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Portfolio diversification through timber real estate investment trusts: A cointegration analysis

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ABSTRACT

Investors who are interested in long-term investments have regarded timberland as an advantageous asset class. The formation of timber real estate investment trusts (REITs) has offered both individual and institutional investors more options to diversify their portfolios through securitized timberlands. Nevertheless, different mixes of REIT stocks will yield various degrees of volatility for the portfolio's performances. The cointegration analyses in this study show that there are no general trends among the historical timber REIT stock prices and the S&P 500 index. Therefore, there is diversification potential in the long run with each timber REIT (except Plum Creek) considered as a unique candidate.

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1. Introduction

Approximately 33% of the U.S. landmass is covered by forested areas. The abundant and productive timber resources in the country have ignited many investment opportunities in the forest sector in the past few decades. Investing in timber assets can be practiced through either direct ownerships or different equity markets in which real estate investment trust (REIT) stocks have become the most common channel of investment.

The first REIT that operates income-producing timberlands was created in 1999 when Plum Creek was converted from a master limited partnership. Since its establishment, the timber REIT structure in the U.S. has become a unique and appealing investment vehicle of which securities can be easily bought and sold. Besides eliminating the double taxation as levied on C-Corporations, a REIT entity allows its shares to be available to both individual and institutional investors. Because securitized timberlands can be traded openly on public stock exchanges, timber REIT assets possess less liquidity risk compared to private-equity timberlands. Furthermore, a number of empirical studies indicate that timberland assets could effectively hedge against inflations and reduce investments' volatility (Caulfield, 1998; Mei et al., 2013; Sun and Zhang, 2001; Washburn and Binkley, 1993). Regardless of market conditions, trees continue to grow as they become mature and merchantable. In an unfavorable market condition, timber harvesting can be postponed until stumpage prices recover to a desired value. In addition, bare land values usually appreciate over time and add more benefits to holding securitized timberlands. Given these investment benefits, timber REIT assets have continuously gained interest from investors in the equity markets.

Although publicly-traded REIT stocks can be quickly sold for cash returns, investments in timberlands are intended for a long planning horizon. Traditionally, timberland-related investments often involve timberland investment management organizations (TIMOs). TIMOs are responsible for identifying, acquiring, and subsequently managing the timberlands on behalf of their clients. Nevertheless, investing through TIMOs requires a significant amount of initial capitals that exceed the majority of small retail and institutional investors' budgets. The appraisal-based valuation approach used by TIMOs also creates barriers to investment. With the emergence of timber REITs, investors find an attractive means to expand the range of their assets. Combining heterogeneous types of investments helps smooth out unexpected losses because positive returns neutralize the impact of negative returns. Likewise, diversification strategy requires minimal correlations among the assets in the portfolio. Therefore, whether different REIT stock prices share a common trend over time has crucial implications on investment decisions in the timberland industry. At present, the U.S. public timber REIT market is comprised of Plum Creek (PCL), Rayonier (RYN), Potlatch (PCH), Weyerhaeuser (WY), and CatchMark (CTT).[1] The corresponding correlation table shows imperfect correlations between the timber REIT stock prices and the S&P 500 index levels (Table 1). Several studies suggest that there is little correlation between the stock market and the performance of the timberland investments (Cascio and Clutter, 2008; Sun and Zhang, 2001). Therefore, the question remains whether portfolios with composite timber REIT equities

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[1] CatchMark went public in December 2013.

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Table 1
Correlation matrix among the S&P 500 index level and the timber REIT stock prices from December 2009 to December 2013.

	S&P 500	PCH	PCL	RYN	WY
S&P 500	1.00				
PCH	0.92	1.00			
PCL	0.94	0.82	1.00		
RYN	0.97	0.91	0.91	1.00	
WY	0.93	0.87	0.83	0.94	1.00

Note: Data are available at the Center for Research in Security Prices database from Wharton Research Data Services.

could perform better than those with a single timber REIT stock in terms of risk managing.

The objective of this study is to determine whether only one or all publicly-traded timber REIT securities should be included for the diversification purpose. Therefore, two cointegration tests, the Engle–Granger and Johansen procedures, are used to examine the long-run equilibrium relationships among the stock prices of four REITs. When cointegrating vectors exist among the four variables, the REIT stock prices will converge over time, and such result indicates a restricted portfolio diversification in the long run. Alternatively, when the companies' stock prices are not cointegrated, the systematic risk can be lessened by investing in multiple REITs. The outcomes of this study can provide some insight for managing investment risk through timber REITs.

