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Essays on Real Estate Investment Trusts

Yunqing Wang
University of New Orleans

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Yunqing Wang

B.A. Capital University of Economics and Business, 1996
M.S. South Dakota State University, 2001
M.S. University of New Orleans, 2004

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Dedication

This dissertation is dedicated to
my most wonderful husband, Steve
and to
my parents and sister

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Abstract

The first essay of this dissertation investigates the relationship between downside risk and returns of real estate investment trusts (REITs) and assesses the performance of real estate mutual funds (REMFs). We measure the asymmetric risk through downside and upside betas and through the measures incorporated higher moments such as coskewness and Leland's beta. We do not find significant contemporary relationship between the asymmetric risk and returns of REITs. There are only a small portion of REITs reacting to up and down market conditions differently. We find weak evidence that this asymmetric movement of REITs to market may be due to small and value components embedded in REITs. We evaluate the performance of real estate mutual funds (REMFs) from the asymmetric risk perception. According to our results, most of REMFs do not outperform the market. The downside risk helps to explain some of the abnormal returns associated with REMFs. However, the evaluation may be sensitive to the choices of the model and the market index being used.

The second essay examines the liquidity of Asian REITs. We use various measures to assess the liquidity of JREITs and SREITs. The overall evidence indicates that the liquidity of JREITs is greater than that of SREITs. Comparing to non-REIT stocks, JREITs are less liquid than Japanese common stocks while there is no significant difference in liquidity between SREITs and Singaporean common stocks. There is also strong evidence that US REITs have smaller spreads and are traded more often than both JREITs and SREITs. We also find that the primary determinants of JREIT spreads are turnover and return volatility. The secondary factors that affect the spread of JREITs are life and property holdings. The dominant factors affecting

SREITs' spreads are price, return volatility, and life. The significance of life suggests that there is a learning effect existed in both JREIT and SREIT markets in 2005.

Keywords: Real Estate Investment Trusts, REITs, Mutual Funds, Downside Risk, Liquidity

Introduction

This dissertation intends to provide a better understanding of real estate investment trusts (REITs). REITs provide investors a unique opportunity to invest in real estate while enjoying liquidity through trading in public exchanges. The first chapter focuses on the US REIT market. US REITs have developed substantially over the past few decades. This paper is motivated by the findings of the asymmetric return distribution of small-capitalization stocks and real estate. Since REITs are often considered as small-capitalization stocks with underlying assets of real estate, REIT returns are more likely to be non-normally distributed. Therefore, in order to better understanding the performance of REITs, it is necessary to explore the relationship between asymmetric risk and REITs returns. This paper examines 335 REITs traded on NYSE, AMEX, and NASDAQ over the time period of 1965 to 2005. The sample includes both survived and non-survived REITs. Various asymmetric risk measures are estimated such as downside and upside betas, coskewness, and Leland's beta.

Chapter two extends the study of REITs to the Asian market. The Asian REIT markets have grown steadily since 2001. Despite relatively high dividend yields, the ultimate success of Asian REITs might depend on the improvement of market liquidity. The paper examines the liquidity of Japanese REITs (JREITs) and Singaporean REITs (SREITs) – these two countries represent the most established REIT markets in Asia. We obtain the complete data set of JREITs for the years 2005 and 2006 and SREITs for the year 2005. We estimate the liquidity in terms of bid-ask spreads, trading frequency, and price impact. Factors affecting the spread of JREITs and SREITs are also investigated.

Chapter One

Downside Risk of Real Estate Investment Trusts and Real Estate Mutual Funds

I. Introduction

Downside risk of asset returns has been noted in finance for a few decades. It all started with the "safety first" rule promoted by Andrew D. Roy (1952). The risk of an investment that is relevant to investors is the possibility that actual returns are below a certain required rate of return. Particularly, a risk-averse investor would be reluctant to invest in an asset that would have a larger decline in returns in downward market conditions than an increase in uprising market conditions. So, if investors are more concerned with downside risk rather than upside potential of their investments, then assets that are highly sensitive to downward market movements will be associated with high average returns.

Under the mean-variance framework, the distribution of asset returns is assumed to be normal. However, this assumption does not often hold realistically. Many asset returns are proved to be not normally distributed with the presence of skewness and/or kurtosis (Fama [1965], Badrinath and Chatterjee [1988], and Peiró [1999]). Therefore, risk measures under the mean-variance framework are not sufficient in an asymmetric world, and consequently, the evaluation of performance is systematically biased (Ang and Chua [1979] and Pedersen and Rudholm-Alfvin [2003]). The asymmetry in returns is particularly significant for small-capitalization stocks (Harvey and Siddique [2000] and Pederson and Hwang [2003]). It also has been observed in real estate returns (Liu, Hartzell and Grissom [1992] and Cheng [2005]). Both findings are interesting because they are closely related to the study of returns of Real Estate Investment Trusts (REITs).

As an investment vehicle aiming at providing access to real estate investment to small investors, REITs have been through tough time in the 70s and 80s and have shown outstanding performance for the last few years. According to the existing literature (Han and Liang [1995] and Gyourko and Nelling [1996]), REITs' returns have small stock component. This implies that REITs' returns are most likely to be asymmetric in nature. Furthermore, since the underlying assets of REIT investments are tied to real estate, fluctuations in the real estate market would be expected to have an impact on REIT returns. REITs have been considered as less volatile compared to traditional stocks. Investors selecting REITs as a form of investment may expect to do better when the market goes downward. Therefore, exploring the asymmetry in REIT returns will help us better understand the performance of REITs.

The main purposes of this paper are twofold. First, we explore the relationship between downside risk and the returns of REITs. REITs have stepped into a new era after the 1993 boom. Market capitalization of REITs has increased substantially since then, and it is about 335.8 billion U.S. dollars by the end of 2005 (National Association of Real Estate Investment Trusts [NAREIT] Chart Book January 2006). Institutional investors are also able to participate in this expanded market, and have raised the portion of REIT holding in their investment portfolios. Existing studies do show that there is an asymmetric relationship between REITs and the general stock market on an aggregate level (Chatrath, Liang and McIntosh [2000] and Chiang, Lee and Wisen [2004]). They document that REIT returns are more closely related to the declining markets than with the uprising market. Our study is different from theirs since we focus on the asymmetry of individual REIT returns.

Even though there are a few studies examining the behavior of individual REIT returns in the up and down markets, research regarding this issue is far from completion. Bond and Patel

(2003) and Sagalyn (1990) examine only 16 and 20 survived REITs, respectively. Survivorship bias may cause their results of downside risk to be underestimated. Our sample is obtained from the Center for Research in Security Prices (CRSP), which is a database that is free of survivorship bias. And we conduct our research on all REITs rather than just equity REITs (EREITs) like Conover, Friday and Howton (2000) and Vines, Hsieh and Hatern (1994). Additionally, previous studies may no longer be adequate for truly understanding the behavior of REIT returns since REITs have been through a well-documented structure change (Ziering, Liang, and McIntosh [1999] and Clayton and MacKinnon [2001]). Our sample period fully encompasses the sample periods of earlier studies and extends by roughly a decade.

Second, we assess the performance of real estate mutual funds (REMFs) from the asymmetric risk perception. To our knowledge, there are no similar studies conducted before in this particular type of investments. As a restricted class of mutual funds, REMFs are open-end funds that invest in real estate-related securities, especially in equity REITs. In spite of the advantages of REITs such as no double taxation on income to investors, the existence of REMFs is much needed. As we all know that diversification is a very important issue of investments in any risky assets, and there is no exception for investments in REITs. REMFs have been considered to provide diversification benefits to investors since many REITs specialize in a particular type of properties. According to NAREIT, only 17 out of 198 REITs hold diversified assets in 2005, which is roughly 8.6 percent of total number of REITs. And the market capitalization of these diversified REITs accounts for even less percentage (7.7 percent) of total REIT market capitalization at the end of 2005. Thus, REMFs play a crucial role of providing investors an inexpensive and easy way to diversify in REIT investment.

Recent research regarding the performance of this sector has produced conflicting results – some believe that REMFs have positive abnormal returns (Gallo, Lockwood, and Rutherford [2000]) and Kallberg, Liu, and Trzcinka [2000]), while others show that abnormal returns do not exist (O'Neal and Page [2000] and Lin and Yung [2004]). All previous studies assess the issue from the symmetric risk perspective. However, negative skewness in mutual fund returns has been observed since Simonson (1972). Further, Leland (1999) points out that since skewness is priced by the market, the abnormal returns obtained through the mean-variance framework do not necessarily imply that mutual funds outperform the market. Therefore, it is important to take into account of asymmetric risk when evaluating REMF performance.

Specifically, we examine the monthly returns of all REITs listed on NYSE, AMSE, and NASDAQ over the sample period of June 1965 to December 2005, and monthly returns of REMFs during the time period of March 1984 to February 2004 from Morningstar Principia 2004 CD. In order to fully understand the relationship between downside risk and returns of real estate related assets, we explore the issue using different methods. Upside betas and downside betas are calculated under the lower partial moment framework. It is expected that downside betas are associated with higher contemporary returns and upside betas are accompanies with lower contemporary returns. We also examine the downside risk using higher-order moments. There are two measures of higher-order moments employed in our study: co-skewness and Leland's (1999) beta. Finally, we apply the asymmetric response model to evaluate the performance of REMFs. Jensen's alpha is used to analyze whether REMFs have superior performance.

The rest of paper is organized as follows. Section II reviews the existing studies regarding the issue of downside risk of securities' returns in general and of REIT returns in particular. Research on the performance of REMFs is also discussed here. Section III elaborates the methodology applied in this paper. Section IV discusses our sample of data in detail. Section V presents the empirical results of REITs and REMFs. The conclusions are drawn in the last section.

II. Literature Review

There have been substantial studies on asymmetric risk over the last few decades. Scholars explore the issue from different angles and develop various methods to measure the asymmetric risk, namely semi-variance, lower partial moment, skewness, and asymmetric correlation. We review the literature related to each of these measures and the corresponding asset pricing models if available in the first subsection, followed by the review of studies on the relation between the asymmetric risk and REITs. Literature on performance of REMFs is reviewed at last.

2.1 Asymmetric Risk in General

Since Roy (1952) originates the safety-first rule, academia of finance and economics have realized that investors are concerned differently on downside losses than on upside gains. For investment decisions, there is a minimum rate of return that is required in order to accomplish certain established goals. Thus, the risk to investors is the possibility that returns fall below this minimum rate. All the returns above this rate are attractive to investors. Accordingly, the uncertainty of returns above the minimum rate is not risk. Theoretically, standard deviation encapsulates the risk associated with achieving the mean of returns, which punishes the downside losses and upside gains equally.

Accepting the idea of the safety-first rules, Markowitz(1959) specifies that investors are interested in reducing the risk of downside losses for two reasons: (1) only downside risk is related to an investor and (2) the returns of securities may not be normally distributed. He suggests using semivariance as a measure of risk, rather than variance, since semivariance measures downside risk rather than upside potential. A semivariance may be calculated from returns that are below the mean return, or it may be calculated from returns that are below a target return. Based on the mean-semivariance portfolio theory, Hogan and Warren (1974) developed a semivariance capital market model. In this model, the market beta is the ratio of the co-semivariance of market returns and an asset return that are both below the risk-free rate and the semivariance of market returns below the risk-free rate. However, under the assumption of bivariate normal distribution of both the market returns and an asset return, Nantell and Price (1979) prove theoretically that the mean-variance equilibrium pricing model is indifferent from the mean-semivariance one.

Bawa and Lindenberg (1977) introduce a lower partial moment risk measure. It is different from semivariance measurement in the sense that it relaxes the square (calculating the semi-variance) to any possible non-negative values of n^{th} moment. In other words, semivariance measurement becomes a special case of the lower partial moment measure. Under the traditional Capital Asset Pricing Model (CAPM), the market risk denoted as beta is assume to be constant across periods of high and low market returns. Bawa and Lingdenberg suggest modifying the CAPM to include downside beta in order to capture the asymmetry of risk. Applying the two-beta model associated with constant betas and time-varying betas respectively, Kim and Zumwalt (1979) and Chen (1982) find that investors do require the compensation for assuming the downside risk of returns, and pay a premium for the upside potential. Both studies indicate that the downside beta measuring downside risk is a more appropriate measure of portfolio risk than the traditional single beta.

Harlow and Rao (1989) cast doubt on earlier studies that specify the target rate to equal the risk-free interest rate. They indicate that this assumption has been imposed by technical convenience rather than economic explanations since there is limited knowledge of how investors set up their minimum (target) rates. They develop a generalized Mean-Lower Partial Moment (MLPM) equilibrium valuation consistent with any pre-specified target rate of return. They claim that various risk measures (such as variance, semivariance, probability of loss etc.) discussed in the financial economics literature and their corresponding asset pricing models are all special cases within this generalized MLPM framework. Based on the likelihood ratio tests, they state that the MLPM model is superior to the CAPM. They also find that investors appear to characterize risk as downside deviations below a target rate that is related to the mean equity market returns and is greater than the risk-free rate.

Using the Asymmetric Response model[1] introduced by Bawa, Brown, and Klein (1981) (BBK), Pedersen and Hwang (2007) examine the explanatory power of the traditional CAPM, lower partial moment (LPM) model, and unrestricted version of BBK model. Using U.K. stock market data with three different firm sizes (small, medium, and large) and three different frequencies (daily, weekly, and monthly), they find that CAPM is preferred when returns are normally distributed, especially for monthly returns of large firms. It is not expected, however, that for non-normally distributed returns, the CAPM is still preferred in 55-80% cases, and the LPM model is preferred in additional 15-30% cases. Pedersen and Hwang claim that the size and frequency play important roles in evaluating the applicability of CAPM. According to their results, LPM model may be more suitable than CAPM for daily or weekly returns of small firms.

[1] Pederson and Hwang (2003) assume that there is no intercept term for simplicity.

Ang, Chen, and Xing (2006) examine how downside risk is priced in the cross-section of stock returns. They consider the market as a rising market if market excess returns are greater than the average market excess return and a declining market otherwise. Using the daily data of all NYSE ordinary common stocks over the period of July 1963 to December 2001, they document a significant positive contemporaneous relationship between downside betas and average stock returns, i.e. higher average returns are associated with high downside betas. A significant inverse contemporaneous relationship is also documented between average returns and upside betas. These two contemporaneous relationships remain significant after controlling for size, book-to-market, and momentum effects. After additional controls beyond firm characteristics (i.e. other risk factors such as stock volatility, coskewness, cokurtosis, and liquidity betas), the premium associated with downside risk remains statistically significant at around 6% annually. However, the discount associated with upside potential diminishes. These results confirm that investors are more risk-averse on the downside risk than on upside potential. Additionally, Ang et al. reveal that downside beta and coskewness measures different aspects of downside risk because the positive relation between downside beta (coskewness) and returns is robust to controlling for coskewness (downside beta).

Through examining monthly returns of the value-weighted CRSP all-share index from 1933 to 2002, Post and van Vliet (2006) find that this market portfolio proxy is mean-variance inefficient but third-order stochastic dominance efficient relative to the well-known size, value, and/or momentum portfolios. This mean-variance inefficiency could be caused by neglecting high-order central moments or lower partial moments. They examine the marginal utility function, derived from the quartic utility function that Dimmar (2002) uses to design the four-moment model. They find that the marginal utility function contravenes the conditions of nonsatiation, risk aversion and/or skewness seeking. Post and van Vliet believe that lower partial moments are more important in explaining the mean-variance inefficiency than skewness or kurtosis. According to their results, the size, value, and/or momentum portfolios have larger lower partial moment betas in declining markets. The mean-variance inefficiency of the market portfolio is the result of omitting the effect of downside risk. They further find that downside risk is time-varying.

There is also a substantial amount of financial literature that examines the downside risk of assets through higher-order moments. Kraus and Litzenberger (1976) modify the traditional CAPM by adding the effect of systematic skewness (i.e., coskewness) in asset pricing. They demonstrate that under equilibrium, investors are averse to variance (the second order condition of the utility function) but prefer positive skewness (the third order condition of the utility function). This implies that besides the traditional market beta risk, the systematic skewness (named, market gamma) should also be taken into account when valuing an asset. They examine the monthly deflated returns of all stocks listed on the NYSE during the time period of January 1926 to June 1970. Using the estimate procedure similar to Fama-MacBeth (1973), the empirical results confirm their theory, i.e. both market beta and systematic skewness are priced in asset returns. Accordingly, they suggest that the pricing error associated with the single-factor CAPM may be caused by neglecting the high-order moment in the asset pricing model.

Badrinath and Chatterjee (1988) examine high-order characteristics of the market index distribution adopting Tukey's (1977) distributions. Rather than providing point estimates of skewness and kurtosis, they study the behavior of these high-order moments. Both equal-weighted and value-weighted CRSP indices are investigated under both daily and monthly frequencies over the sample period of July 1962 to December 1985. For all four indices, the skewness is not constant over the entire distribution; rather the upper tail is more skewed than the lower tail. They suggest that the skewness and the kurtosis should be considered simultaneously. For the two value-weighted indices, two separate estimates of kurtosis in two tails are recommended, which are indicative of the investors' different attitudes toward upside and downside risks. As expected, the two equal-weighted indices are more skewed than the value-weighted ones. However, a single estimate of the kurtosis is sufficient to capture the fat-tail effect in equal-weighted indices.

Using a two-period binomial example, Leland (1999) demonstrates that when returns of the market portfolio are independently identically distributed, the market portfolio is mean-variance inefficient. Thus, the CAPM beta is not a correct measure of risk since it ignores the high-order moments of the return distribution, and in turn the assessment of portfolio performance based on the CAPM is misleading. He develops a new beta based on Rubinstein (1976) that takes high-order moments into accounts while its calculation requires no more information than the calculation of the CAPM beta. Using the same sample, Leland shows that this new beta is able to measure portfolio performance correctly, especially when options or dynamic trading strategies are involved. Even though the difference between the CAMP beta and the new beta is insignificant when the returns of assets (or portfolios) and the market portfolio are jointly lognormal, the new beta is superior to the CAMP beta when the returns of assets (or portfolios) are markedly skewed.

Harvey and Siddique (2000) introduce an asset pricing model with the incorporation of systematic conditional coskewness, and try to find the connections between well-known factors (such as size, book-to-market, and momentum) and coskewness. They assume that the marginal rate of substitution is a quadratic function of the market return. This formula adapts nonincreasing absolute risk aversion, which implies that investors prefer positive skewness. Thus, assets with negative coskewness should have higher expected returns. Their data sample includes monthly domestic stock returns from the CRSP universe over the time period of July 1963 to December 1993. The results indicate that conditional coskewness is able to explain a significant portion of the cross-sectional variation in asset returns beyond the Fama-French three-factor model. Unfortunately, coskewness cannot explain the entire abnormal returns. Harvey and Siddique provide two possible explanations. First, conditional coskewness based on past returns may not be a perfect proxy for ex ante conditional coskewness. Second, two Fama-French factor, SMB and HML, may capture the similar information as conditional coskewness. Furthermore, they find that momentum trading strategies is associated with significant negative skewness.

From the asymmetric correlation aspect, Ang and Chen (2002) assess the asymmetric risk for the returns of equity portfolios and the market return below or up a pre-determined level. They examine daily, weekly, and monthly returns of common stocks listed on NYSE, AMEX, and NASDAQ from July 1, 1963 to December 31, 1998, using CRSP's value-weighted returns of all stocks as a proxy for market returns. They observe the asymmetric correlations in declining and rising markets in the data. They also show that changes in downside betas are mainly caused by the changes in downside correlations relative to upside correlations. Furthermore, Ang and Chen design an *H* statistic, which equals "a weighted average of the squared differences of the exceedance correlations implied by a model and those given by data (p. 464)." They claim that the *H* statistic captures a different aspect of asymmetric risk from other measures such as skewness and coskewness, and it is inversely related to the traditional market beta from the CAPM. Using this new statistic, they find that frequencies of data do not affect the magnitude of correlation asymmetries. The results also show that small stocks, value stocks, and recent past losers have greater correlation asymmetries.

Ang, Chen, and Xing (2002) admit that downside correlation, a component of downside beta, only reveals the direction of co-movement of an asset return and the market return. However, unlike downside betas, by construction downside correlation does not suffer from the changes in volatility of an individual stock and the overall market, which could hinder the liability of their estimates of downside and upside betas. Therefore, Ang et al. suggest that downside correlations may be superior to downside betas to measure the asymmetric risk, which is confirmed by their empirical results in predicative nature.

2.2 REITs and Asymmetric Risk

There are a few studies focusing on the asymmetry of the returns of real estate assets (including REITs). Sagalyn (1990) analyzes the quarterly returns of 20 survived REITs (i.e., 14 percent of the REIT market in terms of the number of REITs and their market capitalization) over the sample period of the third quarter of 1973 to the fourth quarter of 1987. The sample period includes two major recessions: the 1974-1975 recession and the 1981-1982 recession. He defines up and down periods of the market based upon NBER's upswing/downswing classification and upon the higher/lower growth GNP periods. The results suggest that REITs have higher returns in the upswing or high-growth periods and lower returns in the downswing or low-growth periods. Furthermore, he shows the asymmetry of market betas: REITs have higher market betas during low-growth periods than during high-growth periods. Unfortunately, Chiang et al. (2004) do not find the similar patter of REIT betas in the more recent sample periods (i.e., 1986 to 2001 and 1993 to 2001). They believe that the asymmetry in betas observed by Sagalyn over the business cycles might be sample specific.

Chatrath et al. (2000) examine the monthly returns of the Equity REIT (EREIT) Index constructed by the National Association of Real Estate Investment Trusts (NAREIT) over the sample period of 1972 to 1998. The REIT betas are found to be significantly larger when the market is down. They determine that the asymmetry in REIT betas is not caused by dividend yield spreads between REITs and the market or by decay in the REIT-stock market relationship. Instead, the pattern in REIT betas is similar to that for small-capitalization stocks in general. However, return-variance dependence, the traditional explanation of the asymmetry in small-stock betas, fails to explain the beta pattern in REITs. However, Chiang et al. (2004) suspect that this asymmetry in REITs' market betas is due to misspecification of the asset pricing model. They re-examine the monthly returns of the EREIT index from 1972 to 2001, and find that the asymmetry of REIT-betas is no long significant when using the Fama-French three-factor model.

