MASTER OF FINANCE PROGRAM SAINT MARY'S UNIVERSITY

The Impact of Subprime Crisis on U.S. Real Estate Investment Trust

Copyright By

Chen Xi, 2013

A research project submitted in partial fulfillment for the Degree of Master of Finance

Written for MFIN 6692, August 2013

Under the Direction of Dr. Francis Boabang

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Date: <u>   Aug 27, 2013   </u>

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Abstract

The Impact of Subprime Crisis on U.S. Real Estate Investment Trust

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August 26, 2013

The purpose of this study is to analyze how the Subprime crisis affected on U.S. real estate investment trusts (REITS). This is achieved by testing the relationship between REITs and utility stocks using data from the United States. REITs and utility stocks have been viewed to belong to same asset class unit, because utility stocks and REITs can bring people high incomes by dividends with low risks. But when Subprime Crisis occurred, investors began to look at the risk characteristics of REITs. Our results show that a major macroeconomic crisis can have additional effects on the relationship between financial assets that have been thought to be quite similar. And our results remind us the fact that the correlation matrices of returns on different financial assets regularly used in financial optimizations are not necessarily stable over time.

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CHAPTER 1

Introduction

1.1 The purpose of the study

A Real estate investment trust is a company formed by investment agents who collect investors' money to different types of invest in real estate or mortgages. REITs can be held publicly or privately, and are listed on stock exchanges. REITs and utility stocks have been viewed to belong to same asset class unit, because utility stocks and REITs can bring people high incomes by dividends with low risks. But when Subprime Crisis occurred, investors began to look at the risk characteristics of REITs. This paper is to investigate how Subprime mortgage crisis affected REITs by testing the relationship between REITs and utility stocks with data from the United States

1.2 Background

Real estate investment trusts (REITs) represent pool of investments in real estate assets directly; REITs offer investors high yields and are highly liquid. What's more, Investors can choose different ways to invest in REITs, like paying for their shares on an open trading exchange or investing in a mutual fund of the real estate market. Always, REITs invest in houses, apartments, shopping plazas as well as some office buildings, but some will invest shopping malls or houses in specific state or country.

REITs have a long history in United States, which created in 1960. In the United States, REITs have to distribute at least 90% of their taxable income to shareholders by dividends annually. Since then, with the establishing of REIT systems in more than 20 countries around the world, the awareness and acceptance of investing in real estate securities is raising quickly.

However, the Subprime crisis happened in 2007 in U.S. and it led to a recession began in 2008, there is a significant reduction in returns of major important assets in U.S. financial system. The real estate market had been affected much than other markets. The housing prices dropped dramatically in 2006-2007 in some regions in U.S. At the same time, defaults increased sharply because of higher Adjustable Rate Mortgage interest rates. 'During 2007, nearly 1.3 million U.S. housing properties were subject to foreclosure, up to 79% from 2006. The Economist estimated subprime defaults would reach a level between $200–300 billion. Falling U.S. housing prices and rising delinquencies in mortgage-market losses, including securities tied to commercial real estate and loans to consumers and companies, may reach $945 billion according to the IMF. The financial-services industry has posted losses of $476 billion since July of 2007, while average U.S. home prices have fallen 15%.' (Hamid, A. James, A. K. & Sanjay, V. Stress Test For The Financial Optimization. Journal of Business & Economics Research – January, 2010) According to initial analysis, the average portfolio returns indicate an big decrease in returns for the Dow Jones Equity REIT (DJEREIT) Index during the period from the end of August 2005 to August 2008.

It seems to be challenging classify REITs as stock market or real estate investment. As a matter of fact, many econometricians have analyzed the relationship between REITs, the aggregate stock market and the traditional real estate assets. "Mueller and Pauley (1995), for example, have argued that REITs are often seen to be very similar to utility stocks which are traditionally assumed to be one of the most." (Tobias, B. REITs and the Financial Crisis: Empirical Evidence from the U.S. l Journal of Business and Management). High dividend payments and the strong relative performance of U.S. REITs give the understandable classification. And, the objective of this paper is to examine whether the relationship between U.S. utility stocks and REITs has changed due to the financial crisis and how dramatic that affects REITs.

1.3 Subprime crisis

The subprime crisis has been regarded as one of the most severe economic hit during modern history, which might be the worst situations since the Great Depression. This crisis was result from the real estate bubble in the U.S. Based on a report by the Joint Economic Committee of the United States Congress the real estate bubble has developed due to an "overly accommodative U.S. monetary policy" prior to the crisis. During the crisis, most products related to the real estate market suffered a lot.

