A TEST OF MULTI-INDEX ASSET PRICING MODELS:
THE US REIT MARKET

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ABSTRACT

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This study examines the relationship between the performances of US equity REITs and the market risk premium, SMB, HML, MOM as well as an industry index and a real estate index. The statistical significance of the abnormal returns and the beta coefficients of independent variables are examined. The REITs are categorized in seven groups according to their investment areas and the analysis results are compared. Daily return indexes of US equity REITs are collected for the period between 2005 and 2011. These data are then used to estimate the Capital Asset Pricing Model (CAPM) of Sharpe (1964) and Lintner (1965), the Fama and French's 3-Factor Model (1993) and Carhart's 4-Factor Model (1995). These models are re-estimated by adding an industry and a real estate index. The empirical results show that these added independent variables improve the available models. Additionally, no abnormal return is detected for REITs and their returns have a positive correlation with the SMB and HML factors and a negative correlation with the MOM factor. Therefore,, the REITs are relatively small and have high book-to-market ratios. The negative MOM coefficients indicate that the losers will win and the winners will lose.

Keywords: REITs, CAPM, Fama and French's 3-Factor Model, Carhart's 4-Factor Model, abnormal return.

ÖZ

ÇOKLU-ENDEKS VARLIK FİYATLANDIRMA MODELİ TESTİ:
AMERİKAN GYO PİYASASI

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Bu çalışmada Amerikan özkaynak GYO'larının performansı ile piyasa risk primi, SMB, HML, MOM faktörleri, endüstri endeksi ve gayrimenkul endeksi arasındaki ilişki araştırılmaktadır. Olağandışı getiri ve bağımsız değişkenlerin beta katsayılarının istatiksel anlamlılığı incelenmiştir. GYO'lar yatırım alanlarına bağlı olarak yedi kategoriye ayrılmış ve analiz sonuçları karşılaştırmalı olarak değerlendirilmiştir. Amerikan özkaynak GYO'larının günlük getiri verileri 2005-2011 yılları için toplanmıştır. Bu incelemeleri gerçekleştirmek için Sharpe'ın Sermaye Varlıkları Fiyatlandırma Modeli (SVFM) (1965), Fama ve French'in 3 Faktörlü Modeli (1993) ve Carhart'ın 4 Faktörlü Modeli (1995) kullanılmıştır. Bunlara ek olarak, endüstri ve gayrimenkul endeksi eklenmiş modeller oluşturulmuştur. Deneysel sonuçlar yeni eklenmiş bağımsız değişkenlerin mevcut modelleri geliştirdiğini göstermektedir. Aynı zamanda olağandışı getiri tespit edilmemiştir. Amerikan GYO'ları SMB ve HML faktörleriyle pozitif, MOM faktörüyle ise negatif korelasyona sahiptir. Dolayısıyla GYO'lar nispeten küçük firmalardır ve büyük defter/piyasa oranına sahiplerdir. Negatif MOM faktörü ise kazananların kaybedeceğinin, kaybedenlerin ise kazanacağının göstergesidir.

Anahtar Kelimeler: GYO, SVFM, Fama ve French'in 3 Faktörlü Modeli, Carhart'ın 4 Faktörlü Modeli, olağandışı getiri.

To My Mother and Father

and

To My Beloved Sister and Brother

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CHAPTER I

INTRODUCTION

1.1. Motivation of Research

Real Estate Investment Trusts (REITs) are real estate companies and offer common shares to the public on stock exchanges. Around the world, the Real Estate Investment Trusts first became available in the US and Australia and now 40 other markets such as Japan, New Zealand, Canada, Netherlands, Belgium, France, and Germany offer similar securities which trade on their stock exchanges. Furthermore, in Turkey the same situation exists, there are many REITs which are traded on the İstanbul Stock Exchange (ISE). As of January 1, 2011, there were 153 REITs registered with the Securities and Exchange Commission in the United States that trade on one of the major stock exchanges.[1] Since the Real Estate Investment Trusts were first started in the US and the NYSE has the largest portfolio of REITs around the world, sufficient data are available for long periods and they are analyzed in this study. Since investing in REITs provides diversification of the stock portfolio, their popularity among investors increased over time.

[1] National Association of Real Estate Investment Trusts

Like any other stock, REITs represent an equity ownership in a corporation and the owner of a REIT common share has similar rights as the common shareholder of a business.

There are three types of REITs: mortgage REITs, equity REITs and hybrid REITs (a combination of the first two types). The mortgage REITs make loans and use the real estate as collateral for them. The mortgage REITs have no ownership position on the property and do not operate it. In the research the data come from the equity REITs, which are the owner of the properties and sell common shares to the public. Besides being the owner of the real estate, the real estate companies also operate the property. In addition to the operations of mortgage and the equity REITs, the hybrid REITs both transact mortgage loans and are the owner and operator of the real estates. The equity REITs invest in different properties and become the owner of them, additionally many of these equity REIT companies operate the real estate. Therefore,, the equity REITs are categorized in groups according to their investment areas. These are healthcare facilities, hotel-motel, office, residential, retail, industrial, and diversified REITs. Since US REITs have a range of variety, it provides a medium to compare the properties of these REITs category by category.

In the literature, the REITs have been examined according to their return and models such as the Capital Asset Pricing Model (CAPM) of Sharpe (1964) and Lintner (1965), the Fama and French's 3-Factor Model (1993) and Carhart's 4-Factor Model (1995) are used in order to analyze the following variables: the systematic risk (beta), the rate of return, existence of abnormal returns, the hedge effect of REITs in the portfolio, REITs being either defensive or aggressive stocks, diversification benefits, momentum effect, and the statistical significance of these parameters. Additionally, the same methodologies are used for mutual funds.

The statistical significance of abnormal returns of REITs has been examined by K. C. Chan, Patrick H. Hendershott and Anthony B. Sanders, (1990), the similar methodology was applied to the persistence of mutual fund performance by Mark M. Carhart (1997) and a cross-country study to analyze the performance of mutual funds around the world was done by Miguel A. Ferreira, Antonio F. Miguel, Sofia Ramos (2006). A comparison of the common risk factors in the returns on REITs was carried out by James D. Peterson and Cheng-Ho Hsieh, (1997). The dynamics of REIT capital flows and the REIT returns have examined by David Ling and Andy Naranjo (2003). In Kevin C.H. Chiang, Ming-Long Lee and Craig H. Wisen's (2004), the diversification benefit of REITs; in Jeroen Derwall, Joop Huij, Dirk Brounen, and Wessel Marquering, (2009), the relation between the momentum effect and the actively managed REIT portfolios have analyzed. In all of these studies, single factor model (CAPM), three factor models were used. In many of them a momentum factor was added to the three factor model and the four factor model was used. The models were established by Sharpe (1964) and Lintner (1965), Fama and French's (1993), the Carhart (1995) respectively.

The motivation behind the research is the unique characteristics of the REITs. Due to the low correlation with the performance of other asset classes, they provide diversification benefits. When stock market conditions are down, the REITs do better than the other stocks. Hence they balance the return of the portfolio. REITs have relatively high total return. The rental incomes are quite predictable. Therefore, the share prices of REITs are not volatile as much as other stock prices. Since REITs have particular characteristics and benefits for the investors, these are analyzed by certain methods. In addition to the Capital Asset Pricing Model (CAPM) of Sharpe (1964) and Lintner (1965), the Fama and French's 3-Factor Model (1993) and the Carhart's 4-Factor Model (1995); an industry index and a real estate index are added to the models separately and the performance of REITs are examined according to the trading and real estate industry conditions. By adding these factors, two, four and five factor models are established. Different from the available studies in the literature, a new point of view is developed in order to research the performance of REITs.

Furthermore,, for each REIT category, the inflation hedging abilities, diversification benefits, systematic and unsystematic risks, trading and the real estate industry performances, and the relationship of REIT returns with the market conditions are analyzed.

To summarize, the main objectives of the thesis are,

- To examine the regression coefficients, the rate of return, risk, volatility, diversification benefit of REITs , performance of REITs relative to the market by using the daily return values of US REITs in the Capital Asset Pricing Model (CAPM) of Sharpe (1964) and Lintner (1965), the Fama and French's 3-Factor Model (1993) and the Carhart's 4-Factor Model (1995).
- To model the regression by using the industry and real estate indexes and to establish two-, four- and five-factor models and examine the regression coefficients, the rate of return, risk, volatility, diversification benefit of REITs , performance of REITs relative to the market, trade and real estate industries.
- To make a comparative analysis between the types of REITs.
- To analyze the significance of the regression coefficients which are the intercept, the beta, SMB, HML and momentum factor parameters, industry and real estate indexes.

1.2. Organization of Thesis

The rest of the thesis is prepared in the following order. Chapter II reviews the studies that employ a similar methodology in the literature. Chapter III gives the properties and the types of US equity REITs. Chapter IV describes the data and methodology under three main titles: 1- Capital Asset Pricing Model, 2- Fama and French's Three Factor Model, and 3- Carhart's Four Factor Model. Chapter V presents the empirical results with tables and figures. Lastly, Chapter VI presents the concluding remarks.

CHAPTER II

LITERATURE REVIEW

There is a significant amount of studies examining the relationship between the performance of REITs and the macroeconomic factors by using different methods. One of the studies is the risk and return on equity REITs by K. C. Chan, Patrick H. Hendershott, and Anthony B. Sanders, (1990). The aim of the research is to analyze the monthly REIT returns and their risk adjusted performance and to find how various macroeconomic factors affect the REIT returns in order to see whether REITs provide a hedge against unexpected inflation or not. REIT data between 1973 and 1987 are used in the study and the Multifactor Arbitrage Pricing Model and CAPM are estimated. The results of the analysis show that the alphas of REITs are not statistically significant, so there are no abnormal returns.

Furthermore,, the similar methodology was applied to the persistence of mutual fund performance by Mark M. Carhart (1997). The aim of the article is explaining the persistence in equity mutual funds' mean and risk adjusted returns by common factors in stock returns and investment expenses. The data covers monthly diversified equity funds from January 1962 to December 1993 which are free of survivor bias.   The research methodology consists of two models of performance measurement: the Capital Asset Pricing Model (CAPM) described in

Sharpe (1964) and Lintner (1965) and the Carhart (1995) 4-Factor Model which is the Fama and French's (1993) 3-Factor Model with Jegadeesh and Titman's (1993) one-year momentum factor. The results are expense ratios, portfolio turnover and load fees are significant and have a negative relationship with performance. Additionally a fund with high returns last year has higher average expected returns than next year, but not in years thereafter and it is not possible to gain abnormal returns from the stocks that follow the momentum strategy, because of the losses from transaction costs.

The second application was done to compare the common risk factors in the returns on REITs by James D. Peterson and Cheng-Ho Hsieh, (1997). The aim of the research is to analyze the risk and return characteristics of REITs and decide which Fama and French model better explains the EREIT and MREIT returns. In order to do that, the single and the five factor model of Fama and French (1993) were used. The data consists of the monthly returns of equity and mortgage real estate investment trusts between July 1976 and December 1992. The result is that the risk premium of equity REITs has significant relationship with risks premiums of market portfolio of stocks and the returns on mimicking portfolios for size and book-to-market equity of common stock returns. Additionally it was found that MREIT risk premiums have significant relationship with stock and bond market factors.

The existence of the momentum effect in REITs was investigated by Chui, Titman and Wei (2001). For this reason all REITs which were equity, mortgage and hybrid REITs were used over the 1982-99 period. The momentum portfolios were constructed. For the pre-1990 period no momentum effect was detected, on the other hand for the post-1990, a strong momentum factor was found.

In David Ling and Andy Naranjo (2003) research, the dynamics of REIT capital flows and the REIT returns have examined. The aim is to determine the effect of REIT cash flows on the REIT returns and vice versa and to find whether there is a momentum effect or not. The data consists of the quarterly REIT capital flows between 1979 and the second quarter of 2002. The used model is a dynamic model not a static model, by using this model the short and long run relationships, impulse response functions are determined and the model forecasts variance decompositions. The model gives that REIT equity flows have a positive significant relationship with previous quarter's flows and a negative relationship with the flows of two quarters ago. It is seen from the results that the REIT equity flows are positively correlated with the prior returns, so it proves the existence of momentum effect.

Additionally, in Kevin C.H. Chiang, Ming-Long Lee and Craig H. Wisen's (2004) research, the diversification benefit of REITs has been analyzed to find the symmetry between the REIT return and the market capitalization, market beta and how it changes due to the model selection. The data consists of the monthly returns of the NAREITs that start from January 1972 and end in December 2001. The analyses were done by using the Sharpe's Single Factor Model (1964) and the Fama-French's Three Factor Model (1993). It is seen from the results that the relationship between REIT returns and capitalization-weighted market return depends on the model selection. In this case the additional Fama-French factors explain the asymmetric REIT-beta better than the single factor model.

In this study, the risk premia of size effect on equity REITs (EREITs) has been analyzed by G.D. Chang and Y.T. Chang (2007). The time-varying volatility of publicly traded EREITs has been examined for size effect and the conditional volatility between macroeconomic variables and the size premia. For this purpose the data for monthly returns of EREITs between July 1995 and December 2006, was used. In order to do that, GARCH models and vector autoregressive (VAR) method were used. It is found that the volatility of the term spread in the bond market caused the volatility of size premia on returns to be low, that means it was better to invest in big size EREITs in the risky conditions of the market.

There is a cross county study which has been implemented by Miguel A. Ferreira, Antonio F. Miguel, Sofia Ramos (2006) exists. The performances of mutual funds around the world that were 10,568 open-end actively managed equity funds in 19 different countries were examined. The data covers the years 1999 and 2005. The abnormal performances of the mutual funds are regressed on the fund size, age, fees, management structure and managerial tenure. The alphas were determined by using various methods. These were CAPM, Fama-French three factor model (1993), international market model which included the domestic and the foreign factors, Fama-French three factor model plus momentum factor: the four factor model of Carhart (1997). The aim of the article is to investigate the relation between the abnormal return of mutual funds and their characteristics. Additionally it was examined that there was any significant relation between the country characteristics and the abnormal return of mutual funds. These country characteristics were economic development, financial development, familiarity, investor protection and other variables such as country's mutual fund industry age and average correlation between a country's market return and all other countries' returns. The results show that large funds perform better due to the economies of scale. Additionally the mutual fund performance is better for the countries which have strong legal institutions.

By similar methods the performance of real estate FOFs has been examined by Chiang, Kozhevnikov and Lee (2008). In this article the performance of real estate FOFs were examined related to the risk and fees adjustment to see whether the real estate funds produce a higher return than the random selection of REITs. The data consists of 55 real estate FOFs till the end of 2003. For the analysis the Capital Asset Pricing Model and the Fama-French Three-Factor model (1993) were used. The result is that the real estate mutual funds were not generating abnormal returns. In spite of that the real estate FOFs had higher returns than the other mutual funds.

Moreover the momentum effect and the performance of Real Estate Mutual Funds were investigated by Jeroen Derwall, Joop Huij, Dirk Brounen, and Wessel Marquering, (2009). The relation between the momentum effect and the actively managed REIT portfolios were examined, the relation between the momentum factor and the R^2 of regression was considered. The data consists of the all US mutual funds that cover the range between January 1962 and July 2008 and the 282 REIT mutual funds of January 1980 and July 2008. Single factor model, a model which uses REIT market return instead of stock market return, the Fama-French (1993) Three Factor Model and the four factor model which was established by Carhart (1997) were used as the research methodologies. It was seen that only the abnormal returns remained when single factor model was used, otherwise a positive alpha did not exist in three factor and four factor models.

Size, book-to-market and momentum factors were investigated for the 1926-2007 business cycles by Scheurle and Spremann (2010). The Fama-French (1993-1998) and the Carhart (1997) methodologies were used for the data analysis. As a result, it was found that the SML and HML have relation with risks associated with business cycle, on the other hand the MOM factor does not have.

The corporate governance and the performance in the market for corporate control have been examined by using the REITs by Campbell, Ghosh, Petrova and Sirmans (2011). The relationship between acquirer external and internal corporate governance mechanisms and the announcement abnormal returns were analyzed. For this aspect, the data for 1997-2006 REITs was used and the research contains 132 announcements. The standard event study methodology was used to compute the abnormal return for an equally weighted portfolio. No significant relationship was found between the presence of a staggered board of directors and the abnormal returns as a result of the research.

CHAPTER III

OVERVIEW OF US REITS

The REITs are real estate investment companies which offer common shares to the investors. The dividends that are paid to the shareholders by the company are the rental income and the profit. A REIT shareholder has the same rights as a regular stockholder. REIT industry occupies an important part in the US investment market. The total equity market capitalization of REITs has increased from $150 billion to approximately $400 billion in the past 10 years.[2]

In order to be qualified as a REIT in the US market, the company must abide the rules of the Internal Revenue Code. The company should invest at least 75% of its total assets in real estate, at least 75% of its gross income should be derived as rents from real property or interest from mortgages on real property and they should distribute the 90% of their rental income and profit as dividends to the shareholders of the company.[3] Additionally, equity REITs are free from paying corporate tax.

The share prices of REITs are less volatile than the other stock prices. Therefore, they are not volatile as much as other stock prices are.

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[2] http://www.reit.com/IndustryDataPerformance/MarketCapitalizationofUSREITIndustry.aspx

[3] National Association of Real Estate Investment Trusts

Although the equity stocks give quick response to the inflation changes, REIT share prices do not directly affected form these changes. According to the study of Simpson, Ramchander & Webb (2007) indicates that the EREIT returns shows asymmetric response to the inflation changes especially when the inflation is going down the EREIT returns show negative relationship with the down movement of inflation. Therefore, when the inflation rises the EREIT returns increase and when inflation decreases the EREIT returns increase.

Hence they have low correlation with other equity stocks. The rental income of a real estate is easily predictable. Hence the performance of REITs is more foreseeable.

The Table 1.1 gives the REITs in National Association of Real Estate Investment Trusts. These REITs are collected according to their data availability. Only the available REITs which have data since 2005 are chosen in order to apply the analysis.

Table 1. 1. REITs since 2005

Company Name	Ticker	Category
HCP Inc.	HCP	Healthcare
Health Care REIT, Inc.	HCN	Healthcare
LTC Properties, Inc.	LTC	Healthcare
National Health Investors, Inc.	NHI	Healthcare
Omega Healthcare Investors, Inc.	OHI	Healthcare
Universal Health Realty Income Trust	UHT	Healthcare
Ventas, Inc.	VTR	Healthcare
Host Hotels & Resorts	HST	Hotel-Motel
LaSalle Hotel Properties	LHO	Hotel-Motel
Strategic Hotels & Resorts	BEE	Hotel-Motel

Table 1. 1. (cont'd)

Company Name	Ticker	Category
Sunstone Hotel Investors, Inc.	SHO	Hotel-Motel
Ashford Hospitality Trust	AHT	Hotel-Motel
Supertel Hospitality, Inc.	SPPR	Hotel-Motel
MHI Hospitality Corp.	MDH	Hotel-Motel
FelCor Lodging Trust Inc.	FCH	Hotel-Motel
Alexandria Real Estate Equities, Inc.	ARE	Office
Boston Properties, Inc.	BXP	Office
Highwoods Properties, Inc.	HIW	Office
Kilroy Realty Corporation	KRC	Office
CapLease Inc.	LSE	Office
Corporate Office Properties Trust	OFC	Office
Digital Realty Trust, Inc.	DLR	Office
Duke Realty Corporation	DRE	Office
Liberty Property Trust	LRY	Office
Mack-Cali Realty Corporation	CLI	Office
Mission West Properties	MSW	Office
Parkway Properties, Inc.	PKY	Office
American Campus Communities, Inc.	ACC	Residential
Apartment Investment & Mgmt. Co.	AIV	Residential
Associated Estates Realty Corp.	AEC	Residential
AvalonBay Communities Inc.	AVB	Residential
Home Properties, Inc.	HME	Residential
BRE Properties, Inc.	BRE	Residential
Mid-America Apartment Communities	MAA	Residential
Camden Property Trust	CPT	Residential
Colonial Properties Trust	CLP	Residential
Equity Lifestyle Properties	ELS	Residential
Equity Residential	EQR	Residential
Essex Property Trust, Inc.	ESS	Residential
Post Properties, Inc.	PPS	Residential
Senior Housing Properties Trust	SNH	Residential
Sun Communities, Inc.	SUI	Residential
UDR Inc.	UDR	Residential
First REIT of New Jersey	FREVS	Residential
Alexander's Inc.	ALX	Retail
CBL & Associates Properties	CBL	Retail
Cedar Shopping Centers	CDR	Retail
Developers Diversified Realty Corporation	DDR	Retail

Table 1. 1. (cont'd)

Company Name	Ticker	Category
Entertainment Properties Trust	EPR	Retail
Equity One, Inc.	EQY	Retail
Federal Realty Investment Trust	FRT	Retail
Getty Realty Corp.	GTY	Retail
Glimcher Realty Trust	GRT	Retail
Hersha Hospitality Trust	HT	Retail
Hospitality Properties Trust	HPT	Retail
Inland Real Estate Corporation	IRC	Retail
Investors Real Estate Trust	IRET	Retail
Kimco Realty Corporation	KIM	Retail
Kite Realty Group Trust	KRG	Retail
Monmouth Real Estate Investment Corp.	MNR	Retail
Northstar Realty Finance Corp.	NRF	Retail
One Liberty Properties Inc.	OLP	Retail
Pennsylvania REIT	PEI	Retail
PS Business Parks Inc.	PSB	Retail
Ramco-Gershenson Properties Trust	RPT	Retail
Realty Income Corporation	O	Retail
Regency Centers Corporation	REG	Retail
Roberts Realty Investors, Inc.	RPI	Retail
Saul Centers, Inc.	BFS	Retail
Simon Property Group, Inc.	SPG	Retail
SL Green Realty Corp.	SLG	Retail
Tanger Factory Outlet Centers, Inc.	SKT	Retail
Taubman Centers, Inc.	TCO	Retail
Macerich Co.	MAC	Retail
Urstadt Biddle Properties, Inc.	UBA	Retail
Washington Real Estate Investment Trust	WRE	Retail
Weingarten Realty Investors	WRI	Retail
BioMed Realty Trust Inc.	BMR	Industrial
EastGroup Properties, Inc.	EGP	Industrial
Extra Space Storage, Inc.	EXR	Industrial
First Industrial Realty Trust	FR	Industrial
Plum Creek Timber Company	PCL	Industrial
PMC Commercial Trust	PCC	Industrial
Potlach Corp.	PCH	Industrial
ProLogis	PLD	Industrial

Table 1. 1. (cont'd)

Company Name	Ticker	Category
Sovran Self Storage, Inc.	SSS	Industrial
Anworth Mortgage Asset Corporation	ANH	Diversified
Annaly Mortgage Management, Inc.	NLY	Diversified
First Potomac Realty Trust	FPO	Diversified
Winthrop Realty Trust	FUR	Diversified
UMH Properties Inc.	UMH	Diversified
Lexington Realty Trust	LXP	Diversified
RAIT Investment Trust	RAS	Diversified
MFA Financial, Inc.	MFA	Diversified
Brandywine Realty Trust	BDN	Diversified
Pittsburgh & West Virginia Rail Road	PW	Diversified
Vornado Realty Trust	VNO	Diversified
National Retail Properties	NNN	Diversified
iStar Financial Inc.	SFI	Diversified
Public Storage, Inc.	PSA	Diversified
Arbor Realty Trust, Inc.	ABR	Diversified
Newcastle Investment Corporation	NCT	Diversified
Redwood Trust, Inc.	RWT	Diversified
Cousins Properties, Inc.	CUZ	Diversified
Capstead Mortgage Corporation	CMO	Diversified
Gladstone Commercial Corporation	GOOD	Diversified

REITs are traded on major stock exchanges. REITs must distribute the 90 percent of their taxable income to the shareholders every year. They have no corporate tax because REITs are permitted to deduct the dividends that are paid to shareholders from their corporate taxable income. They do not pay state income tax. Since stocks issuers should pay corporate taxes before settling the dividend payout, REITs offer relatively higher yields than stocks. Therefore, the tax advantage of REITs can turn out to superior yields relative to the other stocks at the same stability. Hence we can say that REITs provide portfolio diversification with high and reliable dividend income. REITs also provide liquidity, solid long term performance and transparency. As of January 1, 2011, there were 153 REITs registered with the Securities and Exchange Commission in the United States that trade on one of the major stock exchanges. The total equity market capitalization of REITs is $389 billion.[4]

For the time interval 2005 and 2011, 117 REITs are selected due to their data availability and they are categorized under main titles. The types of REITs are given in the Table 1.1. They are divided into seven categories according to the investment areas of the REITs. These are healthcare facilities, hotel-motel, office, residential, retail, and industrial and finally the diversified REITs.

