REIT ETFs performance during the financial crisis

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ABSTRACT

In this study the "disintegration hypothesis" is tested. It is examined whether the Vanguard Real Estate Investment Trust and iShares Dow Jones US Real Estate Index Fund exchange traded funds disintegrate from their underlying indexes during the recent financial crisis. Failure to support the "disintegration hypothesis" of the exchange traded fund and underlying index is found. It is also found that the Vanguard Real Estate Investment Trust exchange traded fund is consistently cointegrated with its underlying index the MSCI US REITs Index, before, during and after the financial crisis. It is also found that the iShares Dow Jones US Real Estate Index Fund before the financial crisis is not cointegrated with its underlying index, the Dow Jones U.S. Real Estate Index; whereas during and after the crisis the exchange traded fund and index are cointegrated. Additionally, it is documented that the tracking error of these two exchange traded funds increases and becomes more volatile during the financial crisis relative to the before and after crisis period.

Keywords: ETF, REIT, tracking error, disintegration hypothesis, cointegration, financial crisis

INTRODUCTION

In this study it is tested for the "disintegration hypothesis." It is examined whether the Vanguard REIT ETF (VNQ) and iShares Dow Jones US Real Estate Index Fund (IYR) REIT Exchange Traded Funds (ETFs) disintegrate from their underlying indexes, MSCI US REITs Index and Dow Jones U.S. Real Estate Index, respectively, during the recent financial crisis. The consensus is that this financial crisis has been triggered by the bursting of the real estate bubble in the United States. 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 (http://www.house.gov/jec/studies/2008/The_US_Housing_Bubble_June_2008_Study.pdf). During the crisis, products associated with the real estate market experienced severe corrections which might have caused disintegration of financial products linked to the real estate market, including REIT ETFs. REIT ETFs are designed to track their underlying REIT index. The REIT indexes are portfolios of Real Estate Investment Trusts (REITs) developed by companies to track the real estate market. REITs are unit trusts which legally in order to qualify for REIT status are required to invest at least 75% of all of their assets in real estate or deriving at least 75% of all revenue from real estate property or mortgages on real estate property and distributing at least 90% of all income to the REIT investors (http:\\www.reit.com). REITS trade on an exchange just like stock and exchange traded funds.

ETF shares are then created to track the REIT index by exchanging in ETF shares for baskets of the underlying REIT index securities. The exchange is performed in-kind and as such constitutes the tax advantage of ETFs to mutual funds. Besides creation of ETF shares redemption of ETF shares for the underlying index baskets is also continuously allowed which is the ETF arbitrage mechanism which ensures that the ETF closely tracks the ETF underlying index. Thus, theoretically and practically there is a strong relation between ETFs and the underlying index. However, it is possible that during the most recent financial crisis, which consensually is caused by the real estate bubble burst in 2007, this strong relation between REIT ETFs and underlying REIT indexes might be "disintegrated" due to the increased toxicity of real estate assets which might have accumulated in REITs.

The question that the study attempts to answer is: "Are the ETFs disintegrating from their underlying indexes during the most recent financial crisis?" It is documented in the study a failure to support the "disintegration hypothesis" of the ETFs and underlying indexes. It is found that VNQ is consistently cointegrated with its underlying index, before, during and after the financial crisis. It is also found that IYR before the financial crisis is not cointegrated with its underlying index, whereas during and after the crisis the ETF and index are cointegrated. Additionally, it is documented that the tracking error of these two ETFs increases and becomes more volatile during the financial crisis relative to the before and after crisis period.

LITERATURE REVIEW

Harris (1989) uses the October 1987 crash to examine the S&P 500 spot-futures basis and documents an increase in the spot-futures basis around this event. He provides evidence that nonsynchronous trading might cause linkage breakdown which is in support of the proposed by him "disintegration hypothesis" of spot and futures market. Blume, Mackinlay and Terker (1989) do not directly test the "disintegration hypothesis" but their analysis can be related to this

literature but find a linkage-breakdown between S&P 500 and non-S&P 500 stocks and futures and cash markets on both October 19, 1987 and October 20, 1987.

