An Investigation of the risk-adjusted performance of Canadian REIT mutual funds and the market timing skills of fund managers

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Abstract

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Huang Feiyu

I investigate the performance of Canadian REIT mutual funds over the period March 24, 2006 through March 5, 2012, focusing on their timing skills. Firstly, using standard, conditional and modified Value at Risk measures, I investigate the risk-adjusted-performance of the universe of 18 Canadian REIT mutual funds, as well as that of an equal weighted portfolio of these funds. In my analysis, I investigate the performance of the funds over different stages of a business cycle, as identified by recession indicators developed and made available by the Organization of Economic Development. Secondly, I extend Treynor and Mazuy's model using Markov regime switching, to examine the market timing ability of Canadian REIT mutual fund managers and further determine if their timing ability can explain the variation in performance of REIT mutual funds over the business cycle. The results indicate that Canadian REIT mutual funds have positive risk-adjusted performance in recession periods and negative performance in bull markets. In addition, using the regime switching Treynor and Mazuy's model, I find that fund managers exhibit negative market timing skills, particularly in a falling market.

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1. Introduction

During the recent financial crisis in the first decade of the twenty first century, the U.S. subprime mortgage crisis exploded and resulted in a series of mortgage loan defaults including soaring of subprime mortgage delinquencies and foreclosures and a corresponding decrease in the market value of securities backed by mortgages. In mid-2006, U.S. house sales prices reached a peak and then started to slide so that refinancing turned out to be more difficult than before. Furthermore, global investors also reduced purchases of mortgage-backed debt and other securities. With the termination of the severe recession at the end of 2009, the real estate market showed a slow and increasing trend across the world, according to one report of the US Real Estate Market Outlook 2012 from UBS Global Asset Management. Consequently, better understanding of the dynamic real estate market can not only regain investors' confidence and motivate them to reinvest more but also enable managers to reasonably predict the risk-adjusted performance of the mutual funds. In addition, regulators can establish adequate legislation to maintain the stability of the real estate market.

Since researchers are more likely to examine mutual funds in the US because of the availability of complete data on US mutual funds, as well as their widespread impact on the rest of the world, there are few papers on Canadian mutual funds, particularly in the real estate sector. In addition, although there are similarities between the economies of Canada and the U.S., key differences in government policies, geography, market size, banking systems and productivity prevent generalizations from results of research on U. S. funds to the Canadian market. Real Estate Investment Trusts (REITs) in the U. S. were created by Congress in 1960 by the Real Estate Investment Act and have experienced high growth rates over 50 years. By 2005, although the number of REITs declined to 208 from a total of 230 in 1994, the total market capitalization had reached $355 billion, constituting a compound annual rate exceeding 20% (Roll, 2011). REIT mutual funds, one of the major subcategories of REITs, have had an even greater growth. The number of REIT mutual funds has increased from 27 to 235 between 1994 and 2005. During the same period, the total market capitalization of REIT mutual funds has risen at a growth rate of nearly 40% to $50 billion, indicating the popularity of the sector fund among the industry-specific investment funds (Roll, 2011; Price, 2011).

On the other hand, REITs are relatively new to Canada, resulting from a change to the Canadian Income Tax Act in 1995 that trusts do not need to pay taxes when they pay out at least 90% of net profits to the unitholders. In 1994, there were only three REIT mutual funds trading in Canada. In 1997, 13 REITs traded on the Toronto Stock Exchange (TSE). Currently 34 REIT mutual funds trade due to several reasons. Firstly, the income obtained by the REITs is not taxed at the trust level, preventing the double taxation in dividend payments from corporations and sheltering the cash flow earned from payment of tax at the trust level. Secondly, REITs are eligible investments to include in retirement saving plans. Thirdly, REITs are traded daily and therefore can be tracked frequently to assess the value of real estate holdings, which is attractive to institutional investors. In addition, with respect to regulations of REITs, Muhlhofer (2005) states that though the holding period of four years which is imposed on Canadian REITs may hinder Canadian REIT mutual fund managers' ability to time the market, most fund managers will integrate fundamentals-based information with any technical trading strategy, thereby lessening the effect of this constraint.

In this thesis I will investigate two aspects of REIT mutual funds. Firstly, I focus on the Canadian real estate market by comparing the risk performance of REITs in recessionary periods with their performance in expansionary periods. Secondly, I also address the market timing abilities of Canadian fund managers in the real estate market to further investigate if market timing ability can explain the performance of mutual funds in the different sub-periods. While analyzing past performance in detail can enable us to understand the influence of the financial crisis in depth, the managers' timing ability can help them to improve the REITs' performance and prevent repetition of past failures. As for the sample period, I choose to cover the Canadian business cycles between 2006 and 2012.

I summarize an extensive literature review in Chapter II. In Chapter III, I explain the objectives of the thesis. In Chapter IV, I describe the data, followed by Chapter V in which I explain the methodology of the empirical tests. Chapter VI provides the results and Chapter VII concludes with a discussion.

2. Literature review

2.1. REITs

An REIT is a closed ended investment corporation which provides investors with the chance to invest in a diversified portfolio of commercial assets in a liquid way (Lin & Yung, 2004; Martinez, 2011), offers retail investors opportunities to gain high returns from large-scale, income-generating real estate properties, mortgages or other relevant entities (Buttiemer, 2012), and diminish or even eliminate corporate tax. REITs are also companies which possess and manage portfolios of properties as a connection between private real estate markets and stock exchanges by both asset transactions and construction activities (Martinez, 2011). REITS can be classified as equity REITs, Mortgage REITs and Hybrid REITs.

There are many previous research articles on the general profiles of REITs. For example, it is believed that idiosyncratic risk is pivotal for both real estate investments in general and REITs in particular, because investors tend to possess small undiversified portfolios owing to the localized feature of real estate assets. Roll (2011) found that there is a positive relationship between expected returns and idiosyncratic risk in REITs. REIT returns are also found to be non-normal and exhibit volatility clustering (Roll, 2011; Lizieri, 2007). Lizieri applies an independent component analysis procedure based on a kurtosis maximization algorithm to REIT returns and to capture excess kurtosis related to fat tails. Hartzell (2009) showed that when REITs choose to diversify by investing in different types of property and in different locations, diversified REITs appear to be valued lower than those REITs with assets in a tighter geographical concentration.

2.2. REIT mutual funds

There is an extensive body of research on REIT mutual funds. Price (2011) finds that the performance of REIT mutual funds may impact the level of holdings in real estate mutual funds. Ling (2006) finds that REIT mutual funds' flows are correlated positively and significantly with previous returns, whereas prior REIT mutual funds' flows do not lead REIT returns. Derwall (2009) shows that the REIT momentum factor can explain the greater part of the abnormal returns which fund managers gain in aggregate, as well as the cross-sectional variation in performance of REIT funds using Carhart's four factor model. Layfield (2011) concludes that the stock selection skills of REIT mutual fund managers cannot be identified by using a parametric bootstrap methodology. In addition, Bond (2010) also finds that fund managers in the real estate market are not able to generate excess risk-adjusted returns.

Furthermore, previous papers offer possible explanations for the unexpected underperformance of REIT mutual funds. Firstly, REIT mutual fund managers are restricted by internal asset allocation policies because regulations effectively constrain fund managers' ability to actively manage REIT mutual funds. Secondly, the REIT market is made up of a relatively small number of large cap companies and a large number of small cap companies. As a result, this may impact a manager's capacity to shift the portfolio into large cap REITs because it is relatively harder to liquidate smaller firms quickly and to trade them frequently (Hartezll, 2009). Thirdly, Barras (2010) finds that the number of funds entering into the real estate sector is negatively correlated with the level of performance of mutual funds and implies that the increased number of funds leads to a higher percentage of poorer mangers and a longer time to search for outperforming funds.

2.3 Timing ability of REIT mutual funds

Previous research has examined the performance of mutual funds by decomposing a fund's return to reflect two kinds of abilities of the manager. One is the selective or stock-picking ability (Chen, 2010) or micro-forecasting ability, which means that the fund managers can systematically pick stocks that are undervalued. Kacperczyk, Nieuwerburgh and Veldkamp (2011) find that stock picking dominates in market booms. Cici (2011) finds, after controlling for property type, size and momentum factors, that REIT mutual funds possess significant selection abilities.

The other ability is timing ability or macro-forecasting ability, which is the ability of the managers to be always invested in a market when its return is expected to be high and to not be invested in the market when its return will fall. Previous research arrives at no consensus with regard to the timing skills of fund managers. Cuthbertson (2010) reports, by using a nonparametric methodology, that there are few funds which exhibit positive market timing skills among UK equity and balanced mutual funds, whereas a large number of mutual funds tend to demonstrate negative market timing ability or mis-time the market. This is consistent with the results of Qiu, Faff & Benson (2011). It is believed that easy availability and public sharing of information which promotes an efficient market (Kacperczyk, Nieuwerburgh and Veldkamp , 2011) is the reason that the mutual fund market has lost the ability to benefit from its forecasting ability. Lee (2010) also applies the Treynor-Mazuy, and Henriksson-Merton models and find that the results are consistent with a lack of timing ability on the part of U.S. mutual funds. However, Jiang (2007) uses the holding-based tests and find that actively monitored U.S. domestic equity mutual funds have positive timing ability; fund managers can time the market in response not only to macroeconomic conditions, but also to private information.