Glascock (1991) examines real estate performance using the monthly returns of a portfolio of 109 real estate firms (including builders, contractors, developers, and REITs) publicly traded in American and New York Stock Exchanges from January 1965 and December 1986.[2] He introduces a dummy variable to separate bull and bear markets. The dummy variable is set to one if the returns of the market portfolio are greater than the risk-free rate or if the National Bureau of Economic Research (NBER) categorizes the time period as nonrecessionary. The empirical results show that all the alphas are statistically insignificant, which implies that real estate companies do not have superior performance to the market portfolio both in the entire sample period and in the sub-sample period from 1977 to 1989. There is no asymmetric behavior between bull and bear market betas when using the risk-free rate as the benchmark. However, the

[2] There are only 31 out of 109 real estate firms that last the entire sample period. Additionally, REITs only count for a small portion in the sample. The author indicates that there are only 15 REITs in the sub-sample of 1977-1989, and implies that the number of REITs is even less in the period of 1965 to 1976.

bull market beta is statistically significant higher than the bear market beta when considering the NBER's nonrecessionary period as the bull market.

Liu, Hartzell, and Grissom (1992) explore the relationship between the systematic skewness and asset pricing of real estate assets. They apply the Kraus-Litzenberger's (1976) three-moment CAPM. The data include quarterly holding period returns of five appraisal-based commingled real estate funds (CREFs) and four common-stock portfolios for the period of the first quarter of 1979 to the fourth quarter of 1989. Compared to the stock portfolios, CREFs have lower returns and lower standard deviations but larger total positive excess skewness. The empirical results reveal that skewness is price – there is a market discount associated with systematic skewness. In general, CREFs have higher (or less negative) systematic skewness than do stocks. The findings are consistent with their rationale that investors are willing to accept a lower expected return on real estate assets relative to other risky assets due to the lower negative coskewness with the market. Vines, Hsieh, and Hatem (1994) conduct the similar research on monthly returns of transactions-based real estate, i.e., equity REITs and hybrid REITs from 1971 to 1991. Their results suggest that the traditional CAPM beta is sufficient to explain risk, whereas coskewness does not have significant impact on REIT pricing. They point out that the differences between their results and those of Liu et al. may be caused by differences in data sample or by different estimation methodology applied.

Conover, Friday, and Howton (2000) investigate the relationship between risk and returns of equity REITs over the time period of 1978 to 1995. They use the market median return as the target rate to separate bull and bear markets. Through adding a dummy variable, they modify the traditional CAPM into a dual-beta model. The results show that bull-market betas are significantly lower than the bear-market betas, which are opposite to the results of Glascock

(1991). They apply the Fama-MacBeth (1973) method and find that bull-market betas are associated with a significant premium and suffice to explain the risk of equity REITs while size, value, and expense factors have no explanatory power. However, there is no significant relationship between either the static CAPM betas or bear-market betas and returns. They suggest that the explanatory power of betas on EREITs' returns is sensitive to market conditions.

Adopting the autoregressive conditional density function model of Hansen (1994), Bond and Patel (2003) try to investigate the distribution symmetry of listed property companies and whether the skewness is time-varying if it does exist. They examine monthly returns of 16 UK property companies from January 1970 to March 2000 and 16 US REITs from January 1977 to December 2000. The rather small sample size is caused by the restricted criteria imposed by the authors. First of all, the selected firms must be continually listed throughout the entire sample period. Further, they delete any firms that have at lease 10 percent of monthly returns equal to zero. Ten UK companies and 16 US REITs have significant unconditional skewness coefficients. However, under the student's *t*-distribution, less than half of the companies analyzed reject the symmetry hypothesis. They find weak evidence (one quarter of their sample) of time-varying skewness. Furthermore, the authors find no evidence that the skewness is related to either economic cycles or companies' market capitalization.

Cheng (2005) examines the relationship between various asymmetric risk measures and real estate returns over the sample period of 1992 to the second quarter of 2002. The risk measures include downside beta, upside beta, unconditional and conditional skewness, and unconditional and conditional coskewness. The real estate returns investigated are the quarterly returns of the National Council of Real Estate Investment Fiduciaries (NCREIF) property subindices (apartment, industry, office, and retail), and the NCREIF total property return index is the proxy for the market. Using the univariate cross-sectional OLS regression, Cheng finds that the traditional CAPM beta has no explanatory power to the real estate returns. The downside beta has a statistically significant and positive relationship with the returns, which implies that there is a risk premium associated with the downside beta. On the other hand, the upside beta is negatively related to the real estate returns but is not priced. Both skewnesses are significant risk factors when estimating real estate returns, while coskewnesses fail to explain the variation in real estate returns. The author further suggests that the skewness and downside beta encapsulate the distinct aspects of downside risk regardless the property types.

2.3 Performance of Real Estate Mutual Fund

Early studies regarding mutual funds (Treynor [1965], Sharpe [1966], and Jensen [1968]) provide little evidence of superior performance persistence over time. Studies in the early 1990's, in contrast, provide evidence of the existence of persistent superior performance [Grinblatt & Titman (1992), Hendricks, Patel & Zeckhauser (1993), Goetzmann & Ibbotson (1994), Elton, Gruber & Blake (1996a), and Gruber (1996)]. However, more recent studies put some doubts over the persistence results. First, survivorship bias in the mutual fund samples may induce upward bias on fund performance and give rise to the appearance of persistent superior returns. This arises because the non-surviving funds tend to be those with poor performance [Elton, Gruber and Blake (1996a), Carhart, Carpenter, Lynch, and Musto (2002)]. As a result, the high-performing funds tend to be over-represented in the sample. Second, Carhart (1997) found that the "hot hand" result is mostly driven by the one-year momentum in stock returns, which should not be considered as a superior portion of performance. After he controls the momentum factor, evidence of persistently superior performance vanished. However, he finds positive persistence in strongly underperforming funds.

Despite the extensive academic literature on mutual fund performance, limited studies have been done on the performance of REMFs. Gallo, Lockwood, and Rutherford (2000) appear to be the first group to examine the performance of REMFs. They select 24 domestic real estate funds with at least 15 months continuous returns available over the sample period of 1991 to 1997. Using the Wilshire Real Estate Securities Index as a proxy for the market, they find that real estate funds outperform the market both at the individual level and the aggregate level (i.e. the portfolio of funds selected and the portfolio of Morningstar real estate funds combined). They adopt Sharpe's (1992) effective-mix test to identify the sources of this superior performance. They rule out asset allocation to bond, non-real-estate stocks, and small-capitalization REITs as possible explanations for the superior performance. Instead, their results show that "real estate funds displayed superior asset allocation by overweighting outperforming property types and underweighting underperforming property types." (p. 169)

Kallberg, Liu, and Trzcinka (2000) examine 44 REMFs that are exclusively invested in 128 REITs over the period of 1987 to 1998. Their empirical results show that the average and median alphas are positive and significant using the standard benchmarks from previous mutual fund studies. However, this superior performance is lacking in persistence. The authors argue that most of positive alphas occur during the early 1990s – a period when real estate returns were generally low. This strongly suggests that positive performance in these funds occurs primarily in down markets. This can at least partially explain the lack of persistence in their results. The authors also believe that lack of persistence is due to conditions in the credit market. In particular, during the early 1990s, banks reduced their lending to corporations in general, and to real estate firms especially. Furthermore, the authors indicate that larger funds and more active funds have higher alphas.

O'Neal and Page (2000) examine 28 REMFs during the period from 1996 to 1998. Using a multiple-index model, their empirical results show that the overall alphas for the entire market are positive but insignificant. For each individual fund, 14 funds have positive alphas and 14 funds have negative alphas. However, only two out of each group are significant at 5% level. These results suggest that most funds are not achieving abnormal performance.

Lin and Yung (2004) examine 83 REMFs over the period of 1993 to 2001. They find that nearly all alphas are negative regardless of the choice of evaluation models. They suggest that REMFs do not outperform the market no matter whether the benchmark is the entire stock market portfolio or the real estate sector market portfolio. They also indicate that the performance of the entire real estate sector, to a large extent, determines the performance of REMFs. The empirical results also present evidence that past performance of REMFs affects future performance. They indicate that the performance persistence does exist for REMFs in the short term. Finally, they state that risk-adjusted real estate fund returns are related to fund size.

III. Methodology

In this section, we discuss various measures of asymmetry used in this paper. The first two measures, downside/upside betas and coskewness, have been used extensively in the existing literature including studies conducted on REITs. The third measure, Leland's (1999), is the first time used in examining returns of REITs and REMFs.

3.1 Asymmetric Response Model

We apply the asymmetric response model (ARM)[3] to estimate the downside and upside betas. The unrestricted version of this model is as follows:

[3] This model was originally proposed by Bawa, Brown, and Klein (1981). Harlow and Rao (1989) claim that the asymmetric response model is an empirical version of their generalized Mean-Lower Partial Moment (MLPM)

$$R_i(t) = \alpha_i + \beta_i^- R_m^-(t) + \beta_i^+ R_m^+(t) + \pi_i \delta(t) + \varepsilon_i(t) \qquad (1)$$

where $R_i(t)$ is the excess return over the risk-free rate on each REIT *i* in the sample; $R_m^-(t) = R_m(t) - \tau(t)$, when $R_m(t) < \tau(t)$ and zero otherwise; $R_m^+(t) = R_m(t) - \tau(t)$, when $R_m(t) > \tau(t)$ and zero otherwise; $R_m(t)$ represents the market excess return over the risk-free rate and $\tau(t)$ is the target rate that separate the up and down markets; $\delta(t)$ is dummy variable set 1 when $R_m(t) > R_f(t)$ and zero otherwise; $\varepsilon_i(t)$ represents an error term.

This model divides the market returns into to two separate groups – above and below the target rate in order to capture the downside response of asset returns. It seizes the asymmetry in excess market return via the separation of β_i^- and β_i^+, which represent the downside risk and upside potential, respectively. These measures are different from other asymmetric measures such as higher-order moments. Ang, Chen and Xing (2002) state that "downside and upside betas capture the notion of asymmetric exposures to risk across periods when the market falls and periods when the market rises. These moments are different from centered moments because they emphasize the asymmetry across upside market moves and downside market moves explicitly by the conditioning level (p. 5)." Neither skewness nor kurtosis has the ability to distinguish the risk in downward and upward markets.

Another advantage of this model is that it can be transformed to other asset pricing models by simply imposing certain restrictions. For example, without distinguishing $R_m^-(t)$ and $R_m^+(t)$, β_i^- and β_i^+ would be equal to the market beta β, and equation (1) reduces to the traditional CAPM. By letting $\pi = 0$, equation (1) transform into a model that has been used to examine the bull- and bear- market betas (Kim and Zumwalt [1979], Chatrath et al. [2000], etc.).

model. More specifically, it is a special case of MLPM model in that the ARM set the target rate as the risk-free rate. Later on, Pedersen and Satchell (2000) use the ARM to explore the small-sample properties of three performance measures, namely the Sharpe Ratio, the Treynor Index, and Jensen's Alpha.

Additionally, Pedersen and Satchell (2000) point out that this model allows us to study the return asymmetry free of any distributional assumptions such as skewness and kurtosis.

Using the asymmetric response model, we test the null hypothesis of $\beta_i^- = \beta_i^+$. If the results fail to reject the null hypothesis, then there is no asymmetric relationship between REITs and the overall market. This implies that the CAPM under the mean-variance framework is sufficient to capture the market risk. The asymmetric response model is not appropriate. If the results reject the null hypothesis, this means that $\beta_i^- \neq \beta_i^+$, it is evidence of the existence of the asymmetry in the REIT-market relationship. Accordingly, the asymmetric response model is more appropriate than the CAPM.

The question comes to which target rate we should use to divide the market into the uprising and declining markets. There have been numerous ways appeared in the previous literature, such as the risk-free rate, the mean of market returns, the median of market returns, etc. Nantell and Price (1979) indicate that choosing the mean return of the market portfolio as the target rate is meaningless, especially under the normal distribution assumption. One of the most common choices is the risk-free rate. In our empirical work, we choose to use one-month Treasury-Bill rate as the target rate to separate the up and down markets. In a series of robustness checks in section 5, we also investigate the asymmetric relationship using the mean of the market excess returns as the target rate and using the National Bureau of Economic Research's (NBER) business cycle expansion and contraction periods to split the market.

3.2 Coskewness

Based on the review conducted in section 2, it is important to incorporate the higher-order moments into the investigation of the asymmetry of REIT returns. Majority of studies on higher-order moments has focused on skewness. Skewness is based upon the third standardized moment that measures the degree of asymmetry in the variable distribution. If a distribution is positively skewed, it is skewed to the right that has a long tail on the right side of the distribution. This generally implies that its mean is greater than its median. On the contrary, if a distribution is negatively skewed, it is skewed to the left that has a long tail on the left side of the distribution. This generally implies that its means is less than its median.

Investors prefer positive skewness. In finance, positive skewness refers to an investment having a higher potential of a large gain and a lower potential of a large loss than one with the normal distribution. The uncertainty associated with an asset with a positively skewed distribution is largely related to the dispersion above the mean, which is not necessary risky to investors. Through analyzing an investor's utility function, Scott and Horvath (1980) assert that investors with "positive marginal utility of wealth for all wealth levels, consistent risk aversion at all wealth level" prefer positive skewness and dislike negative skewness.

However, skewness, like variance, could be diversified away. Simkowitz and Beedles (1978) demonstrate that skewness of a portfolio can be diversified away fast with a small number (five) of assets adding into the portfolio. Therefore, only systematic skewness (i.e., coskewness) is relevant to an investor. A positive coskewness implies that an asset adds positive skewness to a portfolio. Thus, it should be associated with a lower expected return since investors prefer positive skewness. In contrast, a negative coskewness should be related to a higher expected return since the asset reduces the portfolio's skewness. The coskewness is defined as

$$\text{coskew} = \frac{E[(R_i - \mu_i)(R_m - \mu_m)^2]}{\sqrt{\text{var}(R_i)}\ \text{var}(R_m)} \tag{2}$$

where μ_i is the mean of the excess return of REIT *i*, μ_m is the mean of the market excess return, $\text{var}(R_i)$ is the variance of the excess return of REIT *i*, and $\text{var}(R_m)$ is the variance of the market excess returns. Kraus and Litzenberger (1976), Harvey and Siddique (2000), and Ang, Chen, and Xing (2006) find that lower coskewness is associated with higher expected returns.

Furthermore, Ang, Chen, and Xing uncover the fact that downside beta risk differs from coskewness risk. Downside betas are explicitly conditioned on market downward movement, which provides us a measure of risk when the market is in distress. On the other hand, coskewness is estimated based on the return distribution of an individual asset and the overall market. It does not distinguish up and down market conditions. So, downside betas and coskewness may capture the different aspects of the asymmetric risk associated with an asset. Thus, examining coskewness of REIT returns is necessary.

3.3 Leland's Beta

Leland (1999) develops a risk measure based on Rubinstein (1976), which takes into account of the effect of higher-order moments such as skewness, kurtosis, and other higher-moments of the return distribution. Leland's beta is defined as

$$\beta_L = \frac{\mathrm{cov}[r_i, -(1+r_m)^{-b}]}{\mathrm{cov}[r_m, -(1+r_m)^{-b}]} \tag{3}$$

where r_i is the return of REIT *i* and r_m is the market return. b represents the preference parameter, and is defined as

$$b = \frac{E[\ln(1+r_m)] - \ln(1+r_f)}{\mathrm{var}[\ln(1+r_m)]} \tag{4}$$

Leland indicates that the traditional CAPM is not able to accurately assess performance of a portfolio because it ignores the effect of higher-moments. He claims that the modified beta is superior to the traditional CAPM beta, especially when the asset returns are clearly skewed.

To investigate the asymmetry in REIT returns, our empirical work comprises the following procedures. First, we present the descriptive statistics for our data. The return distribution of each REIT in our sample is tested for normality. These statistics and tests show that non-normally distribution in REIT returns is significant enough that provides an adequate rationale for investigating the asymmetry in REIT returns. Second, we estimate the above three asymmetric measures for each REIT using time series data. We test whether the relationship between REITs and the market is different during up and down market conditions. Third, we sort our sample into quintiles based on each estimated risk measure respectively. After controlling the risk factor, we identify any possible relationship between REIT returns and these measures.

3.4 Evaluation of REMFs' Performance

In order to evaluate the performance of REMFs, we employ the asymmetric response model. The null hypothesis to be tested is that Jensen's alphas is equal to zero, which mean that REMFs do not produce abnormal returns. If the null hypothesis is rejected, it suggests that managers do add value to REMFs. Since the real estate markets in general are considered to be inefficient since their own characteristics prevent instantaneous price adjustment to new information. Obtaining timely information in real estate markets is costly because of the decentralized nature of transactions. Thus, investment professionals with valuable private information are likely to have a chance to beat the market.

IV. Data

This paper examines monthly returns of REITs that are publicly traded on NYSE, AMEX, and NASDAQ. The data are collected from CRSP over the sample period of June 1965 to December 2005. The REIT sample includes all three categories of REITs, namely equity, mortgage, and hybrid. In particular, they are identified as securities with the following share codes under the CRSP's definitions: 18 and 48, and with the primary four-digit SIC code of 6798.[4] The sample is free of survivorship bias since CRSP makes the data of not-survived companies available. In order to obtain the reliable estimates of the asymmetric measures, especially for the downside and upside betas, we require that REITs in the sample must have at least 60-month consecutive returns. We also delete any REITs that have more than 12 month missing returns. After the selection process, our sample has total 335 REITs, including 168 survived REITs that were traded as of December 2005 and 167 not-survived REITs that were delisted from the CRSP database sometime before the end of 2005. In our empirical work, we concentrate on presenting the results of the full sample. We examine survived REITs separately in robustness checks.

Table 1.1 presents descriptive statistics of our REIT sample, including mean and standard deviation of monthly excess returns and market capitalization. From June 1965 to December 2005, the shortest time series of a particular REIT is 62 months, and the longest is 487 months. The average monthly excess return over the risk-free rate for the entire sample is 0.75%, with the minimum monthly excess return equals -3.57% and the maximum is 3.35%. This tells us that the average annual excess return of REITs is about 9%, which is higher than the average annual excess return of common stocks (8.12%) in Ang et al. (2006). The standard deviation of monthly excess return is 9.41%. The average market capitalization of our sample is $469 million. The smallest REIT is about $3 million while the largest REIT is about $9,550 million. We further divide our sample into five quintiles based upon the mean market capitalization of each REIT. Each quintile has 67 REITs, and the first quintile has the smallest REITs in our sample. We

[4] CRSP specifies that the second digit of 8 in the share code represents REITs. The SIC code of 6798 is defined as REITs.

observe that the larger REITs in our sample provide higher average returns than the smaller ones. On the other hand, the standard deviations have a generally monotonically decreasing pattern: the smallest quintile has the highest standard deviation, and the largest quintile has the lowest. The similar pattern is spotted by Chen, Ho, Lu, and Wu (2005). They observe that in the lowest book-to-market ratio category the mean monthly returns increase as the sizes of REITs increase while the standard deviations of returns decrease.

Table 1.1 Descriptive Statistics for REITs

This table presents descriptive statistics of our REIT sample. The overall statistics are the averages of 335 REITs, and the statistics for each quintile are the averages of 67 REITs. Mean is the time-series and cross-sectional average monthly excess return, recoded in %. Capitalization is the time-series and cross-sectional average market capitalization, expressed in million dollars.

		Periods	Mean	Std Dev.	Capitalization
Overall	Mean	165	0.75	9.41	469.24
	Min	62	-3.57	2.89	3.03
	Max	487	3.35	35.30	9549.60
Quintile 1 (smallest)	Mean	168	0.30	13.88	16.42
	Min	63	-3.26	4.11	3.03
	Max	487	3.35	35.30	32.21
Quintile 2	Mean	144	0.73	9.71	51.10
	Min	62	-1.35	4.34	32.40
	Max	391	2.51	27.16	80.86
Quintile 3	Mean	184	0.56	8.27	162.67
	Min	65	-3.57	2.89	81.58
	Max	470	1.72	18.40	270.80
Quintile 4	Mean	156	1.06	7.58	476.84
	Min	65	-0.07	4.23	272.02
	Max	423	3.29	19.14	755.57
Quintile 5 (largest)	Mean	171	1.10	7.63	1639.14
	Min	85	-0.28	4.41	767.07
	Max	487	2.26	29.55	9549.60

Table 1.2 reports skewness, kurtosis, Jarque-Bara statistics and the results of the Shapiro-Wilk normality test of return distributions of the REITs.

Table 1.2 Skewness, Kurtosis, and Normality Tests

Skewness is the third standardized moment and kurtosis is the fourth standardized moment. JB is the Jarque-Bera test statistic and the W is the Shapiro-Wilk test statistic.

Penal A: Normality Tests of Return Distribution of REITs					
		Skewness	**Kurtosis**	**JB**	**W**
Overall	Mean	0.50	4.85	2763.28	0.93
	Min	-2.97	-0.48	0.13	0.32
	Max	13.39	225.22	775891.28	1.00
Quintile 1 (smallest)	Mean	1.12	7.12	1123.58	0.89
	Min	-0.99	0.99	4.44	0.60
	Max	4.81	37.91	25142.24	0.98
Quintile 2	Mean	0.76	8.04	11950.79	0.91
	Min	-2.97	-0.24	0.29	0.32
	Max	13.39	225.22	775891.28	0.99
Quintile 3	Mean	0.36	4.10	392.22	0.94
	Min	-2.13	0.49	1.47	0.62
	Max	3.93	39.19	12782.66	0.99
Quintile 4	Mean	0.13	2.42	97.22	0.96
	Min	-1.08	-0.07	0.20	0.77
	Max	2.71	13.00	1957.68	1.00
Quintile 5 (largest)	Mean	0.16	2.55	252.58	0.96
	Min	-0.83	-0.48	0.13	0.60
	Max	5.00	36.59	6235.24	1.00

Panel B: Number and Percentage of REITs With Significant Normality Test Statistics					
		Skewness	**Kurtosis**	**JB**	**W**
Overall	# of Significance	177	271	271	252
	% of Significance	53%	81%	81%	75%
Quintile 1 (smallest)	# of Significance	50	66	66	65
	% of Significance	75%	99%	99%	97%
Quintile 2	# of Significance	48	53	53	54
	% of Significance	72%	79%	79%	81%
Quintile 3	# of Significance	33	62	60	57
	% of Significance	49%	93%	90%	85%
Quintile 4	# of Significance	26	50	51	45
	% of Significance	39%	75%	76%	67%
Quintile 5 (largest)	# of Significance	20	40	41	31
	% of Significance	30%	60%	61%	46%

Skewness is the third standardized moment and defined by

$$\text{Skewness} = \frac{E[(R_i - \mu_i)^3]}{\sigma_i^3} \tag{5}$$

where σ_i is the standard deviation of REIT *i*. If skewness is greater than zero, the distribution is positively skewed (i.e., skewed to the right). If skewness is less than zero, the distribution is negatively skewed (i.e., skewed to the left). Panel A shows that our overall sample has the smallest skewness of -2.97 and the largest skewness of 13.39. We observe that in general the average skewness in the first quintile is the largest, and it decreases as the size of REITs increases. Panel B shows that there are 177 out of 335 (or 53%) REITs with significant skewness. Breaking down to different size groups, the smallest quintile has the highest percent (75%) of REITs with significant skewness and the largest quintile has the lowest percent (30%). The results further show that the smallest quintile has the least number of negatively skewed returns.[5] And this number keeps increasing as the size of REITs goes up and ends with the fifth (largest-size) quintile having the highest number of negatively skewed returns. Since investors dislike negative skewness, this may partially explain why the largest quintile has the highest mean excess returns.

