Performance Comparison Between Real Estate Securities and Real Estate Investment Using Stochastic Dominance and Mean-Variance Analysis

Assoc. Prof. Aekkachai NITTAYAGASETWAT Ph.D.¹, Jiroj BURANASIRI Ph.D.²

¹ National Institute of Development Administration, Bangkapi, Bangkok, 10240, Thailand
Tel: +66 2 727 3932, Fax: +66 2 374 3282

² Srinakharinwirot University, Wattana, Bangkok, 10110, Thailand, Tel: +66 2 169 1018

Abstract: Unlike in the past, different choices for real estate investment are now available for investors. Real estate securities were introduced as another alternative investment vehicle for real estate investors. To promote efficient investment in real estate and real estate securities, this paper explores the relative performance of different types of real estate investment including land, town home, single house, and real estate securities in Thailand from April 2008 to May 2016 by applying mean-variance and stochastic dominance techniques. The results of this examination suggest that the real estate market is not efficient and asset allocation plays important role in real estate investment performance. Mean-variance and stochastic dominance analysis report the same result that town home investment dominates single house investment and land investment dominates condominium investment. Beside trying to choose the best real estate or real estate security in their portfolio, investors should put extra effort in finding the proper types of real estate for their portfolio.

Keywords: Performance; investment; real estate; real estate securities; mean-variance analysis; stochastic dominance.

JEL classification: G

Introduction

The real estate class is one of the common asset classes in many investment portfolios for many reasons. For example, real estate is considered a low risk asset. It always has value even when the economy is extremely poor. The imperfect correlation of its return and other assets’ return also helps in lowering a portfolio’s diversifiable risk. Recently, the
trend of aging society in many countries leads to more demand of long-term and safe investment like real estate investment.

Real estate securities are introduced to let low-wealth investors be able to invest their money in real estate. As a result, the real estate investment is more accessible for ordinary investors. Different types of real estate with different level of risk and return are available for investors to choose. However, the increase in real estate investment’s choices also confuses investors. In addition, the highly uncertain and volatile economic condition nowadays also brings about more difficulty for investors in making proper investment decision.

However, the knowledge about the investment in real estate and real estate securities is quite limited. Researches on the comparative performance of different types of real property are relatively rare.

This paper applies the mean-variance and stochastic dominance techniques to compare the performance of the different types of real estate and real estate securities to promote more understanding on real estate investment so that investors would be able to built more efficient portfolio.

The study focuses on the relative performance of different types of real estate investment including land, townhome, single house, and real estate securities in Thailand because of its obvious and lucrative real estate and real estate securities investment’s demand and opportunity. As a member of ASEAN Economic Community (AEC) which was formed in late 2015 to promote trade and investment among the member countries including Brunei, Indonesia, Malaysia, Singapore, Philippines, Laos, Cambodia, Myanmar, Vietnam and Thailand, Thailand is expected to have higher economic growth and more real estate development in many types of real estate such as offices, hotel, condominium, industrial estate and etc. Consequently, the issuing of real estate securities to raise capital to support the real development is inevitable. The growth in real estate investment is foreseeable.

The findings should help investors to gain more understanding on real estate and real estate securities investment and provide academic researchers who are interested in real estate and real estate securities investment additional evidence about the existence of market efficiency in real estate investment and comparative nature of the performance of different types of real estate investment.

This paper is organized by starting with introduction. Then, literature reviews, data collection and methodology, findings, and conclusion.

1. Literature Reviews

Several researchers have investigated real estate investment in relation to other investment vehicles and showed the diversification advantage of adding the real estate asset class on investors’ portfolio. [Ibbotson & Siegel, 1984] reports that the correlation between the returns of real estate investment and other investments is low and [Westerheide, 2006] concludes that real estate securities are different from other
securities. In other words, adding real estate into an investor’s portfolio could help to lower his/her portfolio’s diversifiable risk. In addition, [Hoesli et al., 2009] confirms that real estate could be used to lower the unsystematic risk effectively.

For the comparison of the different types of real estate investment, [Andrew & Glenn, 2003; Brounen & Eichholtz, 2003] argues that the returns of real estate and real estate securities are not significantly correlated and [Clayton & MacKinnon, 2003] reports the existence of the difference between the performance of direct and indirect real estate investments for the test on short horizon. However, the study by [Giliberto, 2009] finds evidence that real estate and real estate securities might be influenced by the same fundamental factors. In addition, many long-run studies, [Oikarinen et al., 2011; Hoesli & Oikarinen, 2012] report that, in the long-run, REIT and direct real estate investments are highly related and REIT investment could be used as a substitute for direct real estate investment. Many reviewed literatures on real estate investment, hence, obviously point on practical implication for investors to add real estate and real estate securities in their portfolio for diversification benefit. The next important issue is which type of real estate should be added into investors’ portfolio so that their wealth will be maximized.