Although more researchers have examined timing skills in general, less attention has been paid to the timing ability of REITs in particular. In contrast to traditional mutual funds, REIT mutual funds managers are able to obtain positive returns because of entry barriers, which include capital requirements, high transaction costs and slow information flow which causes information asymmetry (Buttiemer, 2012), which may give fund managers' the opportunity to time the market. Moreover, the results of Kacperczyk, Nieuwerburgh and Veldkamp (2011) also suggest that market timing skills are more prevalent for all the categories of REIT mutual funds in recessions than in expansions, whereas REIT mutual funds portfolio managers exhibit little market timing ability over the overall period analyzed. Buttiemer (2012) also demonstrates that REIT mutual funds in the U.S. do not exhibit superior timing ability by applying the Treynor-Mazuy and Henriksson-Merton models and their extension. Hochberg (2011) also finds that in the commercial real estate market, both public and private portfolio managers show little or negative timing ability, implying that investors should search for mutual funds with investment selection ability rather than timing ability.

2.4. Markov regime switching model and Regime Switching Treynor-Mazuy model (RSTM)

Hamilton's (1989) Markov regime switching model captures occasional but recurrent regime changes in a simple dynamic econometric model (Diebold, Lee & Weinbach, 1994). It was introduced by Hamilton as a vehicle to cope with structural breaks in time series and asymmetric effects of business cycles. In Hamilton's model, time-series dynamics are controlled by a finite-dimensional parameter vector which changes depending upon different states, where transitions between states are managed by a first-order Markov process with constant transition probabilities and can be estimated using Maximum Likelihood Estimation (MLE) (Qiu, Faff & Benson, 2011). The model, which has been extensively used in recent articles to address one economic phenomenon, particularly since 2010, is extended to consider a continuous state probability. Filardo (1994) suggests that allowing the state transition probabilities to vary over time as a function of an independent variable can provide more flexibility and make the results of the performance evaluation more convincing and reliable. Moreover, a Markov regime switching model with time-varying transition probabilities can portray the dynamics of business cycles and help identify and capture the expansions and depressions in a country's economy as captured by relevant output data. Above all, the time-varying transition probability model (TVTP) has several advantages over the fixed transition probability model (FTP) in three respects. Firstly, transition probabilities in the TVTP model can fluctuate over the entire business cycle but are unchanged in the FTP model. Secondly, the TVTP model might have a more complicated temporal business cycle persistence than the FTP model owing to changing transition probabilities. Thirdly, the expected duration of a state is varying in the TVTP model while in the FTP model, it remains unchanged.

On the other hand, the Treynor-Mazuy (TM) model can be considered as an extension of the Capital Asset Pricing model (CAPM), because it adds one quadratic term based on the excess market return to the usual linear index model. The model is also identified as one traditional measure that can be used to time the market. Specifically, mutual fund managers will reallocate a percentage of the market portfolio if they can appropriately predict the market trend using the market timing model, (Lee, 2010; Qiu, Faff& Benson, 2011). This implies that market timer should increase (decrease) their holdings of the market portfolio when the overall return is expected be high (low). Nevertheless, Ferruz (2010) suggests that an inverse relationship between market timing and stock-picking exists, indicating the possibility of bias in the TM model because the model cannot take into account the cost of the implicit option, as explained in what follows. For example, a negative timing coefficient in the TM model is the congruent with selling a market put option without receiving the price of the option (the option is free), the increase in return that should arise from the proceeds of the sale will instead be represented by a positive alpha coefficient which indicates the selectivity ability of fund managers, resulting in the unexpected inverse relationship between timing and selectivity skills of fund managers.

Previous researchers have modified the TM model to avoid this problem. Thus, a regime switching Treynor-Mazuy (RSTM) model has been used in recent research to examine the timing ability of mutual funds. Only one article (Qiu, Faff & Benson, 2011) utilizes an RSTM model to measure the market timing ability of fund managers, although there is considerable previous research that examines market timing skills using the TM model and its modification, without considering regime switching change.

2.5. Performance evaluation methods

Although there are a large number of papers which analyze the performance of mutual funds including REIT mutual funds (Lin & Yung, 2004; Kuhle & Bhuyan, 2009), the majority of the papers measure the performance of mutual funds using traditional evaluation metrics such as Jensen's alpha (Jensen, 1968) and the Sharpe ratio (Sharpe, 1966). To test the market timing ability of mutual funds, many researchers also use traditional and non-linear models such as the TM and the HM models.

The Sharpe ratio is a measure created by Sharpe (1966) to determine risk adjusted performance and is defined as the average excess return per unit of risk over the period of performance evaluation (Nafees, 2011). Jensen (1968) measures performance of mutual funds using Jensen's alpha to compare the average excess return of a portfolio with the risk adjusted return by using the Capital Asset Pricing Model (CAPM). However, these two methods underestimate or overestimate performance if the returns of the mutual funds are not normally distributed (Eling, 2008).

The Treynor-Mazuy model (1966) is one widely accepted quadratic regression method to examine the timing skills of fund managers, suggesting that the beta of the portfolio fluctuates depending on the size of the market excess return. The Henriksson and Merton model (1981) is another nonlinear model to determine market timing ability, indicating that "the portfolio beta fluctuates between two values depending on whether the market return is larger or lower than the risk-free rate (Ferruz, 2010). However, both of the models ignore the cost of the option implied in timing ability as explained previously.

Eling (2008) uses a new measure, Value at Risk (VaR), to assess the performance of mutual funds, particularly hedge funds with asymmetrical return distributions. VaR is denoted as "the possible loss of an investment that is not exceeded with a given probability of 1-α in a certain period”. The measure has received more acceptance by investment firms, large banks and pension funds. Compared to the Sharpe ratio which has been widely accepted in investment fund performance analysis, the VaR model modifies the classic Sharpe ratio by taking into account the possibility of an asymmetrical return distribution, which prevents traditional measures such as the Sharpe ratio from being able to distinguish both between upside and downside risk (Gregoriou, 2003; Eling, 2008). VaR therefore corrects for this problem. However, the serious shortcoming of the use of VaR is that it does not deal with losses in excess of VaR.

Thus, I will use two extended measures, conditional VaR (CVaR) and modified VaR (MVaR) to test the performance of REIT mutual funds. CVaR which is developed by Rockafellar and Uryasev (2002) has more advantages than VaR because CVAR focuses on losses that exceed the VaR threshold. MVaR was developed by Favre and Favre (2002) to further improve the accuracy of risk-adjusted performance evaluation of mutual funds. The difference between traditional VaR and MVaR is that the former only considers the mean and standard deviation of the return distribution whereas the latter takes into account higher moments including skewness and kurtosis (Gregoriou, 2003).

Finally, there are several articles which focus on the changing mutual fund performance over the business cycle. Lynch (2002) finds that for all fund types except growth funds, abnormal performance rises during downturns, proving that there has been outperformance in recessions rather than in expansions, consistent with previous articles (Kaushik 2010; Sun 2009; Glode, 2008; Kosowski, R. 2006) which conclude that mutual funds performed well in recessionary periods whereas they have statistically significant negative performance in expansionary periods. However, few papers find there is no positive abnormal performance of mutual funds over the business cycle. (Lin & Yung, 2004).

3. Objectives

Firstly, I test the normality of the returns on 18 individual REIT mutual funds and the equal weighted portfolio of these Canadian REIT mutual funds.

Secondly, I calculate VaR, CVaR and MVaR for the 18 individual Canadian REIT mutual funds as well as for an equal weighted portfolio which combines the returns of all the funds. The performance of the funds is addressed in both the overall period and in different economic cycles. I then classify the different mutual funds into groups on the basis of the types of property held and compare the performance of the different groups over the same period.

Thirdly, I use the TM Markov regime-switching model to examine the market timing ability of fund managers and investigate if timing skills can explain the differing performance of these funds over sub-periods. I incorporate the Markov Switching scheme into the TM model to investigate the market timing abilities of REIT mutual fund managers in Canada both in the overall period and in different economic periods (recession or expansion). I first use a simple regime switching model which restricts the transition probability to be constant over time and investigate the timing ability of the equal-weighted portfolio of mutual funds. Next, I further investigate the model using a time varying transition probability that depends on one economic variable which reflects the future state of the economy. In the transition probability model, the Canadian volatility index (VIXC) is used as the state variable to measure the market's expectation of stock market volatility over the following one-month period. By application of the time-varying transition probability regime switching model, the timing ability of the equal-weighted portfolio and the individual mutual funds is estimated and differentiated. In addition, the different groups of funds based on the type of property held are also compared in terms of their timing skills.

4. Data

From the universe of 34 Canadian REIT mutual funds, I obtain a final sample of 18 Canadian REIT mutual funds with daily returns data over the period March 24, 2006 to March 5, 2012. The other 16 REIT mutual funds are dropped because they were either established after 2008, or do not have a sufficiently long time series of daily returns available from Bloomberg. I use the last price of every mutual fund from Bloomberg to calculate the fund returns on a daily basis. In addition, I average the returns of the 18 mutual funds for each date to calculate the return of an equal weighted portfolio of the funds.