In a subsequent study Jones, Nachtmann and Phillips-Patrick (1993) study the linkage breakdown between S&P 500 and non-S&P 500 index stocks during the October 1987 and October 1989 crises and use an alternative interpretation of the "disintegration hypothesis" as the linkage breakdown between S&P 500 and non-S&P 500. Jones, Nachtmann and Phillips-Patrick (1993) find that the cointegration between S&P 500 and non-S&P 500 NYSE listed stocks does not breakdown, which is contrary to the "disintegration hypothesis."

DATA AND METHODOLOGY

Two ETFs are examined in this study, the Vanguard REIT ETF, with a ticker symbol – VNQ and underlying index the MSCI US REITs index (symbol RMZ), and the iShares Dow Jones US Real Estate Index Fund with a ticker symbol – IYR and underlying index the Dow Jones U.S. Real Estate Index (symbol DJUSRE). There are more REITs ETFs available for trading today but we are constrained in this study. Only these two ETFs are used because the data available is only for these two ETFs' underlying indexes. Data are not available for the other ETFs underlying indexes despite the fact that data are available for all ETFs. Even though only these two ETFs are used they are statistically representative of the ETF segment because VNQ and IYR represent 71% of all assets under management and 84% of all trading activity in terms of volume as of 01/23/2012 in this segment. The complete list of REITs ETF assets and average volume as of 01/23/2012 are presented in Table 1. These data are retrieved from http://etfdb.com/index/msci-us-reit-index/ on 01/24/2012. The REITs ETF data are from the Center for Research in Security Prices (CRSP). The MSCI US REITs index data are from http://www.msci.com. The Dow Jones U.S. Real Estate Index data are from http://finance.yahoo.com.

The question that this study addresses is: "Are the ETFs disintegrating from their underlying indexes during the most recent financial crisis?" It is possible because of the nature of an ETF, in-kind creation and redemption of ETF units for shares in the underlying index REITs or cash, that the REITs ETFs do not experience disintegration from their underlying index. Tracking error is normally used in the examination of how well an ETF is tracking its underlying index. The most basic definition of tracking error among many is used in this study. The tracking error metric used in Chen, Noronha and Singal (2006) us employed in this study. The tracking error is defined as the difference between the return of the underlying index and the return of the ETF.

It is also possible that the most basic tracking metric might not be able to capture ETF and underlying index disintegration, thus cointegration methodology as in Jones, Nachtmann and Phillips-Patrick (1993) is also employed. ETFs are designed to track their underlying index and this suggests that there is a theoretical relation between the ETF and the REIT index. However, what practically happens is that ETF management companies do not necessarily exactly track the index because they employ a replicating strategy. The management companies do not necessarily acquire all index components and do not always keep these underlying index components in the right proportions. This is clearly stated in all ETFs prospectuses. This is where a potential disintegration between ETF and index might occur.

The theoretical association between ETF and underlying index suggests cointegration. In the foundation of cointegration is the Granger Representation Theorem which states that if two

series are both integrated of order one there might exist a joint long-term error correction representation of their relation. There are different ways to test for cointegration. The most widely used method is based on the Johansen Test using Trace Statistic (Johansen, 1991). The advantage of this method is that it allows for the identification of multiple cointegrating vectors. The Engle-Granger two-step cointegration methodology (Engle and Granger, 1987) is also popular but it is limited to testing only for one cointegrating vector.

The data are daily and are for the period January 01, 2005 until December 31, 2010. The end date is determined by the availability of data on CRSP. The National Bureau of Economic Research (NBER) identifies December 2007 as the start of the most recent recession and the end of this recession as June 2009 (http://www.nber.org/cycles.html). The overall consensus is that this recession was caused by the bursting of the real estate bubble which provides us with an excellent laboratory to test the disintegration hypothesis of the REIT ETFs disintegrate from their underlying index during the crisis.