Kurtosis is the fourth standardized moment that measures the degree of peakedness of a distribution. It is defined by

$$\text{Kurtosis} = \frac{E[(R_i - \mu_i)^4]}{\sigma_i^4} - 3 \tag{6}$$

Precisely, equation (6) produces so called excess kurtosis. Here we use kurtosis and excess kurtosis interchangeably. If kurtosis of an asset is less than zero, the distribution is less peaked and has shorter tails compared to a normal distribution. If kurtosis is greater than zero, the

[5] The number of negatively skewed REIT returns for each quintile is not provided in Table 2.

distribution has a higher peak and longer tails (i.e., leptokurtic). For any given level of means and variances, investors prefer low kurtosis due to the less frequent occurrence of extreme results. Over 96% of the REITs in our sample have positive kurtosis. Additionally, 271 out of 335 REITs have significant kurtosis, which is about 81%. Both quintile 1 and quintile 3 have over 90% of REITs with significant kurtosis (mainly positive) shown in Panel B.

Skewness and kurtosis are based upon the empirical data and are more descriptive. We further test normality of REIT return distribution with Jarque-Bera test and Shapiro-Wilk test. The test statistic JB of Jarque-Bera is computed from skewness and kurtosis, specifically

$$JB = \frac{n}{6} \cdot (S^2 + \frac{(K-3)^2}{4}) \tag{7}$$

where n is the number of time series observations, S denotes the sample skewness as defined by equation (5) and (K-3) denotes the sample excess kurtosis defined by equation (6). JB asymptotically follows the χ^2 distributed with two degree of freedom. The null hypothesis of normal distribution can be rejected at α level if JB is larger than or equal to $\chi^2_{1-\alpha,2}$. The Shapiro-Wilk W statistic is constructed by considering the regression of ordered sample observations on the corresponding expected order statistics from the normal distribution. The Shapiro-Wilk test requires the sample size between 7 and 2000.[6] Our sample has the observations between 62 and 487, which falls into the range perfectly. The value of the W statistic ranges between 0 and 1. Being close to one indicates normality.

The results of both tests are presented in Panel A and B of Table 1.2. Both JB and W statistics suggest that large portion of our sample has non-normal distribution: 81% according to JB and 75% according to the W statistic. Most of the quintiles also have more than half of REITs

[6] The original W statistics is valid for the sample sizes between 3 and 50, but Royston (1992) extended the test to the sample size of 2000.

exhibiting non-normal distribution. Combining these statistics, the results assure us that it is necessary to explore the asymmetry of REIT returns.

The monthly returns of REMFs are obtained on Morningstar Principia CD (February 2004 version) from March 1984 to February 2004. Even though the sample for the real estate mutual funds suffer from survivorship bias, the magnitude of the bias is rather small since there have been very few real estate mutual funds discontinued over the sample period. There are 200 mutual funds that are categorized as "Specialty – Real Estate" by Morningstar Inc. Among them, minimum fifteen continuous monthly returns are required. The remaining data deal with the issue of multiple share class funds. The share classes represent a common pool of assets but differ in term of how distribution-related fees are paid. The distribution expenses can be paid with a front-end load, a rear-end load, or a 12b-1 fee. Morningstar Inc. treats each share class as a separate fund. Most of existing studies of mutual fund loads tend to agree that expenses of all types, whether annual or one-time charges, are not related to mutual fund performance [Grinblatt and Titman (1994), Elton, Gruber, Das, and Hlavka (1993), and Elton, Gruber, and Blake(1996b)]. Since the method of payment does not enhance mutual fund performance, different criteria should not induce inconsistent results. Previous studies regarding real estate mutual funds have chosen the sample of funds with front-end load only or funds with the largest share class [Kallberg, Liu and Trzcinka (2000) and O'Neal and Page (2000)]. However, this paper selects only the original share class[7] for each fund [Carhart et al. (2002)]. As a result, 71 real estate mutual funds are included in our sample.

Panel A of Table 1.3 provides descriptive statistics for REMFs' excess returns. Our sample has an average of 86 month observations per REMFs, with the shortest time series of 17 months and the longest time series of 240 months. The mean excess return is 0.92% per month,

[7] When multiple share classes have the same inception date, we choose the largest share class.

which is about 0.17% higher than that of REITs. The mean standard deviation is 3.59%, which is considerably lower than that of REITs. This higher return and lower risk combination is expected for REMFs. As we mentioned earlier, REMFs are much more diversified than regular REITs. Investors put money into mutual funds and expect to achieve the goal of higher return and lower risk through professional management. As of the return distribution of REMFs, majority of them have normal distribution. Panel B shows that only 15 Jarque-Bara statistics and 12 W statistics out of 71 total REMFs reject the normality hypothesis.

Table 1.3 Descriptive Statistics and Normality Tests for REMFs

This table presents descriptive statistics of our REMF sample. All statistics are calculated based on 71 REMFs. Mean is the time-series and cross-sectional average monthly excess return, recoded in %. Skewness is the third standardized moment and kurtosis is the fourth standardized moment. JB is the Jarque-Bera test statistic and the W is the Shapiro-Wilk test statistic.

Panel A: Descriptive Statistics of REMFs' Excess Returns			
	Periods	**Mean**	**Std Dev.**
Mean	86	0.92	3.59
Min	17	0.26	1.32
Max	240	2.55	5.93

Penal B: Normality Tests of REMFs' Excess Returens				
	Skewness	**Kurtosis**	**JB**	**W**
Mean	-0.18	0.4	3.93	0.98
Min	-1.45	-0.71	0.01	0.85
Max	0.57	2.82	41.37	1
# of Significance	7	11	15	12

We use CRSP value-weighted index that includes all the stocks traded on NYSE, AMEX, and NASDAQ as the proxy for the market. The mean monthly return of the index over our sample period is 0.441% with a standard deviation equal to 4.51%. The index is significantly negatively skewed and has a significant positive kurtosis at 5% level. Both JB test and Shapiro-Wilk test reject the null hypothesis of normal distribution for the index monthly returns. We focus on presenting our results with CRSP value-weighted index. However, we also employ CRSP equal-weighted index and NAREIT index for robustness checks.

V. Empirical Results

In this section, we present the estimations of the asymmetric risk measures discussed in section 3. We investigate whether there are any patterns in REIT returns for quintiles sorted by the risk measures. We also conduct robustness checks for our results. In the second part of this section, we discuss the downside risk and REMFs. We investigate whether downside risk play a role in examining the performance of REMFs.

5.1 Empirical Results of REITs

5.1.1 Downside Risk

For each REIT return series in our sample, we estimate the market beta (β) using the traditional CAPM and the downside beta (β^-) and the upside beta (β^+) using the asymmetric response model.

The regression results are summarized in Table 1.4. The average β of our sample is 0.438, which indicates that REITs on average are less risky than the market. There are 69% of these estimates are statistically significant at 10% or lower level. The average β^- is 0.626 and the average β^+ is 0.235. The minimum values of three β's are all negative. This is not unique to our sample. Ang, Chen, and Xing (2006) report the average β^+ of the lowest quintile is negative when the stocks are sorted by realized β^+. Cheng (2005) reports the minimum values of both downside beta and upside beta are negative. O'Neal and Page (2000) show some of beta coefficients for Russell 2000 and S&P 500 are negative. In fact, Cloninger, Waller, Bendeck, and Revere (2004) report about average 10% of NYSE and AMEX stocks have negative beta during 1987 to 1995.

Table 1.4 Summary of Regression Results using CRSP Value-Weighted Index

This table summarizes the regression results using CRSP value-weighted index. CAPM stands for the capital asset pricing model, and ARM stands for the asymmetric response model (equation (1)). β is the market beta estimated using the CAPM. β^- and β^+ are the downside beta and the upside beta, respectively, estimated using the asymmetric response model.

	CAPM		ARM			
	β	Adj. R^2	β^-	β^+	$\beta^- - \beta^+$	Adj. R^2
Mean	0.438	0.054	0.626	0.235	0.391	0.056
Minimum	-0.426	-0.016	-0.738	-1.946	-1.897	-0.044
Maximum	1.925	0.431	3.228	4.817	3.854	0.445
Std Dev.	0.356		0.582	0.625	0.658	
# of Significant Coefficients	232		148	77	44	

The average difference between downside and upside betas, $\beta^- - \beta^+$ is 0.391. Specifically, there are 258 out of 335 REITs that have larger downside betas than upside betas. This implies that REITs' relationship to the overall market is stronger during declining conditions than during the uprising conditions. However, only 44 (i.e., 13%) of these differences are significant at 10% level.[8] This implies that majority REITs in our sample do not react to up and down market conditions differently. According to adjusted R^2, there is no clear evidence that the ARM has better goodness of fit than the CAPM. The negative adjusted R^2 indicates a very poor fit model relative to the degree of freedom. Furthermore, 108 alphas from the CAPM are significant at 10% level, and majority (96%) of them is positive. However, only 45 alphas from the ARM are significant at 10% level, and all of them are positive. Therefore, according to Jensen's alphas, the ARM does help to explain some of REIT abnormal returns.

We compute the coskewness and Leland's beta following equations (2) and (3). We divide our sample into five quintiles based upon each REIT's realized β, realized relative β^- (i.e., $\beta^- - \beta$), realized relative β^+ (i.e., $\beta^+ - \beta$), coskewness, and Leland's beta (β_L). We apply the

[8] 43 out of these 44 REITs have larger downside betas than upside betas.

relative β^- and β^+ in order to control the effect of β. Table 1.5 reports the average realized excess return in each equal-weighted quintile portfolio. The panels A through E also report the average cross-sectional realized β, relative β^- (i.e., β^- - β), relative β^+ (i.e., β^+ - β), coskewness, and β_L of each quintile portfolio. Through Table 1.5, we investigate relationships between contemporaneous factor loadings and returns.

In Panel A, REITs are sorted by β. We observe a week pattern that the average excess returns decreases as the market β increases. The lowest quintile has an average excess return of 0.93% per month while the highest quintile has an average monthly excess return of 0.63%. The difference of 0.3% is significant at 5% level.[9] It implies that the average returns and the market risk are negatively related. This panel also reports the relative β^-, relative β^+, and β_L. We spot that in general all four risk factors move in the same direction. Ang et al. (2006) point out that by construction, either higher conditional β^- or β^+ should suggest higher unconditional β. Leland (1999) also shows that there is a positive relationship between β and β_L. In Panel B and C of Table 1.5, we separate the market risk into downside and upside components. There is no obvious pattern between average REIT returns and downside: As β^- increases, the average excess returns fluctuate among different quintiles. However, there is a weak pattern showing that β^+ and average excess returns are negatively related. Since investor prefer upside potentials, a higher upside beta should be accompanied with a lower contemporaneous returns. Panel D shows that there is no significant relationship between coskewness and average excess returns. Panel E reveals a monotonically decreasing pattern between realized average excess returns and realized

[9] The t-test for the difference of monthly excess returns between the lowest quintile and the highest quintile is not presented in Table 2.

β_L. The difference between quintile 1 and quintile 5 is about 0.33% monthly and is significant at 5% level.

Table 1.5 Asymmetric Risk and Returns Using CRSP Value-Weighted Index

This table presents the risk and returns using CRSP value-weighted index. The overall data are divided into five quintiles based on each risk measure. Return is the monthly average return of REITs cross each quintile. β is the average market beta of each quintile estimated using the CAPM. β^- and β^+ are the average downside and upside betas of each quintile, respectively, estimated using the asymmetric response model. Coskew denotes the average coskewness of each quintile. β_L is average Leland's beta.

	Return	β	β^-	β^+	Coskew	β_L
Panel A: REITs Sorted by Realized β						
Quintile 1 (Low)	0.926	0.060	0.289	-0.195	-0.162	0.071
Quintile 2	0.851	0.228	0.392	-0.025	-0.237	0.240
Quintile 3	0.671	0.353	0.482	0.156	-0.300	0.363
Quintile 4	0.673	0.551	0.726	0.337	-0.314	0.560
Quintile 5 (High)	0.628	0.999	1.242	0.905	-0.196	1.003
Panel B: REITs Sorted by Realized Relative β^-						
Quintile 1 (Low)	0.978	0.403	0.133	0.334	-0.113	0.393
Quintile 2	0.657	0.381	0.369	0.142	-0.200	0.382
Quintile 3	0.759	0.412	0.529	0.165	-0.287	0.422
Quintile 4	0.731	0.498	0.765	0.307	-0.298	0.513
Quintile 5 (High)	0.624	0.497	1.334	0.229	-0.312	0.526
Panel C: REITs Sorted by Realized Relative β^+						The
Quintile 1 (Low)	0.619	0.402	0.711	-0.366	-0.342	0.429
Quintile 2	0.883	0.355	0.493	-0.032	-0.268	0.364
Quintile 3	0.877	0.382	0.544	0.188	-0.289	0.394
Quintile 4	0.747	0.469	0.621	0.443	-0.218	0.474
Quintile 5 (High)	0.623	0.582	0.761	0.944	-0.093	0.576
Panel D: REITs Sorted by Coskewness						
Quintile 1 (Low)	0.546	0.504	0.855	0.118	-0.507	0.531
Quintile 2	0.877	0.395	0.678	0.103	-0.324	0.413
Quintile 3	0.782	0.401	0.496	0.105	-0.242	0.409
Quintile 4	0.817	0.374	0.534	0.165	-0.154	0.378
Quintile 5 (High)	0.726	0.517	0.568	0.685	0.016	0.505
Panel E: REITs Sorted by β_L						
Quintile 1 (Low)	0.935	0.060	0.258	-0.178	-0.149	0.070
Quintile 2	0.862	0.229	0.384	-0.036	-0.236	0.239
Quintile 3	0.735	0.355	0.476	0.145	-0.290	0.363
Quintile 4	0.610	0.549	0.734	0.397	-0.317	0.559
Quintile 5 (High)	0.606	0.997	1.278	0.848	-0.218	1.006

The patterns observed in Panels A and E seems inconsistent with agents disliking risk – a lower return is associated with a higher β or β_L. However, either measure does not control for the effects of β^+. The decreasing patterns of returns in Panels A and E may be due to the patterns of β^+, which show that returns decrease as β^+ increases. After controlling for the effect of β^+, the decreasing patters in Panels A and E vanish.[10] In short, the results presented in Table 1.5 are different from those of Ang et al. (2006). Even though we do find a weak relation between β^+ and average excess returns, we do not find any detectible relationship between average excess return and β^-. This difference may be due to the completely different samples: our sample focus exclusively on REITs while Ang et al. use all common stocks. Since the REIT market is a unique market with the characteristics of both stocks and real estate, this is not a complete surprise that we do not reach the same results as those of Ang et al.

Overall, using CRSP value-weighted index we find that there are 77% of REITs in our sample that have larger beta when the market is down. This finding is consistent with those of Sagalyn (1990), Chatrath et al. (2000), and Conover et al. (2000). However, the asymmetry between up and down markets is only significant for a small portion (44) of REITs. In line with Ang et al. (2006), we find that there is a weak negative relationship between average returns and upside betas. This implies that investors prefer upside potentials and thus require lower returns. However, we do not find any significant relationship between downside betas and average returns, which is similar to Conover et al. (2000). We also find that there is lack of relationship between coskewness and returns, which is consistent with the finding of Vines et al. (1994).

[10] In order to control for the effects of β^+, we sort average excess returns using (β - β^+) and (β_L - β^+). The results are not shown in Table 5.

5.1.2 Robustness Checks

In the rest of this section, we conduct a series of robustness checks to show whether our results are influenced by the way we have measured asymmetry in REIT returns. Specifically, we examine whether the choice of market index, model specification, survivorship bias, and the cutoff point of up and down markets can affect our results.

First, the previous results are estimated using CRSP value-weighted index as the proxy for the market. One of the common market indices used in previous literature is S&P 500. However, this index is criticized because it only includes the largest firms in the stock market. This character is particularly harmful for our study since REITs are believed to be similar to small-capitalization stocks. Han and Liang (1995) find that the use of the S&P 500 index as a performance benchmark tends to overstate REIT performance. Another possible index is CRSP equal-weighted index. By construction, CRSP value-weighted index puts large weights on large-capitalization stocks, while CRSP equal-weighted index treats large- and small-capitalization stocks equally. This may have a significant impact on our estimation due to the market capitalization of REITs.

Furthermore, for REITs, there may be other potential market indices other than the above widely-used indices for analyzing the common stock market. There are two popular REIT indices available: NAREIT REIT (NAREIT) index and Dow Jones (DJ) Wilshire REIT index. NAREIT index includes all types of REITs, namely equity REITs, mortgage REITs, and hybrid REITs, that are publicly traded. On the other hand, DJ Wilshire REIT index mainly includes equity REITs and excludes small REITs. According to Grinblatt and Titman (1989), the appropriate benchmark does not necessarily have to include all asset classes, but only those assets under consideration. We repeat the estimation procedure in the previous section using CRSP equal-weighted index and NAREIT REIT index, respectively.

Table 1.6 shows the descriptive statistics and the normality tests for CRSP value-weighted and equal-weighted indexes and NAREIT index. The average monthly excess return of NAREIT index is similar to that of CRSP value-weighted index but is much smaller than the average excess return of CRSP equal-weighted index. NAREIT index has the least standard deviation among the three, while the equal-weighted index is most volatile. This is consistent with the belief that REITs are less risky than the general stock market. The equal-weighted index is driven by small stocks. Smaller stocks tend to be more volatile. Among three indexes, two CRSP indexes are negatively skewed but only the value-weighted one is significant at 5% level. The NAREIT index is slightly positively skewness. All three indexes have significant kurtosis at 5% level, and the excess return distribution of the NAREIT index has the highest peak. Both Jarque-Bera statistics and W statistics reject the normal-distribution hypothesis for all three indexes.

Table 1.6 Descriptive Statistics for Market Indexes

Mean is the average excess return for each index. Std Dev is the standard deviation of the index excess returns. Skewness is the third standardized moment and kurtosis is the fourth standardized moment. JB is the Jarque-Bera test statistic and the W is the Shapiro-Wilk test statistic. * denotes 5% significance level.

	Periods	Mean	Std Dev	Skewness	Kurtosis	JB	SW
CRSP Value-weighted	487	0.441	4.509	-0.482*	1.916*	93.349*	0.980*
CRSP Equal-weighted	487	0.781	5.822	-0.159	2.855*	167.446*	0.972*
NAREIT Index	408	0.449	4.453	0.063	6.345*	684.619*	0.930*

We plot the three indexes in Figure 1. The graph shows that in general all three indexes following a rising trend over the period of 1972 to 2005. Comparing to the overall market, the REIT market is much less volatile. It is also interesting to notice that between 1998 and 2003, REIT market move slightly opposite to the general stock market.

Figure 1.1 Three Indexes (1972 to 2005)

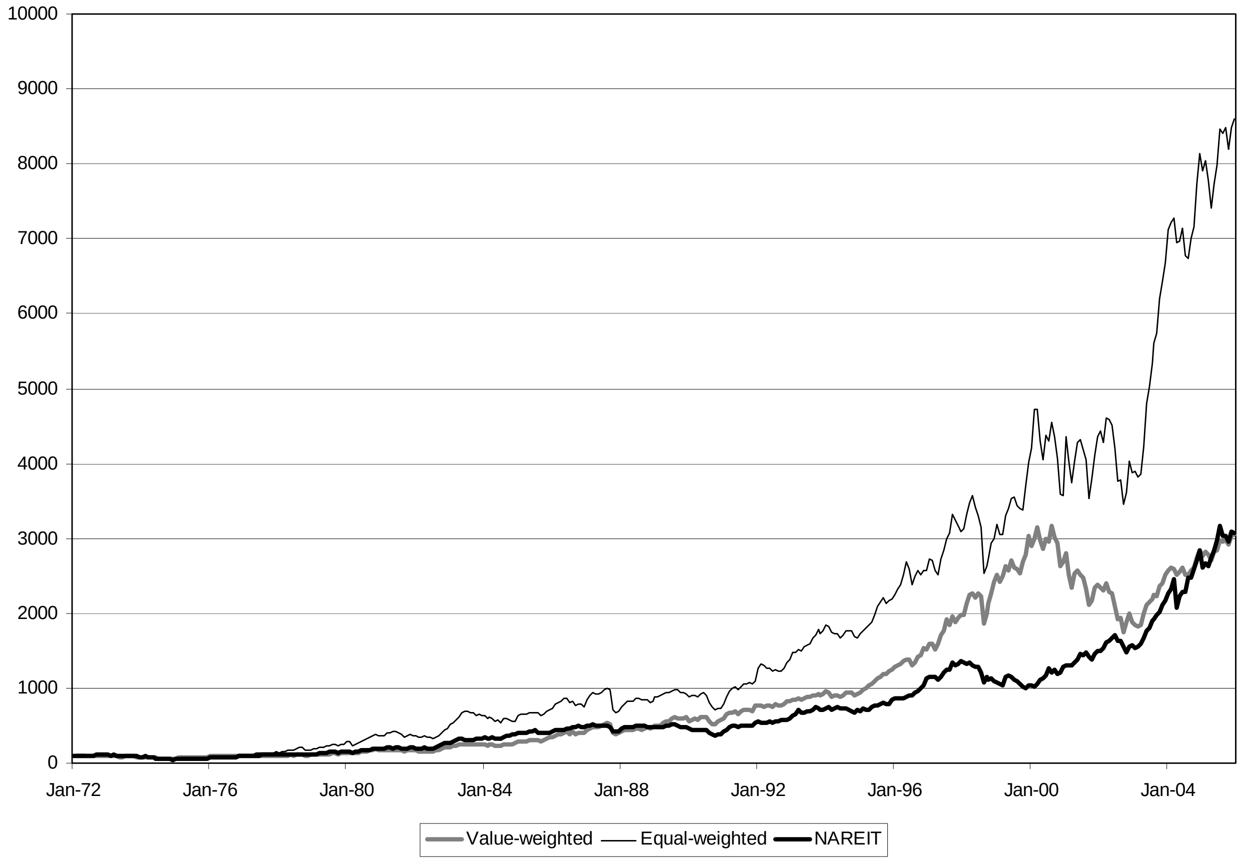

Table 1.7 summarizes the regression results using CRSP equal-weighted index. The average market beta is almost the same as that using CRSP value-weighted index. There are 278 beta coefficients that are significant at 10% level, which are 46 more than using value-weighted index. The average adjusted R-square of CAPM is slightly higher with the equal-weighted index, 0.085 versus 0.054 with the value-weighted index. Under the asymmetric response model, average β^- is smaller and β^+ is larger than those using the value-weighted index. 60% of REITs have larger downside betas than upside betas. The average difference between the downside risk and upside risk (i.e., β^- - β^+) is much smaller. The numbers of significant β^-, β^+ and β^- - β^+ are 179, 157, and 57, which all increase compared to those using the equal-weighted index.