Data on the Organization of Economic Development's (OECD) recession indicators for Canada from the peak through the trough (CANRECDM) are obtained from the Federal Reserve Bank of St. Louis. The database covers a total of 29 countries. The OECD Composite is a binary variable which represents periods of expansion (1) and recession (0). The composite indicates that in my sample, the period from June 1, 2007 to June 30, 2009 is classified as a recession, while the other two periods are classified as expansions. Firstly, I analyze the returns over the entire period. Next, I divide the overall period into three periods. These are: Period I: expansion period from March, 24, 2006 to May 30, 2007; Period II: recession period from June 1, 2007 to June 30, 2009; and Period III: expansion period from July 1, 2009 to March 5, 2012, which is the last date of the available data.

The stock market volatility indices, VIX index (USA) and VIXC index (Canada) are obtained from Bloomberg to be included in the state equation when estimating the Markov switching model with time varying transition probability. The S&P/TSX 60 VIX index (VIXC) is used to estimate the 30 day stock market volatility. The VIXC index is also considered a good proxy for investor sentiment in the Canadian equity market. The higher the VIXC index, the greater the risk of market turmoil, reflecting the investors' fears for the coming month. However, because the VIXC index was initiated in 2009, I will use the VIX index for the period before 2009, since the VIXC index is positively correlated with the US VIX based on the research of the McGraw Hill companies in 2010. For example, the moving average of the 21 day correlation between the two indices for the period between October 2009 and October 2010 is 52%. Consequently, in the regime switching model of my thesis, time varying transition probabilities which depend on the VIXC index and VIX index are introduced. Filardo (1994) suggests that using a transition probability which varies over time can provide more flexibility and smooth the final results.

For the benchmark, both the Canadian one-month Treasury Bill rate, which is a proxy for the Canadian risk free rate, and Standard & Poor's S&P/TSX composite index (SPTSX), which is a proxy for the value-weighted market return are also downloaded from Bloomberg, for the period March 24, 2006 through March 5, 2012 on a daily basis. These are used as fundamental variables in the regime switching model.

5. Methodology

In this thesis, different risk-adjusted performance measures are used to examine the performance of the Canadian REIT mutual funds and the market timing ability of the fund managers. I discuss these methods separately in the following paragraphs.

5.1. Tests of normality

I use the Shapiro-Wilk test to examine if the equal weighted portfolio's return distribution or individual mutual fund is normal and double check the reliability of the Shapiro-

Wilk test by using three other tests of normality, which are the Kolmogorov-Smirnov, Cramer-von Mises and Anderson-Darling tests, to investigate the appropriateness of using VaR based risk measures.

The Shapiro-Wilk test statistic (Shapiro, 1965) is

$$W=\frac{(\sum_{i=1}^{n} a_i X_i)^2}{\sum_{i=1}^{n}(X_i-\bar{x})^2} \quad (1)$$

Where

X_i is the return on the equal weighted portfolio or individual mutual fund on day i.

$\bar{x}$ is the average return on the equal weighted portfolio or individual mutual fund.

The coefficients a_i are given by

$$(a_1, \dots, a_n) = m^T V^{-1}(m^T V^{-1} V^{-1} m)^{1/2}$$

Where

$$m = (m_1, \dots m_n)^T$$

$m_1, \dots m_n$ are the expected values of the daily returns of the equal weighted portfolio or individual mutual fund from the standard normal distribution

V is the covariance matrix of the daily returns of the equal weighted portfolio or individual mutual fund.

If W is too small, it is reasonable to reject the null hypothesis that the returns distribution is normal. Otherwise, the null hypothesis is accepted. I use the SAS procedure univariate to test the normality of the distribution of returns on the equal weighted portfolio or individual mutual fund.

According to previous research, it is expected that the returns of Canadian REIT mutual funds are not normally distributed (Young, 2006). Since the financial crisis, the magnitude of real estate risk has been changing quickly over time, leading to changes in skewness and kurtosis of returns. The following hypotheses are investigated.

Null hypothesis:

The returns of Canadian REIT mutual funds do not follow a normal distribution.

Alternative hypothesis:

The returns of Canadian REIT mutual funds follow a normal distribution.

If the returns of Canadian REIT mutual funds are normally distributed, performance measures based on both the Sharpe ratio and VaR can be applied, whereas if non-normality of the returns is found, it is better to use risk measures based on VaR.

5.2. Risk-adjusted performance measures based on VaR

I examine and compare the risk-adjusted performance of REIT mutual funds over the overall period as well as in different sub-periods using performance measures based on VaR, CVaR and MVaR. These periods are classified using the OECD based recession indicator for Canada into periods of recession and expansion as mentioned previously.

The performance measures based on VaR are described in what follows:

Excess return over VaR = (r_i^{α} -r_f)/VaR_i (2)

Conditional Sharpe ratio= (r_i^{α} -r_f)/$CVaR_i$ (3)

Modified Sharpe ratio= (r_i^{α} -r_f)/$MVaR_i$ (4)

where

r_i^{α} = mean return for an equal weighted portfolio of REIT mutual funds or 18 Canadian REIT mutual funds, equivalent to $(1/T)\sum_{t=1}^{T} r_{it}$, where r_{it} represents the return on the portfolio on day t, T represents the number of days over the period and i stands for the equal weighted portfolio or the individual mutual fund.

r_f = mean risk-free interest rate over the period T.

VaR_i = value at risk of the equal weighted portfolio or individual mutual fund, equal to $-(r_i^{\alpha}+z_{\alpha})$

z_{α} = the α-quantile of the standard normal distribution.

$CVaR_i$ = conditional value at risk = Expected value ($-r_{it} | r_{it} \leq -VaR_i$) of the equal weighted portfolio or the individual mutual fund

$MVaR_i$ = modified value at risk= $-\{ r_i^{\alpha} +\sigma_i[z_{\alpha} +(z_{\alpha} +(z_{\alpha}^2-1)*S_i/6+(z_{\alpha}^3-3 z_{\alpha})*E_i/24-(2 z_{\alpha}^3-5 z_{\alpha})*S_i^2/36]\}$

S_i = Skewness of the return on the equal weighted portfolio or the individual mutual fund.

E_i = excess kurtosis of the return on the equal weighted portfolio or the individual mutual fund

σ_i = standard deviation of the return on the equal weighted portfolio or the individual mutual fund, equal to $\sqrt{\left[\frac{1}{T-1}\sum_{t=1}^{T}(r_{it}-r_i{}^{\alpha})^2\right]}$

In equations (2), (3) and (4), the excess return over VaR, the conditional Sharpe ratio and the modified Sharpe ratio are computed as the excess return of the fund over the risk free rate divided by the three different VaR measures respectively. The rationale is the same as that of the traditional Sharpe ratio. The risk-adjusted performance of these funds is positively correlated with the excess return over VaR, the conditional Sharpe ratio and the modified Sharpe ratio. The higher these performance measures, the better is the risk-adjusted performance of these funds.

In accordance with the results of previous research on the performance of mutual funds over different business cycles (Kaushi, 2010; Sun, 2009; Glode, 2008; Kosowski, R. 2006), it is expected that in the Canadian REIT market, mutual funds will have a better performance in recessions rather than in expansions. Specifically, they may have positive performance in a recession, but perform negatively in an expansion. In fact, fund managers may tend to be more active to not only help clients, but also benefit themselves in recessionary periods because investors may be willing to pay a premium in exchange for high returns in relatively higher risk circumstances (Kaushik, 2010). Another explanation is related to fund managers' stock picking ability. It is shown that fund managers possess better stock selection skills in the down market than in the up market. The strong correlation between active mutual fund selection and counter-cyclicality is probably based on insider information on firm specific information (Sun, 2009).

Moreover, some economic rationale can clearly explain the reason for the outperformance of skilled fund managers in the down market. Firstly, top managers of corporations tend to withhold more bad news than good news during recessions, resulting in less information being released to the public. This information asymmetry can afford some informed fund managers a better profit-making opportunity. Secondly, the bull market tends to be much more influenced by investor sentiment or noise trader risk because individual investors prefer to trade in the up market, limiting arbitrage and leading to big losses even for rational investors. In the down market, these noise traders normally withdraw their money so that skilled fund managers can successfully trade on the signals about the fundamentals of the firms.

Accordingly, hypothesis 2 is as follows:

Null hypothesis:

The risk-adjusted measures of performance are positive in recessions and negative in expansions.

Alternative hypothesis:

The measures of performance have the same sign in both recessions and expansions.

For the next section, I will describe the framework and estimation process of the regime switching model. Compared with single regime models used by many previous researchers, the regime switching model could overcome the effect of averaging the timing coefficient over the entire sample period by capturing the time varying risks over the business cycle. Thus, a regime switching model can help us identify the market timing ability of Canadian REIT mutual fund managers in different states of the economy.

5.3. The regime switching framework

Before introducing the Markov regime switching TM model used in the thesis, in the following section, I will explain the structure of the regime switching framework.

