Two Studies of Japan-REIT Performance: Modeling Risk and Tracking Property-Level Performance

by

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B.A., Economics, 2002

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Submitted to the Center for Real Estate in Partial Fulfillment of the Requirements for the Degree of Master of Science in Real Estate Development

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ABSTRACT

This paper is intended to recognize the performance of REITs in Japan (J-REITs) by conducting two kinds of studies in a REIT-level and an underlying property-level: first, to do "factor loadings" that identify systematic risks of long run investment performance in J-REITs; second, to demonstrate "Pure Play Indices," segment-specific indices of REIT-based property market returns by tracking monthly REIT return data and property holding data.

The first study employs the Fama-French three-factor model for monthly J-REIT returns from September 2001 to September 2008. This investigation upgrades past similar research with longer data periods in a two-stage regression (a time-series regression and a cross-sectional regression) for all the listed J-REITs. Nevertheless, the model results in a limited explanatory power for the J-REIT performance, probably due to too short a market history, as in the past research.

The second study applies the Pure Play Indices, originally proposed by Geltner and Kluger [1995, 1998], to the J-REITs for office, residential, and retail segments since January 2006 when the J-REIT market became sizable enough for study. The developed Pure Play Indices perform similarly with the J-REIT return indices, except the Pure Play Residential Index during the down market due to the effect of non-target segments within the J-REITs. The reason for this effect will require a further study.

As the market matures with more data accumulated, this two-fold study that shows demonstration of returns from J-REITs will become more valuable to derive risk of J-REITs and different types of information of properties.

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Chapter 1 Introduction

1-1. Research Objective

Real Estate Investment Trusts in Japan (J-REITs) have undergone a dramatic change since they were established in September 2001. There was a time when the J-REIT market grew to 60 billion U.S. dollars with 42 REITs, but it shrank to around one-third by April 2009, due to the credit crunch caused by subprime problems. The J-REIT market history is still too short for a practical study to be conducted. However, because the market history has contained up-down economic cycles, it would be worthwhile to study the historical performance of J-REITs.

This paper examines the performance characteristics of J-REITs from the two standpoints of their stock returns and underlying properties' return, thinking of a historical perspective. REITs are a unique hybrid of real property assets and the firm-level financial conditions, with liquidity as publicly traded securities. The daily value judgment of J-REITs in the market considers those features, so it is fundamental to study the different two fields of underlying real estates and securities (capital) for the purpose of a comprehensive understanding of a product such as J-REITs. What affects J-REIT returns and how much of their performance can be explained by capital market factors? How have the J-REIT properties performed so far and how have they related to the firm-level returns (J-REIT returns)? How do these observations vary throughout the study period or the property segments?

1-2. Thesis Framework

In order to answer these questions, this paper has a two-fold objective after introducing a brief history and characteristics of the J-REIT market in the second chapter. The first objective is described in

the third and fourth chapters where this paper conducts “factor loadings,” which identify systematic determinants of long run investment performance in J-REITs. The other objective is explored in the fifth and sixth chapters which demonstrate a “Pure Play” model that retrieves REIT-based property returns purely to target property segments. The Pure Play model is used to observe their historical performance and to demonstrate how it can be used for a practical investment strategy in J-REITs.

Discussion of the factor loadings begins with reviewing the past research on the effectiveness of a representative asset pricing model such as the Fama-French three-factor model (FF model) in the Japanese market. Kubota and Takehara [2007] examined the effectiveness of the FF model in the Japanese stock market. Ohashi [2003, 2004, 2005], Kawaguchi [2005], The Association for Real estate Securitization (ARES) [2007] did factor loading by stocks, bonds, or the FF three-factors in the J-REIT market. However, in general these preceding studies did not directly mention the relationship between the J-REIT returns and real estate returns. Due to data constraints, a research methodology was limited to a time-series regression for a J-REIT index that measures only the impact of the risk factors.

To compensate for these limitations, in the fourth chapter this paper actually applies the FF model to the J-REIT market by extending the data period up to seven years and modifying the methodology into a two-stage regression. This experiment not only identifies betas (estimated coefficients) across all the J-REIT monthly returns by a time-series regression, but also examines the robustness of the model by a cross-sectional regression for the betas gained from the time-series regression. In addition, to ensure the interpretation, this paper analyzes by sub-periods and by main-asset segments (property type).

The study of application of a “Pure Play” model starts in the fifth chapter with providing the characteristics and methodology of REIT-based property return indices originally proposed in the U.S. REITs by Geltner and Kluger [1995, 1998] and Horrigan [2009]. In the sixth chapter this study applies

the model to the J-REITs. This paper firstly demonstrates the "Pure Play" indices to retrieve the property returns to the three major use (office, residential, and commercial[1]), based on the twenty eight months since January 2006. Then this study illustrates sample Pure Play Portfolio weights with targets on each property segment and Markowitz efficient portfolios to show how the "Pure Play" method can be useful in principle for synthetic investment in property through derivatives.

The last chapter summarizes the findings of these two core experiments, and proposes the requirements for further studies. Since the data infrastructure of J-REITs is not yet well consolidated, this kind of meticulous but comprehensive investigation is rare and therefore will be hopefully of help to both academic pursuits and practical business.

[1] Conforming to Japanese parlance, in this paper, "commercial" means a retail-type property.

Chapter 2 Overview of the Japan-REIT Market

Now REITs in Japan are getting a significant portion among twenty-one countries in the world, with the fifth largest market capitalization of 36.5 billion U.S. dollars, which constitutes around a 6% share of the global REIT market as of March 2008. However, because the REIT market in Japan has only an eight and a half year history, and many of the research works on the market have been limited in Japanese, its characteristics have not become widely known to the world. In order to provide a thorough understanding of J-REITs before going into further analyses, this chapter describes a brief history and characteristics of the J-REIT market since its inception.

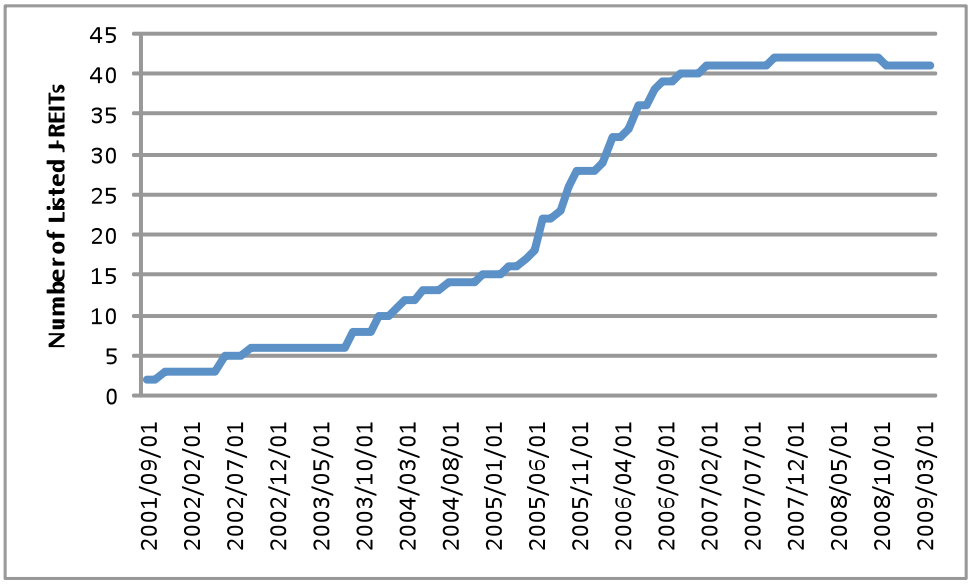
2-1. Brief History

A REIT is an investment trust dedicated to owning, and in most cases, operating income-producing real estate, such as apartments, shopping centers, offices and warehouses. Most REITs raise equity capital from investors, but have a special tax status that allows them to avoid corporate tax as long as nearly all REIT-income is distributed to investors in the form of dividends. This REIT structure enables small business transactions with a high liquidity and a transparent price in real estate investment. The first REIT debuted in the United States in the 1960s as a financial product of real estate investments; it was hoped that REITs would diversify investment portfolios, since they offered both high liquidity as a financial product and stable earnings based on income as a real estate product.

Japan-REITs (J-REITs) started in May 2000, when the revision of the Investment Trust and Investment Corporation Act (ITICA) expanded a trust's target assets, which used to be limited to marketable securities, into real estate. Two J-REITs were first listed on the Tokyo Stock Exchange (TSE) on September 10, 2001 (see Table [2-I]). Then capitalization of the J-REIT market grew rapidly

to 60 billion U.S. dollars with forty-two listed J-REITs in the prime of May 2007, but afterwards fell below 20 billion U.S. dollars as of February 2009, shrinking 67% from the peak after one J-REIT de-listed (see Table [2-II]). Depending on market size and returns, the history of the J-REIT market can be divided generally into two stages. One is an external growth period until August 2004, when the number of J-REITs was still limited but J-REITs were expanding in asset size. Thereafter, another is an internal growth period, when the market became sizable enough, and J-REITs switched their focus to raising the internal rate of return.

Table [2-I]: Number of Listed J-REITs (Sept. 2001 ~ Apr. 2009)

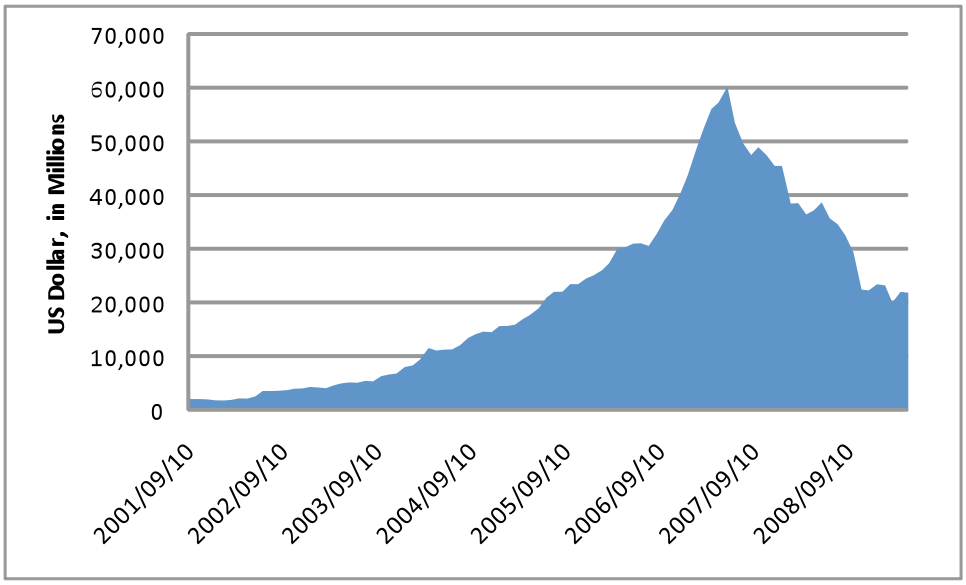


(Created by the author, on the basis of monthly data from the ARES[2])

[2] The Association for Real estate Securitization (ARES).

Table [2-II]: Market Capitalization of the J-REIT Market (Sept. 2001 ~ Apr. 2009)

(The average exchange rate since inception of the J-REIT market: 1 U.S. dollar = 113.12 yen)



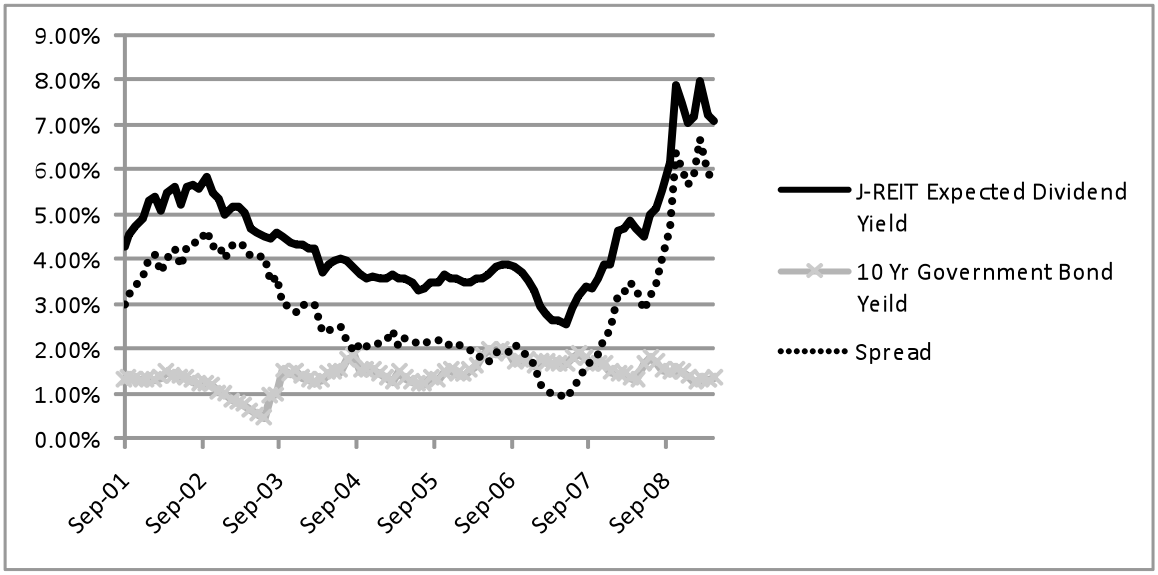
(Created by the author, on the basis of daily data from the ARES)

Behind the rapid growth of the market in the early stage, there were several factors that encouraged investment in J-REITs. One of the leading causes for the stable growth of the J-REIT markets was new institutional supports to drive investors into J-REIT investment. For instance, both dividend tax and transfer tax were reduced from 20% to 10% by the government in December 2002. Around the same time, banks were allowed by the Japanese Bankers Association to count dividend income from J-REIT investments in the bank's operating profit. Furthermore, in May 2003, two J-REITs were built into the MSCI Japan Index that foreign pension funds utilized as their investment benchmark. In July 2003, the new rule changed self-imposed regulation and allowed fund of funds to invest in J-REITs. These changes expanded the range of type of investors in J-REITs to individuals and bankers.

Another factor that led to the rapid growth of the J-REIT market was a large gap ("spread")

between dividend yields of J-REITs and interest yields of ten-year government bonds (see Table [2-III]). In general, the higher the spread is, the higher the investment risk and return of the product are, in comparison with the risk-free ten-year government bond. The spread hovered at a high of 2.0%~4.6% at the beginning of J-REIT market, which was risky and yet attractive enough to investors who faced low interest rates and the flagging stock market. In the subsequent internal growth period, the spread decreased to, and kept at about 2%, which indicated that investors had become less uncertain in their response to J-REITs, and the J-REIT market entered a stable phase. Afterwards, in the middle of 2007, the spread lowered to 1% along with the increasing capitalization of the J-REIT market, but turned out to expand in the recent subprime-effect period.