ANALYSIS

The first step in the analysis is to visually inspect the behavior of the REIT ETFs tracking error during the crisis period December 2007 to June 2009. Figure 1 provides the plot of the VNQ tracking error across time whereas Figure 2 provides the IYR tracking error. It is visible that during the crisis period the tracking error has not only increased but has also become more volatile. However, what becomes apparent as well is that the tracking error for the two ETFs has started increasing prior to the announced by NBER start of the recession and ended a bit later than the announced by NBER end of the recession. The tracking error has started increasing five months earlier than the NBER recession start date, around July 01, 2007 for both VNQ and IYR, and has decreased and stabilized two months after the NBER recession end date, around September 01, 2009. This is in agreement with the consensus that financial markets react much sooner to economic troubles than the rest of the economy. Therefore, in the analysis that follows this longer period of the recession, July 01, 2007 to September 01, 2009, will be used.

Table 2 reports summary statistics of the VNQ and IYR tracking error, defined as the difference between the return of the underlying index and the return of the ETF. The average tracking errors are negative indicating overall daily underperformance of the ETF relative to the underlying index. The table also shows that the tracking error has increased during the crisis period and decreased after the crisis for both VNQ and IYR. The increase in tracking error average and volatility might be due to the increased toxicity of real estate assets which have accumulated in REITs. The increased supply of real estate assets and foreclosures has devastated not only the real estate market but also investments in REITs.

Table 3 reports results of the Augmented Dickey Fuller (ADF) and Phillips-Perron (PP) Unit Root tests. Both tests have null hypothesis unit roots. Both tests fail to reject the null hypothesis of unit root in each ETF price and underlying index level for both the zero mean and single mean model specifications but reject the null for the trend model specification. The presence of unit roots indicates that we can use the Granger representation theorem (Engle and Granger, 1987) to formally test for cointegration and estimate a formal model of the relation between ETFs and indexes.

Table 4 reports the Johansen Cointegration Test results on the logarithms of ETF price and index levels before, during and after the financial crisis. For VNQ there is at least one cointegrating vector and as such constituting presence of cointegration before, during and after

the crisis. This is not the case for IYR however. There is no cointegration between ETF and index prior to the crisis but there is cointegration during and after the crisis.

As robustness, the Engle-Granger two-step cointegration methodology (Engle and Granger, 1987) is also used. The Engle-Granger methodology runs an OLS regression of the ETF on the index and testing the residuals for unit-root with ADF. If ADF rejects unit-root of the residuals, the null hypothesis, cointegration is present, if the ADF fails to reject the null there is no cointegration. Similar to the Johansen results the Engle-Granger two-step cointegration methodology confirms no-cointegration for IYR before the recession whereas cointegration is present in all other cases. These results are reported in Table 5.

The cointegration test results suggest lack of support for the "disintegration hypothesis" of the ETF and underlying index. On the contrary, some evidence is found indicating that the financial crisis actually improved the integration of ETF and index. For the IYR it is found that before the crisis this ETF is not cointegrated with its underlying index, the Dow Jones U.S. Real Estate Index, whereas during and after the crisis the ETF and index are cointegrated. The reason might be the poor replicating strategy of the IYR. The tracking error did not reveal significant misalignment between ETF and index prior to the crisis but further analysis reveals low correlation between IYR and underlying index levels. The correlations are presented in Table 6. The table clearly shows low negative correlation between IYR and its underlying index in the period before the crisis and very high positive correlation between ETF and index in the rest of the cases. VNQ is consistently cointegrated with its underlying index the MSCI US REITs index, before, during and after the financial crisis.

Despite the lack of "disintegration" the performance of the ETFs suffers. These REIT ETFs tracking errors increase and become more volatile during the financial crisis which is a direct cost to investors. The increase in tracking error is during the financial crisis relative to the modified pre and post crisis periods. Thus, even though an investor might not own a home they might still have incurred direct real estate investment losses through the REITs that they might own in retirement portfolios. Of course, this is not a surprise considering that just like any other investment, in order to obtain return one needs to bear risk.