Healthcare REITs invest in the real estates of hospitals, nursing facilities, retirement homes and medical office buildings. The aging population and the demand for the healthcare affect the performance of healthcare REITs. Similar to all other REITs, due to the Internal Revenue Code, the healthcare REITs are required to distribute 90% of their taxable income to the shareholders as dividends. Therefore, they issue equity and debt to finance the expansion of the company instead of using the operating income. In this case, the healthcare REITs are affected more from the changes of interest rates than other REITs.

[4] National Association of Real Estate Investment Trusts

A change in interest rate may result with a decrease in the REITs' stock price. Hence the healthcare REITs' stock prices are more sensitive to the market conditions than other type of REITs. The data is gathered for seven companies.

Hotel & Motel REITs includes the companies which invest in the hospitality properties. The performance of the hotel-motel REITs are affected from the demand for the accommodation. The number of hotel-motel REITs is eight.

Office REITs invest in office buildings. Twelve office REITs are examined in the analyses. The companies' income is rental which is received from the tenants. The performance of the office REITs are related to the economic condition of the state and the unemployment rate.

Residential REITs invest in apartment buildings. When home prices are high, the demand for renting increases. Similarly when interest rates are high the demand of mortgage financing decreases and it increases the number of tenants. The residential REITs receive rental income from the apartment tenants. When the interest rates are high, the REIT is expected to have high incomes and it increases the investors' expectations for high dividend payments. Otherwise it may cause decline in stock prices. The data is gathered for seventeen companies.

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[5] http://www.investopedia.com/articles/mortgages-real-estate/10/real-estate-investment-trust-reit.asp#axzz1kw70xPtu

Retail REITs own and operate the retail properties such as shopping malls. Approximately 24% of REIT investments are in shopping centers freestanding retails in the US.[5] Retail REITs receive rental income from the tenants.

The economic situation of the state, the purchasing power affects the demand for retail properties and it influences the income of retail REITs. The bankruptcies of the tenants and closing down the stores decrease the demand for retail properties. Therefore, it causes decline in share prices. The analyses are done for thirty three different retail REITs.

Industrial REITs own and manage industrial properties such as research and development facilities, warehouses, and manufacturing and distribution centers. As long as there is demand for any kind of product, the industry REITs are doing well.

Even though there was a slowdown in the manufacturing, the industry REITs would not be directly affected from that case in the short-term like it was happened in the US, in 2007. In this sense, it shows the diversified effect of REITs. In the analysis nine industrial REITs are examined.

Diversified REITs invest in different properties at the same time. For instance Cousins Properties, Inc. owns and manages office, multi family, retail and industrial properties. Another example is Lexington Realty Trust which acquires, owns and manages office, industrial and retail properties, the company provides investment advisory and asset management services to corporate tenants and net-lease property investors.[6] The analysis are done for twenty diversified REITs.

Table 1.2. REITs in Category

	Number of REITs
Healthcare	7
Hotel-Motel	8
Office	12
Residential	17
Retail	33
Industrial	9
Diversified	20
Total	106

[6] http://finance.yahoo.com/q/pr?s=CUZ+Profile, http://finance.yahoo.com/q/pr?s=LXP+Profile

The other types of REITs which do not present in the above categories are listed in the Table 1.3. Since the number of REITs in a single group is not enough to make analyses, these REITs are not examined under a different group.

Table 1.3. REITs out of Category

Company Name	Ticker
Acadia Realty Trust	AKR
AMB Property Corporation	AMB
BRT Realty Trust	BRT
Capital Trust, Inc.	CT
Dynex Capital, Inc.	DX
Nationwide Health Properties, Inc.	NHP
U-Store-It Trust	YSI
Agree Realty Corporation	ADC
Rayonier, Inc.	RYN
Pacific Office Properties Trust	PCE
Presidential Realty Corporation (Class B)	PDL.B

CHAPTER IV

DATA & METHODOLOGY

4.1. Data

In order to examine the performance of REITs in the market and to analyze the types of REITs separately, the adjusted close prices of REITs, market risk free rate of return, SMB (Small Minus Big) which is the average return on the three small portfolios minus the average return on the three big portfolios, HML (High Minus Low) which is the average return on the two value portfolios minus the average return on the two growth portfolios, momentum factor (MOM) which is the average return on the high prior return portfolios minus the average return on the two prior return portfolios, the industry index and the real estate index are obtained from different data sources. The prices of REITs and the market risk free rate of return are gathered from Morningstar Database and Yahoo Finance[7]. The SMB, HML, MOM factors, industry index and the real estate index values are derived from the Fama French Data Library[8].

7 http://finance.yahoo.com/

8 http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html

The data is gathered in daily basis; it starts from 31st of January, 2005 and ends at 1st of February, 2011. In this time interval, the information for 117 numbers of REITs is collected. Capital Asset Pricing Model of Sharpe (1964) and Linter (1965), the Fama - French's Three Factor Model (1993) and the Carhart's Four Factor Model (1997) are used to analyze the data. The same procedure is applied to the data by adding industry index and the real estate index.[9]

First of all, an equally weighted portfolio which is composed of 117 numbers of REITs is established. The analysis that are mentioned above are applied to the equally weighted portfolio and the results are given in the tables in Empirical Results chapter.

For single factor model, the coefficient of the intercept, the beta value of the risk premium, p values of these coefficients, adjusted R^2, and the F test result of the regression equation are given. In addition to the given results for the single factor model, in the three factor model, the SMB and the HML beta coefficients and their p values are given. Similarly, for the four factor model, the momentum factor coefficient and its p value is added to the results.

The industry index and the real estate index are added separately to the single, three and four factor model. Therefore, the two, four and five factor models are established.

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[9] Note: The content information about the industry index and the real estate index portfolio data can be found in Fama French Data Library.

In addition to the results of the single, three and four factor models, the industry and the real estate index betas and their p values are given separately for each model. Hence, nine models are applied to the equally weighted portfolio data and the regression results are given in the tables and discussed in Empirical Results chapter. The statistical significance of the independent variables and the negativity-positivity of the coefficients are examined.

Secondly, for each REIT, the single, three, four factor models and the industry – real estate index added two, four and five factor models are applied separately. Therefore, for a single REIT, nine models applied. In total 1053 regression analysis are applied. As a result of the regression equations, 117 risk premium beta coefficients are obtained for single factor model. In addition to the single factor model results 117 SMB and 117 HML beta coefficients are obtained for the three factor model. For the four factor model 117 MOM beta coefficients are added to these results and the same procedure is valid for the industry and the real estate index added two, four and the five factor models. The beta coefficients' mean, standard deviation, minimum and the maximum values are given in the tables and the variation of beta coefficients are given in figures in the Empirical Results chapter.

Thirdly, the REITs are separated to seven categories according to their investment areas. These are healthcare facilities, hotel – motel, office, retail, residential, industrial, diversified REITs.[10]

The lists of REITs, the company names and tickers, are given in the Introduction chapter. The equally weighted portfolios of each category are established Therefore, seven equally weighted portfolios are obtained. The same procedure, which is applied for the equally weighted portfolio that is composed of 117 REITs, is applied for these categories. By using nine different type of regression equations, 63 regression equations are obtained.

The values of betas, p and adjusted R^2 values and the F test results are given for each model and category.

Lastly the beta coefficients of REITs are separated according to the categories. The standard deviation, mean, maximum and minimum values of the beta coefficients are given in the tables in Empirical Results in Chapter VI.

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[10] Note: For more information about the types of REITs and company index, see http://finance.yahoo.com/

4.2. Methodology

In this study, three models are used to determine the significance of abnormal returns of REIT portfolios, these are the Capital Asset Pricing Model of Sharpe (1964) and Linter (1965), Three Factor Model of Fama and French (1993) and the Four Factor Model of Carhart (1997). A couple of econometric tests are applied to the regressions in order to test the significance of alpha which indicates the reliability of abnormal return.

4.2.1. Capital Asset Pricing Model

The Capital Asset Pricing Model of Sharpe (1964) and Linter (1965), gives the relationship between the risk of an asset and its expected return. CAPM provides a benchmark rate of return to compare the expected return which is forecasted for a stock with actual return associated for that risk. Additionally it is used to evaluate a stock's return which has not yet been traded in the market.

$$E(r_i) - r_f = \frac{\mathrm{Cov}(r_i, r_m)}{\sigma_M^2}\left[E(r_M) - r_f\right] + e_{it} = \beta_i\left[E(r_M) - r_f\right] + e_{it} \qquad (1)$$

- r_f is the risk free rate of return which is the time value of money

- $\frac{\mathrm{Cov}(r_i, r_m)}{\sigma_M^2}$ is the beta (β_i) of the security, beta is the systematic risk, the sensitivity factor to market and shows how the returns of the stock moves relative to the market
- r_M is the expected market return
- $[E(r_M) - r_f]$ is the market risk premium
- $E(r_i) - r_f$ is the excess return.

Although the assumptions for the CAPM are homogeneous expectations and ignore many real-market complexities, some substantial comprehensions can be gained about the nature of stock market equilibrium. These assumptions are:

- Perfect competition, the investors are price takers, the security prices are not affected from their own trades.
- The investors plan for a single period horizon.
- The investors pay no transaction costs for the trades and no taxes for the returns.
- The all investors decide their transactions according to the Markowitz's portfolio selection model (1952)
- All investors have the same economic view and examine the securities which they are going to trade in the same way.

The data is derived from Morningstar Database and the data consists of the time interval between 1972 and 2011 but for the past times less REIT data available than the current time. Additionally the t test is applied to determine the significance of beta and the intercept of the regression. The null hypothesis is H_o: $\beta = 0$ which is to test the significance of beta the slope of the regression line. On the other hand the alternative hypothesis is H_1: $\beta \neq 0$. Additionally the null hypothesis is H_o: $\alpha = 0$ and the alternative hypothesis is H_1: $\alpha \neq 0$ to examine the significance of the intercept.

In addition to the Capital Asset Pricing Model, a second factor is included to the model, the index is obtained from Fama-French Data Library, the factor includes REIT return index. The factor is added to the Capital Asset Pricing Model as Industry Index.

$$E(r_i) - r_f =$$

$$\frac{\mathrm{Cov}(r_i, r_m)}{\sigma_M^2}\left[E(r_M) - r_f\right] + \beta_{iII} II_t + e_{it} = \beta_i\left[E(r_M) - r_f\right] + \beta_{iII} II_t + e_{it} \qquad (2)$$

- II_t is the industry index
- β_{iII} is the regression coefficient

Similarly, a Real Estate Index is added to the Capital Asset Pricing Model to see the relation between the REIT returns and the Real Estate Industry Index. As mentioned before for the Industry Index, the Real Estate Index is obtained from the Fama-French Data Library.

$$E(r_i) - r_f =$$

$$\frac{\mathrm{Cov}(r_i, r_m)}{\sigma_M^2}\left[E(r_M) - r_f\right] + \beta_{iReI} ReI_t + e_{it} = \beta_i\left[E(r_M) - r_f\right] + \beta_{iReI} ReI_t + e_{it} \quad (3)$$

- ReI_t is the real estate index
- β_{iReI} is the regression coefficient

4.2.2. Fama-French's Three Factor Model

The Fama and French's Three Factor Model (1993)

$$E(r_i) - r_f = \beta_{iM}\left[E(r_M) - r_f\right] + \beta_{iSMB} SMB_t + \beta_{iHML} HML_t + e_{it} \quad (4)$$

- $E(r_i) - r_f$ is the excess return
- $\left[E(r_M) - r_f\right]$ is the market risk premium
- β_{iM} , β_{iHML} and β_{iSMB} are the regression coefficients
- SMB_t is the excess return of small cap minus big
- HML_t is the excess return of high book-to-market ratio minus the low book-to-market
- e_{it} is the error term

The Fama-French Factors are determined from the Fama-French Data Library and they are constructed using the 6 value-weight portfolios formed on size and book-to-market. SMB (Small Minus Big) is the average return on the three small portfolios minus the average return on the three big portfolios.

SMB =

$$\frac{1}{3}\ (Small\ Value + Small\ Neutral + Small\ Growth)\ -$$

$$\frac{1}{3}\ (Big\ Value + Big\ Neutral + Big\ Growth)^{11} \qquad (5)$$

HML (High Minus Low) is the average return on the two value portfolios minus the average return on the two growth portfolios.

HML =

$$\frac{1}{2}\ (Small\ Value + Big\ Value)\ - \frac{1}{2}\ (Small\ Growth + Big\ Growth)^{12} \qquad (6)$$

Three factor model includes the size and the book to market equity factors. In addition to the market risk factors in the CAPM, Fama and French (1993) expanded the CAPM model by adding the size and the value factors. By including these two additional factors, it is expected to capture systematic risk that is coming from the macroeconomic factors.

[11, 12] See http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/Data_Library/f-f_factors.html

Moreover these factors eliminates the errors in measuring the managers' performance by using CAPM and able to adjust the outperformance tendency. Fama-French model gives more precise results in obtaining the returns of stocks. The firm characteristics variables these are the corporate capitalization (long standing observation of firm size) and book-to-market ratio attempt to measure the deviations from the stock returns that are calculated by using the CAPM. According to the studies done by Fama and French (2004), the value stocks which trades at a relatively low price and pays high dividends, outperform growth stocks which are expected to grow above average rate because of the negative relationship between the return variance and the size.

Additionally the small-cap stocks outperform large-cap stocks. Furthermore, in Fama and French's study (1992), it was also concluded that the book-to-market ratio has more explanatory power on the excess return than the size factor. In the study of Fama and French (1995), it is seen that when the stocks are grouped on BE/ME and size it reflects the differences in profitability.

A high BE /ME indicates a high book value relative to its market price and it shows low earnings, Therefore, high BE/ME stocks are less profitable than the low BE/ME stocks. This ratio gives an insight whether the stock is sold below or above its intrinsic value. Strong firms have low BE/ME and weak firms have high BE/ME. HML is the measure of financial distress, so high BE/ME firms result with positive HML slope and these firms are financially distressed relative to the low BE/ME firms. Similarly, low BE/ME firms have high earnings and they are well managed firms so negative HML slope exists. Negative SMB slopes show that the firm is a large firm and has a negative sensitivity to the factor. On the contrary, positive SMB slopes indicates small firms which are relatively financially distressed and have high expected returns and low long term returns.

The t test is applied to the regression results. If the t statistics of intercept, SMB and HML are smaller than 2, so it is failed to reject the null hypothesis that the coefficients are not statistically significantly different from zero. Similarly, if the t statistic for the beta is bigger than 2, so reject the null hypothesis that is the beta coefficient is zero.

When the significance of F test is bigger than the 5% significance level so fail to reject the null hypothesis which is H_o : $\beta_{iM} = \beta_{iSMB} = \beta_{iHML} = 0$. If the t statistics of intercept, SMB and HML and beta are smaller than 2, it is failed to reject the null hypothesis that the coefficients are not statistically significantly different from zero. Therefore, it can be said that, there is no relationship between the explanatory variables and the independent variable.

The industry index is added to the Fama and French's Three Factor Model (1993) and the four factor model is obtained.

$$E(r_i) - r_f =$$

$$\beta_{iM}\left[E(r_M) - r_f\right] + \beta_{iSMB}SMB_t + \beta_{iHML}HML_t + \beta_{iII}II_t + e_{it} \qquad (7)$$

Furthermore, a Real Estate Index is added to the Fama and French's Three Factor Model (1993) and the following equation is obtained.

$$E(r_i) - r_f =$$

$$\beta_{iM}\left[E(r_M) - r_f\right] + \beta_{iSMB}SMB_t + \beta_{iHML}HML_t + \beta_{iReI}ReI_t + e_{it} \qquad (8)$$

4.2.3. Carhart's Four Factor Model

Carhart's Four Factor Model (1997), in large trade volumes the stocks which gain or loss will continue to same manner in the future.

$$E(r_i) - r_f =$$

$$\beta_{iM}\left[E(r_M) - r_f\right] + \beta_{iSMB}SMB_t + \beta_{iHML}HML_t + \beta_{iMOM}MOM_t + e_{it} \qquad (9)$$

Additional variables are:

- β_{iM} , β_{iSMB}, β_{iHML} and β_{iMOM} are the regression coefficients
- SMB_t is the excess return of small cap minus big
- HML_t is the excess return of high book-to-market ratio minus the low book-to-market
- MOM_t is the momentum factor

Moreover, Carhart (1997) concluded that individual mutual funds which use the one-year momentum strategy earns relatively low abnormal returns because of the expenses originate from the transaction costs.

Jagadeesh and Titman (1993) found that the momentum effect is when a particular stock gains or losses this movement is likely to continue over 3 to 12 - month holding periods. It is seen that in unpredictable situations the past good performers are said to be perform better in the future than the past bad performers.

Additionally, similar tests are applied for the Four Factor Model. When the significance of F test is bigger than the 5% significance level so fail to reject the null hypothesis which is H_o : β_{iM} = β_{iSMB} = β_{iHML} = β_{iMOM} = 0. If the t statistics of intercept, market sensitivity factor, sensitivity factor to small firm effect, sensitivity factor to spread in returns between value and growth stocks and momentum factor are smaller than 2, it is failed to reject the null hypothesis that the coefficients are not statistically significantly different from zero. Therefore, it can be said that, there is no relationship between the explanatory variables and the independent variable. The momentum factor is obtained from Fama-French Data Library and the factors are constructed by using six value-weight portfolios on size and prior (2-12) returns. The portfolios, which are formed monthly, are the intersections of 2 portfolios formed on size (market equity, ME) and 3 portfolios formed on prior (2-12) return. The monthly size breakpoint is the median NYSE market equity.[13]

The monthly prior (2-12) return breakpoints are the 30th and 70th NYSE percentiles.[14] MOM is the average return on the high prior return portfolios minus the average return on the two low prior return portfolios:

$$\text{MOM} = \frac{1}{2}\ (Small\ High + Big\ High) - \frac{1}{2}\ (Small\ Low + Big\ Low)^{\ 15} \qquad (10)$$

[13] http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/Data_Library/det_mom_factor.html

[14, 15] http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/Data_Library/det_mom_factor.html

As it is mentioned for the Capital Asset Pricing Model of Sharpe (1964) and Linter (1965) and the Fama - French's Three Factor Model (1993), the same procedure is applied to the Carhart's Four Factor Model (1997). Therefore, an industry index and a real estate index are added to the model separately. Hence the following regression equations are formed.

$$E(r_i) - r_f =$$

$$\beta_{iM}\left[E(r_M) - r_f\right] + \beta_{iSMB}SMB_t + \beta_{iHML}HML_t + \beta_{iMOM}MOM_t + \beta_{iII}II_t + e_{it} \quad (11)$$

$$E(r_i) - r_f =$$

$$\beta_{iM}\left[E(r_M) - r_f\right] + \beta_{iSMB}SMB_t + \beta_{iHML}HML_t + \beta_{iMOM}MOM_t + \beta_{iReI}ReI_t + e_{it} (12)$$

CHAPTER V

RESULTS & ANALYSIS

5.1. Equally Weighted Portfolios of 117 REITs and Each Category

In this part of the analysis, firstly the returns are calculated for all REITs and then the excess returns are estimated. Secondly the equally weighted portfolio is established from these REITs. The excess return of the portfolio is used as the dependent variable. The independent variables are obtained from the Fama-French Data Library. Furthermore, the REITs are divided into seven categories. The Capital Asset Pricing Model of Sharpe (1964) and Linter (1965), the Fama and French's Three Factor Model (1993) and the Carhart's Four Factor Model (1997) and the industry index and real estate index added models are applied to equally weighted portfolio which is constructed form 117 REITs , and the seven different category of REITs separately. Consequently, for a single model, eight regression results are obtained. The results are given in the Tables 5.1 to 5.10. Although the β values of the risk premium are bigger than one for the the Capital Asset Pricing Model of Sharpe (1964) and Linter (1965), the Fama and French's Three Factor Model (1993) and the Carhart's Four Factor Model (1997), these coefficients are smaller than one for the industry index added models. When the industry index and the real estate index are added separately to the available models the β coefficient decreases below one. In this case the portfolio is aggressive due to the results of the CAPM, Fama-French and the Carhart's Models, and it goes up more than the market does and vice versa. Additionally it means that the equally weighted portfolio which is constructed by the combination of 117 listed EREITs is more volatile than the market. On the other hand, the portfolio is defensive according to the results of the industry index added models. Hence the industry and real estate index added models change the condition of the portfolio in opposite direction.

In Tables 5.1 to 5.9, the Adjusted R^2 value of the regression results for the real estate index added models are bigger than the industry index added models and the single- three and four factor models. That means the real estate index added models explain the statistical relation between the dependent and the independent variables more than the other models. Furthermore, the Adjusted R^2 values increases when a new independent variable is added to the model. That means the new term improves the model. When new coefficients are added to the Capital Asset Pricing Model of Sharpe (1964) and Linter (1965), the Fama and French's Three Factor Model (1993) and the Carhart's Four Factor Model (1997), the readily available coefficients remain significant. In Chiang, Lee and Wisen's (2004) research, it was found that the Fama-French factors explain the asymmetric REIT-beta better than the single factor model.

Moreover the newly added coefficients which are industry and real estate index show statistical significance. This result shows that the single, three and four factor models are not sufficient to explain the movements of return of the REIT. The significance of new added independent coefficients and the decreasing value of betas of (Mrk-Rf), SMB and HML identifies that their effects in the model decrease and lose their importance in explaining the sample. Since the new added models are statistically significant; the single, three and four factor models are general models; they are not enough to explain the dependence of return. Additionally the similar result was found by Peterson and Hsieh (1997). In the research, the common risk factors of the returns on REITs were examined and it was found that risk premium of equity REITs have a significant relationship with risk premiums of market portfolio of stocks.

The p-values of the t-statistics of intercept coefficient are bigger than the 5% significance level. Therefore, it is failed to reject the null hypothesis which says the intercept is not statistically significantly different from zero. According to the insignificant intercept, there is no return in excess of the reward for the assumed risk.[16] The same result was found by Chan, Hendershott, and Sanders (1990), Chiang, Kozhevnikov, Lee and Wisen (2008), Derwall, Huij, Brounen and Marquering (2009) and Campbell, Ghosh, Petrova and Sirmans (2011); the alphas were not significant. Therefore, no abnormal return was detected.

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[16] http://en.wikipedia.org/wiki/Alpha_(investment)

The SMB and the HML coefficients are positive numbers for all regression results. By reason of that almost all REIT companies are small. Since the HML shows the relation between the value stock and the growth stock, positive HML beta means that all REITs are value stocks and they are valued less when the price is compared to its dividend payments. The common characteristics of these stocks are high dividend yield, low market-to-book value ratio.