The average adjusted R-square for the ARM also increases from 0.056 with the value-weighted index to 0.089 with the equal-weighted index. Based on adjusted R-squares, there is a preference for using the equal-weighted index. There are 93 Jensen's alphas from CAPM that are significant, and majority of them are positive. When using ARM, the number of significant alphas drops to 57. However, CRSP equal-weighted index do not have higher explanatory power to the performance of REITs compared to the value-weighted index.

Table 1.7 Summary of Regression Results using CRSP Equal-Weighted Index

This table summarizes the regression results using CRSP equal-weighted index. CAPM stands for the capital asset pricing model, and ARM stands for the asymmetric response model (equation (1)). β is the market beta estimated using the CAPM. β^- and β^+ are the downside beta and the upside beta, respectively, estimated using the asymmetric response model.

	CAPM		ARM			
	β	**Adj. R^2**	**β^-**	**β^+**	**β^-- β^+**	**Adj. R^2**
Mean	0.478	0.085	0.558	0.5	0.058	0.089
Minimum	-0.106	-0.015	-0.838	-2.329	-3.679	-0.04
Maximum	2.173	0.519	3.789	4.651	3.364	0.514
Std Dev.	0.359		0.495	0.664	0.635	
# of Significant Estimates	278		179	157	57	

Table 1.8 shows the relationship between different risk measures and average returns. When REITs are sorted by the market risk β, average monthly excess returns fluctuate across five quintiles. There is a weak increasing pattern between average return and relative β^- : as relative β^- increases, the average returns increases except the largest quintile. We also find a weak decreasing pattern between relative β^+ and average returns, which implies that there is a discount associated with β^+ . There is no clear pattern between average returns and coskewness, Furthermore, the inverse relationship between returns and β_L when using the value-weighted index is no longer detectable.

Table 1.8 Asymmetric Risk and Returns Using CRSP Value-Weighted Index

This table presents the risk and returns using CRSP value-weighted index. The overall data are divided into five quintiles based on each risk measure. Return is the monthly average return of REITs cross each quintile. β is the average market beta of each quintile estimated using the CAPM. β- and β+ are the average downside and upside betas of each quintile, respectively, estimated using the asymmetric response model. Coskew denotes the average coskewness of each quintile. βL is average Leland's beta.

	Return	β	β^-	β^+	Coskew	β_L
Panel A: REITs Sorted by Realized β						
Quintile 1 (Low)	1.055	0.115	0.173	0.017	-0.150	0.122
Quintile 2	0.942	0.254	0.330	0.173	-0.183	0.263
Quintile 3	0.571	0.391	0.498	0.393	-0.167	0.395
Quintile 4	0.768	0.575	0.667	0.539	-0.133	0.578
Quintile 5 (High)	0.413	1.055	1.122	1.378	0.056	1.021
Panel B: REITs Sorted by Realized Relative β^-						
Quintile 1 (Low)	0.723	0.581	0.219	0.798	0.089	0.537
Quintile 2	0.753	0.449	0.391	0.507	-0.049	0.438
Quintile 3	0.822	0.389	0.469	0.385	-0.167	0.390
Quintile 4	0.914	0.481	0.694	0.425	-0.184	0.495
Quintile 5 (High)	0.536	0.491	1.017	0.385	-0.265	0.520
Panel C: REITs Sorted by Realized Relative β^+						
Quintile 1 (Low)	0.831	0.415	0.644	-0.006	-0.316	0.445
Quintile 2	0.945	0.346	0.488	0.191	-0.222	0.361
Quintile 3	0.781	0.371	0.452	0.344	-0.182	0.379
Quintile 4	0.764	0.496	0.504	0.609	-0.042	0.487
Quintile 5 (High)	0.427	0.762	0.701	1.362	0.185	0.708
Panel D: REITs Sorted by Coskewness						
Quintile 1 (Low)	0.724	0.393	0.644	0.205	-0.484	0.424
Quintile 2	0.871	0.363	0.498	0.179	-0.255	0.382
Quintile 3	0.673	0.499	0.633	0.451	-0.134	0.503
Quintile 4	0.854	0.428	0.436	0.511	-0.002	0.416
Quintile 5 (High)	0.626	0.708	0.579	1.154	0.299	0.655
Panel E: REITs Sorted by β_L						
Quintile 1 (Low)	1.013	0.118	0.145	0.042	-0.113	0.121
Quintile 2	0.926	0.253	0.327	0.183	-0.166	0.260
Quintile 3	0.629	0.393	0.479	0.391	-0.170	0.396
Quintile 4	0.729	0.576	0.682	0.549	-0.164	0.579
Quintile 5 (High)	0.451	1.051	1.157	1.335	0.036	1.024

In order to using NAREIT index, we have to reduce our sample size to 314 REITs because NAREIT index has only existed since 1972. Table 1.9 reports the summary statistics for the regression results. All three betas are much higher than those using CRSP indexes. This is because NAREIT index represents a much small market than CRSP indexes. On average, REITs are less risky than the overall stock market but they have much stronger co-movements with their own kind. There are about 60% or higher of downside and upside betas that are significant at 10% level. More specifically, slightly over half of REITs move closer to the down market while the other half move closer to the up market. However, only about 17% of the asymmetric movements are significant. The average adjusted R-squares are much higher both for CAPM and ARM, implying NAREIT index is a much better market proxy for REITs than both CRSP indexes. The results of Jensen's alphas also show that NAREIT index is more suitable for evaluating the performance of REITs. Under the CAPM, only 56 alphas are significant, which are much less than using either CRSP index. And only 31 alphas from the ARM are significant, which implies that the asymmetric risk measure help explain the REIT abnormal returns.

Table 1.9 Summary of Regression Results using NAREIT Index

This table summarizes the regression results using NAREIT index. CAPM stands for the capital asset pricing model, and ARM stands for the asymmetric response model (equation (1)). β is the market beta estimated using the CAPM. β^- and β^+ are the downside beta and the upside beta, respectively, estimated using the asymmetric response model.

	CAPM		ARM			
	β	Adj. R^2	β^-	β^+	β^-- β^+	Adj. R^2
Mean	0.832	0.198	0.876	0.752	0.124	0.200
Minimum	-0.273	-0.016	-1.867	-2.275	-3.163	-0.037
Maximum	2.089	0.650	3.711	4.604	4.706	0.653
Std Dev.	0.391		0.527	0.782	0.884	
# of Significant Estimates	276		211	185	54	

Table 1.10 presents the asymmetric risk measures estimated with NAREIT index and average REIT excess returns. Panel A shows the quintiles sorted by the market beta. There is a weak positive relationship between β and excess returns – as β increases, the average excess returns increases from low to high β quintiles except for the highest quintile. When REITs are sorted based on relative β^- and relative β^+, no clear relations between returns and risk are

Table 1.10 Asymmetric Risk and Returns Using NAREIT Index

This table presents the risk and returns using NAREIT index. The overall data are divided into five quintiles based on each risk measure. Return is the monthly average return of REITs cross each quintile. β is the average market beta of each quintile estimated using the CAPM. β- and β+ are the average downside and upside betas of each quintile, respectively, estimated using the asymmetric response model. Coskew denotes the average coskewness of each quintile. β_L is average Leland's beta.

	Return	β	β^-	β^+	Coskew	βL
Panel A: REITs Sorted by Realized β						
Quintile 1 (Low)	0.670	0.283	0.529	0.103	-0.135	0.289
Quintile 2	0.689	0.679	0.756	0.512	-0.261	0.686
Quintile 3	0.806	0.835	0.829	0.641	-0.166	0.838
Quintile 4	0.969	1.003	1.039	0.962	-0.233	1.003
Quintile 5 (High)	0.662	1.366	1.234	1.554	-0.058	1.347
Panel B: REITs Sorted by Realized Relative β-						
Quintile 1 (Low)	0.639	1.001	0.450	1.148	0.051	0.974
Quintile 2	0.854	0.945	0.791	1.040	-0.114	0.933
Quintile 3	0.802	0.815	0.827	0.787	-0.165	0.812
Quintile 4	0.838	0.767	0.990	0.681	-0.305	0.778
Quintile 5 (High)	0.662	0.627	1.330	0.093	-0.324	0.657
Panel C: REITs Sorted by Realized Relative β+						
Quintile 1 (Low)	0.680	0.719	0.992	-0.154	-0.367	0.743
Quintile 2	0.678	0.713	0.880	0.484	-0.272	0.723
Quintile 3	0.995	0.807	0.812	0.770	-0.225	0.810
Quintile 4	1.058	0.870	0.832	0.991	-0.058	0.862
Quintile 5 (High)	0.380	1.051	0.865	1.683	0.071	1.021
Panel D: REITs Sorted by Coskewness						
Quintile 1 (Low)	1.030	0.810	1.081	0.409	-0.540	0.834
Quintile 2	0.872	0.893	1.061	0.649	-0.339	0.903
Quintile 3	0.712	0.747	0.913	0.568	-0.192	0.752
Quintile 4	0.585	0.805	0.695	0.849	-0.045	0.792
Quintile 5 (High)	0.596	0.905	0.627	1.294	0.268	0.875
Panel E: REITs Sorted by βL						
Quintile 1 (Low)	0.676	0.284	0.502	0.097	-0.131	0.289
Quintile 2	0.720	0.681	0.709	0.578	-0.215	0.683
Quintile 3	0.706	0.834	0.860	0.654	-0.177	0.839
Quintile 4	1.034	1.003	1.066	0.903	-0.256	1.004
Quintile 5 (High)	0.660	1.364	1.249	1.540	-0.074	1.347

detected, shown in Panels B and C. When REITs are sorted based on coskewness, there is a rather clear decreasing pattern in average returns as coskewness goes up. Since investors do not like negative skewness, lower (and negative) coskewness should be accompanied by higher returns. Panel D shows that as coskewness become less negative and eventually becomes positive from quintile 1 to quintile 5, the average excess returns from quintile 1 to quintile 4 decreases steadily while the average return of quintile 5 is slightly higher than that of quintile 4. Panel E shows no pattern between returns and Leland's beta.

A model that only considers an asset's covariance with the market like CAPM and ARM may not be able to fully explain time series returns of REITs. Han and Liang (1995) demonstrate that REITs are closer related to small stocks than large stocks. Chatrath et al (2000) also indicate that return pattern of REITs are similar to that of small stocks. Chiang et al (2004) show that after taking into account size and value factor, the downside and upside beta become insignificant. Therefore, it is necessary to examine REIT returns using Fama-French (1993) three-factor model, defined as

$$R_i(t) = \alpha_i + \beta_i^- R_m^-(t) + \beta_i^+ R_m^+(t) + s_i SMB(t) + h_i HML(t) + \varepsilon_i(t) \qquad (8)$$

where SMB is the average difference between returns on small-stock portfolios and on large-stock portfolios, HML is the average difference between returns on value-stock portfolios and on growth-stock portfolios.[11] Equation (8) is incorporated the asymmetry of betas. When $\beta^- = \beta^+$, equation (8) becomes to the single-beta Fama-French three-factor model.

Table 1.11 summarizes the regression results of Fama-French three-factor models. Based upon the adjusted R-squares, there is a preference for the three factor models. The average adjusted R-squares for CAPM and ARM are 0.054 and 0.056, respectively. The average adjusted R-squares for the three-factor models with β and with β^- and β^+ are both 0.128. This implies that after adjusting for the difference in degrees of freedom, the three-factor models are better. 75-78% of the coefficients associated with small and value factors are statistically significant at 10%

[11] The data of SMB and HML are obtained from Kenneth French website.

level. The average β^- and the average β^+ are 0.66 and 0.56, respectively. The difference between these two betas is 0.10 on average, which is much smaller than the difference of 0.39 with the ARM. Additionally, only 29 out 335 (less than 9%) of the differences are significant at 10% level in which 18 of them have larger downside betas than upside betas. This suggests that there is no strong evidence that REITs co-move asymmetrically in up and down markets after controlling size and value factors. Additionally, the three factor models also increase the explanatory power toward the performance of REITs. 54 alphas from the single-beta three-factor model and 26 alphas from the dual-beta three factor model are significant at 10% level, in which over two thirds of alphas are positive from both models. Substantial amount (over 50%) of abnormal returns that cannot be explained by the CAPM and ARM are explained by the two three-factor models.

Table 1.11 Summary of Regression Results using Fama-French Three-Factor Model

This table summarizes the regression results using Fama-French three-factor model. 3-Factor represents equation (8). 3-Factor with ARM represents the model with up and down betas and SMB and HML. β is the market beta estimated using the CAPM. β^- and β^+ are the downside beta and the upside beta, respectively.

	3-Factor		3-Factor with ARM			
	β	Adj. R^2	β^-	β^+	β^-- β^+	Adj. R^2
Mean	0.584	0.128	0.66	0.563	0.097	0.128
Minimum	-0.891	-0.029	-0.847	-1.813	-3.17	-0.051
Maximum	2.296	0.507	3.394	4.985	2.801	0.519
Std Dev.	0.372		0.537	0.67	0.693	
# of Significant Estimates	278		180	137	29	

We sort our sample into different quintiles based on betas that are estimated with the three-factor models. Table 1.12 shows average excess returns and betas in different quintiles. REITs are sorted based on β in Panel A. As β becomes larger from quintile 1 to quintile 5, the average excess returns of the quintiles do not show any pattern. In Panel B and C, REITs are grouped according to relative β^- and relative β^+, respectively. As betas increases through quintiles monotonically, average returns of quintiles fluctuate with no definite directions. Combined the results in Table 1.11 and Table 1.12, they suggest that the asymmetric movements between REITs and the overall market may be partially caused by the small-capitalization components of REITs.

Table 1.12 Asymmetric Risk and Returns Using Fama-French Three-Factor Model

This table presents the risk and returns estimated with Fama-French three-factor model. The overall data are divided into five quintiles based on each risk measure. Return is the monthly average return of REITs cross each quintile. β is the average market beta of each quintile estimated using the CAPM. β- and β+ are the average downside and upside betas of each quintile, respectively, estimated using the model with dual beta and SMB and HML.

	Return	β	β^-	β^+
Panel A: REITs Sorted by Realized β				
Quintile 1 (Low)	0.745	0.177	0.343	0.153
Quintile 2	0.928	0.380	0.422	0.259
Quintile 3	0.738	0.517	0.552	0.433
Quintile 4	0.654	0.705	0.747	0.731
Quintile 5 (High)	0.683	1.139	1.234	1.239
Panel B: REITs Sorted by Realized Relative β^-				
Quintile 1 (Low)	0.678	0.671	0.284	0.836
Quintile 2	0.674	0.520	0.417	0.490
Quintile 3	0.836	0.537	0.577	0.463
Quintile 4	0.927	0.546	0.728	0.455
Quintile 5 (High)	0.633	0.643	1.292	0.571
Panel C: REITs Sorted by Realized Relative β^+				
Quintile 1 (Low)	0.710	0.586	0.791	-0.041
Quintile 2	0.931	0.504	0.516	0.278
Quintile 3	0.825	0.542	0.632	0.506
Quintile 4	0.765	0.541	0.622	0.697
Quintile 5 (High)	0.518	0.744	0.737	1.375

Our sample covers four decades of US REIT history. During this time period, the REIT market has been through many ups and downs, which are often tied with changes in tax regulations. In order to thorough examine the relationship between asymmetric risk and REIT returns, we divide our sample period to two sub-periods: 1965-1986 and 1987-2005. This division is motivated by the Tax Reform Act of 1986. This reform makes it possible for REITs to manage their properties internally, which reduces agency problems. 74 REITs and 307 REITs are examined during 1965-1986 and 1987-2005, respectively. The average CAPM β is 0.85 over the period of 1965-1986, which is higher than the average β (0.44) for the overall sample. The average β is 0.37 for the period of 1987-2005, which is lower than that for the overall sample. The results indicate that REITs are more risky in their early years, and are less risky as the market becomes more mature. The average downside and upside betas in the first sub-period are 1.08 and 0.81, respectively. In the second sub-period, the average downside and upside betas decrease substantially and are 0.56 and 0.12, respectively. Once again, the results show that REITs at the early stage are much riskier than matured REITs. Especially, earlier REITs are riskier than the market when the overall market is down. The patterns of downside and upside betas in the sub-periods are consistent with Chiang et al (2004). More specially, 52 out of 74 REITs during 1965-1986 have larger downside betas than upside betas; however, only 10 of them are significant at 10% level. Over 1987-2005, 79% of REITs have larger downside betas than upside betas while only 43 of them are significant at 10%.

We sort average excess returns of 74 REITs during 1965-1986 into five quintiles based on different risk measures. The results are shown in Table 1.13. Panels A and C show the returns sorted by β and relative β^+, respectively. We do not observe any patterns between returns and β/relative β^+. Panels B and D present the returns sorted by relative β^- and coskewness, respectively. In general, average returns increase as β^- increase, and returns decrease as coskewness becomes more positive. This is weak evidence of a premium associated with β^- and negative coskewness, which is consistent with agents disliking downside risk and negative skewness. We also divide 307 REIT over 1987-2005 into five quintiles based on various risk measures. We do not detect any clear pattern between returns and those measures. The results are shown in Appendix A.

Table 1.13 Asymmetric Risk and Returns For REIT over 1965-1986

This table presents the risk and returns for REITs during 1965-1986. CRSP value-weighted index is used a proxy for the market. The overall data are divided into five quintiles based on each risk measure. Return is the monthly average return of REITs cross each quintile. β is the average market beta of each quintile estimated using the CAPM. β^- and β^+ are the average downside and upside betas of each quintile, respectively. Coskew denotes the average coskewness.

	Return	β	β^-	β^+	Coskew
Panel A: REITs Sorted by Realized β					
Quintile 1 (Low)	0.803	0.344	0.516	0.281	-0.065
Quintile 2	0.730	0.580	0.864	0.435	-0.074
Quintile 3	0.491	0.837	1.011	0.885	0.040
Quintile 4	1.021	1.085	1.314	1.037	0.018
Quintile 5 (High)	0.882	1.445	1.735	1.468	0.004
Panel B: REITs Sorted by Realized Relative β^-					
Quintile 1 (Low)	0.619	0.905	0.776	1.033	0.082
Quintile 2	0.759	0.700	0.739	0.679	0.030
Quintile 3	0.839	0.808	1.009	0.764	-0.029
Quintile 4	0.838	0.936	1.285	0.763	-0.084
Quintile 5 (High)	0.870	0.906	1.624	0.824	-0.081
Panel C: REITs Sorted by Realized Relative β^+					
Quintile 1 (Low)	0.799	0.907	1.226	0.386	-0.177
Quintile 2	0.884	0.830	1.033	0.662	-0.081
Quintile 3	0.601	0.747	1.015	0.759	-0.021
Quintile 4	0.961	0.618	0.787	0.753	0.057
Quintile 5 (High)	0.668	1.171	1.354	1.551	0.156
Panel D: REITs Sorted by Coskewness					
Quintile 1 (Low)	1.154	0.705	1.091	0.279	-0.220
Quintile 2	0.634	0.895	1.247	0.722	-0.094
Quintile 3	0.619	0.859	1.028	0.813	-0.010
Quintile 4	0.591	0.714	0.919	0.855	0.061
Quintile 5 (High)	0.932	1.095	1.114	1.434	0.200

So far, our sample combines survived REITs and not-survived REITs. Since some of the previous studies only focus on survived REITs, it is worth examining survived REITs separately. The average number of observations for each survived REITs is 190 (months), which is about 2-year longer than the average number of observations for the overall sample. The average monthly excess return is roughly 1 percent, which is 0.25 percent higher than the overall sample. However, the standard deviation of survived-REIT returns is about 1 percent lower than the overall sample. The average market capitalization is about 770 million US dollars, higher than the combined group. While examining the return distributions of survived REITs, they are similar to those of the overall sample. There are about 44% of survived REITs with significant skewness and 78% with significant kurtosis. These numbers for the overall sample are 53% and 81%, respectively. For survived REITs, 79% of Jarque-Bera statistics and 70% of the W statistics reject the normality hypothesis. However, after carefully examining the asymmetric risk measures and average excess returns, we do not find any obvious patterns between risk and returns. The results are presented in Appendix A.

Finally, we investigate whether the choice of the cutoff point of up and down markets can alter our results. Until now, we separate the up and down markets using the one-month Treasury bill rate. However, there is not a specific theory that supports a particular way to divide the market. Ang et al. (2006) use the mean of market excess returns and Sagalyn (1990) and Glascock (1991) use NBER business cycles to define up and down markets. For robustness check, we run the ARM using the mean market excess returns and NBER contraction and expansion periods to separate the market. Table 1.14 compares the market conditions with different cutoff points. Over our sample period (487 month in length), using the risk-free rate as the cutoff point, we have 208 months as down markets and 279 as up markets. Using the mean market excess return as the cutoff point, we have 225-month down condition and 262-month up condition, which are similar to those using the risk-free rate. However, following NBER business cycle's definition, the length of market conditions changes dramatically. We only have 71 months classified as contraction period while overwhelmingly 416 months as expansion period. An expansion period may last from 1 year up to 10 years. In order to receive meaningful estimations, all REITs must have at least 12-year (144-months) consecutive returns available when using NBER's definition as the cutoff point. Our sample size reduces to 147 REITs. We are not able to identify any relationship between returns and asymmetric risk using either cutoff point. The detailed results are shown in Appendix A.

