Do Socially Responsible Mutual Funds Outperform Non-Socially Responsible Mutual Funds under A Regime-switching Model?

by

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

ABSTRACT

In this thesis, the regime dependent mean and abnormal returns are studied to examine whether socially responsible mutual funds have a different performance from traditional mutual funds, since there may be different patterns in the economy. Five economic factors - stock returns, treasury yield spread, credit spread, economic confidence and building permits - are used to identify the market regimes, which are determined as bear and bull markets. The regime-dependent abnormal returns are calculated with a regime-switching Fama & French three factor asset-pricing model. The empirical results show that socially responsible mutual funds have statistically higher mean return than non-socially responsible mutual funds in both bear and bull markets. However, using the measurement of the abnormal returns, socially responsible mutual funds statistically underperform non-socially responsible mutual funds in bull market, while the performance of the two types of funds are not statistically differentiable in the bear market.

LIST OF ABBREVIATIONS USED

AIC	Akaike Information Criteria
APD	Accuracy of Predicting Direction
BE	Book Equity
BIC	Bayesian Information Criteria
BP	Building Permits
CC	Index of Consumer Confidence
CLI	Composite Index of Eleven Leading Indicators
CRSP	Board of Canadian Registered Safety Professionals
CS	Credit Spread
DFI	CLI's Diffusion Index
EM	Expectation Maximization
GDP	Gross Domestic Product
HML	High Minus Low
HQC	Hannan-Quinn Information Criteria
JB	Jarque-Bera
L	Likelihood Function
ME	Market Equity
MF	Market Factor
NBER	National Bureau of Economic Research
RMSE	Root Mean Square Errors
SPR	S&P 500
SMB	Small Minus Big
TYS	Treasury Yield Spread
VAR	Vector Auto-regressive

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CHAPTER 1 INTRODUCTION

During the past decade, socially responsible mutual funds have grown faster than traditional mutual funds. Managers of ethical mutual funds believe that they can make a meaningful remarkable long-term profit by selecting securities according to a set of negative and positive ethical screening.

1.1 LITERATURE REVIEW OF SOCIALLY RESPONSIBLE MUTUAL FUND PERFORMANCE

The rapid growth of the socially responsible investment brings up a question of whether or not socially responsible mutual funds can earn similar returns to or outperform conventional mutual funds. According to Markowitz (1952), a portfolio should be diversified across industries. However, investing with socially responsible criteria may lack sufficient diversification, which may result in underperformance when compared with the conventional mutual fund over the long term. In addition, carrying out various ethical screenings on mutual funds may weaken fund managers' incentive to pursue high risk-adjusted excess returns. Some studies support the above viewpoint (Renneboog et al. 2008a; Geczy 2005; Rudd 1981). Rudd (1981) argues that socially responsible mutual funds constrain the type of industry, product and other characteristics of the portfolio, which may result in deterioration in long-run performance. Rennegoog et al. (2008a) report that socially responsible mutual funds underperform the domestic conventional mutual funds in the US, the UK and in many European and Asia-Pacific countries by 2.2% to 6.5%.

As suggested by Alexander and Bucholz (1978) and Moskowitz (1972), socially responsible mutual funds may attract investors by requiring managers' requisite skills to run a superior company. As a result, socially responsible mutual funds might be more profitable than non-socially responsible mutual funds. In support of the above argument Mallin (1995) calculates the risk-adjusted Jensen's alpha of ethical trusts and non-ethical trusts and concludes that ethical trusts tend to outperform the non-ethical trusts.

Meanwhile, some authors argue that the abnormal returns between socially responsible mutual funds and non-socially responsible mutual funds are not statistically different from each other. By examining US data Bello (2005), Goldreyer et al. (1999), and Hamilton et al. (1993) argue that there is no statistically significant difference of abnormal returns between socially and non-socially responsible investments. For example, Hamilton (1993) applies Jensen's alpha to measure the risk-adjusted excess return of socially responsible mutual funds and concludes that these funds do not outperform non-socially responsible mutual funds. In other words, the results indicate that the market does not take the characteristics of social responsibility into price determination. For UK investment portfolios, Gregory et al (1997) and Luther et al. (1992) show that the difference in performance between socially and non-socially responsible mutual funds is not statistically significant. Some international studies also support the above argument. For example, Bauer, R., Otten, R. & Rad, A. (2006) study the Australian ethical mutual funds relative to the Australian traditional mutual fund by applying the four-factor Carhart model, finding that the difference in returns on socially responsible and traditional mutual funds is not statistically significant for the period of 1992 to 2003.

Another issue is how to construct the conventional mutual funds since the characteristics - size, fund turnover, inception date, etc. - of mutual funds may have an effect on their performance. This issue has been addressed by many studies. Mallin et al (1995) form the conventional mutual fund by matching the fund size and the inception date and find that socially responsible mutual funds tend to outperform the matched non-socially responsible mutual fund. On the other hand, by matching the net assets between socially responsible mutual funds and randomly selected conventional fund, Bello (2004) finds that the difference of the abnormal returns between socially and non-socially responsible mutual funds is not statistically significant during the period 1994 to March 2001.

1.2 REGIME-SWITCHING FRAMEWORK

In the above-mentioned research, the performance of socially responsible fund is measured based on the single regime model in the sense that these models limit the analysis to the average return performance. However, the early bearish periods in 1990s and the recent financial crisis have reminded us of cyclical pattern in financial markets. Table 1.1 illustrates the degree of bullishness, neutrality and bearishness from TIM Group. As one can see from this table, published on October 28, 2013, currently, the market is most probabily in the neutral sentiment.

The existing literature has examined the regimes of the business cycle (Hamilton, 1989) and the effects of government policy changes on the economy (Sims and Zha, 2006). Different approaches have been applied to identify the turning points of a business cycle or the timing of abrupt breaks in observed time series. As suggested by Bry and

Boschan (1971), the dating algorithm, based on a set of rules for classification can be used to identify the turning points or abrupt breaks. However, turning points of the business cycle can only be identified after they occur; therefore, the ex-post-dating methods cannot be used to forecast the future turning points or to investigate the statistical inference on assets returns. Mamaysky et al. (2004) propose a Kalman Filter Model incorporating a latent variable, which governs the parameters in the time series framework. Their research finds that the overall fitness of this model is no better than the traditional OLS model. The drawback of the OLS model is that the dummy variable, which represents the unobservable state, is unable to assign a state probability on the continuous interval.

An alternative approach to modelling the bearishness and bullishness of the economy is suggested by Hamilton (1989). He proposes that the underlying but unobservable states of financial markets, which determine the changes of real GDP in various economic phases, can be uncovered from historical GDP data by fitting two different auto-regressions into the real GDP, with the transition between the two distinct economic phases governed by a first-order Markov process. By assuming the existence of the unobservable states of the economy, both the mean of industrial production growth and the scale of stock volatility can be determined. Hamilton and Lin (1996) apply a bivariate model in which the underlying and unobservable states drive both the changes of monthly stock return and the real output. They conclude that economic bearish periods have a significant economic effect on the fluctuation of stock return. Moreover, the regime-switching model can forecast future states of the economy since part or all of the parameters in the model are governed by the latent state.

Early studies have also addressed that mutual funds' returns are more likely generated by a mixture of two or more regression equations rather than by a standard linear model, as suggested by Kon and Jen (1979). Miller and Gressis (1980) also argue that some mutual funds have non-stationary risk-return relationships since well-managed mutual funds should change their betas in accordance with their forecasts of general market movements. Billio, Getmansky and Pelizzon (2006) approve Gressis's idea and argue that the exposure of hedge fund to risk factors could be very low in the normal state of the market. However, the exposure to S&P 500 and other risk factors may change significantly as soon as the market risk factor captured by S&P 500 moves to a down-market state characterized with negative returns and high volatilities. As stated by Kosowski (2006), ignoring the correlation in performance time-variation across fund questions the ability of traditional linear factor models to fully explain cross-sectional fund returns. Moskowitz (2000) notes that examination of the unconditional performance of mutual funds may not properly answer the question of how mutual funds perform under the NBER classifications of bearish and bullish periods and argues that mutual funds provide higher performance in bearish than in bullish periods. However, the use of pre-defined NBER bearish dates is a serious weakness of the Moskowtiz study, since the more accurate states can be determined by the financial data using the Markov-switching model, as proposed by Billio, et al (2006). Moreover, the NBER classification is a backward looking and cannot be used predictively.

To the best of my knowledge, there has been no empirical work, using the regime-switching methodology, to measure the financial performance of socially responsible mutual funds. Since there may be different patterns in the financial market, this thesis

analyzes the difference between the performances of socially and non-socially responsible mutual funds, using the regime-switching risk-adjusted measures such as the regime-switching Jensen's alpha. The remainder of this thesis is organized as follows. Section 2 introduces the regime-switching autoregressive model and the regime-switching asset-pricing model employed in this thesis. The next section describes the data employed in this study. Section 4 provides the empirical results. Concluding comments are given in section 5.

CHAPTER 2 METHODOLOGY

The US business cycle of bearish and bullish dates from the National Bureau of Economic Research (NBER) is shown in Table 2.1. According to NBER, a bearish period is a significant decline in economic activities - real GDP, real income, employment, industrial production and wholesale-real sales - lasting more than a few months. In contrast, a continuous rise in these variables in the economy is determined to be a bullish period. As Table 2.1 illustrates, there are, on average, 33 business cycles during the period from 1854 to 2009. In these 33 business cycles, the average duration for bearish period is 17.5 months, while the average duration for bullish periods is 38.7 months. It appears that the economy may follow a pattern for some time before it moves to another pattern or another regime and the bullish periods seem to be more persistent than the bearish periods. Unexpected events such as abrupt changes in government policy or monetary policy may cause the dramatic changes of GDP, real income, etc., which may result in different economic patterns.

2.1 REGIME-SWITCHING VECTOR AUTO-REGRESSIVE MODEL

To take into account the effects of events such as financial crises, or abrupt changes in government policy, Jeanne and Masson (2000) and Sims and Zha (2004) propose a regime-switching autoregressive model to analyze the behaviour of economic indicators and to characterize the state of the economy. They assume that the financial market regimes follow a Markov chain with a finite number of regimes (K) and a constant regime transition probability matrix:

$$\mathrm{P}=\begin{bmatrix} P_{11} & \cdots & P_{1K} \\ \vdots & \ddots & \vdots \\ P_{K1} & \cdots & P_{KK} \end{bmatrix}$$

$$p_{ij}(\phi_{t-1}) = Pr\{M_t = j | M_{t-1} = i, \Omega_{t-1}\} = Pr\{M_t = j | M_{t-1} = i\}$$

$$\sum_{j=1}^{K} p_{ij} = 1 \; for \; i = 1, \ldots N,$$

where $p_{ij}(\phi_{t-1})$ is the transition probability from regime i at time t-1 to regime j at time t; ϕ_{t-1} is the information set available at time t-1 and N is the number of observation. As suggested by Guidolin (2011), time-varying transition probabilites do not improve the forecasting performance of Markov Switching Models. Furthermore, to guarantee the existence of a stationary vector of probabilities ξ, where $\xi = P'\xi$ is satisfied, and to access all possible unobservable states, we assume that the transition matrix is ergodic and irreducible. As a result, the transition probabilities in the regime-switching autoregressive model is time homogenous, ergodic and irreducible.

Let $\boldsymbol{X}_t = (X_{1t}, X_{2t} \cdots X_{nt})$ be a set of economic indicators, which can represent the sourse of the market risk. Then the economic indicators follow a first order regime-switching vector autoregressive model:

$$\boldsymbol{X}_t = \mu_{M_t} + \boldsymbol{X}_{t-1}\theta_{M_t} + \epsilon_{M_t}$$

where μ_{M_t} and θ_{M_t} are regime dependent parameters, ϵ_{M_t} is multivariate normally distributed with zero mean and covariance matrix $\sum_{M_t}^{X}$. Since a higher order Markov chain can be converted to a higher dimentional first order Markov chain , M_t is assumed to be a time homogenous and stationary first order Markov chain with K regimes. The number of estimated parameters in the autoregressive model is:

$$K[N + pN^2 + N(N+1)/2 + (K-1)],$$

where K is the number of regimes, p is the transition probability, and N is the number of observations. As suggested by Timmerm ann (2000), the Markov Switching model can characterize the patterns of volatility, skewness and kurtosis of the underlying states as a function of the transition probabilites and parameters. For example, the Markov Switching model can capture the effect on volatility caused by the differences in regime dependent means and the interaction between variances across regimes.