Furthermore, the momentum factors, for the Carhart's (1997) Model, industry and real estate index added Five Factor Models, are negative numbers; in this case the portfolio shows small expected returns.

The p-value of the industry index β coefficient is smaller than the 5% significance level; it is statistically significant for each model and smaller than one. In consequence of that, the portfolio gives less return than the industry does.

Since the beta values of risk premium of equally weighted portfolio are bigger than 1, the diversification benefit does not exist due to the results of single, three and four factor models. The correlation of 60% or less between the REIT beta and the total market provides diversification.[17] According to the results of the index added models, the industry index and the real estate index betas are smaller than 1. Therefore, when the trading and the real estate industries' conditions are good, they are providing better returns than the REITs and vice versa.

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[17] http://www.reit.com/InstitutionalInvestors/Diversification.aspx

The beta values of the risk premium are smaller than the market beta, 1. These values changes between 0.484 and 0.895. As it is mentioned above, the correlation of 60% or less provides diversification. Due to the results of industry index added models and the real estate index added two factor model, the portfolio provides diversification. On the other hand, the beta values for risk premium are bigger than 0.6 for the real estate index added four and five factor models. In this case diversification does not exist.

Additionally the same analyses in Table 5.1 are done by using the daily Dow Jones Equity REIT Index.[18] The index is composed of the all publicly traded equity real estate investment trusts in the Dow Jones U.S. stock universe. The excess return is calculated from the close prices of Dow Jones Index. According to the results the market risk premium beta coefficients are smaller than one for all types of models and all beta coefficients remain statistically significant.

The SMB and the HML coefficients are positive and the MOM betas are negative as they are shown in Table 5.1.

In Table 5.2, the correlations between the independent variables are given. In order to find the correlation coefficients between them, for each independent variable 1513 values are used.

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[18] http://www.djindexes.com/mdsidx/index.cfm?event=showReitIndexData

Therefore, as it is seen in Table 5.2, there is a positive correlation between risk premium and the SMB, but the correlation coefficient (0.075) is close to zero which indicates that they have a low correlation. Additionally the correlation between the risk premium and the HML is positive (0.501) but stronger than the correlation between the risk premium and SMB. The MOM has negative correlation with all independent variables except SMB. Furthermore, there is a strong positive correlation between industry index, real estate index and the risk premium. That means a strong linear relationship exists between these independent variables.

In Table 5.3, for healthcare facilities the Adjusted R^2 of the single factor regression is 0.644 which is smaller than the Adjusted R^2 values the single factor model regression results of office, retail, industrial and diversified REITs which are given in the Tables 5.4 to 5.9. In Table 5.7, the retail REITs have the highest Adjusted R^2 value which is 0.694 for CAPM, 0.777 for Fama-French Model and 0.801 for the Carhart's Model, that means the explanatory variable explains the variability in the retail REITs more than it explains the variability of the other type of REITs.

Since all companies perform in the same industry, the Adjusted R^2 values do not much differ from each other. According to the results of the analysis of the Capital Asset Pricing Model of Sharpe (1964) and Linter (1965), in Table 5.3, on the different types of REITs, the β_{iM} coefficient of $\left[E(r_M) - r_f\right]$ is 1.824, it is 1.571 for Fama-French Model and 1.469 for the Carhart's Model which belongs to the hotel-motel REITs and it is the highest one among other types of REITs. Hence the systematic risk for hotel-motel category is bigger than the other categories and for this category the unsystematic risk is the lowest one. The β_{iM} values for the equally weighted portfolio of all types of REITs are bigger than the market β. Therefore, the REITs are aggressive and more risky than the overall market. When market goes up the REITs increase more than the market does and vice versa.

As seen in Table 5.3 to Table 5.9 for the single factor model, the p-values of the intercept coefficients are bigger than the 5% significance level for all categories of REITs, in this case fail to reject the null hypothesis that is the intercept is not statistically significantly different from zero. The p values of t statistics for the beta coefficients are zero for all REIT categories which is smaller than the 5% significance level, Therefore, the null hypothesis which is the beta coefficient is not statistically significantly different from zero is rejected. There is a significant relationship between the excess return of REITs (dependent variable) and the market risk premium (independent variable).

The p-values of SMB and HML are smaller than the 5% significance level in the Fama-French Model for all categories of REITs. Hence the null hypothesis which says the SMB and HML are not statistically significantly different from zero is rejected. These values are statistically significantly different from zero. The same results were detected by Scheurle and Spremann (2010) that the SML and HML have relation with risks associated with business cycle. Additionally in the

Carhart's Four Factor Model (1997), the p-value of MOM is smaller than 0.05, in this case, similarly the null hypothesis is rejected. Therefore, there is a statistically significant relationship between the excess return and the market risk premium, SMB, HML and MOM in a 5% significance level.

Since the SMB and HML coefficients are bigger than zero, the REIT companies are small and the REITs are value stocks. In the results of the REIT analysis, the HML and MOM are significant for all categories and the constructed portfolios. Furthermore,, the REIT portfolios load positively on HML and negatively on momentum factor. Momentum effect explains the relation between the excess return and its repeatability. The positive momentum indicates that the winners continue to win and the losers continue to lose and vice versa. According to the results of the analysis, the momentum effect is negative and that means the winners will lose and the losers will win; this indicates small expected returns.

5.2. Descriptive Statistics of REITs

In this part of the research, the beta coefficients of risk premium of 117 REITs are plotted as a histogram from Figure 1.1.1 to Figure 1.9.5.[19] The number of observations, mean, standard deviation of sample and minimum and maximum values are given in the tables from Table 1.1.1 to Table 1.9.5.[20]

The descriptive statistics for each category are listed in the Table 2.1.1 to Table 2.21.3.[21] The mean values of independent variables are given in the Table 5.10, for the equally weighted portfolio and for the seven categories. The value of standard deviation is smaller for the Carhart's Four Factor Model (1997) than Capital Asset Pricing Model of Sharpe (1964) and Linter (1965), the Fama and French's Three Factor Model (1993). It is concluded that when the number of independent variables increases, the dispersion around mean decreases. When the deviation decreases the values get closer to each other. The dispersion around mean is smaller for the real estate index added models than the industry index added models. The dispersion of real estate index beta around the mean is smaller than the dispersion of industry index beta for the two factor model. The opposite situation is valid for the four and the five factor models.

[19,20] The Tables and the Figures are attached as Appendix A.

[21] The Tables are attached as Appendix B.

The standard deviation shows the magnitude of dispersion around mean. The values of standard deviations of the beta coefficients for the all independent variables are smaller for the real estate index added models than the other models with narrower range. The graphs show the independent variables' values around mean.

When the number of independent variables increases, the mean of the risk premium beta coefficient decreases. It is 1.437 for single factor model, 1.218 for three factor model and 1.142 for the four factor model in Table 5.10. The value declines towards one.

That shows the decreasing effect of risk premium on the model. Therefore, many variables which are particular to industry exist. These variables cannot be measured by the single, three and four factor models. On the contrary, the mean of risk premium beta coefficients increases when a new variable added to industry index models. It is 0.484 for the two-factor model, 0.741 for the four-factor model and 0.895 for the five-factor model. The same situation is valid for the real estate index models. For the two-, four- and five-factor models, the mean of the risk premium beta coefficients are 0.572, 0.642, and 0.671 respectively. For all of these index models only the two factor model risk premium mean betas are smaller than 60% of diversification level. The means of SMB, HML betas are positive for all models, indicate the small firm and value stock. Furthermore, the means of momentum factor betas are negative for all models. Therefore, the

REITs shows small expected returns. The mean of industry index beta decreases when new variables are added to the models.

The values are 0.841, 0.461 and 0.250 for two, four and five factor models respectively. The mean of real estate index beta decreases when new variables are added to the models. The values are 0.562, 0.432 and 0.376 for two, four and five factor models respectively. The deviation from mean decreases in the similar way for both industry and real estate index added models.

In this part of the analysis, for the each category of REITs, the values of beta coefficients of the independent variables are obtained for each model. The standard deviation, mean and range of beta coefficients are given in the tables. For almost all risk premium betas, the standard deviation decreases when a new variable is added, except for the momentum factor. For the single factor model the highest value for the mean of risk premium belongs to the hotel-motel REITs which is 1.824 and the lowest one belongs to the healthcare REITs which is 1.263 given in Table5.10. Therefore, the hotel-motel REITs are more aggressive than other type of REITs. The same situation is valid for the three and four factor models. As it is mentioned in the overview in Chapter III, the healthcare REITs are affected from the changes in interest rates more than the other types of REITs. Hence the healthcare REITs moves with the market and the mean value of the risk premium beta is the closest one to the market beta among the other REITs.

The results of the industry and real estate index added models show that the residential REITs have the lowest mean coefficients and similar to the single, three and four factor models the hotel-motel REITs have the highest mean beta coefficients. Since the mean of risk premium beta values of residential REITs are smaller than the 60%, the residential REITs provide diversification benefits.

The beta values of the Carhart's Four Factor Model (1997) for equally weighted portfolio and for the seven categories of REITs are given in the Figures 5.1 to 5.4. As it is seen in the figures, there is not much difference between the values. The risk premium beta is closest to the market beta for the healthcare facilities REITs. The healthcare REITs are affected from the changes in interest rates because they finance their investments by issuing equity and debt instead of using the operating income. Therefore, the correlation between the healthcare REITs' returns and the market conditions is bigger than the other categories. The SMB value is highest for hotel-motel and lowest for the diversified REITs. That means the small firm effect is high for hotel-motel and low for diversified REITs. Small firm effect is investing in the stocks with low market capitalization to earn an abnormal return. These small firms tend to outperform the large ones. On the other hand the HML is lowest for the healthcare facilities. The HML value of healthcare facilities is closer to zero relative to the other REIT groups. In this case the market price of healthcare facilities is lower than its book value which is relatively better than other categories. Therefore, it is a value stock. The momentum factor is highest for the healthcare facilities and lowest for the hotel-motel REITs. The MOM is negative and that shows the underperformance of REITs. The negative load of the momentum effect indicates small expected returns. This can be the result of the debt dependence of healthcare facilities due to financing of their growth.

Table 5.1. Equally Weighted Portfolio – All REITs in the Sample

Coefficients	Single Factor	FF Three Factor	Carhart's Four Factor	Single Factor + Indusrty Ind.	FF Three Factor + Indusrty Ind.	Carhart's Four Factor + Indusrty Ind.	Single Factor + Real Estate Ind.	FF Three Factor + Real Estate Ind.	Carhart's Four Factor + Real Estate Ind.
Intercept[1]	0.035	0.024	0.025	-0.005	0.005	0.015	0.042	0.034	0.033
Mrk – Rf[2]	1.437	1.219	1.142	0.484	0.741	0.895	0.572	0.642	0.671
SMB		0.792	0.844		0.549	0.704		0.452	0.527
HML		0.849	0.549		0.686	0.507		0.511	0.374
MOM			-0.379			-0.321			-0.228
Industry Ind.				0.841	0.461	0.250			
Real Estate Ind.							0.562	0.432	0.376
Adj. R^2	0.725	0.797	0.818	0.778	0.808	0.821	0.823	0.842	0.849
F	3987.921	1978.472	1702.301	2650.998	1592.233	1387.000	3513.277	2019.296	1703.445

[1] All factors are statistically significantly different from zero in 1% significance level, except intercept.

[2] The Mrk-Rf beta values for Single-Three and Four Factor Models are statistically bigger than 1 in 5% significance level.

Table 5.2. Correlation Between Independent Variables

	Mrk-Rf	SMB	HML	MOM	Industry Index	Real Estate Index
Mrk-Rf	1.000					
SMB	0.075	1.000				
HML	0.501	-0.016	1.000			
MOM	-0.462	0.058	-0.566	1.000		
Industry Index	0.926	0.239	0.553	-0.555	1.000	
Real Estate Index	0.854	0.233	0.566	-0.559	0.864	1.000

Table 5.3. Equally Weighted Portfolio – Healthcare Facilities

Coefficients	Single Factor	FF Three Factor	Carhart's Four Factor	Single Factor + Indusrty Ind.	FF Three Factor + Indusrty Ind.	Carhart's Four Factor + Indusrty Ind.	Single Factor + Real Estate Ind.	FF Three Factor + Real Estate Ind.	Carhart's Four Factor + Real Estate Ind.
Intercept[1]	0.053	0.044	0.044	0.020	0.029	0.032	0.058	0.051	0.051
Mrk – Rf[2]	1.263	1.113	1.073	0.486	0.735	0.798	0.580	0.662	0.670
SMB		0.744	0.771		0.552	0.616		0.478	0.501
HML		0.556	0.401		0.428	0.354		0.292	0.251
MOM			-0.197			-0.131			-0.068
Industry Ind.				0.686	0.364	0.278			
Real Estate Ind.							0.444	0.338	0.321
Adj. R^2	0.644	0.697	0.704	0.684	0.705	0.708	0.714	0.729	0.730
F	2732.800	1162.731	899.425	1638.302	905.840	732.995	1885.292	1019.113	817.674

[1] All factors are statistically significantly different from zero in 1% significance level, except intercept.

[2] The Mrk-Rf beta values for Single-Three and Four Factor Models are statistically bigger than 1 in 5% significance level.

Table 5.4. Equally Weighted Portfolio – Hotel / Motel

Coefficients	Single Factor	FF Three Factor	Carhart's Four Factor	Single Factor + Indusrty Ind.	FF Three Factor + Indusrty Ind.	Carhart's Four Factor + Indusrty Ind.	Single Factor + Real Estate Ind.	FF Three Factor + Real Estate Ind.	Carhart's Four Factor + Real Estate Ind.
Intercept[1]	0.038	0.026	0.027	-0.011	0.001	0.014	0.047	0.038	0.037
Mrk – Rf[2]	1.824	1.571	1.469	0.667	0.940	1.148	0.800	0.875	0.917
SMB		0.899	0.969		0.578	0.788		0.489	0.599
HML		0.986	0.582		0.770	0.528		0.578	0.378
MOM			-0.509			-0.433			-0.332
Industry Ind.				1.021	0.609	0.324			
Real Estate Ind.							0.666	0.521	0.440
Adj. R^2	0.640	0.692	0.713	0.683	0.702	0.715	0.715	0.728	0.736
F	2688.629	1131.805	938.486	1627.213	892.757	759.861	1897.480	1011.797	843.084

[1] All factors are statistically significantly different from zero in 1% significance level, except intercept.

[2] The Mrk-Rf beta values for Single-Three and Four Factor Models are statistically bigger than 1 in 5% significance level.

Table 5.5. Equally Weighted Portfolio – Office

Coefficients	Single Factor	FF Three Factor	Carhart's Four Factor	Single Factor + Indusrty Ind.	FF Three Factor + Indusrty Ind.	Carhart's Four Factor + Indusrty Ind.	Single Factor + Real Estate Ind.	FF Three Factor + Real Estate Ind.	Carhart's Four Factor + Real Estate Ind.
Intercept[1]	0.028	0.018	0.019	-0.013	-0.002	0.008	0.036	0.028	0.028
Mrk – Rf[2]	1.415	1.189	1.111	0.444	0.703	0.860	0.501	0.567	0.595
SMB		0.798	0.850		0.551	0.708		0.431	0.504
HML		0.884	0.578		0.718	0.535		0.519	0.387
MOM			-0.386			-0.326			-0.220
Industry Ind.				0.857	0.469	0.008			
Real Estate Ind.							0.594	0.465	0.411
Adj. R^2	0.666	0.737	0.758	0.718	0.748	0.760	0.769	0.787	0.793
F	3010.449	1412.605	1183.111	1922.361	1121.659	960.178	2516.558	1395.641	1158.071

[1] All factors are statistically significantly different from zero in 1% significance level, except intercept.

[2] The Mrk-Rf beta values for Single-Three and Four Factor Models are statistically bigger than 1 in 5% significance level.

Table 5.6. Equally Weighted Portfolio – Residential

Coefficients	Single Factor	FF Three Factor	Carhart's Four Factor	Single Factor + Indusrty Ind.	FF Three Factor + Indusrty Ind.	Carhart's Four Factor + Indusrty Ind.	Single Factor + Real Estate Ind.	FF Three Factor + Real Estate Ind.	Carhart's Four Factor + Real Estate Ind.
Intercept[1]	0.041	0.030	0.031	-0.001	0.010	0.019	0.049	0.042	0.041
Mrk – Rf[2]	1.399	1.165	1.092	0.406	0.662	0.802	0.424	0.483	0.505
SMB		0.797	0.846		0.542	0.682		0.396	0.452
HML		0.918	0.634		0.747	0.584		0.519	0.416
MOM			-0.359			-0.290			-0.171
Industry Ind.				0.876	0.484	0.294			
Real Estate Ind.							0.633	0.510	0.468
Adj. R^2	0.637	0.710	0.728	0.691	0.722	0.731	0.753	0.769	0.772
F	2658.502	1235.865	1011.521	1688.777	980.456	823.553	2300.310	1258.402	1026.941

[1] All factors are statistically significantly different from zero in 1% significance level, except intercept.

[2] The Mrk-Rf beta values for Single-Three and Four Factor Models are statistically bigger than 1 in 5% significance level.

Table 5.7. Equally Weighted Portfolio – Retail

Coefficients	**Single Factor**	**FF Three Factor**	**Carhart's Four Factor**	**Single Factor + Indusrty Ind.**	**FF Three Factor + Indusrty Ind.**	**Carhart's Four Factor + Indusrty Ind.**	**Single Factor + Real Estate Ind.**	**FF Three Factor + Real Estate Ind.**	**Carhart's Four Factor + Real Estate Ind.**
Intercept[1]	0.025	0.014	0.014	-0.017	-0.004	0.007	0.033	0.024	0.023
Mrk – Rf[2]	1.484	1.231	1.147	0.482	0.789	0.970	0.541	0.620	0.653
SMB		0.877	0.934		0.652	0.834		0.516	0.602
HML		0.988	0.656		0.837	0.626		0.630	0.473
MOM			-0.418			-0.376			-0.260
Industry Ind.				0.884	0.427	0.179			
Real Estate Ind.							0.613	0.458	0.394
Adj. R^2	0.694	0.777	0.801	0.747	0.786	0.802	0.798	0.823	0.831
F	3431.982	1761.921	1520.066	2228.543	1389.567	1225.203	2996.375	1761.785	1491.204

[1] All factors are statistically significantly different from zero in 1% significance level, except intercept.

[2] The Mrk-Rf beta values for Single-Three and Four Factor Models are statistically bigger than 1 in 5% significance level.

Table 5.8. Equally Weighted Portfolio – Industrial

Coefficients	Single Factor	FF Three Factor	Carhart's Four Factor	Single Factor + Indusrty Ind.	FF Three Factor + Indusrty Ind.	Carhart's Four Factor + Indusrty Ind.	Single Factor + Real Estate Ind.	FF Three Factor + Real Estate Ind.	Carhart's Four Factor + Real Estate Ind.
Intercept[1]	0.032	0.021	0.021	-0.007	0.004	0.014	0.039	0.031	0.030
Mrk – Rf[2]	1.475	1.261	1.187	0.540	0.858	1.014	0.580	0.670	0.696
SMB		0.896	0.946		0.691	0.848		0.548	0.616
HML		0.817	0.527		0.680	0.498		0.471	0.346
MOM			-0.365			-0.324			-0.208
Industry Ind.				0.825	0.389	0.175			
Real Estate Ind.							0.581	0.442	0.391
Adj. R^2	0.666	0.735	0.752	0.710	0.742	0.753	0.757	0.776	0.781
F	3015.549	1396.866	1146.621	1854.690	1085.549	922.638	2357.140	1311.791	1080.136

[1] All factors are statistically significantly different from zero in 1% significance level, except intercept.

[2] The Mrk-Rf beta values for Single-Three and Four Factor Models are statistically bigger than 1 in 5% significance level.

Table 5.9. Equally Weighted Portfolio – Diversified

Coefficients	Single Factor	FF Three Factor	Carhart's Four Factor	Single Factor + Indusrty Ind.	FF Three Factor + Indusrty Ind.	Carhart's Four Factor + Indusrty Ind.	Single Factor + Real Estate Ind.	FF Three Factor + Real Estate Ind.	Carhart's Four Factor + Real Estate Ind.
Intercept[1]	0.045	0.037	0.038	0.006	0.013	0.022	0.051	0.045	0.044
Mrk – Rf[2]	1.486	1.288	1.208	0.548	0.691	0.838	0.753	0.795	0.829
SMB		0.590	0.644		0.287	0.435		0.299	0.390
HML		0.787	0.474		0.583	0.411		0.498	0.333
MOM			-0.395			-0.307			-0.273
Industry Ind.				0.827	0.576	0.374			
Real Estate Ind.							0.476	0.369	0.302
Adj. R^2	0.665	0.708	0.728	0.709	0.723	0.733	0.725	0.737	0.745
F	2998.394	1225.294	1013.327	1839.063	989.153	832.604	1992.020	1058.734	885.279

[1] All factors are statistically significantly different from zero in 1% significance level, except intercept.

[2] The Mrk-Rf beta values for Single-Three and Four Factor Models are statistically bigger than 1 in 5% significance level.

Table 5.10. Mean Values of Betas

	B_{Mrk-Rf}[1]	B_{SMB}	B_{HML}	B_{MOM}	$B_{Ind.I}$	$B_{RE.I}$
A[2]						
Equally Weighted P.	1.437					
Healthcare Facilities	1.263					
Hotel-Motel	1.824					
Office	1.415					
Residential	1.399					
Retail	1.484					
Industrial	1.475					
Diversified	1.486					
B[3]						
Equally Weighted P.	1.219	0.792	0.849			
Healthcare Facilities	1.113	0.744	0.556			
Hotel-Motel	1.571	0.899	0.986			
Office	1.189	0.798	0.884			
Residential	1.165	0.797	0.918			
Retail	1.231	0.877	0.988			
Industrial	1.261	0.896	0.817			
Diversified	1.288	0.590	0.787			

Table 5.10. (cont'd)

	B_{Mrk-Rf}	B_{SMB}	B_{HML}	B_{MOM}	$B_{Ind.I}$	$B_{RE.I}$
C[4]						
Equally Weighted P.	1.142	0.844	0.549	-0.379		
Healthcare Facilities	1.073	0.771	0.401	-0.197		
Hotel-Motel	1.469	0.969	0.582	-0.509		
Office	1.111	0.850	0.578	-0.386		
Residential	1.092	0.846	0.634	-0.359		
Retail	1.147	0.934	0.656	-0.418		
Industrial	1.187	0.946	0.527	-0.365		
Diversified	1.208	0.644	0.474	-0.395		
D[5]						
Equally Weighted P.	0.895	0.704	0.507	-0.321	0.250	
Healthcare Facilities	0.798	0.616	0.354	-0.131	0.278	
Hotel-Motel	1.148	0.788	0.528	-0.433	0.324	
Office	0.860	0.708	0.535	-0.326	0.254	
Residential	0.802	0.682	0.584	-0.290	0.294	
Retail	0.970	0.834	0.626	-0.376	0.179	
Industrial	1.014	0.848	0.498	-0.324	0.175	
Diversified	0.913	0.786	0.590	-0.354	0.208	

Table 5.10. (cont'd)

	$B_{Mrk\text{-}Rf}$	B_{SMB}	B_{HML}	B_{MOM}	$B_{Ind.I}$	$B_{RE.I}$
E[6]						
Equally Weighted P.	0.671	0.527	0.374	-0.228		0.376
Healthcare Facilities	0.670	0.501	0.251	-0.068		0.321
Hotel-Motel	0.917	0.599	0.378	-0.332		0.440
Office	0.595	0.504	0.387	-0.220		0.411
Residential	0.505	0.452	0.416	-0.171		0.468
Retail	0.647	0.594	0.479	-0.261		0.405
Industrial	0.696	0.617	0.346	-0.208		0.391
Diversified	0.829	0.390	0.333	-0.273		0.302

[1] The Mrk-Rf beta values for Single-Three and Four Factor Models are statistically bigger than 1 in 5% significance level.