The reasons for the crisis are various, so systematically underestimated risks maybe is the major cause for the global financial system. The root causes lying on the U.S. housing and mortgage market. The disproportion of economic in the U.S. happened with a sustained decline of U.S. interest rates. The house industry boomed in the U.S. until spring 2007 due to the surplus of

available funds from abroad. Further with quick expansion of careless mortgage, housing had an unusually low risk. Based on such forecasting on real estate prices, the lending decisions were taken wrongly.

At the same time, after the dot-com bubble occurred in 2001, investors all around the world want to find some investments with two advantages: safe and profitable, leading to reduction of returns on some long-term investments like bonds and so on. The bankers reacted quickly to this new requirements and designed complicated capital market instruments to satisfy investors, some ones derived their value from mortgage payments and house prices. Such as mortgage-backed securities (MBS) and collateralized debt obligations (CDO). It is a way to transform illiquid assets into liquid and tradable capital market implements. With the development of such tools, the booming U.S. housing market would affect all markets around the word. Finally, the beginning of crisis was in 2007, because of such new financial tools appearing quickly in the years.

The credit boom began in early 2007, at the same time, economy started to weak. And the rise of interest rates pressed mortgaging and crushed real estate demand. The problem started with decline of housing prices in parts of the U.S., then mortgage delinquencies and defaults rose, which forced sales of collaterals increased and the downturn in house prices intensified.

The crisis deepened in September 2008, market participants became panic when several major financial institutions started to bankrupt. As a consequence, the markets of financing and crediting froze up. Moreover, the gloomy economic prospects not only affected the local markets, but also had a huge negative influence on share prices all over the world. In addition, declining stock markets and an emerging credit crisis initiated an extremely rapid and deep contraction in global markets.

One of the principal factors of the mortgage credit was that borrowers, those had questionable and troubled credit histories, got sub-prime lending requiring little or no down payment at the first place, even those who cannot reach minimal income requirement for loan origination can also got loans. 'In 2006, the booming sub-prime market reached 25% of all mortgages. Sub-primes were typically adjustable rate mortgages with low initial teaser rates but can be reset to higher interest rates over time due to rising interest rates or expiring "teaser" periods. As monthly repayments go up, more mortgages could go into default. Further, financial institutions pool both prime and subprime mortgages and issue securities backed by these mortgage pools, with the advent of complex securitization.' (Hamid, 2010)

According to Hamid, in 2006, the subprime borrowers started to have difficulty making their mortgage payments or refinancing the mortgages when the housing prices got flat, or even began declining. Moreover, at the beginning of the burst of the bubble, about 25% of the subprime mortgages were in delinquency, and the estimate was that 12 million borrowers had negative net

worth. The crisis in the subprime market came in the open when many subprime mortgage lenders began declaring bankruptcy around March 2007. (Hamid, 2010)

According to Lemma, in September 2008 (Black September), the mortgage market collapsed completely with most of the values of the MBS backed by subprime vanishing, with rising crisis of confidence in the credit market. Moreover, spreads relative to LIBOR raise steeply, even the LIBOR itself shot up, and the credit market essentially froze.

This paper is organized into five parts of which Chapter 1 has served as the introduction. Chapter 2 consists of the literature review. Chapter 3 describes the methodology used in this study. Chapter 4 presents the analysis of results, and Chapter 5 provides a summary and conclusion.

CHAPTER 2

Literature Review

2. Overview

For the U.S. there is mixed empirical evidence as to whether REITs have or have not a systematic link to either the aggregate stock market or the real estate market. Libo Sun, Sheridan Titman and Garry Twite (2013) asserted that the huge degree of price decline was because of the costs associated with financial distress. The writers explained the fell down of the REITs price by leverage effect. They believed that the debt to assets ratio decided the degree of the decline. Specifically, price decreased greatly for REITs with shorter maturity debt and this kind of REITs raised more equity capital and had sales exceeded acquisitions. Besides that, the authors believed that the financial crisis could have worse effect on REITs, if REITs had been forced to keep their payouts. 'Legislation that allowed REITs to substitute stock dividends for cash dividends allowed those that were the most exposed to financial distress costs to conserve their cash, allowing them to mitigate the costs of financial distress.' Ming-Che Wu1, Yung-Shi Liau2 and Yung-Chang Wang (2010) indicates that All- REITs, Equity-REITs, Mortgage-REITs and Hydird-REITs acted as the defensive stocks during the time when market is declining. The writers used dynamic conditional correlations bivariate threshold GARCH (DCC- TGARCH) model to test whether the REITs assets are defensive investment when the market in bad condition. They found that the stocks are transitory and the DCC moves around a long-term steady level. That means 'the dynamic process displays a mean-reverting one.' In addition, their reports claimed that E-REITs have the lowest systematic risk among all types of REITs.