2.2 ESTIMATION ALGORITHM

With the autoregressive regime-switching model, the parameters of interest are estimated with the expectation maximization (EM) algorithm, proposed by Dempster et al (1997) and Hamilton (1989). In addition, Kiefer (1978) argues that the likelihood equations yields consitant, asympototically normal and asympototicallly efficient estimators.

To describe the EM algorithm, I assume that a vector of observable economic indicators **X** represented as $\mathbf{X}=(\boldsymbol{x_1}, \boldsymbol{x_2} \ldots \boldsymbol{x_N})$. Suppose that there exists a finite number of states $\mathbf{M}=(m_1, m_2 \ldots m_N)$ and that each $\boldsymbol{x_i}$ is associated with an unobserable state. Further more, we assume that the joint density function are

$$P(\mathbf{x}, \mathrm{m}|\Phi) = P(\mathrm{m}|\mathbf{x}, \Phi)P(\mathbf{x}|\Phi):$$

where $\Phi = (P, B, \pi)$ is the set of parameters, including the transition matrix of the hidden Markov chain M_t , the set of distribution parameters for the observed economic indicators by regime and the probability distribution of the regimes in the beginning period, respectively. In other words, we assume we have K component densities mixed together with mixing coefficients q_i, which are the time dependent prior probabilities. The time dependent prior probability at time t is the same as the time dependent posterior

probability at time t-1 and can be obtained by the Forward and Backword Algorithm and the Bayesian Inference using the initial prior probability distribution and transition matrix. From this density function, the likelihood function of the parameters given the data can be expressed as:

$$\mathcal{L}(\Phi|\mathbf{X},\mathbf{M}) = P(\mathbf{X},\mathbf{M}|\Phi)$$

The main purpose of the expectation maximization (EM) algorithm is to calculate the log-likelihood function, based on the iterative calculation of one step forward given the information of the last period, enabling us to forecast new parameters. The first step, which is the expectation step (E-step), is to find the expected value of the complete data log-likelihood $P(\mathbf{X},\mathbf{M}|\Phi)$ with respect to the unobservable states $\mathbf{M}$ given the observed economic indicators data and the initial parameters for the density of a mixture distributions. As Lerous (1990) points out, the consistency of the maximum likelihood estimators does not depend on the intial parameters. We assume the current initial parameters are $\Phi^i = (q_1^i, \dots q_k^i, \phi_1^i, \dots \phi_k^i)$. Given the initial parameters and the observed data $\boldsymbol{X}$, we can compute the expected vuale of the log-likelihood function:

$$\Theta\left(\Phi, \Phi^i\right) = E\left(\log p(\boldsymbol{X},\boldsymbol{M}|\Phi)\,\middle|\boldsymbol{X}, \Phi^i\right)$$

After obtaining the expected value of the log-likelihood function, the optimal parameters set Φ^{i+1} can be found by maximizing $\Theta\left(\Phi, \Phi^i\right)$ with respect to Φ. With Φ^{i+1} as the new initial value for Φ, we return to the E-step and repeat as necessary. Because of the convexity property of the log-likelihood function for regular exponential families, it is guaranteed that the algorithm converges to a local optimal solution. I also use a simulation approach to find the initialization of the model parameters to ensure the robustness in the estimation of the EM algorithm.

2.3 Optimal Number of Regimes

The determination of the number of regimes of the regime-switching vector autoregressive model is critical because of the risk of over-fitting, which may cause poor out of sample predictive performance. A number of papers rely on maximized log-likelihood function and information criteria, such as the Akaike Information Criterion (AIC), Hannan-Quinn Information Criteria (HQC) and Bayesian Information Criterion (BIC), to compare the fitness performance of different regimes models (Guidolin and Timmermann, 2006). McLachlan and Peel (2000) suggests that the BIC provides a more accurate estimation of model parameters compared to the AIC and HQC. Therefore, this thesis applies the Bayesian Information Criterion (BIC) to determine the optimal number of regimes of the regime-switching vector autoregressive model. Mathematically speaking, to find the optimal number of regimes, I will minimize BIC:

$$BIC(K) = -2\ln\big(L\big|K, \phi(K)\big) + g\big(K, \phi(K)\big)\ln(N),$$

where L is the likelihood function given the number of regimes K and the set of parameters, $\varphi(K) = \{\mu_{M_t}, \theta_{M_t}, \Sigma_{M_t}, p_{ij}\}$; $g\big(K, \varphi(K)\big)$ stands for the number of estimated parameters given the number of regimes K; N is the number of observed data.

2.4 An Econometric Pricing Model with Regime-switching

The capital asset-pricing model is a typical traditional asset-pricing model is, which only contains the overall market factor. A Fama-French three factor asset-pricing model (1993), contains three stock market factors: the overall market factor, the factor related to firm size, and the factor related to firm book-to-market value. The traditional asset-pricing model assumes that asset returns are linearly related to these factors. In other

words, it assumes that asset returns are normally distributed. Combining the traditional asset-pricing model with the regime-switching autoregressive model, I specify the following regime dependent asset-pricing model:

$$r_t = \alpha_{M_t} + \beta_{M_t} F_t + e_{M_t}$$

Here r_t is the vector of asset returns at time t in excess of T-bill return, F_t is a vector of economic factors at time t, α_{M_t} and β_{M_t} are regime dependent parameters, and e_{M_t} is multivariate normally distributed with zero mean and covarance matrix $\sum_{M_t}^{F}$. One assumption here is that the unconditional joint probability distribution of the returns is a multivariate mixture of normals with mixing parameters equal to the prior distribution of the regime at time t. By applying the posterior probability at time t-1 that I estimate from the regime-switching vector autoregressive model, parameters of the regime dependent asset pricng model can be estimated by using the weighted least square regression model. As suggested by Jensen (1986), the manager will tend to earn more than the "normal" risk premium, including market premium, size effect premium and the book-to-marekt effect premium, which is indicated by α. In addition, certain managers may have different superior abilities in bear and bull markets, therefore, the abnormal return that they obtain may vary in different regimes, indictated by α_{M_t}. Due to the contributions of Fama and French (1993), the market excess return, the return of a portfolio of small stock in excess of the return on a portfolio of large stocks and the return of a portfolio of stock with a high book-to-market ratio in excess of the return on a portfolio of stocks with a low-to-market ratio are all considered as important factors in explaining asset returns. In this thesis, the regime-dependent abnormal return α_{M_t} and the single regime abnormal return α will be determined by using the regime-switching and single regime Fama &

French three factor asset-pricing models, respectively. The three factors included in this thesis are: the vector of monthly return of the excess return on the market, which is the value weighted return on CRSP minus the one-month Treasury bill rate; the average differential return on three small size portfolios and three large size portfolios; and the average differential return on two value portfolios and two growth portfolios.

CHAPTER 3 DATA

3.1 ECONOMIC INDICATORS

Chen, Roll and Ross (1986) suggest that the yield spread (YS) and credit spread (CS) factors might be good measures of economic conditions, specially in the financial markets. Mulvey & Zhao (2010) selecte S&P 500 stock returns, Treasury bond yields, U.S. dollar index, implied volatility, aggregate dividend yield, the short term interest rate, the treasury yield spread, and credit spread as the macroeconomic indicators to obtain the market regimes. Liu et al. (2010) applies monthly market excess returns, excess returns of small capitalization portfolios over big capitalization portfolios, excess returns of valued portfolio over the growth portfolio, market volatility, yield spread, and credit spread as the macroeconomic indicators. Filardo (1994) suggests that the feasible economic indicators that are useful as business cycle predictors, include the Composite Index of Eleven Leading Indicators (CLI), the CLI's diffusion index (DFI) etc. In addition to the indicators listed above, the Business Cycle Indicators Handbook notes building permit measures the monthly number of changes in housing units and it typically leads most other types of economic production. The Business Cycle Indicators Handbook also refers to S&P 500 as a key indicator, as the index reflects the overall price movement of the New York Stock Exchange. Treasury yield spread, represented by the difference between 10-year Treasury bond rate and Federal fund rate, can also be treated as an indicator of the variation of monetary policy and general financial conditions. The Index of consumer expectation reflects the consumer attitudes on the future economic conditions, which can be represented by the US Conference Board Leading Economic Indicators. As suggested

by Chen, Roll and Ross (1986), Mulvey et al. (2010) and Liu et al. (2010) credit spread is also treated as an economic indicator. In this thesis, five economic indicators, building permits (BP), S&P 500 return (SPR); treasury yield spread (TYS); credit spread (CS); and index of consumer confidence (CC), are selected to analyze the regime-switching vector autoregressive model.

Figures 3.1a and 3.1b display the historical performance of five economic indicators from February 1978 to May 2013. Table 3.1 shows the summary statistics of these five economic indicators. From this table, the TYS factor has the highest mean and standard deviation compared to the other four factors. The CBP factor has the only negative and lowest mean and the second lowest standard deviation. The SPR factor has the second lowest mean and the lowest standard deviation. The negative skewness of SPR, CS, CCC, and CBP indicates that the tails on the left side of these factors' probability density functions are longer or fatter than the right side. Conversely, the positive skewness of YTS means that the tail on the right side is longer or fatter than on the left side. The kurtosis of these five factors is higher than 3. By using the Jarque-Bera test, I can reject the null hypothesis that these economic indicators come from a normal distribution as suggested by the p-value, which is smaller than 5% significance level. All of this evidence may indicate that a regime-switching model is a more suitable model than a single-regime model to describe the behaviour of economic indicators.

3.2 ASSET PRICING FACTORS

In the regime-dependent Fama & French three factor asset-pricing model, I employ the Fama & French market index[1] to approximate the market factor. The market factor (MF) is calculated by subtracting the one-month T-bill rate from the Fama & French market index monthly return. In the regime-dependent Fama & French three factor pricing model, SMB and HML are constructed using the 6 portfolios, "which are the intersections of 2 portfolios formed on size (market equity, ME) and 3 portfolios formed on the ratio of book-to-market equity (BE/ME)" (Fama & French, 1993). In particular, the SMB is the average return on the three small portfolios minus the average return on the three big portfolios. HML is the average return on the two value portfolios minus the average return on the two growth portfolios.

3.3 SOCIALLY RESPONSIBLE AND NON-SOCIALLY RESPONSIBLE MUTUAL FUNDS

3.3.1 Type of Screening of Socially Responsible Mutual funds

Table 3.2 and 3.3 summarize the ethical screening used by socially responsible mutual funds, collected from Bloomberg database. Renneboog et al. (2008b) point out that 64% of socially responsible mutual funds in the United States use more than five screening. 18% of socially responsible mutual funds use only one social screen.

[1] Fama & French market return is the value-weight return of all CRSP firms incorporated in the US and listed on the NYSE, AMEX or NASDAQ that have a CRSP share code of 10 or 11 at the beginning of month t, good shares and price data at the beginning of t, and good return data for t.

3.3.2 Monthly Return of Socially Responsible and Non-Socially Responsible Mutual funds

The socially responsible mutual fund is obtained from Bloomberg with the following criteria: active, equity and open-end US socially responsible mutual funds with inception dates earlier than 2009. Their monthly return data range from their inception dates, until May 2013. A group of non-socially responsible mutual funds, with inception dates earlier than 2000, is created by matching their total assets and fund turnover with those of the non-socially responsible group. The effect of funds specific characteristics on the difference between performances of socially and non-socially mutual funds can be obviously decreased by using the matching method suggested by Mallian (1995) and Bello (2004). Table 3.4 describes the total asset and fund turnover of socially responsible and their matching non-socially responsible mutual funds, ranging from 41.39 million to 2435.84 million, which include small, medium and large size.