Table 1.14 Frequency of Market Conditions

This table reports different ways to separate the up and down market conditions.

Benchmark	Market Conditions	Frequency of Months	Percentage
Risk-free Rate	down	208	42.7%
	up	279	57.3%
Mean of Market Excess Returns	down	225	46.2%
	up	262	53.8%
NBER Business Cycles	Contraction	71	14.6%
	Expansion	416	85.4%

5.2 Empirical Results of REMFs

Different from the study of downside risk and REITs, we focus on evaluating the performance of REMFs in terms of downside risk. We apply four different models to assess the performance of REMFs. The first model is the traditional CAPM. The second model is the asymmetric response model (equation (1)) discussed in section 3. The third model is Fama-French three-factor model. The last model is a model with downside and upside betas plus SMB and HML, which is a combination of the asymmetric response model and Fama-French model (equation (8)). The intercepts of these four models are Jensen's alpha. A positive alpha indicates superior performance of REMFs over the market, a negative alpha suggests inferior performance, and an insignificant alpha implies that REMFs do not have abnormal returns.

Table 1.15 presents the regression results of the four models using CRSP value-weighted index as a proxy for the market. Across four models, all the average alphas are positive.

Especially, 40 alphas from the CAPM are significant at 10% level and positive. This suggests that more than half of REMFs outperform the general market. However, when using the ARM to estimate the alpha, 25 out of 71 alphas are positive and significant at 10% level. This suggests that asymmetric relation between REMFs and the market helps to explain some of the abnormal returns. According to adjusted R-squares, the ARM is not obviously better than the CAPM.

Table 1.15 Jensen's Alphas Using CRSP Value-Weighted Index

This table reports Jensen's alphas from four different models, and they are CAPM, ARM, Fama-French three-factor model, and the model with dual betas and SMB and HML. 3-Factor represents equation (8). 3-Factor with ARM represents the model with up and down betas and SMB and HML.

	CAPM		ARM		3FF		3FF ARM	
	alpha	Adj. R^2	alpha	Adj. R^2	alpha	Adj. R^2	alpha	Adj. R^2
Mean	0.815	0.116	1.620	0.113	0.245	0.414	1.075	0.410
Min	-0.151	-0.053	0.663	-0.102	-0.412	0.076	0.078	0.082
Max	2.262	0.369	3.128	0.379	1.459	0.620	3.499	0.619
# of Significance	40		25		8		6	

REMFs focus on investing in REITs, which have similar characteristics as small and value stocks as we discussed in previous section. So, it is important to evaluate REMF performance using Fama-French three-factor model. With the three-factor model, Table 1.15 shows that the number of alphas that are significant and positive decreases even further down to 8. This implies that small and value factors help to partially explain the abnormal returns in REMFs. These results are consistent with O'Neal and Page (2000) and Lin and Yung (2004). There is no significant improvement using the dual betas plus SMB and HML.

We also use the NAREIT index as a proxy for the market and rerun all four models. According to previous studies, an appropriate benchmark for evaluating mutual fund performance does not have to be the overall market index. The regression results using the NAREIT index are shown in Table 1.16. After using NAREIT index, the explanatory power of all four model increases dramatically based on adjusted R-squares. All four models have the average adjusted R-squares in the 0.84 range, while the average adjusted R-squares using CRSP value-weighted index are much lower between 0.11 to 0.41. Therefore, NAREIT index is much more suitable market proxy when evaluating REMF performance.

Table 1.16 Jensen's Alphas Using NAREIT Index

This table reports Jensen's alphas from four different models, and they are CAPM, ARM, Fama-French three-factor model, and the model with dual betas and SMB and HML. 3-Factor represents equation (8). 3-Factor with ARM represents the model with up and down betas and SMB and HML.

	CAPM		ARM		3FF		3FF ARM	
	alpha	Adj. R^2	alpha	Adj. R^2	alpha	Adj. R^2	alpha	Adj. R^2
Mean	0.099	0.843	0.124	0.843	0.124	0.843	0.133	0.848
Min	-0.797	0.088	-2.166	0.130	-2.166	0.130	-2.484	0.130
Max	1.061	0.985	3.350	0.983	3.350	0.983	4.205	0.985
# of Significance	17		9		18		9	

Under the CAPM, there are only 17 out of 71 funds have positive and significant alpha. When applying the ARM, this number drops substantially to 9. Once again, downside risk shows its explanatory power toward the performance of mutual funds. The two models with Fama-French factors do not show any improvement in evaluating the performance. This may be due to the characteristics of the NAREIT index. The NAREIT index includes all public traded REITs, which has the small and value factors built into the index. Therefore, SMB and HML do not show superior explanatory power when the NAREIT index is used.

In general, majority of REMFs do not have superior performance over benchmarks such as CRSP value-weighted index and NAREIT index. However, the results are sensitive to the choice of models and indexes being used to evaluate the funds.

VI. Conclusions

This paper investigates the relationship between downside risk and REIT returns. The REIT market has expanded substantially since the early 90s. As a unique investment vehicle, REITs have both the characteristics of a stock and real estate. It is important for us to better understand the risk and return relationship of them. We examine total 335 REITs traded on NYSE, AMEX, and NASDAQ over the sample period of 1965 to 2005, including survived and non-survived REITs. We apply downside and upside betas, coskewness and Leland's beta to assess the asymmetric risk of REIT returns. There is no strong evidence that REIT returns has a contemporary relationship with any of the asymmetric risk. Only a small portion of REITs in our sample shows significant asymmetric movement between up and down market conditions. The results remain consistent with different market indexes, different cutoff points for the up and down market, and with survived REITs. We find weak evidence that some of the asymmetric movement of REIT returns may be caused by small and value factors.

We also evaluate the performance of REMFs from the downside risk perception. We find that majority of REMFs do not have significant abnormal returns. The results may be sensitive to the choice of models and market indexes being used. We find that NAREIT index is more suitable when assess the performance of REMFs.

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Appendix A

Table A.1 Asymmetric Risk and Returns for Survived REITs

This table presents the risk and returns for survived REITs. The risk measures are estimated with CRSP value-weighted index. Return is the monthly average return of REITs cross each quintile. β is the average market beta of each quintile estimated using the CAPM. β^- and β^+ are the average downside and upside betas of each quintile, respectively, estimated using the asymmetric response model. Coskew denotes the average coskewness of each quintile. β_L is average Leland's beta.

	Return	β	β^-	β^+	Coskew	β_L
Panel A: REITs Sorted by Realized β						
Quintile 1 (Low)	0.951	0.101	0.072	-0.176	-0.150	0.107
Quintile 2	0.996	0.229	0.294	-0.147	-0.241	0.237
Quintile 3	1.000	0.320	0.366	0.055	-0.314	0.329
Quintile 4	0.961	0.478	0.596	0.252	-0.282	0.487
Quintile 5 (High)	1.090	0.889	1.008	0.605	-0.271	0.896
Panel B: REITs Sorted by Realized Relative β^-						
Quintile 1 (Low)	1.129	0.375	0.076	0.244	-0.109	0.367
Quintile 2	0.894	0.321	0.262	0.039	-0.220	0.324
Quintile 3	0.952	0.411	0.474	0.055	-0.263	0.421
Quintile 4	1.048	0.401	0.564	0.148	-0.307	0.415
Quintile 5 (High)	0.976	0.495	0.956	0.083	-0.363	0.517
Panel C: REITs Sorted by Realized Relative β^+						
Quintile 1 (Low)	0.898	0.438	0.684	-0.323	-0.311	0.459
Quintile 2	1.080	0.380	0.431	-0.029	-0.271	0.389
Quintile 3	1.052	0.302	0.302	0.045	-0.260	0.309
Quintile 4	0.926	0.394	0.375	0.288	-0.230	0.397
Quintile 5 (High)	1.040	0.489	0.523	0.608	-0.183	0.488
Panel D: REITs Sorted by Coskewness						
Quintile 1 (Low)	0.904	0.529	0.847	0.154	-0.451	0.554
Quintile 2	1.067	0.358	0.447	0.034	-0.318	0.371
Quintile 3	0.829	0.404	0.427	0.027	-0.255	0.411
Quintile 4	1.122	0.426	0.474	0.146	-0.183	0.430
Quintile 5 (High)	1.081	0.281	0.109	0.213	-0.041	0.271
Panel E: REITs Sorted by β_L						
Quintile 1 (Low)	0.987	0.101	0.041	-0.164	-0.135	0.105
Quintile 2	1.028	0.229	0.273	-0.130	-0.240	0.236
Quintile 3	0.922	0.319	0.406	0.053	-0.307	0.330
Quintile 4	1.048	0.479	0.557	0.232	-0.295	0.487
Quintile 5 (High)	1.015	0.888	1.059	0.596	-0.282	0.898

Table A.2 Asymmetric Risk and Returns of REITs over 1987-2005

This table presents the risk and returns for REITs over 1987-2005. The risk measures are estimated with CRSP value-weighted index. Return is the monthly average return of REITs cross each quintile. β is the average market beta of each quintile estimated using the CAPM. β^- and β^+ are the average downside and upside betas of each quintile, respectively, estimated using the asymmetric response model. Coskew denotes the average coskewness of each quintile.

	Return	**β**	**β^-**	**β^+**	**Coskew**
Panel A: REITs Sorted by Realized β					
Quintile 1 (Low)	0.921	0.041	0.328	-0.221	-0.164
Quintile 2	0.711	0.208	0.360	-0.062	-0.248
Quintile 3	0.863	0.309	0.426	0.040	-0.333
Quintile 4	0.536	0.451	0.611	0.223	-0.357
Quintile 5 (High)	0.567	0.825	1.072	0.597	-0.385
Panel B: REITs Sorted by Realized Relative β^-					
Quintile 1 (Low)	0.998	0.372	0.085	0.287	-0.121
Quintile 2	0.638	0.316	0.295	-0.014	-0.242
Quintile 3	0.736	0.335	0.450	0.047	-0.352
Quintile 4	0.621	0.403	0.668	0.194	-0.373
Quintile 5 (High)	0.603	0.416	1.293	0.071	-0.397
Panel C: REITs Sorted by Realized Relative β^+					
Quintile 1 (Low)	0.576	0.412	0.769	-0.436	-0.396
Quintile 2	0.806	0.299	0.487	-0.139	-0.307
Quintile 3	0.837	0.342	0.464	0.110	-0.312
Quintile 4	0.819	0.360	0.454	0.274	-0.298
Quintile 5 (High)	0.557	0.429	0.631	0.764	-0.178
Panel D: REITs Sorted by Coskewness					
Quintile 1 (Low)	0.514	0.505	0.901	0.082	-0.622
Quintile 2	0.747	0.424	0.714	0.115	-0.374
Quintile 3	0.776	0.293	0.432	0.027	-0.276
Quintile 4	0.831	0.368	0.494	0.042	-0.194
Quintile 5 (High)	0.722	0.255	0.270	0.319	-0.028

Table A.3 Risk and Returns with Mean Excess Market Return as the Cutoff Point

This table presents the risk and returns using the mean excess market return as the cutoff point. The risk measures are estimated with CRSP value-weighted index. Return is the monthly average return of REITs cross each quintile. β is the average market beta of each quintile estimated using the CAPM. β^- and β^+ are the average downside and upside betas of each quintile, respectively, estimated using the asymmetric response model. Coskew denotes the average coskewness of each quintile. β_L is average Leland's beta.

	Return	β	β^-	β^+
Panel A: REITs Sorted by Realized Relative β^-				
Quintile 1 (Low)	0.814	0.732	0.108	-0.141
Quintile 2	0.994	0.406	0.312	0.042
Quintile 3	0.745	0.272	0.497	0.197
Quintile 4	0.585	0.175	0.808	0.447
Quintile 5 (High)	0.611	0.110	1.475	0.725
Panel B: REITs Sorted by Realized Relative β^+				
Quintile 1 (Low)	0.680	0.746	0.414	-0.412
Quintile 2	0.996	0.408	0.475	-0.073
Quintile 3	0.921	0.313	0.526	0.163
Quintile 4	0.641	0.175	0.781	0.442
Quintile 5 (High)	0.511	0.052	1.005	1.150

Table A.4 Risk and Returns with NBER Business Cycle

This table presents the risk and returns using NBER contraction and expansion periods to define the down and up markets. The risk measures are estimated with CRSP value-weighted index. Return is the monthly average return of REITs cross each quintile. β is the average market beta of each quintile estimated using the CAPM. β^- and β^+ are the average downside and upside betas of each quintile, respectively, estimated using the asymmetric response model. Coskew denotes the average coskewness of each quintile. β_L is average Leland's beta.

	Return	β	β^-	β^+
Panel A: REITs Sorted by Realized Relative β^-				
Quintile 1 (Low)	0.58	0.84	-0.13	0.28
Quintile 2	0.68	0.62	0.35	0.30
Quintile 3	0.61	0.42	0.66	0.40
Quintile 4	0.74	0.30	0.89	0.45
Quintile 5 (High)	0.99	0.28	1.57	0.64
Panel B: REITs Sorted by Realized Relative β^+				
Quintile 1 (Low)	0.61	0.96	0.27	0.20
Quintile 2	0.73	0.61	0.51	0.29
Quintile 3	0.47	0.38	0.68	0.35
Quintile 4	0.84	0.25	0.81	0.44
Quintile 5 (High)	0.95	0.27	1.11	0.78

Chapter Two

A First Look at the Liquidity of Asian REITs

I. Introduction

The United States real estate investment trust (REIT) market has become very well-developed since Congress passed the Real Estate Investment Trust Act of 1960. While REITs are popular investment vehicles in the U.S., they have only recently caught on in Asia. The trend in Asian REITs is noteworthy for several reasons. First, Asia has become a crucial region of the global economy. Rapid economy growth has pushed five countries and regions onto the list of top forty countries by GDP per capita, namely Japan, Singapore, Hong Kong, South Korea, and Taiwan.[12] For real estate investment, demand growth relies substantially on income gains. Second, many parts of Asia are among the most densely populated regions in the world with relatively scarce land resources, making them suitable for REIT development. However, the breadth and liquidity of Asian REITs were initially low. These two characteristics are important for investors when considering whether to invest in this newly organized market. Further, studies such as Amihud and Mendelson (1986) demonstrate that liquidity has important impacts on pricing. Therefore, the success of Asian REITs may partially depend on improvement in the market liquidity.

Liquidity is an important characteristic for any security. This is especially true for REITs, which bring liquidity to investments in real estate. Real estate markets are commonly considered to be loosely organized and decentralized. Direct investment in real property is normally characterized as illiquid because it is typically associated with high transactions costs, time-consuming property searches, and intensive management involvement. With the creation of

[12] The information of global GDP per capita is obtained online from wikipedia.org.

REITs, investments in real estate may be traded on exchanges or over-the-counter (OTC) with much less transactions costs. Additionally, investment diversification can be easily achieved through REITs, by holding portfolios with mixed property types and located in various geographic regions.[13]

Asian REITs have gained acceptance as an alternative for investors who are averse to stock market volatility and for those who are looking for high returns. As interest rates have remained historically low in Asia in recent years, the creation of REITs attracts both institutional and individual investors. At the end of 2005, the returns of both Japanese REITs and Singaporean REITs were 2.2% and 3% higher, respectively, than the returns of these two countries' government bonds (Conner and Halle [2006]). Many investors have considered the Asian market an opportunity to diversify their investment portfolios. The birth of Asian REITs may also represent a good opportunity for investors to add Asian real estate to their portfolios, without actually owning the physical real estate assets.[14]

It is important to explore the liquidity issue in this new Asian market for the following reasons. First, even though REITs inject liquidity into real estate investment, they may not be as liquid as other publicly traded common stocks in the Asian markets. Research on U.S. REITs shows conflicting results. Some studies suggest that REITs are less liquid than non-REIT stocks (Below, Kiely and McIntosh [1995] and Below et al. [1996]), while others suggest that there is no significant difference in liquidity between REITs and comparable non-REIT stocks (Nelling, Mahoney, Hildebrand and Goldstein [1995] and Bhasin, Cole and Kiely [1997]). If Asian REITs are less liquid than other local stocks, they may not be a possible substitute for other Asian

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[13] For more complete discussion of direct and indirect real estate investment and investment diversification with real estate, see, for example, Maroney and Naka (2006).

[14] A strong positive relationship between U.S. REIT returns and real estate in the 1990s was documented by Clayton and MacKinnon (2001, 2003).

stocks or an ideal choice for diversification of investment portfolios. Second, the Asian REIT markets have grown steadily over last few years. Studies on U.S. REITs have shown that the liquidity of REITs has improved over time as the overall market capitalization of REITs has increased (Bhasin et al. [1997], Clayton and MacKinnon [1998]). As the Asian REIT markets grow strongly, it would be interesting to find out whether the liquidity of these markets is improving over time. Additionally, comparing the relative liquidity of this newly formed Asian market to that of its mature U.S. counterpart will provide a general idea of how active this market is, i.e., whether there is sufficient interest in investing in this market.

To our knowledge, this paper is the first attempt to study the liquidity of Asian REITs. We focus on Japanese REITs (JREITs) and Singaporean REITs (SREITs) since these two markets are relatively more developed than the rest of the Asian REIT markets. A better understanding of these two leading markets might shed light on the development of REITs in the surrounding countries. First, we use various measures to estimate the liquidity of JREITs and SREITs in terms of bid-ask spread, trading frequency, and price impact. This approach is chosen because the inconsistent results regarding U.S. REIT liquidity (see literature review) may be due to differing liquidity measures used in the previous studies. Relying on correlation coefficients, we identify which measures are most appropriate for assessing Asian REIT liquidity. Second, we match the non-REIT stocks in Japanese and Singaporean markets to JREITs and SREITs with similar market capitalization, respectively. Comparisons of liquidity measures between REITs and non-REIT stocks are conducted. This allows us to detect any differences in liquidity between these two types of investment instruments in Japan and Singapore. The comparison also goes beyond the borders of these two countries. We match U.S. REITs to JREITs and SREITs according to market capitalization and analyze the liquidity between the mature (U.S.) and the newly organized (Japan and Singapore) markets. This sheds light on how active the Asian REIT markets are. Third, we apply Stoll's (1978 and 2000) framework with modifications to investigate the factors that affect the liquidity of this newly formed Asian market.

The rest of the paper is organized as follows. Section 2 provides background information for the Asian REIT market. Section 3 discusses the existing literature regarding liquidity. Section 4 presents the methodology and data. Section 5 analyzes the empirical results. The summary is provided in section 6.

II. Background Information of Asian REITs

Four decades after the US Congress implement the REIT Act, Japan enacted amendments to the Investment Trust and Investment Corporation Law in November 2000, which made the creation of real estate investment trusts possible. Shortly thereafter, in March 2001, the Tokyo Stock Exchange (TSE) established and implemented a listing system for REITs to be traded on its exchange. The first two JREITs were successfully listed on TSE in September 2001, which initiated the REIT sector in Asia. The Japanese REIT market has expanded substantially since its debut. There were 39 JREITs registered on the TSE by the end of 2006, with the market capitalization of US$ 41.8 billion.

The Monetary Authority of Singapore (MAS) established the Guidelines for Listed Property Trusts in May 1999, which were amended in November 2000. Real estate investment trusts in Singapore must comply with the legal requirements of Collective Investment Schemes (CIS) under Singapore's Securities and Futures Act issued by the MAS, especially the guidelines of property trusts. Capitamall Trust, the first SREIT listed on the Singapore Stock Exchange (SGX), commenced trading in July 2002. In just over a year, Singapore, as a rival investment center in the region, listed its first cross-border REIT (Future Real Estate Investment Trust) in 2003. By the end of 2006, there was a total nine SREITs listed on SGX.

Following the lead of Japan and Singapore, REITs have become a trend in other Asian markets. Hong Kong Securities and Futures Commission (SFC) released the final code on REITs on July 30, 2003. However, the listing of the first REIT did not go smoothly. The firm encountered a law suit, which resulted in an extensive delay. Finally, after more than a year-long battle, the first Hong Kong REIT, named "Link Real Estate Investment Trust," was listed on Hong Kong Stock Exchange on November 25, 2005. In South Korea, there are currently seven REITs traded publicly. However, unlike the conventional REIT concept, these REITs were created solely for the purpose of corporate restructuring. Because of this, the REIT market in South Korea is not developing at the pace seen in Japan and Singapore. In Taiwan, Fubon No. 1 REIT was listed on February 14, 2005. Aimed at providing opportunities for individual investors investing in real estate, 60% of the assets in this Taiwan REIT fund are from individual investors.[15] As of October 2006, there were seven publicly traded REITs in Taiwan. In both Malaysia and Thailand, legislation concerning REITs has only recently been put into place. Axis REIT, the first Malaysian REIT, and CPN Retail Growth Property Fund, the first Thai REIT, began trading in July and August 2005, respectively.

The future of the Asian REIT market looks promising for the following reasons. The creation of REITs provides an opportunity for Asian private investors, banks, and companies that do not specialize in real estate to sell their investment properties to REITs (Conner and Halle [2006]). As an alternative to bank financing, REITs also inject additional funding into Asian real estate markets. Investors consider REITs a competitive investment due to their attractive returns when compared to bonds and their lower risk when compared to stocks. The aging of the

[15] *Taiwan Investment Biweekly*, February 21, 2005.

population in East and Southeast Asia has encouraged an increase in the investment in real estate as investors seek capital stability and a steady income stream. This phenomenon highlights REITs as a suitable investment vehicle (Ooi, Newell and Sing [2006]).

III. Literature Review

Liquidity has long been an important concept in finance. It is defined as the ability to trade quickly at minimum cost. Academic research on the issue of liquidity is quite intensive. Amihud and Mendelson (1986) reveal that liquidity plays an important role in asset pricing. Using the bid-ask spread as a liquidity measure, they find a positive relationship between the spread and expected returns. Jones (2002) explores the long-term relationship between asset pricing and aggregate liquidity over the entire 20th century. There are also studies done on the cross-sectional determinants of liquidity, such as Stoll (1978) and Chiang and Venkatech (1988). The literature that is most closely related to this paper is the research of liquidity conducted on REIT sector. Since they are still in the early stage of development, academic research on Asian REIT markets is very limited, especially the liquidity of Asian REITs. Existing literature on REIT liquidity focuses solely on U.S. REITs.