[2] Single Factor Model

[3] Fama-French Three Factor Model

[4] Carhart's Four Factor Model

[5] Carhart's Four Factor + Industry Index

[6] Carhart's Four Factor Model + Real Estate Index

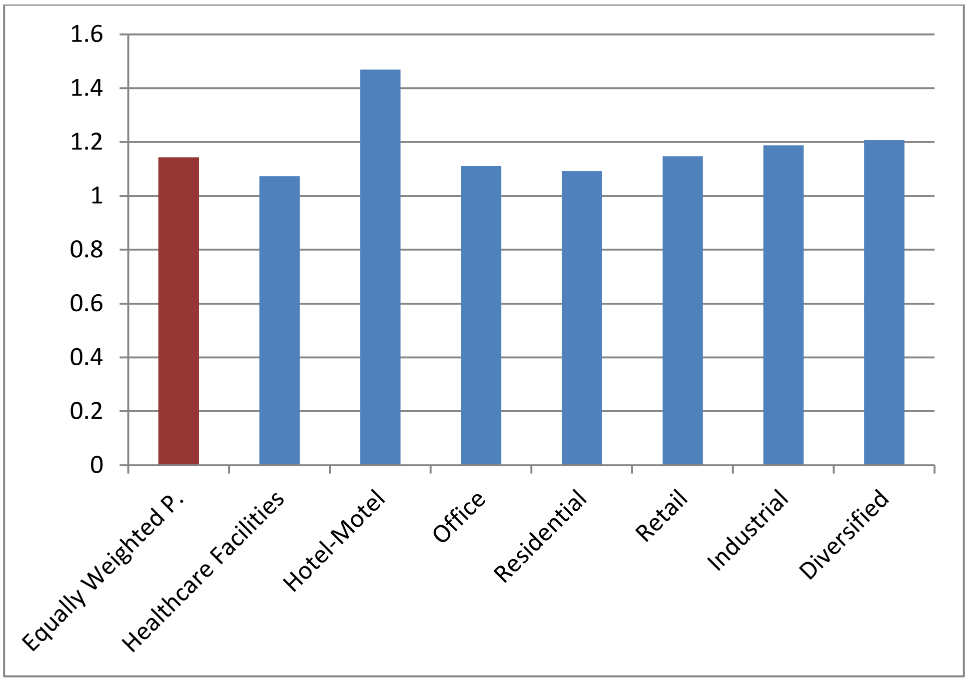

Figure 5.1. $\beta_{Mrk\text{-}Rf}$ of Carhart's Four Factor Model

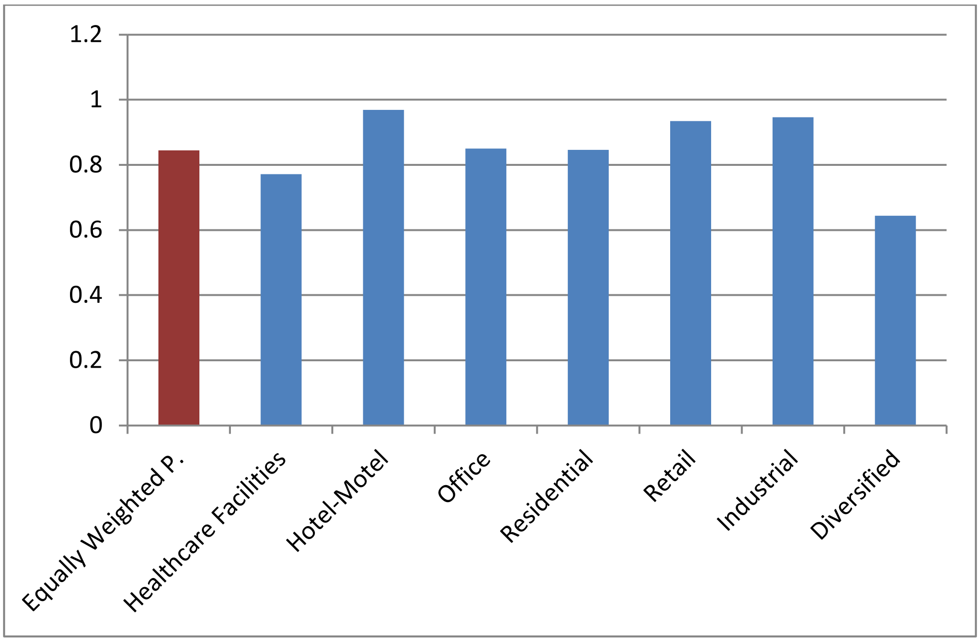

Figure 5.2. β_{SMB} of Carhart's Four Factor Model

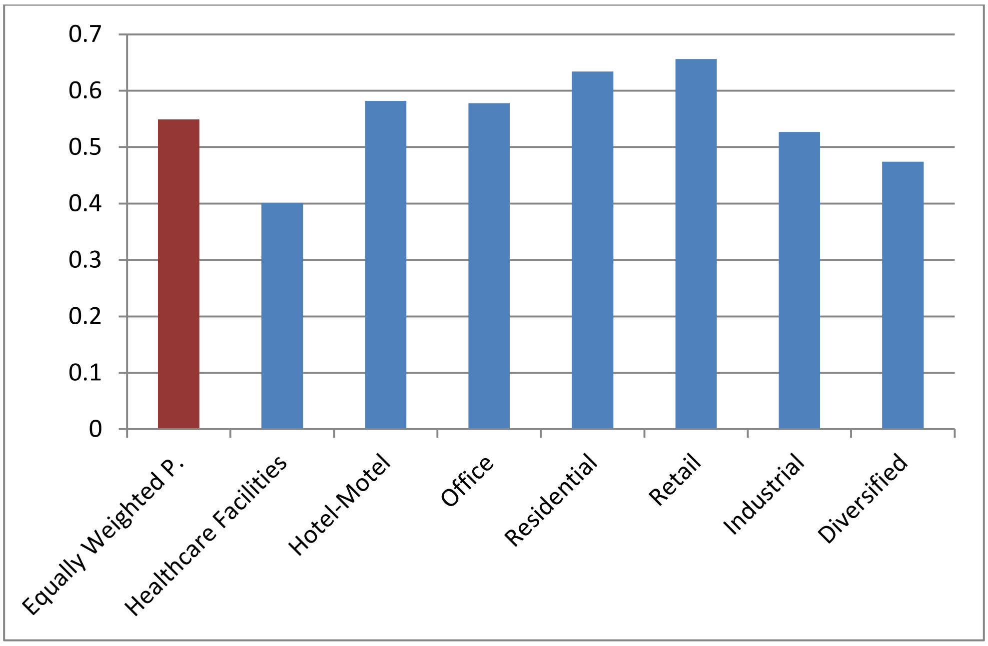

Figure 5.3. β_{HML} of Carhart's Four Factor Model

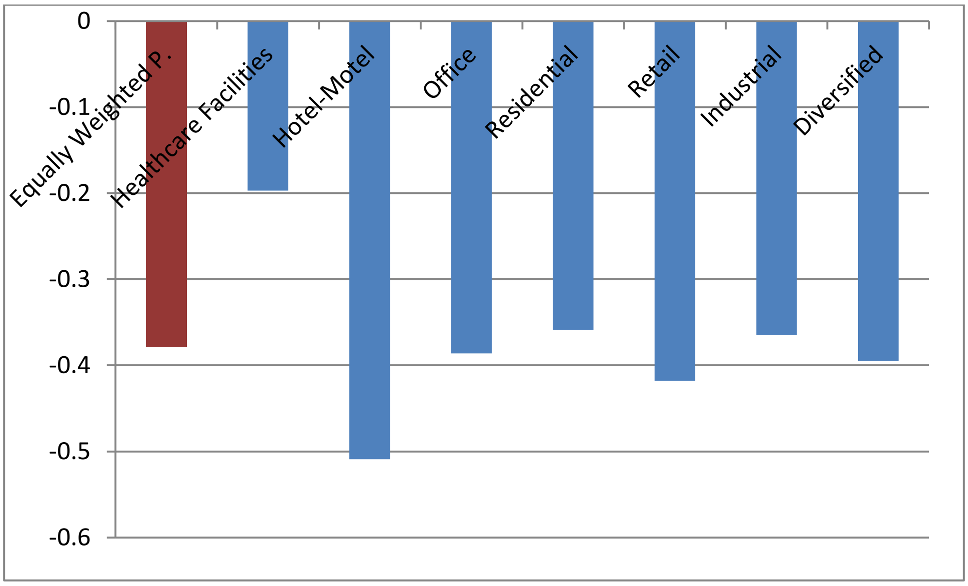

Figure 5.4. β_{MOM} of Carhart's Four Factor Model

CHAPTER VI

CONCLUSION

Using REITs in the portfolio has diversification benefits according to the results of the studies in the literature and the analyses that are done by NAREIT. Additionally there is evidence that REITs which have 60% or less correlation with the market provide diversification. By using various methods, the beta coefficients of REITs are examined. These methods are Capital Asset Pricing Model (CAPM) of Sharpe (1964) and Lintner (1965), the Fama and French’s 3-Factor Model (1993) and the Carhart’s 4-Factor Model (1995). In addition to these models, the industry and the real estate indexes are added to the each model. Therefore, two, four and five factor models are established. The daily returns of US equity REITs are used. Moreover the US REITs are categorized in many groups according to their investment areas. These are healthcare, hotel-motel, office, residential, retail, industrial and diversified REITs.

The results are divided into four groups; these are the equally weighted portfolio, descriptive statistics of REITs, equally weighted portfolios for the each category and the descriptive statistics for the each category.

From the results of the analyses which are done for the constructed equally weighted portfolio and the significance of descriptive statistics of all REITs, the followings are concluded:

- The β values of the risk premium are bigger than one, for the the Capital Asset Pricing Model of Sharpe (1964) and Linter (1965), the Fama and French's Three Factor Model (1993) and the Carhart's Four Factor Model (1997). Therefore, the portfolio does better than the market does when market conditions are good and vice versa. That shows the portfolio provides no diversification and the portfolio is more volatile than the market. However when the industry and the real estate indexes are added to the models, the β values of the risk premium decrease below one. In spite of that the beta value is smaller than 60% level only for the two factor models. The diversification benefit is seen in this model only for the equally weighted portfolio.
- All beta values are statistically significantly different from zero and the intercept is not statistically significantly different from zero for all applied models. Therefore, there is no abnormal return exists. The same result was concluded in the research of K. C. Chan, Patrick H. Hendershott and Anthony B. Sanders, (1990).
- The positiveness of the SMB and HML betas indicates that the REIT companies are small and well-managed companies have high book-to-market ratios. Additionally the momentum factor is negative for all models.

The momentum effect is an empirical result of the tendency of stock prices. When a stock price increase, it continues to increase and when it falls, it tends to fall further. In this case negative momentum factor shows small expected returns.

- When new independent variables are added to the models, the Adjusted R^2 value increases and the deviation from mean decreases. Therefore, the data better fits to the new variable added models.

The finding for the categorized REITs and the results for descriptive statistics are listed as follows:

- When the beta coefficients of the risk premium are compared, the hotel-motel REITs have the highest and the healthcare REITs have the lowest beta. The betas of the single, three and four factor models are bigger than the market beta. Therefore, the diversification benefit does not exist according to these models. Although the betas are bigger than one for the single, there and the four factor models, the mean of risk premium betas for the residential REITs are smaller than 60% for the industry and the real estate index added models. Similarly the highest beta coefficients belong to the hotel-motel REITs and provide no diversification benefit.
- The betas of SMB, HML are positive and the momentum factors are negative. Therefore, the results are same for the categorized REITs either.

In summary, REITs have no abnormal return and the beta fo the risk premium decreases when new variables are added. That shows the incapability of single, three and four factor models in explaining the return movements of REITs. According to the results of the analyses, the REITs are inconsistent in providing the diversification. The new variable added models indicate betas which are smaller than the 60% level for residential REITs.

BIBLIOGRAPHY

Berman, M., Momentum Effect – Does it Exist in REITs?, May, 2010. Available at http://www.velocity-trading.com/admin/upload/research/Momentum_Effects.pdf

Bodie, Z., Kane, A., Marcus, A. J., Investments, McGraw-Hill, Eight Edition, 2009

Campbell, Robert D., Ghosh, C., Petrova, M., Sirmans, C. F., Corporate Governance and Performance in the Market for Corporate Control: The Case of REITs, Journal of Real Estate Finance and Economics, V.42, N.4, pp: 451 – 480, May, 2011

Carhart, Mark M., On Persistence in Mutual Fund Performance, The Journal of Finance, Vol.52, No.1, pp: 57 – 82, Mar., 1997.

Chan, K. C., Hendershott, Patrick H. and Sanders, Anthony B., Risk and Return on Real Estate: Evidence from Equity REITs, NBER Working paper Series, Working Paper No: 3311, Cambridge, March, 1990

Chang, G. D., Chang, Y. T., Time-Varying Risk Premia for Size Effects on Equity REITs, National Taiwan University of Science and Technology, Taiwan, 2007

Chiang, Kevin C. H., Lee, Ming-Long and Wisen, Craig H., Another Look at the Asymmetric REIT-Beta Puzzle, Journal of Real Estate Research, Vol.26, No: 1, 2004

Chiang, Kevin C.H., Kozhevnikov, K., Lee Ming-Long and Wisen, Craig H., Further Evidence on the Performance of Funds of Funds: The Case of Real Estate Mutual Funds, Real Estate Economics, Vol.36, No.1, pp: 47 – 61, Spring, 2008

Chui, Andy C. W., Titman, Sheridan and Wei, John K. C., Intra-Industry Momentum: The Case of REITs, Working Paper, 2001

Derwall, Jeroen, Huij, Joop, Brounen, Dirk and Marquering, Wessel, REIT Momentum and the Performance of Real Estate Mutual Funds, Financial Analyst Journal, Vol.65, No: 5, 2009

Doane, David P., Seward, Lori E., Applied Statistics in Business and Economics, McGraw-Hill/Irwin, Second Edition, 2009

Fama, Eugene F., and French, Kenneth R., The Capital Asset Pricing Model: Theory and Evidence, Journal of Economic Perspectives, Vol.18, No.3, pp: 25 – 46, Summer, 2004.

Fama, Eugene F., and French, Kenneth R., Common Risk Factors in the Returns on Stocks and Bonds, Journal of Financial Economics, Vol.33, pp: 3 – 56, 1993.

Fama, Eugene F., and French, Kenneth R., Multifactor Explanations of Asset Pricing Anomalies, Journal of Finance, Vol.51, Issue.1, pp: 55 – 84, Mar., 1996.

Fama, Eugene F., and French, Kenneth R., Industry Costs of Equity, Journal of Financial Economics, Vol.43, pp: 153 – 193, 1997.

Fama, Eugene F., and French, Kenneth R., The Cross-Section of Expected Stock Returns, Journal of Finance, Vol.47, Issue.2, pp: 427 – 465, Jun., 1992.

Fama, Eugene F., and French, Kenneth R., Size and Book-to-Market Factors in Earnings and Returns, Journal of Finance, Vol.50, Issue.1, pp: 131 – 155, Mar., 1995.

Fama, Eugene F., and MacBeth, James D., Risk, Return, and Equilibrium: Empirical Tests, The Journal of Political Economy, Vol.81, No.3, pp: 607 - 636, May – Jun., 1973.

Ferreira, Miguel A., Freitas Miguel, António and Ramos, Sofia Brito, The Determinants of Mutual Fund Performance: A Cross-Country Study, Swiss Finance Institute Research Paper N.31, Nov., 2006.

Frequently Asked Questions About REITs?

Available at http://www.reit.com/portals/0/PDF/2011FAQ.pdf

Global Real Estate Investment Trust Report, Ernst & Young, 2010. Available at http://www.ey.com/Publication/vwLUAssets/Global-REIT-report-2010-Against-all-odds/$FILE/Global_REIT_report_2010_Against_all_odds.pdf

Jegadeesh, N., Titman, S., Returns to Buying Winners and Selling Losres: Implications for Stock Market Efficiency, Journal of Finance, V.48, Issue.1, pp: 65 – 91, Mar., 1993.

Lam, Kenneth, Is the Fama-French Three-Factor Model Better than the CAPM?, Simon Fraser University, Canada, 2005

Le Sourd, V., Performance Measurement for Traditional Investment, Literature Survey, Edhec Risk and Asset Management Research Centre, Jan., 2007

Levitt, Aaron, The Wide World of Real Estate, Sep, 2009

Available at http://stocks.investopedia.com/stock-analysis/2009/The-Wide-World-Of-Real-Estate-RWX-WPS-IFGL-RWO0923.aspx#axzz1kwOzPrpp

Ling, David and Naranjo, Andy, The Dynamics of REIT Capital Flows and Returns, Real Estate Economics, Vol.31, Issue.3, pp: 405 – 434, Aug., 2003

Peterson, James D. and Hsieh, Cheng-Ho, Do Common Risk Factors in the Returns on Stock and Bonds Explain Returns on REITs?, Real Estate Economics, Vol.25, No: 5, Summer, 1997

Sharpe, William F., Capital Asset Prices: A Theory of Market Equilibrium under Conditions of Risk, The Journal of Finance, Vol.19, No.3, pp: 425 – 442, Sep., 1964

Scheurle, P., Spremann, K., Size, Book-to-Market, and Momentum During the Business Cycle, Review of Managerial Science, V.4, pp: 201 – 215, 2010

Simpson, M. William, Ramchander, Sanjay, Webb, James R., The Asymmetric Response of Equity REIT Returns to Inflation, Journal of Real Estate Finance nad Economics, V.34, No.4, 2007

APPENDICES

APPENDIX A

Descriptive Statistics of REITs

1.1. Single Factor Model

Table 1.1.1. Single Factor Model - Risk Premium Beta

Descriptive statistics[1]	
count	117
mean	1.437
sample standard deviation	0.576
minimum	-0.026
maximum	4.229

[1] The minimum and the maximum values are statistically different from each other in 5% significance level.

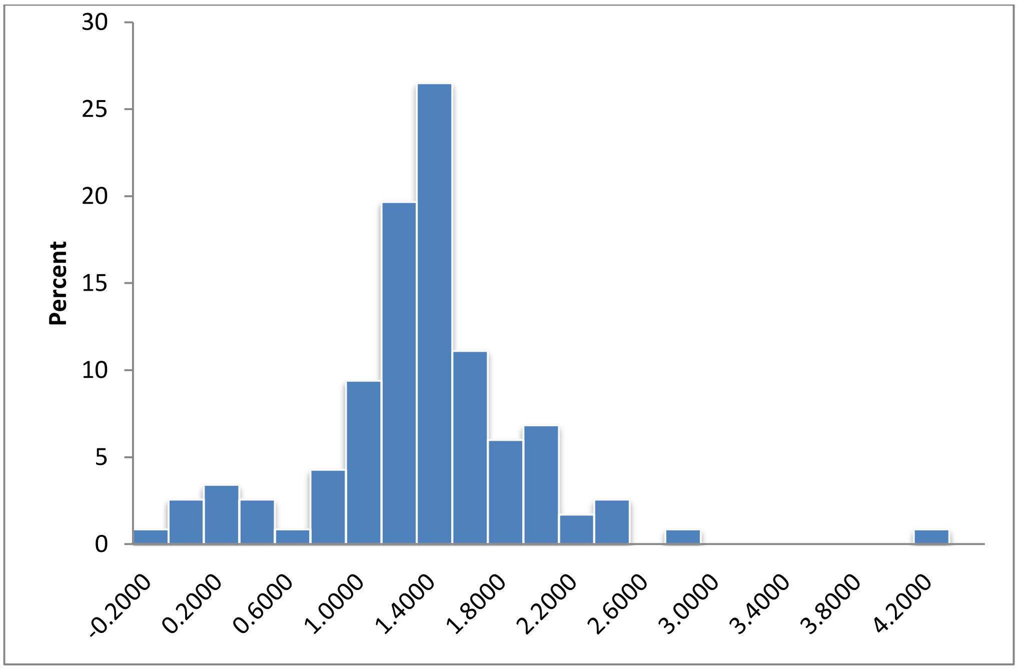

Figure 1.1.1. Single Factor M. Risk Premium Beta

1.2. Three Factor Model

Table 1.2.1. Three Factor Model - Risk Premium Beta

Descriptive statistics[1]	
count	117
mean	1.219
sample standard deviation	0.515
minimum	-0.038
maximum	4.301

[1] The minimum and the maximum values are statistically different from each other in 5% significance level.

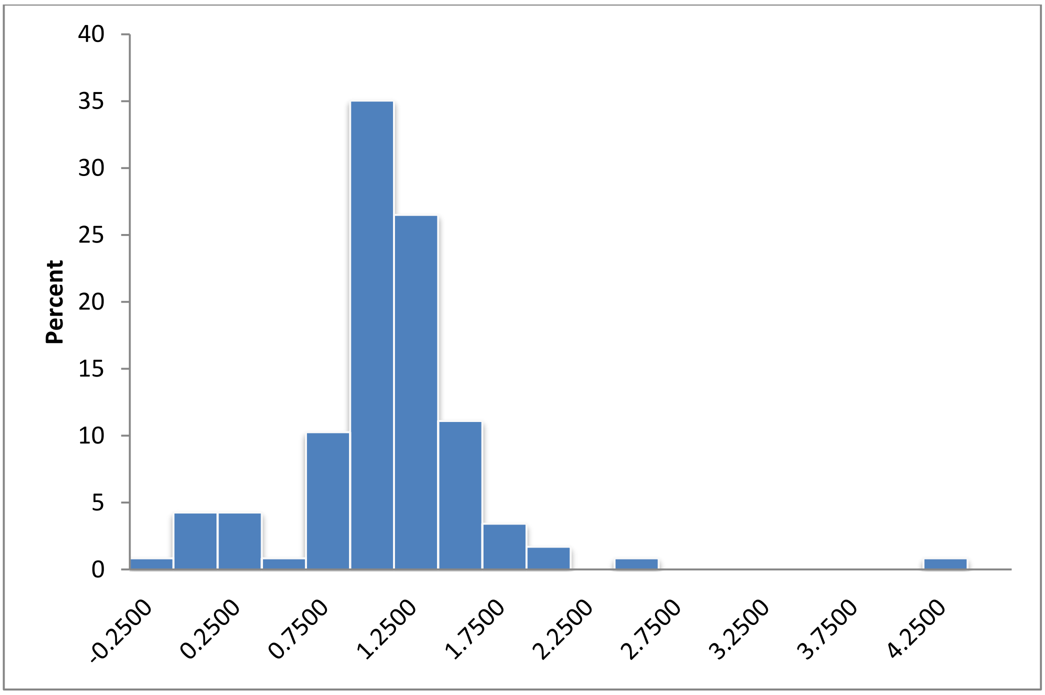

Figure 1.2.1. Three Factor M. Risk Premium Beta

Table 1.2.2. Three Factor Model – SMB Beta

Descriptive statistics[1]	
count	117
mean	0.792
sample Standard Deviation	0.431
minimum	-0.864
maximum	2.063

[1] The minimum and the maximum values are statistically different from each other in 5% significance level.