The monthly return data of socially responsible mutual funds are calculated by the total return index and range from their inception dates until May 2013. However, all matching non-socially responsible mutual funds' are created earlier than 2000. Thus, non-socially responsible mutual funds monthly returns are measured from February 2000 to May 2013. Tables 3.5 and 3.6 depict the mean, standard deviation, median, kurtosis and skewness for the monthly return of socially responsible and conventional mutual funds, respectively. Tables 3.5 and 3.6[2] show that some of the socially responsible mutual fund have negative average monthly return; however, all selected non-socially

[2] Note that due to the fact that some of socially responsible mutual funds were unfortunately incepted after February 2000, their mean returns are measured in a shorter time horizon.

responsible mutual fund have positive average monthly return. All socially and non-socially responsible mutual funds exhibit skewness and kurtosis of varying degrees. Moreover, 29 socially responsible mutual fund returns do not come from a normal distribution as suggested by the p-values in Table 3.5 that are smaller than 5% significance level. Also Table 3.6 shows that 38 conventional mutual fund returns do not come from normal distribution. These observations may suggest that regime switching is much better than single-regime to model monthly returns of socially and non-socially responsible mutual funds. Table 3.7 summarizes the average mean and standard deviation of 39 socially and matching non-socially responsible mutual funds. The average monthly return for socially responsible mutual funds is 0.41% compared with 0.5% for non-socially responsible mutual funds. A two-sample t-test with p-value of 0.3911 indicates that the mean returns of socially responsible and non-socially responsible mutual funds are not significantly different. The median of standard deviation of monthly returns for socially responsible and non-socially responsible mutual funds are also not significantly different, as indicated by a 0.3274 p-value from two-sample Wilcoxon rank-sum test.

CHAPTER 4 EMPIRICAL ANALYSIS

4.1 EMPIRICAL RESULTS OF MARKOV SWITCHING AUTOREGRESSIVE MODEL

4.1.1 Optimal Number of Regimes

As discussed in section 3, I estimate the regime-switching autoregressive model with different numbers of regimes and calculate these models' maximum log-likelihood (MLL) and the corresponding BIC values to determine the optimal number of regimes. Table 4.1 illustrates that the minimum BIC occur when number of regimes is two. Hence, the optimal number of regimes of the economy is two.

4.1.2 Economic Interpretation of the Regimes

Now that a two regimes economy is determined, the characterization of the economic indicators can be determined under these two regimes, which are categorized as bear and bull markets, respectively. The transition probability matrix of the regime-switching autoregressive model is illustrated in Table 4.2. The transition probabilities represent the probability from regime i (i=1,2) to regime j (j=1,2). The high probabilities of remaining in the same regime indicate that these two regimes are highly persistent. To illustrate, there is a 0.9154 percent probability that "regime 1" will stay as regime 1 and a 0.0296 percent probability that it will switch to regime 2. Moreover, regime 2 especially has a higher probability to remain in the regime 2 than the probability of regime 1 to remain in regime 1. The most probable state sequence as illustrated in Figure 4.1 is derived using the Viterbi Algorithm. The Markov Switching model captures several bearish periods, for example, the early bearish periods in 1990s and the financial crisis around 2007.

4.1.3 Estimated Parameters of RS and SR Models

Table 4.3 presents the estimated parameters of the regime-switching (RS) and the single regime (SR) vector autoregressive models. From Table 4.3, when a regime-switching structure is imposed, many parameters are statistically significant, especially in regime 1.

Once the estimated parameters and the probability matrix are obtained, the summary statistics of economic indicators by regime are presented in Table 4.4. P-values of the JB test illustrate that none of the economic indicators by regime are statistically significant. In other words, the null hypothesis that any of these economic indicators follows a normal distribution cannot be rejected for either regime. Furthermore, regime 2 can be labeled as a 'bull' market as suggested by the higher S&P 500 return, the lower credit spread, and higher changes of confidence than regime 1, which can be labeled as a 'bear' market. Combining the defined bear and bull market regimes with the probability transition matrix, one may conclude that the bull market is a more persistent state than the bear market.

4.1.4 Performance of Regime-switching and Single Regime Models

In order to further examine the appropriateness of the regime-switching model compared with the single regime model in analyzing the behavior of these economic indicators, the fitted values of the economic indicators are obtained for both the in and out of sample data. The predicted or fitted value of each factor is calculated by the following criteria:

$$\widehat{X_{\iota,t}} = \sum_{k=1}^{K} E\left(\widehat{X_{\iota,k,t}} \middle| M_{t-1} = k\right) * q_k,$$

where $\left(\widehat{X_{\iota,k,t}} \middle| M_{t-1} = k\right)$ is the regime dependent predicted return of each factor and

$$E\left(\widehat{X_{\iota,k,t}}\middle|M_{t-1}=k\right)=\sum_{m=1}^{K}\left(\widehat{X_{\iota,k,t}}*p_{mk}\right)$$

$$\widehat{X_{\iota,k,t}}=\widehat{\mu_k}+\widehat{\theta_k}X_{i,k,t-1},$$

where p_{mk} is the transition probability matrix, q_k is the posterior probability calculated at time t-1, and $\widehat{\mu_k}$ and $\widehat{\theta_k}$ are the estimated parameters calculated from the regime-switching autoregressive model.

As shown in Figure 4.2, on average, the in-sample predicted percentage changes of each factor using the regime-switching model are more close to the actual values than the predicted percentage change of each factor using the single regime model. Among the five factors, predicted values and observed values of YS and CS fit perfectly for both regime-switching and single regime models. Predicted values calculated from the regime-switching model for S&P 500, CC and BP fit the actual values much better than that of the single regime model; however, neither the regime-switching model nor the single regime model does a good job in the out of sample test.

Other popular criteria to measure model predictability is the root mean square errors (RMSE) and the accuracy of predicting direction (APD), which are calculated as follows:

$$RMSE=\sqrt{\left(\frac{\sum_{t=1}^{N}(X_{i,t}-\widehat{X_{\iota,t}})^2}{N}\right)}$$

$$APD=\frac{Number\ of\ Postive\ (\Delta X_{i,t}*\Delta\widehat{X_{\iota,t}})}{N},$$

where $\Delta X_{i,t}$ and $\Delta\widehat{X_{\iota,t}}$ are the change of actual value and the change of predicted value. As illustrated in Table 4.5, both the APD and RMSE report better performance for the regime-switching model than the single regime model for all five economic indicators.

For the in-sample APD test, the accuracy of predicting the direction of BP and CC using the regime-switching model are the highest and lowest among these five factors, which are 62.72% and 48.59%, respectively. In contrast, using the single regime model, the accuracy of predicting the direction of BP and CC are 56.81% and 47.81%, respectively, which are smaller than that in the regime-switching model. The regime-switching model is more efficient at predicting the value of S&P 500 in comparison with the single regime model as indicated by the percentages: 60.41% (regime-switching model) and 38.56% (single regime model). For the in-sample root mean square error test, the RMSE calculated using regime-switching model is smaller than the RMSE calculated using single regime model for all five factors. For the out of sample test, the APDs for the S&P 500 and CC calculated by the regime-switching model increase from their in-sample values to 61.76% and 58.82%, respectively. The APDs for S&P 500 and CC increase to 61.76% and 58.82%, respectively, under the single regime model. The APDs of other factors decrease compared to the values of the in-sample APD test for both the regime-switching and single regime models. For the out of sample test, the APDs of the regime-switching model are higher than the APDs of the single regime model for these five factors. In regards to the out of sample RMSE test, the RMSE test performs better for S&P 500, YS, and CS compared to the in-sample RMSE test. The opposite results are obtained for the other two factors, CC and BP. In addition, on average, the regime-switching model provides a smaller RMSE relative to the single regime model.

In conclusion, the regime-switching autoregressive model captures the observed values of these five factors quite well, and it provides a better result compared to the

single regime autoregressive model as indicated by the fitted values, the root mean square errors and the accuracy of predicting directions.

4.2 Empirical Results of Regime-switching Asset Pricing Model

In order to show that the regime-switching model is more suitable to measure the performance of socially responsible and non-socially responsible mutual funds, I first present the summary statistics of monthly returns for socially and non-socially responsible mutual funds.

4.2.1 Summary Statistics of Socially and Non-socially Responsible Mutual funds by Regime

Tables 4.6 and 4.8 show the mean, standard deviation, coefficient of variation, kurtosis, skewness and p-value of JB test of socially and non-socially responsible mutual funds in the bear market, respectively. Compared with Tables 3.5 and 3.6, 38 socially and 39 non-socially responsible mutual funds that have lower kurtosis in the bear market. For skewness, only 18 socially and 14 non-socially responsible mutual funds have lower absolute skewness compared with the results obtained in Tables 3.5 and 3.6. This means that the improvement in skewness of mutual funds is not significant. However, as suggested by the p-value from the JB test, 39 socially and 38 non-socially responsible mutual funds come from a normal distribution. These results show that most mutual funds have returns that follow a linear model with regime-dependent risk sensitivity. This is an obvious improvement compared to the results in a single regime, where for most mutual funds returns did not follow a normal distribution as indicated by the p-values in Tables 3.5 and 3.6.

Tables 4.7 and 4.9 reveal the fluctuation of kurtosis and skewness of monthly returns for socially and non-socially responsible mutual funds in the bull market, which are also less compared to the results obtained in the single regime case. Meanwhile, returns on 9 socially and 13 non-socially responsible mutual funds do not follow a normal distribution. These observations would suggest that regime-switching model is much better than the single-regime to model the monthly returns of socially and non-socially responsible mutual funds.

4.2.2 Average Monthly Returns of Socially and Non-Socially Responsible Mutual funds by Regime

The average mean return and standard deviation of socially and non-socially responsible mutual funds by regime are presented in Table 3.7. The average mean returns of socially responsible mutual funds in bear and bull markets, are -3.247% and 1.383% respectively. The corresponding results for non-responsible mutual funds are -3.557% and 1.048%, respectively. In regard to the average standard deviation, both socially and non-socially responsible mutual funds have a higher average of standard deviation in the bear market than in the bull market, which is consistent with our definition of bear and bull markets. Table 3.7 shows that, in both bear and bull markets, the mean return for socially responsible mutual funds is statistically greater than that of non-socially responsible mutual funds as suggested by a one-sided t-test with p-values of 0.0496 and 0.0016, respectively. This indicates that on average, socially responsible mutual funds obtained statistically higher mean return compared with non-socially responsible mutual funds in both bear and bull markets. Also, the one-sided two-sample Wilcoxon rank-sum test with p-value of 2.83e-04 indicates that the median of standard deviation of socially

responsible mutual funds is significantly lower than that of non-socially responsible mutual funds in regime 1. In regime 2, there is no significant difference between the medians of standard deviations of the returns of socially and non-socially responsible mutual funds at 5% significance level. Overall, these results show that in regime 1, socially responsible mutual funds statistically outperforms the conventional mutual funds as suggested by the statistically greater mean return and smaller median of standard deviation. In regime 2, socially responsible mutual funds also gains statistically significant greater mean than non-socially responsible mutual funds; the medians of standard deviations of socially and non-socially responsible mutual funds are not statistically different from each other.

4.2.3 Comparison Performance between Socially and Non-Socially Responsible Mutual funds

Tables 4.10 and 4.11 present the estimated the abnormal return of socially and non-socially responsible mutual funds of the regime-switching and single regime models. Table 4.12 shows the mean and mean absolute deviation of the 39 socially and non-socially responsible mutual funds'[3] estimates of α_M, β_{ME_M}, β_{SMB_M}, $and\ \beta_{HML_M}$.

As column 1 of Table 4.12 shows, the average abnormal return in the bear market is 0.1790 for socially responsible mutual funds, and 0.0675 for non-socially responsible mutual funds. The corresponding figures for the bull market, as shown in column 3, are -0.1551 and 0.1879, respectively. The results reported for single regime market in column

[3] Note: Because of different periods, there may be more number of bull markets faced by non-socially responsible mutual funds.

5, are similar to that of bull market; average abnormal return for socially and non-socially responsible mutual funds are 0.1489 and 0.3237, respectively.

On average, the market factor has a positive effect on both socially and non-socially responsible mutual funds regardless of the asset pricing model, as suggested by the positive mean of β_{ME_M}. The size factor (SMB) on average has a positive premium for socially responsible mutual funds across regimes and/or without regime. For non-socially responsible mutual funds, the size factor on average has a positive premium in the bull market but has a negative effect in the bear market. In the single-regime pricing model, the size factor, on average, has a positive effect on the returns of non-socially responsible mutual funds. On the other hand, the book-to-market factor (HML) has the same effect on the returns of socially and non-socially responsible mutual funds across regimes and/or without regime-switching condition. In the bull market, HML on average has a negative premium in the mutual funds returns; however, on average, HML has a positive effect on the returns of mutual funds in the bull market or the single regime market.

In order to examine the performance of socially and non-socially responsible mutual funds using the regime switching and the single regime asset-pricing models, Table 4.13 shows the number of significant abnormal returns of socially and non-socially responsible mutual funds under the regime switching and the single regime models. On average, the bear market provides more number of statistically significant abnormal returns than those of the single regime model. The bull market also provides more number of statistically significant abnormal returns for socially responsible mutual funds than the single regime model. One potential explanation is that in the single regime model, positive and negative abnormal returns of mutual funds during different regimes

may offset each other, which would lead us to a biased conclusion. However, if I examine the returns of mutual funds by regime, part of the biased effect may be eliminated and a more accurate conclusion can be obtained.