CONCLUSION

In this study the "disintegration hypothesis" of ETF underlying index is examined. It is tested whether the REIT ETFs disintegrate from their underlying indexes during the recent financial crisis. The paper fails to find support for the "disintegration hypothesis" of the ETF and underlying index. On the contrary, it is documented that the financial crisis actually improved the integration of REIT ETFs and indexes. It is found that the IYR before the financial crisis is not cointegrated with its underlying index, the Dow Jones U.S. Real Estate Index, whereas during and after the crisis the ETF and index are cointegrated. The VNQ is consistently cointegrated with its underlying index the MSCI US REITs index, before, during and after the financial crisis.

Even though "disintegration" does not materialize investors in these investment products suffered in that the performance of these ETFs deteriorated. ETF performance is measured with tracking error and it is documented that the tracking error increased and became more volatile during the financial crisis relative to the before and after crisis period.

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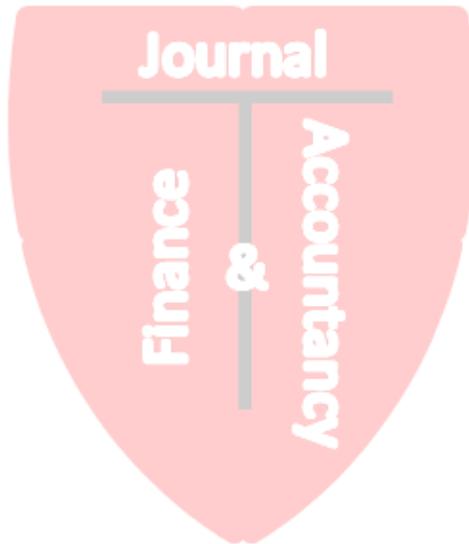
APPENDIX

Table 1. Summary Information on REITs ETFs

ETF Ticker	ETF Name	Inception	Underlying Index	Exp	Assets	Avg. Vol
VNQ	Vanguard REIT ETF	09/23/2004	MSCI US REIT Index	0.12	9,968,412	1,826,699
IYR	iShares Dow Jones US Real Estate Index Fund	06/12/2000	Dow Jones U.S. Real Estate Index	0.47	3,159,920	6,665,541
ICF	iShares Cohen & Steers Realty Majors Index Fund	01/29/2001	Cohen & Steers Realty Majors Index	0.35	2,555,054	620,470
RWR	SPDR Dow Jones REIT ETF	04/23/2001	Dow Jones U.S. Select REIT Index	0.20	1,593,394	259,668
FRI	First Trust S&P REIT Index Fund	05/08/2007	S&P United States REIT Index	0.50	379,819	282,807
REM	iShares FTSE NAREIT Mortgage REITs Index Fund	05/01/2007	FTSE NAREIT All Mortgage Capped Index	0.48	238,655	166,554
SCHH	Schwab U.S. REIT ETF	01/13/2011	Dow Jones U.S. Select REIT Index	0.13	217,776	135,706
REZ	iShares FTSE NAREIT Residential Index Fund	05/01/2007	FTSE NAREIT All Residential Capped Index	0.48	177,920	66,821
FTY	iShares FTSE NAREIT Real Estate 50 Index Fund	05/01/2007	FTSE NAREIT Real Estate 50 Index	0.48	45,225	17,146
PSR	PowerShares Active U.S. Real Estate Fund	11/20/2008	active	0.75	23,454	4,559
MORT	Market Vectors Mortgage REIT Income ETF	08/16/2011	Market Vectors Global Mortgage REITs Index	0.52	21,798	19,860
ROOF	IQ US Real Estate Small Cap ETF	02/08/2010	IQ US Real Estate Small Cap Index	0.69	19,919	4,667
IFNA	iShares FTSE EPRA/NAREIT North America Index Fund	11/12/2007	FTSE EPRA/NAREIT North America Index	0.48	13,122	1,734
FNIO	iShares FTSE NAREIT Industrial/Office Index Fund	05/01/2007	FTSE NAREIT Industrial/Office Capped Index	0.48	10,688	1,936
RTL	iShares FTSE NAREIT Retail Index Fund	05/01/2007	FTSE NAREIT Retail Capped Index	0.48	9,033	2,557
WREI	Wilshire US REIT ETF	03/09/2010	Wilshire U.S. REIT Index	0.65	8,275	4,115
KBWY	PowerShares KBW Premium Yield Equity REIT	12/02/2010	KBW Premium Yield Equity REIT Index	0.35	7,452	1,819
FRL	Focus Morningstar Real Estate Index	06/16/2000	Morningstar Real Estate Index	0.12	5,148	720