2 . Literature review

2.1 . Cointegration analysis

In the economic literature, the notion of cointegration was first introduced prior to the 1980s but the testing procedure had not been formalized until 1987 by Robert F. Engle and Clive W.J. Granger. Testing for cointegration between several time series had frequently been used to analyze the possibility of long-term relationships among the variables of interest. Within the forest economics literature, a number of studies employed cointegration tests to draw inferences and predict behaviors of various forest related markets. In earlier research, the cointegration analysis led to the conclusion that the U.S. pulp prices had an important impact on the Canadian pulp prices since the test statistics suggested a long-run relationship between the two price time series (Alavalapati et al., 1997). Based on cointegration results, Sun and Zhang (2006) found that among eleven southern states, which accounted for the majority of timber harvesting in the country, no individual state was leading the logging sector and the logging market was not perfectly integrated.

Recent research investigated the impacts of different macroeconomic factors on the U.S. forest commodity exports. Sun and Zhang (2003) suggested a negative econometric relationship between exchange rate volatility and the exports of forest products. On the other hand, a positive correlation existed between the economic growths of importing countries and the export volumes of the U.S. (Cheng et al., 2013). Cointegration analyses had also been applied extensively to examine market integration between forest related markets of different countries (Kainulainen and Toppinen, 2006; Olsson et al., 2011; Stordal and Nyrud, 2003; Toivonen et al., 2002).

2.2 . Timberland market and portfolio diversification

Several seminal studies investigated the diversification of portfolios through forest related investments in both the short run and long run (Aronow et al., 2004; Cascio and Clutter, 2008; Deforest et al., 1991; Redmond and Cubbage, 1988). Investments on timberland assets provided distinctive potentials to minimize volatility since the biological growth factor of timber did not depend on economic expansions and recessions (Mei et al., 2010). The authors stressed that biological growth was the strongest return driver compared to timber price change and bare land value appreciation. Therefore, holding stocks of publicly-traded timber firms would be considered a sound practice for diversification.

On the other hand, Liao et al. (2009) indicated that timberland and softwood were not adequate in reducing the market risk of a portfolio comprised of the Standard and Poor's 500 stocks. Their empirical results implied that changes in the stock market would ultimately influence timber prices and returns on timberland investments. In the paper, Johansen cointegration test revealed one cointegrating vector among seven financial assets and two forestry related investment instruments. Similarly, Sun (2013) concluded that after converting to the REIT structure, the four timber firms had gradually become dependent on the overall performance of the stock market. As publicly-traded entities, timber REIT stock values were more receptive to market fluctuations and provided fewer financial diversification advantages for investors. Furthermore, when compared to private-equity timberland assets, returns on REIT investments were perceived to be less effective in outperforming the market and minimizing the systematic risk (Mei and Clutter, 2010).

To our best knowledge, studies to date have not examined the long-term relationship among stock prices of the four REITs. If the REIT stock prices tend to move in similar directions, investment in various REITs will offer little benefit. In this paper, cointegration analyses are applied to determine whether the timber REIT sector is cointegrated.

3 . Data and methodology

3.1 . Data

Historical daily stock price data from December 2009 to December 2013 were available and provided 1018 observations for each timber REIT. Adjusted close prices were used to allow data to be more comparable at different points in time. The starting point of the time window was determined based on the date of conversion announcement from Weyerhaeuser. Within the described period, no new REIT had been formed and none of the existing firms had been dissolved.[2] The stock quotes for all four REITs were obtained from the Center for Research in Security Prices database from Wharton Research Data Services (WRDS, 2013). In order to improve the stationarity property, price time series were converted to natural logarithmic forms. In the remaining discussions, all variables therefore refer to the adjusted data.

3.2 . Unit root test

Prior to performing any cointegration analysis, a time series must be tested for stationarity. The concept of stationarity is important and necessary in characterizing a time series for regression modeling purposes. A stationary time series must have constant mean and variance over time. In addition, its covariance only depends on the distance between two time periods but not on a specific point in time. When the test statistics indicate the same order of integration for all data series, the cointegration analysis can be applied (Wooldridge, 2013). If the time series is nonstationary and no cointegration exists, the Ordinary Least Squares (OLS) estimations will produce spurious regressions with meaningless interpretations. However, when at least one stationary combination is present among the nonstationary time series, implications of the regression results can be valuable.

A nonstationary time series is said to be integrated of order q, denoted as $I(q)$, if the series becomes stationary after being differenced q times (Tsay, 2005). In order to determine the number of unit roots that each price time series contains, the augmented Dickey–Fuller

[2] CatchMark was not included in the analysis because of data limitation.