Table [2-III]: Dividend Yield of J-REITs and Government Bonds



(Created by author, based on monthly data from STB and Bank of Japan during Sept.2001 ~Feb. 2009)

2-2. Characteristics of J-REIT Investment

As for the forms of investment, the ITICA sets two types: the Investment Trust Institution and

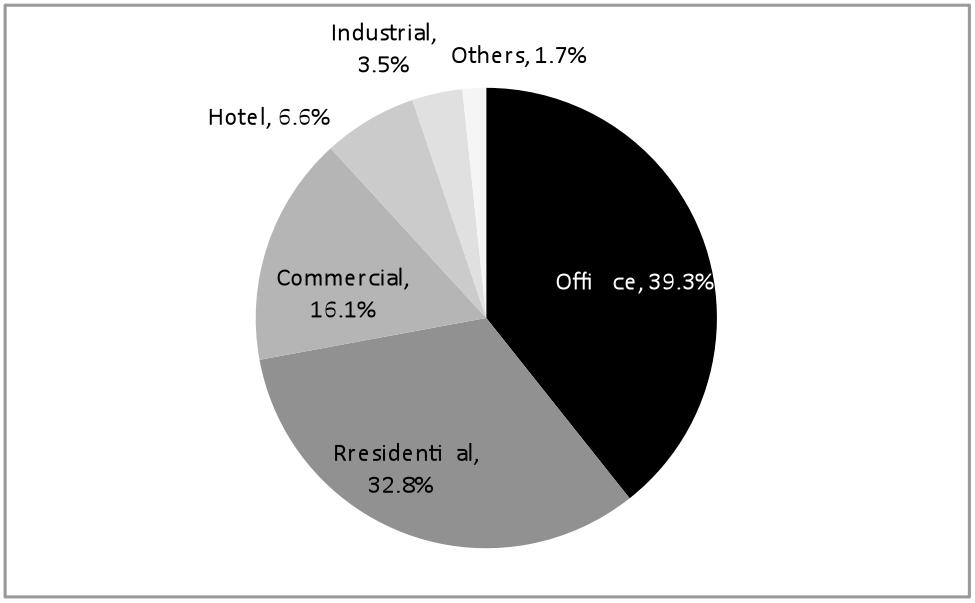
Investment Corporation Institution. At this point in time, J-REITs are all based on the Investment Trust Institution. Furthermore, there are two types of Investment Trust Institution: one is an open-end type, which allows its investors to claim a refund; another is a closed-end type, which does not. Traditional marketable securities employ an open-end type, since it offers liquidity to investors. But all the existing J-REITs choose a closed-end type, since it is difficult for J-REITs to sell their properties expeditiously and thereby gain cash. Instead, J-REITs offer the chance for redemption in market dealings.

In terms of business, J-REITs are prohibited from operating under general management, storage of investment, and asset management, but they are allowed to outsource those jobs to management companies. REITs with such a scheme are called "externally operated REITs," and J-REITs are taking this form, while many REITs in the United States ("US-REITs") are internally operated. Also, there is more than one type of REIT in the United States, depending on the type of asset—including an equity REIT[3], a mortgage REIT[4], and a hybrid REIT[5]—but in Japan there is only an equity REIT.

The total value of the properties held by all the J-REITs as of April 2009 is around 68 billion U.S. dollars, based on purchase prices. Table [2-IV] shows the breakdown of the properties according to their uses: office and residential uses dominate almost equally more than 70% of the total assets. In addition, J-REITs tend to focus on a certain property type, as will be described in the sixth chapter. The breakdown of the properties by regions in Table [2-V] shows nearly 60% of them concentrated inside Tokyo, and over 70% in the Kanto area, in the vicinity of Tokyo.

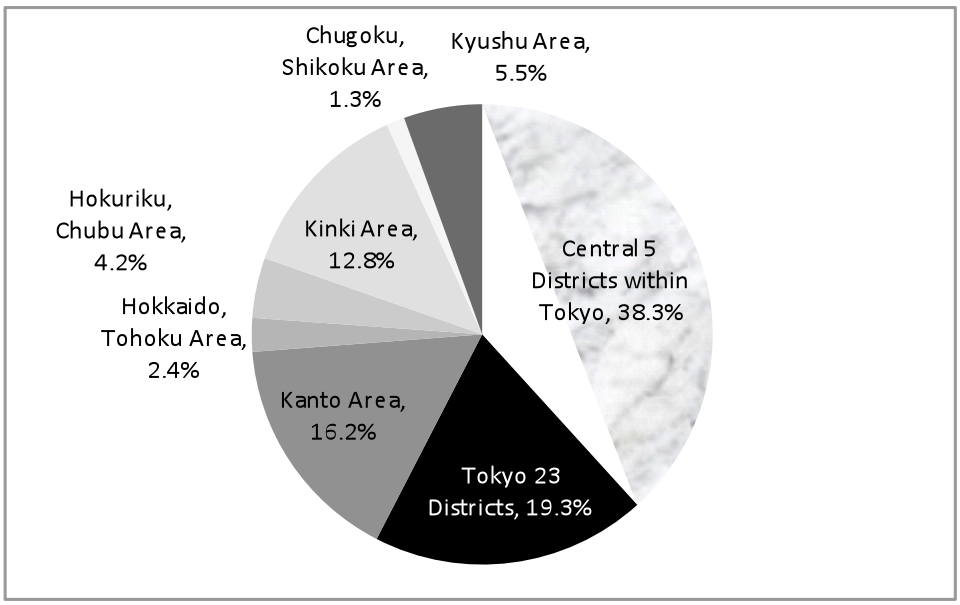
[3] An Equity REIT is a trust that purchases, owns and manages real estate properties; it does not own or originate real estate loans.
[4] A mortgage REIT is a trust that purchases owns and manages real estate loans; it does not own real estate properties.
[5] A hybrid REIT is a trust that purchases owns and manages both real estate loans and real estate properties. It has the qualities of both an equity and mortgage REIT which is why it is referred to as a hybrid.

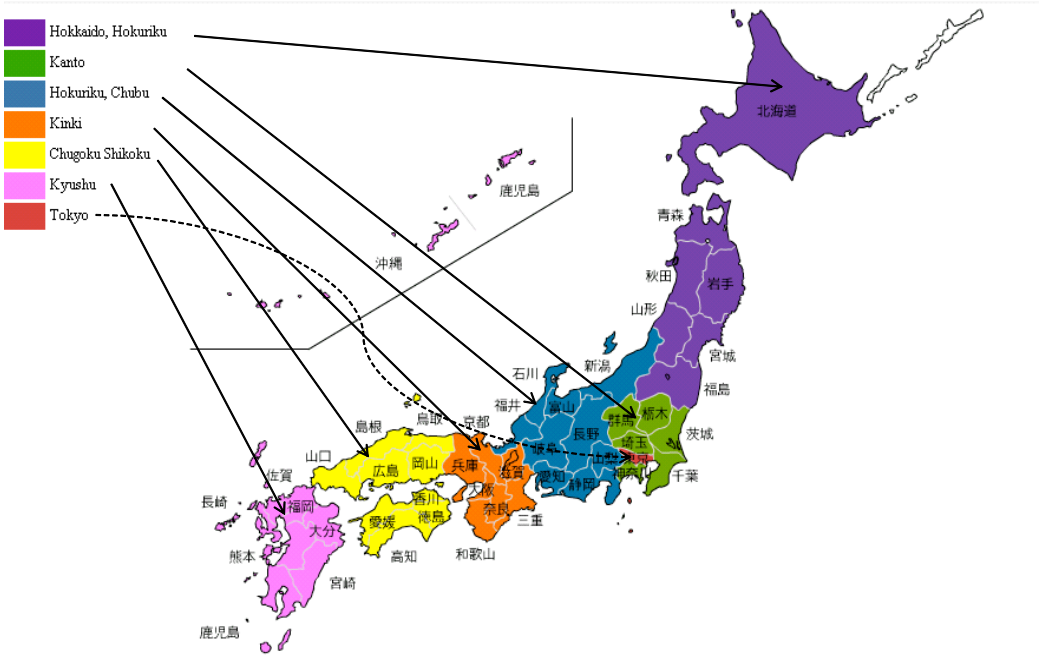
Table [2-IV]: J-REIT Property Type Breakdown as of April 2009



(Created by author, based on J-REITs' settlement report)

Table [2-V]: J-REIT Property Region Breakdown as of April 2009, and Map of Japan Districts





(Created by author, based on individual J-REITs' settlement report)

2-3. Performance of J-REITs

J-REITs remained stagnant in the initial stage, not only because investors were unfamiliar with the characteristics of J-REITs, but also because a huge supply of large-scale buildings in 2003 was anticipated to affect the balance between supply and demand in the real estate market. When it turned out in late 2004 that the building supply did not affect the market as much as anticipated, and as more and more J-REITs proved their high dividend payout ratio at closings, the J-REIT market started to flourish.

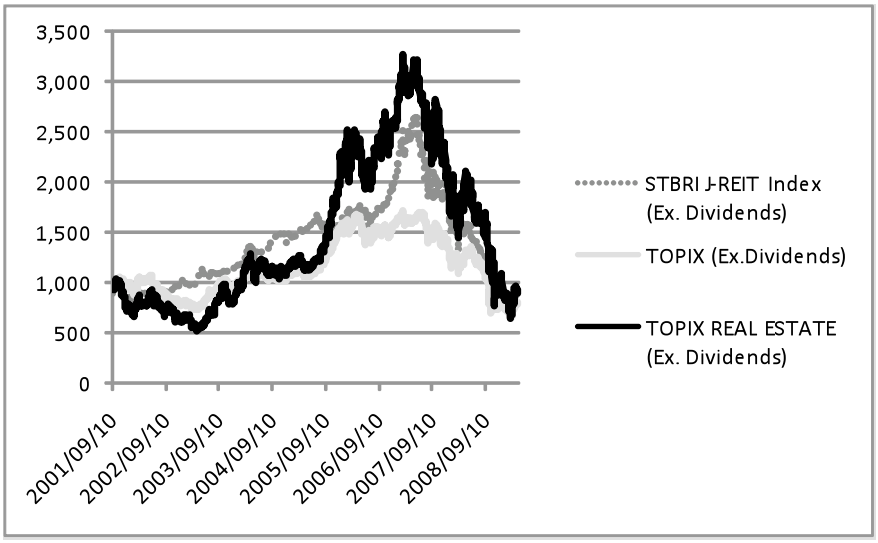
Table [2-VI] shows historical price indices of J-REITs presented by STBRI J-REIT Index,[6] stocks by the Tokyo Stock Price Index (TOPIX) [7], and real estate company stocks by the TOPIX Real

[6] The STBRI J-REIT Index consists of a composite index that includes all listed J-REITs and sub-indices classified by property types since September 10, 2001, the date of the first listing of J-REIT issues on the Tokyo Stock Exchange. The STBRI J-REIT Index® is calculated by accumulating the daily weighted average of returns, similar calculation methods used by the FTSE NAREIT US Real Estate Index, which is the best-known REIT benchmark in the United States. This index is developed by the STB Research Institute (STB Research).

[7] TOPIX is a free-float adjusted market capitalization-weighted index that is calculated based on all the domestic common stocks listed on the TSE First Section. TOPIX shows the measure of current market

Estate Index[8]. The J-REIT price index reached the top in May 2007, but headed straight downhill thereafter, due to the global credit crunch originally caused by a subprime problem. J-REITs fell by 73.0% in price during the period from May 2007 to the most recent, which is well below 60.9% of TOPIX's drop around the same period. This notable drop in J-REIT prices in late 2008 can be attributed to the default of a J-REIT as the first default case of an equity REIT in the world and to consecutive defaults of J-REITs' sponsors. TOPIX Real Estate Index fluctuates more than STBRI J-REIT Index since companies that operate or develops real estate have a riskier profit structure than REITs whose business is limited to hold real estate.

Table [2-VI]: Price Indices of J-REITs, Stocks and Real Estate



(Created by author, based on daily data during Sept.2001 ~Apr. 2009, with assumption that a price as of the base date (September 10, 2001) is 1,000 point)

But it was not only Japan that has had such a terrible performance since 2008. In Table [2-VII],

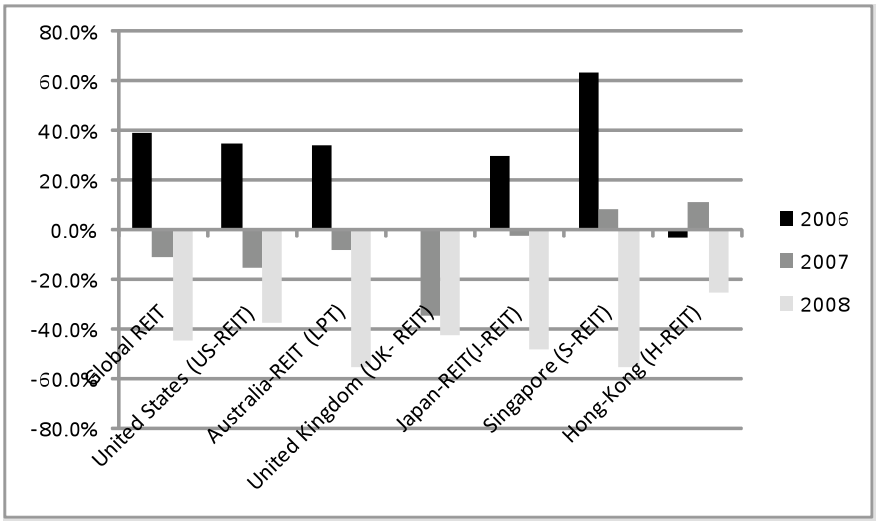
capitalization assuming that market capitalization as of the base date (January 4, 1968) is 100 point.

[8] TOPIX Real Estate Index is one of the TOPIX Sector Indices that consist of indices created by dividing the constituents of TOPIX into the following 33 categories according to the industrial sectors defined by the Securities Identification Code Committee (SICC). The TOPIX Sector Indices shows the measure of current market capitalization assuming that market capitalization as of the base date (January 4, 1968) is 100 point.

many other REITs in the world, especially REITs in Asia, have also posted drastically negative returns. This table indicates that the poor performance is not necessarily due to factors specific to the J-REIT market.