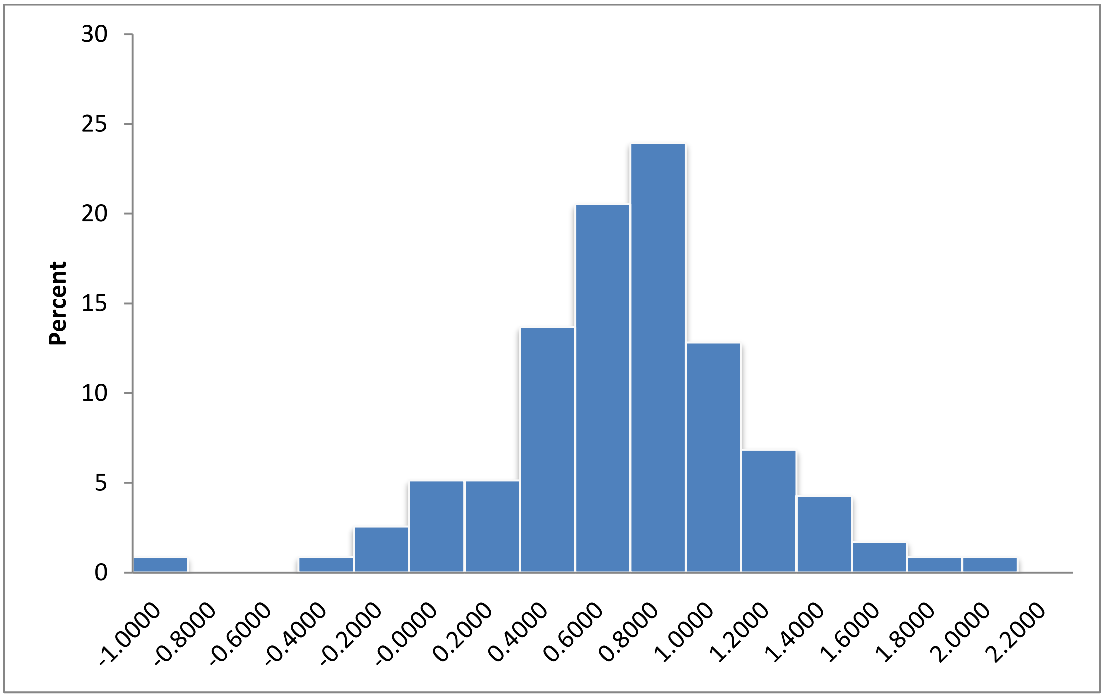

Figure 1.2.2. Three Factor M. SMB Beta

Table 1.2.3. Three Factor Model – HML Beta

Descriptive statistics[1]	
count	117
mean	0.849
sample standard deviation	0.510
minimum	-0.194
maximum	2.630

[1] The minimum and the maximum values are statistically different from each other in 5% significance level.

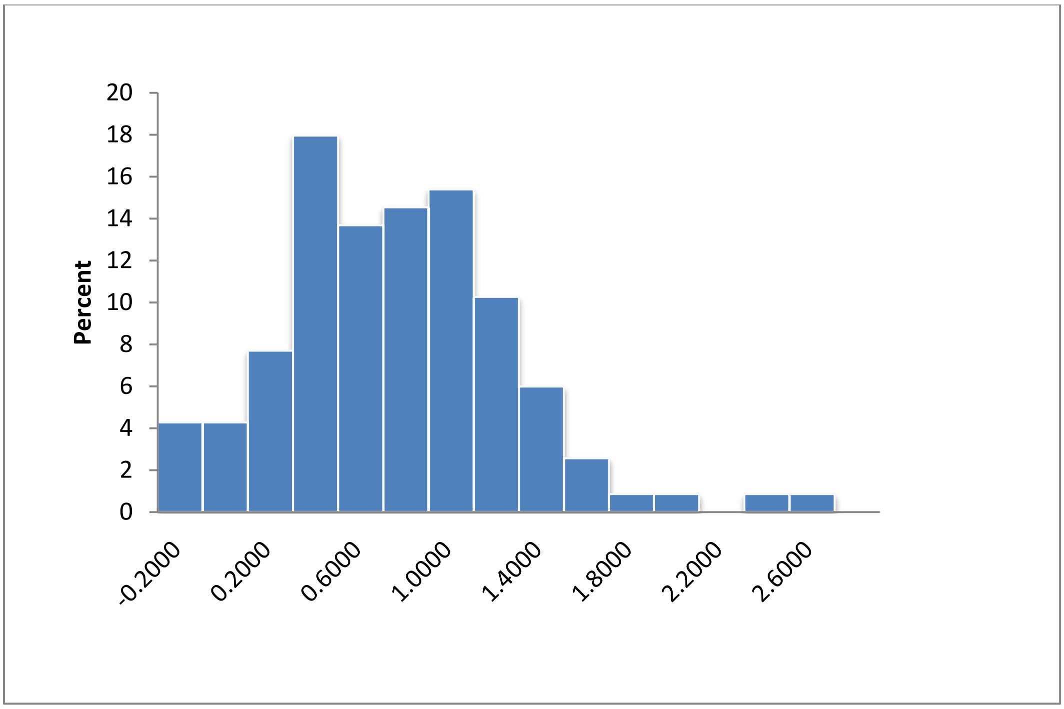

Figure 1.2.3. Three Factor M. HML Beta

1.3. Four Factor Model

Table 1.3.1. Four Factor Model - Risk Premium Beta

Descriptive statistics[1]	
count	117
mean	1.142
sample standard deviation	0.477
minimum	-0.037
maximum	4.048

[1] The minimum and the maximum values are statistically different from each other in 5% significance level.

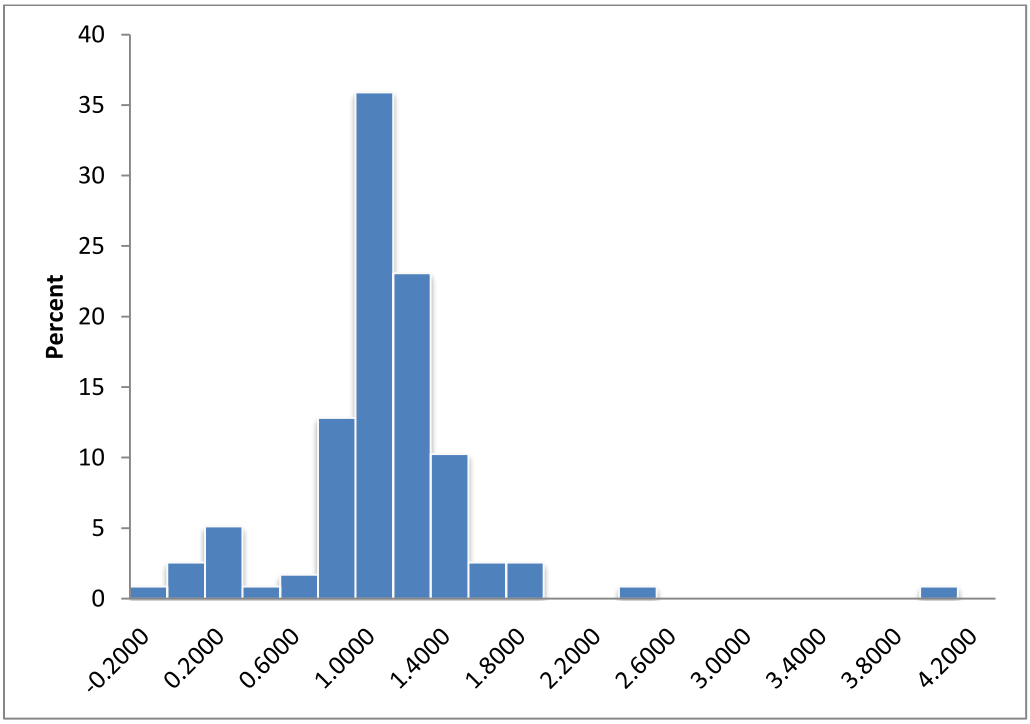

Figure 1.3.1. Four Factor M. Risk Premium Beta

Table 1.3.2. Four Factor Model – SMB Beta

Descriptive statistics[1]	
count	117
mean	0.844
sample standard deviation	0.438
minimum	-0.693
maximum	2.159

[1] The minimum and the maximum values are statistically different from each other in 5% significance level.

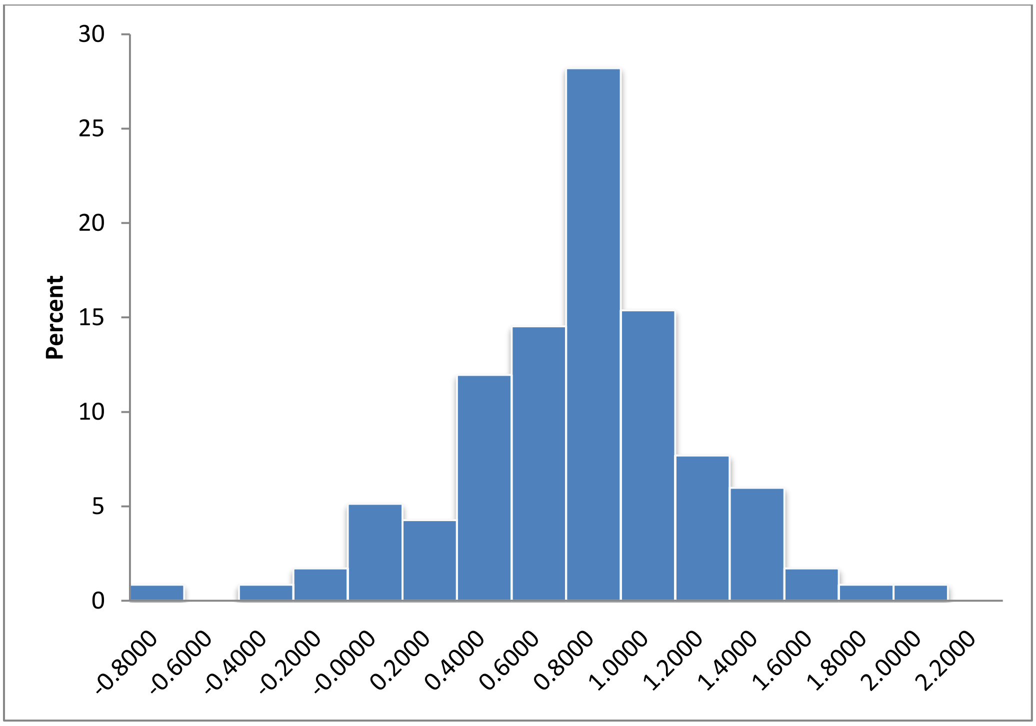

Figure 1.3.2. Four Factor M. SMB Beta

Table 1.3.3. Four Factor Model – HML Beta

Descriptive statistics[1]	
count	117
mean	0.549
sample standard deviation	0.398
minimum	-1.189
maximum	2.007

[1] The minimum and the maximum values are statistically different from each other in 5% significance level.

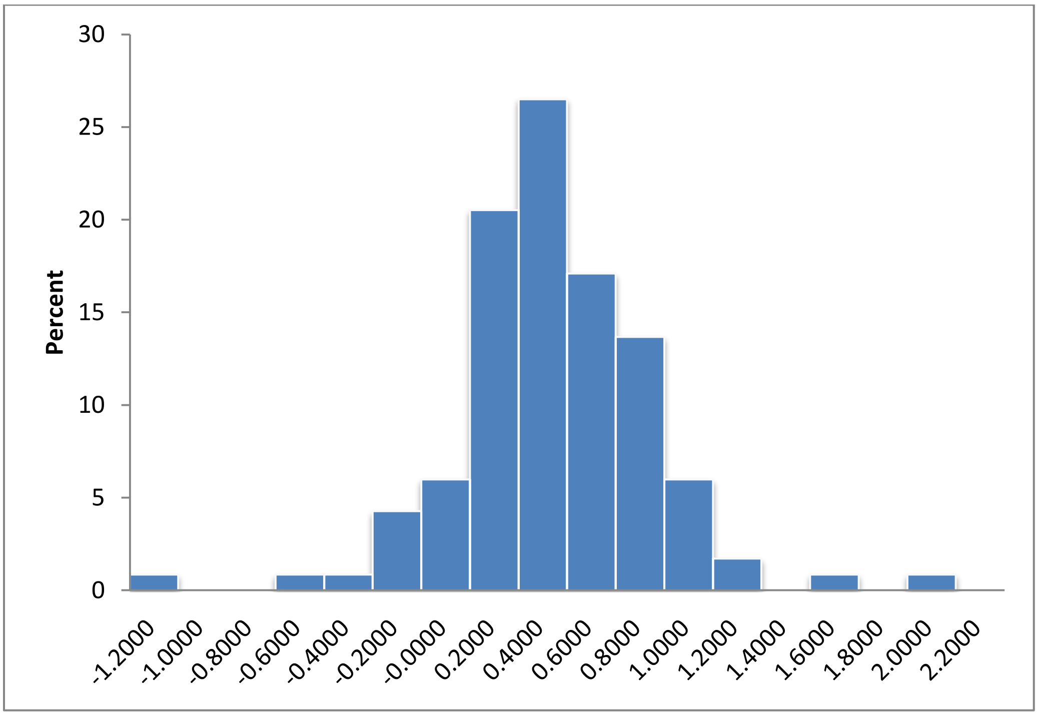

Figure 1.3.3. Four Factor M. HML Beta

Table 1.3.4. Four Factor Model – MOM Beta

Descriptive statistics[1]	
count	117
mean	-0.379
sample standard deviation	0.245
minimum	-1.254
maximum	0.240

[1] The minimum and the maximum values are statistically different from each other in 5% significance level.

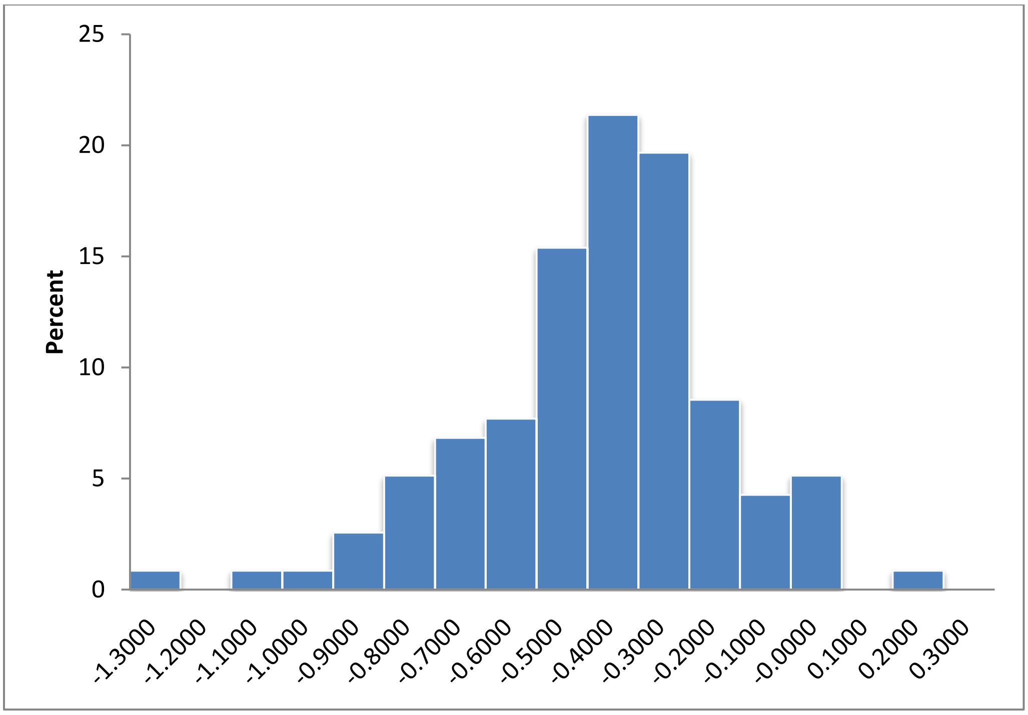

Figure 1.3.4. Four Factor M. MOM Beta

1.4. Two Factor Model - Industry Index Added

Table 1.4.1. Two Factor Model Industry Index Added- Risk Premium Beta

Descriptive statistics[1]	
count	117
mean	0.484
sample standard deviation	0.366
minimum	-0.366
maximum	3.158

[1] The minimum and the maximum values are statistically different from each other in 5% significance level.

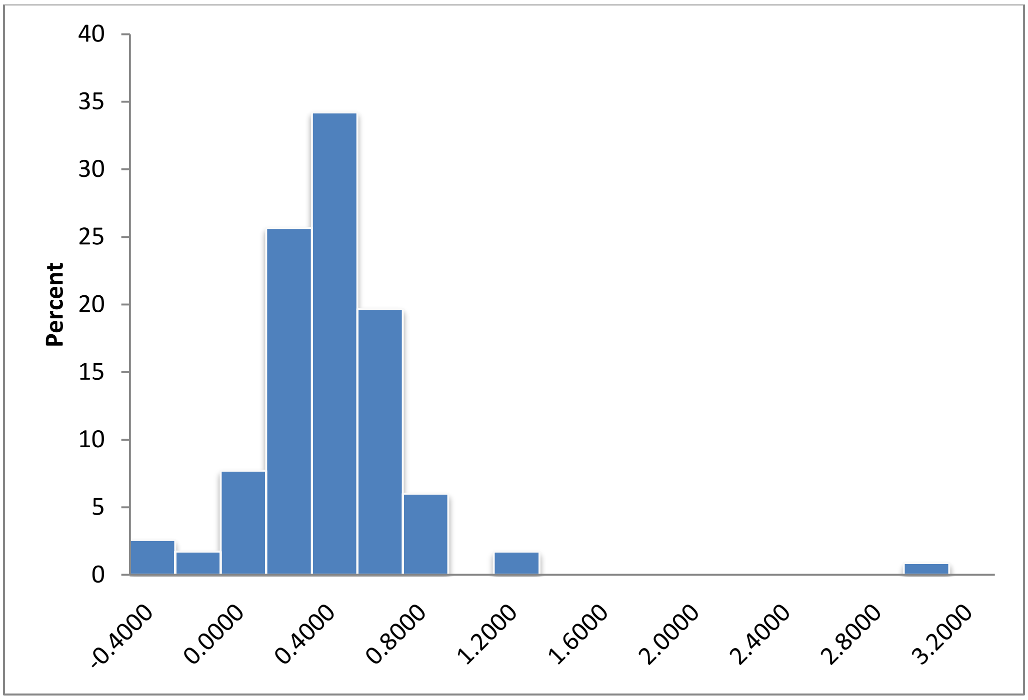

Figure 1.4.1. Two Factor M. Risk Premium Beta

Table 1.4.2. Two Factor Model Industry Index Added - Industry Index Beta

Descriptive statistics[1]	
count	117
mean	0.841
sample standard deviation	0.336
minimum	-0.081
maximum	1.617

[1] The minimum and the maximum values are statistically different from each other in 5% significance level.

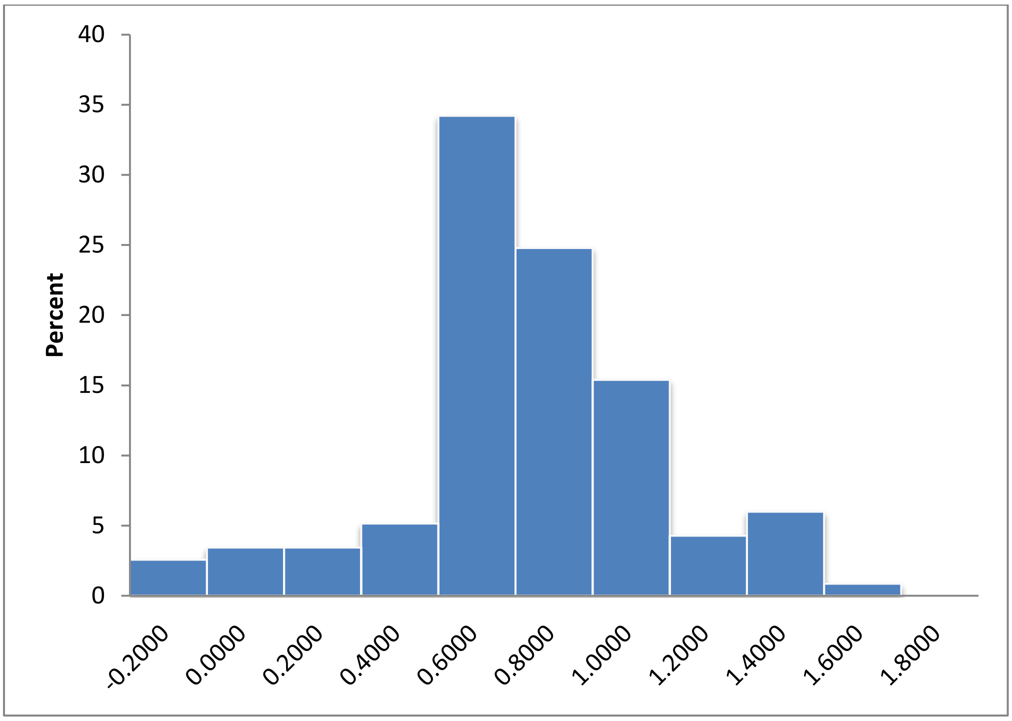

Figure 1.4.2. Two Factor M. Industry Index Beta

1.5. Four Factor Model - Industry Index Added

Table 1.5.1. Four Factor Model Industry Index Added - Risk Premium Beta

Descriptive statistics[1]	
count	117
mean	0.741
sample standard deviation	0.344
minimum	-0.289
maximum	2.338

[1] The minimum and the maximum values are statistically different from each other in 5% significance level.

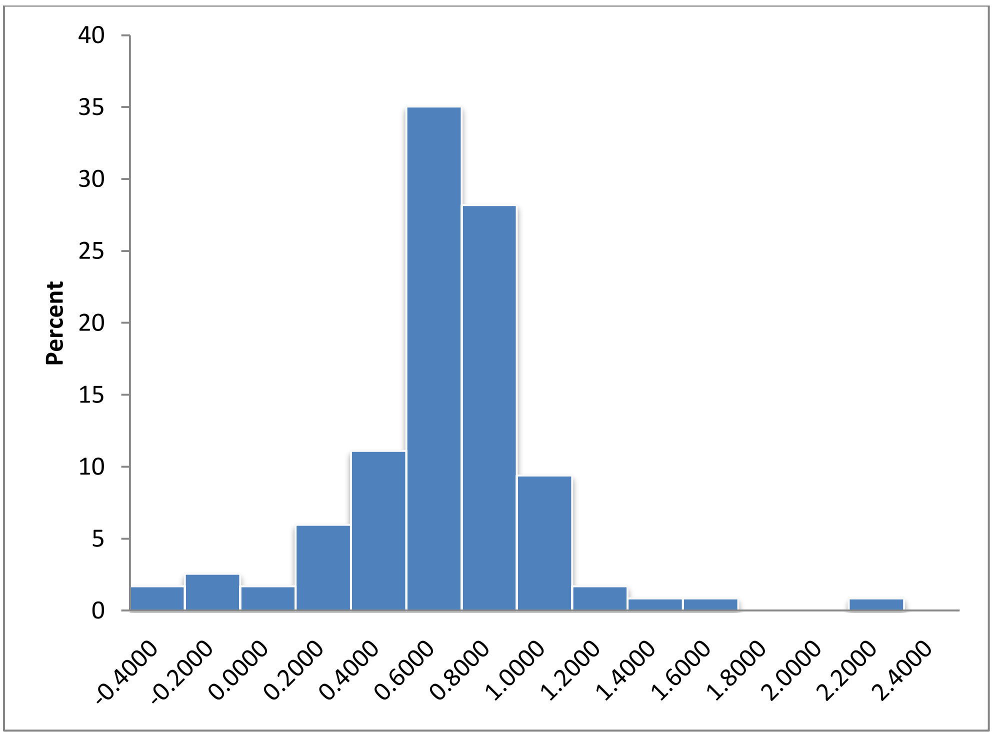

Figure 1.5.1 Four Factor Model Risk Premium Beta

Table 1.5.2. Four Factor Model Industry Index Added – SMB Beta

Descriptive statistics[1]	
count	117
mean	0.549
sample standard deviation	0.447
minimum	-1.861
maximum	1.747

[1] The minimum and the maximum values are statistically different from each other in 5% significance level.