The regime switching framework connects two or more model coefficients into one system. The specific coefficient vector is attributed to a particular state at a certain time point. For example, a two-state switching model can be represented by the following equation:

$$Z_t = \alpha_{st}+\beta_{st}*Z_{t-1}+\varepsilon_t \qquad S_t=1 \text{ or } 2 \qquad (5)$$

In equation (5), Z_t is a function of its lagged term Z_{t-1} . α_{st} and β_{st} are unknown parameters of regime S_t which is defined by a state variable that changes over time according to a process that is unobservable. ε_t is an unobserved residual with the following distribution N(0, ${\sigma_{st}}^2$). The transition process of the state variable from one state to another through time is determined by a one-period Markov chain.

The one-period Markov chain is described in the following four equations.

$$\text{Probability } [s_t=1 \text{I} s_{t-1}=1]=P \qquad (6)$$

$Pr[s_t=2Is_{t-1}=1]=1-P$ (7)

$Pr[s_t=2Is_{t-1}=2]=Q$ (8)

$Pr[s_t=1Is_{t-1}=2]=1-Q$ (9)

Equation (6), indicates that the probability of staying in regime 1 at t, when the regime at time t-1 was also regime 1, is P. Equation (7) shows that the probability of moving from regime 1 at t-1 to regime 2 at t is 1-P. Similarly, equation (8) shows the probability of remaining in regime 2 at t, when the regime at time t-1 was also regime 2, is Q, while equation (9) shows the probability of moving from regime 2 at t-1 to regime 1 at t is 1-Q.

Fixed probabilities of transition (FTP) between the different states have been used extensively in previous research. For example, if in the two-state regime switching model, state one denotes an expansionary period and state two denotes a recessionary period, the probability of moving from state one to state two is assumed to be fixed or unchanging over the sample periods. However, in recent research, time-varying state transition probabilities (TVTP) have been considered. Filardo (1994) shows that TVTP has more advantages over FTP on three aspects which include changing probability, complex temporal business cycle persistence and varying duration of the states. Moreover, Diebold (1994) supports the application of a time varying Markov switching model by introducing one example in which the likelihood of exchange rate revaluation may change with economic factors in different states of the economy.

In this thesis, I use the regime switching TM model with both fixed and time-varying transition probabilities and use the WinRats software to estimate the parameters of the RSTM model by maximum likelihood estimation.

5.4. Markov regime switching TM model with fixed transition probabilities

In this thesis, I use a Markov regime switching TM model to estimate state-dependent timing coefficient shown below in equation (10) to examine the market timing skills of Canadian REIT mutual fund managers. If the coefficient is positive in certain states, it means that fund managers exhibit positive market timing ability. Otherwise, a negative or zero coefficient implies that they are unable to predict market trends to obtain above average returns. I firstly use fixed transition probabilities to conduct a state-dependent regime switching model. The regime switching TM regression model with fixed transition probabilities is represented as follows (Qiu, Faff& Benson, 2011).

$$r_{jt} = \alpha_{j,S_t} + \beta_{j,S_t} RMRF_t + \gamma_{j,S_t} RMRF_t^2 + \varepsilon_{jt} \tag{10}$$

$$\varepsilon_{jt} \sim N(0, \sigma_{S_t}^2)$$

where

r_{jt}= excess return of the mutual fund j (j=1,…,18) over the risk-free interest rate on day t;

α_{j,S_t} = selectivity performance of mutual fund j in different states of the economy;

β_{j,S_t}= beta of mutual fund j estimated based on the market excess return in different states of the economy

s_t= state-dependent variable with fixed transition probability (S_t=0 or 1, representing a recession or expansion respectively);

γ_{j,S_t} = market timing ability of the manager of fund j in the two different states;

$RMRF_t$ = excess return on a value-weighted aggregate market proxy on day t over the risk-free interest rate.

ε_{jt} is the error term for fund j on day t which is assumed to follow a Student's t distribution

$\sigma_{S_t}^2$ = the residual's variance in the two different states.

5.5. Markov regime switching TM model with time-varying transition probability

Secondly, the time varying transition probability TM model is specified by equation (10) as well. In addition, the transition probabilities associated with s_t switching between states are assumed to be time varying. The state variable s_t depends on the VIX or VIXC index.

VIX is the Chicago Board Options Exchange market volatility index, based on the implied volatility of S&P 500 index options. This indicates the market's expectation of the U. S. stock market's volatility over the next 30 days.

VIXC is the Toronto Stock exchange market volatility index based on the implied S&P/TSX 60 index used to predict stock market volatility over the next 30 day period in Canada.

For the transition probability model, any function which could limit the information variable into unit interval is a valid candidate. However, maximum likelihood estimation will further restrict these candidates to the logistic function and probit function. In contrast to Qiu, Faff & Benson (2011), who use the probit function to model the transition probabilities, I use another valid candidate, the logistic distribution based on Filardo (1994). In addition, the logistic distribution is more frequently applied to regime switching models (Mount, 2006).

I model the transition probabilities as follows.

Probability: $p(z_t) = \exp(c1+d1*z_{t-1})/(1+\exp(c1+d1*z_{t-1}))$

Probability: $q(z_t) = \exp(c2+d2*z_{t-1})/(1+\exp(c2+d2*z_{t-1}))$

where

$p(z_t)$ is the transition probability of going from state 1 at t-1 to state 1 at t, equal to $P(s_t=1|s_{t-1}=1)$

$q(z_t)$ is the transition probability of going from state 1 at t-1 to state 2 at t, equal to $P(s_t=2|s_{t-1}=1)$

z_{t-1} is the information variable (VIX or VIXC) with lag one;

5.6. Estimation

Here, I will briefly describe several processes used to estimate the Markov regime switching model with both fixed and time-varying transition probabilities by maximum likelihood estimation. We consider one of the different individual mutual funds or one equal weighted portfolio so that the equation for the Markov regime switching TM model is as follows:

$$r_t = \alpha_i + \beta_i X_t + \gamma_i X_t^2 + \varepsilon_t \quad (11)$$

$$\varepsilon_t \sim N(0, \sigma_i^2)$$

The regime on day t is indexed by an unobserved variable i ($i = 1$ or 2) and the excess return r_t is assumed to follow a normal distribution conditional on the state variable i. X_t is defined as the excess return on a value-weighted aggregate market proxy at day t over the risk-free interest rate.

If the regime is 1, r_t follows a normal distribution described by N (μ_1, σ_1^2). If the regime is 2, r_t follows a normal distribution described by N(μ_2, σ_2^2) . Thus, the probability density function for r_t conditional on s_t is

$$f(r_t | s_t = i, x_t, x_t^2; \theta_i) = \frac{1}{\sqrt{2\pi\sigma_i^2}} \exp\{-\frac{1}{2}(\frac{(r_t - \mu_{it})^2}{\sigma_i^2})\} \quad (12)$$

where

i = 1 or 2, representing an expansion or recession respectively.

θ_i= $\{\alpha_i, \beta_i, \gamma_i, \sigma_i\}$, a vector of population parameters conditional on the regime.

μ_{it} = $E[r_t | s_t = i]$

The probability of staying in the same regime (transition probability) is specified by the following logistic function:

$$P_{it} = \Pr[s_t = i | s_{t-1} = i] = \frac{\exp(c_i + d_i z_{t-1})}{1 + \exp(c_i + d_i z_{t-1})} \quad \text{for } i = 1, 2 \tag{13}$$

Where c_i and d_i are unknown parameters conditional on regime i

z_{t-1} is an explanatory variable represented by VIX and VIXC index with lag one. In the function, when $d_i = 0$, the transition probability is fixed whereas when $d_i \neq 0$, the transition probability is time varying.

To construct the log-likelihood function of the regime switching model in (11) and (13), firstly it is necessary to derive the regime probabilities.

For the FTP model, the unconditional probability that s_t takes on the value j is defined by:

$$P\{s_t = i;\ \theta_i\} = \ \pi_i \ for\ i = 1, 2 \tag{14}$$

The joint density distribution function of r_t and s_t is then given by:

$$P(r_{t\,,}\, s_t = i;\ \theta_i) = \frac{\pi_i}{\sqrt{2\pi\sigma_i^2}} \exp\{-\frac{1}{2}\left(\frac{(r_t - \mu_{it})^2}{\sigma_i^2}\right)\} \tag{15}$$

Then the unconditional density of r_t for every sample day t is given by:

$$g(r_t;\ \theta) = \ \sum_{i=1}^{2} P(r_{t\,,}\, s_t = i;\ \theta_i) = \frac{\pi_1}{\sqrt{2\pi\sigma_1^2}} \exp\{-\frac{1}{2}(\frac{(r_t - \mu_{1t})^2}{\sigma_1^2}\} + \frac{\pi_2}{\sqrt{2\pi\sigma_2^2}} \exp\{-\frac{1}{2}(\frac{(r_t - \mu_{2t})^2}{\sigma_2^2}\}$$

Where θ is consist of the parameter vectors in regime 1 and regime 2 respectively ($\theta_1 and\ \theta_2$).

The log likelihood function to sum every sample day t over the full sample period is then given by:

Log L = $\sum_{t=1}^{1493} \log[g(r_t\ ;\ \theta\ )]$

which is estimated using maximum likelihood estimation to obtain the parameter vectors θ.

For the TVTP model, the conditional probability of being in regime i in the current period given the information in the previous period is:

$$\pi_{it|t-1} = \Pr(s_t = i |\, \omega_{t-1}) \text{ for } i = 1, 2 \quad (16)$$

Where $\omega_{t-1} = [r_1, r_2, \dots, r_{t-2}, x_1, \dots, x_{t-1}]$, represents the information available to forecast r_{t-1} in both regimes.