The results of the two-sample t-test, presented in Table 4.14 show that in the bear market, the mean abnormal return of socially responsible mutual funds is not statistically different from that of non-socially responsible mutual funds at the 5% significance level. On the other hand, the average abnormal return of nonsocially responsible mutual funds is statistically higher than that of socially responsible mutual funds in the bull market. However, as suggested in Table 3.7, the mean of socially responsible mutual funds are statistically higher than that of non-socially responsible mutual funds at 5% significance level in both bear and bull markets. One potential explanation of these contradictory results is as follows. Socially responsible mutual funds have certain criteria, which might result in excessive risk control than non-socially responsible mutual funds in bull market.

Table 4.14 illustrates that using the single regime asset-pricing model, non-socially responsible mutual funds statistically outperforms socially responsible mutual funds at 5% significance level.

CHAPTER 5 CONCLUSION

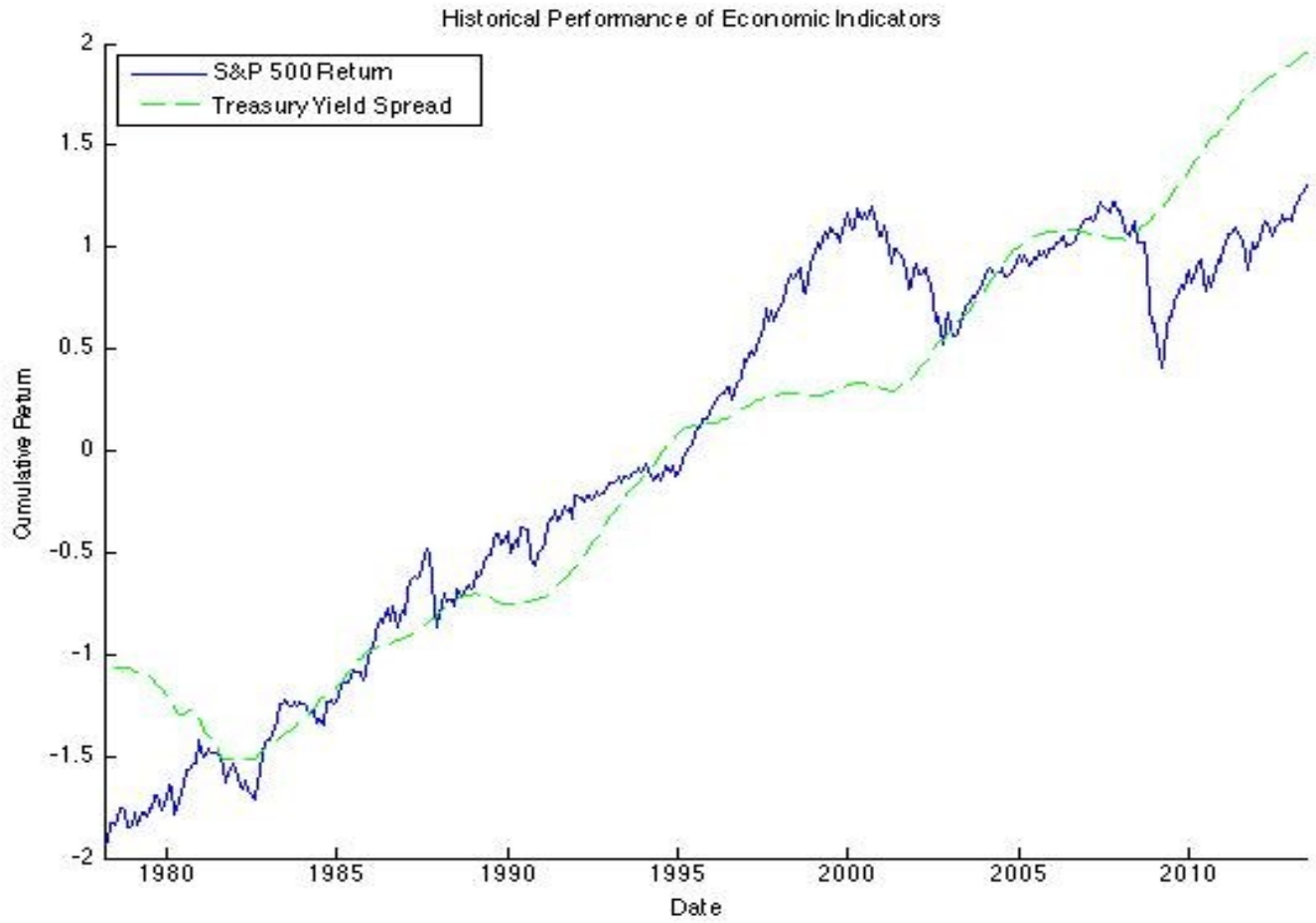
In this thesis, I extend the Fama & French (1993) three factor model with the regime dependent parameters to characterize the exposure of socially and non-socially responsible mutual funds to risk factors.

It is important to analyze the performance of socially responsible mutual funds under the condition of varying market states as the performance may change when the market switches from one state to another. In particular, socially responsible mutual funds have significantly greater mean return than the matching non-socially responsible mutual funds across regimes and/or in a single regime. However, different results are obtained using abnormal returns derived from the regime dependent Fama & French three factor asset pricing model to measure the performance of socially and non-socially responsible mutual funds. In particular, non-socially responsible mutual funds show significantly higher abnormal returns than socially responsible mutual funds in the single regime asset-pricing model. Under the regime-switching model, non-socially responsible mutual funds still have statistically higher abnormal returns than socially responsible mutual funds in the bull market. Whereas, the abnormal returns of socially and non-socially responsible mutual funds are not statistically different from each other in the bear market. Secondly, this thesis finds that the market factor has a positive effect on the return of socially and non-socially responsible mutual funds across regimes. In addition, both the size and book-to-market factors have a positive effect on the returns of socially and non-socially responsible mutual funds in the single and bull market. However, the size and book-to-market factors have a negative relationship with the returns of mutual

funds in the bear market, except for the effect of size factor on socially responsible mutual funds.

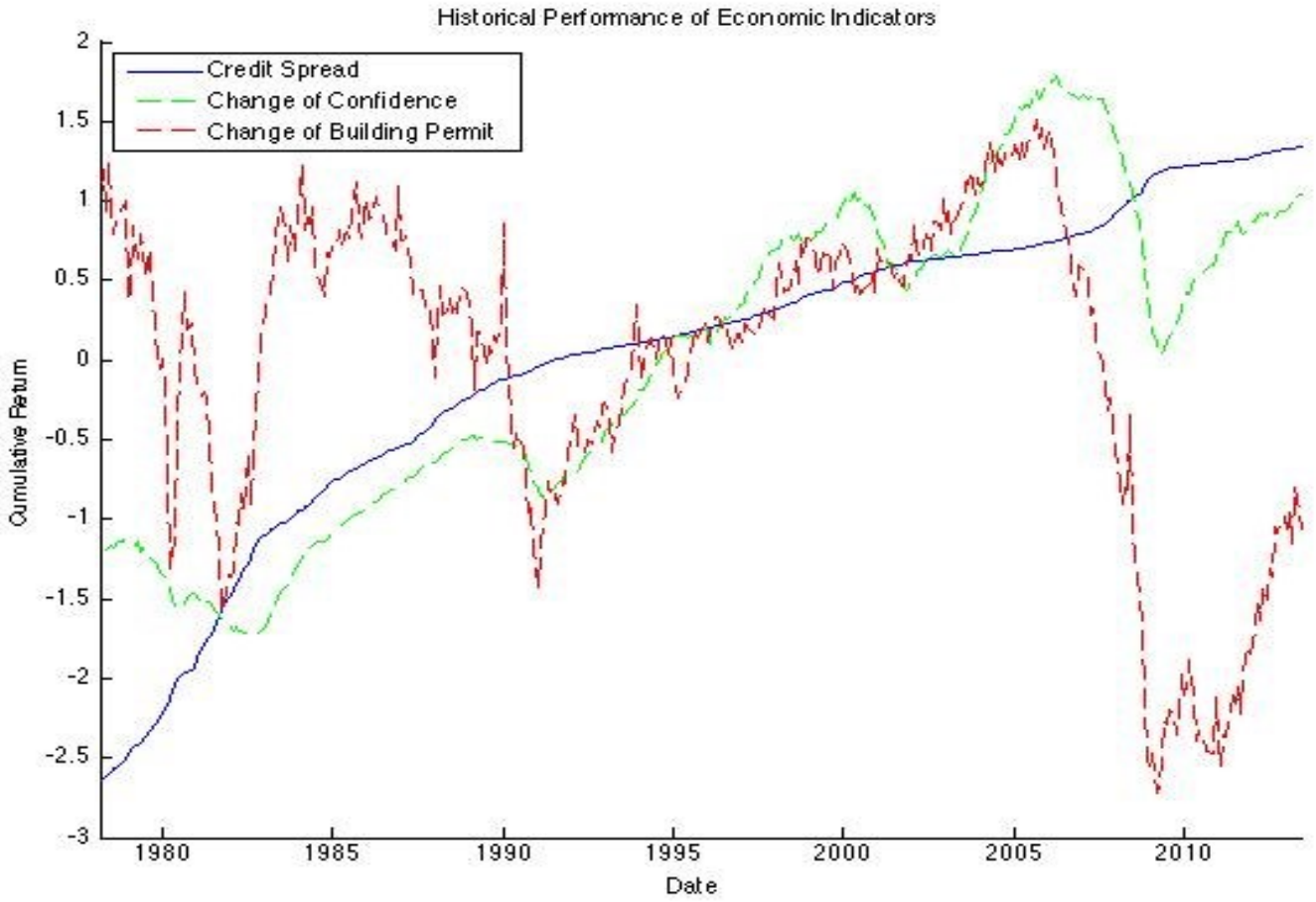
One weakness of this thesis is that 39 out of 39 non-socially responsible mutual funds' returns start from February, 2000 compared to 7 out of 39 socially responsible mutual funds. Thus, it will exclude most of socially responsible mutual funds if socially responsible mutual funds also start from February, 2000. However, the mismatching of mutual funds' returns may bring some biases into the conclusion since there might be economic fluctuations between 2000 and 2006, which will have effect only on the return of non-socially responsible mutual funds.

Figure 3.1. a The performance of S&P 500 and TYS for the period of February 28, 1978 to May 31, 2013.



Note: S&P stands for the S&P 500 return; TYS stands for the Treasury Yield Spread.

Figure 3.1. b The performance of CS, CC and BP for the period of February 28, 1978 to May 31, 2013.



Note: CS stands for the Credit Spread; CC stands for the Change of Confidence; CBP stands for the change of Building Permits.

Figure 4. 1 Two-state most probable state sequence.