Hideki Nishigaki (2007) insists that investigated the relationship between REIT and house price. He found that in the long-term, the US equity REIT index is negatively correlated with inflation and has positive correlation with house price. The writer concluded that REIT performance would worsen, if the price of the house decease further and the inflation index increase more. Stoyu I. Ivanov (2010) tested whether the REIT ETFs disintegrate from their underlying indexes during the time period of financial crisis. The writer found that financial crisis not disintegrated but improved the integration of REIT ETFs and indexes. He said that the IYR is not cointegrated with its underlying index before the financial crisis; however, the results showed that during and after the crisis the ETF and index are cointegrated with Dow Jones U.S. Real Estate Index.

Tobias Basse, Meik Friedrich and Eduardo Vazquez Bea (2009) found that the relationship between the monthly return on the utilities sector equity index and the return on the REIT index changed dramatically. Investing in REITs became more risky relative to investing in utility stocks. This huge change happened in the financial crisis. And the writer believed that this structural break directly caused by this financial crisis. Kotly Wilson (2011) defines that the mortgage crisis had many bad effects on the economy and the lending process, because many lenders require much tougher verifications and higher credit scores to qualify for home loans currently. The writer asserted sub-prime mortgage defaults and a downturn in the housing market have had a great impact on real estate investment trusts. In the last two years most REIT returns have been lowered significantly. Before the economic and housing downturn these trusts were popular, and this was partly due to the booming housing market and the high returns that were

offered. However, the author claimed, REIT index funds that hold residential mortgage debt suffered the most, because a large percentage of defaults and foreclosures occur on residential mortgages.

CHAPTER 3

Data Sources and Methodology

3.1 Data Sources

This paper will compare the data of two time series of Dow Jones Composite All REIT total Return Index and S&P 500 Utilities Total Return Index. The Dow Jones Composite All REIT total Return Index includes all REITs' public trading in U.S. And based on S&P 500 Utilities Total Return Index, it provides all members in the utilities sector.

In order to find out the impact of subprime crisis on REITs in U.S., data should be collected from two series, and then separate the data into two groups those monthly return on the REIT index before February 2007, and the other returns that after the financial crisis. The first period is April 1999 to January 2007, which is exact before the financial crisis. The other one is from February 2007 to June 2009, which is the period after subprime crisis. Also use the same way to get monthly returns on the S&P 500 Utilities Total Return Index. This paper will test whether there are similarities between REITs and utility stocks or not, and whether such relationship still exists between them after subprime crisis occurred by running regression, because REITs are always regarded as similar stocks with utility stocks. While when subprime crisis occurred, there are some changes happened, which raised some doubts on this relationship.

Based on the historical prices, using monthly closing prices to calculate monthly returns during two time periods. For example, using closing price on the first day of the first month and the first day of next month to get the month total returns. The first period is April 1999 to January 2007, using the closing price on April 1st in 1999 minus the closing price on January 1st in 1999, the result divides the price of February1st, as a result, it is the first month return. By that analogy, every month's return can be calculated. So using the same ways to find out the second period and the other index. Then the important thing is to compare the monthly return of two indexes to see what the change is before and after subprime crisis. In addition, the first obvious sign of the subprime mortgage crisis is an overheating of U.S. house prices. And, REITs and house prices are always precision connected, which raised the question that whether the structural change is caused by the financial crisis and decline of the house price. In order to figure that, I will run the regression of monthly return of REIT index and the average market price of the house.

The data mentioned above will be showed in the Appendices. The Appendix A includes the data of REIT index monthly prices and returns from April 1st 1999 to January 2007. And Appendix B will show the data of REIT index monthly prices and returns from February 2007 to June 2009. And then Appendix C has the data of S&P 500 Utilities Total Return Index monthly prices and returns from April 1st 1999 to January 2007. Finally Appendix D will show the data of REIT index monthly prices and returns from February 2007 to June 2009.