The probability density function of r_t conditional on the regimes is given by equation (12). Therefore, the conditional likelihood value for every individual observation (every sample day t) can be written as a weighted average of the likelihood in (12) for the two regimes as demonstrated below:

$$g(r_t|x_t, z_{t-1};\ \varphi_i) = \frac{\pi_{1t|t-1}}{\sqrt{2\pi\sigma_1^2}} \exp\{-\frac{1}{2}(\frac{(r_t-\mu_{1t})^2}{\sigma_1^2}\} + \frac{\pi_{2t|t-1}}{\sqrt{2\pi\sigma_2^2}} \exp\{-\frac{1}{2}(\frac{(r_t-\mu_{2t})^2}{\sigma_2^2}\} \quad (17)$$

Where $\varphi_i = \{\theta_i, c_i, d_i\}$ for i =1 or 2.

The log likelihood function to sum every sample day t over the full sample period is then given by:

$$\log \text{L} = \sum_{t=1}^{1493} \log\,[g(r_t|x_t, z_{t-1};\ \varphi_i)] \quad (18)$$

Mount (2006) gives us the updated conditional regime probabilities which are weighted averages of probabilities using the transition probability model in (13) as follows:

$$\begin{bmatrix}\pi_{1t|t-1}\\ \pi_{2t|t-1}\end{bmatrix} = \begin{bmatrix}\pi_{1t|t-1}P_{1t} + \pi_{2t|t-1}(1-P_{2t})\\ \pi_{1t|t-1}(1-P_{1t}) + \pi_{2t|t-1}P_{2t}\end{bmatrix} \quad (19)$$

Where P_{it} is the probability staying in the same regime i from the previous period $t-1$ to the current period t for i = 1 or 2.

I use WinRats to estimate the population parameter vector and transition probabilities by providing initial values for the coefficients and maximizing the log of the likelihood function using non-linear optimization routines.

According to previous research on the timing ability of REIT mutual fund managers in the US (Buttiemer, 2012), it is expected that Canadian REIT mutual fund managers have no or negative timing skills. Friseson (2007) and Cuthbertson (2010) offer some explanations for the lack of evidence of significantly positive market timing among UK mutual funds. Firstly, this could be due to the impact of cash flow on fund behavior. In a rising market, increased cash inflows lead to high cash positions and lower the overall exposure to the market, leading to lower returns. In a falling market, increased redemptions will lead the funds to reduce their cash positions and increase market exposure, and possibly earn high returns. Secondly, interdependency between timing level and market volatility may prevent fund managers increasing or decreasing the portfolio's market exposure without taking into account the volatility of the market even if they can predict the market trend. Thirdly, from fund investors normally believe that a single large return event indicates a fund with a high mean return, overestimating managers' ability to exploit the return persistence and failing to rebalance at the right time. In addition, limitations arising from asset allocation policy, the huge percentage of small caps within the REIT sector and the increased number of REIT mutual funds may cause negative market timing skills for managers. Thus, my third hypothesis is as follows.

Null hypothesis:

Canadian REIT mutual fund managers do not have timing ability over the business cycle, implying $\gamma_{j,S_t} < 0$

Alternative hypothesis:

Canadian REIT mutual fund managers do have timing ability over the business cycle, implying $\gamma_{j,S_t} > 0$

6. Empirical Results

Using the computer software SAS, I test the normality of both 18 Canadian REIT mutual funds and one equal weighted portfolio of these mutual funds. Using Microsoft Excel, I obtain the results of the risk-adjusted performance measures of these REIT mutual funds. Using WinRats, the results with respect to market timing skills of these fund managers are as follows.

6.1. Tests of normality

Table 1 provides descriptive statistics for the equal weighted portfolio. The total number of daily returns is 1493. The skewness of the daily returns on the portfolio is -0.5886 and the kurtosis is 12.9923.

Table 1

Descriptive statistics of the daily returns on the equal weighted portfolio of REIT mutual funds in the overall period March 24, 2006 to March 5, 2012

Number of observations	1493
Mean	0.0003
Standard deviation	0.0115
Skewness	-0.5886
Kurtosis	12.9923

Table 2 indicates the results of the Shapiro-Wilk, Kolmogorov-Smirnov, Cramer-von Mises and Anderson-Darling tests of normality of the daily returns on the equal weighted portfolio. Note that the P value for the four tests is close to zero, implying that the null hypothesis that the portfolio's return follows a normal distribution is rejected.

Table 2

Results of the tests of normality of the returns on the equal weighted portfolio in the overall period

Test	Statistic	P Value
Shapiro-Wilk	0.8574	<0.0001
Kolmogorov-Smirnov	0.1070	<0.0100
Cramer-von Mises	7.1264	<0.0050
Anderson-Darling	40.9320	<0.0050

Table 3 also implies the results of the Shapiro-Wilk tests of normality of the returns on 18 Canadian REIT mutual funds. According to the table, all P values close to zero also reject the null hypotheses that these individual mutual funds follow normal distribution.

Table 3

Results of the tests of normality of the returns on individual mutual funds in the overall period

Shapiro-Wilk test		
REIT mutual funds	Statistic	P Value
AP	0.8568	<0.0001
AX	0.8082	<0.0001
BEI	0.9392	<0.0001
CAR	0.9283	<0.0001
CRR	0.9025	<0.0001
CSH	0.8908	<0.0001
CUF	0.8856	<0.0001
CWT	0.8969	<0.0001
D	0.7547	<0.0001
EXE	0.8506	<0.0001
HR	0.7975	<0.0001
INN	0.8557	<0.0001
MRT	0.8658	<0.0001
PMZ	0.8773	<0.0001
REF	0.9234	<0.0001
REI	0.9539	<0.0001
RMM	0.8064	<0.0001
WRK	0.8084	<0.0001

Table 4 shows the risk-adjusted performance of the equal weighted portfolio in the overall period and in the three sub-periods, as described by the performance measures based on standard, conditional and modified VaR. The excess return over VaR, the conditional Sharpe ratio and modified Sharpe ratio are computed in accordance with equations (2), (3) and (4), respectively.

Columns (2) through (4) provide the risk-adjusted performance measures for the equal-weighted portfolio over the three sub-periods. The performance of the portfolio in the first two sub-periods is positive whereas the performance in the last sub-period is negative. Moreover, in the recession period, whose results are provided in column (3), the portfolio exhibits a better performance than in the expansion periods, whose results are provided in columns (2) and (4).

The findings are consistent with previous research, although the performance in the first expansion period from March 24, 2006 to May 30, 2007 is more close to that in the recession period from June 1, 2007 to June 30 2009. Column (5) shows that the performance over the overall period March 24, 2006 through March 5, 2012 is negative on the basis of all three measures.

6.2. Risk-adjusted performance measures

Table 4

Risk adjusted-performance of the equal weighted portfolio in the overall period and in the three sub-periods

Performance measures (1)	Expansion 1 (2)	Recession (3)	Expansion 2 (4)	The overall period (5)
Excess return over VaR	0.0124	0.0276	-0.2395	-0.0545
Conditional Sharpe ratio	0.0089	0.0178	-0.1644	-0.0321
Modified Sharpe ratio	0.0111	0.0209	-0.1840	-0.0345

Table 5 and Table 6 provide the results on the risk-adjusted performance of the groups using performance measures based on VaR, CvaR and MVaR. The Canadian REIT mutual funds are classified into nine groups, diversified, hospitality, industrial, multi-residential, office, medical office, private, retail and retirement REITs.

Table 5 shows the risk-adjusted performance of the different groups of mutual funds classified on the basis of property type in the overall period. It is clearly seen that multi-residential REITS have relatively higher risk-adjusted performance with -0.0276 of excess return over VaR while hospitality REITS possess the lowest performance with -0.0341 of excess return over VaR. However, when we consider the conditional Sharpe ratio and modified Sharpe ratio to rank the groups, office and diversified REITs are ranked the highest (-0.0176) on the basis of the conditional Sharpe ratio and the highest (-0.0221) on the basis of the modified Sharpe ratio respectively. Overall, over the entire period, there are identical but negative risk-adjusted performances among the six groups.

Table 5

Risk-adjusted performance in the overall period of different groups of mutual funds classified on the basis of property type

Group	Overall period		
	Excess return over VaR	Conditional Sharpe ratio	Modified Sharpe ratio
diversified	-0.0315	-0.0195	-0.0221
hospitality	-0.0341	-0.0226	-0.0267
multi-residential	-0.0276	-0.0192	-0.0246
office	-0.0302	-0.0176	-0.0237
retail	-0.0334	-0.0217	-0.0255
retirement	-0.0313	-0.0189	-0.0223

Table 6 shows the risk-adjusted performance of different groups of mutual funds grouped by property type in the three sub-periods. Columns (1), (4) and (7) show the results for the ratio of the excess return over VaR (ERVAR). Columns (2), (5) and (8) show the results for the conditional Sharpe ratio (CSR). Columns (3), (6) and (8) show the results for the modified Sharpe ratio (MSR). It is observed that for the six groups, in the recession period (June 1, 2007 to June 30 2009), except for hospitality REITs, all the other five groups have positive performance. On the other hand, in the first expansion period (March 24, 2006 to May 30, 2007) except for the hospitality and retail groups, the remaining four groups have positive performance; while in the second expansion period (July 2, 2009 to March 5 2012), all the groups exhibit negative performance.