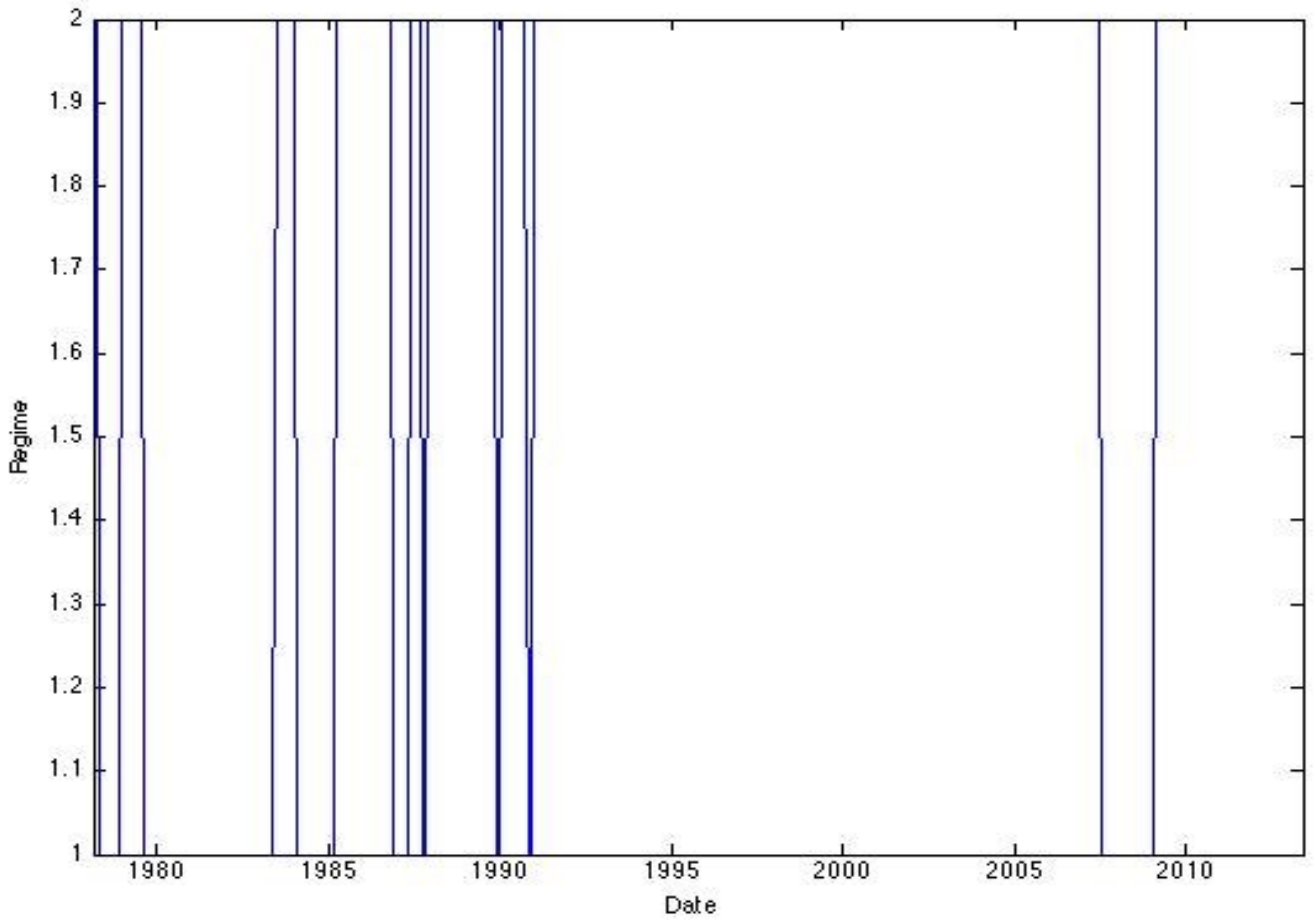
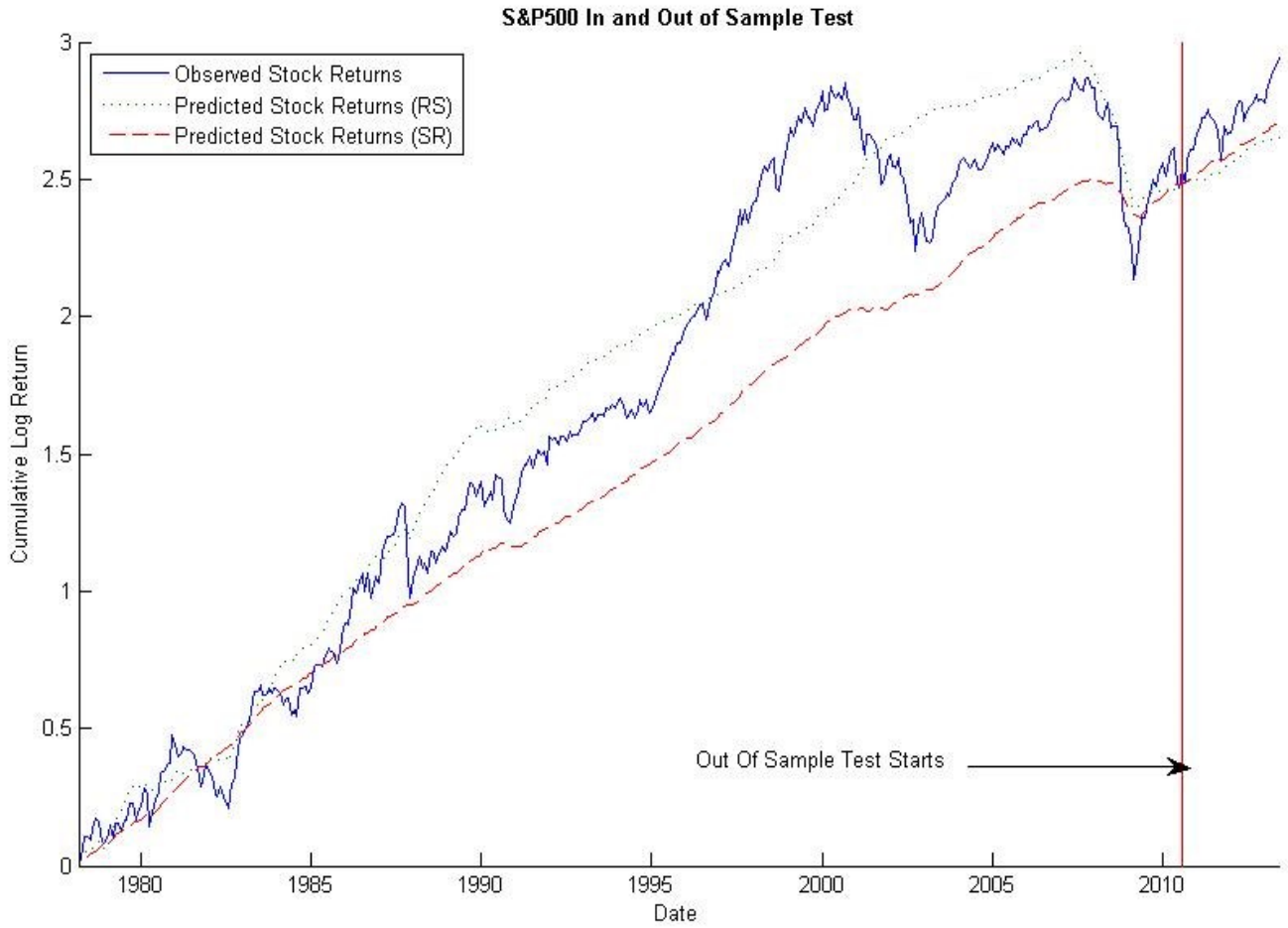
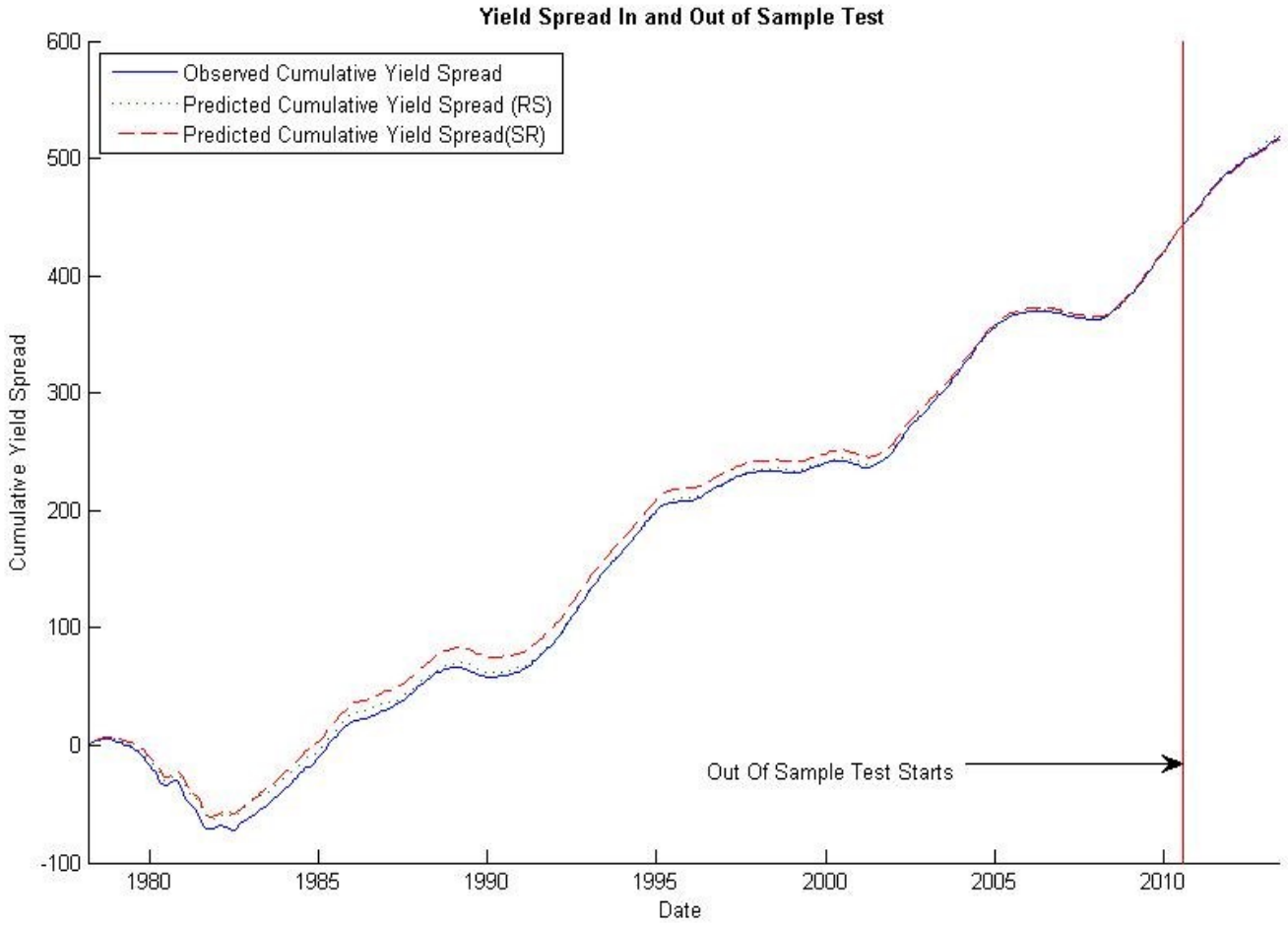


Figure 4.2. a The predicted value of S&P 500 against the actual value for the period of February 28, 1978 to May 31, 2013.



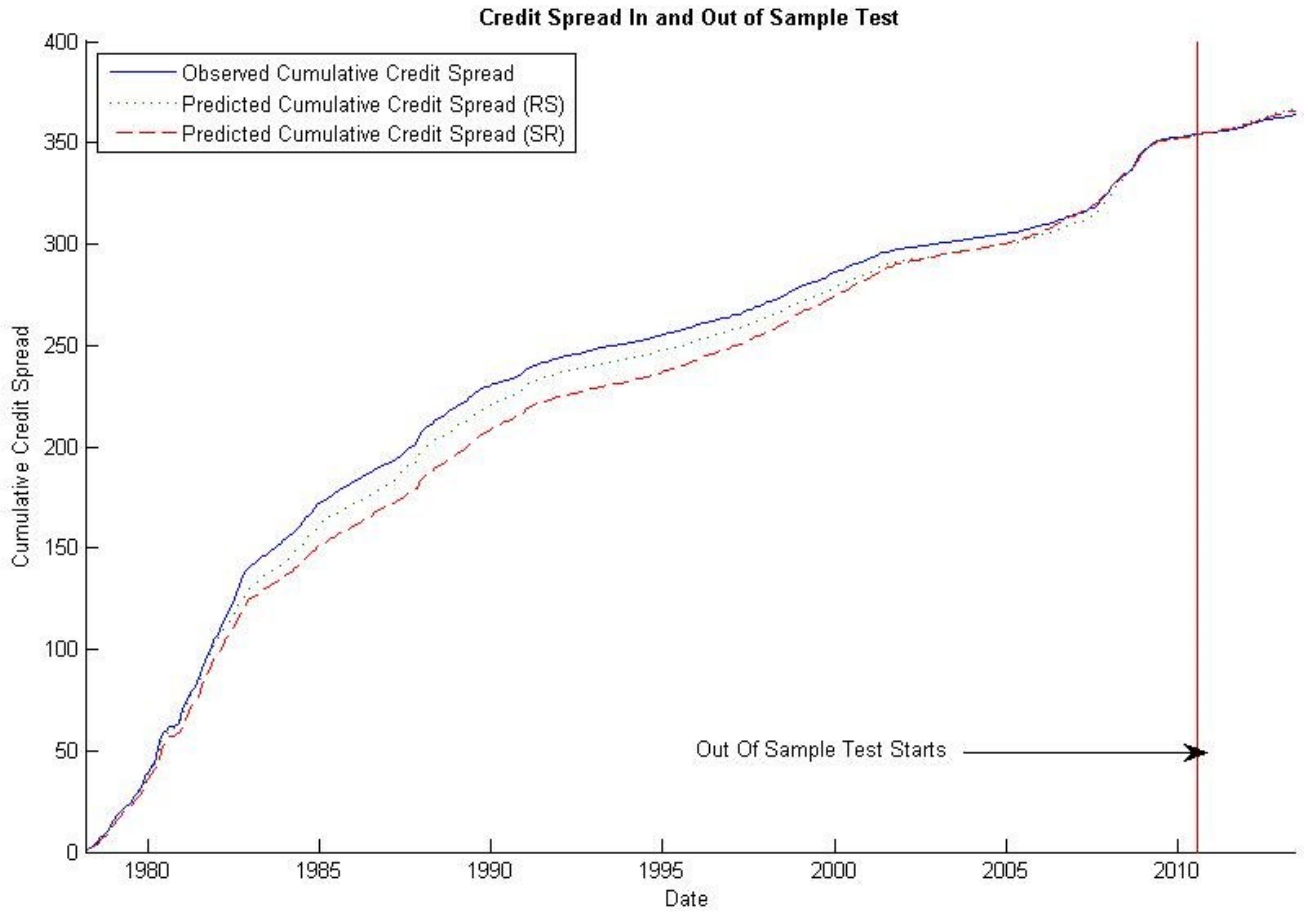
Note: Cumulative Log Returns means that the cumulative sum returns of each economic indicators.