The data was from Bloomberg database, and it provides the last prices of each month. Finally, using data to calculate the monthly returns.

3.2 Model Building

3.2.1 Objective

This study will separate options into two simple groups, and for each group use the observed monthly return of S&P 500 Utilities Total Return Index and REIT index. To compare these two indexes, we must insure that whether the variables have unit roots problem. If it has unit root, this paper must use the returns to find their relationship and running regression to decide the effects coursed by Subprime crisis.

3.2.2 Unite Root test

The augmented Dickey-fuller (ADF) Unite Root test is used for determining the order of integration in the data series. The model is:

(1)

$$\Delta y_t = \alpha + \beta t + \gamma y_{t-1} + \delta_1 \Delta y_{t-1} + \cdots + \delta_{\rho-1} \Delta y_{t-y+1} + \varepsilon_t$$

Source: Augmented Dickey–Fuller test, Wikipedia.

Where:

y_t = the time series being tested .

Δ = the first different order; i.e. $\Delta y_t = y_t - y_{t-1}$

α = a constant.

ρ = the lag order of the autoregressive process t= a time trend

ε_t = a white noise disturbance term

In order to determine that whether the sample is consistent with an $I(1)$ process with a stochastic trend, or if it is consistent with an $I(0)$ process, which is stationary, with a determinative trend. The unit root test is then carried out under the null hypothesis γ= 0 against the alternative hypothesis of γ< 0 Once a value for the test statistic

(2)

$$DF_t = \frac{\hat{\gamma}}{SE(\hat{\gamma})}$$

Source: Augmented Dickey–Fuller test, Wikipedia.

The result can be compared to the critical value for the Dickey–Fuller Test. If the test statistic is less than the critical value, then the null hypothesis of γ= 0 is rejected and no unit root is present.

What's more, according to some econometricians who mentioned that there is a close relationship between U.S. REITs and house prices in the United States, which will be changed affecting by financial crisis. As a result, assuming the breakpoint is the February 2007, using the Chow test to test whether it is the massive structural break or not.

CHAPTER 4

Results and Analyses

4.1 ADF Unite Test

In order to figure out the impact of subprime crisis on REITs, this paper chooses the utility stock as REITs' comparison, which will bring better results about the impact.

At first, we tested the relationship between prices of REITs index and Utilities Index. Then we used ADF Unite Test to see if the variables have unit roots problem. From the following two figures, Figure 1 and Figure 2, we found that the Utilities Index has unit roots. Thus, we cannot simply regress these two index prices. Therefore, we decided to run the regression by two index returns to avoid unit roots problem.

Figure 1

```
. reg var2 lastprice
```

Source	SS	df	MS
Model	836745.17	1	836745.17
Residual	2619794.72	91	28788.953
Total	3456539.89	92	37571.0858

Number of obs = 93
$F(1, 91) = 29.06$
Prob > F = 0.0000
R-squared = 0.2421
Adj R-squared = 0.2337
Root MSE = 169.67

var2	Coef.	Std. Err.	t	P>|t|	[95% Conf. Interval]	
lastprice	2.050762	.3803921	5.39	0.000	1.295159	2.806364
_cons	8.528965	83.10367	0.10	0.918	-156.5463	173.6042

Figure 2:

```
. tsset date
        time variable:  date, 1 to 121
                delta:  1 unit

. dfuller var2

Dickey-Fuller test for unit root                        Number of obs   =        93

                        ————————— Interpolated Dickey-Fuller —————————
                 Test        1% Critical        5% Critical       10% Critical
              Statistic          Value              Value             Value
            —————————————————————————————————————————————————————————————————
 Z(t)          -3.754           -3.520             -2.896            -2.583
            —————————————————————————————————————————————————————————————————
MacKinnon approximate p-value for Z(t) = 0.0034

. dfuller lastprice

Dickey-Fuller test for unit root                        Number of obs   =        92

                        ————————— Interpolated Dickey-Fuller —————————
                 Test        1% Critical        5% Critical       10% Critical
              Statistic          Value              Value             Value
            —————————————————————————————————————————————————————————————————
 Z(t)          -2.091           -3.521             -2.896            -2.583
            —————————————————————————————————————————————————————————————————
MacKinnon approximate p-value for Z(t) = 0.2481
```