Figure 1. VNQ Tracking Error across Time
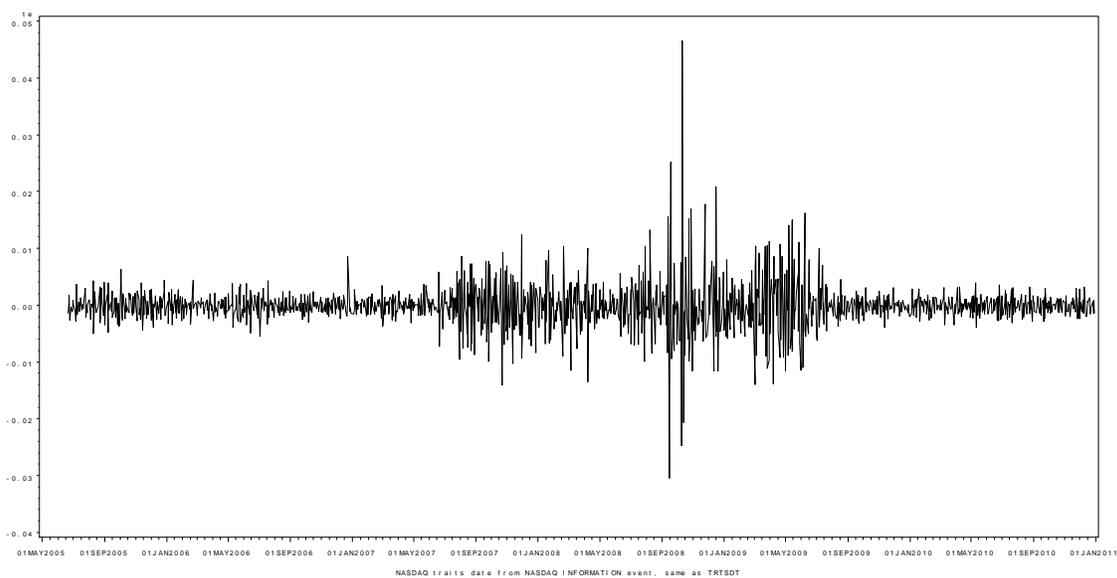
Figure 2. IYR Tracking Error across Time
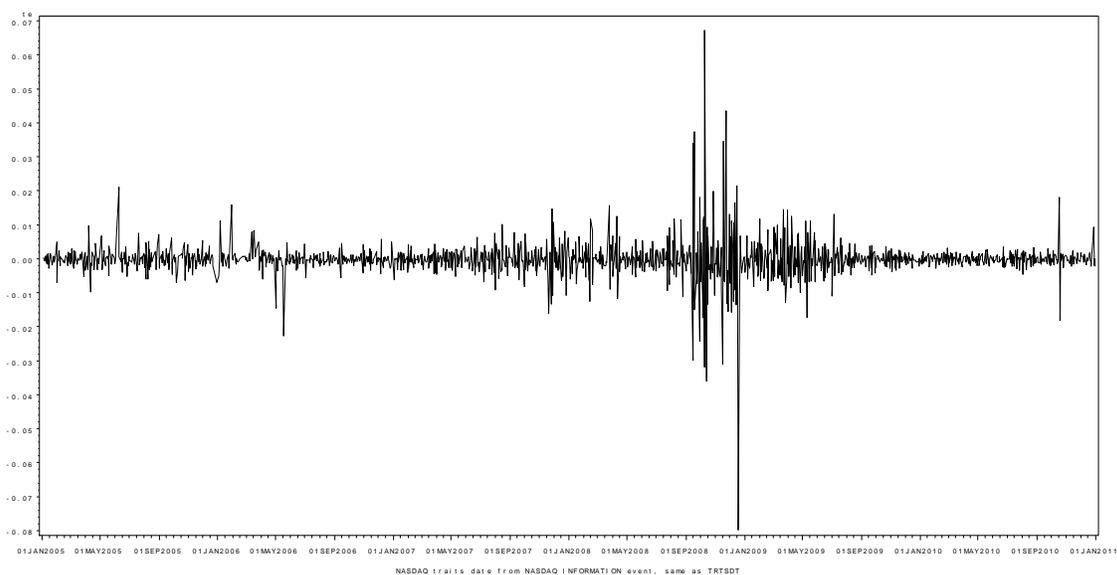
Table 2. Tracking Error Before, During and After the Financial Crisis