Figure 4.2. b The predicted value of YS against the actual value for the period of February 28, 1978 to May 31, 2013.



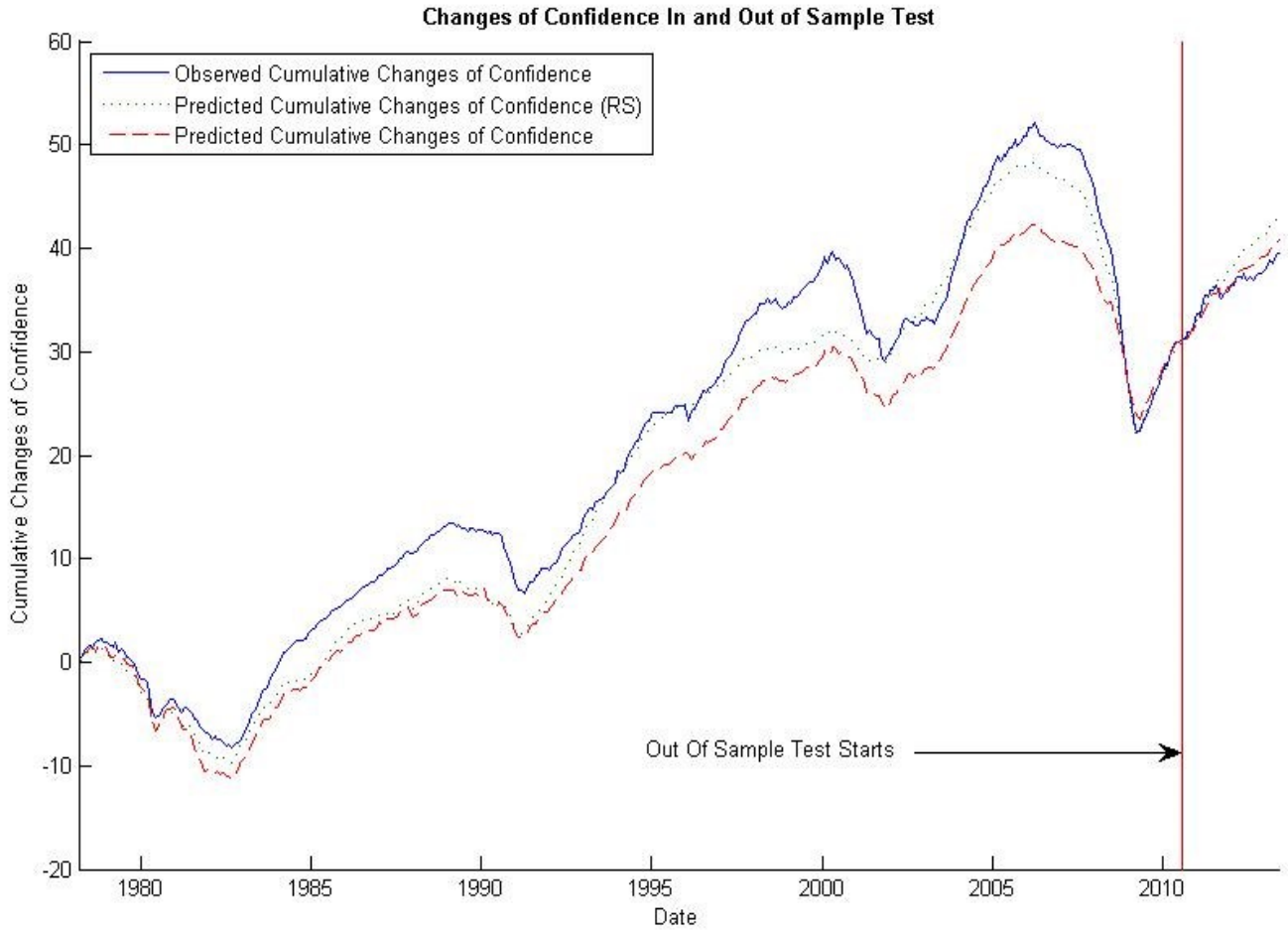
Note: Cumulative Log Returns means that the cumulative sum returns of each economic indicators.

Figure 4.2. c The predicted value of CS against the actual value for the period of February 28, 1978 to May 31, 2013.



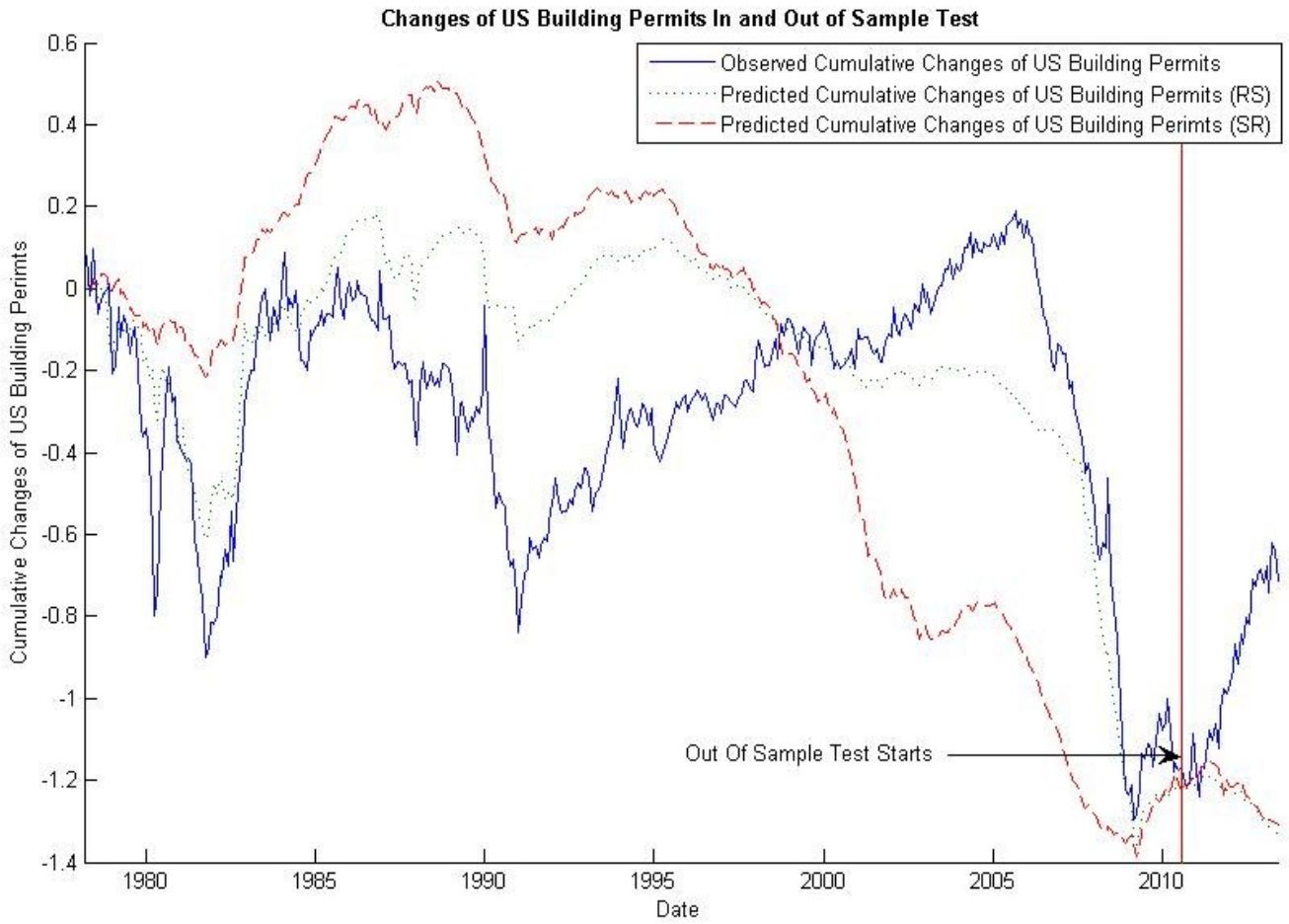
Note: Cumulative Log Returns means that the cumulative sum returns of each economic indicators.

Figure 4.2. d The predicted value of CC against the actual value for the period of February 28, 1978 to May 31, 2013



Note: Cumulative Log Returns means that the cumulative sum returns of each economic indicators.

Figure 4.2. e The predicted value of BP against the actual value for the period of February 28, 1978 to May 31, 2013



Note: Cumulative Log Returns means that the cumulative sum returns of each economic indicators.

Table 1. 1 TIM Group Market Sentiment, Barron's October 28, 2013.

	Last Week	2 Weeks Ago.	3 Weeks Ago.
Indicator (Formerly First Coverage)	51.90%	52.90%	53.70%

Note: Market Sentiment, is an indicator derived from actionable sell-side trade ideas sent by over 5000 institutional sales people to their buy-side clients over the TIM Group platform. The TIM Group Market Sentiment score ranges from 0 to 100 (0=most bearish, 50=neutral, and 100=most bullish). Source: TIM Group 101 Arch St., Suite 1765 Boston, MA 02110 (617) 933-8160. Timsupport@timgroup.com

Table 2. 1 Summary statistics of Economic Indicators.

Business Cycle Reference Dates		Duration In Months			
Peak	**Trough**	**Bearish**	**Bullish**		**Cycle**
June 1857	December 1858	18	30		48
October 1860	June 1861	8	22	40	30
April 1865	December 1867	32	46	54	78
June 1869	December 1870	18	18	50	36
October 1873	March 1879	65	34	52	99
March 1882	May 1885	38	36	101	74
March 1887	April 1888	13	22	60	35
July 1890	May 1891	10	27	40	37
January 1893	June 1894	17	20	30	37
December 1895	June 1897	18	18	35	36
June 1899	December 1900	18	24	42	42
September 1902	August 1904	23	21	39	44
May 1907	June 1908	13	33	56	46
January 1910	January 1912	24	19	32	43
January 1913	December 1914	23	12	36	35
August 1918	March 1919	7	44	67	51
January 1920	July 1921	18	10	17	28
May 1923	July 1924	14	22	40	36
October 1926	November 1927	13	27	41	40
August 1929	March 1933	43	21	34	64
May 1937	June 1938	13	50	93	63
February 1945	October 1945	8	80	93	88
November 1948	October 1949	11	37	45	48
July 1953	May 1954	10	45	56	55
August 1957	April 1958	8	39	49	47
April 1960	February 1961	10	24	32	34
December 1969	November 1970	11	106	116	117
November 1973	March 1975	16	36	47	52
January 1980	July 1980	6	58	74	64
July 1981	November 1982	16	12	18	28
July 1990	March 1991	8	92	108	100
March 2001	November 2001	8	120	128	128
December 2007	June 2009	18	73	81	91
Average, All Cycles					
1854-2009 (33 Cycles)		17.45	38.73	56.44	56.18
1854-1919 (16 Cycles)		21.56	26.63	48.93	48.19
1919-1945 (6 Cycles)		18.17	35.00	53.00	53.17
1945-2009 (11 Cycles)		11.09	58.36	68.55	69.45

Source: Public Information Office, National Bureau of Economic Research, Inc., 1050 Massachusetts Avenue, Cambridge MA 02138, USA, 617-868-390.