Firstly, using monthly returns from April 1999 to January 2007 both indexes: Dow Jones Composite All REIT total Return Index and S&P 500 Utilities Total Return Index to run regression. The results are showed in table following:

Figure 3

```
. tsset date
        time variable:  date, 1 to 121
                delta:  1 unit

. reg return return2

      Source |       SS       df       MS              Number of obs =      93
-------------+------------------------------           F(  1,    91) =   15.03
       Model |  .020944842      1  .020944842           Prob > F      =  0.0002
    Residual |  .126848504     91   .00139394           R-squared     =  0.1417
-------------+------------------------------           Adj R-squared =  0.1323
       Total |  .147793347     92  .001606449           Root MSE      =  .03734


      return |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
     return2 |   .2827278   .0729377     3.88   0.000     .137846    .4276095
       _cons |    .013648   .0038982     3.50   0.001    .0059047    .0213913


. *(1 variable, 120 observations pasted into data editor)

. *(1 variable, 120 observations pasted into data editor)
```

Secondly, using another two data from February 2007 to June 2009 of both indexes, running regression in the same way, the result is in the figure:

Figure 4

```
. reg return11 return22

      Source |       SS       df       MS              Number of obs =      28
-------------+------------------------------           F( 1,    26) =    4.79
       Model |  .054358487     1  .054358487           Prob > F      =  0.0377
    Residual |  .294784576    26  .011337868           R-squared     =  0.1557
-------------+------------------------------           Adj R-squared =  0.1232
       Total |  .349143063    27  .012931225           Root MSE      =  .10648


    return11 |     Coef.   Std. Err.       t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
    return22 |   .843326   .3851479     2.19   0.038     .0516432    1.635009
       _cons | -.0167894   .0202922    -0.83   0.416    -.0585006    .0249219
```

From above two regression results of two figures, we can see that in the first period, the coefficient is 0.2827278; R^2 is 14.17%. However after January 2007 to June 2009, the coefficient is 0.843326; R^2 is 15.57%. These four figures indicate that after subprime crisis, the performance of REITs had closer and closer relationship with utility stock. So there is a change occurred after subprime crisis that REITs become more similar to utility stocks.

At the same time, this paper needs to test what is the breakpoint from April 1999-June 2009. We use Chow test to find out the breakpoint. Firstly, we assume the breakpoint is the February 2007, then use Chow test to determine the results. Running by Stata, getting the results in Figure 5 and Figure 6:

Figure 5: It is the stata commands

```
. qui reg var4 var5 in 1/94

. est store A

. qui reg var4 var5 in 95/121

. est store C

. qui reg var4 var5 in 1/121

. est store all

. lrtest (all) (A C), stats
```

Figure 6:

```
Likelihood-ratio test                                    LR chi2(2)  =     67.77
                                                         Prob > chi2 =    0.0000

Assumption: (all) nested in (A, C)
```

Model	Obs	ll(null)	ll(model)	df	AIC	BIC
all	121	157.1037	165.06	2	-326.12	-320.5285
A	94	169.4906	176.116	2	-348.232	-343.1455
C	27	20.38852	22.82865	2	-41.6573	-39.06563

Note: N=Obs used in calculating BIC; see [R] BIC note

From Figure 5, firstly we can look at the Prob > 0.000, which means there is impossible that the probability of no breakpoint during this period. The Chow test assumes that there is no breakpoint during this period. So the Prob >0.000 means there is a breakpoint in this test, which is February 2007. In addition, the coefficients from two time series changed a lot, which were dramatic rising from 1999 to 2009 because of subprime crisis occurring.

CHAPTER 5

Conclusion

The empirical evidence found above quite clearly indicates that the relationship between the monthly return on the utilities sector equity index and the return on the REIT index has changed dramatically. The performances showed that REITs had closer and closer relationship with utility stock. As a result, REITs become more similar to utility stocks. This change coincides with the economic and financial crisis, of course, which has its roots in the U.S. housing market. Therefore, this structural break is most probably directly related to the Subprime crisis. Our findings do have a number of implications. Most importantly, this paper shows that a major macroeconomic crisis can also have additional effects on the relationship between financial assets that have been thought to be quite similar. Therefore, the empirical evidence reported above is also a reminder of the fact that the correlation matrices of returns on different financial assets regularly used in financial optimizations are not necessarily stable over time. In fact, financial markets are always on the move.

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