk premium (Black, 1972). The average institutional ownership increases respectively from 51.4% for the lowest beta portfolio to 75.4% for the highest beta portfolio. Finally, the lottery-like return in the lowest beta portfolio is lower than the highest beta portfolio, the data is consistent with the empirical evidence in the equity market that beta has positive correlation with lottery-like return (Bali et al., 2017).

Table 2 Summary Statistic data of sorted Beta portfolio

	Low beta	2	3	High beta	Low - High
Beta	0.414	0.442	0.675	0.919	-0.505
Mean Return	0.929	1.277	1.475	0.858	0.071
S.D.	3.116	3.402	4.407	5.812	4.158
Market Cap.	13,718.12	23,871.21	37,573.30	99,688.30	-85,970.18
SKEW	0.235	0.159	0.036	0.034	0.201
Inst. Ownership	51.385	51.661	74.571	75.443	-24.058
Lottery-like return	1.540	1.593	1.839	2.456	-0.916

Noted: The table shows the mean of variables ordering from the lowest beta portfolio to the highest beta portfolio. Beta is the beta coefficient. Mean Return is the median of monthly portfolio return. S.D. is the standard deviation. Market Cap is the market capitalization. SKEW is the skewness. Lottery—like return is the mean of the five highest daily return. Inst. Ownership is the value weighted portfolio institutional ownership.

EMPERICAL RESULT

This section demonstrates empirical results corresponding to the questions and hypotheses. The regression result of the beta-sorted portfolios from Fama-French 3-factor model is used to find the evidence of the beta anomaly in hypothesis 1. To demonstrate hypothesis 2, the controlling variables are added into Fama-French 3-factor model to find the cause of the beta anomaly. GRS test is used to clarify whether the additional factors add value to the model. To further examine cause of the beta anomaly according to the leverage constraint hypothesis, the panel data of pooled OLS regression is used to test the relation between institutional ownership and average REIT betas.

1. European REIT market has the evidence of the beta anomaly. – There is the empirical evidence of the beta anomaly

The results of the portfolios sorting by beta from Fama-French 3-factor model show that MRP (market risk premium) respectively increases from 0.421 in low-beta portfolio to 0.888 in high-beta portfolio. Their coefficients are statistically significant at 1% implying that REITs return can be explained by return of equity market. In term of alpha of beta-sorted portfolio, the alpha for the lowest beta portfolio is 0.819% and statistically significant at 1%. Although the highest beta portfolio

provides positive alpha of 0.25% but the coefficient isn't statistically significant. Finally, the alpha of long/short portfolio is 1.032% and statistically significant at 1% which demonstrates that European REIT market has the empirical evidence of the beta anomaly.

Table 3A Regression result of the Quartile portfolio sort on beta from Fama-French 3- factor model

	Fama French 3 Factors				
Independent Variables	Low beta	2	3	High beta	Low - High
MRP	0.421***	0.501***	0.704***	0.888***	-0.463***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
SMB	0.100	-0.021	0.021	-0.399*	0.502***
	(0.468)	(0.888)	(0.908)	(0.078)	(0.008)
HML	-0.054	-0.219**	-0.123	0.138	-0.197
	(0.575)	(0.039)	(0.322)	(0.379)	(0.128)
Alpha	0.819***	1.007***	0.957***	0.250	1.032***
	(0.001)	(0.000)	(0.004)	(0.541)	(0.003)
Observations	118	118	118	118	118
Adjusted R-squared	0.336	0.343	0.453	0.497	0.333

Noted: The table shows the OLS regression results on the beta sorted portfolio from Fama French 3 Factor model. The dependent variable is monthly total portfolio return between 2012 – 2021. Independent variables include market risk factor (MRP), size factor (SMB), book to market factor (HML). The p-values present in parentheses. *, **, and *** indicate $p<0.1$, $p<0.05$, and $p<0.01$ respectively.

2. The beta Anomaly in European REIT market can be explained by the REITs specific characteristic – Only INST factor is the explanation behind the beta anomaly.

To find the clause of the beta anomaly, controlling variables including MAX, SKEW, and INST factors are included into Fama-French 3-factor model.