Nelling, Mahoney, Hildebrand and Goldstein (1995) examine REIT liquidity from 1986 to 1990. The sample includes 25 REITs listed on NASDAQ and 31 REITs listed on the New York Stock Exchange (NYSE). They collect daily ask and bid prices for all NASDAQ REITs from the Center for Research in Security Prices (CRSP), whereas they have the intraday data for REITs on NYSE for the year 1990 only. In general, they find that the average percentage spreads of NASDAQ REITs are similar across different asset holdings, but NASDAQ REITs become less liquid over time. They indicate that the reduction in liquidity may have been caused by an increase in the dollar spread, a fall in share prices, or both. Compared to NASDAQ REITs, NYSE REITs have smaller spreads (both in dollar and in percentage terms), which implies that NYSE REITs are more liquid. Nelling et al. reveal that there is no significant difference in liquidity between REITs and non-REITs on either the NASDAQ or the NYSE. Additionally, they find that market capitalization and trading on an exchange are fundamental factors that affect REIT spreads.

Below, Kiely and McIntosh (1995) use intraday trading data to study the trading patterns of REITs versus non-REITs in 1991. They examine 37 REITs and other non-REIT stocks traded continuously on NYSE in 1991. In terms of the number of transactions and trading volume, REITs are generally less liquid than non-REITs after controlling for size and price. Taking the 1993 REIT boom into account, Below et al. (1996) extend their study by comparing the trading patterns of equity REITs in 1992 and 1994 (i.e., before and after the boom). Their empirical results suggest that the spreads are narrower after the boom, which indicate that the REIT market became more liquid and price efficiency improved. These results indicate a structural shift in the way REITs are priced. Additionally, they observe that the difference in spreads between REITs and non-REIT stocks decreased almost 50%, when compared to the results in their 1995 paper. This confirms that the REIT market became more liquid after the boom.

Bhasin, Cole and Kiely (1997) use intraday trading data to examine the liquidity of REITs in 1990 and in 1994. They find that REIT bid-ask spreads decline over their sample period, and this decline is driven by rising share prices rather than narrower bid-ask spreads. They suggest that return volatility, share price and exchange listing dominate market capitalization in explaining the variation in REIT spreads. According to their results, the liquidity of REITs is similar to that of non-REIT stocks comparable in prices and return volatility.

Analyzing the liquidity of REITs from a price impact of trade perspective, Clayton and MacKinnon (2000) employ a measure of market depth based on Kyle's (1985) method and a fixed trading cost per share similar to Brennan and Subrahmanyam (1996). Using the intraday data for March, April and May in both 1993 and 1996, they find that REIT liquidity increases from 1993 to 1996, which is consistent with the results from Bhasin et al. (1997). However, Clayton and MacKinnon point out that this increase is mainly driven by the substantial increase in the liquidity of the new self-managed REITs while the liquidity of traditional REITs remains at a similar level in both samples.

More recently, Bertin, Kofman, Michayluk and Prather (2005) use the data from the Trades and Quotes (TAQ) database in 1996 to examine the intraday trading patterns of REITs and non-REIT stocks. Specifically, they match REITs and non-REIT stocks in three ways. The first is based upon trading volume. The second is based upon time-weighted average percentage bid-ask spreads. And the third match uses both of the previous criteria. Their findings indicate that REITs are less liquid than non-REIT stocks that exhibit similar trading volume. The results for comparing REITs and non-REIT stocks with similar spreads are mixed, but in general, REITs appear to be less liquid for a large portion of the trading day.

The studies on the liquidity of U.S. REITs examined in this section provide us differing, and sometimes conflicting results. One possible explanation may be the choice of different liquidity measures such as quoted spreads, volume, number of transactions, etc. Since none of the existing measures is considered to be perfect, we use several commonly known measures to assess the liquidity of Asian REITs. The lack of consistency in the empirical results regarding the liquidity of U.S. REITs may also imply a time-varying nature in REITs. As the market expands, it is expected to experience an improvement in liquidity. To examine whether the liquidity of

Asian REIT markets exhibit the same characteristic, we compare the liquidity of JREITs in 2005 to that in 2006.

IV. Methodology and Data

4.1 Liquidity Measures

There are many different ways to measure liquidity that are noted in the academic literature. The broad range of different estimates implies that little consensus exists as to how to measure liquidity. We categorize the liquidity measures used in this paper as spread-related, trading frequency, and price impact measures.

4.1.1 Spread-Related Measures

The quoted bid-ask spread directly measures trading costs associated with transactions (Demsetz [1968]). Even though it is a well-accepted measure for liquidity, it does not include commissions to brokerages and other relevant costs associated with transactions such as expected price impact. Also, it often appears that trading prices move away from the bid and ask quotes as trades are carried out at various prices from inside or even outside the quotes (Grossman and Miller [1988] and Lee, Mucklow and Ready [1993]). One alternative is the percentage bid-ask spread, which connects the size of the spread to the share price. It is considered to be more precise, representing the percentage cost of transactions (Bertin et al. [2005]). The percentage bid-ask spread is defined as

$$BA = \frac{ASK - BID}{\frac{ASK + BID}{2}} \qquad (1)$$

where BA denotes the percentage bid-ask spread, ASK denotes the daily ask price, and BID denotes the daily bid price.

Another alternative is the effective bid-ask spread. This measure resolves to some extent the imperfectness associated with the quoted spread – it considers that the transactions may have occurred between the quoted bid and ask. The formula for the percentage effective spread is as follows

$$\mathrm{EBA} = \left(\frac{\left| \mathrm{PRICE} - \frac{\mathrm{ASK} + \mathrm{BID}}{2} \right|}{\frac{\mathrm{ASK} + \mathrm{BID}}{2}} \right) \times 2 \qquad (2)$$

where EBA denotes the effective percentage spread, and PRICE denotes the daily trading price.

In our sample, we calculate the daily bid-ask spreads for each JREIT and SREIT. If daily bid prices exceed ask prices or if ask or bid prices are missing, that day's percentage spread is deleted from the average bid-ask spread calculation of each REIT and of the entire sample.

Roll (1984) recommends measuring trading costs indirectly based upon the price behavior. He argues that in an efficient market, serial covariance between consecutive price changes should not reflect new information but rather the effective trading costs faced by investors. He defines the measure as

$$\mathrm{IBA} = 2\sqrt{-\operatorname{cov}(\Delta \mathrm{PRICE}_t, \Delta \mathrm{PRICE}_{t+1})} \qquad (3)$$

where IBA denotes the implied effective bid-ask spread, cov() denotes the serial covariance of price changes, and $\Delta\mathrm{PRICE}_t$ represents the percentage change in the daily trading prices. There is a potential technical problem embedded in Roll's measure – whenever serial covariance is positive, the IBA becomes undefined. In order to overcome this, we adopt the solution from Harris (1990). If the serial covariance is positive, we move the negative sign in the square root out, obtain the square root of the serial covariance directly, and then take the absolute value of the results. Specifically,

$$IBA = \begin{cases} 2\sqrt{-\text{cov}(\Delta \text{PRICE}_t, \Delta\text{PRICE}_{t+1})} \text{ if cov} \le 0 \\ \left| -2\sqrt{\text{cov}(\Delta \text{PRICE}_t, \Delta\text{PRICE}_{t+1})} \right| \text{ if cov} > 0 \end{cases} \quad (3')$$

4.1.2 Trading Frequency

Volume as a measure of liquidity reveals the extent of trading. It can be measured as the number of shares traded, dollar volume of shares traded, or the number of transactions completed during a specified period (usually daily). We use the volume of shares traded in local currency as a measure of liquidity. Trading volume should be negatively related to the bid-ask spread since higher trading volume implies that the market is more liquid.

Turnover is a proxy for holding period or trading frequency. The measure for turnover is defined as

$$TO = \frac{\text{Volume}}{\text{SHR}} \quad (4)$$

where TO denotes daily turnover, Volume denotes daily trading volume in number of shares, and SHR denotes the number of shares outstanding. Theoretically, turnover should be inversely associated with the bid-ask spread because more frequent trades usually produce smaller spreads (Amihud and Mendelson [1986]). Turnover is widely used to study liquidity and asset pricing. Rouwenhorst (1999) and Bekaert, Harvey and Lundblad (2005) find that there is no significant relationship between turnover and returns in emerging markets. Jones (2002) reveals a negative relationship between returns and turnover in the US stock market.

Lesmond, Ogden, and Trzcinka (1999, hereafter, LOT) assume that the marginal trader will trade only if the value of information exceeds the marginal transactions cost, otherwise a zero return occurs. They assert that these zero returns result from high transactions costs (both explicit costs and implicit costs). The obvious advantage of this estimate is that it only requires daily historical market data, which is widely available for most markets (worldwide) and for an extended period of time.

$$\text{ZERO} = \frac{\text{number of zero return days in month } t}{\text{number of trading days in month } t} \qquad (5)$$

where ZERO represent the proportion of zero returns in month *t*, expressed in percentage. The proportion of zero returns is presumed to be positively related to the spread. LOT further confirm this relationship using all stocks traded on NYSE and AMEX. However, Bekaert et al. (2005) suggest that the zero-return measure does not account for potential price impact. Even with this shortcoming, they present evidence that the proportion of zero returns is a preferred measure of liquidity to turnover. We calculate the daily returns on each trading day using the daily trading prices. Then the percentage of zero returns is calculated with a monthly frequency.

4.1.3 Price Impact

The Amivest measure of liquidity (also called the liquidity ratio) is the ratio of trading volume to absolute returns on a security:

$$\text{AMIV} = \frac{\text{Volume}}{|\text{R}|} \qquad (6)$$

where AMIV denotes the Amivest measure, and R denotes the daily return of a REIT. This measure shows us the trading volume associated with a one percent change in REIT price, which reveals the change in the REIT's market depth. The ratio should be negatively related to the bid-ask spread since a higher Amivest measure implies greater market liquidity. Amihud, Mendelson, and Lauterbach (1997) and Berkman and Eleswarapu (1998) use the measure to examine security returns on Israeli and Indian stock exchanges. The main problem with this measure is that when the return is zero AMIV becomes undefined. In order to avoid this problem, we calculate it on a monthly basis rather than a daily basis as follows:

$$\mathrm{AMIV} = \frac{\sum_t \mathrm{Volume}}{\sum_t |\mathrm{R}|} \quad (7)$$

The denominator of the Amivest measure is the sum of the daily returns in month *t*. In this way, zero returns do not affect the calculation of AMIV.

Amihud (2002) measures *illiquidity* by using the ratio of the daily absolute return to the dollar trading volume, which captures the price impact of daily trading. The formula for the Amihud measure is:

$$\mathrm{AMIH} = \frac{|\mathrm{R}|}{\mathrm{VOL}} \quad (8)$$

where AMIH denotes the Amihud measure and VOL denotes the daily trading volume in local currency. This ratio and the bid-ask spread should be positively related because smaller spreads are associated with lower price impact. This measure is not suitable for relatively illiquid markets in that when the trading volume is zero, AMIH is undefined. In our calculation, if zero volume occurs, that day is deleted from the average calculation for each REIT.

Last but not least, Pástor and Stambaugh (2003) derived a measure of liquidity based upon the relationship between order flow and temporary returns. If a stock is illiquid, then order flow at time *t*, represented by signed trading volume, is expected to be accompanied by a reversed future return at time *t+1*. The measure is defined as,

$$\mathrm{r}^{e}_{i,d+1,t} = \theta_{i,t} + \varphi_{i,t}\mathrm{r}_{i,d,t} + \gamma_{i,t}\mathrm{sign}(\mathrm{r}^{e}_{i,d,t}) \cdot \mathrm{v}_{i,d,t} + \varepsilon_{i,d+1,t} \qquad d = 1, \ldots, D \text{ (trading days in month } t\text{)} \quad (9)$$

where $r_{i,d,t}$ is the return on JREIT/SREIT *i* on trading day *d* in month *t*;

$r^{e}_{i,d,t}$ is the excess return on JREIT/SREIT *i* over the Japanese or Singaporean market return ($r_{m,d,t}$) on trading day *d* in month *t*; and

$v_{i,d,t}$ is the trading volume for JREIT/SREIT *i* on trading day *d* in month *t* in 100 millions of yen and in millions of Singapore dollar.

We use Nikkei 225 index and All-Singapore Equity index as the proxies for Japanese and Singaporean stock market, respectively. Equation (9) is estimated using ordinary least squares (OLS). The coefficient $\gamma_{i,t}$ is the liquidity measure for JREIT/SREIT *i* in month *t*, and is expected to be negative because trading volume should be associated with future return reversals if the stock is not perfectly liquid. Additionally, this measure should be negatively correlated with the bid-ask spread. Negative $\gamma_{i,t}$ of a larger magnitude is a signal that the stock is more illiquid, thus the stock should have a larger bid-ask spread.

We calculate and compare all measures discussed in this section to assess the liquidity of JREITs and SREITs. These measures are calculated for each JREIT and SREIT on a daily basis, except for Roll's measure, percentage of zero returns, Amivest measure, and Pástor and Stambaugh's measure that are computed on a monthly basis. The Pearson correlation coefficients are calculated using the percentage bid-ask spread as a basis in order to explore the relationship among these measures. Since the bid-ask spread is the most utilized measure of liquidity in the literature, if a measure is highly correlated with the bid-ask spread, we consider it to be a good measure of liquidity.

4.2 Factors Affecting Liquidity

Simply comparing different liquidity measures does not provide insight on the factors that may affect the liquidity of JREITs and SREITs; nor does it control for the effects of various liquidity factors. Stoll (1978) identifies the factors affecting the bid-ask spread: the variance of the stock's return, trading volume, turnover, the stock price and the number of dealers actively trading in the stock. Examining the stocks traded on NASDAQ, he finds that these five variables are able to explain 82.2 percent of the cross-sectional variation in percentage spreads. Using Stoll's (1978) framework to examine the impact of insider and institutional holdings on spread, Chiang and Venkatesh (1988) regress the percentage spread against the return volatility, trading volume, the percentage of insider holdings/institutional holdings, and market capitalization. They find that insider holdings have a positive effect on spreads while institutional holdings have no impact on spreads.

More than two decades later, Stoll (2000) revisits the factors that affect the spread. He incorporates the stock's size and the number of trades into his 1978 model, dropping turnover and the number of dealers in the stock. The modified model is able to explain about 65 percent and over 77 percent of the variation in spreads of NASDAQ stocks and NYSE/AMSE stocks, respectively. Lesmond (2005) utilizes Stoll's (2000) framework to examine liquidity measures in emerging markets.

Based on the theoretical and empirical work, we specify the relationship between the spreads of JREITs and SREITs and their sources in the following cross-sectional regression:

$$\text{Spread}_{i,t} = a_0 + a_1\,\text{VOL}_{i,t} + a_2\,\text{TO}_{i,t} + a_3\,\text{PRICE}_{i,t} + a_4\,\text{SIZE}_{i,t} + a_5\,\text{RV}_{i,t} + a_6\,\text{LIFE}_{i,t} + a_7\,\text{PROT}_{i,t} + \varepsilon_{i,t} \quad (10)$$

where $\text{Spread}_{i,t}$ is defined as the monthly average of the daily percentage bid-ask spread as the dependent variable. $\text{VOL}_{i,t}$ and $\text{TO}_{i,t}$ represent the monthly average of the daily trading volume in local currency and the daily turnover ratio, respectively. $\text{PRICE}_{i,t}$ is the monthly average of the daily trading prices for each Asian REIT. $\text{SIZE}_{i,t}$ is measured as the market capitalization for JREIT/SREIT *i* at the end of month *t*, calculated as the daily trading price multiplied by shares outstanding. $\mathrm{RV}_{i,t}$, the monthly volatility of a JREIT/SREIT's return, is measured by the variance of the daily returns calculated by using daily trading prices in a given month. $\mathrm{LIFE}_{i,t}$ is the length of existence, in months, of REIT *i* in month *t*. It is measured since the first full month after the trust was listed on either TSE or SGX. $\mathrm{PROT}_{i,t}$ is a dummy measuring diversification of properties. $\mathrm{VOL}_{i,t}$, $\mathrm{TO}_{i,t}$, $\mathrm{PRICE}_{i,t}$, $\mathrm{SIZE}_{i,t}$, and $\mathrm{LIFE}_{i,t}$ are in their natural log form. This model is run on Japan and Singapore REIT markets separately with monthly observations for 2005 and 2006.

Stoll (1978 and 2000) explains that trading volume, size and return volatility are proxies for inventory costs. Trading volume is expected to be negatively related to spreads. High trading volume implies a short holding period, and in turn indicates that the market is more liquid. The size is expected to be negatively associated with the spreads. The larger the firm size, the lower the inventory risk. Volatility represents the risk of adverse price change to a stock, so it should be positively related to the spread. The spread may be either an increasing or a decreasing function of turnover. If turnover is a proxy for adverse information costs, it is expected to be positively correlated with spread. However, if turnover is a proxy for holding period, then it should be negatively related to spread. The shorter the holding period, the more liquid the market is. Share price is a proxy for the unobservable minimum order cost, and it is expected to be negatively related to spreads.

Two variables are added into Stoll's framework to reflect the uniqueness of the JREIT/SREIT markets. The variable $\mathrm{LIFE}_{i,t}$ is a proxy for learning effect. Since Asian REITs are a rather new investment vehicle, it may take some time for investors to understand this market and evaluate trusts. The longer the time elapses, the better investors assess the market. Therefore, the life of a REIT is expected to be negatively related to the bid-ask spread with the existence of a learning effect. The dummy variable $\text{PROT}_{i,t}$ is introduced into the model based on the belief that REITs holding diversified assets are more attractive to investors. There are three major property types invested by JREITs – commercial, office, and residential properties. Table B.1 in Appendix B shows that among 26 JREITs examined in this paper, 14 hold a single-type property, 8 hold two different type properties, and 4 hold diversified properties. We define two property dummy variables for JREIT market. $\text{PROT1}_{i,t}$ is set to one if a JREIT holds two different type properties and zero otherwise. $\text{PROT2}_{i,t}$ is set to one if a JREIT holds diversified (more than two types) assets and zero otherwise. So, the base group presents JREITs holding a single type property. In the case of SREITs in our sample, three out of five hold a single-type, namely commercial, property. The rest of two holds diversified assets. So we define one property dummy variable for SREIT market. $\text{PROT}_{i,t}$ is set to one if the assets of a SREIT are diversified and zero otherwise. The property-type dummy variable is expected to be negatively related to the spread since diversified REITs are assumed to be less volatile.

4.3 Data

The data of JREITs traded on TSE in 2005 and 2006 are obtained from Nikkei America, Inc. The data for all stocks traded on SGX (including SREITs) in 2005 are obtained directly from the exchange. For each JREIT/SREIT, we collect daily trading prices, daily last bid and ask prices, daily trading volumes, and number of shares outstanding.

The number of JREITs has been increasing steadily since the first two JREITs were created in September 2001. There was an annual increase of four JREITs from 2002 to 2004. In 2005, TSE embraced 12 new JREITs. There were 26 and 39 JREITs traded on TSE by the end of year 2005 and 2006, respectively.[16] When selecting our sample, we avoid the first six month after the initial public offerings (IPOs) of JREITs, because this time period may be characterized by abnormal trading activities. Additionally, we require each JREIT having at least six-consecutive-month observations in order to achieve reasonable estimation for its liquidity. As a result, our sample includes 14 and 26 JREITs in 2005 and 2006, respectively. Each JREIT's inception date and year-end market capitalization are shown in Table B.2 in Appendix B. The market capitalization for the entire 2005 sample is about 2390 billion yen (= 20.26 billion US dollar[17]), which accounts for 84 percent of the total JREIT market at the end of 2005. The market capitalization for the entire 2006 sample is 4,032 billion yen (or 33.90 billion US dollars), which is about 69 percent higher than that of the 2005 sample. The size of 2006 sample is about 81 percent of the total JREIT market at the end of 2006. The increase in market capitalization of JREITs is clearly observed from Table B.2. The overall Japanese REIT market increased about 75 percent from 2005 to 2006. This increase comes from not only the new JREITs in the 2006 but the value from existing JREITs as well. The market values of all 14 JREITs in the 2005 sample increase in 2006, and 8 of them rise 30 percent or higher.

Table 2.1 reports the descriptive statistics for our JREIT sample. The number of observations (cross sections and across time) in 2006 is 6124, which is almost double that in 2005. This is because we have 12 more JREITs in the 2006 sample. The average bid-ask spread

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[16] We only focus on JREITs that are traded on TSE. There are only three JREITs that are not traded on the TSE. Fukuoka REIT Corporation was listed on the Fukuoka Stock Exchange in July 2005, Starts Proceed Investment Corporation was listed on the Jasdaq in November 2005, and TGR Investment Inc. was listed on the Osaka Stock Exchange in May 2004. Furthermore, TGR Investment Inc. also has been listed on TSE August 1, 2006. The market capitalization of all three combined accounts for approximately 0.57 and 0.66 percent of the JREIT market in 2005 and 2006, respectively.

[17] The exchange rate is obtained from the Exchange Rate Archives by Month on the International Monetary Fund (IMF) website (http://www.imf.org/external/np/fin/data/param_rms_mth.aspx). Since the market capitalization is calculated at the end of each year, we used the exchange rates on the last of December 2005 and December 2006, respectively.
On 12/30/2005, 1 US dollar =117.97 yen = 1.6642 Singapore dollar.
On 12/29/2006, 1 US dollar = 118.95 yen = 1.5044 Singapore dollar.

in 2006 is 5,077 yen, increased by 1,809 yen compared to the spread in 2005. The average price of JREITs in 2006 is about 34,000 yen less than that in 2005. The average daily trading volume is about 565 shares and 457 shares in 2005 and in 2006, respectively. The average market capitalization of JREITs decreases from 152.54 billion yen in 2005 to 129.13 billion yen in 2006. This reduction is understandable since most of the additional 12 JREITs in the 2006 sample are smaller in size compared to the original 14 JREITs already existed in 2005 sample (refer to Table B.2). All the above mentioned differences are highly significant at 1% level.