As aging society becomes important issues nowadays, another useful group of studies is related to the performance of different types of real estate investment in long-term. [MacKinnon & Al Zaman, 2009] discovers the supportive evidence for real estate investment and claims that the risk of real estate investment becomes lower when its investment horizon increases. In contrast, [Fugazza et al. 2007] finds that there is mean reversion in long-run investment for the European listed real estate and the risk of investment in the listed real estate is higher than other asset investments.

For the examination of the relative performance of different types of real estate and real estate securities investment, there are at least two important methods; stochastic dominance and mean-variance analysis. Both methods could be used as tools for judging for the better type of real estate to investors’ portfolio. Mean-variance analysis is continuously extensively used in investment performance analysis, for example, [Markowitz et al. 2000; Alexander & Baptista 2002; Björk et al. 2014; Shinzato, 2015]. The Stochastic dominance compares the outcome and probability of the two examined candidates. The technique is developed to overcome the drawback of mean-variance analysis which could not be used for ranking the investment choices. Stochastic dominance was mainly improved by [Hadar & Russell, 1969; Whitmore, 1970; Levy, 1992] and widely applies in many researches in economics and finance related areas.

In Thailand, very few literatures are done on examining the performance of different types of real estate and real estate securities investment. Hence, the investors who would like to allocate their funds for different real estate sub-classes have very limited information to help for making appropriate investment decision. This paper should fill up the mentioned gap and provide academic area additional evidence of the real estate investment’s performance.
2. Data Collection And Research Methodology

2.1 Data Collection

The data used for the paper’s investigation are the monthly returns of different types of real estate investment from April 2008 to May 2016. The returns of real estate including land, town home, single house and condominium are calculated from their price appreciation from the Bank of Thailand’s database and the returns of real estate securities are market weighted average returns which are calculated from the return of securities listed under property fund and REIT section of the stock exchange of Thailand.

2.2 Research Methodology

The research method used in this study is stochastic dominance and mean-variance analysis. Stochastic Dominance is introduced by [Levy, 1998].

2.2.1 Mean-variance Analysis

First, mean ($\overline{r}$) and standard deviation (S.D.) of the return of each type of real estate investment are calculated as follows:

$$\overline{r} = \frac{\sum_{i=1}^{N} r_i}{N} \quad (1)$$

$$S. D. = \frac{\sum_{i=1}^{N} (r_i - \overline{r})^2}{N-1} \quad (2)$$

Where $r_i$ is the return of month $i$ and $N$ is number of months.

Then, both mean and standard deviation are annualized for analysis as follows:

$$\overline{r_a} = (1 + \overline{r})^{12} - 1 \quad (3)$$

$$S. D. \times = S. D. \times \sqrt{12} \quad (4)$$

General rule of mean-variance analysis is that a better investment is the investment which has higher return at the same level of standard deviation or has lower standard deviation at the same level of return. The investment cannot be claimed as a better investment if it does not meet this condition. When low risky investment has low return and high risky investment has high return according to risk-return trade-off nature, no investment dominates other investment.

2.2.2 Stochastic Dominance Analysis

The test for stochastic dominance is done in three levels: first-order, second-order, and third-order stochastic dominance. When the result shows the first-order stochastic dominance, there exist the second and the third-order stochastic dominance. Also, when
the result shows the second-order stochastic dominance, it implies the third-order stochastic dominance exists.

- Conditions for first order stochastic dominance (FOD)

Let \( F_A(r) \) and \( F_B(r) \) be two continuous distribution functions for random return \( r \in [a, b] \). Then, \( F_A(r) \) first order stochastically dominates (FSD) \( F_B(r) \) if and only if

1. \( F_A(r) \leq F_B(r) \) for all \( r \in [a, b] \) and
2. \( E_A U(r) \geq E_B U(r) \) for all non-decreasing utility function

Where A and B are two different types of real estate investment.

- Conditions for second order stochastic dominance (SSD)

Let \( F_A(r) \) and \( F_B(r) \) be two continuous distribution functions for random return \( r \in [a, b] \). Then, \( F_A(r) \) second order stochastically dominates (SSD) \( F_B(r) \) if and only if for any \( r \)

1. \( \int_{-\infty}^{r} [F_B(t) - F_A(t)] \ dt \geq 0 \)
2. \( E_A U(r) \geq E_B U(r) \) for all non-decreasing utility function and concave utility function \( U \)

- Conditions for Third order stochastic dominance (TSD)

Let \( F_A(r) \) and \( F_B(r) \) be two continuous distribution functions for random return \( r \in [a, b] \). Then, \( F_A(r) \) third order stochastically dominates (TSD) \( F_B(r) \) if and only if for any \( r \)

1. \( \int \int_{-\infty}^{r} [F_B(t) - F_A(t)]dt \ dz \geq 0 \)
2. \( E_A U(r) \geq E_B U(r) \) for all non-decreasing utility and concave utility function \( U \) which are positively skewed.