Table 3. 1 Summary statistics of Economic Indicators.

	Mean	**Standard Deviation**	**Median**	**Kurtosis**	**Skewness**	**JB Test**
SPR	0.0069	0.0447	0.0121	6.1277	-0.8841	1.00E-03
TYS	1.2245	1.7043	1.415	5.7076	-1.2023	1.00E-03
CS	0.8599	0.9089	0.53	12.4101	2.642	1.00E-03
CCC	0.0939	0.5899	0.2	6.8924	-1.3965	1.00E-03
CBP	-0.0016	0.0605	-0.0007	5.8613	-0.3373	1.00E-03

Note: The sample data of economic indicators are monthly from January 1978 to May 2013. The p-values from Jarque-Bera Test are smaller than 5% significance level for all factors. SPR, TYS, CS, CCC and CBP represent the S&P 500 return, treasury yield spread, credit spread, changes of index of consumer confidence and changes of US building permits.

Table 3. 2 Types of screening of socially responsible mutual funds.

Field	Definition
Environment	
Climate/ Clean Tech	Focus on risk and opportunities related to climate change and greenhouse gas emissions, or on businesses dedicated to environmentally sustainable technologies, efficient use of natural resources, or mitigating negative ecological impacts; includes clean energy generation, infrastructure and storage.
Pollution/ Toxics	Consideration of toxicity of products and operations and/or pollution management and mitigation, including recycling, waste management and water purification.
Environment	Focus on environmental issues outside of criteria specified here.
Social	
Community Development	Focus on provision of affordable housing, fair consumer lending, small and medium business support and other services and support to low- and medium-income communities.
Diversity & EEO	Consideration of diversity and equal employment opportunity policies and practices relating to employees, company ownership or contractors.
Human Rights	Consideration of risks associated with human rights and companies' respect for human rights with their internal operations and the countries in which they do business, often with particular emphasis on relations with indigenous peoples, supply-chain management and conflict zones.
Labor Relations	Consideration of Companies' labor or employee relations programs, employee involvement, health and safety, employment and retirement benefits, union relations or workforce reductions
Sudan	Exclusion or partial exclusion of companies that conduct business in Sudan because of its human rights abuses or support of terrorism
Governance	
Board Issues	Consideration of the directors' independence, diversity, pay and responsiveness to shareholders
Executive Pay	Consideration of companies' executive pay practices, especially whether pay polices are reasonable and aligned with shareholders' or other stakeholders' long term interests

Table 3. 3 Types of screening of socially responsible mutual funds (continued).

Field	Definition
Products	
Alcohol	Exclusion of partial exclusion of companies involved in the production, licensing and/or retailing of alcohol products, or in the manufacturing of products necessary for production of alcoholic beverages, as well as ownership by an alcohol company.
Animal Welfare	Consideration of companies' policies and practices toward animals in consumer product-testing, where such test inflict pain or suffering on the test animals, and on the treatment of animals raised or used for and other goods and services.
Defense/ Weapons	Exclusion or partial exclusion of companies that derive a significant portion of their revenues from the manufacture or retailing of firearms or ammunition for civilian use, or from military weapons.
Gambling	Exclusion or partial exclusion of companies involved in licensing, manufacturing, owning or operating gambling interests.
Tobacco	Exclusion or partial exclusion of companies involved in the production, licensing, and/or retailing of tobacco products, or in the manufacturing of products necessary for production of tobacco products
Other Qualitative	Consideration of other environmental, social, governance or product-specific criteria
Shareholder Engagement	Filling or co-filling shareholder resolution and/or engaging in private dialogue on environmental, social or governance issues with companies in this investment strategy portfolio.

Table 3. 4 Information of socially and Non-Socially responsible mutual funds.

Socially Responsible Mutual funds			Non-Socially Responsible Mutual funds		
Ticker	**TA**	**FT**	**Ticker**	**TA**	**FT**
AHRAX US Equity	38	80.23046	NTHFX US Equity	36	75.55
AHSRX US Equity	38	80.23046	ICTEX US Equity	35.22	79.08
DFCCX US Equity	7	110.3981	CALEX US Equity	8	108.45
DFCUX US Equity	9	89.77497	VALUX US Equity	10.77	90.05
DFESX US Equity	44	753.9114	VGEQX US Equity	40	765.15
DFUEX US Equity	12	413.4643	TMFSX US Equity	12.65	409.49
DOMAX US Equity	87	202.9829	RSGRX US Equity	93	195.66
DOMIX US Equity	87	202.9829	GBFAX US Equity	92	192.47
DRTCX US Equity	48.33	284.212	MJFOX US Equity	48.58	278.17
DRTHX US Equity	48.33	284.212	EGLBX US Equity	47	291.03
DSEFX US Equity	97	905.5494	NITRX US Equity	100	945.67
DSFRX US Equity	97	905.5494	NIENX US Equity	100	945.67
DTCAX US Equity	48.33	284.212	STCAX US Equity	40	287.48
DTCCX US Equity	48.33	284.212	STCIX US Equity	40	287.48
EGOAX US Equity	67	225.8827	SCQGX US Equity	67	211.44
EGOCX US Equity	67	225.8827	ETGIX US Equity	65	220.09
EGOIX US Equity	67	225.8827	EMGIX US Equity	65	220.09
FOGRX US Equity	55	162.9715	EGWAX US Equity	57	164.26
MMSCX US Equity	49.78	76.22091	ATGCX US Equity	44	77.93
MMSIX US Equity	49.78	76.22091	GICPX US Equity	42	77.96
NBSLX US Equity	28	2411.613	VGPMX US Equity	30	2,435.84
NBSRX US Equity	28	2411.613	CHTTX US Equity	28.06	2,392.12
NBSTX US Equity	28	2411.613	OAKEX US Equity	33	2,413.65
SCECX US Equity	25	119.6047	THPGX US Equity	30	121.88
SEECX US Equity	26	190.1171	CBMDX US Equity	25	199.37
SEEKX US Equity	26	190.1171	MFCPX US Equity	21	180.65
SNTCX US Equity	15	106.3523	PISZX US Equity	16	105.78
SNTKX US Equity	15	106.3523	PISAX US Equity	16	105.78
SRIAX US Equity	27	70.03851	SIEIX US Equity	24	58.96
SRICX US Equity	27	70.03851	SIIIX US Equity	24	58.96
SRIDX US Equity	27	70.03851	MGINX US Equity	21	65.58
SRIGX US Equity	27	70.03851	WINTGRO US Equity	21.54	67.92
TPIAX US Equity	34	43.06737	WESCX US Equity	39	43.7
TPICX US Equity	34	43.06737	FLCGX US Equity	31	41.49
TPLNX US Equity	65	75.83829	SCMVX US Equity	67.85	72.39
TRDFX US Equity	25	119.6047	THPGX US Equity	30	121.88
TSVCX US Equity	65	75.83829	DVGIX US Equity	63	76.37
VFTNX US Equity	45	907.9029	HBGIX US Equity	44	913.44
VFTSX US Equity	45	907.9029	NBMTX US Equity	40	917.4

Note: This table summarizes the fund turnover (FT) and total assets (TA) of socially and non-socially responsible mutual funds. The total-assets of each fund is the market capitalization of the fund at the end of 2012. Total-assets of each fund is in millions of dollars.

Table 3. 5 Summary statistics of socially responsible mutual funds.

Ticker	Mean	Std.	Cov	Kurtosis	Skewness	JB Test
AHRAX US Equity	0.41	5.01	12.12	4.41	-0.80	0.001
AHSRX US Equity	0.42	5.67	13.54	4.18	-0.80	0.001
DFCCX US Equity	0.58	4.84	8.30	4.13	-0.70	0.1074
DFCUX US Equity	0.40	6.16	15.51	3.83	-0.71	0.0593
DFESX US Equity	0.51	5.31	10.41	4.22	-0.84	0.0078
DFUEX US Equity	-0.07	4.64	-63.51	3.21	-0.65	0.0784
DOMAX US Equity	0.41	5.05	12.42	3.64	-0.79	0.0116
DOMIX US Equity	0.75	9.17	12.23	6.10	-0.49	0.014
DRTCX US Equity	0.11	5.37	51.12	3.40	0.14	0.0164
DRTHX US Equity	0.41	5.57	13.46	4.16	-0.70	0.0153
DSEFX US Equity	0.23	5.49	23.81	5.38	-0.77	0.0215
DSFRX US Equity	0.52	5.71	10.93	6.07	-0.94	0.0015
DTCAX US Equity	0.31	4.62	14.77	3.97	-0.41	0.0162
DTCCX US Equity	0.27	4.60	16.96	4.01	-0.41	0.0145
EGOAX US Equity	0.42	5.30	12.55	3.33	-0.41	0.1223
EGOCX US Equity	-0.22	10.40	-47.33	5.11	0.53	0.1247
EGOIX US Equity	-0.27	10.39	-38.52	5.11	0.53	0.13
FOGRX US Equity	0.67	6.54	9.75	3.79	-0.16	0.027
MMSCX US Equity	0.35	6.26	17.87	3.85	-0.75	0.0227
MMSIX US Equity	0.48	6.17	12.93	3.89	-0.61	0.0246
NBSLX US Equity	-0.30	10.67	-35.56	4.73	-0.72	0.0134
NBSRX US Equity	1.13	6.21	5.48	4.68	-0.39	0.002
NBSTX US Equity	0.99	5.89	5.96	6.28	-0.61	0.002
SCECX US Equity	0.32	5.75	17.74	3.80	-0.42	0.0035
SEECX US Equity	0.74	5.41	7.31	4.19	-0.75	0.0029
SEEKX US Equity	0.90	6.09	6.79	5.64	-1.01	0.0061
SNTCX US Equity	0.36	5.80	16.30	4.23	-0.65	0.0087
SNTKX US Equity	0.33	5.80	17.33	4.21	-0.64	0.0087
SRIAX US Equity	-0.07	6.80	-102.76	3.31	-0.50	0.5
SRICX US Equity	-0.09	6.81	-76.96	3.29	-0.50	0.5
SRIDX US Equity	-0.02	6.46	-321.52	4.25	-0.80	0.5
SRIGX US Equity	0.15	6.81	46.35	4.96	-0.77	0.5
TPIAX US Equity	0.78	7.33	9.38	4.45	-0.22	0.001
TPICX US Equity	0.76	7.75	10.13	5.22	0.12	0.0099
TPLNX US Equity	1.24	7.77	6.28	3.82	-0.31	0.001
TRDFX US Equity	0.55	5.51	10.08	3.85	-0.33	0.001
TSVCX US Equity	0.51	4.28	8.47	5.06	-0.92	0.0034
VFTNX US Equity	0.67	4.12	6.13	6.41	-1.14	0.001
VFTSX US Equity	0.19	6.05	32.07	5.13	-0.92	0.0093

Note: The data are collected from Bloomberg and are in percent.

Table 3. 6 Summary statistics of Non-Socially responsible mutual funds.