Table 2.1 Descriptive Statistics for JREIT Sample

This table reports the descriptive statistics for JREIT sample. N represents the number of daily observations for all JREITs. Ask, bid, and price represent the daily ask price, bid price, and trading price, respectively. They are all expressed in yen. Bid-ask spread is the daily spread in yen. Return is the average daily returns, recorded in %. Volume is the daily trading volume in shares. Market cap is the daily market capitalization, expressed in billion yen.

	2005 JREIT Sample			2006 JREIT Sample			Difference
	N	Mean	Std. Dev.	N	Mean	Std. Dev.	(2006-2005)
Ask	3312	754,128	168,143	6124	720,566	237,641	-33,562***
Bid	3312	750,860	167,454	6124	715,490	235,449	-35,370***
Bid-ask spread	3312	3,268	2,695	6124	5,077	4,479	1,809***
Price	3312	753,355	167,943	6124	718,962	236,876	-34,393***
Return	3312	0.03	0.18	6124	0.07	0.23	0.04***
Volume	3312	565.15	633.02	6124	456.93	669.65	-108.22***
Market Cap	3312	152.54	90.08	6124	129.13	129.26	-23.41***

Through the analysis of Table 2.1, we become aware that the 2005 and 2006 may be fundamentally different. First of all, the 2006 sample includes almost doubled number of JREITs than the 2005 sample. Even though they both represent the Japanese REIT market, the two samples have their own distinct characteristics, in terms of prices, trading volumes, and market capitalization. Second, the JREIT market is such a young market with rapid expansion. It is not likely that the market remains stable over time. From here on, we analyze the 2005 and 2006 samples individually. This can provide us more information of JREIT development over time. It also allows us to conduct robustness check across years.

Even though the expansion of the SREIT market was much slower than the JREIT market, the number of publicly traded SREITs has been steadily increasing since 2002. There were seven publicly traded SREITs by the end of 2005. Applying the same selection criteria of JREITs (i.e., six-month after IPOs and six-consecutive-month data), we include five SREITs in our sample (shown in Table B.3). The selected REITs have a market capitalization of 9.28 billion Singapore dollars (or 5.58 billion US dollars), which comprises slightly over 86 percent of the entire SREIT market. The overall SREIT market is much smaller than the JREIT market – it is slightly over a quarter of the JREIT market. In our sample, the average daily trading price for SREITs is 1.66 Singapore dollars. The average daily bid-ask spread is 0.13 Singapore dollar. The daily trading volume ranges from 1000 shares to 37,415,000 shares, with an average of 2,104,039 shares. The average market capitalization of our sample is 1.78 billion Singapore dollars.

V. Empirical Results

The empirical results are presented in this section. Since our JREIT sample is much larger, both in terms of number of REITs and the time period, than the SREIT sample, we begin our discussion with JREITs. We provide the summary statistics for the liquidity measures of JREITs, reveal the relationship between the measures, and compare the liquidity of JREIT to that of Japanese non-REIT stocks. Then our discussions go to SREITs. The liquidity of SREITs is presented in the same fashion as that of JREITs. We then direct our analysis beyond country borders - we compare the liquidity of JREITs/SREITs to that of US REITs. At last, we present the results of factors that affect the bid-ask spread of JREITs and SREITs.

5.1 Liquidity of JREITs

5.1.1 Liquidity Measures

Table 2.2 reports the summary statistics for the liquidity measures of our JREIT sample. Panel A shows the summary statistics for the spread-related measures. The average daily percentage bid-ask spread for JREITs in 2005 is 0.44%, the average daily percentage effective spread is 0.40%, and the average Roll's implied bid-ask spread is 0.70%. It is worth pointing out that Roll's implied spread may not represent the transactions cost of JREITs accurately. The reason is that the estimated first-order serial covariances of JREITs are positive at a 50% or higher rate for ten out of fourteen JREITs in 2005 sample. Consequently, we have to apply Harris' (1990) remedy to obtain Roll's measure indirectly. Harris (1990) criticizes that Roll's measure is not ideal when using daily data for individual securities since the serial covariances are positive for over half of the securities, a situation that leaves the Roll's measure undefined. For these reasons, Roll's measure should be interpreted with caution in this paper.

Panel A of Table 2.2 also indicates that JREIT spreads have increased over the two-year sample period. The average percentage bid-ask spread for JREITs in 2006 is 0.69%, which is 0.25% higher than that in 2005. The average effective spread is 0.62%, which is 0.22% higher than that in 2005. The implied spread increases 0.43% to 1.13% in 2006. All differences are significantly at 1% level. This increase in the percentage spreads may come from two sources. First, the difference between the daily bid and ask prices has increased over the entire sample period. Table 2.1 shows that the average daily yen bid-ask spread increases from 3,268 yen in 2005 to 5,077 yen in 2006. Second, the average daily price of JREITs has decreased over the same time period. The average price of JREITs is 753,355 yen in 2005 while it becomes 718,962 yen in 2006. Both the changes are statistically significant. So, the increase in yen spreads and/or the decrease in prices may cause the percentage spread to increase over time. The results from the bid-ask spreads imply that the transactions costs of JREIT have increased over time.

Panel B of Table 2.2 presents the liquidity measures related to trading frequency for JREITs in 2005 and 2006. The average daily trading volume is 364 million yen in 2006, which is 35 million yen less than in 2005. The average turnover ratios are similar in both 2005 and 2006, which are about 0.27%. The proportion of zero returns increases slightly over the sample period, from 11.8% to 12.5%. However, these differences between 2005 and 2006 are not statistically significant. The results from the trading frequency suggest that the JREITs' trading activities have remained at the similar level over the two-year period.

Panel C of Table 2.2 shows the liquidity measures related to price impact for JREITs in 2005 and 2006. Over the two-year period, the average Amivest measure decreases. This means that one percent change in REIT price is accompanied with a smaller value of trading volume. Meanwhile, the average Amihud's measure increases, indicating that the daily trading volume has a larger impact on price in 2006 than in 2005. Both changes in Amivest and Amihud measures are significant at 1% level. Additionally, these changes are somewhat expected. According to the information in Table 2.1 and Panel B of Table 2.2, the average daily return has increased while the average daily trading volume (both in shares and in Japanese yen) has decreased over the sample period. The two opposite forces result in the changes in Amivest and Amihud's measures. Pástor and Stambaugh's measure (γ) has decreased slightly but this change is not statistically significant. In general, the measures related to price impact suggest that the JREIT market becomes less liquid over the sample period, which is consistent with the inference obtained from the spread-related measures.

Table 2.2 Summary Statistics for Liquidity Measures of JREITs

This table reports the summary statistics for the liquidity measures of JREITs in 2005 and 2006. Panel A includes the measures related to the bid-ask spread. BA is the percentage bid-ask spread. EBA is the percentage effective spread. IBA is Roll's measure. All are recorded in %. Panel B includes the measures related to trading frequency. VOL is the trading volume in million Japanese yen. TO is the turnover ratio, expressed in %. Zero is the proportion of zero returns, expressed in %. Panel C includes the measures related to price impact. AMIV is Amivest's measure. AMIH is Amihud's measure. γ is the Pastor and Stambaugh's measure. Standard deviations are recorded in brackets. Differences are the changes in 2006 compared to 2005. *** denotes significance at 1% level.

	Panel A: Spreads			**Panel B: Trading Frequency**			**Panel C: Price Impact**		
	BA	**EBA**	**IBA**	**VOL**	**TO**	**ZERO**	**AMIV**	**AMIH**	**γ**
2005 JREITs	0.44	0.4	0.7	398.37	0.27	11.78	0.92	0.003	0.002
	[0.14]	[0.12]	[0.40]	[330.06]	[0.15]	[8.16]	[0.70]	[0.002]	[0.152]
2006 JREITs	0.69	0.62	1.15	377.62	0.27	12.51	0.51	0.012	-0.051
	[0.25]	[0.23]	[0.71]	[551.74]	[0.19]	[9.82]	[0.56]	[0.018]	[0.852]
Difference	0.26***	0.22***	0.45***	-20.75	-0.01	0.72	-0.41***	0.009***	-0.053

5.1.2 Correlation Analysis

To better assess the relation between each liquidity measure, we provide the Pearson correlation coefficients for all liquidity measures, using the percentage bid-ask spread as a basis (shown in Table 2.3). Since the percentage effective spread is also a direct measure of transactions cost, it is expected to be highly correlated to the percentage bid-ask spread. The correlation coefficient between the bid-ask and the effective spread is close to 1, which is not presented in the table.

Table 2.3 Correlations of The Bid-ask Spread and Alternative Liquidity Measure for JREITs

The table represents the Pearson correlation coefficient of the bid-ask and alternative liquidity measures for JREITs in 2005 and 2006. IBA is Roll's measure, recorded in %. VOL is the trading volume in million Japanese yen. TO is the turnover ratio, expressed in %. Zero is the proportion of zero returns, expressed in %. AMIV is Amivest's measure. AMIH is Amihud's measure. γ is the Pastor and Stambaugh's measure. *** denotes significance at 1% level; ** denotes significance at 5% level.

	IBA	VOL	TO	ZERO	AMIV	AMIH	γ
JREITs in 2005	0.39***	-0.18**	-0.15**	-0.04	-0.28***	0.49***	0.05
JREITs in 2006	0.33***	0.16***	-0.16***	0.39***	-0.11*	0.33***	-0.04

Table 2.3 reports the correlation of the bid-ask spread with other alternative measures. In terms of the magnitude of the correlation coefficient, Amihud's measure appears to have a stronger relationship than the other liquidity measures in representing the co-movement with the bid-ask spread – the correlation coefficients are 0.49 in 2005 and 0.33 in 2006, and both are significant at 1% level. Roll's implied spread also performs well according to the correlation matrix – it is significantly correlated with the bid-ask spread: the correlation coefficients are 0.39 and 0.33, respectively. The strong correlation between the bid-ask spread and Amihud's and

Roll's measures is consistent with Lesmond (2005), who use quarterly sampling intervals to investigate the liquidity in emerging market. The turnover ratio is significantly correlated with the bid-ask spread but at a less scale. Pástor and Stambaugh's measure has no significantly relationship with the bid-ask spread. The correlation coefficients reveal that different liquidity measures capture different aspects of liquidity.

5.1.3 Liquidity Comparison between JREITs and Japanese non-REIT Stocks

There are two categories of stocks on the TSE: the first section and the second section. As of December 2006, there are 1749 first section stocks and 549 second section stocks. The criteria for stocks assigned to the first section significantly differ from those in the second section. Newly-listed stocks are generally assigned to the second section (not including JREITs). Based on the criteria set by TSE, the first section stocks are larger than those in the second section, in terms of a number of shares, market capitalization, etc. In the process of matching JREITs, we select only the first section stocks because JREITs are listed in the first section. The daily data of first section stocks are obtained from Nikkei America, Inc. We sort the first section stocks by their average market capitalizations and divide them into 10 deciles where decile 10 is the largest and decile 1 is the smallest. We then match JREITs to the first section stocks - each JREIT is matched to the first section stocks within +/- 1% of its average market capitalization. Additionally, all selected stocks must have been listed on the TSE throughout 2005 and/or 2006. There are 96 and 165 first section stocks that fit the requirements in 2005 and 2006, respectively.[18]

In 2005, the smallest JREIT in size fits into the fifth decile of the first section stocks. Four JREITs are in the sixth decile, two in the seventh decile, four in the eighth decile, and four

[18] Initially, there are 98 and 169 first section stocks matched JREITs in 2005 and 2006, respectively. Among them, however, two stocks in 2005 and four stocks in 2006 have missing values. We delete those stocks from our sample.

in the ninth decile. Comparing to JREITs in 2005, there are more small-size JREITs in the 2006 sample. There are seven JREITs in the first to third deciles of non-REIT stocks, eleven middle-size JREITs are in the fifth to seventh deciles, five fit into the eighth decile, and the rest of three are in ninth decile.

The liquidity measures for all matched Japanese non-REIT stocks are compared to those for JREITs.[19] The difference between the liquidity measures of JREITs and those of non-REITs are presented in Table 2.4. Both the percentage bid-ask spread and percentage effective bid-ask spread are higher for JREITs than for non-REIT stocks in both 2005 and 2006. All the differences are highly significant at 1% level except for the difference of the percentage bid-ask spread in 2005. This indicates that the transactions costs of JREITs are higher than non-REIT stocks. In terms of trading frequency, the turnover ratio and trading volume of JREITs are lower than those of Japanese non-REIT stocks. Meanwhile, the proportion of zero returns of JREITs is higher than that of non-REIT stocks. These differences are all significant at 1% level. The same patterns are observed in 2006. These imply that JREITs trade less often than common stocks. Both bid-ask spreads and trading frequency suggest that JREITs are less liquid than non-REIT stocks. However, both Amivest and Amihud's measures indicate that JREITs have less price impact of trading than non-REITs.

5.2 Liquidity of SREITs

The liquidity measures for SREITs in 2005 are shown in Table 2.5. Panel A reports that the average daily percentage bid-ask spread across the sample is 0.81%, and the daily effective

[19] We do not apply Roll's measure in the comparison due to its potential bias caused by substantial amount of positive serial covariances in the sample. We do not use Pastor and Stambaugh's measure in the comparison due to insignificant, also non-existing, relationship with the bid-ask spread.

percentage spread is 0.80%. Both spreads roughly double those of JREITs: the average percentage bid-ask spread of JREITs in 2005 is 0.44% and the effective spread of JREIT is

Table 2.4 Liquidity Comparison between JRETIs and Japanese non-REITs Stocks

The table presents the liquidity measures for JREITs and Japanese non-REITs stocks with comparable market capitalization. BA is the percentage bid-ask spread. EBA is the percentage effective half-spread. IBA is Roll's measure, recorded in %. TO is the turnover ratio, expressed in %. VOL is the trading volume in million Japanese yen. Zero is the proportion of zero returns, expressed in %. AMIV is Amivest's measure. AMIH is Amihud's measure. P-values of the differences are recorded in parenthesis.

	BA	EBA	TO	VOL	ZERO	AMIV	AMIH
Difference (2005)	0.01	0.05	-0.17	-265.8	5.2	0.91	-548.57
	(0.675)	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Difference (2006)	0.14	0.16	-0.2	-136.56	7.57	0.48	-307.59
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)

Table 2.5 Liquidity Measures for SREITs

The table presents the liquidity measures for SREITs in 2005. Panel A presents summary statistics for the measures. Panel B reports the Pearson correlation coefficients between the percentage bid-ask spread and the alternative liquidity measures. BA is the percentage bid-ask spread. EBA is the percentage effective half-spread. IBA is Roll's measure, recorded in %. TO is the turnover ratio, expressed in %. VOL is the trading volume in million Japanese yen. Zero is the proportion of zero returns, expressed in %. AMIV is Amivest's measure. AMIH is Amihud's measure. γ is the Pastor and Stambaugh's measure. Standard deviations are recorded in brackets. *** denotes significance at 1% level.

	BA	EBA	IBA	VOL	TO	ZERO	AMIV	AMIH	γ
Panel A: Summary Statistics									
Mean	0.81	0.80	1.21	3.32	0.18	25.08	2226.11	2.725	0.114
	[0.43]	[0.22]	[0.72]	[3.93]	[0.21]	[10.94]	[2009.31]	[34.114]	[0.32]
Panel B: Correlation with Bid-ask Spread									
Correlation Coefficient			0.44***	-0.06	-0.44***	0.20	0.5***	-0.18	0.37***

0.40%. The implied spread is 1.21%, which is 0.51% higher than that of JREITs. The differences in all three spreads are significant at 1% level. The comparison between the spreads of JREITs and SREITs indicates that the SREIT market has higher transactions costs. From the trading frequency aspect, the average turnover for SREITs is 0.18%. It is smaller than 0.27%, the turnover ratio of JREITs. The average proportion of zero returns is about 25%, which is more than twice as much as that of JREITs. The differences in trading frequency are significant at 1% level.[20] This implies that SREITs are traded less often than JREITs. As pointing out earlier, the overall SREIT market is much smaller than the JREIT market. Therefore, it is not surprise to see that SREITs are less liquid than JREITs.

Panel B of Table 2.5 shows the Pearson correlation coefficients between the percentage bid-ask spread and alternative liquidity measures. Only Roll's measure and turnover ratio have significant and expected relationship with the bid-ask spread.

It is interesting to know whether SREITs have the similar liquidity as Singaporean non-REIT stocks. The daily data of Singaporean non-REIT stocks are obtained from SGX. There were publicly traded 696 common stocks in 2005. Since the sample of SREITs is rather small, we match the Singaporean common stocks to SREITs within +/- 5% of the average market capitalization of each SREIT in the sample. There are a total of 22 common stocks that satisfy the criterion. Among them, we select those that have been traded throughout the calendar year of 2005. As a result, 18 common stocks[21] fit into the criteria. All five SREITs in the sample fit into the largest decile of non-REIT stocks. Table 2.6 shows the comparison of liquidity measures of SREITs and Singaporean common stocks. There is no significant difference in terms of bid-ask spreads and trading frequency between SREITs and non-REIT stocks. This implies that the transactions costs of SREITs are similar to non-REIT stocks, and SREITs are traded as often as non-REITs. However, in terms of price impact, both Amivest and Amihud's measures of SREITs are significantly different those of non-REIT stocks. Both measures indicate that trading SREITs have less price impact than trading common stocks.

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[20] We do not compare the trading volume of SREITs to that of JREITs because of different currency.

[21] Actually, 19 stocks satisfied the conditions. However, one of them, Yeo Hiap Seng, Ltd., was not traded much in 2005. Therefore, we exclude this stock so the number of matching stocks is eighteen.

Table 2.6 Liquidity Comparison between SRETIs and Singapore non-REITs Stocks

The table presents the liquidity measures for SREITs and Singapore non-REITs stocks with comparable market capitalization. BA is the percentage bid-ask spread. EBA is the percentage effective half-spread. IBA is Roll's measure, recorded in %. TO is the turnover ratio, expressed in %. VOL is the trading volume in million Japanese yen. Zero is the proportion of zero returns, expressed in %. AMIV is Amivest's measure. AMIH is Amihud's measure. P-values of the differences are recorded in parenthesis.

	BA	EBA	TO	VOL	ZERO	AMIV	AMIH
Difference (2005)	0.003	0.02	0.006	-0.48	2.26	0.2	-1088163
	(0.94)	(0.76)	(0.88)	(0.63)	(0.39)	(0.000)	(0.001)

5.3 Liquidity Comparison between JREITs/SREITs and US REITs

The US REIT market represents a mature market of its kind. For investors, it would be very information if they have an idea of how liquid JREITs and SREITs are compared to US REITs. We collect all US REITs (SIC code of 6798) and the listed on New York Stock Exchange, American Stock Exchange, or NASDAQ throughout 2005 and/or 2006 from CRSP database. The selected US REITs must also have CRSP share code of 18[22]. We use the exchange rate at the end of 2005 and 2006 (refer to footnote 5) to convert the average market capitalization of US REITs from US dollars to Japanese yen and Singapore dollars. We divided all the selected US REITs into 10 deciles, where the tenth decile is the largest and the first decile is the smallest. The market capitalization of matched US REITs should fall within the range of +/-5% of the average market capitalization of each individual JREIT/SREIT. There are 39 and 57 US REITs matching JREITs in 2005 and 2006, respectively, and 19 US REITs matching SREITs in 2005.

14 JREITs in the 2005 sample are comparable in size to the fourth to the ninth deciles of US REITs. Even though the 26 JREITs in 2006 sample spread out among the second to the tenth

[22] CRSP assigns a two-digit share code to each stock to identify the security type. The second digit of 8 represents real estate investment trusts (REITs).

deciles of US REITs, they tend to be clustered in the smaller (the third to the fifth) deciles of US REITs. The results of the comparison are shown in Table 2.7.[23] Panel A reports the difference between the liquidity measures of JREITs and USREITs. The positive differences in spreads show that JREITs have larger percentage bid-ask spread and larger effective spread than US REITs in both 2005 and 2006. Furthermore, the difference of the spread between JREITs and US REITs becomes larger over the sample period. All the differences in spreads are significant at 1% level. This implies that the US REITs market is more liquid than the JREITs market. The same conclusion is reached based on the turnover and the proportion of zero returns. In both 2005 and 2006, the negative (positive) difference indicates that JREITs have much lower (higher) turnover ratios (percentage of zero returns) than US REITs. Both differences are statistically significant. This implies that US REITs are traded more often than JREITs with comparable market capitalization.

Table 2.7 Liquidity Comparison between JREITs/SREITs and US REITs

The table shows the spread-related and trading frequency measures for JREITs/SREITs and US REITs with comparable market capitalization. BA is the percentage bid-ask spread. EBA is the percentage effective half-spread. IBA is Roll's measure, recorded in %. TO is the turnover ratio, expressed in %. Zero is the proportion of zero returns, expressed in %. P-values of the differences are recorded in parenthesis.

	BA	EBA	TO	ZERO
Panel A: Comparison of JREITs and US REITs				
Difference (2005)	0.24	0.27	-0.37	9.53
	(0.000)	(0.000)	(0.000)	(0.000)
Difference (2006)	0.52	0.40	-0.32	10.16
	(0.000)	(0.000)	(0.000)	(0.000)
Panel B: Comaprison of SREITs and US REITs				
Difference	0.61	0.53	-0.31	22.92
	(0.000)	(0.000)	(0.000)	(0.000)

[23] We only compare the liquidity measures that are expressed in percentage, namely the percentage bid-ask spread, the percentage effective bid-ask spread, turnover ratio, and the proportion of zero returns, since these measures are unit-free and can be easily compared cross different markets.

The five SREITs in 2005 are comparable to the middle deciles of US REITs. Panel B of Table 2.7 reveals that SREITs have much larger bid-ask spreads, lower turnover ratios, and higher percentage of zero returns than do US REITs. The results clearly indicate that US REITs are more liquid than SREITs.

The results of the comparison between the liquidity measures of US REITs and JREITs/SREITs are due to one of the following two reasons. First, the US REIT market has developed over more than four decades and is a rather matured market. On the other hand, the JREIT/SREIT markets are still in their beginning stage and much narrower than their US counterpart. Second, the overall market for the US is more liquid than the Japanese and Singaporean markets. Given earlier results that JREITs are less liquid than non-REIT stocks and SREITs have the similar liquidity level as other common stocks, it is reasonable to find that JREITs and SREITs are less liquid than the US REIT market.