For the test, each pair of investment is examined one by one for the stochastic dominant level. Once a stochastic dominant level is found, the investigation will stop or the further investigation will stop after the third order test has been examined.

3. FINDINGS

3.1 Descriptive Analysis

The descriptive data based on data of 98 months during April 2008 to May 2016 in Table 1 shows that generally, risk and return are positively correlated. The real estate securities
investment has the highest standard deviation and average monthly return at 2.88% and 0.88%, respectively. It also has the lowest minimum return at -16.86% and the highest maximum return at 6.02%. The town home investment has the lowest standard deviation at 0.76% and has the second lowest return at 0.46%. Among the different type of real estate investment, its minimum return is the highest at -1.6% and its maximum return is the lowest at 2.52%. The single house investment has the lowest average monthly return at 0.41% and the second lowest standard deviation of 0.88%. In addition, the nature of real estate securities investment is quite different from the group. Besides its high average return and standard deviation, its return distribution is obviously skewed to the left and its kurtosis is the highest.

Table 1: Descriptive Data of the Monthly Returns of Each Type of Real Estate Investment in Thailand from April 2008 to May 2016.

<table>
<thead>
<tr>
<th></th>
<th>Single House</th>
<th>Town Home</th>
<th>Condominium</th>
<th>Land</th>
<th>Real Estate Sec</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>0.41%</td>
<td>0.46%</td>
<td>0.49%</td>
<td>0.68%</td>
<td>0.88%</td>
</tr>
<tr>
<td>Median</td>
<td>0.25%</td>
<td>0.49%</td>
<td>0.47%</td>
<td>0.61%</td>
<td>1.23%</td>
</tr>
<tr>
<td>Standard Deviation</td>
<td>0.88%</td>
<td>0.79%</td>
<td>1.70%</td>
<td>1.46%</td>
<td>2.88%</td>
</tr>
<tr>
<td>Kurtosis</td>
<td>0.412</td>
<td>0.231</td>
<td>0.676</td>
<td>-0.508</td>
<td>14.119</td>
</tr>
<tr>
<td>Skewness</td>
<td>-0.012</td>
<td>-0.070</td>
<td>0.425</td>
<td>0.0488</td>
<td>-2.7119</td>
</tr>
<tr>
<td>Range</td>
<td>5.22%</td>
<td>4.12%</td>
<td>9.66%</td>
<td>6.60%</td>
<td>22.88%</td>
</tr>
<tr>
<td>Minimum</td>
<td>-2.19%</td>
<td>-1.60%</td>
<td>-3.55%</td>
<td>-2.50%</td>
<td>-16.86%</td>
</tr>
<tr>
<td>Maximum</td>
<td>3.03%</td>
<td>2.52%</td>
<td>6.12%</td>
<td>4.10%</td>
<td>6.02%</td>
</tr>
<tr>
<td>Count</td>
<td>98</td>
<td>98</td>
<td>98</td>
<td>98</td>
<td>98</td>
</tr>
</tbody>
</table>

Source: The Bank of Thailand and Reuter Database

3.2 Mean-variance Analysis

For mean-variance analysis, Table 2 and Figure 1 show that the town home, land, and real estate securities investment are not dominated by any investment. Higher standard deviation is accompanied by higher return. The single house investment is dominated by the town home investment. The average annual return of the single house investment (5.05%) is lower than the average annual return of town home investment (5.66%), the standard deviation of the single house investment (3.06%) is higher than the standard deviation of the town home investment (2.73%). The condominium investment is dominated by the land investment. The average annual return of the condominium investment (6.05%) is lower than the average annual return of land investment (8.41%), the standard deviation of the condominium investment (5.88%) is higher than the standard deviation of the land investment (5.05%). The real estate securities investment has highest average annual return (11.14%) and highest standard deviation (9.98%).
Table 2: Relationship between Standard Deviation and Return of Different Types of Real Estate Investment in Thailand based on Data of 98 Months from April 2008 to May 2016.