Table [2-VII]: Annual Returns of REITs in the World

(REITs are listed in descending order of the size in market capitalization from the left)



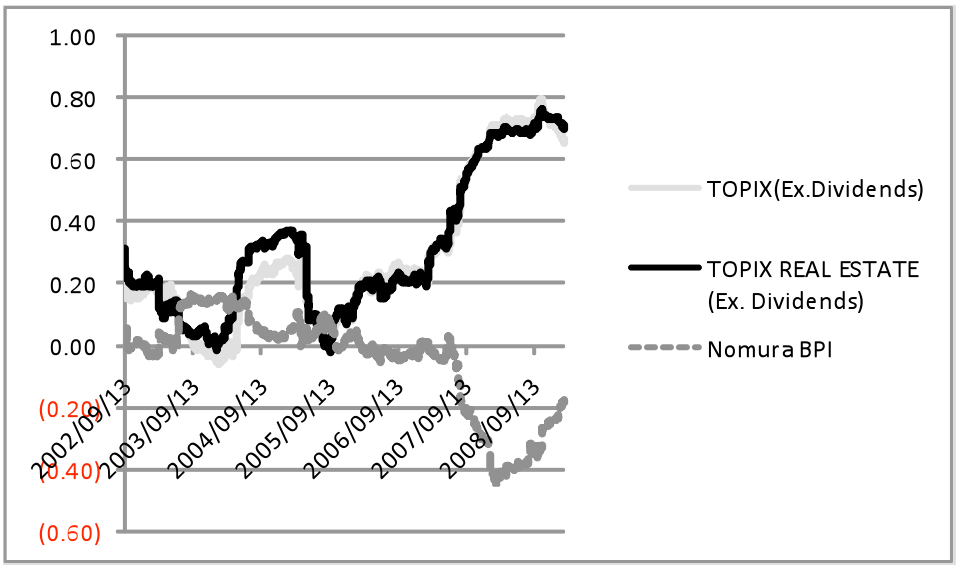
(Created by the author, based on data from the S&P global REIT TR Index for Global REIT, TSE NAREIT EQUITY REITs Total Return Index for United States-REIT (US-REIT), S&P/ASX 300 A-REIT Accumulation Index for Australia-REIT (LPT), TSE EPRA NAREIT UK REIT TR Index for the United Kingdom- REIT (UK- REIT), STBRI-J-REIT Total Return Index for Japan-REIT(J-REIT), FTSE EPRA/NAREIT SINGAPORE - TOT RETURN IND for Singapore-REIT (S-REIT), FTSE EPRA/NAREIT HONG KONG REIT - TOT RETURN IND for Hong-Kong-REIT (H-REIT))

The characteristics of risks and returns to J-REITs have changed dramatically since 2007. Table [2-VIII] and [2-IX], where bonds are represented by the NOMURA Bond Performance Index (Nomura BPI[9]), show correlation and volatility of J-REITs, stocks and bonds. The J-REITs have gradually performed more and more favorably with stocks since 2007, and have accordingly increased the volatility,

[9] The Nomura BPI Index is developed by Nomura Securities Global Quantitative Research (Nomura Securities) to measure the movement of Japanese bonds in the secondary market. This index is calculated with the return on investments of a portfolio of all fixed income securities that meet certain criteria.

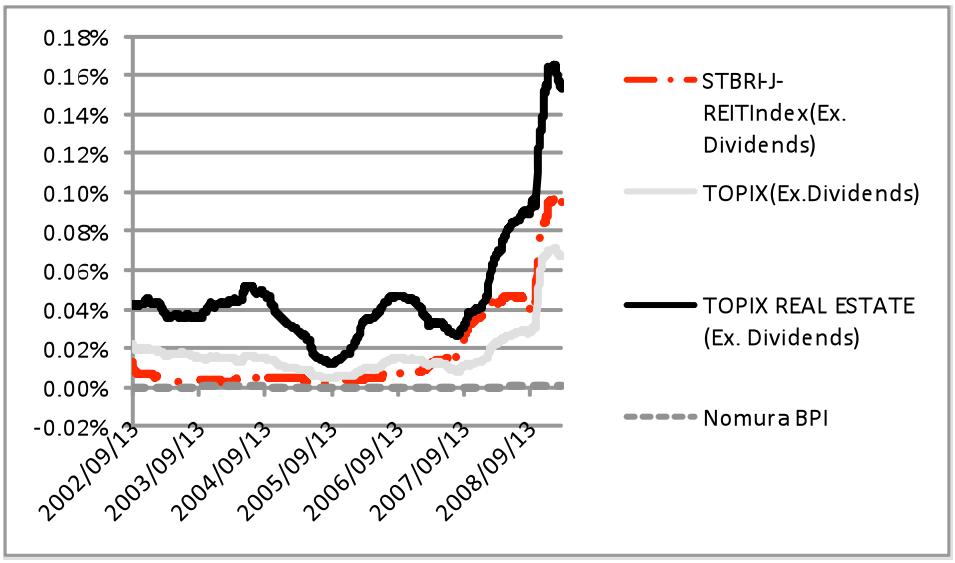
which has exceeded TOPIX's volatility. The market situation has deviated from how the attributes of J-REITs were originally expected, such as middle risk and middle return. In addition, as can be seen in Table [2-III], it can be assumed from excessively widening spreads of the return of J-REITs over the risk-free rate that the current price level of J-REITs is greatly undervalued.

Table [2-VIII]: Correlation of J-REITs with Stocks and Bonds



(Created by the author, in 250 day-rolling, based on daily return data from STB, TSE, Nomura Securities, from Sept.2001 ~Feb. 2009)

Table [2-IX]: Volatility of J-REITs, Stocks, and Bonds



(Created by the author, in 250 day-rolling, based on daily return data from Sept.2001 ~Feb. 2009)

This chapter found some characteristics of J-REIT investment. The forty-one existing J-REITs are all equity REITs, focusing on office or residential types in Tokyo. Also, the performance of J-REITs has shown a new trend from the effect of the weakening capital market, which has actually held down the growth of the J-REIT market. Investigating risk factors to J-REITs in the capital market, and observing the underlying assets (properties) of J-REITs to capture performance characteristics, would be an important task for the robust recovery of the J-REIT market in future.

Chapter 3 Factor Loading: Literature Review

This chapter reviews the past research of basic asset pricing models in the Japanese stock market including the J-REIT market, with a focus on the Fama-French three-factor model which will be performed in the next chapter.

3-1. Evolution of Asset Pricing Model

It is an asset pricing model for the estimation of expected returns and risks that creates the basis of risk management in capital market investment. In an asset pricing model, a total risk based on the total volatility of an asset price consists of two types of risks: systematic risks and idiosyncratic (specific) risks. Systematic risks refer to the risks based on the volatility of returns that are associated with common factors in the aggregate market. Idiosyncratic risks refer to the component of an asset's volatility that cannot be explained by those common factors in the market, but rather by a specific factor to the individual stock. In Modern Portfolio Theory (MPT), idiosyncratic risks can be minimized by diversification, while systematic risks cannot. For this reason, systematic risks have been intensively researched as intrinsic risks.

The Capital Asset Pricing Model (CAPM) proposed by Sharpe [1962], Lintner [1963], and Mossin [1966] played a major role in MPT, on the basis of the mean-variance model.

Capital Asset Pricing Model (CAPM):

$$\mathbf{r_i - r_f = \alpha_i + \beta_{Mi}\{r_M - r_f\} + \varepsilon_i}$$

α_i… excess return of stock$_i$ against $\boldsymbol{\beta_{Mi}\{r_M - r_f\}}$, the portion related to the entire market. In an efficient market, α_i should have a mean of zero over the long run.

r_i…equity total return of $stock_i$

$r_{M...}$total return of the market portfolio

β_M…exposure of $stock_i$ against the market portfolio

r_f….risk free rate

ε_i…disturbance term that represents the idiosyncratic risk components for $stock_i$. The average of ε_i is zero. The correlation of ε_i and r_i is zero.

Here $r_i - r_f$ represents a risk premium of $stock_i$ over the risk free rate. $r_M - r_f$ represents a market factor, an excess return of the $stock_i$ over the risk free rate.

However, the accumulated evidence since the 1970s suggests that the original single-factor CAPM did not fully explain the long-run average returns achieved by different stocks. In the mid-70s, Arbitrage Pricing Theory (APT) appeared and laid the basis for a multifactor model. On the other hand, in some cases, the model had too many factors, as researchers wanted to raise the model's explanatory power. Consequently, it was the Fama-French (FF) three-factor model proposed by Fama and French [1993] that tested whether a model with a few common risk factors had an enough explanatory power. The FF model successfully improved the explanatory power of the model by adding a size-related factor (SMB) and a value-related factor (HML) to CAPM. The model has become known for a high explanatory power in major equity markets in the world, and has been considered as a new de facto standard in academic papers.

Fama-French Three-Factor Model:

$$\mathbf{r_i - r_f = \alpha_i + \beta_{Mi}\{r_M - r_f\} + \beta_{SMBi}\, r_{SMB} + \beta_{HMLi}\, r_{HML} + \varepsilon_i}$$

where:

r_{SMB}… return of small-firm stocks less return of large-firm stocks.

r_{HML}…return of high book-to-market ratio stocks less return on low book-to-market ratio stocks.

In the United States, a multi-factor asset pricing model has been widely used and already established in the business world. Likewise, in Japan, research on a multi-factor asset pricing model has been done, though not many studies so far and no clear indication has yet been produced. There still exists a great need for more studies.

3-2. Effectiveness of the Fama-French Three-Factor Model in the Japanese Stock Market

Daniel and Titman [2001] carried early research on Japanese stock returns. They ran a cross-sectional regression by the FF model for their own characteristic-sorted portfolios—with monthly indices from 1971 to 1997—given from a securities company, Nihon Keizai Shinbun, Inc., and others. They concluded that CAPM does not hold in the Japanese stock market, while the FF model does well.

In recent years, however, academic researchers have begun to throw doubt on the effectiveness of the FF model, which used existing indices, including stock price indices based on the stock's attributes—such as liquidity, market capitalization, and price-book ratio—provided by securities companies and widely used in the business world. Consequently, Kubota and Takehara [2007] proposed new indices specific to the FF model. The newly measured indices there have been announced on the website of Nikkei Media Marketing, Inc., and they have been basics for the academic studies afterwards, as this paper employs them.

In addition, Kubota and Takehara verified the effectiveness of the FF model in the Japanese Common Stock Market, using the multi-beta model proposed by Generalized Method of Moments, and the mean-variance efficiency test proposed by Gibbons, Ross and Shanken [1989]. Kubota and

Takehara used monthly returns for twenty-nine years from September 1977. Although the FF model explained more than the CAPM did, its applicability in the Japanese stock market still left many questions unanswered, the research concluded. The FF model worked only in the first half of the period—that is, until 1991—which agreed with Daniel and Titman, but did not do well in any other period. Interestingly, the indication that the FF model basically did not work in the Japanese stock market contradicted similar studies on the United States Stock Market, where both the CAPM and the FF model basically did work. The inapplicability of the model was due to the SMB factor's unstable relationship with the expected returns, depending on the periods. In contrast, some common observations were reported with the studies on the United States stock market: the SMB factor has gotten less powerful and the HML factor is still working well. But somehow, the observed HML factor in the Japanese market had a much stronger effect on the expected stock return than the HML factor in the U.S. market.

3-3. Effectiveness of the Fama-French Three-Factor Model in the Japan-REIT Market

Previous studies of the characteristics of the J-REIT market commonly indicate that the returns of J-REITs cannot be explained by systematic factors, but by idiosyncratic factors, the contents of which have not been clarified yet.

Early representative work on this has been done by Ohashi [2003, 2004, 2005] and Kawaguchi [2005]. Ohashi pointed out that stocks and bonds could not explain the volatility of J-REIT returns, based on the monthly and weekly data, from the inception of the J-REIT market. Kawaguchi tested the relationship among stocks, bonds and J-REITs, and as a result reminded that the different risk-characteristics of J-REITs from real estate stocks arise from their difference in the business description and earnings structure.

The Association for Real Estate Securitization (ARES) [2007] widely examined multi-factor

models, including FF three-factors and long- and short-term interest rate disparities, based on the monthly returns for the five years since September 2001. The ARES did a time-series regression for the monthly return of J-REITs represented by the QUICK REIT Index[10] (with dividend) on the FF three-factors represented by the indices from Nikkei Media Marketing, Inc.

In CAPM analysis, the ARES found that the Alpha was significant while the Beta was not. J-REITs produced more returns than risks during the study period. But the coefficient of determination was much smaller than the US-REIT research of 10%. In the FF model analysis, the size (SMB) factor was significant in a whole-period over the past five years, while it lost its significance within any one of the sub-periods. The other two factors were rarely significant, except occasionally in the later sub-period. The most notable conclusion was that the coefficient of determination was so low (although higher than that in CAPM analysis) that the excess returns of J-REITs must contain independent portions aside from the ordinarily used risk factors. These results were in direct contrast to many research results concerning the US-REIT market, where all the FF three-factors show significance and the coefficient of determination actually becomes high enough. However, because the US-REIT market has a much longer history and many more REITs, it may not be fair to compare the US-REITs with J-REITs, which have only a few newly-formed REITs.

Most of the preceding works have missed an issue in that they have not taken into account the risk characteristics of the individual J-REIT firms, probably due to data constraints. The analytical method has been basically limited to a time-series regression of an aggregate J-REIT index to measure its sensitivity to the risk factors. In that sense, STB Research [2007] was a new study of a FF-like model with risk factors of stocks, bonds, and rents, by adding cross-sectional regression to time-series regression for the average excess returns of 25 J-REITs. The data used was current up to February 2007. Still, it

[10] The QUICK REIT Index is a capitalization-weighted index based on all J-REITs listed on the Tokyo stock exchange since September 10, 2001. This index is published by QUICK Corp.

turned out that those risk factors could explain only 30% of the J-REIT returns, and that the specific risk factors were significant only at the 15% level.

To sum up, the review of the past research in this chapter illustrates that the FF model is superior to the CAPM as an asset pricing model, but so far does not work in the Japanese market as well as in the United States market. In addition, it is indicated that a cross-sectional study of the pure FF model over the J-REIT market has not been done so much, due to data constraints. These findings are followed up in the next analytical chapter.

Chapter 4 Factor Loading: Methodology and Result

4-1. Methodology

This chapter aims to investigate the relationship between risks and returns of the J-REITs, by using the Fama-French (FF) three-factor model. The approach here upgrades the reliability of analysis in relation to past research in the following ways: this paper [1] considers the risk characteristics of individual J-REITs by a series of regressions in a two-stage process; [2] is based on a longer dataset, including periods after 2007 when the J-REIT market was most volatile, and including the major market downturn; and [3] tests the robustness of the regression result by two patterns of sub-period analysis and by asset type-classification of the J-REITs.

In the first stage, this chapter regresses price returns of a J-REIT on the FF three-factors in order to estimate "Beta," estimated coefficient (sensitivity of the J-REIT to risk factors) for the individual J-REITs. This is a longitudinal analysis based on the historical data. The estimated coefficients at this stage are referred to as the "factor loadings." At the second stage, this chapter runs a regression of the historical average risk premiums of the individual J-REITs onto the factor loadings ($\beta_{Mi,t,}$ $\beta_{SMBi,t,}$ $\beta_{HMLi,t}$)—or the Beta from the first stage regression—in order to examine the explanatory power of this model on the expected returns across the individual J-REITs. The definitions of the variables in the following formulas are omitted as they are the same as those in Chapter 3.