5.4 Analysis of Factors Affecting Spread

This section examines factors affecting the spread of JREITs and SREITs. Both JREITs and SREITs have rather small sample sizes. It would be ideal to pool these two data sets together in order to have larger number of observations for the analysis. However, Japanese and Singaporean stock markets have their own unique characteristics in terms of liquidity, history of development, etc. It is not suitable to investigate both markets simultaneously. We study these two markets independently.

5.4.1 Factors Affecting the Spread of JREITs

In order to have sufficient observations, we pool JREITs data cross sections and across time within 2005 and 2006. Table 2.8 represents the correlation matrix of the factors in the

Table 2.8 Pearson Correlation Matrix of Factors Affecting the JREITs' Spreads

This table presents the Pearson correlation matrix for the variables in the model of factors affecting spread of JREITs. BA is the percentage bid-ask spread. VOL is the trading volume recorded in million Japanese yen. TO is the turnover ratio. Price is the daily trading price. Size is the average market capitalization of each REIT. RV is the return volatility, measured as the variance of daily returns. Life is the life of each REIT since the first full month listed on TSE. PROT1 and PROT2 are the dummy variables for the major property types in each REIT. N denotes the number of observations. Volume, turnover, trading price, market capitalization and life are log scaled. *** denotes significance at 1% level; ** denotes significance at 5% level; * denotes significance at 10% level.

	VOL	TO	PRICE	Size	RV	Life	PROT1	PROT2
Panel A: JREITs in 2005								
BA	-0.21***	-0.21***	-0.18**	-0.09	0.51***	-0.19**	0.08	-0.17**
VOL		0.60***	0.11	0.79***	0.2**	0.61***	-0.12	-0.03
TO			-0.14*	-0.02	0.33***	0.11	0.07	-0.07
PRICE				0.24***	-0.1	0.06	-0.56***	0.14*
Size					-0.001	0.67***	-0.2***	0.02
RV						-0.03	-0.04	-0.21***
Life							0.22***	-0.08
PROT1								-0.29***
N	162	162	162	162	162	162	162	162
Panel B: JREITs in 2006								
BA	-0.05	-0.16***	0.09	0.02	0.35***	0.05	-0.02	-0.08
VOL		0.58***	0.62***	0.91***	0.08	0.71***	-0.27***	0.16***
TO			0.09	0.18***	0.20***	0.09	-0.17***	0.04
PRICE				0.71***	-0.05	0.51***	-0.23***	0.14**
Size					-0.01	0.81***	-0.24***	0.18***
RV						0.01	0.16***	-0.12**
Life							-0.11*	0.12**
PROT1								-0.29***
N	297	297	297	297	297	297	297	297

equation (10) discussed in section 4.2. Panel A shows that in 2005 most of the factors have the expected relationship with the bid-ask spread except PROT1. Trading volume, turnover, price, size, life and PROT2 are significantly and negatively correlated with the bid-ask spread at 5% or less level. Return volatility and the bid-ask spread are significantly positively correlated. Even though PROT1 is positively related to the bid-ask spread, the correlation coefficients are not statistically significant. Panel B, however, shows that only turnover and return volatility are significantly related to the bid-ask spread at 1% level in 2006. Turnover (return volatility) is negatively (positively) associated with the bid-ask spread, which is consistent with our expectations. According to Pearson correlation coefficients, the rest of factors such as trading volume, price, size, life and property types have no linear relationship with the spread.

Meanwhile, Table 2.8 reveals some potential multicollinearity problems. Trading volume is highly and significantly related to turnover, size and life in both 2005 and 2006, with correlation coefficients 0.60 or higher. Trading volume is also significantly correlated with price in 2006 sample. The correlation between size and life is 0.67 and 0.81 in 2005 and 2006, respectively. Additionally, price is highly correlated with PROT1 in 2005 and with size and life in 2006. As a result, we perform the tolerance tests, a collinearity statistic, to detect multicollinearity among these factors. A high tolerance statistic (close to 1) indicates low multicollinearity, while a tolerance statistic close to zero means that a particular variable is highly correlated with other independent variables in the model. We run the equation (10) with different versions in order to avoid variables that are highly correlated.

The pooled OLS regression results are presented in Table 2.9. Panel A reports the regression results for the 2005 sample. Version 1 is the full version of equation (10). The tolerance statistics for log trading volume, log turnover, and log size are zero, which means that these three variables are highly correlated with other independent variables. In this version, only two factors are statistically significant at 5% level – return volatility and log life. The return volatility is positively related to the bid-ask spread and the life is negatively related to the spread, which are consistent with our expectations. Version 2 of equation (10) drops log trading volume. The tolerance statistics show that there are no severe multicollinearity problems in the model.

Table 2.9 Regression Results of Factors Affecting the JREITs' Spreads

The table reports the OLS regression results of the model of factors affecting spread. VOL is the trading volume recorded in million Japanese yen. TO is the turnover ratio. Price is the daily trading price. Size is the average market capitalization of each REIT. RV is the return volatility, measured as the variance of daily returns. Life is the life of each REIT since the first full month listed on TSE. PROT1 and PROT2 are the dummy variables for the major property types in each REIT. Tolerance is the tolerance statistics for testing collineraity. Volume, turnover, trading price, market capitalization and life are log scaled. The t-statistics are reported in parentheses. *** denotes significance at 1% level; ** denotes significance at 5% level; * denotes significance at 10% level.

Panel A: JREITs 2005								
	Version 1		**Version 2**		**Version 3**		**Version 4**	
	Coefficient	**Tolerance**	**Coefficient**	**Tolerance**	**Coefficient**	**Tolerance**	**Coefficient**	**Tolerance**
Constant	0.276		0.897*		1.209**		0.844*	
	(0.123)		(1.861)		(2.485)		(1.717)	
VOL	0.275	0.000			-0.138***	0.318	0.024	0.269
	(0.283)				(-6.731)		(1.058)	
TO	-0.411	0.000	-0.137***	0.844			-0.161***	0.448
	(-0.425)		(-6.741)				(-5.749)	
PRICE	-0.053	0.630	-0.052	0.633	-0.052	0.633	-0.052	0.633
	(-1.467)		(-1.457)		(-1.447)		(-1.459)	
Sice	-0.252	0.000	0.023	0.418	0.162***	0.262		
	(-0.259)		(1.051)		(5.736)			
RV	0.128***	0.787	0.127***	0.821	0.127***	0.823	0.127***	0.821
	(9.809)		(9.991)		(9.969)		(9.998)	
Life	-0.057**	0.397	-0.057**	0.398	-0.057**	0.398	-0.057**	0.398
	(-2.354)		(-2.351)		(-2.344)		(-2.355)	
PROT1	0.043	0.474	0.044	0.478	0.044	0.478	0.044	0.479
	(1.544)		(1.579)		(1.592)		(1.581)	
PROT2	-0.008	0.862	-0.008	0.862	-0.008	0.862	-0.008	0.862
	(-0.403)		(-0.401)		(-0.399)		(-0.401)	
Adj. R^2	0.457		0.461		0.46		0.461	

Table 2.9 continued

Panel B: JREITs 2006								
	Version 1		Version 2		Version 3		Version 4	
	Coefficient	Tolerance	Coefficient	Tolerance	Coefficient	Tolerance	Coefficient	Tolerance
Constant	-1.038		0.736***		-0.93		0.334***	
	(-1.544)		(10.617)		(-1.455)		(3.876)	
VOL	drop		-0.023*	0.902	-0.039	0.147	drop	
			(-1.878)		(-1.299)			
TO	-0.132***	0.884			-0.094**	0.356	-0.136***	0.89
	(-4.725)				(-2.13)		(-4.878)	
PRICE	0.112**	0.478			0.11**	0.479		
	(2.058)				(2.027)			
Sice	-0.04	0.215					-0.005	0.319
	(-1.352)						(-0.212)	
RV	0.059***	0.911	0.052***	0.949	0.059***	0.911	0.058***	0.912
	(7.795)		(6.737)		(7.781)		(7.707)	
Life	0.041	0.334			0.04	0.333	0.031	0.342
	(1.245)				(1.206)		(0.94)	
PROT1	-0.076	0.821	-0.067**	0.843	-0.076**	0.821	-0.081***	0.826
	(-2.475)		(-2.131)		(-2.469)		(-2.618)	
PROT2	-0.044	0.897	-0.035	0.9	-0.044	0.897	-0.045	0.897
	(-1.199)		(-0.917)		(-1.206)		(-1.21)	
Adj. R^2	0.197		0.132		0.196		0.188	

Log turnover, return volatility, and log life are significant at 5% level, all with expected signs. Log size remains insignificant. Version 3 of equation (10) deletes log turnover. Log trading volume becomes a significant factor at 1% level and is negatively related to the spread. Even though log size becomes significant, however, it has wrong sign. The tolerance statistic of 0.262 indicates that it is somewhat correlated with other factors, which may cause the wrong sign. Version 4 of equation (10) eliminates log size. With the presence of log turnover, log trading volume is no longer significant. The coefficient of log turnover is significant at 1% level and has the expected negative sign. The property dummies remains insignificant in four different versions. Through all four versions, return volatility and log life remains the significant and right relationship with the spread. For the spread of JREITs in 2005, return volatility, life and turnover are dominant factors.

Panel B of Table 2.9 shows the regression results for 2006 JREITs. Since trading volume is highly correlated (0.91) with size, these two factors are not able to exist in the same equation. Version 1 of equation (10) excludes log trading volume. Log turnover and return volatility have the right sign and are significant at 1%. Version 2 of equation (10) drops log turnover, log price, and log size since all of them are highly correlated with log trading volume. Return volatility remains significant. The coefficient of log trading volume becomes significant at 10% level. Additionally, PROT1 is significantly and negatively related to the spread. This indicates that JREITs holding two different types of properties have smaller spreads than those holding only single type of properties. Version 3 leaves out log size. Again with the presence of log turnover, log trading volume is no longer a significant factor. The tolerance statistic shows that log trading volume is correlated with other variable. Return volatility and PROT1 remains significant. Version 4 eliminates log trading volume and log price. Log turnover, return volatility and

PROT1 are the only significant factors. Log size remains insignificant throughout the four version of equation (10). The tolerance statistics associated with log size indicate that it remain somewhat correlated with other factors in the model. The fundamental factors that affect the spread of JREITs in 2006 are return volatility, turnover, and property dummy representing holding two types of properties.

Overall for JREITs, the most important factors affecting the spread are return volatility and turnover. The higher the return volatility is, the higher the spread is. Since the JREIT market is such a young market, returns are expected to be somewhat volatile. There are also two minor factors affecting the spread – life and property type. The life of JREITs is negatively related to the spread in 2005, indicating the existence of learning effect. However, it is puzzled that it is no longer a significant factor in 2006 sample. This may be due to shorter lives of some of JREITs in the 2006 sample. The property dummy, specifically, the dummy representing two-type properties, is negatively correlated with the spread. This implies that JREITs holding two different type properties have smaller spreads.

5.4.2 Factors Affecting the Spread of SREITs

Table 2.10 reports that all factors have the expected relationship with the bid-ask spread. Among them, the correlation coefficients of log trading volume, log price, log size, return volatility and log life are significant at 5% level. Multicollinearity is an issue in the SREIT sample also. Log trading volume is highly correlated with log turnover, log size and the property dummy with the correlation coefficients of 0.68 or higher. Especially, log trading volume is perfectly positively related to log life. There are other high correlations among log size, log life, log price and the property dummy.

Table 2.10 Pearson Correlation Matrix of Factors Affecting the SREITs' Spreads

This table presents the Pearson correlation matrix for the variables in the model of factors affecting spread of SREITs. BA is the percentage bid-ask spread. VOL is the trading volume recorded in million Japanese yen. TO is the turnover ratio. Price is the daily trading price. Size is the average market capitalization of each REIT. RV is the return volatility, measured as the variance of daily returns. Life is the life of each REIT since the first full month listed on TSE. PROT is the dummy variable for the major property types in each SREIT. N denotes the number of observations. Volume, turnover, trading price, market capitalization and life are log scaled. *** denotes significance at 1% level; ** denotes significance at 5% level; * denotes significance at 10% level.

	VOL	TO	PRICE	Size	RV	Life	PROT
BA	-0.57***	-0.14	-0.79***	-0.88***	0.32**	-0.57***	-0.21
VOL		0.86***	0.27**	0.70***	-0.08	1	0.68***
TO			-0.19	0.24*	0.03	0.86***	0.71***
PRICE				0.78***	-0.09	0.27**	-0.10
Size					-0.2	0.70***	0.31
RV						-0.08	-0.13
Life							0.68***
N	60	60	60	60	60	60	60

Similar to JREITs, we run different version of equation (10) for SREITs in order to minimize multicollinearity problems. However, we drop log trading volume from equation (10) because it is highly and significantly correlated with all the factors but return volatility. The regression results are shown in Table 2.11. Version 1 of equation (10) keeps all the factors but log trading volume. Log price and return volatility are the only two significant factors and have the expected signs. The tolerance statistics of almost zero indicate that log turnover, log size and log life are highly correlated with other independent variables. Version 2 deletes log size from the model. Log price and return volatility remains significant. Meanwhile, log life becomes a significant factor with the right sign. The tolerance statistics still show the multicollinearity problem. Version 3 deletes both log size and log turnover. The tolerance statistics are no longer close to zero. Log price, return volatility and log life remain significant. The dominant factors affecting SREITs' spread are price, return volatility and the life of SREITs.

Table 2.11 Regression Results of Factors Affecting the Spread of SREITs

The table reports the OLS regression results of the model of factors affecting the spread of JREITs. VOL is the trading volume recorded in million Japanese yen. TO is the turnover ratio. Price is the daily trading price. Size is the average market capitalization of each REIT. RV is the return volatility, measured as the variance of daily returns. Life is the life of each REIT since the first full month listed on TSE. PROT is the dummy variable for the major property types in each REIT. Tolerance is the tolerance statistics for testing collineraity. Volume, turnover, trading price, market capitalization and life are log scaled. The t-statistics are reported in parentheses.

	Version 1		Version 2		Version 3	
	Coefficient	Tolerance	Coefficient	Tolerance	Coefficient	Tolerance
Constant	2.804 (1.303)		1.572*** (9.594)		1.073*** (27.933)	
VOL						
TO	0.775 (0.829)	0.000	0.24*** (3.119)	0.058		
PRICE	-0.271*** (-2.655)	0.202	-0.279*** (-2.78)	0.206	-0.547*** (-9.742)	0.764
Sice	0.525 (0.574)	0.001				
RV	0.028*** (3.046)	0.896	0.028*** (3.034)	0.899	0.036*** (3.726)	0.968
Life	-0.796 (-0.859)	0.000	-0.265*** (-4.438)	0.052	-0.091*** (-4.018)	0.420
PROT	-0.004 (-0.111)	0.421	0 (0.011)	0.441	0 (0.002)	0.441
Adj. R^2	0.816		0.819		0.790	

VI. Conclusions

This paper presents the first examination of liquidity in Asian REIT markets, specifically the Japanese REIT and Singaporean REIT markets. The sample includes 14 JREITs in 2005, 26 JREITs in 2006, and 5 SREITs in 2005. We use various liquidity measures to assess the liquidity of these two Asian markets. The use of multiple liquidity measures serves two purposes. First, it provides a robustness check. Second, liquidity has at least three dimensions: trading costs, trading frequency, and price impact. Third, it can suggest more relevant liquidity measures for these markets. Overall evidence indicates that JREITs are more liquid than SREITs in the same time period. The results show that JREITs have smaller spreads, higher turnover, and lower percentage of zero returns than SREITs do.

There is evidence showing that JREITs becomes illiquid over the two-year sample period. This may be caused by the increase in the bid-ask spread in yen increase and/or the decrease in the price of JREITs from 2005 to 2006. In terms of bid-ask spreads and trading frequency, JREITs are less liquid than Japanese non-REIT stocks. We find that there is no significant difference in liquidity between SREITs and non-REIT stocks in Singapore. Comparing JREITs/SREITs to US REITs, there are strong evidence that US REITs are more liquid than both JREITs and SREITs, that is US REITs have smaller spread and higher trading frequency.

Finally, our analyses reveal that the primary determinants of JREIT spreads are turnover and return volatility in both 2005 and 2006 sample. Learning effect and diversification in asset holding are secondary factors in 2005 and in 2006, respectively. The fundamental factors affecting SREIT spreads are trading price, return volatility and learning effect.

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Appendix B

Table B.1 Major Property Types in JREITs/SREITs

The information of property types in JREITs is obtained Nomura Institute of Capital Markets Research, based on data of Japan Association for Real Estate Securitization. The information of property types in SREITs is collected on WrightReport.com.

Code	Name	Property Types
Panel A: JREITs' Major Property Types		
8951	Nippon Building Fund Inc.	Office
8952	Japan Real Estate Investment Corporation	Office
8953	Japan Retail Fund Investment Corporation	Retail
8954	ORIX JREIT Inc.	Diversified
8955	Japan Prime Realty Investment Corporation	Office, Retail
8956	Premier Investment Company	Office, Residential
8957	TOKYU REIT, Inc.	Office, Retail
8958	Global One Real Estate Investment Corporation	Office
8959	Nomura Real Estate Office Fund, Inc.	Office
8960	United Urban Investment Corporation	Diversified
8961	MORI TRUST Sogo Reit, Inc.	Diversified
8962	Nippon Residential Investment Corporation	Residential
8964	Frontier Real Estate Investment Corporation	Retail
8965	New City Residence Investment Corporation	Residential
8966	CRESCENDO Investment Corporation	Office, Residential
8967	Japan Logistics Fund, Inc.	Residential
8968	Fukuoka REIT Corporation	Office, Retail
8969	Prospect Residential Investment Corporation	Residential
8970	Japan Single-residence REIT Inc.	Residential
8972	Kenedix Realty Investment Corporation	Diversified
8973	Joint Reit Investment Corporation	Retail, Residential
8974	eASSET Investment Corporation	Residential
8975	FC Residential Investment Corporation	Residential, Retail
8976	DA Office Investment Corporation	Office
8977	Hankyu REIT, Inc.	Office, Retail
8978	Advance Residence Investment Corpoation	Residential
Panel B: SREITs' Major Property Types		
A17	Ascendas real estate inv trust	Diversified
C38	Capitamall trust	Commercial
C61	Capitacommercial trust	Commercial
F25	Fortune real estate inv trust	Commercial
T82	Suntec real estate inv trust	Diversified

Table B.2 List of JREITs in 2005 and 2006 Sample

This table lists the JREITs included in 2005 and 2006 sample. The code is assigned by TSE and is unique for each company. The inception dates are obtained from the TSE website (www.tse.or.jp). The year-end market capitalization is recorded in billion yen.

Code	Name	Inception date	Market capitalization		
			2005	2006	Change (%)
8951	Nippon Building Fund Inc.	9/10/2001	420.59	802.64	90.84
8952	Japan Real Estate Investment Corporation	9/10/2001	335.73	524.80	56.32
8953	Japan Retail Fund Investment Corporation	3/12/2002	277.09	374.91	35.30
8954	ORIX JREIT Inc.	6/12/2002	173.76	179.62	3.37
8955	Japan Prime Realty Investment Corporation	6/14/2002	175.43	228.96	30.51
8956	Premier Investment Company	9/10/2002	72.10	76.86	6.61
8957	TOKYU REIT, Inc.	9/10/2003	136.01	176.16	29.51
8958	Global One Real Estate Investment Corporation	9/25/2003	76.25	90.92	19.24
8959	Nomura Real Estate Office Fund, Inc.	12/4/2003	193.17	289.83	50.04
8960	United Urban Investment Corporation	12/22/2003	110.29	125.00	13.33
8961	MORI TRUST Sogo Reit, Inc.	2/13/2004	156.96	179.20	14.17
8962	Nippon Residential Investment Corporation	3/2/2004	107.30	121.43	13.16
8964	Frontier Real Estate Investment Corporation	8/9/2004	89.42	125.86	40.74
8965	New City Residence Investment Corporation	12/15/2004	66.21	90.24	36.29
8966	CRESCENDO Investment Corporation	3/8/2005		31.76	
8967	Japan Logistics Fund, Inc.	5/9/2005		117.50	
8968	Fukuoka REIT Corporation	6/21/2005		94.95	
8969	Prospect Residential Investment Corporation	7/12/2005		30.42	
8970	Japan Single-residence REIT Inc.	7/13/2005		15.86	
8972	Kenedix Realty Investment Corporation	7/21/2005		107.86	
8973	Joint Reit Investment Corporation	7/28/2005		46.96	
8974	eASSET Investment Corporation	9/7/2005		32.64	
8975	FC Residential Investment Corporation	10/12/2005		14.85	
8976	DA Office Investment Corporation	10/19/2005		62.40	
8977	Hankyu REIT, Inc.	10/26/2005		64.89	
8978	Advance Residence Investment Corpoation	11/22/2005		25.54	
	Sample		**2390.32**	**4032.03**	**68.68**
	Overall Japanese REIT market		**2845.63**	**4970.33**	**74.67**

Table B.3 List of SREITs in 2005 Sample

This table lists the SREITs included in 2005 sample. The code is assigned by SGX and is unique for each company. The inception dates for SREITs are obtained from the SGX website (www.sgx.com). The year-end market capitalization is recorded in billion Singapore dollars.

Code	Name	Inception Date	Market Capitalization
A17	Ascendas real estate inv trust	11/19/2002	2.49
C38	Capitamall trust	7/17/2002	3.09
C61	Capitacommercial trust	5/11/2004	1.33
F25	Fortune real estate inv trust	8/12/2003	0.98
T82	Suntec real estate inv trust	12/9/2004	1.40
	Sample		**9.28**
	Overall Singaporean REIT market		**10.76**

Vita

Yunqing Wang was born in Beijing, China. She got her B.A. in Economics Law from Capital University of Economics and Business in Beijing in 1996. After serious considerations, she decided to pursue for higher degree abroad rather than become an attorney. She came to U.S. in 1998, and received her M.S. in Economics from South Dakota State University in 2001.

After graduation, she moved to Bay area in California. During the one-and-half-year stay in Golden state, she had some first-hand experience in the real estate and finance areas. Also during that time, Yunqing realized that she would like to become an educator. In 2002, she joined the Ph.D. program in the Department of Economics and Finance at the University of New Orleans. This program came with a life-time bonus: She found her better half, Steve, who was a fellow student in the same program.

Yunqing started teaching in spring 2004. Since then she has taught Principles of Managerial Finance, Principles of Real Estate, Intermediate Microeconomics, etc. She earned her doctorial degree in Financial Economics in August 2007. Both she and Steve received positions at St. Cloud State University in Minnesota.