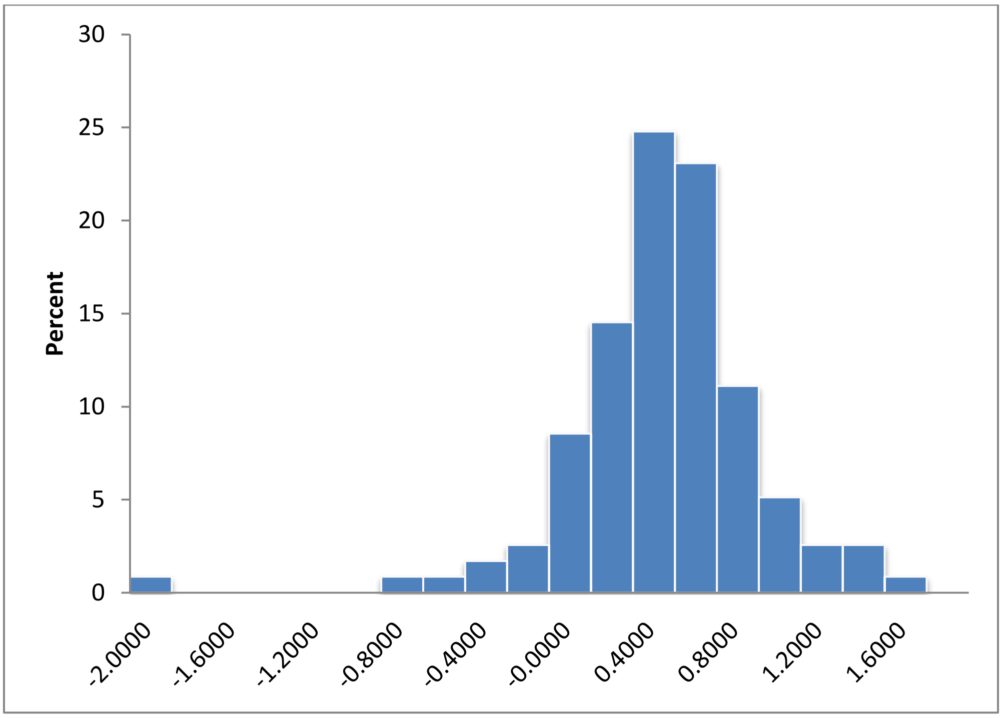

Figure 1.5.1 Four Factor M. SMB Beta

Table 1.5.3. Four Factor Model Industry Index Added – HML Beta

Descriptive statistics[1]	
count	117
mean	0.686
sample standard deviation	0.481
minimum	-0.864
maximum	2.234

[1] The minimum and the maximum values are statistically different from each other in 5% significance level.

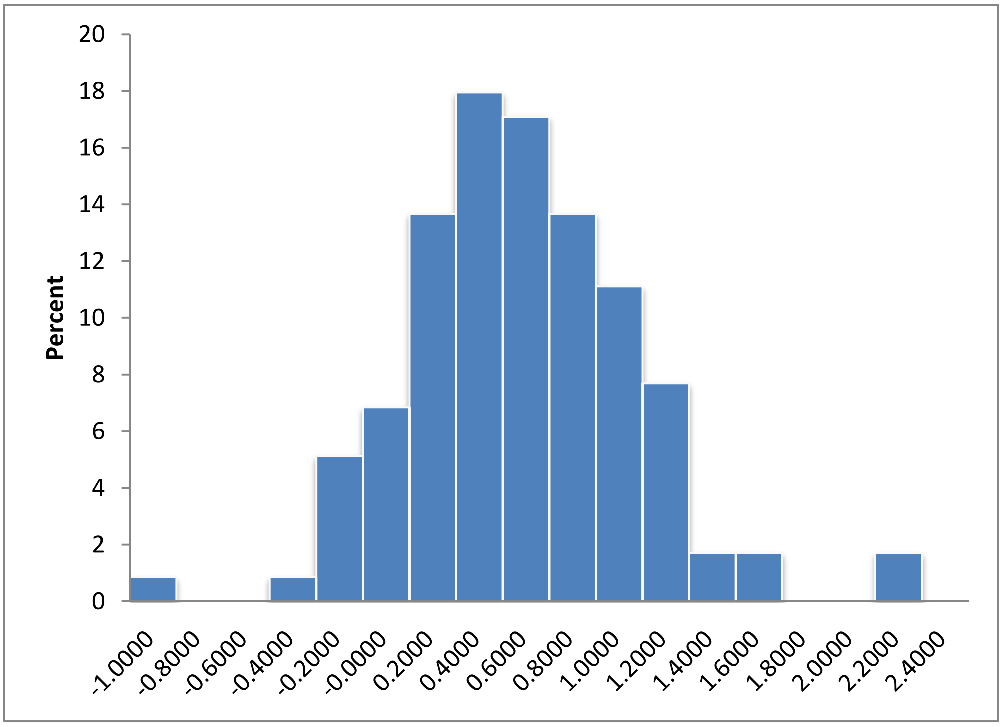

Figure 1.5.3. Four Factor M. HML Beta

Table 1.5.4. Four Factor Model Industry Index Added - Industry Index Beta

Descriptive statistics[1]	
count	117
mean	0.461
sample standard deviation	0.261
minimum	-0.278
maximum	1.894

[1] The minimum and the maximum values are statistically different from each other in 5% significance level.

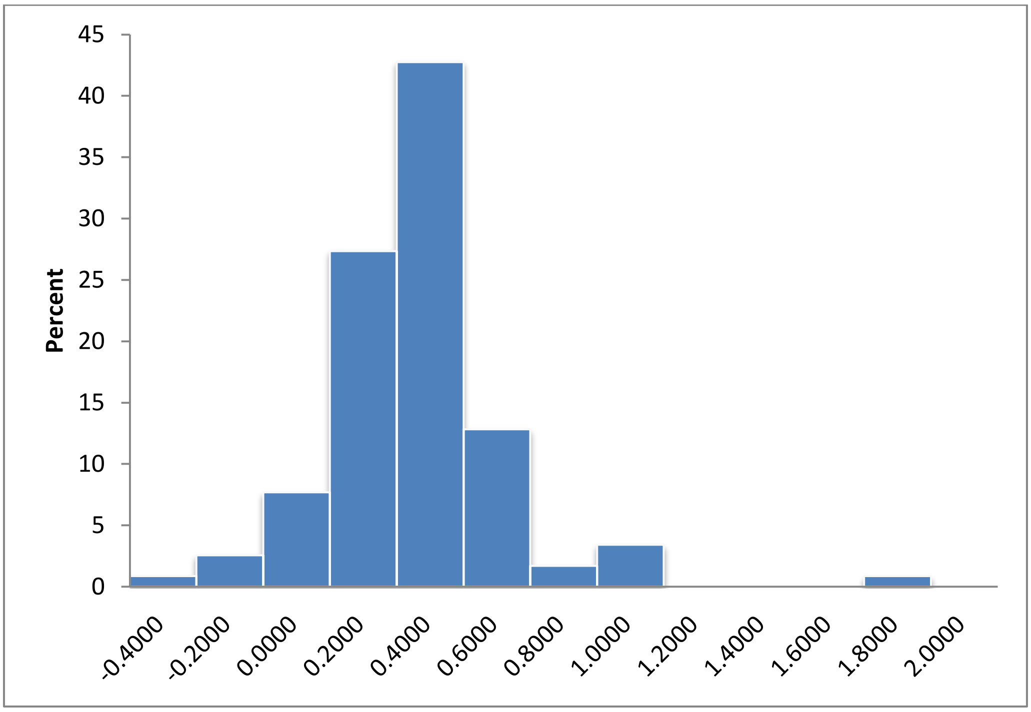

Figure 1.5.4. Four Factor M. Industry Index Beta

1.6. Five Factor Model - Industry Index Added

Table 1.6.1. Five Factor Model Industry Index Added - Risk Premium Beta

Descriptive statistics[1]	
count	117
mean	0.895
sample standard deviation	0.423
minimum	-0.341
maximum	2.799

[1] The minimum and the maximum values are statistically different from each other in 5% significance level.

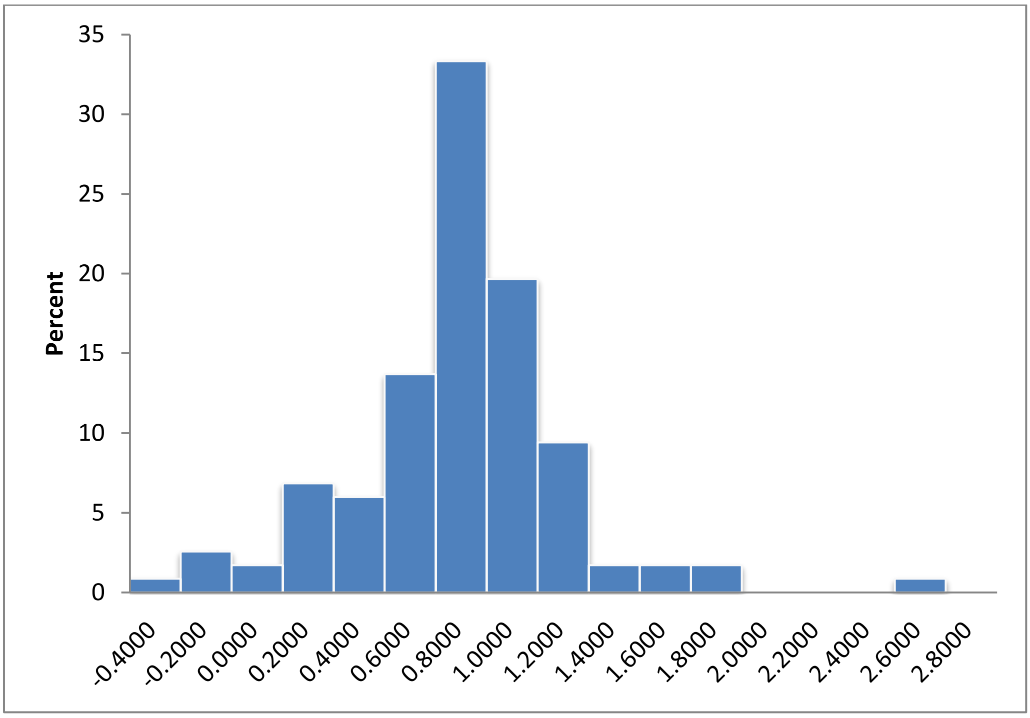

Figure 1.6.1. Five Factor M. Risk Premium Beta

Table 1.6.2. Five Factor Model Industry Index Added – SMB Beta

Descriptive statistics[1]	
count	117
mean	0.704
sample standard deviation	0.466
minimum	-1.398
maximum	2.066

[1] The minimum and the maximum values are statistically different from each other in 5% significance level.

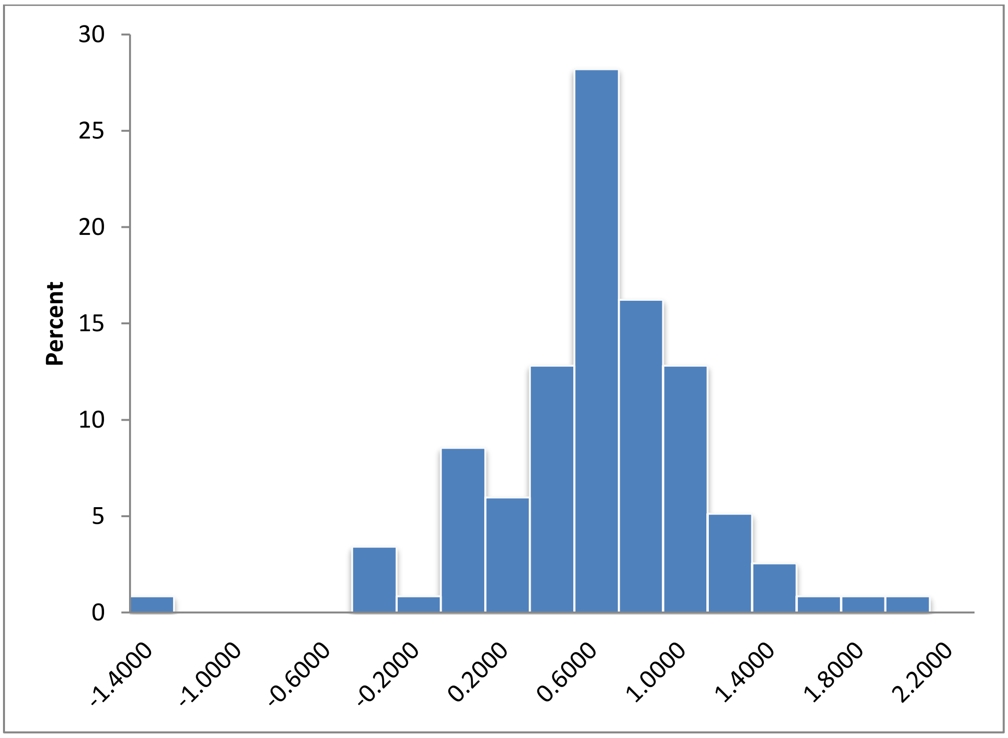

Figure 1.6.2. Five Factor M. SMB Beta

Table 1.6.3. . Five Factor Model Industry Index Added – HML Beta

Descriptive statistics[1]	
count	117
mean	0.507
sample standard deviation	0.405
minimum	-1.401
maximum	1.887

[1] The minimum and the maximum values are statistically different from each other in 5% significance level.

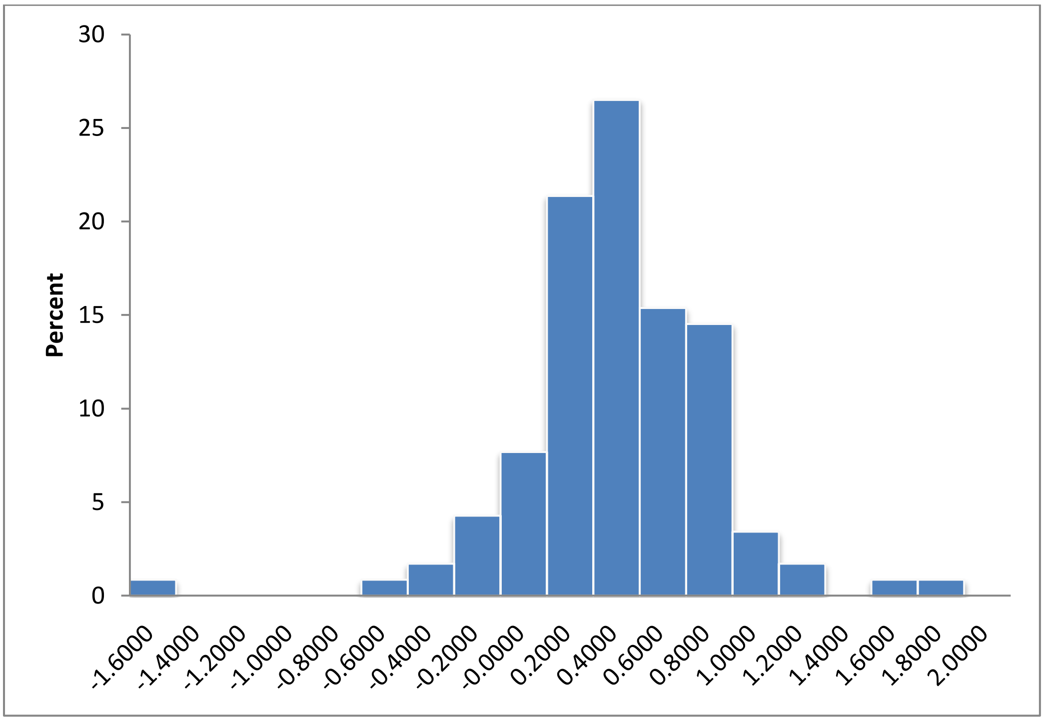

Figure 1.6.3. Five Factor M. HML Beta

Table 1.6.4. . Five Factor Model Industry Index Added – MOM Beta

Descriptive statistics[1]	
count	117
mean	-0.321
sample standard deviation	0.241
minimum	-1.014
maximum	0.236

[1] The minimum and the maximum values are statistically different from each other in 5% significance level.

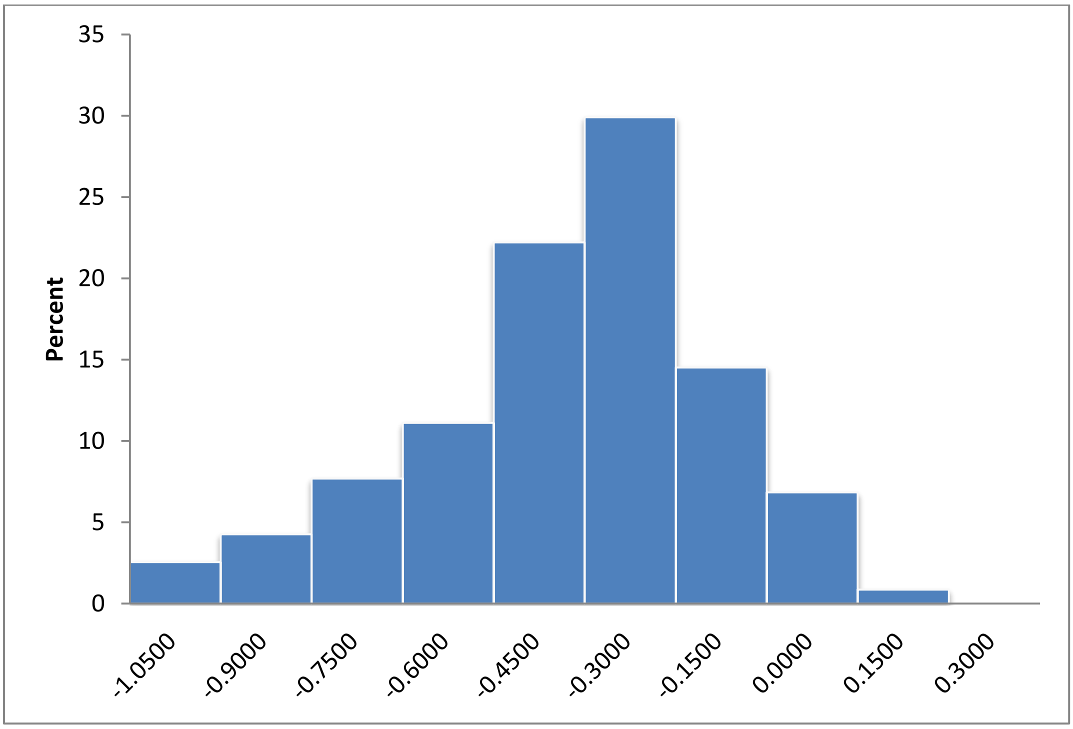

Figure 1.6.4. Five Factor M. MOM Beta

Table 1.6.5. . Five Factor Model Industry Index Added - Industry Index Beta

Descriptive statistics[1]	
count	117
mean	0.250
sample standard deviation	0.209
minimum	-0.302
maximum	1.263

[1] The minimum and the maximum values are statistically different from each other in 5% significance level.

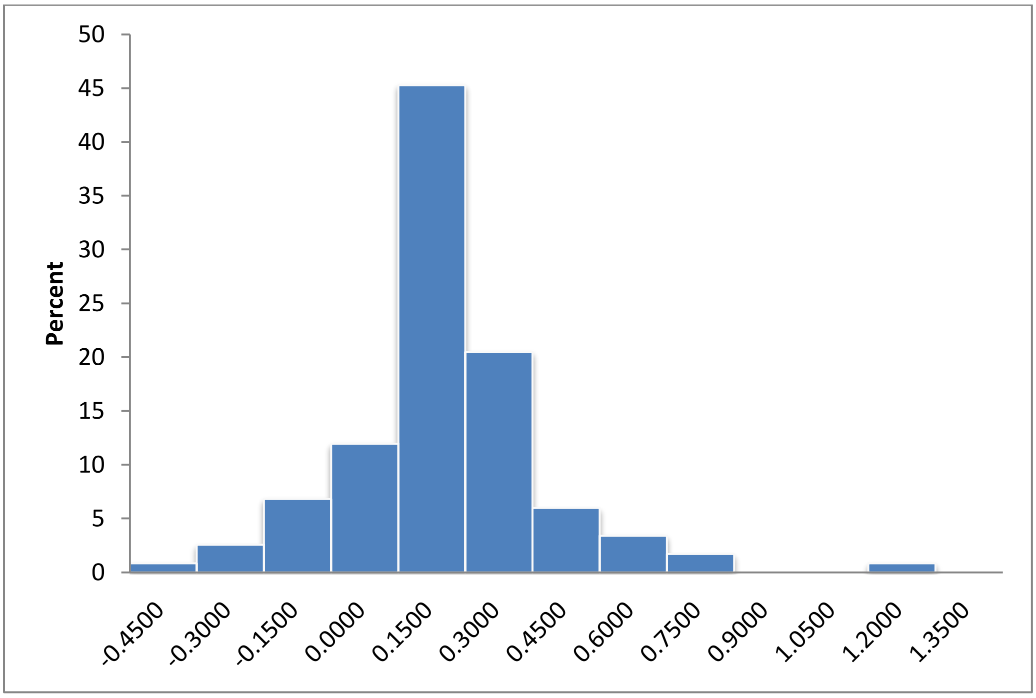

Figure 1.6.5. Five Factor M. Industry Index Beta

1.7. Two Factor Model – Real Estate Index Added

Table 1.7.1. Two Factor Model Real Estate Index Added - Risk Premium Beta

Descriptive statistics[1]	
count	117
mean	0.572
sample standard deviation	0.322
minimum	-0.110
maximum	2.699

[1] The minimum and the maximum values are statistically different from each other in 5% significance level.