Table 6

Risk-adjusted performance in the three sub-periods of different groups of mutual funds classified on the basis of property type

Group	Expansion 1			Recession			Expansion 2		
	ERVAR	CSR	MSR	ERVAR	CSR	MSR	ERVAR	CSR	MSR
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
diversified	0.0086	0.0060	0.0080	0.0200	0.0133	0.0171	-0.1385	-0.1023	-0.1309
hospitality	-0.0017	-0.0013	-0.0016	-0.0004	-0.0003	-0.0004	-0.0905	-0.0628	-0.0711
multi-residential	0.0411	0.0298	0.0381	0.0292	0.0213	0.0285	-0.1487	-0.1110	-0.1476
office	0.0091	0.0068	0.0091	0.0250	0.0176	0.0233	-0.1558	-0.1141	-0.1361
retail	-0.0059	-0.0039	-0.0054	0.0186	0.0126	0.0165	-0.1427	-0.1077	-0.1332
retirement	0.0031	-0.0737	0.0026	0.0050	0.0032	0.0042	-0.0984	-0.0669	-0.0623

Table 7 shows the risk-adjusted performance measures for the individual mutual funds. In the overall period, all the funds (100%) exhibit negative performance. From the three performance measures, it is found that BEI mutual fund‘s performance is the highest while CUF’s is the lowest although all performance measures are negative.

Table 7

Risk-adjusted performance of individual mutual funds in the overall period

The overall period	Excess return based on VaR	Conditional Sharpe ratio	Modified Sharpe ratio
CUF	-0.0409	-0.0288	-0.0328
REI	-0.0378	-0.0260	-0.0318
CWT	-0.0376	-0.0253	-0.0284

CRR	-0.0355	-0.0206	-0.0268
CAR	-0.0348	-0.0244	-0.0328
INN	-0.0341	-0.0226	-0.0267
REF	-0.0331	-0.0216	-0.0283
WRK	-0.0329	-0.0205	-0.0206
PMZ	-0.0326	-0.0220	-0.0282
CSH	-0.0321	-0.0197	-0.0239
EXE	-0.0305	-0.0180	-0.0207
AP	-0.0302	-0.0176	-0.0237
D	-0.0300	-0.0162	-0.0165
AX	-0.0293	-0.0167	-0.0197
MRT	-0.0283	-0.0170	-0.0204
HR	-0.0256	-0.0157	-0.0167
RMM	-0.0237	-0.0144	-0.0125
BEI	-0.0204	-0.0140	-0.0164

Table 8 shows the risk-adjusted performance of the individual mutual funds over the different sub-periods. The results indicate that except for INN REIT, all the mutual funds have positive performance over the recessionary period while in the first expansionary period, eight of the funds (44.44%) exhibit negative performance while the rest exhibit positive performance. In the second expansionary period, all funds exhibit negative performance.

Table 8

Risk-adjusted performance of individual mutual funds in the three sub-periods

	Excess return based on VaR			Conditional Sharpe ratio			Modified Sharpe ratio		
	Expansion 1	Recession	Expansion2	Expansion 1	Recession	Expansion2	Expansion1	Recession	Expansion2

AP	0.0091	0.0250	-0.1558	0.0068	0.0176	-0.1141	0.0091	0.0233	-0.1361
AX	0.0116	0.0132	-0.1268	0.0088	0.0084	-0.0829	0.0112	0.0110	-0.0982
BEI	0.0711	0.0310	-0.1435	0.0525	0.0203	-0.1114	0.0673	0.0267	-0.1427
CAR	0.0112	0.0274	-0.1539	0.0071	0.0224	-0.1106	0.0088	0.0304	-0.1526
CRR	0.0190	0.0225	-0.1767	0.0139	0.0150	-0.1425	0.0177	0.0188	-0.1800
CSH	-0.0056	0.0042	-0.1025	-0.1535	0.0028	-0.0715	-0.0052	0.0037	-0.0657
CUF	0.0014	0.0308	-0.1761	0.0011	0.0219	-0.1290	0.0017	0.0286	-0.1603
CWT	-0.0208	0.0138	-0.1431	-0.0152	0.0083	-0.0975	-0.0204	0.0121	-0.1341
D	0.0391	0.0067	-0.1316	0.0273	0.0042	-0.1005	0.0373	0.0047	-0.1272
EXE	0.0118	0.0058	-0.0943	0.0062	0.0035	-0.0623	0.0104	0.0047	-0.0589
HR	-0.0062	0.0130	-0.1203	-0.0046	0.0085	-0.0965	-0.0061	0.0110	-0.1307
INN	-0.0017	-0.0004	-0.0905	-0.0013	-0.0003	-0.0628	-0.0016	-0.0004	-0.0711
MRT	0.0193	0.0254	-0.1428	0.0115	0.0175	-0.1039	0.0142	0.0213	-0.1292
PMZ	-0.0069	0.0241	-0.1471	-0.0043	0.0176	-0.1134	-0.0063	0.0249	-0.1355
REF	0.0147	0.0390	-0.1716	0.0114	0.0256	-0.1368	0.0153	0.0352	-0.1681
REI	-0.0002	0.0224	-0.1653	-0.0002	0.0157	-0.1292	-0.0002	0.0204	-0.1549
RMM	-0.0204	0.0104	-0.0814	-0.0138	0.0061	-0.0560	-0.0176	0.0064	-0.0615
WRK	-0.0199	0.0118	-0.1004	-0.0138	0.0067	-0.0667	-0.0172	0.0075	-0.1025

6.3. Markov regime switching TM model

Table 9 shows the results of the estimation of the parameters using the time varying transition probability model. As noted, I use the VIX index as a state variable on which to base the time varying regime switching coefficients. The higher the VIX or VIXC index, the more volatile is the stock market. c1, d1, c2 and d2 in the table are the coefficients of the logistic function (13) and are estimated to indicate the economic state of Canada over the full periods. Table 9 shows that c1 and d1 are positive whereas c2 and d2 are negative. When these parameters are used to estimate the time varying transition probabilities using the logistic function (equation (13)), it is found that the probability of staying in state one (c1, d1>0) increases as the VIX (z_{t-1}) index increases. Thus state one is identified as the down market. Conversely, state two is regarded as the up market because the probability of staying in state two decreases as the VIX increases. Therefore, in the corresponding regime switching model, state one is a recessionary period while state two is an expansionary period.

Table 9

Parameters estimated for the time varying transition probability model

Parameter	Parameter estimate	Standard error	t-statistic
c1	33.0965	7.4188	4.4611***
c2	-20.1092	5.0106	(-4.0133)***
d1	9.4836	4.2533	2.2297**
d2	-4.7104	2.7899	(-1.6884)*

"*", "**" and "***" represent the 10%, 5% and 1% significance level respectively.

Table 10 shows all the coefficients of the Markov regime switching TM model based on both fixed transition probability (FTP) and time varying transition probability (TVTP). The second and the fourth rows represent the coefficients of the regime switching TM model; the third and the fifth rows represent the t-statistics associated with the coefficients.

The results for the FTP model indicate that state-dependent alphas in columns (1) and (2) are not statistically significant in either state, but the betas in both states in columns (3) and (4) are significant, indicating the strong dependence of the return on the funds with the market as a whole. Gammas in both states in columns (5) and (6) are negative and statistically significant at the 1% confidence level, demonstrating that Canadian REIT mutual fund managers do not possess market timing ability. In addition, it is noted that the state-dependent variance of the distribution of the residuals from the fixed transition probability TM model in columns (7) and (8) are significant at the 1% confidence level, indicating the striking difference between residual distributions in different regimes. The last two columns provide the fixed transition probabilities. The transition probability from state one in the previous period to state one in the current period is 99.62% while the transition probability from state one in the previous period to state two in the current period is 1.72%.

The results for the TVTP model are similar to those of the FTP model, even when the VIX state variable is taken into account. In state one, the gamma in column (5) is -0.0898 and statistically significant at the 1% confidence level while in state two, gamma in column (6) is -0.0452 and statistically significant at the 10% confidence level. Thus, the timing ability is more negative in the recessionary than in the expansionary period.

Table 10

Parameters estimated for the equal weighted portfolio using FTP and TVTP in the overall period

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	α1	α2	β1	β2	γ1	γ2	σ1	σ2	P(1,1)	P(1,2)
FTP	2.17E-04	1.17E-03	0.965	0.9838	**-0.0855**	**-0.0461**	6.51E-05	3.40E-04	0.9962	0.0172
	0.8909	0.9334	201.5549***	119.4044***	-3.5756***	-2.3707***	24.7801***	14.9397***	564.2844***	2.2728**
TVTP	0.0002	0.0014	0.9625	0.9859	**-0.0898**	**-0.0453**	0.0000	0.0004		
	0.9142	0.8363	192.7718***	96.1370***	-3.9624***	-1.7959*	25.3728***	10.2243***		

"*", "**" and "***" represent the 10%, 5% and 1% significance level respectively.