Time Series Regression (at time *t*):

$$\mathbf{r_{i,t} - r_{f,t} = \alpha_{i,t} + \beta_{Mi,t} \{r_{M,t} - r_{f,t}\} + \beta_{SMBi,t} r_{SMB,t} + \beta_{HMLi,t} r_{HML,t} + \varepsilon_{i,t}} \quad \textbf{(1)}$$

Cross Sectional Regression:

$$\textbf{Average } (\mathbf{r_i - r_f}) = \gamma_0 + \gamma_1 \beta_M + \gamma_2 \beta_{SMBi} + \gamma_3 \beta_{HMLi} + \varepsilon_i$$

(2)

This paper uses monthly data from September 10, 2001 to September 30, 2008, and applies the models over all 42 J-REITs listed on the stock/securities exchange in Japan during that period. Considering the ease with which past research has made comparisons, this paper also employs monthly data, regardless of the length of the period, in this case as short as seven years. In addition, for the purpose of complementing the limited data and checking the structural change of coefficients, this paper runs a series of regressions in two patterned sub-periods. In the first case (Case 1), the data period is sub-divided at August 2004, by which time all the major asset types of J-REITs end external growth (IPO) period and after which entered into the internal growth period (stable set of firms), according to the maturational stage of the J-REIT market. In the second case (Case 2), the data period is sub-divided into upward phase and downward phase at May 2007, the peak of the stock price, according to the stock price trend of the J-REIT market.[11]

Case 1: External Growth Period (September 2001 ~ August 2004),

Internal Growth Period (September 2004 ~ September2008)

Case 2: Upward Phase (September 2001 ~ May 2007),

Downward Phase (June 2007 ~ September2008)

This paper also discusses the regression results classified by the major asset types of the individual J-REITs, in order to see the performance of the model in different portfolios and to identify the effect by asset type.

A difference in approach from Fama and French's research lies in the timing of taking Beta and

[11] For the grounds for definition of these sub-periods, see Chapter 2, "An Overview of the Japan-REIT Market."

the return. Fama and French ran a regression for an ex-post return on an ex-ante Beta by staggering the target period. In contrast, this paper tests the relationship between an ex-post average return and an ex-post Beta within a certain period due to the short period of time since the J-REIT market foundation.

4-2. Data and Its Characteristics

Monthly total returns of J-REITs are calculated on the basis of the data from ARES. As for the data source for FF three-factors, this paper uses indices published by Nikkei Media Marketing, which were calculated especially for the FF model in keeping with the study by the ARES [2007][12]: "The monthly return of the market portfolio is the monthly return (with dividend) of the portfolio for all issues on the first and second tier of the TSE weighted by their market capitalizations, and the size (SMB) factor monthly return is the monthly return obtained by subtracting the stock portfolio of the top 50% market caps from the stock portfolios of the lowest 50% market caps. The value (HML) factor monthly returns is the monthly return obtained by subtracting the bottom 30% of the stock portfolio from the top 30% of the stock portfolio on a book value ratio basis. In addition, the risk free interest rate (short-term interest) is interpreted to be the value when the average monthly overnight secured call rate is converted to a monthly rate." (ARES [2007]: p. 28).

The basic statistics of those monthly returns in the whole period are shown in Table [4-I] with all J-REITs in the listed order. The asset type investment policy of the J-REIT is also shown based on its announcement and actual investment allocation. The average risk premium of the J-REITs falls to well below the averages of the FF three-factors. Although the early-listed J-REITs seem to earn higher and more positive returns, it is not known exactly whether the high returns are due to the listed timing or the asset type, because the J-REITs investing offices seem to earn high returns and the early-listed J-REITs

[12] See Chapter 3, "Factor Loading: Literature Review."

were likely to focus on office types.

Table [4-I]: Basis Statistics

(J-REITs are lined by the listed order.)

Factor	Investment Policy by Asset Type	Average (%)	Standard Deviation		Kurtosis	Skewness	# of Samples
Market Factor		0.24	4.41		0.43	(0.41)	85.00
SMB Factor		(0.08)	2.72		(0.14)	0.15	85.00
HML Factor		0.77	1.80		0.03	(0.20)	85.00
J-REIT 1	Office	0.76	6.18	38.18	1.67	(0.60)	85.00
J-REIT 2	Office	0.64	5.43	29.51	2.43	(0.58)	85.00
J-REIT 3	Commercial	0.15	6.53	42.61	0.65	(0.65)	79.00
J-REIT 4	Complex (Office)	0.27	6.37	40.58	0.83	(0.06)	76.00
J-REIT 5	Complex (Office)	0.45	5.88	34.52	5.05	(1.55)	75.00
J-REIT 6	Complex (Residential)	0.11	6.91	47.79	4.03	(0.23)	73.00
J-REIT 7	Complex (Commercial)	0.71	7.69	59.21	2.21	(0.34)	61.00
J-REIT 8	Office	1.26	6.16	37.94	1.00	(0.29)	61.00
J-REIT 9	Office	0.82	7.29	53.13	1.86	(0.11)	58.00
J-REIT 10	Complex (Commercial)	0.14	7.12	50.69	3.49	0.19	58.00
J-REIT 11	Complex (Office)	0.34	7.34	53.85	4.09	0.22	56.00
J-REIT 12	Residential	(1.03)	6.74	45.45	0.51	0.34	55.00
J-REIT 13	Complex (Residential)	(1.51)	6.85	46.96	5.47	(1.76)	53.00
J-REIT 14	Commercial	0.29	6.95	48.24	0.28	(0.73)	50.00
J-REIT 15	Residential	(2.54)	8.09	65.41	(0.38)	(0.24)	46.00
J-REIT 16	Complex (Residential)	(2.30)	7.20	51.87	(0.03)	(0.37)	43.00
J-REIT 17	Industrial	0.10	7.85	61.59	0.34	(0.34)	41.00
J-REIT 18	Complex (Commercial)	(0.98)	7.58	57.38	3.06	0.74	40.00
J-REIT 19	Residential	(1.84)	6.61	43.68	0.38	(0.10)	39.00
J-REIT 20	Residential	(3.22)	8.05	64.82	0.97	(0.77)	39.00
J-REIT 21	Complex (Office)	(0.88)	7.12	50.66	1.44	(0.29)	39.00
J-REIT 22	Complex (Residential)	(2.26)	7.11	50.58	(0.25)	0.01	39.00
J-REIT 23	Complex (Office)	(1.93)	10.33	106.70	5.53	(0.96)	37.00
J-REIT 24	Residential	(0.67)	6.79	46.11	(0.37)	(0.52)	36.00
J-REIT 25	Office	(0.06)	9.47	89.72	0.22	(0.02)	36.00
J-REIT 26	Complex (Commercial)	(0.34)	8.64	74.63	0.64	(0.51)	36.00
J-REIT 27	Residential	(0.25)	6.69	44.81	3.80	0.67	35.00
J-REIT 28	Residential	(2.07)	6.41	41.03	3.93	0.36	34.00
J-REIT 29	Complex (Residential)	(2.77)	7.69	59.16	0.42	(0.54)	29.00
J-REIT 30	Hotel	(2.69)	9.24	85.36	(0.51)	0.01	32.00
J-REIT 31	Complex (Office)	(1.03)	8.51	72.45	0.04	(0.27)	31.00
J-REIT 32	Office	(2.48)	10.72	114.85	0.17	(0.47)	31.00
J-REIT 33	Complex (Residential)	(0.89)	12.60	158.76	6.97	1.95	31.00
J-REIT 34	Hotel	(1.93)	7.39	54.57	1.38	(0.02)	28.00
J-REIT 35	Residential	(2.77)	8.73	76.23	4.46	0.92	28.00
J-REIT 36	Office	(0.11)	11.10	123.25	1.16	0.79	28.00
J-REIT 37	Residential	(0.18)	9.81	96.27	(0.01)	(0.06)	26.00
J-REIT 38	Complex (Office)	(2.11)	10.55	111.31	0.90	(0.42)	26.00
J-REIT 39	Complex (Office)	(2.38)	10.70	114.39	0.36	(0.56)	25.00
J-REIT 40	Complex (Office)	(2.85)	8.49	72.09	0.10	0.84	22.00
J-REIT 41	Residential	(3.54)	7.44	55.33	1.82	(0.46)	20.00
J-REIT 42	Industrial	(2.45)	12.68	160.85	0.83	(1.00)	12.00
(Average of 42 J-REITs)		(1.05)	8.02		1.69	(0.18)	43.67

Table [4-II] shows correlation among the average risk premium of the J-REITs (defined as "J-REIT Average" in the table), market factor, SMB factor, and HML factor in three patterns of periodical analysis: the whole period, Case 1, Case 2.

Except for the market factor, all the factors are almost uncorrelated to each other, both in the whole period and any sub-periods, which is good for the model. The notable attributes are that the relationship of the J-REITs with the SMB factor is unstable, and that the J-REITs had an extremely low relationship with the HML factor. These attributes tie in with the ARES [2007]. A step to the sub-period analysis in Cases 1 and 2 clarifies that the correlation trends in both cases are the same, in spite of the distant division timing: the J-REITs positively correlate with all the other factors in the early period, but weaken or invert around the middle period, and then come to negatively correlate with the SMB and HML factors in the later period. In particular, the later period strongly shows a similar tendency to that in the whole period. These facts lead an additional indication that the correlative formations in the very early period and the very late period are relatively clear, while they are ambiguous in the middle period.

These results from the correlation matrix should reflect the explanatory power of each factor towards the risk premium of the J-REITs.

Table [4-II]: Correlation Matrix

<Whole Period>

	J-REIT Average	Market Factor	SMB Factor	HML Factor
J-REIT Average	1.00			
Market Factor	0.36	1.00		
SMB Factor	(0.09)	0.06	1.00	
HML Factor	(0.03)	(0.33)	0.09	1.00

<Case 1>

External Growth Period: September 2001 ~ August 2004

	J-REIT Average	Market Factor	SMB Factor	HML Factor
J-REIT Average	1.00			
Market Factor	0.28	1.00		
SMB Factor	0.36	0.23	1.00	
HML Factor	(0.12)	(0.25)	0.15	1.00

Internal Growth Period: September 2004 ~ September 2008

	J-REIT Average	Market Factor	SMB Factor	HML Factor
J-REIT Average	1.00			
Market Factor	0.37	1.00		
SMB Factor	(0.15)	(0.09)	1.00	
HML Factor	(0.05)	(0.42)	(0.06)	1.00

<Case 2>

Upward Phase: September 2001 ~ May 2007

	J-REIT Average	Market Factor	SMB Factor	HML Factor
J-REIT Average	1.00			
Market Factor	0.17	1.00		
SMB Factor	0.10	0.15	1.00	
HML Factor	0.14	(0.31)	0.09	1.00

Downward Phase: June 2007 ~ September 2008

	J-REIT Average	Market Factor	SMB Factor	HML Factor
J-REIT Average	1.00			
Market Factor	0.29	1.00		
SMB Factor	(0.14)	(0.32)	1.00	
HML Factor	(0.18)	(0.54)	0.05	1.00

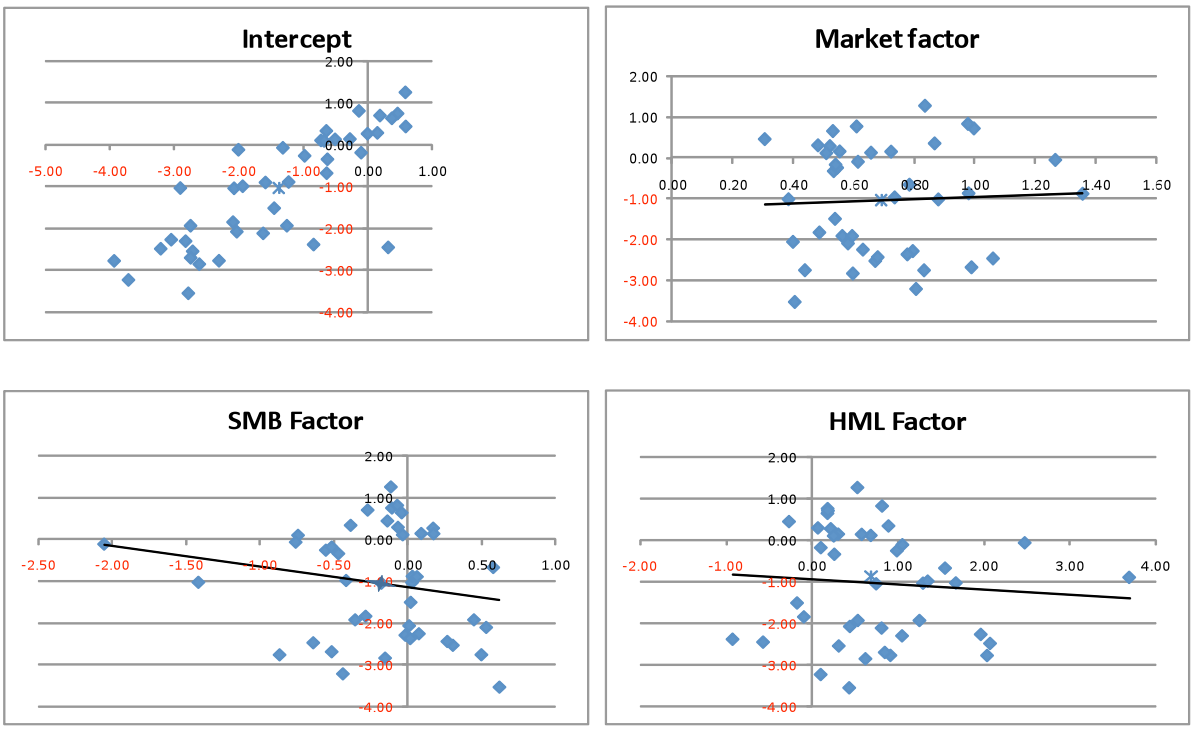
4-3. Time-Series Regression Result

i) Whole Period Analysis:

The result of the time-series regression proved to be interesting. Table [4-III] plots on the

vertical axis the ex-post average excess returns (over the risk-free rate) of each REIT as a function (on the horizontal axis) of the factor loadings estimated for each REIT in the longitudinal regressions. This provides a gross image of the risk/return profile. The four graphs refer to the three risk factors (Market, SMB, and HML) plus the intercept (the Alpha of each REIT over the period studied). An asterisk (*) shows the average result of all the 42 J-REITs.

Table [4-III]: Time-Series Regression – the Average Risk Premium and Alpha/Beta –



The "intercept" plot shows that most of the J-REITs have negative Alphas. It turns out that many J-REITs during the period studied did not give as high returns as what their risk factor loadings would have implied (presuming that the FF model is a good model of J-REIT risk and return expectations among investors). In the plots of the Betas (factor loadings) of the three-factors, there is a lot of dispersion, and it is hard to tell the risk/return relationship. In the "market factor" plot, all the J-REITs have positive factor loadings with a very weak positive relationship between Beta and the achieved excess

return. The average loading on the SMB factor is negative, which means the expected return toward J-REITs with big market capitalization is higher than those with small market capitalization. The plot of the HML factor effect resembles that of the market factor, but shows an even less positive relationship between the risk factor and the achieved returns (indeed, the fitted line is slightly negative sloped).

These results are generally similar to those of Kubota and Takehara [2007], the aforementioned past research on the effectiveness of the FF model with longer historical data, in that they also found that the FF model only weakly explains achieved returns, and especially that the effect of the SMB factor is unclear. To the contrary, the resulted tendency of the Alpha and Betas here does not simply follow the results of the ARES [2007], the past similar research on the J-REIT market. The cause of the mismatch may be attributed to the difference in the regression method,[13] or to the collapse of the J-REIT market since 2007, which this paper includes but the past research does not.

In the results of the time-series regression classified by the main asset type of the individual J-REIT (see Table [4-IV]), the factor loadings of each asset type look similar. Although all the factors rarely signify anyway, it can be read out that the J-REIT mainly targeting the residential group has high risk/low return due to the low return tendency.