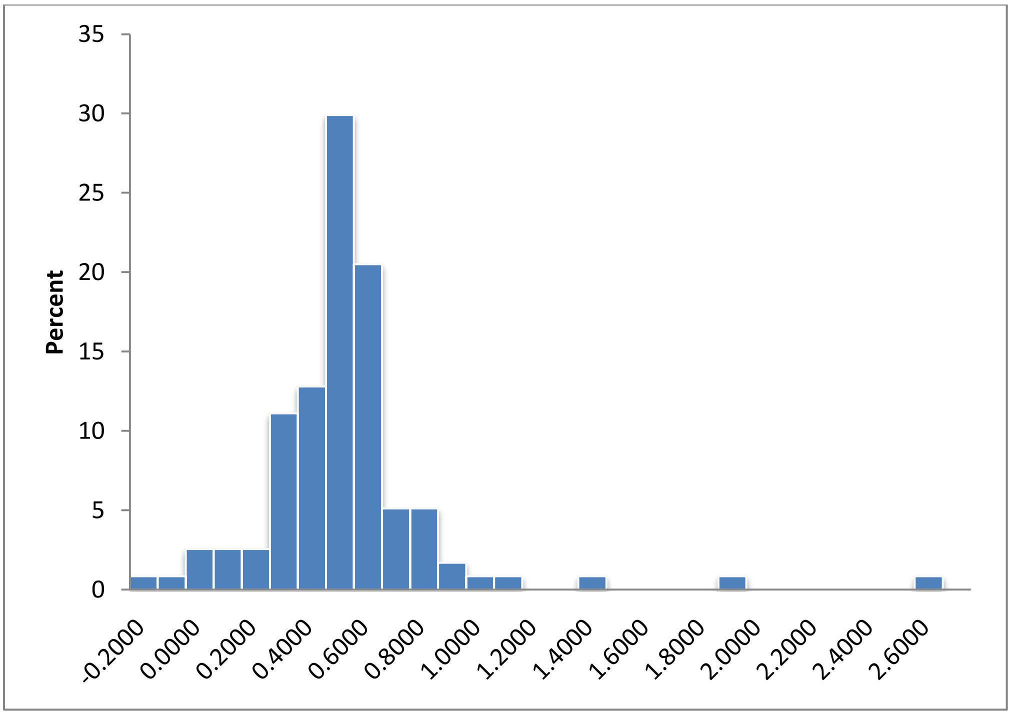

Figure 1.7.1. Two Factor M. Risk Premium Beta

Table 1.7.2. Two Factor Model Real Estate Index Added - Real Estate Index Beta

Descriptive statistics[1]	
count	117
mean	0.562
sample standard deviation	0.283
minimum	-0.168
maximum	1.150

[1] The minimum and the maximum values are statistically different from each other in 5% significance level.

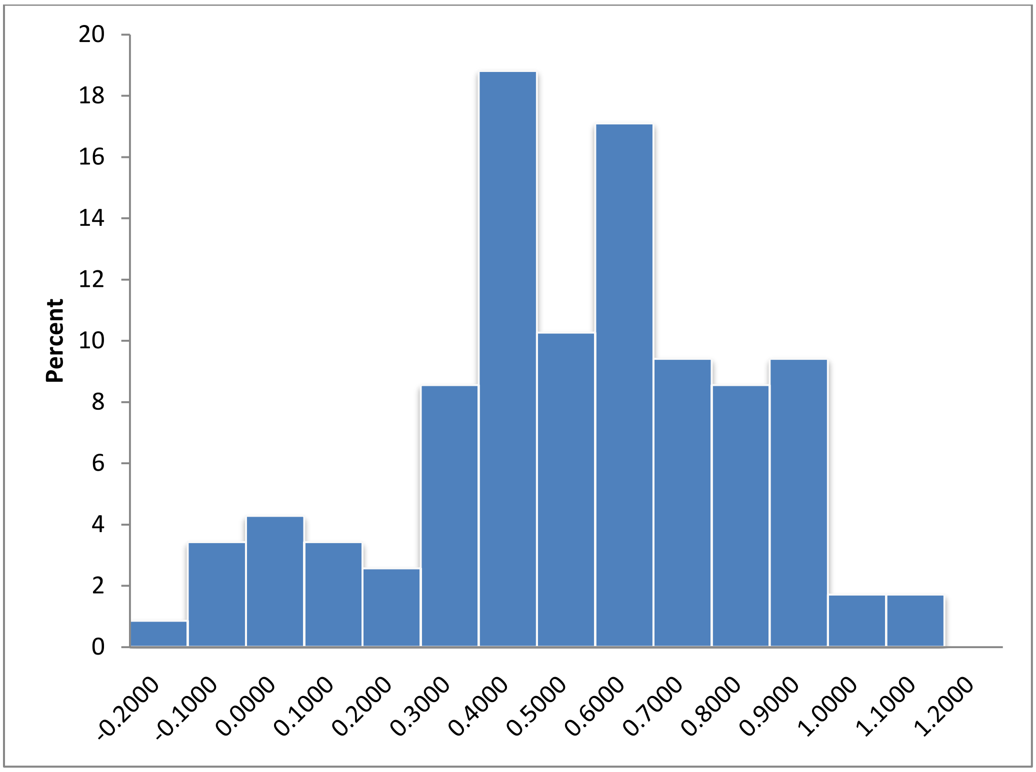

Figure 1.7.2. Two Factor M. Real Estate Index Beta

1.8. Four Factor Model – Real Estate Index Added

Table 1.8.1 Four Factor Model Real Estate Index Added - Risk Premium Beta

Descriptive statistics[1]	
count	117
mean	0.642
sample standard deviation	0.316
minimum	-0.121
maximum	2.360

[1] The minimum and the maximum values are statistically different from each other in 5% significance level.

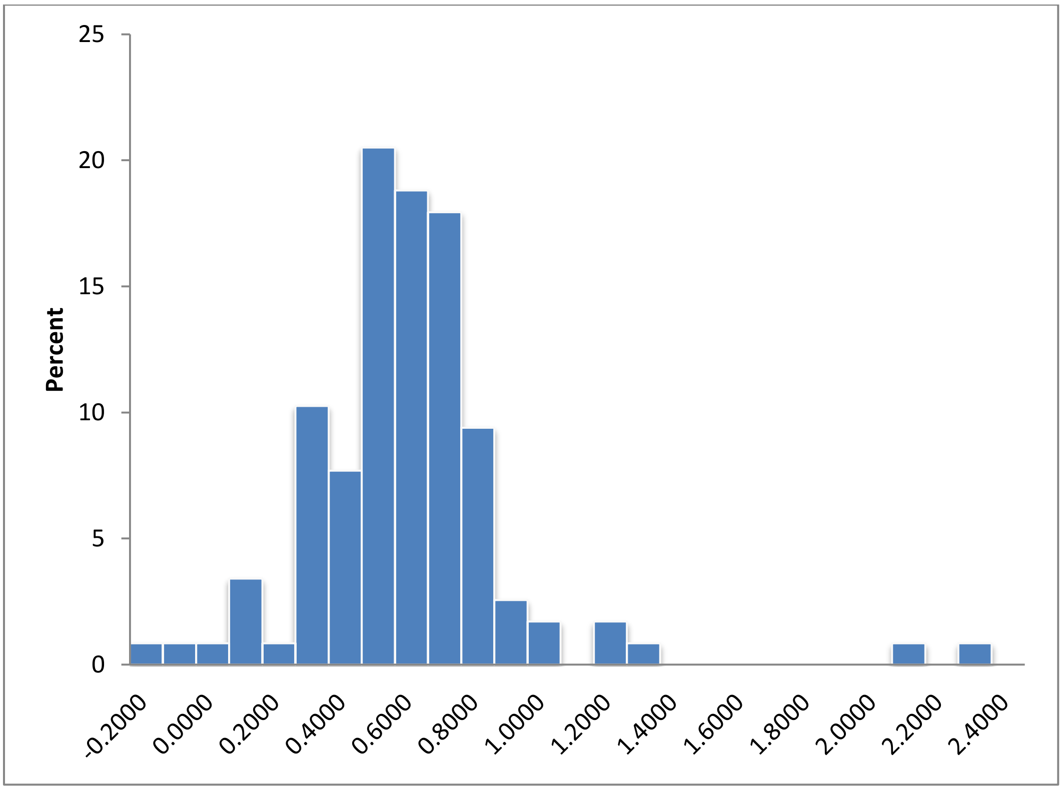

Figure 1.8.1. Four Factor M. Risk Premium Beta

Table 1.8.2. Four Factor Model Real Estate Index Added – SMB Beta

Descriptive statistics[1]	
count	117
mean	0.452
sample standard deviation	0.439
minimum	-2.008
maximum	1.648

[1] The minimum and the maximum values are statistically different from each other in 5% significance level.

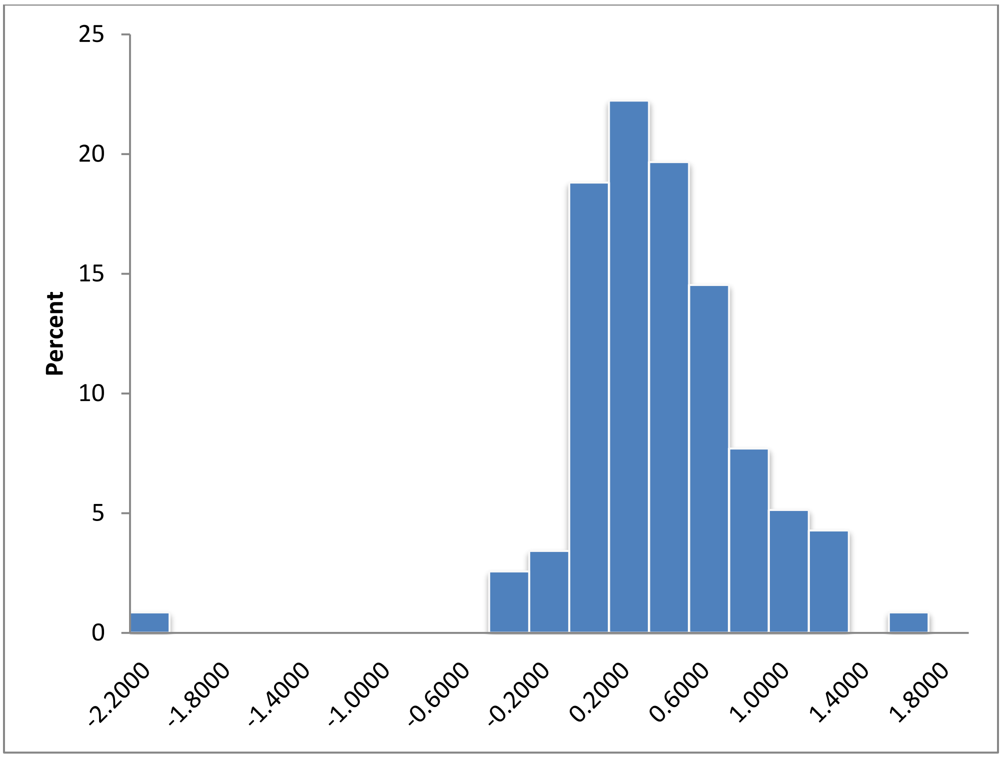

Figure 1.8.2. Four Factor M. SMB Beta

Table 1.8.3. Four Factor Model Real Estate Index Added – HML Beta

Descriptive statistics[1]	
count	117
mean	0.511
sample standard deviation	0.411
minimum	-1.332
maximum	2.345

[1] The minimum and the maximum values are statistically different from each other in 5% significance level.

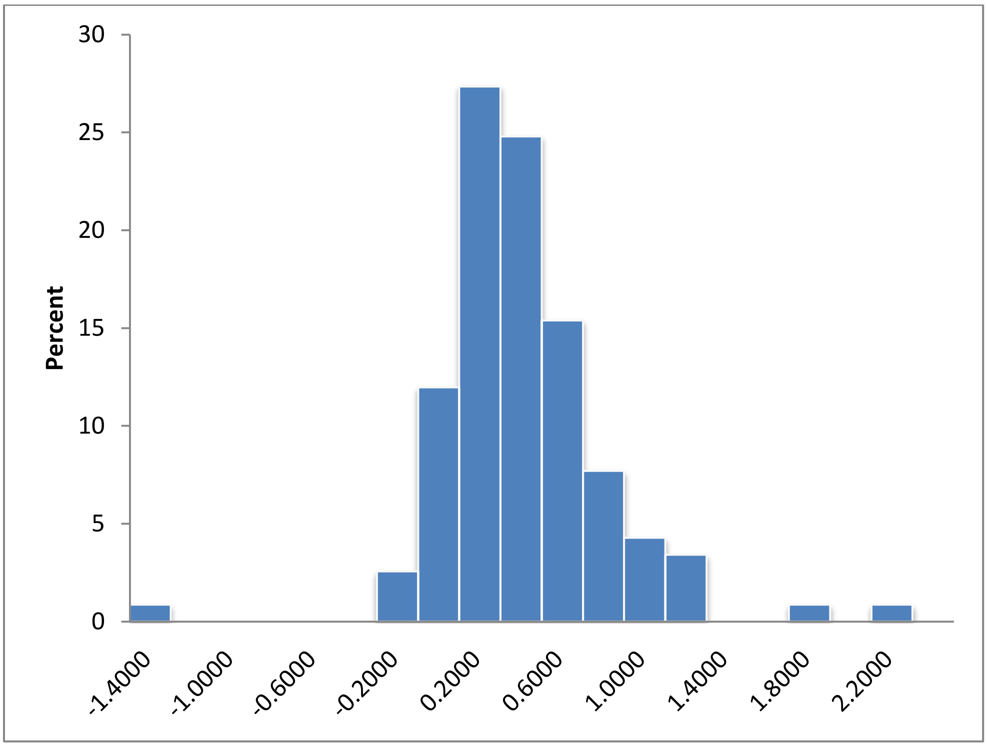

Figure 1.8.3. Four Factor M. HML Beta

Table 1.8.4. Four Factor Model Real Estate Index Added - Real Estate Index Beta

Descriptive statistics[1]	
count	117
mean	0.432
sample standard deviation	0.272
minimum	-0.255
maximum	1.453

[1] The minimum and the maximum values are statistically different from each other in 5% significance level.

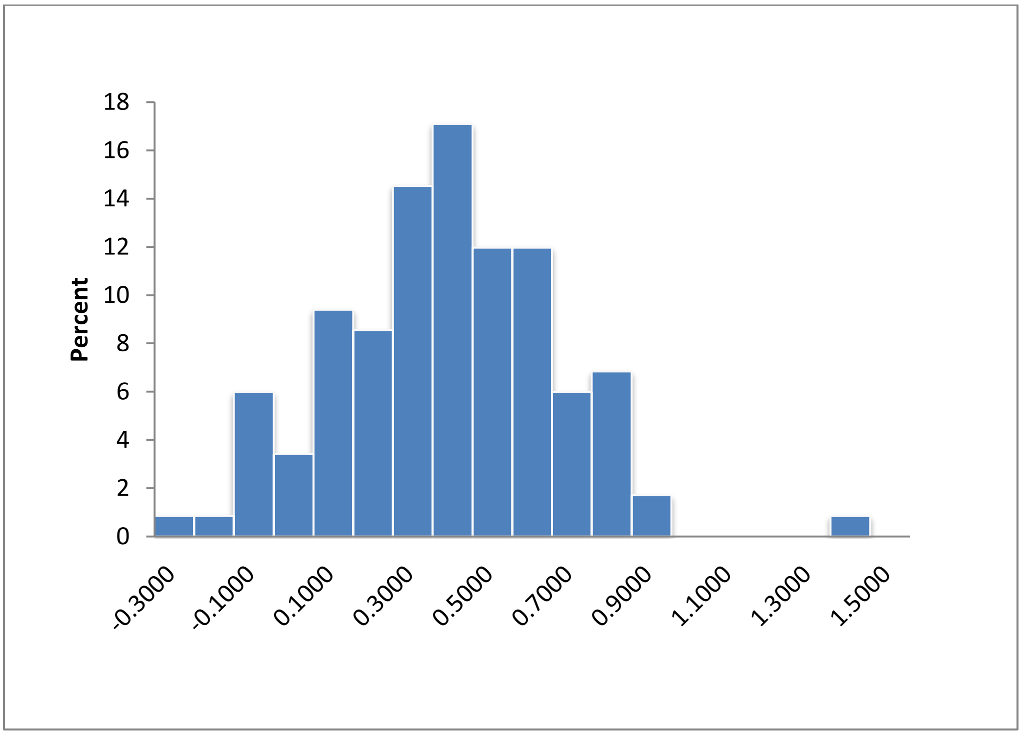

Figure 1.8.4. Four Factor M. Real Estate Index Beta

1.9. Five Factor Model – Real Estate Index Added

Table 1.9.1. Five Factor Model Real Estate Index Added - Risk Premium Beta

Descriptive statistics[1]	
count	117
mean	0.671
sample standard deviation	0.326
minimum	-0.101
maximum	2.454

[1] The minimum and the maximum values are statistically different from each other in 5% significance level.

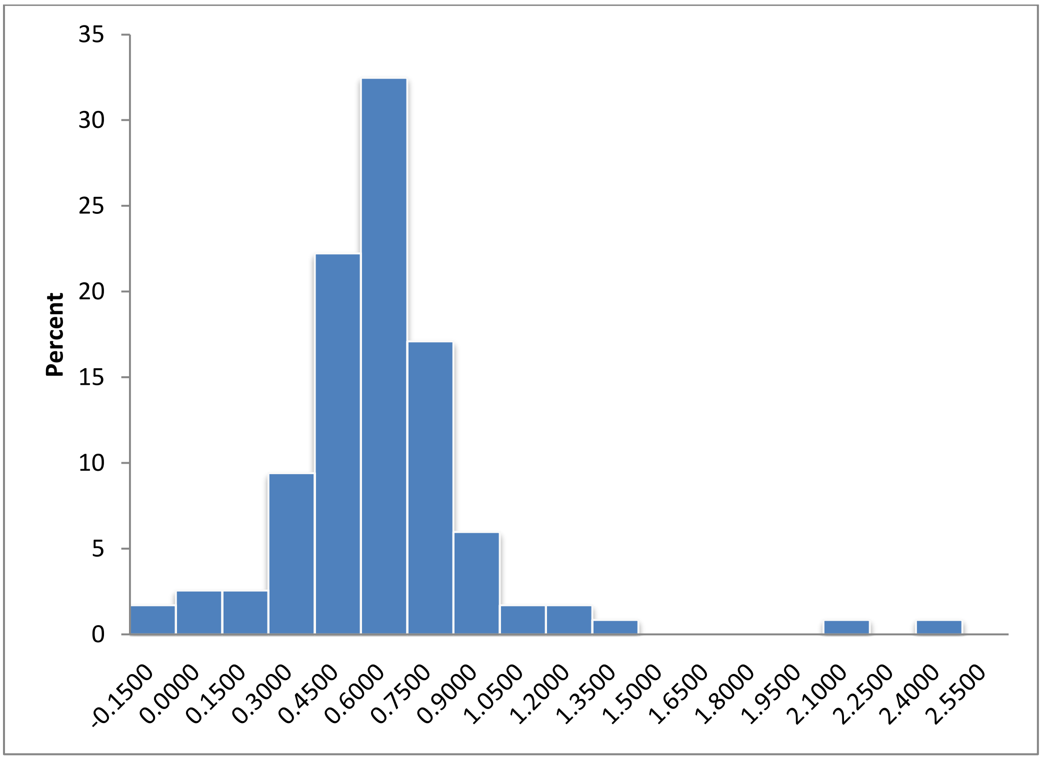

Figure 1.9.1. Five Factor M. Risk Premium Beta

Table 1.9.2. Five Factor Model Real Estate Index Added – SMB Beta

Descriptive statistics[1]	
count	117
mean	0.527
sample standard deviation	0.437
minimum	-1.762
maximum	1.826

[1] The minimum and the maximum values are statistically different from each other in 5% significance level.

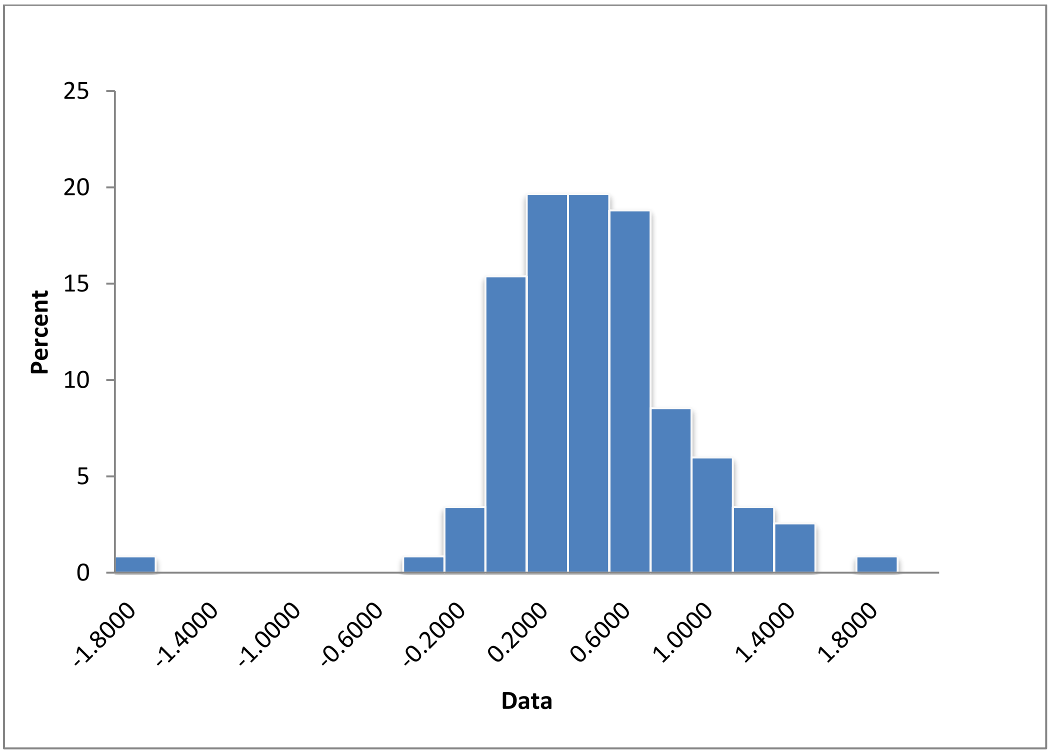

Figure 1.9.2. Five Factor M. SMB Beta

Table 1.9.3. Five Factor Model Real Estate Index Added – HML Beta

Descriptive statistics[1]	
count	117
mean	0.374
sample standard deviation	0.370
minimum	-1.780
maximum	1.919

[1] The minimum and the maximum values are statistically different from each other in 5% significance level.

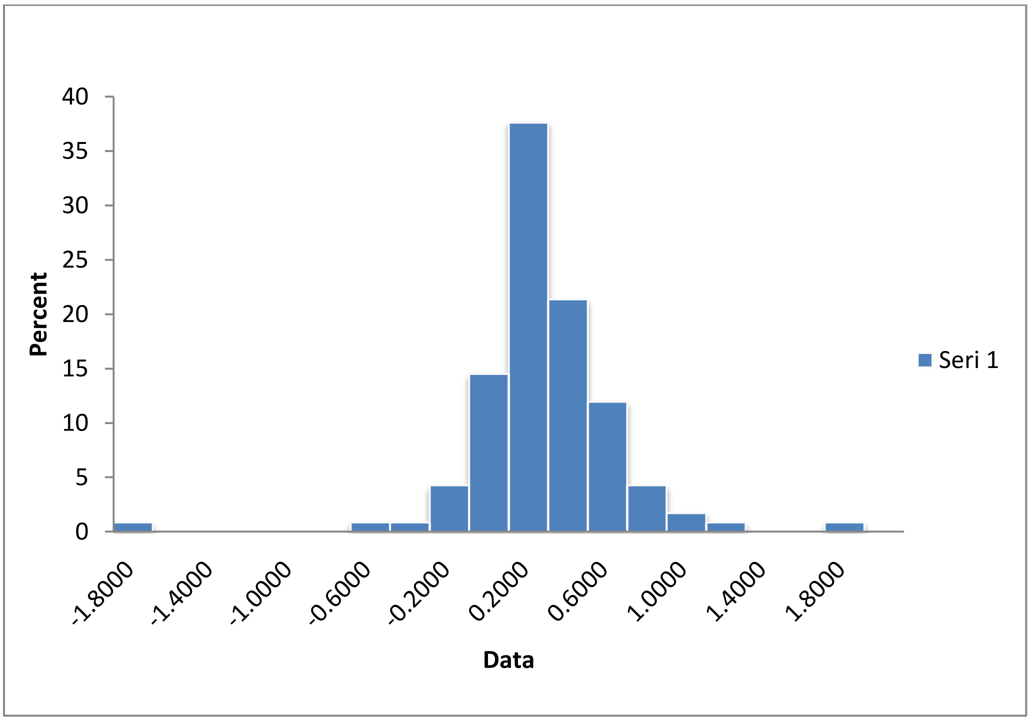

Figure 1.9.3. Five Factor M. HML Beta

Table 1.9.4. Five Factor Model Real Estate Index Added – MOM Beta

Descriptive statistics[1]	
count	117
mean	-0.228
sample standard deviation	0.187
minimum	-0.794
maximum	0.276

[1] The minimum and the maximum values are statistically different from each other in 5% significance level.