Table11 shows the results on the timing ability of the individual funds using the TVTP model. The gammas in columns (5) and (6) indicate that in state one, the fund managers of AX, CRR, CUF, EXE, HR, REF, RMM, WRK (44.44%) exhibit significantly negative timing ability; in state two, fund managers of BEI, CAR, D, MRT and REI (27.78%) demonstrate significantly negative timing ability. However, when we compare them in terms of significance level, we note that overall there are more mutual funds with significantly negative timing ability in the recessionary period than in the expansionary period. In addition, insignificant alphas for all the mutual funds in columns (1) and (2) indicate a lack of selectivity ability of fund managers.

Table 11

Parameters estimated for individual mutual funds using time varying transition probabilities in the overall period

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	α1	α2	β1	β2	γ1	γ2	σ1	σ2
AP	0.0003	0.0017	0.9721	0.9908	**-0.0363**	**-0.0518**	0.0002	0.0019
	0.7979	0.3977	137.2291***	32.0374***	-1.3446	-0.6332	25.6469***	8.6729***
AX	0.0002	0.0021	0.9604	0.9531	**-0.0959**	**-0.0338**	0.0002	0.0017

	0.5169	0.6517	142.7372***	41.2146***	(4.5032)***	-0.4134	23.0590***	12.8674***
BEI	0.0004	0.0043	0.9721	0.9810	**-0.0328**	**-0.1697**	0.0002	0.0009
	0.9123	1.9290*	145.0126***	60.5875***	-1.2590	(4.0547)***	20.4696***	10.1114***
CAR	0.0002	0.0027	0.9701	0.0027	**-0.0423**	**-0.0997**	0.0002	0.0010
	0.3995	1.0395	119.5860***	44.6299***	(1.7071)*	(2.8369)***	22.2663***	7.8674***
CRR	0.0003	0.0018	0.9620	0.9767	**-0.0811**	**-0.0717**	0.0002	0.0014
	0.8507	0.6391	146.7404***	35.8656***	(4.4426)***	-0.9557	22.6495***	11.2751***
CSH	-0.0002	0.0004	0.9765	0.9493	**0.0106**	**-0.0334**	0.0002	0.0025
	-0.4379	0.0932	112.6121***	33.9202***	0.2883	-0.5220	24.6103***	9.0569***
CUF	0.0003	0.0006	0.9494	0.9688	**-0.1592**	**-0.0072**	0.0001	0.0010
	0.9816	0.2392	118.3271***	49.6554***	(4.4053)***	-0.1881	27.1624***	11.0583***
CWT	-0.0001	0.0009	0.9729	0.9933	**-0.0478**	**-0.0269**	0.0001	0.0008
	-0.1450	0.5105	114.7235***	67.7834***	-1.5136	-1.1085	21.6095***	17.8850***
D	0.0002	0.0039	0.9646	0.9641	**-0.0353**	-0.1541	0.0001	0.0022
	0.6039	0.9773	166.6254***	33.7159***	-1.2679	(1.7779)*	24.4437***	11.7448***
EXE	-0.0006	0.0014	0.9636	0.9907	**-0.0769**	**0.0480**	0.0002	0.0019
	-1.2593	0.5474	96.8385***	36.7822***	(2.5358)**	0.7396	17.4709***	16.3431***
HR	0.0003	0.0019	0.9563	0.9983	**-0.1370**	**-0.0028**	0.0002	0.0024
	0.7606	0.4229	150.0877***	31.1666***	(7.9948)***	-0.0296	26.0704***	14.3811***
INN	-0.0006	0.0022	0.9668	1.0079	**-0.0279**	**-0.0988**	0.0002	0.0023
	-1.3765	0.6335	125.7293***	33.8005***	-0.8901	-1.1987	21.5147***	15.4023***
MRT	0.0003	0.0017	0.9926	1.0150	**-0.0069**	**-0.0867**	0.0002	0.0017
	0.6904	0.5492	125.8780***	47.5491***	-0.1934	(1.8232)*	24.7209***	12.2945***
PMZ	0.0001	0.0014	0.9693	1.0055	**-0.0357**	**-0.0284**	0.0002	0.0011
	0.1627	0.5543	110.8313***	59.9264***	-1.4933	-0.4307	22.8282***	11.0199***
REF	0.0003	0.0014	0.9678	1.0057	**-0.0485**	**-0.0314**	0.0002	0.0010
	0.8914	0.5513	148.4740***	36.5894***	(2.1189)**	-0.6347	23.1361***	9.4721***
REI	0.0003	0.0004	0.9767	0.9848	**-0.0096**	**-0.0981**	0.0002	0.0011
	0.8643	0.1582	136.3637***	48.0746***	-0.2842	(2.6713)***	21.6766***	12.1685***
RMM	-0.0001	0.0021	0.9514	0.9835	**-0.1679**	**0.0344**	0.0002	0.0026

	-0.1697	0.5705	103.3385***	49.4371***	(4.3951)***	0.8979	23.2349***	16.2636***
WRK	0.0000	0.0016	0.9550	0.9865	**-0.2104**	**0.0580**	0.0001	0.0011
	0.0122	0.7789	121.4610***	48.7080***	(9.4798)***	0.9813	19.4640***	20.6789***

"*", "**" and "***" represent the 10%, 5% and 1% significance level respectively.

Table12 provides the result on the timing ability of the different groups of mutual funds based on the types of property held. According to columns (5) and (6), overall, the fund managers exhibit negative timing ability or mistiming skills. Specifically, no timing ability is exhibited by the office and hospitality REITs; diversified and retail REITs show markedly negative timing ability only in the recessionary period; multi-residential and retirement REITs possess significantly negative timing ability in both recessionary and expansionary periods.

Table 12

Parameters estimated to determine timing ability of different groups of mutual funds

	(1) α1	(2) α2	(3) β1	(4) β2	(5) γ1	(6) γ2	(7) σ1	(8) σ2
office	0.0003	0.0017	0.9721	0.9908	**-0.0360**	**-0.0518**	0.0002	0.0019
	0.7979	0.3977	137.2291***	32.0374***	-1.3450	-0.6332	25.6469***	8.6729***
hospitality	-0.0006	0.0022	0.9668	1.0079	**-0.0280**	**-0.0988**	0.0002	0.0023
	-1.3765	0.6335	125.7293***	33.8005***	-0.8900	-1.1987	21.5147***	15.4023***
diversified	0.0004	0.0011	0.9601	0.9864	**-0.1130**	**-0.0390**	0.0001	0.0006
	1.5088	0.5687	181.6326***	75.5286	(4.4693)***	-1.3023	27.6708***	12.0632***
retail	0.0001	0.0015	0.9694	0.9869	**-0.0550**	**-0.0443**	0.0001	0.0005
	0.2773	0.8954	172.1336***	87.8086***	(2.4571)**	(-1.24796)	21.9901***	11.4517***

Multi-residential	0.0004	0.0045	0.9694	0.9822	**-0.0490**	**-0.1510**	0.0001	0.0008
	1.0985	1.6721*	153.8948***	54.3914***	(2.1519)**	(4.12849)***	22.3530***	7.5537***
retirement	-0.0001	-0.0008	0.9490	0.9904	**-0.1020**	**-0.1399**	0.0001	0.0010
	-0.2769	-0.3718	165.0244***	47.4654***	(7.0534)***	2.04088**	17.6476***	12.3132***

"*", "**" and "***" represent the 10%, 5% and 1% significance level respectively.

7. Conclusion

Since the financial crisis exploded in 2006, the global stock market has been characterized by high variability, causing investors' concern for the global economic future and raising the question of when the downturn will conclude. Among the industries affected by the financial crisis, real estate is one of the most severely hit, because the subprime crisis, which originated in the U. S., spread across the world. However, different countries may be impacted to different extents.

In the thesis, I focus on the Canadian real estate market, specifically, Canadian Real estate Investment Trusts, which include closed end mutual funds specializing in real estate, to investigate their performance and the market timing skills of fund managers.

I obtain daily returns from 34 Canadian REIT mutual funds from March 24, 2006 to March 5, 2012. Based on OECD indicators, the overall period is classified into one recessionary and two separate expansionary periods in Canada. However, due to incomplete data or not a long enough period of existence for some of the mutual funds, the final sample consists of 18 funds. I also use the daily returns on the 18 mutual funds to estimate the daily return on an equal weighted portfolio of the funds, followed by the analysis of the performance of both the portfolio as well as of the individual funds.

I use two different performance methods to examine the performance of the Canadian REIT mutual funds. Firstly, I apply risk-adjusted performance measures based on standard, conditional and modified VaR (Eling, 2008) to examine the performance of the mutual funds. I find that in the first expansionary period and in the recessionary period, the equal weighted portfolio of the REIT mutual funds has a positive performance, while individual mutual funds and the equal weighted portfolio exhibit a negative performance in the second expansionary period. This is consistent with previous research which shows that mutual funds tend to have better performance in downturns than in upturns.

However, for the first expansionary period, the performance is much more close to that in the recessionary period, in contrast to what is suggested in previous papers. Although the first sub-period is considered as an expansionary period in Canada based on the OECD indicator, it is possible that the period could be regarded as a recessionary period because of the effect of external factors that may influence the Canadian stock market. Moreover, the third sub-period could be defined as a period of recovery across the world, including Canada. This explanation could support our conclusion that mutual funds should have better performance in recessionary periods than in expansionary periods.