[13] Remember that ARES [2007] regressed the QUICK J-REIT Index that is weighted by the market capitalization of all J-REITs.

Table [4-IV]: Time-Series Regression by Main Asset Type

Asset Type	Office + Complex (Office)	Residential + Complex (Residential)	Commercial + Complex (Commercial)	Hotel	Industrial	Average of 42 J-REITs
# of J-REITs	16.00	16.00	6.00	2.00	2.00	42.00
Average Return %	(0.58)	(1.73)	(0.01)	(2.31)	(1.17)	(1.05)
Intercept						
Coef.	(1.08)	(2.07)	(0.50)	(2.00)	(0.18)	(1.37)
St. Error	1.44	1.40	1.08	1.73	3.09	1.46
t Stat	(0.50)	(1.60)	(0.43)	(1.14)	(0.23)	(0.93)
P-value	0.45	0.23	0.64	0.30	0.77	0.40
Market Factor						
Coef.	0.72	0.67	0.67	0.79	0.60	0.69
St. Error	0.30	0.30	0.24	0.36	0.62	0.31
t Stat	2.87	2.42	2.98	2.16	1.25	2.60
P-value	0.09	0.08	0.03	0.06	0.29	0.08
SMB Factor						
Coef.	(0.34)	(0.03)	(0.16)	(0.03)	(0.24)	(0.18)
St. Error	0.60	0.59	0.43	0.73	1.21	0.61
t Stat	(0.52)	(0.05)	(0.27)	(0.04)	(0.59)	(0.28)
P-value	0.58	0.66	0.59	0.52	0.54	0.61
HML Factor						
Coef.	0.77	0.95	0.46	0.69	(0.16)	0.75
St. Error	0.88	0.90	0.70	1.08	2.06	0.93
t Stat	0.87	1.07	0.66	0.63	0.05	0.86
P-value	0.38	0.42	0.57	0.53	0.82	0.45

ii) Sub-period Analysis (Cases 1 & 2):

Let's test the effect of division timing on the results. Table [4-V] lays out the time-series regression results of the whole period, Case 1 and Case 2 in a line for comparison. The figures in the table present the average of the regression results of all the J-REITs.

In both Case 1 and Case 2, the Betas of the factors clearly change its sign from the first half to the second half of the periods, and the second half period shows a similar result to the whole period analysis. In particular, the change is more dramatic in the downward phase in Case 2, the period since the sub-prime effect in 2007, as was expected in the previous section. The Alpha is undervalued in the first half of the period, but is overvalued in the latter half. The market factor always earns positive

premiums in any sub-periods. The SMB factor is consistently unstable throughout the periods, and the expected return on J-REITs with big market capitalization is getting higher in the second half periods. The HML factor also has negative premiums in the downward phase, which means that the expected return on growth stocks is getting higher than the value stocks in the J-REIT market. To interpret Case 1 and Case 2 collectively, it seems that the market factor and HML factor increase their Betas toward the market peak (mid-2007) and decrease afterwards, while the SMB factor behaves oppositely.

Table [4-V]: Time-Series Regression in Sub-Periods

		Case 1		Case 2	
	Whole Period	External Growth Period	Internal Growth Period	Upward Phase	Downward Phase
	Across Time _01.Sept.-08.Sept.	Across Time _01.Sept.-04.Aug.	Across Time _04.Sept.-08.Sept.	Across Time _01.Sept.-07.May	Across Time _07.Jun.-08.Sept.
Average Return %	(1.05)	2.29	(1.20)	2.45	(5.35)
R Square	0.19	0.27	0.21	0.22	0.24
Adjusted R Square	0.11	0.01	0.12	0.07	0.05
Intercept					
Coefficients	(1.37)	0.58	(1.53)	1.99	(4.35)
Standard Error	1.46	2.97	1.50	2.33	2.32
t Stat	(0.93)	0.75	(1.10)	0.97	(2.01)
P-value	0.40	0.49	0.39	0.43	0.18
Market Factor					
Coefficients	0.69	0.22	0.71	0.54	0.36
Standard Error	0.31	0.84	0.32	0.52	0.48
t Stat	2.60	0.33	2.51	1.21	0.86
P-value	0.08	0.60	0.08	0.32	0.47
SMB Factor					
Coefficients	(0.18)	0.70	(0.27)	0.39	(0.23)
Standard Error	0.61	0.98	0.64	1.08	0.89
t Stat	(0.28)	1.01	(0.51)	0.38	(0.28)
P-value	0.61	0.41	0.50	0.54	0.54
HML Factor					
Coefficients	0.75	0.35	0.75	1.01	(0.21)
Standard Error	0.93	1.21	0.97	1.03	1.47
t Stat	0.86	(0.06)	0.82	1.02	(0.15)
P-value	0.45	0.60	0.47	0.37	0.56

4-4. Cross-Sectional Regression Result

Table [4-VI] shows the result of a cross-sectional regression during the whole period as well as during the sub-periods. Colored cells represent significance at the 0.05 level.

It can be guessed that the market factor and the SMB factor have a turning point sometime between September 2004 and May 2007, in terms of their trends. Other than that, there seems no clear difference of significance between the first and second half of the periods. The Alpha basically maintains significance throughout any period, which means that, as a model, the FF model is not working to explain the result. As a whole, the accuracy of the model and the explanatory power of the factors are low in the whole period and any sub-periods, as can be seen from the low R^2 (adjusted R^2) and the P-value exceeding 0.1. Still, the model works relatively well in the external period in Case 1, and an additional sub-period analysis the result table of which is not shown in this paper indicates that the model extends the accuracy until mid-2005, when the J-REIT was expanding its size and was trending upwards.

Table [4-VI]: Cross-Sectional Regression in Sub-periods

		Case 1		Case 2	
	Whole Period	External Growth Period	Internal Growth Period	Upward Phase	Downward Phase
	Across REITs _01.Sept.-08.Sept.	Across REITs _01.Spet.-04.Aug.	Across REITs _04.Sept.-08.Sept.	Across REITs _01.Sept.-07.May.	Across REITs _07.June-08.Sept.
R Square	0.07	0.43	0.22	0.02	0.09
Adjusted R Square	(0.01)	0.21	0.16	(0.06)	0.02
Intercept					
Coefficients	(1.51)	1.12	(1.99)	2.24	(5.87)
Standard Error	0.69	0.76	0.62	0.41	0.36
t Stat	(2.18)	1.48	(3.24)	5.43	(16.18)
P-value	0.04	0.18	0.00	0.00	0.00
Market Factor					
Coefficients	0.87	1.45	1.03	0.45	1.24
Standard Error	1.09	0.88	0.94	0.54	0.66
t Stat	0.80	1.63	1.10	0.82	1.88
P-value	0.43	0.14	0.28	0.42	0.07
SMB Factor					
Coefficients	(0.59)	1.14	(0.99)	0.05	(0.17)
Standard Error	0.42	1.11	0.32	0.19	0.30
t Stat	(1.40)	1.02	(3.06)	0.28	(0.58)
P-value	0.17	0.34	0.00	0.78	0.57
HML Factor					
Coefficients	(0.34)	(0.15)	(0.27)	(0.05)	(0.14)
Standard Error	0.30	0.70	0.24	0.23	0.21
t Stat	(1.11)	(0.22)	(1.14)	(0.20)	(0.64)
P-value	0.27	0.83	0.26	0.84	0.53

Table [4-VII] gives the same regression result of the whole period, classified by the main asset types of the individual J-REIT. If classified by the investment asset type, it looks like the model works relatively well for the J-REITs mainly investing commercial assets, except for the fact that only the HML factor has a negative coefficient. However, the numbers of the listed J-REITs with commercial assets is so small—only six—that result of this indication cannot be fully reliable. For other portfolios by office- or residential-type J-REITs, the FF model does not work. Therefore, even if classified by the asset attribution, the model still does not give a clear indication, as it did not in the all-REIT portfolio of Table [4-VI].

Table [4-VII]: Cross-Sectional Regressions in the Whole Period, by Asset Type

	Across REITs _Office	Across REITs _Residential	Across REITs _Commercial
R Square	0.05	0.07	0.98
Adjusted R Square	(0.19)	(0.17)	0.96
Intercept			
Coefficients	(0.88)	(2.26)	(0.43)
Standard Error	1.20	1.14	0.19
t Stat	(0.73)	(1.99)	(2.24)
P-value	0.48	0.07	0.15
Market Factor			
Coefficients	0.75	0.71	1.52
Standard Error	1.77	2.13	0.29
t Stat	0.42	0.33	5.30
P-value	0.68	0.74	0.03
SMB Factor			
Coefficients	(0.39)	(0.45)	0.76
Standard Error	0.75	0.77	0.21
t Stat	(0.53)	(0.58)	3.66
P-value	0.61	0.57	0.07
HML Factor			
Coefficients	(0.49)	0.04	(1.03)
Standard Error	0.63	0.51	0.12
t Stat	(0.77)	0.08	(8.62)
P-value	0.46	0.94	0.01

In conclusion, despite the fact that some risk factors show their strong premiums depending on the sub-period, the FF model has so far evidenced a very limited capability to explain the risks and returns

of J-REITs. The limited explanatory power of the model may be attributed to the shortness of the data period. In addition, it can be inferred that independent factors specific to the J-REITs may have a strong effect on the performance of the J-REITs. These conclusions confirm the past research on the J-REIT market, leaving the problem of how to find the best explanatory factor in pricing the J-REITs. Still, this paper gained a significant outcome in that it made a thorough investigation and cast doubt on the effectiveness of the FF model in the J-REIT market with updated data and extended research methods.

Chapter 5 REIT-Based Pure Play Indices: Characteristics and a Model

By tracking REIT equity return data, bond data, and property holding data at monthly frequencies, this chapter explains a model and its data to construct "Pure Play" indices—de-leveraged segment-specific indices that represent commercial property market returns—while also incorporating the efficiency and liquidity of the public stock market. This chapter first introduces the purpose and the characteristics of the "Pure Play" indices, and then explains the model to create those indices. Demonstration of the indices follows in the next chapter.

5-1. Background and Purpose of the Index Development

More and more properties are being held by REITs. Researchers and investors expect public stock exchanges to provide more efficiency and higher liquidity than privately traded real estate investment. However, in practice, the diversification and leverage of REITs have prevented investors from fully utilizing their superior liquidity to make target property segment investments. For example, an investor's target segment (asset types or locations) often does not exactly match property holdings of any REITs, because REITs tend to diversify their individual portfolios.

Even with the existing property-type-specific REIT return/price indices that have been developed by a number of industry companies, these problems cannot be solved easily. These indices have generally been constructed simply by classifying each REIT as representing a given property type. The indices are useful, but such an approach has problems in comparison with the direct-property based returns, which are broken out into some major types of commercial property. Again, for one thing, REIT return indices do not control for the effect of leverage. Another problem is that REIT-classification of these indices assumes that each REIT only represents a single type of property, an assumption that is

based on an over-simplification for any REIT that actually diversifies its investment types of commercial property and/or that changes its portfolio mix over time.

In order to deal with these problems, REIT-based commercial property return indices, such as Pure Play Indices, were created. This Pure Play approach retrieves underlying property returns for the specific property market segments, even in cases in which REIT investments are mixed among various property types and this mix changes over time. The idea of the Pure Play Indices is to construct portfolios of long and short positions in REITs, based on their asset holdings in the various property market segments, such that the "Pure Play" portfolio eliminates exposure to all but one target segment.

5-2. Development of the "Pure Play" Indices

Geltner and Kluger [1995] proposed a regression-based model to develop a time-series index of historical, unlevered return to commercial properties held by UE-REITs, based on REIT share return information. Through a pooled regression for the unlevered total asset returns on to the property-holding data by each REIT in each property type, and in each period of time, they got annual returns for each type of property from the regression coefficients. Due to data limitations at that time, however, they could not produce a high frequency index. However, they did find that this commercial property return index led appraisal-based indices, such as the NCREIF index.

In a subsequent paper, Geltner and Kluger [1998] developed a model to construct "REIT-based Pure Play Portfolios," a type of portfolio that approximates the "pure" performance of the target real estate sector with zero exposure to unwanted sectors in the long and short positions of REITs. They extended their original regression-based approach into another index they dubbed, the "Pure Play Index," which eliminates the exposure to unwanted real estate segments by means of a long-and-short portfolio that could in principle be held and traded. This approach seemed technically straightforward, but was

only recently followed up with practical development.

Horrigan, Case, Geltner, Pollakowski [2009] refined the Pure Play Index with the benefits of new, abundant REIT data and modified methodologies. To gain historical segment-specific returns for the US-REIT market, they explored both levered and de-levered models that attribute REIT returns to underlying property segment holdings, with or without adjusting for debt held on REIT balance sheets. They performed the models in a separate regression for each period, rather than a pooled regression as in Geltner and Kluger [1995]. Then they demonstrated that the regression approach and the long/short hedge portfolio approach are equivalent, and that a 16-segment classification of property asset types and geographical regions provides good granularity with high frequency potential in the U.S.

In the Japanese real estate market, researchers and industry practitioners have launched a number of property return indices. Those indices are mostly based on appraisals, since a large, reliable electronic property transaction database is not yet available for practical use in Japan. Many of the indices, except the ARES J-REIT property index, employ in-house appraisals or a database of original sales/asking prices of providers,, and are open exclusively to members. Endo [2006] widely reviewed the indices currently available from industry companies, and proposed a model to remove the lagging effect of the appraisal-based investment indices, for the purpose of inferring the “true” private real estate returns from them.

The “Pure Play” approach can be useful as a unique information source for a variety of purposes. First, for example, they can suggest the relevant price discovery in each property market segment, such as the segments tracked in the U.S. by the Moody’s/REAL CPPI and NCREIF indices, since the REIT-based indices are likely to lead private direct property market indices during market turning points. Second, the Pure Play Indices can offer highly frequent estimates for underlying property markets at various segment levels, with efficiency and granularity, based on daily REIT share closing prices. The high

frequency can be useful in principle for synthetic investment in property through derivatives such as swaps or exchange-traded funds (ETF). Third, ability to trade Pure Play Indices through long and short positions of REITs that compose portfolios enables arbitrage between the underlying portfolio and facilitates the pricing of derivatives. This is also an advantage in the construction of ETFs. It is possible to add or subtract leverage synthetically by scaling the portfolio weights and using debt or bond investments. In addition, a by-product of this approach could be a quantitative measure of REIT-level property management performance.

Pure Play Portfolios, defined as the long and short position weights in the constituent REITs, may be generated purely from structural information on REIT property holdings. The combination of various targeted Pure Play Portfolios can serve as an investment vehicle to make an investment portfolio that is exactly balanced across sectors (or otherwise allocated across segments), making them useful for hedging, speculation, or synthetic investment into portfolios targeted or balanced by a property market segment.

5-3. Model

This paper applies those techniques presented by Horrigan et al. to J-REITs over each month from January 2006 to April 2009,[14] a period when a numbers of J-REITs were already listed with sizable asset portfolios.