<table>
<thead>
<tr>
<th></th>
<th>Standard Deviation per Year</th>
<th>Average Return per Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single House</td>
<td>3.06%</td>
<td>5.05%</td>
</tr>
<tr>
<td>Town House</td>
<td>2.73%</td>
<td>5.66%</td>
</tr>
<tr>
<td>Condominium</td>
<td>5.88%</td>
<td>6.05%</td>
</tr>
<tr>
<td>Land</td>
<td>5.05%</td>
<td>8.41%</td>
</tr>
<tr>
<td>Real Estate Securities</td>
<td>9.98%</td>
<td>11.14%</td>
</tr>
</tbody>
</table>

Source: The Bank of Thailand and Reuter Database

Figure 1: Graph Shows the Relationship between Standard Deviation and Average Returns in Thailand based on Data of 98 Months from April 2008 to May 2016

Source: The Bank of Thailand and Reuter Database

3.3 Stochastic Dominance Analysis

For stochastic dominance analysis, Figure 2 shows the cumulative distribution of each pair of investment types and it appears that there is no type of real estate investment first-order stochastically dominates (FSD) the other type of real estate investment.
Figure 2 Cumulative Distribution of Each Pair of Types of Real Estate Investment in Thailand based on Data of 98 Months during April 2008 to May 2016

Source: The Bank of Thailand and Reuter Database
Second-order stochastic dominance analysis shows the results in line with mean-variance analysis (Figure 1). Figure 3 shows that town home investment second-order stochastically dominates (SSD) single house investment and land investment second-order stochastically dominates (SSD) condominium investment. Consequently; Town home investment third-order stochastically dominates (TSD) single house investment and land investment third-order stochastically dominates (TSD) condominium investment too.

The other pairs with no second-order stochastic dominance (SSD) are then examined for the existence of the third-order stochastic dominance. The results in Figure 4 show that single house investment third-order stochastically dominates (TSD) condominium investment and real estate securities investment. Town home investment third-order stochastically dominates (TSD) condominium investment and real estate securities. Condominium investment third-order stochastically dominates (TSD) real estate securities investment and land investment third-order stochastically dominates (TSD) real estate securities investment.

The pair of town home and land investment and the pair of single house and land investment shows no existence of first-order stochastic dominance, second-order stochastic dominance, and third-order stochastic dominance from the investigation. The summary of the findings is in Table III.
Figure 4. Value of the Difference between Cumulative Value of Cumulative Value of Cumulative Probability Distribution of the Return of Each Pair of Real Estate Investment with Third-order Stochastic Dominance in Thailand based on Data of 98 Months during April 2008 to May 2016.

Source: The Bank of Thailand and Reuter Database
Table 3: Summary of Stochastic Dominance Test

<table>
<thead>
<tr>
<th>Level of Stochastic Dominance</th>
<th>Pairs of investment</th>
</tr>
</thead>
<tbody>
<tr>
<td>First Order Stochastic Dominance</td>
<td>None</td>
</tr>
<tr>
<td>(FSD)</td>
<td></td>
</tr>
<tr>
<td>Second Order Stochastic Dominance</td>
<td>Town home investment SSD Single house investment</td>
</tr>
<tr>
<td>(SSD)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Land investment SSD condominium investment</td>
</tr>
<tr>
<td>Third Order Stochastic Dominance</td>
<td>single house investment TSD condominium investment</td>
</tr>
<tr>
<td>(TSD)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Town home investment TSD real estate securities investment</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Town home investment TSD condominium investment</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Land investment TSD real estate securities investment</td>
</tr>
</tbody>
</table>

Source: The Bank of Thailand and Reuter Database

Conclusion

The problem of real estate investment on the lack of investment tools is less significant since there are many types of real estate investment available for investors in many markets. This study analyses the relative performance of different types of real estate and real estate securities investment by using mean-variance and stochastic dominance techniques to provide more information to investors to use in improving their portfolio.

The examination by mean-variance analysis apparently points that town home investment dominates single house investment and land investment dominates condominium investment. When stochastic dominance analysis is applied, the study finds that there is no type of real estate investment first-order stochastically dominates other types of real estate investment. However, at the second-order stochastic dominance analysis, the results appear the same as mean-variance analysis. In addition, when the further analysis on stochastic dominance is applied, the investigation shows that, for traditional real estate, single house investment and town home investment third-order stochastically dominates condominium investment. All of traditional real estate investment third-order stochastically dominates real estate securities investment.

In theory, the existence of the dominated types of real estate investment is the evidence which is against the idea of market efficiency. In practice, the results imply that investors should pay attention not only on the selection of the specific real estate or real estate security but also on the choosing of the types of real estate investment to avoid having the inferior sub-asset class in their portfolio.

Nonetheless, there are at least two obvious limitations on this study. First, the period of study might be too short. The seasonality impact might not be completely counted into the findings. Second, the scope of the data is limited to only Thailand market. Hence, the
further study should be done to overcome these limitations and to provide more complete results.

References