The individual mutual funds are also examined and further classified into groups based on the types of property investments. The results suggest that all groups, excepting for the hospitality type, as well as all individual mutual funds, excepting for the INN mutual fund, perform positively in the recessionary period and negatively in the second expansionary period. Among the individual mutual funds, BEI mutual fund's performance is the highest while CUF's is the lowest.

Secondly, a Markov regime switching TM model (Qiu, Faff & Benson, 2011) is used to investigate the timing skills of Canadian REIT mutual fund managers. I use not only fixed transition probabilities, but also time varying transition probabilities based on the logistic distribution function (Filardo, 1994), while considering VIX as a state variable. The results indicate that Canadian REIT mutual funds managers do not exhibit any timing ability over the whole business cycle. Particularly in the case of the time varying transition probabilities model, it is evident that there is significantly more negative timing in the recessionary period than in the expansionary periods, although these mutual funds have better performance in the recessionary period, both for the groups and the individual mutual funds.

In future research, we can further extend the analysis to other countries, since REITs have spread globally, especially in Asian regions such as India, and the Philippines. Secondly, areas which deserve further investigation are the reasons that hospitality mutual funds underperform over the business cycle and that negative timing ability of fund managers is much more significant in the recessionary period than expansions. Finally, while I only consider the timing ability of fund managers, in the future, we could extend the research to examine the timing ability of mutual fund investors.

8. References

Barras, L. (2010). False discoveries in mutual fund performance: Measuring luck in estimated alphas. *Journal of Finance*, 65(1), 179-230.

Bond, A. S. & Mitchell, P. (2010). Alpha and persistence in real estate fund performance. *The Journal of Real Estate Finance and Economics,* 41, 53-79.

Buttimer, R.J., Chen, J. and Chiang, I. E. (2012). REIT performance and market timing ability. *Managerial Finance*, 38(3), 1-49.

Chen, L., Adams, A. and Taffler, R. (2010). What style-timing skills do mutual fund "stars" possess? *Working pape*r, 1-45.

Cici, G., Cprgel, J. and Gibson, S. (2011). Can fund managers select outperforming REITs? Examining fund holding and trades. *Real Estate Economics*, 39 (30), 455-486.

Cotter, J. and Roll, R. (2011). A comparative anatomy of REITs and residential real estate indexes: returns, risks and distributional characteristics. *Working paper*, 1-45.

Cuthbertson, K., Nitzsche, D. and O'Sullivan, N. (2012). The market timing ability of UK mutual funds. Journal of Business*, Finance and Accounting*, 37(1), 270-289.

Derwall, J., Huij, J., Brounen, D. and Marquering, W. (2009). REIT momentum and the performance of real estate mutual funds*. Financial Analysts Journal*, 65(5), 1-11.

Diebold, F.X., Lee, J.H. and Weinbach, G.C. (1994). Regime switching with time-varying transition probabilities*. Oxford University Press*, 283-302.

Eichholtz, P., Kok, N. and Margaritova, M. (2009). Investment style and performance in the global real estate mutual fund market. *Working paper*, 1-28.

Eling, M. (2008). Does the measure matter in the mutual fund industry*? Financial Analysts Journal*, 64(3), 1-13.

Elton, E.J., Gruber, M.J. and Blake, C. R. (2011). An examination of mutual fund timing ability using monthly holding data. *Working paper*, 1-41.

Favre, L. (2002). Mean-modified value-at-risk optimization with hedge funds. *Journal of Alternative Investments*, 5(2), 11-31.

Ferruz, L., Munoz, F. and Vargas, M. (2010). Correcting the Merton and Henriksson timing model. *Applied Economics Letters*, 17, 1183-1187.

Filardo, A.J. (1994). Business-cycle phases and their transitional dynamics. *Journal of Business and Economic Statistics*, 12(3), 299-308.

Friesen, G.C. and Sapp, T. (2007). Mutual fund flows and investor returns: an empirical examination of fund investor timing ability. *Journal of Banking and Finance*, 31, 2796-2816,

Glode, V. (2011). Why mutual funds "underperform". *Journal of Financial Economics*, 99, 526-559.

Gregoriou, G.N.& Gueyie, J.P. (2003). Risk-adjusted performance of funds of hedge funds using a modified sharpe ratio*. The Journal of Wealth Management*, 77-83.

Hamilton, J. D. (1994*). Time Series Analysis*. Princeton: Princeton University Press.

Hartzell, J. C., Muhlhofer, T. and Titman, S. (2010). Alternative benchmarks for evaluating mutual fund performance*. Real Estate Economics*, 38(1),121-154.

Hartzell, J., Sun, L. and Titman, S. (2009). Diversification, Corporate Governance and Firm Performance in Real Estate Investment Trusts. *Working papers*, 1-32.

Henriksson, RD. And Merton, RC. (1981). On market timing and investment performance-statistical procedures for evaluating forecasting skills. *Journal of Business Chicago*, 54(4), 513-533.

Hochberg, Y.V. and Muhlhofer, T. (2011). Market timing and investment selection: evidence from real estate investors. *Working paper*, 1-62.

Layfield, L. And Stevenson, S. (2011). Separating skill from luck in REIT mutual funds. *Working paper*, 1-33/

Lee, C., Lee, A.C. and Liu, N. (2010). Alternative model to evaluate selectivity and timing performance of mutual fund managers: theory and evidence. *Handbook of Portfolio Construction: Contemporary Applications of Markowitz Techniques*, 583-599.

Jiang, G.G., Yao, T. and Yu, T. (2007). Do mutual funds time the market? Evidence from portfolio holdings. *Journal of Financial Economics*, 86, 724-758.

Jagannathan, R and Korajczyk, R.A. (2011). Assessing the market timing performance of managed portfolios*. Working paper*, 1-18.

Jensen, M.C. (1968). The performance of mutual fund in the period 1945-1964. *Journal of Finance*, 23,389-416.

Kacperczyk, M., Nieuwerburgh, S.V. and Veldkamp, L. (2011). Time-varying fund manager skill. *Working paper*, 1-46.

Kaushik, A., Pennathur, A. and Barnhart, S. (2010). Market timing and the determinants of performance of sector funds over the business cycle. *Managerial Finance*, 36 (7), 583-602.

Kosowski, R. (2006). Do mutual funds perform when it matters most to investors? US mutual fund performance and risk in recessions and expansions. *Working papers*, 1-53.

Lin, C.Y. and Yung, K. (2004). Real estate mutual funds: performance and persistence. *Journal of Real Estate Research*, 26(1), 69-93.

Ling, D.C. & Naranjo, A. (2006). Dedicated REIT mutual fund flows and REIT performance. *The Journal of Real Estate Finance Economics*, 32, 409-433.

Lizieri, C., Satchell, S. and Zhang, Q. (2007). The underlying return-generating factors for REIT returns: an application of independent component analysis. *Real Estate Economics*, 35 (4), 569-598.

Lynch, A.W., Wachter, J. A. and Boudry, W. (2003). Does mutual fund performance vary over the business cycle. *Working papers*, 1-22.

Martinez, A. (2011). Liquid real estate investment funds in Latin America: analysis of worldwide best practices and portfolio proposal (Master thesis). *Massachusetts Institute of Technology,* Massachusetts.

Mount, T.D., Ning, Y. and Cai, X. (2006). Predicting price spikes in electricity markets using a regime-switching model with time-varying parameters. *Energy Economics*, 28, 62-80.

Muhlhofer, T. (2005). Trading constraints and the investment value of real estate investment trusts: an empirical examination (PhD thesis). London School of Economics and Political Science, London.

Nafees, B. Muhammand, S. and Khan, S. (2011). Performance evaluation of open end and closed end mutual funds in Pakistan. *African Journal of Business Management*, 5(28). 11425-11434.

Pesaran, M. H. and Timmermann, A.G. (1994). A generalization of the non-parametric Henriksson-Merton test of market timing. *Economics Letters*, 44, 1-7.

Price, R.M. (2011). REIT performance from real estate mutual fund holdings. *Journal of Business and Economics Research*, 9(12), 19-32.

Qiu, J., Faff, R. and Benson, K. (2011). Business cycles and mutual fund timing performance: an application of regime switching and Garch modelling. *Working paper*, 1-29.

Rockafellar, R.T. and Uryasev, S. (2002). Conditional value-at-risk for general loss distributions. *Journal of Banking and Finance*, 26, 1443-1471.

Sharpe, WF. (1966). Mutual fund performance. *Journal of Business Chicago*, 39(1), 119-138.

Shapiro, S. S. and Wilk, M.B. (1965). An analysis of variance test for normality (complete samples). *Biometrika*, 52(3/4), 591-611.

Sun, Z,, Wang, A. & Zheng, L. (2009). Do active funds perform better in down markets?-new evidence from cross-sectional study, *Working papers*, 1-59.

Treynor, J. (1966). Can mutual funds outguess the market. *Harvard Business Review*, 44(4), 131-136.

Yong, M.S., Lee, S.L. and Devaney, S.P. (2006). Non-normal real estate return distributions by property type in the UK. *Journal of Property Research*, 23(2), 109-133.