(i) Pure Play Index

The methodology that this thesis will apply to the Japan market is Pure Play Indices by the de-levered regression model as described in Horrigan, Case, Geltner, Pollakowski [2009]—a model which

[14] A de-listed J-REIT is included until the month when it was de-listed.

modified Geltner and Kluger [1995]—for three major industry segment types (office, residential, and commercial). The model runs a separate regression for each period over the whole experimental period for the de-levered J-REIT capital returns on proportional property segment holdings of each J-REIT (each period). The coefficients generated from this regression model reflect the estimated "segment returns," returns of the underlying property segment.

Pure Play Model (regress across all REIT $i = 1,2,...,N$, in each period t):

$$roa_{i,t} = b_{O,t}x_{O,i,t} + b_{R,t}x_{R,i,t} + b_{C,t}x_{C,i,t} + \varepsilon_{i,t} \quad \ldots(1)$$

where:

$roa_{i,t}$…de-levered capital returns in period t to $REIT_{i.}$

$x_{O,i,t}$ …percentage of $REIT_i$'s total assets that are office-type properties (by dollar value of assets) in period t

$x_{R,i,t}$ …percentage of $REIT_i$'s total assets that are residential-type properties (by dollar value of assets) in period t

$x_{C,i,t}$ …percentage of $REIT_i$'s total assets that are commercial-type properties (by dollar value of assets) in period t

$\varepsilon_{i,t}$…the error term (the idiosyncratic return) of REITi in period t

Note that by definition:

$$x_{O,i,t} + x_{R,i,t} + x_{C,i,t} = 1$$

The error term ε_i here represents the specific idiosyncratic performance of $REIT_i$ apart from the systematic performance (across all REITs) of the underlying properties. It reflects management effects

and random effects that are unique to $REIT_i$. The ε_i, term causes "excess" volatility (unrelated to the underlying property market segment returns), which we would like to minimize in our indices (and hence in the Pure Play Portfolios).

In order to eliminate miscellaneous property exposures, this paper gathers them into a single "other" segment and excludes any J-REITs with over 30% of an "other" segment in their property holdings. The regression includes J-REITs with less than 30% of "other," and rescales the remaining segment exposures to equal one. The de-levered capital returns can be calculated on the basis of the Weighted Average Cost of Capital (WACC), which accounts for the identity of each J-REIT as follows (omitting an explanation for the repetition of denotes):

$roa_{i,t}$ = (equity/total asset)*$r_{i,t}$ + (debt/total asset)*cost of $debt_t$ …(2)

where:

equity…total stockholders' equity (market price) of $REIT_i$ at time t

debt…total liability as of the semi-annual fiscal term end of $REIT_i$

total asset…sum of total stockholders' equity and total liability of $REIT_i$

As a proxy, the same cost of debt—that is, the average debt rate of all the J-REITs at the end of term—is applied to every J-REIT for the period within the semi-fiscal term because of limits to the availability of data, although in principle unique debt rates at each J-REIT level would be better. The equity/total asset data and debt/total asset data are updated monthly for each semi-annual fiscal term in this study. The equity/total asset ratios were stable with a mean of 50.0% over the period. The author creates the property holdings share and the debt amount of each J-REIT on a monthly basis, by smoothing the balances from the beginning to the end of the semi-annual fiscal period.

In order to gain some insight into the performance of the Pure Play Indices, this paper contrasts these with the STBRI J-REIT indices,[15] an investment performance benchmark of J-REITs that is calculated in line with NAREIT/FTSE Indices. For comparison, the STBRI J-REIT indices are also delivered in this experiment (similar to the individual REIT returns used to compute the Pure Play Indices).

(ii) Pure Play Portfolio

This paper then develops a couple of examples of Pure Play Portfolios, based on REIT-based segment-specific property returns calculated from the above-mentioned Pure Play Model (formula (1)), in order to illustrate what a typical portfolio of this sort looks like, in terms of the typical shares of long and short weights (or positions) in the individual REITs. This is to illustrate the typical nature of the Pure Play Portfolios. The Pure Play Portfolios are calculated and presented in this thesis for the monthly period of May 2007 as the turn the peak of the market, and for February 2009 as the bottom.

We define a Pure Play Portfolio as a portfolio with unit exposure to the target segment, and zero exposure to all the other segments. For instance, based on formula (1), by eliminating the pure returns to the non-target segments, the return to the portfolios (r_p) that target an office segment can be expressed as follows:

$$r_p = r_O + \sum_{i=1}^{N} (w_i e_i) \qquad \ldots (3)$$

where:

w_i…percentage of the portfolio's holdings in $REIT_i$

[15] For information about the STBRI J-REIT Index, see chapter 2.

under constraints for a Pure Play Portfolio for a single target segment (which is office in the example below):

$$\sum_{i=1}^{N} w_i x_{R,i} = 0, \quad \sum_{i=1}^{N} w_i x_{C,i} = 0, \text{ and } \sum_{i=1}^{N} w_i x_{O,i} = 1$$

The variance of the portfolio (3) can be simplified as:

$$VAR(r_p) = VAR(r_O) + \sum_{i=1}^{N} \{w_i^2 VAR(e_i)\} \quad \ldots (4)$$

As in Holly el al., this paper assumes that the variance of the idiosyncratic return, e_i, of $REIT_i$ is inversely proportional to the dollar value of its property holdings ($total_i$). So the variance of the Pure Play Portfolio can be expressed as:

$$VAR(r_p) = VAR(r_O) + \sum_{i=1}^{N} (w_i^2 * 1/total_i) \quad \ldots (5)$$

As formula (5) indicates, for the purpose of portfolio optimization—which generally means minimizing the variance of the portfolio return (subject to the Pure Play constraints)—the solution is governed entirely by the second term in the preceding formula.

Finally, in order to gain some ideas of the type of role that the Pure Play Indices might play in investment strategy, this paper performs an optimal mean-variance portfolio allocation analysis, considering three asset classes: stocks, bonds, and real estate. Real estate is represented here by the investment in the Pure Play Portfolios presented above, with returns of the three-property segments equally weighted. As for indices of stocks and bonds, this paper uses TOPIX and subscription yields of ten-year government bonds.

By introducing the past literature and the model, this chapter has presented a methodology that can create Pure Play Indices at a high rate of frequency with the REIT data, thereby providing a unique

opportunity to track the commercial property market; and potentially to make targeted investments synthetically or via constructed Pure Play Portfolios, as well as to construct hedges in the real estate market, and to support derivatives trading.

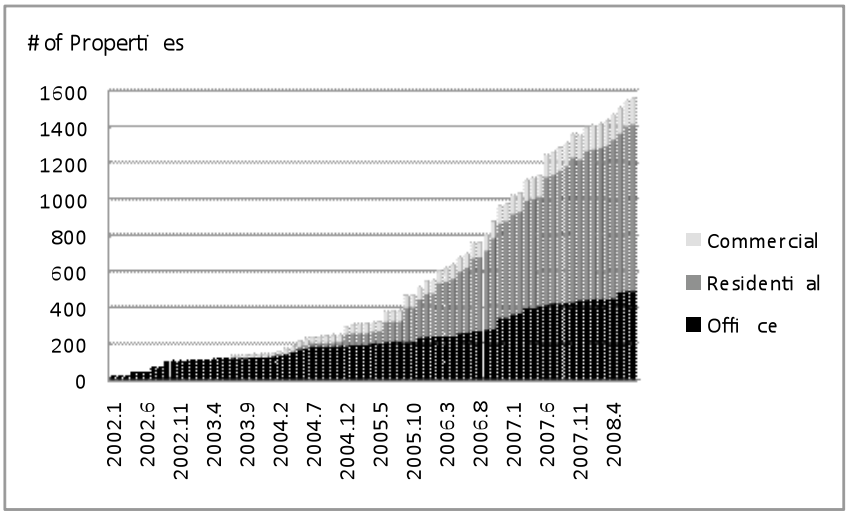
Chapter 6 REIT-Based Pure Play Indices: A Demonstration on Japanese Property Type Sectors

This chapter demonstrates the methodology described in the previous chapter, by applying it to J-REITs. We first describe the data and then the results of the analysis.

6-1. Data Analysis

This study is for each month from January 2006 to April 2009. Table [6-I] shows the number of underlying properties for the ARES J-REIT Property Database.[16] Since May 2004, all three major property segments (office, residential, and commercial) have been ready on the J-REIT market. By around the end of 2005, the number of properties had grown to one third of the current number, so we consider that the period after January 2006 has sufficient data for this study.[17]

Table [6-I]: Number of Underlying Properties in the J-REIT Market



(Created by the author, based on data from ARES)

[16] The ARES J-REIT Property Database is a service provided by The Association of Real Estate Securitization (ARES). It lists information concerning real estate, leasehold rights and surface rights for real estate and trust beneficiary rights placed in trust that are owned by listed J-REITs.

[17] The distribution by values mirrors that for the number of properties.

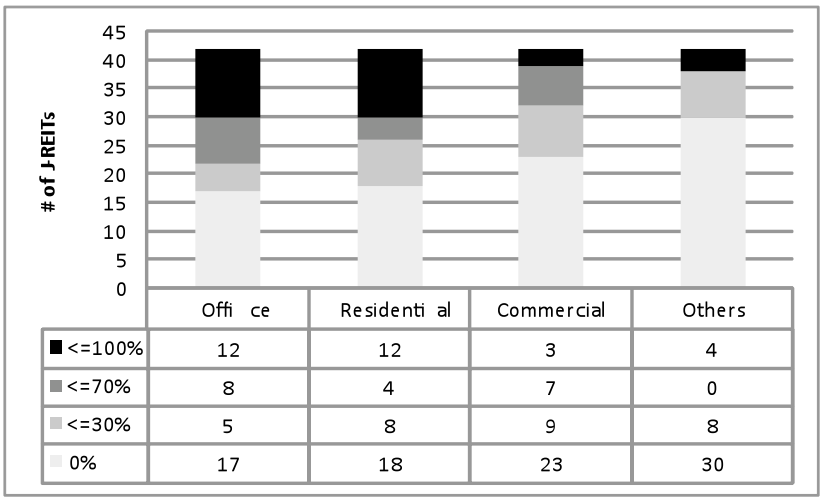
Table [6-II] represents a summary of historical J-REIT investment in properties over the period. As described in Chapter 2, in May of 2007 it was the turning point in the market when the returns to J-REITs changed from positive to negative. The overall mean value of the returns over the entire period shown at the bottom of the table is almost zero, since the study period contains both the up-market and the down-market. Also, as is apparent from the standard deviation at the bottom of the same table, the composition of the property share holdings has not changed much.

Table [6-III] classifies J-REITs into four levels of property-type concentration based on the average property share holdings over the entire period, and summarizes the results into the three major segments plus "others." In that table, every segment has many J-REITs in 0% holding, which indicates that J-REIT tends to focus on one or two property segments. REITs investing in office and/or residential segments tend to have those segments as their main assets, while REITs investing in commercial have those as their minor assets. A small number of J-REITs have their assets in the "others" segment, and even if they have, their share holdings in "others" were just a portion of the total.

Table [6-II]: Summary of Historical J-REIT Property Investment

	# of J-REITs	Mean $r_{del.}$	Stdv. of $r_{del.}$	Debt Ratio	Value Share in Each Property Type			
					Office	Residential	Commercial	Others
Jan-06	28	2.15%	2.41%	38.94%	39.51%	34.63%	20.64%	5.23%
Feb-06	29	1.13%	2.94%	39.08%	38.17%	32.69%	20.39%	8.75%
Mar-06	32	1.22%	3.00%	39.66%	39.63%	33.47%	18.75%	8.15%
Apr-06	32	0.65%	3.29%	40.00%	39.28%	33.52%	18.76%	8.45%
May-06	33	-1.15%	1.97%	40.42%	38.25%	34.35%	18.87%	8.53%
Jun-06	36	-1.52%	2.34%	42.12%	37.66%	34.34%	17.24%	10.77%
Jul-06	36	-1.24%	2.69%	43.14%	37.43%	34.44%	17.19%	10.94%
Aug-06	38	2.06%	2.13%	41.93%	37.37%	35.35%	16.75%	10.54%
Sep-06	39	0.97%	2.48%	40.73%	37.91%	34.52%	17.11%	10.45%
Oct-06	39	1.47%	1.93%	40.65%	37.81%	34.57%	17.03%	10.58%
Nov-06	39	1.87%	3.53%	40.31%	37.76%	34.60%	16.97%	10.67%
Dec-06	40	4.43%	3.87%	39.62%	38.65%	34.47%	16.56%	10.31%
Jan-07	40	5.84%	3.47%	38.32%	38.71%	34.48%	16.60%	10.21%
Feb-07	41	6.17%	7.75%	36.46%	37.81%	36.10%	16.23%	9.86%
Mar-07	41	2.75%	5.18%	35.60%	37.89%	36.13%	16.26%	9.72%
Apr-07	41	0.58%	3.57%	35.82%	37.93%	36.20%	16.29%	9.58%
May-07	41	3.31%	3.79%	34.94%	38.01%	36.29%	16.32%	9.38%
Jun-07	41	-6.19%	4.11%	37.40%	38.09%	36.34%	16.28%	9.30%
Jul-07	41	-4.77%	3.70%	39.28%	38.17%	36.38%	16.23%	9.22%
Aug-07	41	-3.39%	4.33%	41.50%	38.25%	36.43%	16.18%	9.14%
Sep-07	41	-0.34%	3.99%	42.25%	38.27%	36.48%	16.17%	9.07%
Oct-07	42	-2.24%	3.82%	43.79%	37.41%	35.63%	15.77%	11.18%
Nov-07	42	-3.65%	3.41%	45.06%	37.43%	35.50%	15.89%	11.18%
Dec-07	42	0.47%	4.25%	45.68%	37.54%	35.31%	15.98%	11.17%
Jan-08	42	-6.07%	4.55%	49.38%	37.68%	35.12%	16.03%	11.17%
Feb-08	42	-1.01%	2.86%	50.58%	37.83%	34.92%	16.08%	11.17%
Mar-08	42	-3.45%	3.29%	53.38%	37.99%	34.68%	16.11%	11.21%
Apr-08	42	0.10%	3.31%	54.30%	38.19%	34.44%	16.13%	11.24%
May-08	42	0.82%	2.65%	54.40%	38.38%	34.35%	16.00%	11.28%
Jun-08	42	-3.61%	3.05%	56.71%	38.41%	34.35%	15.92%	11.32%
Jul-08	42	-1.62%	3.54%	57.67%	38.42%	34.35%	15.86%	11.37%
Aug-08	42	-2.33%	3.14%	59.25%	38.44%	34.33%	15.81%	11.41%
Sep-08	42	-2.45%	4.16%	60.65%	38.47%	34.32%	15.78%	11.43%
Oct-08	41	-8.19%	4.61%	69.81%	39.40%	32.71%	16.15%	11.74%
Nov-08	41	-0.25%	3.43%	70.25%	39.35%	32.72%	16.17%	11.75%
Dec-08	41	4.01%	6.19%	68.08%	39.28%	32.73%	16.17%	11.82%
Jan-09	41	-0.72%	2.80%	68.98%	39.20%	32.75%	16.16%	11.88%
Feb-09	41	-2.38%	3.66%	70.77%	39.16%	32.77%	16.18%	11.89%
Mar-09	41	4.17%	3.57%	68.50%	39.33%	32.77%	16.11%	11.79%
Apr-09	41	1.86%	3.77%	67.38%	39.32%	32.77%	16.11%	11.79%
Mean	40	-0.26%	3.56%	48.57%	38.35%	34.56%	16.68%	10.42%
Stdv.		3.25%	1.09%	11.73%	0.67%	1.21%	1.18%	1.38%