In Table 3B, the coefficient of MAX decreases from -0.014 for the lowest beta portfolio to -0.213 for the highest beta portfolio but isn't statistically significant in any portfolio. The coefficient of MAX in the long-short portfolio also isn't statistically significant which is inconsistent with the assumption of hypothesis 2A. In the same way of regression results in Table 3C, the coefficients of SKEW aren't statistically significant in both long-only portfolios and long-short portfolio which is inconsistent with the assumption of hypothesis 2B. This can interpret that there is no significant relationship between preference for lottery-like stock factors and REIT returns in European REIT market.

On the other hand, the regression results in Table 3D show that the coefficient of INST factor for the lowest beta portfolio and high-beta portfolio is 0.03 and -0.112 respectively. In term of the long/short portfolio, the coefficient of INST is negative of 0.687 and statistically

significant at 1% which is consistent with the assumption of hypothesis 2C. Moreover, Adjusted R-Squared of the Fama-French 3-factor model adding INST factor is higher than Fama-French 3-factor models.

To test the explainable of the new model, the GRS test on average shown in Figure 3 finds that t-stat of the model adding INST factor is lower to 43.606 from 44.113 in Fama-French 3-factor model. Therefore, this can imply that Fama-French 3-factor model adding INST factor adds value according to higher adjusted R-squared and lower t-stat value illustrated in GRS test.

To further examine explanation behind the beta anomaly from the leverage constraint hypothesis, the panel data of pooled OLS regression is formed to examine the relationship between REIT beta and institutional ownership. The control variables which could examine the clause of the beta anomaly are included. The regression equation which is formed by Gompers and Metrick (2001) and Jianfu, Eddie and Kwokyuen (2021) is given as below,

$$IH_{i,t} = \alpha_{i,t} + \beta_1 Beta_{i,t} + \beta_2 LN(ME)_{i,t} + \beta_3 BM_{i,t} + \beta_4 MOM_{i,t}$$

,where $IH_{i,t}$ is the average institutional ownership in month t, $Beta_{i,t}$ is the beta coefficient in month t ,$LN(ME)_{i,t}$ is the natural logarithm of market capitalization at end of year t-1, $BM_{i,t}$ is the book to market ratio at the end of year t-1, MOM is the cumulative return from previous 12 to previous 2 months in month t.

For the result, the Table 5 shows that the coefficient of beta is 0.098 which is positive and statistically significant at 1%. This can imply that a one-unit increase in beta may cause a 9.8% increase in institutional ownership, holding other factors constant. This result aligns with the assumption of leverage constraint hypothesis that institutional investors have the objective to beat the benchmark and need to tilt the investment toward the high-beta assets. In term of the controlling variables, the coefficient of LN(ME) is positive and statistically significant at 1%. The results can interpret that institutional investors prefer REITs with large market capitalization (Gompers and Metrick, 2001). In term of book to market ratio, the REITs with high book to market ratio are more preferable by institutional investors which is consistent with Gompers and Metrick (2001). Momentum is the only factor that coefficient isn't statistically significant which can interpret that there is no significant relationship between momentum return and Institutional ownership in European REIT market.

Table 3B Regression result of the Quartile portfolio sort on beta from Fama-French 3- factor model adding MAX factor

	Fama French 3 Factors adding MAX Factor				
Independent Variables	Low beta	2	3	High beta	Low - High
MRP	0.422***	0.506***	0.709***	0.899***	-0.473***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
SMB	0.099	-0.030	0.013	-0.417*	0.519***
	(0.476)	(0.844)	(0.941)	(0.066)	(0.006)
HML	-0.058	-0.249**	-0.149	0.075	-0.136
	(0.569)	(0.027)	(0.259)	(0.652)	(0.318)
MAX	-0.014	-0.100	-0.087	-0.213	0.205
	(0.899)	(0.416)	(0.549)	(0.244)	(0.172)
SKEW					
INST					
Alpha	0.825***	1.045***	0.991***	0.332	0.953***
	(0.002)	(0.000)	(0.003)	(0.423)	(0.006)
Observations	118	118	118	118	118
Adjusted R-squared	0.330	0.341	0.449	0.499	0.338

Noted: The table shows the OLS regression results on the beta sorted portfolio from Fama French 3 Factor model adding controlling factor. The dependent variable is monthly total portfolio return between 2012 – 2021. Independent variables include market risk factor (MRP), size factor (SMB), book to market factor (HML), lottery like stock return factor (MAX), skewness factor (SKEW), and institutional ownership factor (INST). The p-values present in parentheses. *, **, and *** indicate $p<0.1$, $p<0.05$, and $p<0.01$ respectively.