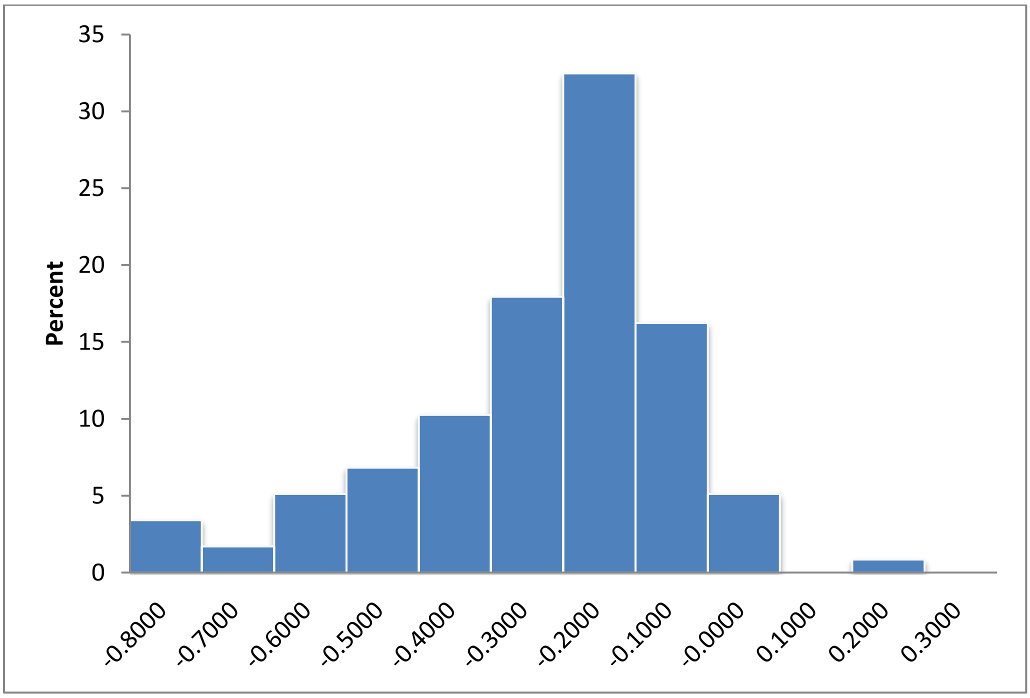

Figure 1.9.4. Five Factor M. MOM Beta

Table 1.9.5. Five Factor Model Real Estate Index Added - Real Estate Index Beta

Descriptive statistics[1]	
count	117
mean	0.376
sample standard deviation	0.250
minimum	-0.302
maximum	1.270

[1] The minimum and the maximum values are statistically different from each other in 5% significance level.

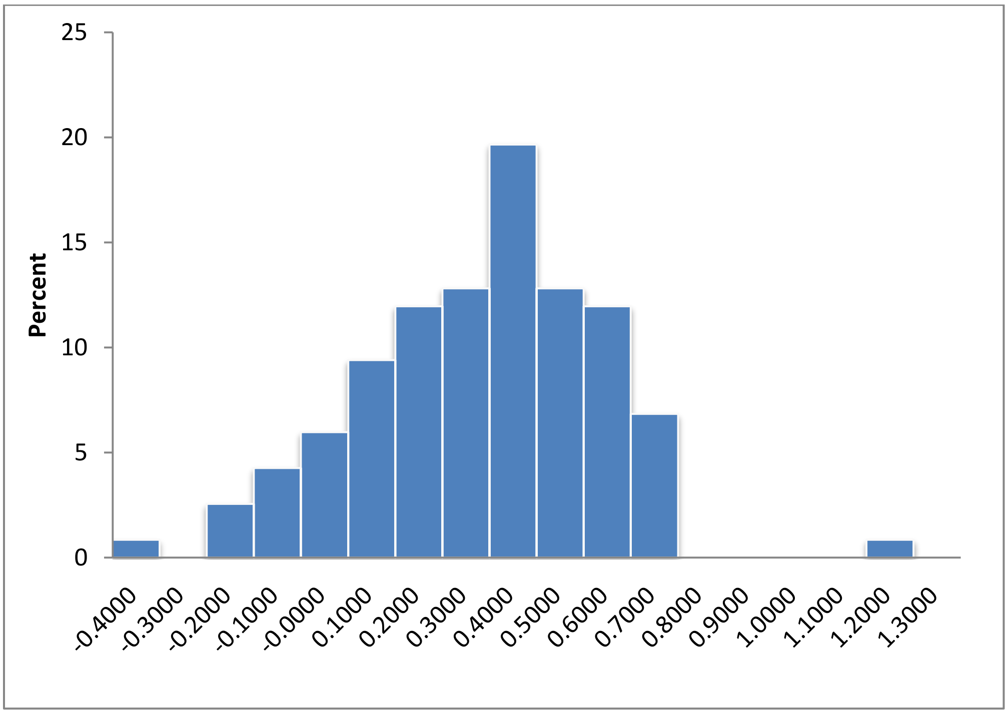

Figure 1.9.5. Five Factor M. Real Estate Index Beta

APPENDIX B

2.1. Healthcare facilities

Table 2.1.1. Single Factor Model Betas

	Mrk – Rf
Standard deviation	0.193
Mean	1.263
Range	1.077; 1.565

Table 2.1.2. Three Factor Model Betas

	Mrk - Rf	SMB	HML
Standard deviation	0.161	0.247	0.240
Mean	1.113	0.744	0.556
Range	0.899; 1.344	0.460; 1.030	0.281; 0.903

Table 2.1.3. Four Factor Model Betas

	Mrk - Rf	SMB	HML	MOM
Standard deviation	0.140	0.236	0.169	0.134
Mean	1.073	0.771	0.400	-0.197
Range	0.863; 1.267	0.484; 1.054	0.145; 0.600	-0.383; 0.024

2.2. Hotel motel

Table 2.2.1. Single Factor Model Betas

	Mrk - Rf
Standard deviation	0.750
Mean	1.824
Range	0.566; 2.878

Table 2.2.2. Three Factor Model Betas

	Mrk - Rf	SMB	HML
Standard deviation	0.741	0.545	0.408
Mean	1.571	0.899	0.986
Range	0.287; 2.735	-0.123; 1.416	0.435; 1.429

Table 2.2.3. Four Factor Model Betas

	Mrk - Rf	SMB	HML	MOM
Standard deviation	0.705	0.572	0.378	0.222
Mean	1.469	0.969	0.582	-0.509
Range	0.234; 2.591	-0.101; 1.514	-0.134; 0.966	-0.744; -0.162

2.3. Office

Table 2.3.1. Single Factor Model Betas

	Mrk - Rf
Standard deviation	0.322
Mean	1.415
Range	0.546; 1.748

Table 2.3.2. Three Factor Model Betas

	Mrk - Rf	SMB	HML
Standard deviation	0.280	0.431	0.295
Mean	1.189	0.798	0.884
Range	0.419; 1.517	-0.171; 1.620	0.335; 1.278

Table 2.3.3. Four Factor Model Betas

	Mrk - Rf	SMB	HML	MOM
Standard deviation	0.278	0.425	0.241	0.097
Mean	1.111	0.850	0.578	-0.386
Range	0.336; 1.432	-0.115; 1.649	0.147; 0.889	-0.548; -0.212

2.4. Residential

Table 2.4.1. Single Factor Model Betas

	Mrk - Rf
Standard deviation	0.427
Mean	1.399
Range	-0.026; 1.892

Table 2.4.2. Three Factor Model Betas

	Mrk - Rf	SMB	HML
Standard deviation	0.350	0.257	0.433
Mean	1.165	0.797	0.918
Range	-0.038; 1.534	0.203; 1.423	0.023; 1.872

Table 2.4.3. Four Factor Model Betas

	Mrk - Rf	SMB	HML	MOM
Standard deviation	0.328	0.270	0.333	0.145
Mean	1.092	0.846	0.634	-0.359
Range	-0.037; 1.428	0.203; 1.507	0.025; 1.384	-0.615; 0.002

2.5. Retail

Table 2.5.1. Single Factor Model Betas

	Mrk - Rf
Standard deviation	0.416
Mean	1.484
Range	0.179; 2.409

Table 2.5.2. Three Factor Model Betas

	Mrk - Rf	SMB	HML
Standard deviation	0.319	0.307	0.523
Mean	1.231	0.877	0.988
Range	0.068; 1.801	0.007; 1.469	0.244; 2.593

Table 2.5.3. Four Factor Model Betas

	Mrk - Rf	SMB	HML	MOM
Standard deviation	0.274	0.311	0.333	0.274
Mean	1.147	0.934	0.656	-0.418
Range	0.076; 1.581	0.002; 1.516	0.051; 1.724	-1.095; 0.035

2.6. Industrial

Table 2.6.1. Single Factor Model Betas

	Mrk - Rf
Standard deviation	0.575
Mean	1.475
Range	0.350; 2.400

Table 2.6.2. Three Factor Model Betas

	Mrk - Rf	SMB	HML
Standard deviation	0.476	0.576	0.480
Mean	1.261	0.896	0.817
Range	0.361; 2.133	-0.233; 1.868	-0.016; 1.723

Table 2.6.3. Four Factor Model Betas

	Mrk - Rf	SMB	HML	MOM
Standard deviation	0.435	0.600	0.315	0.239
Mean	1.187	0.946	0.527	-0.365
Range	0.358; 1.996	-0.231; 1.970	-0.027; 1.134	-0.743; -0.014

2.7. Diversified

Table 2.7.1. Single Factor Model Betas

	Mrk - Rf
Standard deviation	0.886
Mean	1.486
Range	0.042 ; 4.229

Table 2.7.2. Three Factor Model Betas

	Mrk - Rf	SMB	HML
Standard deviation	0.855	0.576	0.681
Mean	1.288	0.590	0.787
Range	0.049; 4.300	-0.864; 1.721	-0.194; 2.630

Table 2.7.3. Four Factor Model Betas

	Mrk - Rf	SMB	HML	MOM
Standard deviation	0.799	0.571	0.634	0.308
Mean	1.208	0.644	0.474	-0.395
Range	0.050; 4.048	-0.692; 1.768	-1.189; 2.007	-1.254; 0.058

2.8. Healthcare facilities – Industry Index Added

Table 2.8.1. Two Factor Model Betas

	Mrk - Rf	Industry Index
Standard deviation	0.179	0.079
Mean	0.486	0.686
Range	0.271; 0.790	0.551; 0.768

Table 2.8.2. Four Factor Model Betas

	Mrk - Rf	SMB	HML	Industry Index
Standard deviation	0.142	0.273	0.227	0.107
Mean	0.735	0.552	0.428	0.364
Range	0.508; 0.928	0.261; 0.815	0.136; 0.761	0.169; 0.508

Table 2.8.3. Five Factor Model Betas

	Mrk - Rf	SMB	HML	MOM	Industry Index
Standard deviation	0.179	0.230	0.176	0.136	0.081
Mean	0.798	0.616	0.354	-0.132	0.278
Range	0.561; 1.092	0.314; 0.858	0.086; 0.570	-0.341; 0.075	0.177; 0.365

2.9. Hotel motel - Industry Index Added

Table 2.9.1. Two Factor Model Betas

	Mrk - Rf	Industry Index
Standard deviation	0.443	0.387
Mean	0.667	1.021
Range	-0.281; 1.262	0.298; 1.495

Table 2.9.2. Four Factor Model Betas

	Mrk - Rf	SMB	HML	Industry Index
Standard deviation	0.564	0.482	0.434	0.286
Mean	0.940	0.578	0.770	0.609
Range	-0.215; 1.625	-0.304; 1.109	0.056; 1.254	0.345; 1.071

Table 2.9.3. Five Factor Model Betas

	Mrk - Rf	SMB	HML	MOM	Industry Index
Standard deviation	0.653	0.582	0.401	0.234	0.294
Mean	1.148	0.788	0.528	-0.433	0.324
Range	-0.129; 1.890	-0.258; 1.428	-0.253; 0.904	-0.767; -0.096	-0.097; 0.767

2.10. Office - Industry Index Added

Table 2.10.1. Two Factor Model Betas

	Mrk - Rf	Industry Index
Standard deviation	0.179	0.179
Mean	0.444	0.857
Range	0.047; 0.713	0.440; 1.038

Table 2.10.2. Four Factor Model Betas

	Mrk - Rf	SMB	HML	Industry Index
Standard deviation	0.290	0.460	0.288	0.097
Mean	0.703	0.551	0.718	0.469
Range	-0.129; 0.997	-0.450; 1.423	0.200; 1.103	0.289; 0.592

Table 2.10.3. Five Factor Model Betas

	Mrk - Rf	SMB	HML	MOM	Industry Index
Standard deviation	0.290	0.442	0.247	0.097	0.079
Mean	0.860	0.708	0.535	-0.326	0.254
Range	0.034; 1.123	-0.286; 1.494	0.102; 0.876	-0.486; -0.147	0.080; 0.383

2.11. Residential - Industry Index Added

Table 2.11.1. Two Factor Model Betas

	Mrk - Rf	Industry Index
Standard deviation	0.258	0.284
Mean	0.406	0.876
Range	-0.201; 0.705	0.154; 1.508

Table 2.11.2. Four Factor Model Betas

	Mrk - Rf	SMB	HML	Industry Index
Standard deviation	0.262	0.216	0.392	0.178
Mean	0.662	0.542	0.747	0.484
Range	-0.137; 0.939	0.153; 1.050	-0.011; 1.621	0.096; 0.730

Table 2.11. 3. Five Factor Model Betas

	Mrk - Rf	SMB	HML	MOM	Industry Index
Standard deviation	0.299	0.250	0.328	0.131	0.126
Mean	0.802	0.682	0.584	-0.290	0.294
Range	-0.151; 1.097	0.140; 1.307	0.005; 1.323	-0.531; 0.028	0.036; 0.513

2.12. Retail - Industry Index Added

Table 2.12.1. Two Factor Model Betas

	Mrk - Rf	Industry Index
Standard deviation	0.212	0.294
Mean	0.482	0.884
Range	0.110; 0.949	-0.081; 1.536

Table 2.12.2. Four Factor Model Betas

	Mrk - Rf	SMB	HML	Industry Index
Standard deviation	0.181	0.304	0.470	0.215
Mean	0.789	0.652	0.837	0.427
Range	0.357; 1.301	-0.037; 1.227	0.083; 2.234	-0.278; 1.015

Table 2.12.3. Five Factor Model Betas

	Mrk - Rf	SMB	HML	MOM	Industry Index
Standard deviation	0.278	0.300	0.336	0.279	0.154
Mean	0.970	0.834	0.626	-0.376	0.179
Range	0.374; 1.691	0.171; 1.359	-0.008; 1.666	-1.014; 0.003	-0.302; 0.401

2.13. Industrial - Industry Index Added

Table 2.13.1. Two Factor Model Betas

	Mrk - Rf	Industry Index
Standard deviation	0.349	0.450
Mean	0.540	0.824
Range	0.214; 1.284	-0.013; 1.617

Table 2.13.2. Four Factor Model Betas

	Mrk - Rf	SMB	HML	Industry Index
Standard deviation	0.356	0.506	0.423	0.184
Mean	0.858	0.691	0.680	0.389
Range	0.237; 1.519	-0.296; 1.520	-0.058; 1.490	0.120; 0.660

Table 2.13.3. Five Factor Model Betas

	Mrk - Rf	SMB	HML	MOM	Industry Index
Standard deviation	0.442	0.582	0.311	0.237	0.086
Mean	1.014	0.848	0.498	-0.324	0.175
Range	0.229; 1.826	-0.304; 1.857	-0.049; 1.100	-0.696; 0.017	0.029; 0.338

2.14. Diversified - Industry Index Added

Table 2.14.1. Two Factor Model Betas

	Mrk - Rf	Industry Index
Standard deviation	0.252	0.290
Mean	0.454	0.872
Range	-0.366; 0.949	-0.081; 1.536

Table 2.14.2. Four Factor Model Betas

	Mrk - Rf	SMB	HML	Industry Index
Standard deviation	0.266	0.334	0.499	0.216
Mean	0.743	0.615	0.788	0.441
Range	-0.289; 1.301	-0.160; 1.227	-0.110 2.234	-0.278; 1.015

Table 2.14.3. Five Factor Model Betas

	Mrk - Rf	SMB	HML	MOM	Industry Index
Standard deviation	0.365	0.352	0.360	0.287	0.191
Mean	0.913	0.786	0.590	-0.354	0.208
Range	-0.341; 1.691	-0.121; 1.359	-0.154; 1.666	-1.014; 0.107	-0.302; 0.754

2.15. Healthcare facilities – Real Estate Index Added

Table 2.15.1. Two Factor Model Betas

	Mrk - Rf	Real Estate Index
Standard deviation	0.116	0.120
Mean	0.580	0.444
Range	0.324; 0.665	0.290; 0.610

Table 2.15.2. Four Factor Model Betas

	Mrk - Rf	SMB	HML	Real Estate Index
Standard deviation	0.161	0.359	0.128	0.154
Mean	0.662	0.478	0.292	0.338
Range	0.337; 0.812	0.046; 0.852	0.103; 0.479	0.152; 0.541

Table 2.15.3. Five Factor Model Betas

	Mrk - Rf	SMB	HML	MOM	Real Estate Index
Standard deviation	0.160	0.346	0.119	0.091	0.139
Mean	0.670	0.501	0.251	-0.068	0.321
Range	0.339; 0.818	0.107; 0.882	0.050; 0.376	-0.183; 0.094	0.175; 0.497

2.16. Hotel motel - Real Estate Index Added

Table 2.16.1. Two Factor Model Betas

	Mrk - Rf	Real Estate Index
Standard deviation	0.573	0.324
Mean	0800	0.666
Range	-0.110; 1.919	0.160; 0.977

Table 2.16.2. Four Factor Model Betas

	Mrk - Rf	SMB	HML	Real Estate Index
Standard deviation	0.636	0.452	0.286	0.298
Mean	0.875	0.489	0.578	0.521
Range	-0.121; 2.115	-0.243; 1.051	0.071; 0.936	0.124; 0.833

Table 2.16.3. Five Factor Model Betas

	Mrk - Rf	SMB	HML	MOM	Real Estate Index
Standard deviation	0.650	0.498	0.334	0.159	0.284
Mean	0.917	0.599	0.378	-0.332	0.440
Range	-0.101; 2.189	-0.206; 1.245	-0.283; 0.842	-0.589; -0.112	0.044; 0.758

2.17. Office - Real Estate Index Added

Table 2.17.1. Two Factor Model Betas

	Mrk - Rf	Real Estate Index
Standard deviation	0.116	0.215
Mean	0.501	0.594
Range	0.309; 0.664	0.040; 0.809

Table 2.17.2. Four Factor Model Betas

	Mrk - Rf	SMB	HML	Real Estate Index
Standard deviation	0.145	0.390	0.206	0.195
Mean	0.567	0.431	0.519	0.465
Range	0.358; 0.820	-0.160; 1.287	0.183; 0.803	-0.014; 0.665

Table 2.17.3. Five Factor Model Betas

	Mrk - Rf	SMB	HML	MOM	Real Estate Index
Standard deviation	0.139	0.364	0.182	0.102	0.206
Mean	0.595	0.504	0.387	-0.220	0.411
Range	0.377; 0.826	-0.008; 1.303	0.077; 0.700	-0.462; -0.047	-0.127; 0.601

2.18. Residential - Real Estate Index Added

Table 2.18.1. Two Factor Model Betas

	Mrk - Rf	Real Estate Index
Standard deviation	0.198	0.233
Mean	0.424	0.633
Range	-0.083; 0.721	0.037; 1.046

Table 2.18.2. Four Factor Model Betas

	Mrk - Rf	SMB	HML	Real Estate Index
Standard deviation	0.203	0.236	0.305	0.207
Mean	0.483	0.396	0.519	0.510
Range	-0.046; 0.849	0.080; 0.882	0.018; 1.273	0.006; 0.764

Table 2.18.3. Five Factor Model Betas

	Mrk - Rf	SMB	HML	MOM	Real Estate Index
Standard deviation	0.205	0.247	0.269	0.084	0.195
Mean	0.505	0.452	0.416	-0.171	0.468
Range	-0.047; 0.868	0.161; 0.953	0.021; 1.067	-0.342 0.005	0.007; 0.680

2.19. Retail - Real Estate Index Added

Table 2.19.1. Two Factor Model Betas

	Mrk - Rf	Real Estate Index
Standard deviation	0.162	0.252
Mean	0.537	0.623
Range	0.083; 0.853	0.062; 1.150

Table 2.19.2. Four Factor Model Betas

	Mrk - Rf	SMB	HML	Real Estate Index
Standard deviation	0.190	0.374	0.382	0.244
Mean	0.614	0.507	0.636	0.469
Range	0.071; 0.972	-0.246; 1.210	0.072; 1.853	-0.002; 0.945

Table 2.19.3. Five Factor Model Betas

	Mrk - Rf	SMB	HML	MOM	Real Estate Index
Standard deviation	0.193	0.361	0.282	0.215	0.210
Mean	0.647	0.594	0.479	-0.261	0.404
Range	0.066; 1.062	-0.004; 1.286	-0.032; 1.376	-0.794; 0.046	0.008; 0.768

2.20. Industrial - Real Estate Index Added

Table 2.20.1. Two Factor Model Betas

	Mrk - Rf	Real Estate Index
Standard deviation	0.186	0.342
Mean	0.580	0.581
Range	0.352; 0.988	-0.168; 0.996

Table 2.20.2. Four Factor Model Betas

	Mrk - Rf	SMB	HML	Real Estate Index
Standard deviation	0.166	0.458	0.327	0.284
Mean	0.670	0.548	0.471	0.442
Range	0.443; 1.000	-0.100; 1.360	0.117; 1.218	-0.169; 0.848

Table 2.20.3. Five Factor Model Betas

	Mrk - Rf	SMB	HML	MOM	Real Estate Index
Standard deviation	0.175	0.486	0.254	0.164	0.259
Mean	0.696	0.617	0.346	-0.208	0.391
Range	0.481; 1.048	-0.070; 1.538	0.062; 0.895	-0.537; -0.072	-0.191; 0.756

2.21. Diversified - Real Estate Index Added

Table 2.21.1. Two Factor Model Betas

	Mrk - Rf	Real Estate Index
Standard deviation	0.546	0.344
Mean	0.753	0.476
Range	0.090; 2.699	-0.083; 1.006

Table 2.21.2. Four Factor Model Betas

	Mrk - Rf	SMB	HML	Real Estate Index
Standard deviation	0.478	0.682	0.691	0.388
Mean	0.795	0.300	0.498	0.369
Range	0.120; 2.360	-2.008; 1.386	-1.332; 2.346	-0.255; 1.453

Table 2.21.3. Five Factor Model Betas

	Mrk - Rf	SMB	HML	MOM	Real Estate Index
Standard deviation	0.498	0.658	0.680	0.212	0.361
Mean	0.829	0.390	0.333	-0.273	0.302
Range	0.123; 2.454	-1.762; 1.525	-1.780; 1.919	-0.744; 0.034	-0.302; 1.270