	VNQ			IYR		
	before	during	after	before	during	after
N	513	548	336	592	544	333
mean	-0.00015	-0.00019	-0.00016	-0.00008	-0.00028	-0.00013
stdev	0.00174	0.00584	0.00146	0.00278	0.00820	0.00212
min	-0.00728	-0.03042	-0.00397	-0.02263	-0.07973	-0.01822
max	0.00861	0.04658	0.00388	0.02104	0.06735	0.01812

Table 3. Augmented Dickey Fuller and Phillips-Perron Unit Root Tests Results

		ADF				PP			
		VNQ		IYR		VNQ		IYR	
	model	lprice	lindex	lprice	lindex	lprice	lindex	lprice	lindex
before	Zero Mean	0.8458	0.8717	0.4110	0.8942	0.8560	0.8790	0.3960	0.8940
	Single Mean	0.5640	0.5843	0.1624	0.6482	0.5940	0.6100	0.1590	0.6910
	Trend	0.5298	0.6319	0.4870	0.3243	0.6320	0.7010	0.4870	0.3350
during	Zero Mean	0.2958	0.3105	0.2640	0.2809	0.2840	0.2940	0.2460	0.2630
	Single Mean	0.6573	0.6548	0.6494	0.6362	0.6630	0.6630	0.6590	0.6470
	Trend	0.7096	0.6852	0.7220	0.6977	0.6660	0.6440	0.7030	0.6630
after	Zero Mean	0.9479	0.9512	0.9464	0.9472	0.9510	0.9530	0.9490	0.9490
	Single Mean	0.2273	0.2206	0.2154	0.2134	0.1740	0.1690	0.1660	0.1590
	Trend	0.0126	0.0116	0.0107	0.0114	0.0050	0.0040	0.0040	0.0030

Table 4. Johansen Trace Cointegration Test Results

			VNQ		IYR			
				5%		5%		
	H0:	H1:		Critical		Critical	Drift	Drift in
	Rank=r	Rank>r	Trace	Value	Trace	Value	in ECM	Process
before	0	0	18.4572	15.34	7.4861	15.34	Constant	Linear
	1	1	2.0488	3.84	2.2564	3.84		
during	0	0	27.9297	15.34	33.3376	15.34	Constant	Linear
	1	1	1.3974	3.84	1.4197	3.84		
after	0	0	20.83	15.34	23.3539	15.34	Constant	Linear
	1	1	2.953	3.84	3.1624	3.84		

Table 5. Engle-Granger Two-Step Cointegration Test Results

		VNQ	IYR
before	Zero Mean	<.0001	0.0206
	Single Mean	<.0001	0.1706
	Trend	0.0002	0.4556
during	Zero Mean	<.0001	<.0001
	Single Mean	<.0001	<.0001
	Trend	0.0002	<.0001
after	Zero Mean	<.0001	<.0001
	Single Mean	<.0001	<.0001
	Trend	0.0001	<.0001

Table 6. Correlation Table

		VNQ	IYR
		lindex	lindex
before	lprice	0.9990	-0.1387
		<.0001	0.0007
during	lprice	0.9999	0.9998
		<.0001	<.0001
after	lprice	0.9996	0.9996
		<.0001	<.0001