Table 3C Regression result of the Quartile portfolio sort on beta from Fama-French 3- factor model adding SKEW factor

	Fama French 3 Factors adding SKEW Factor				
Independent Variables	Low beta	2	3	High beta	Low - High
MRP	0.422***	0.485***	0.683***	0.869***	-0.446***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
SMB	0.099	0.033	0.089	-0.334	0.446**
	(0.493)	(0.831)	(0.628)	(0.155)	(0.022)
HML	-0.055	-0.182*	-0.077	0.182	-0.235*
	(0.582)	(0.095)	(0.55)	(0.263)	(0.081)
MAX					
SKEW	-0.005	0.159	0.200	0.190	-0.163
	(0.967)	(0.198)	(0.169)	(0.301)	(0.281)
INST					
Alpha	0.819***	1.012***	0.964***	0.256	1.027***
	(0.001)	(0.000)	(0.003)	(0.531)	(0.003)
Observations	118	118	118	118	118
Adjusted R-squared	0.330	0.347	0.457	0.498	0.334

Noted: The table shows the OLS regression results on the beta sorted portfolio from Fama French 3 Factor model adding controlling factor. The dependent variable is monthly total portfolio return between 2012 – 2021. Independent variables include market risk factor (MRP), size factor (SMB), book to market factor (HML), lottery like stock return factor (MAX), skewness factor (SKEW), and institutional ownership factor (INST). The p-values present in parentheses. *, **, and *** indicate $p<0.1$, $p<0.05$, and $p<0.01$ respectively.

Table 3D Regression result of the Quartile portfolio sort on beta from Fama-French 3- factor model adding INST factor

	Fama French 3 Factors adding INST Factor				
Independent Variables	Low beta	2	3	High beta	Low - High
MRP	0.317***	0.408***	0.566***	0.615***	-0.29***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
SMB	0.130	0.005	0.060	-0.32*	0.452***
	(0.316)	(0.97)	(0.718)	(0.087)	(0.008)
HML	-0.110	-0.269***	-0.197*	-0.009	-0.104
	(0.23)	(0.009)	(0.095)	(0.948)	(0.377)
MAX					
SKEW					
INST	0.43***	0.384***	0.571***	1.126***	-0.712***
	(0.000)	(0.002)	(0.000)	(0.000)	(0.000)
Alpha	0.694***	0.895***	0.791**	-0.078	1.239***
	(0.004)	(0.001)	(0.011)	(0.818)	(0.000)
Observations	118	118	118	118	118
Adjusted R-squared	0.414	0.392	0.521	0.657	0.456

Noted: The table shows the OLS regression results on the beta sorted portfolio from Fama French 3 Factor model adding controlling factor. The dependent variable is monthly total portfolio return between 2012 – 2021. Independent variables include market risk factor (MRP), size factor (SMB), book to market factor (HML), lottery like stock return factor (MAX), skewness factor (SKEW), and institutional ownership factor (INST). The p-values present in parentheses. *, **, and *** indicate $p<0.1$, $p<0.05$, and $p<0.01$ respectively.

Table 3E Regression result of the Quartile portfolio sort on beta from Fama-French 3- factor model adding 3 controlling variables

	Fama French 3 Factors adding 3 controlling variables				
Independent Variables	Low beta	2	3	High beta	Low - High
MRP	0.319***	0.406***	0.56***	0.621***	-0.296***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
SMB	0.111	0.036	0.099	-0.317	0.44**
	(0.416)	(0.81)	(0.572)	(0.105)	(0.013)
HML	-0.118	-0.261	-0.178	-0.030	-0.082
	(0.238)	(0.021)**	(0.168)	(0.835)	(0.525)
MAX	0.030	-0.072	-0.042	-0.112	0.145
	(0.775)	(0.545)	(0.757)	(0.464)	(0.29)
SKEW	-0.068	0.112	0.126	0.042	-0.075
	(0.53)	(0.352)	(0.364)	(0.787)	(0.589)
INST	0.443***	0.361***	0.549***	1.109***	-0.687***
	(0.000)	(0.004)	(0.000)	(0.000)	(0.000)
Alpha	0.677***	0.933***	0.818***	-0.029	1.174***
	(0.006)	(0.001)	(0.009)	(0.933)	(0.000)
Observations	118	118	118	118	118
Adjusted R-squared	0.406	0.388	0.516	0.653	0.453

Noted: The table shows the OLS regression results on the beta sorted portfolio from Fama French 3 Factor model adding controlling factor. The dependent variable is monthly total portfolio return between 2012 – 2021. Independent variables include market risk factor (MRP), size factor (SMB), book to market factor (HML), lottery like stock return factor (MAX), skewness factor (SKEW), and institutional ownership factor (INST). The p-values present in parentheses. *, **, and *** indicate $p<0.1$, $p<0.05$, and $p<0.01$ respectively.