Table [6-III]: J-REIT Investment Concentration by Property Type



	Offi ce	Residenti al	Commercial	Others
<=100%	12	12	3	4
<=70%	8	4	7	0
<=30%	5	8	9	8
0%	17	18	23	30

(Created by the author, based on the individual J-REIT's annual report)

6-2. Result and Analysis

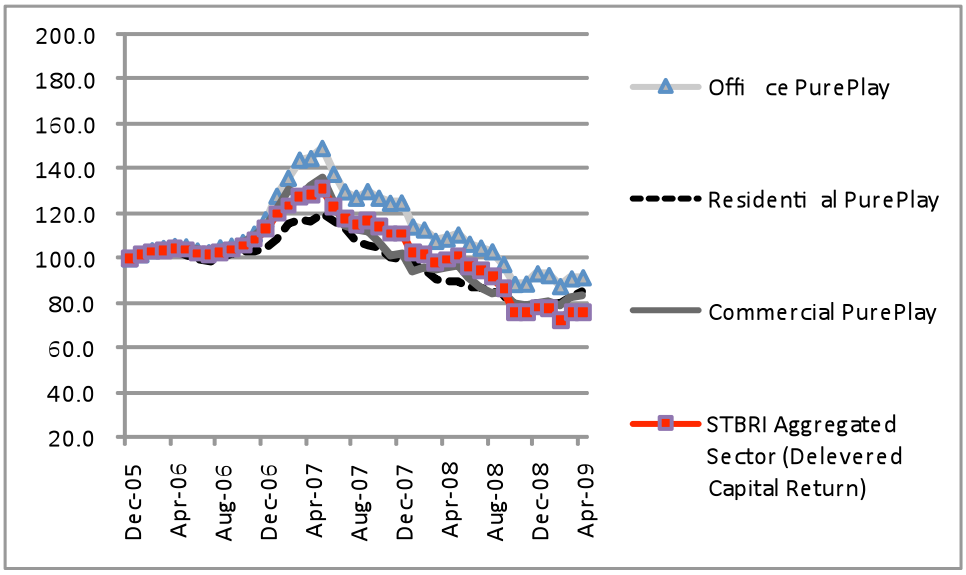
(i) Pure Play Indices

The results of the estimates of monthly REIT-based property return indices for the three property segments over the period January 2006 – April 2009 are presented in Table [6-IV] as the cumulative capital value levels (price indices, in effect). In the table, they are compared with the STBRI-JREIT Aggregated Sector Index that represents J-REIT returns to the aggregated sectors, adjusted for leverage. All three segment indices compare favorably with the STBRI-JREIT Aggregated Sector Index in that they present a similar picture, but in some cases with less volatility. The STBRI-JREIT Aggregated Sector Index basically moves among those Pure Play Indices, but starts to shoot downward in the latter half of 2008 when the consecutive defaults of J-REITs or J-REIT sponsors occurred. The downward trend can probably be attributed to the effect of "non-pure" (non-target) segments within the STBRI-JREIT Index against those negative events, because REITs tend to hold a mixture of properties from different segments for portfolio diversity. The indices have recently trended upward since 2009, which may anticipate a

recovery for the entire market.

Table [6-V] and Table [6-VI] show the same results based on the office and residential segments, respectively. Due to data constraints, the STBRI-JREIT Index for the commercial sector could not be compared with the Pure Play Commercial Index[18]. In Table [6-V], the Pure Play Office Index tracks similarly to the STBRI-JREIT Office Index. This seems natural because many J-REITs have office properties as their major assets. In contrast, in Table [6-VI], the STBRI-JREIT Residential Index starts to underperform the Pure Play Residential Index at the end of 2007, and the gap then becomes larger in fall of 2008, as is shown in Table [6-IV]. This underperformance of returns to residential J-REITs assumedly also reflects the effect of the non-pure segments within REITs against the negative market trend, and therefore indicates it is residential J-REITs that mostly contribute to the overshooting downward of the STBRI-JREIT Aggregated Sector Index in Table [6-IV].

Table [6-IV]: Pure Play Indices vs. STBRI J-REIT Aggregated Sector Index-Cumulative Return



[18] The Pure Play has superiority to it in the flexibility of creating as many segments as one likes.

Table [6-V]: Pure Play Office Index vs. STBRI J-REIT Office Index - Cumulative Return

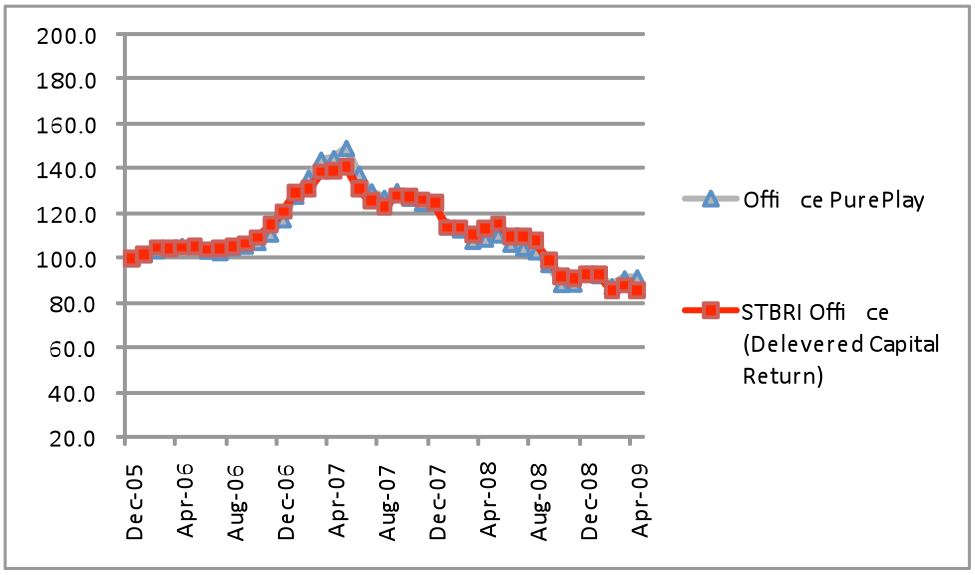
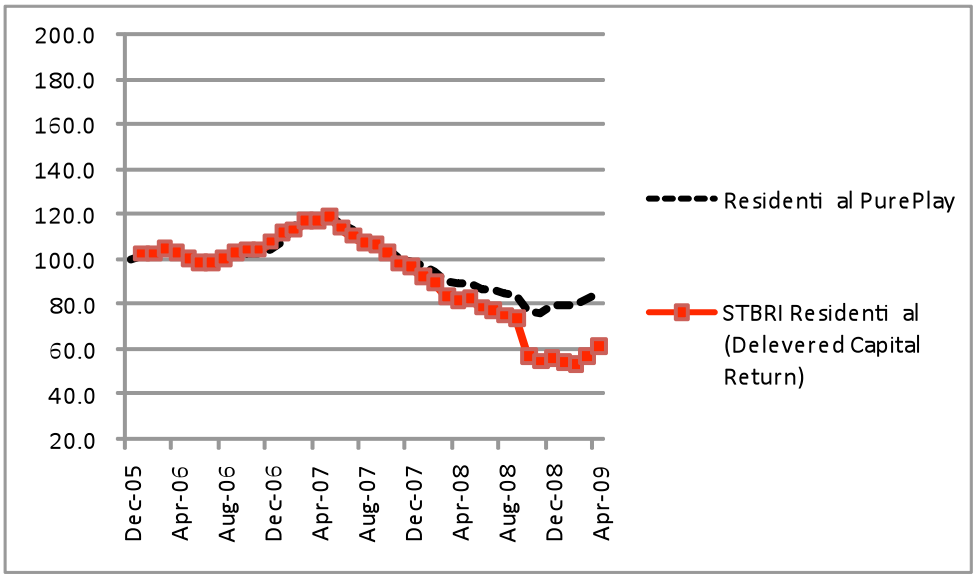


Table [6-VI]: Pure Play Residential Index vs. STBRI J-REIT Residential Index - Cumulative Return



Look at Table [6-VII], which presents the basic statistics and correlations of Pure Play returns and STBRI JREIT Office/Residential Indices by sub-periods. The first sub-period from January 2006 to May 2007 stands for the upward-market term of J-REITs, and the second sub-period for the rest of the study period for the downward-market term. Not surprisingly, Pure Play returns are mostly positive in

the upward term, and are negative in the downward. The trends of Pure Play returns are led for the most part by office segments, somewhat by commercial, and least of all by residential segments. The standard deviations (volatilities) of Pure Play returns in the downward period are larger than those in the upward period, and thus the overall trend in the whole period would be dragged more by the downward trend. In terms of the correlation among Pure Play returns and J-REIT returns by each sector, total correlations between the sectors are high in any sub-period. The tendency of the correlations across segments looks similar between the two indices, and does not change greatly over the two sub-periods. The correlation of the Pure Play return in the residential segment with the J-REIT return in the residential increases in the second sub-period, because the residential is the sector that was most affected by the crash in the equity market.

Table [6-VII]: Basic Statistics and Correlation of Pure Play Indices in the First Sub-period (Jan. 2006 ~ May 2007) and the Second Sub-period (Jun. 2007 ~ Apr. 2009)

Whole Period (Jan. 2006 ~ Apr. 2009)

	PurePlay Returns (%)			STBRI J-REIT Returns (%)	
	Office	Residential	Commercial	Office	Residential
Mean	(0.14)	(0.36)	(0.36)	(0.30)	(1.10)
Median	0.34	(0.58)	0.44	0.09	(1.33)
Maximum	8.93	6.54	7.13	7.16	8.14
Minimum	(9.13)	(8.27)	(8.78)	(9.01)	(22.58)
Stdv.	4.05	2.87	3.75	3.77	4.76
Contemporaneous Correlation (Jan. 2006 ~ Apr. 2009)					
PurePlay Index:					
Office	1.00				
Residential	0.76	1.00			
Commercial	0.79	0.70	1.00		
STBRI J-REIT Index					
Office	0.92	0.54	0.64	1.00	
Residential	0.72	0.82	0.63	0.58	1.00

First Sub-Period (Jan. 2006 ~ May 2007)

	PurePlay Returns (%)			STBRI J-REIT Returns (%)	
	Office	Residential	Commercial	Office	Residential
Mean	2.42	1.09	1.87	2.06	1.04
Median	1.73	1.33	2.18	1.21	1.36
Maximum	8.93	6.54	7.13	7.16	3.79
Minimum	(1.75)	(2.20)	(2.36)	(1.24)	(2.67)
Stdv.	2.84	2.16	2.63	2.39	1.92
Contemporaneous Correlation (Jan. 2006 ~ May. 2007)					
PurePlay Index:					
Office	1.00				
Residential	0.73	1.00			
Commercial	0.65	0.69	1.00		
STBRI J-REIT Index					
Office	0.83	0.37	0.32	1.00	
Residential	0.68	0.65	0.47	0.60	1.00

Second Sub-Period (Jun. 2007 ~ Apr. 2009)

	PurePlay Returns (%)			STBRI J-REIT Returns (%)	
	Office	Residential	Commercial	Office	Residential
Mean	(2.03)	(1.43)	(2.01)	(2.03)	(2.67)
Median	(1.62)	(1.45)	(1.20)	(1.16)	(2.93)
Maximum	5.16	4.50	4.14	3.97	8.14
Minimum	(9.13)	(8.27)	(8.78)	(9.01)	(22.58)
Stdv.	3.81	2.91	3.63	3.69	5.60
Contemporaneous Correlation (Jun. 2007 ~ Apr. 2009)					
PurePlay Index:					
Office	1.00				
Residential	0.67	1.00			
Commercial	0.73	0.58	1.00		
STBRI J-REIT Index					
Office	0.90	0.41	0.56	1.00	
Residential	0.68	0.85	0.58	0.47	1.00

(ii) Pure Play Portfolios

In Table [6-VIII], chart (a) shows sample of Pure Play Portfolio weights in each segment—of office, residential, and commercial—in the month of May 2007, which was the peak of J-REIT market capitalization. Chart (b) shows the same portfolio weights in February 2009, which was the bottom. Highlighted cells have negative weights (short positions). In chart (a), in which the office is a target segment of the portfolio, an investor needs to take a short position in a great number of residential

J-REITs. When residential is a target, the opposite is the case. When the commercial is a target, a short position should be high in office and the rest in residential J-REITs. At any rate, the weight is widely distributed among J-REITs. In the downward phase illustrated in chart (b), however, the weight is highly concentrated in a few J-REITs that are still outperforming the average J-RET return and are specializing in a certain property segment. Additionally, almost a half of short positions move from single-segment focusing REITs to multiple-segment (complex) diversifying REITs.

Table [6-IX] represents the Markowitz efficient portfolios of the three asset classes (stocks, bonds, real estate – with real estate represented by the Pure Play Index), as a function of the target return rates on the horizontal axis. Since the period studied from January 2006 to April 2009 is the period with the highest volatility both in the equity market and in the real estate market and when mean returns to stocks and real estate over the period were actually negative, it is natural that stocks and real estate do not play a role in optimizing the portfolio in chart (a). In chart (b), which covers the first sub-period until May 2007 when the equity and the real estate both had an "up" market, real estate had a strong negative correlation with bonds, so that it plays a significant role. Chart (c), which covers the second sub-period thereafter, resembles chart (a). The data period of the Pure Play Indices in this study may be still too short to derive a stable interpretation from it. If a longer period of data is available in the future, an investor will be able to construct a more asset-distributed portfolio.