Table 4 GRS tests

Asset Pricing Model	Model Equation	GRS Test Statistic
Fama French 3-factor	$R_{i,t} = \alpha_{i,t} + \beta_1 MRP_{i,t} + \beta_2 SMB_{i,t} + \beta_3 HML_{i,t}$	44.113
Fama-French 3-Factor Including		
- INST	$R_{i,t} = \alpha_{i,t} + \beta_1 MRP_{i,t} + \beta_2 SMB_{i,t} + \beta_3 HML_{i,t} + \beta_6 INST_{i,t}$	43.606
- INST SKEW MAX	$R_{i,t} = \alpha_{i,t} + \beta_1 MRP_{i,t} + \beta_2 SMB_{i,t} + \beta_3 HML_{i,t} + \beta_4 MAX_{i,t} + \beta_5 SKEW_{i,t} + \beta_6 INST_{i,t}$	43.523

Noted: The table shows the results of the GRS Test. The dependent variable is monthly total portfolio return between 2012 – 2021. Independent variables include market risk factor (MRP), size factor (SMB), book to market factor (HML), lottery like stock return factor (MAX), skewness factor (SKEW), and institutional ownership factor (INST).

Table 5 Pooled OLS regression of institutional ownership on beta

Independent Variables	Average Coefficient	Average SE	Test-Statistic	Statistically significant result
Intercept	0.302	0.036	8.46	Significant ***
Beta	0.098	0.022	4.53	Significant ***
BM	0.019	0.007	2.72	Significant ***
Ln(ME)	0.044	0.005	8.05	Significant ***
MOM	-0.026	0.032	-0.82	Insignificant
Observation	9,998			

Noted: The table shows the pooled OLS regression of institutional ownership on beta. The dependent variable is monthly institutional ownership between 2012 – 2021. Independent variables include the beta coefficient (Beta), the natural logarithm of market capitalization (Ln(ME)), Book to Market (BM),and cumulative return from prior 12 to prior 2 months (MOM). *, **, and *** indicate significance at 10% ,5%, and 1% respectively.

Conclusion

Capital Asset Pricing Model hypothesis (CAPM) (Sharpe, 1964; Lintner, 1965; Mossin, 1966) indicates that the stocks with higher beta always have a higher return than lower beta stocks. However, many empirical results show that low beta stocks outperform high beta stocks.

In this study, the result shows that European REIT market has the empirical evidence of the beta anomaly in the period 2012 – 2021. The alpha of a low minus high beta portfolio is positive and statistically significant and aligns with the empirical evidence in equity market. Secondly, to examine the clause of the beta anomaly, the controlling factors including SKEW, MAX and INST factors are added into the Fama-French 3-factor model. For the results, the coefficients of SKEW and MAX factors aren't statistically significant in the long/short portfolio, this can interpret that there is no significant relationship between Preference for lottery-like stock factors and REIT returns in European REIT market. However, the coefficient of INST factor in the long/short portfolio is statistically significant and the Fama-French 3-Factor model adding INST factor has higher adjusted R-squared than Fama-French 3-factor model. Therefore, to examine that the leverage constraint hypothesis causes the beta anomaly, the panel data of pooled OLS

regression is constructed to examine the relationship between REIT betas and institutional ownership and the result summarily shows significant relationship between REIT betas and institutional ownership. This empirical evidence clearly supports that the leverage constraints hypothesis is the explanations behind the beta anomaly. The rationale behind the hypothesis can explain through the obligation of fund managers to beat the benchmark. They need to invest in REITs with higher beta. This event leads to the higher demand of high beta REITs. Consequently, the over demand of high beta REITs overcharges the price of high beta REITs which bring to the empirical evidence in this paper that the alpha of a long/short portfolio is positive and statistically significant.

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