Table [6-VIII]: Sample Portfolio Segment Weights – Office (O), Residential (R), Commercial (C) Segments

(a) May 2007 (the peak of J-REIT market capitalization)

Investment Asset Type	Company Initials	REIT Asset Holdings (shares, x):			PurePlay Portf: wj		
		O	R	C	O	R	C
Office	NBF	100.0%	0.0%	0.0%	8.58%	-0.72%	-3.54%
Office	JRE	100.0%	0.0%	0.0%	8.59%	-0.72%	-3.54%
Office	GO	100.0%	0.0%	0.0%	8.59%	-0.72%	-3.54%
Office	NOF	100.0%	0.0%	0.0%	8.59%	-0.72%	-3.54%
Office	DAO	100.0%	0.0%	0.0%	8.59%	-0.72%	-3.54%
Office	JOI	100.0%	0.0%	0.0%	8.59%	-0.72%	-3.54%
Office	JE	100.0%	0.0%	0.0%	8.59%	-0.72%	-3.54%
Residential	NRI	0.0%	100.0%	0.0%	-0.77%	7.64%	-0.78%
Residential	NCR	0.0%	100.0%	0.0%	-0.77%	7.62%	-0.79%
Residential	PRI	0.0%	100.0%	0.0%	-0.77%	7.62%	-0.79%
Residential	JSR	0.0%	100.0%	0.0%	-0.77%	7.62%	-0.79%
Residential	FCR	0.0%	100.0%	0.0%	-0.77%	7.62%	-0.79%
Residential	ARI	0.0%	100.0%	0.0%	-0.77%	7.62%	-0.79%
Residential	SPI	0.0%	100.0%	0.0%	-0.77%	7.62%	-0.79%
Residential	JRH	0.0%	100.0%	0.0%	-0.77%	7.62%	-0.79%
Residential	NAF	0.0%	100.0%	0.0%	-0.77%	7.62%	-0.79%
Residential	NRF	0.0%	100.0%	0.0%	-0.77%	7.61%	-0.79%
Commercial	JRF	0.0%	0.0%	100.0%	-3.58%	-0.93%	24.40%
Commercial	FRI	0.0%	0.0%	100.0%	-3.58%	-0.93%	24.38%
Complex (Office)	OJR	95.5%	2.0%	2.5%	8.10%	-0.56%	-2.80%
Complex (Office)	JPR	62.3%	0.0%	37.7%	4.00%	-0.80%	6.98%
Complex (Office)	MTR	71.5%	2.5%	26.0%	5.18%	-0.57%	3.80%
Complex (Office)	KRI	66.9%	24.1%	9.0%	5.23%	1.27%	-0.36%
Complex (Office)	LSJ	38.9%	28.8%	32.2%	1.97%	1.62%	6.26%
Complex (Office)	TOP	72.0%	8.3%	19.7%	5.41%	-0.07%	2.18%
Complex (Office)	MID	80.9%	0.0%	19.1%	6.25%	-0.76%	1.81%
Complex (Office)	NCI	67.4%	0.0%	32.6%	4.62%	-0.79%	5.55%
Complex (Office)	MHR	72.9%	27.1%	0.0%	6.04%	1.54%	-2.79%
Complex (Residential)	PIC	49.2%	50.8%	0.0%	3.83%	3.51%	-2.14%
Complex (Residential)	TGR	21.9%	73.9%	4.2%	1.16%	5.43%	-0.32%
Complex (Residential)	CIC	32.3%	67.7%	0.0%	2.25%	4.93%	-1.68%
Complex (Residential)	JOR	0.0%	60.8%	39.2%	-1.45%	5.87%	9.08%
Complex (Residential)	LCP	21.2%	63.0%	15.8%	0.77%	4.50%	2.60%
Complex (Residential)	BLI	0.0%	96.0%	4.0%	-0.88%	7.27%	0.21%
Complex (Commercial)	TRE	49.7%	0.0%	50.3%	2.46%	-0.83%	10.51%
Complex (Commercial)	UUR	41.7%	18.9%	39.3%	2.03%	0.78%	7.97%
Complex (Commercial)	FRC	35.7%	2.0%	62.4%	0.81%	-0.69%	13.93%
Complex (Commercial)	Hankyu	4.6%	0.0%	95.4%	-3.02%	-0.92%	23.09%

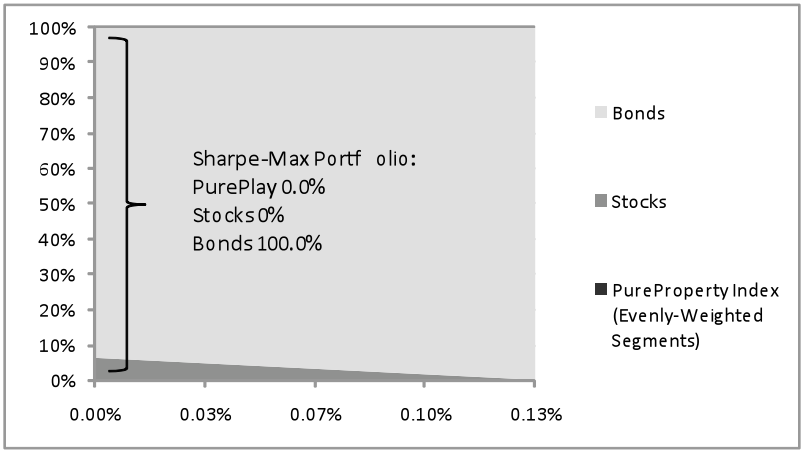
(b) February 2009 (the bottom of J-REIT market capitalization)

Investment Asset Type	Company Initials	REIT Asset Holdings (shares, x):			PurePlay Portf: wj		
		O	R	C	O	R	C
Office	NBF	100.0%	0.0%	0.0%	51.63%	-57.60%	-48.37%
Office	JRE	100.0%	0.0%	0.0%	8.51%	8.51%	8.51%
Office	GO	100.0%	0.0%	0.0%	8.51%	8.51%	8.51%
Office	NOF	100.0%	0.0%	0.0%	8.51%	8.51%	8.51%
Office	DAO	100.0%	0.0%	0.0%	8.51%	8.51%	8.51%
Office	JOI	92.9%	0.0%	7.1%	6.97%	6.97%	6.97%
Office	JE	100.0%	0.0%	0.0%	8.51%	8.51%	8.51%
Residential	NRI	0.0%	100.0%	0.0%	13.79%	25.81%	13.79%
Residential	NCR*	0.0%	0.0%	0.0%	0.00%	0.00%	0.00%
Residential	PRI	0.0%	100.0%	0.0%	-0.53%	7.48%	-0.53%
Residential	JSR	0.0%	100.0%	0.0%	-0.53%	7.48%	-0.53%
Residential	FCR	0.0%	100.0%	0.0%	-0.53%	7.48%	-0.53%
Residential	ARI	0.0%	100.0%	0.0%	-0.53%	7.48%	-0.53%
Residential	SPI	0.0%	100.0%	0.0%	-0.53%	7.48%	-0.53%
Residential	JRH	0.0%	100.0%	0.0%	-0.53%	7.48%	-0.53%
Residential	NAF	0.0%	100.0%	0.0%	-0.53%	7.48%	-0.53%
Residential	NRF	0.0%	100.0%	0.0%	-0.48%	7.53%	-0.48%
Commercial	JRF	0.0%	0.0%	100.0%	63.80%	58.52%	163.80%
Commercial	FRI	0.0%	0.0%	100.0%	-24.34%	-24.34%	-24.34%
Complex (Office)	OJR	95.9%	1.8%	2.2%	8.11%	8.26%	8.11%
Complex (Office)	JPR	64.5%	0.0%	35.5%	-4.40%	-4.40%	-4.40%
Complex (Office)	MTR	72.8%	1.8%	25.4%	0.25%	0.39%	0.25%
Complex (Office)	KRI	88.8%	5.7%	5.5%	5.69%	6.14%	5.69%
Complex (Office)	LSJ	19.8%	16.3%	63.9%	-13.04%	-11.73%	-13.04%
Complex (Office)	TOP	74.3%	9.9%	15.8%	3.30%	4.09%	3.30%
Complex (Office)	MID	82.1%	0.0%	17.9%	3.21%	3.21%	3.21%
Complex (Office)	NCI	68.7%	0.0%	31.3%	-2.32%	-2.32%	-2.32%
Complex (Office)	MHR	81.0%	19.0%	0.0%	7.54%	9.07%	7.54%
Complex (Residential)	PIC	46.4%	53.6%	0.0%	3.49%	7.79%	3.49%
Complex (Residential)	TGR	12.2%	71.8%	16.0%	-3.24%	2.51%	-3.24%
Complex (Residential)	CIC	56.0%	44.0%	0.0%	1.17%	4.70%	1.17%
Complex (Residential)	JOR	0.0%	70.9%	29.1%	-6.29%	-0.61%	-6.29%
Complex (Residential)	LCP	22.7%	68.0%	9.3%	-2.32%	3.13%	-2.32%
Complex (Residential)	BLI	0.0%	95.3%	4.7%	-1.70%	5.94%	-1.70%
Complex (Commercial)	TRE	56.2%	0.0%	43.8%	-8.84%	-8.84%	-8.84%
Complex (Commercial)	UUR	36.2%	18.4%	45.4%	-9.17%	-7.70%	-9.17%
Complex (Commercial)	FRC	32.3%	2.8%	64.9%	-15.33%	-15.11%	-15.33%
Complex (Commercial)	Hankyu	36.7%	0.0%	63.3%	-16.35%	-16.35%	-16.35%

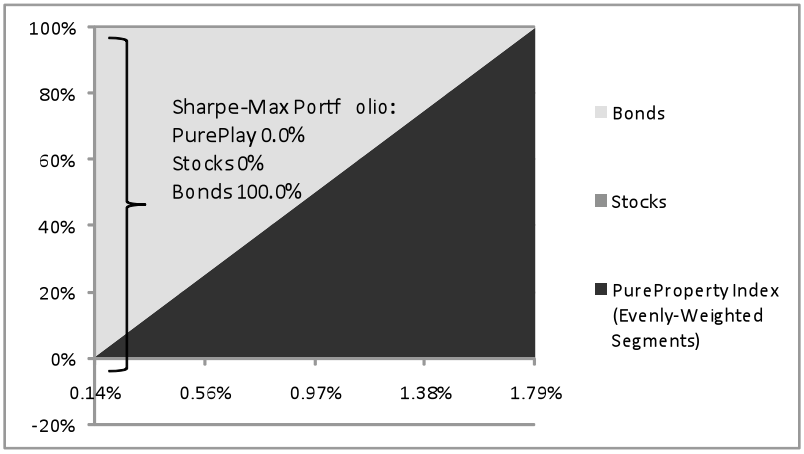
* Delisted in Oct. 2008

Table [6-IX]: Markowitz Mean-Variance Diagram by three Asset Classes (Stocks, Bonds, Real Estate) with Real Estate as a Pure Play Index (equally-weighted segments)

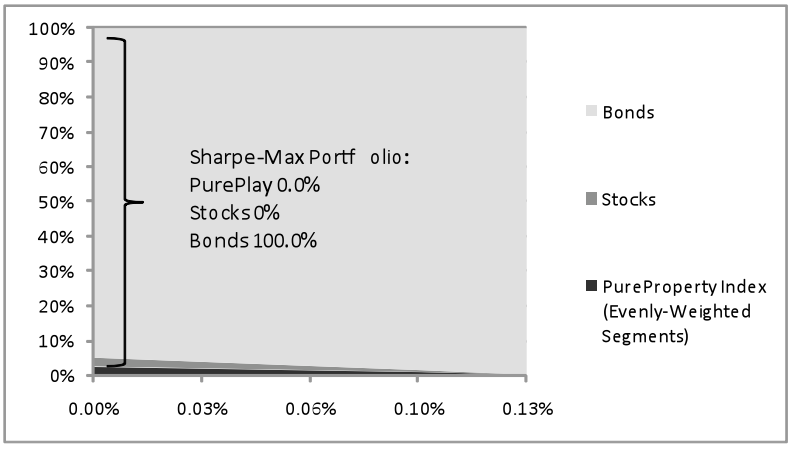
(a) Whole Period from Jan. 2006 ~ Apr. 2009



(b) First Sub-period from Jan. 2006 ~ May. 2007



(c) Second Sub-period from Jun. 2007 ~ Apr. 2009



In conclusion, this chapter confirms that REIT-based property return indices (or portfolios) can be constructed with unit exposure only to a desired property segment and with minimum idiosyncratic risk, on the basis of J-REIT return data, property holdings data, and financial information. We find that the REIT-based property return indices have a similar volatility to J-REIT return indices, but are somewhat less volatile.

While the Pure Play Indices generated have various potential uses for investment and provide unique information about the market, more interesting insights and a more developed study would be possible if longer types of data, and a greater number, were available in the real estate market for J-REITs. For example, a reliable private-market-based/ transaction-based property return index is currently not available in the Japanese real estate market, so that unfortunately it is impossible to get insight by comparing Pure Play Indices with such indices, a comparison which has already been studied in the US-REIT market. Moreover, data infrastructure of J-REIT property asset and financial information is not built at a level of high frequency and detail. It is difficult to develop Pure Play Indices by crossing property types and regions, or to construct a monthly dataset that is consistent with the J-REIT's actual financial or property holding situations. (Keep in mind that this paper is intending to smooth the data between the ending balance and beginning balance of the semi-annual financial term).

Considering the potential important contribution of these types of indices and tradable portfolios described in the previous chapter, there is a need for a more frequent and comprehensive dataset in the Japanese real estate market.

Chapter 7 Conclusion

This paper pursued a two-fold objective about J-REITs' performance: first, to conduct factor loadings of the J-REIT return (stock return at a firm-level); second, to demonstrate "Pure Play" indices, REIT-based property return indices without exposure to unwanted property segments. The objective was to capture the comprehensive performance-characteristics of J-REITs that are hybrid products of real estate and financial securities.

After establishing the importance of such research in the first chapter and the background of the J-REIT market in the second chapter, this paper accomplished those two objectives. For the first objective, in order to discover the systematic determinants of J-REIT returns, this paper conveyed factor loadings based on the Fama-French (FF) three-factor model in a time-series and a cross-sectional regression for monthly returns of all the individual J-REITs from September 2001 to September 2008. As a result, the paper found that the explanatory power of the FF model for the J-REIT performance was limited in almost any sub-period probably due to shortage of data periods and to the existence of a specific factor to J-REITs. This result followed the findings from past similar research, but confirmed them more comprehensively and visually. Resolution of the specific factor to J-REITs will be a major topic in the J-REIT market in future.

Second, this paper aimed to demonstrate the Pure Play Indices for office, residential, and commercial property types with historical data of J-REIT returns and property share holdings. The resulted Pure Play Indices performed similarly with J-REIT equity return indices, but with less volatility. They once lost touches with J-REIT return indices around from 2008, which is likely attributed to the effect of "non-pure" segments especially within residential REITs. The Pure Play Portfolios that were created only from one period of J-REITs' property share holding data indicated that the portfolio weights

change significantly, depending on the timing. Therefore, elements of the Pure Play method such as a high rate of frequency and granularity will potentially be useful in timely determining an investment strategy in the J-REITs. Also, these benefits can be true to optimal mean-variance portfolios that invest in other types of asset as well, such as stocks and bonds.

Considering the results from the two studies collectively, effective factors of J-REIT returns have still been left to something specific to J-REITs, and interestingly, the REIT-based property returns performed similarly, at least on a normal basis. Further tracking of the relationship between returns to pure/non-pure property segments and returns to J-REITs will also be one of the upcoming challenges for a comprehensive understanding of J-REITs' performance.

As for data inquiry, although both of these studies will be greatly improved with more abundant data about the J-REIT market and real estate market, it can be expected that the Pure Play Indices will leave more room for improvement. For instance, a longer period or more detail information of J-REITs' property share holdings will enable cross-segmented property return indices with property use and region. If private direct property market indices were available, the Pure Play Indices might be able to suggest the relevant price discovery in each property market segment by comparing with them, as the past U.S.-REIT study proved the REIT-based indices lead private direct property market indices.

This two-fold study showed a demonstration of returns from J-REITs to derive risk of J-REITs and different types of information of properties. Due to the limited length of history, however, the study could not make the fullest possible use of its potential. As the J-REIT market matures more in future, the approaches here will become more valuable to offer a rich resource of information about risk of J-REITs and their underlying-properties.

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