Ticker	Mean	Std.	Cov	Kurtosis	Skewness	JB Test
NTHFX US Equity	0.19	4.95	26.14	3.62	-0.54	0.0144
ICTEX US Equity	0.29	7.19	24.89	3.82	-0.36	0.0253
CALEX US Equity	0.53	4.44	8.38	4.49	-0.40	0.0032
VALUX US Equity	0.90	6.21	6.88	3.79	-0.28	0.0409
VGEQX US Equity	0.08	5.94	74.51	4.01	-0.57	0.0055
TMFSX US Equity	0.64	4.15	6.45	4.13	-0.42	0.0082
RSGRX US Equity	0.29	5.10	17.61	3.11	-0.65	0.0118
VMNIX US Equity	0.79	7.63	9.61	6.45	-0.50	0.001
MJFOX US Equity	0.09	5.51	61.17	3.32	0.09	0.5
EGLBX US Equity	0.41	5.57	13.46	4.16	-0.70	0.0022
NITRX US Equity	0.23	5.49	23.81	5.38	-0.77	0.001
NIENX US Equity	0.22	5.48	24.80	5.36	-0.76	0.001
STCAX US Equity	0.37	4.64	12.56	4.07	-0.31	0.0149
STCIX US Equity	0.33	4.64	13.89	4.09	-0.31	0.014
SCQGX US Equity	0.08	4.96	61.25	3.67	-0.50	0.0165
ETGIX US Equity	0.88	8.91	10.18	4.65	-0.01	0.0037
EMGIX US Equity	0.83	8.91	10.75	4.64	-0.01	0.0038
EGWAX US Equity	0.67	6.54	9.75	3.79	-0.16	0.0672
ATGCX US Equity	0.55	5.29	9.69	4.13	-0.69	0.0024
GICPX US Equity	0.16	5.84	36.72	3.59	-0.52	0.0176
VGPMX US Equity	1.26	8.89	7.03	5.21	-0.78	0.001
CHTTX US Equity	1.13	6.21	5.48	4.68	-0.39	0.002
OAKEX US Equity	0.99	5.89	5.96	6.28	-0.61	0.001
THPGX US Equity	0.55	5.51	10.08	3.85	-0.33	0.0268
CBMDX US Equity	1.01	5.12	5.06	4.13	-0.70	0.0023
EWEAX US Equity	0.71	6.61	9.28	4.46	-0.50	0.0026
PISZX US Equity	0.39	5.14	13.32	4.44	-0.61	0.0018
PISAX US Equity	0.37	5.13	14.04	4.43	-0.61	0.0019
SIEIX US Equity	0.28	5.46	19.38	4.17	-0.66	0.0026
SIIIX US Equity	0.25	5.47	21.58	4.16	-0.65	0.0028
MGINX US Equity	0.30	5.54	18.32	4.58	-0.61	0.0013
WINTGRO US Equity	0.26	5.70	21.54	5.34	-0.77	0.001
WESCX US Equity	0.39	7.17	18.25	4.18	-0.14	0.0163
PXWEX US Equity	0.49	6.07	12.33	6.55	0.13	0.001
SCMVX US Equity	1.24	7.77	6.28	3.82	-0.31	0.0323
THPGX US Equity	0.55	5.51	10.08	3.85	-0.33	0.0268
DVGIX US Equity	0.13	4.72	36.23	3.68	-0.62	0.0077
HBGIX US Equity	0.32	4.56	14.08	4.21	-0.64	0.0026
NBMTX US Equity	0.37	6.74	18.18	5.51	-0.20	0.001

Note: The data are collected from Bloomberg and are in percent

Table 3. 7 Average monthly returns of socially and non-socially responsible mutual funds.

	Socially Responsible (%)	Non-Socially Responsible (%)	p-value
All Observations In Single Regime			
Average Mean Return	0.41	0.5	0.3911
Average Standard Deviation	6.2	5.91	0.3274
Observations In Regime 1			
Average Mean Return	-3.247	-3.557	0.0496**
Average Standard Deviation	6.382	7.505	2.83E-04***
Observation In Regime 2			
Average Mean Return	1.383	1.048	0.0016***
Average Standard Deviation	5.236	5.449	0.2190

Note: ** Significant at the 5% level. *** Significant at the 1% level. The alternative hypothesis of the t-test for average mean return in single regime is that the mean returns of socially and non-socially responsible mutual funds are different. The alternative hypothesis of the t-test for fund return in both regime 1 and regime 2 is that the mean return of socially responsible mutual funds is greater than mean return of non-socially responsible mutual funds; The alternative hypothesis of the two-sample Wilcoxon rank-sum test for standard deviation in regime 1 is that the median of standard deviation of non-socially responsible mutual funds is higher than that of socially responsible mutual funds; The null hypothesis of two-sample Wilcoxon rank-sum test for standard deviation in regime 2 and single regime is that the median of standard deviation of socially responsible mutual funds is different from that of non-socially responsible mutual funds.

Table 4. 1 Maximum log-likelihood and BIC of different regimes.

Number Of Regimes	**1**	**2**	**3**	**4**
Maximum Log-Likelihood	-296.34	996.19	815.10	912.87
BIC	771.66	-1389.50	-812.34	-715.95

Note: BIC stands for the Bayesian Information Criteria.

Table 4. 2 Estimated transition probabilities.

	To	
From	**Regime 1**	**Regime 2**
Regime 1	0.9154	0.0846
Regime 2	0.0296	0.9704

Note: Table 4.2 presents the estimated transition probabilities from one state to another state per month.

Table 4. 3 Estimated parameters for the regime-switching (RS) and single regime (SR) autoregressive models.

		μ	$\theta_{S\&P}$	θ_{YS}	θ_{CS}	θ_{CC}	θ_{BP}
S&P 500							
RS Model	Regime 1	-0.0177***	0.2515***	0.0017	0.0098***	0.0199***	-0.069**
	Regime 2	-0.0011	-0.0853*	0.001	0.0191***	-0.0039	0.062
SR Model		0.0058	0.0334	-0.001	0.001	0.0074	0.0313
Yield Spread							
RS Model	Regime 1	-0.3888***	0.0286	0.9509***	0.2244***	-0.2431***	2.8909***
	Regime 2	0.0359	0.4411	0.991***	-0.0611	-0.0599*	0.1191
SR Model		-0.0842	0.0267	0.9819***	0.1298**	-0.0765	1.4324**
Credit Spread							
RS Model	Regime 1	1.1518***	-2.2401**	-0.1417***	0.4297***	0.064	-2.8039***
	Regime 2	0.1468***	-1.1394***	-0.0311***	0.8002***	0.0336*	0.0039
SR Model		0.3359***	-1.1821*	-0.0706***	0.7202***	0.0044	-1.6561***
Changes Of Confidence							
RS Model	Regime 1	-0.2207***	2.7149***	0.0224***	0.0774***	0.7313***	1.9435***
	Regime 2	-0.0374	2.7232***	0.1318***	-0.0109	0.1495***	2.8924***
SR Model		-0.0067	2.3817***	0.052***	-0.019	0.4677***	2.8142***
Changes Of US Building Permits							
RS Model	Regime 1	-0.0963***	0.6523***	0.0149***	0.0406***	0.0154**	-0.1417***
	Regime 2	-0.0183***	0.1647***	0.0072***	0.0191***	-0.013**	-0.0923**
SR Model		-0.0265***	0.3054***	0.0075***	0.0138***	0.0024	-0.0577

Note: ***, ** and * mean that estimated parameters are statistically significant at 1%, 5% and 10% significance level. $\theta_{S\&P}$, θ_{YS}, θ_{CS}, θ_{CG}, θ_{BP} are the coefficients of the S&P 500 return, treasury yield spread, credit spread and the index of consumer confidence by regime or without regime, respectively. μ is the intercept which is the abnormal return by regime or without regime.

Table 4. 4 Summary statistics of Economic Indicators by regime.

	Mean		Standard Deviation		Median		JB Test	
Factor	**R1**	**R2**	**R1**	**R2**	**R1**	**R2**	**R1**	**R2**
S&P 500	0.0003	0.0086	0.0559	0.0405	0.0012	0.0139	0.3654	0.5000
Yield Spread	0.1986	1.4630	2.2482	1.4028	0.8300	1.4450	0.2263	0.0825
Credit Spread	1.9404	0.5591	1.2431	0.3909	1.6200	0.4500	0.3448	0.1385
Changes Of Confidence	-0.2434	0.1907	0.7524	0.4896	0.0000	0.2000	0.1306	0.5000
Changes Of US Building Permits	-0.0085	-0.0011	0.0884	0.0478	-0.0032	-0.0007	0.2197	0.5000

Note: R1 stands for Regime 1, which is the bear market; R2 represents the Regime 2, which is the bull market.

Table 4. 5 Room mean square errors and accuracy of predicting direction.

	In-sample				Out Of Sample			
	Regime Switching		Single Regime		Regime Switching		Single Regime	
	APD	**RMSE**	**APD**	**RMSE**	**APD**	**RMSE**	**APD**	**RMSE**
S&P 500	60.41%	0.0427	38.56%	0.0446	61.76%	0.0416	47.06%	0.0417
Yield Spread	60.15%	0.5475	58.10%	0.5708	52.94%	0.2520	38.24%	0.2543
Credit Spread	48.59%	0.4660	47.81%	0.5235	47.06%	0.1147	41.18%	0.1442
Changes Of Confidence	56.56%	0.3584	47.56%	0.4010	58.82%	0.4833	38.24%	0.5376
Changes Of US Building Permits	62.72%	0.0541	56.81%	0.0581	55.88%	0.0581	50.00%	0.0624

Note: APD and RMSE represent the accuracy of predicting direction and the root mean square errors, respectively.

Table 4. 6 Summary statistics of socially responsible mutual funds in the bear market

Ticker	Mean	Std.	Cov	Kurtosis	Skewness	JB Test
AHRAX US Equity	-3.25	6.24	-1.92	3.38	-0.96	0.07
AHSRX US Equity	-3.24	6.22	-1.92	3.33	-0.95	0.07
DFCCX US Equity	-3.94	7.60	-1.93	3.01	-0.55	0.45
DFCUX US Equity	-3.82	6.66	-1.75	2.71	-0.64	0.27
DFESX US Equity	-3.77	9.72	-2.58	3.64	-0.62	0.20
DFUEX US Equity	-4.49	6.96	-1.55	2.43	-0.50	0.46
DOMAX US Equity	-4.25	7.25	-1.70	3.31	-0.86	0.09
DOMIX US Equity	-4.32	7.27	-1.68	3.25	-0.83	0.11
DRTCX US Equity	-2.60	5.63	-2.17	2.65	-0.60	0.30
DRTHX US Equity	-2.61	5.65	-2.16	2.66	-0.60	0.30
DSEFX US Equity	-3.31	6.01	-1.81	2.69	-0.68	0.20
DSFRX US Equity	-3.29	6.02	-1.83	2.72	-0.68	0.20
DTCAX US Equity	-2.64	5.63	-2.14	2.67	-0.60	0.31
DTCCX US Equity	-2.68	5.66	-2.11	2.68	-0.60	0.30
EGOAX US Equity	-4.01	5.54	-1.38	2.14	-0.12	0.50
EGOCX US Equity	-4.06	5.54	-1.37	2.09	-0.11	0.50
EGOIX US Equity	-3.98	5.54	-1.39	2.13	-0.12	0.50
FOGRX US Equity	-2.88	6.02	-2.09	2.24	-0.40	0.42
MMSCX US Equity	-3.32	6.82	-2.05	3.17	-0.84	0.10
MMSIX US Equity	-3.31	6.81	-2.06	3.15	-0.83	0.11
NBSLX US Equity	-3.92	6.20	-1.58	3.48	-0.76	0.15
NBSRX US Equity	-3.05	5.83	-1.91	4.06	-1.01	0.04
NBSTX US Equity	-3.06	5.83	-1.90	4.08	-1.01	0.04
SCECX US Equity	-3.50	7.15	-2.04	3.26	-0.90	0.08
SEECX US Equity	-3.43	6.12	-1.78	2.87	-0.77	0.14
SEEKX US Equity	-3.45	6.12	-1.77	2.89	-0.77	0.13
SNTCX US Equity	-3.48	7.69	-2.21	3.51	-0.58	0.29
SNTKX US Equity	-3.50	7.69	-2.20	3.50	-0.58	0.29
SRIAX US Equity	-2.61	5.07	-1.94	3.12	-0.79	0.13
SRICX US Equity	-2.67	5.05	-1.89	3.05	-0.76	0.14
SRIDX US Equity	-2.59	5.05	-1.95	3.11	-0.78	0.13
SRIGX US Equity	-2.59	5.05	-1.95	3.11	-0.78	0.13
TPIAX US Equity	1.44	4.78	3.31	4.51	-0.05	0.15
TPICX US Equity	-3.23	7.76	-2.40	3.36	-0.55	0.37
TPLNX US Equity	-3.02	7.09	-2.35	2.85	-0.75	0.15
TRDFX US Equity	-3.53	7.14	-2.03	3.24	-0.90	0.08
TSVCX US Equity	-3.08	7.08	-2.30	2.85	-0.75	0.15
VFTNX US Equity	-3.79	6.71	-1.77	2.51	-0.58	0.29
VFTSX US Equity	-3.80	6.71	-1.77	2.51	-0.57	0.30

Table 4. 7 Summary statistics of socially responsible mutual funds in the bull market

Ticker	Mean	Std.	Cov	Kurtosis	Skewness	JB Test
AHRAX US Equity	1.39	3.87	2.78	5.33	0.47	0.00
AHSRX US Equity	1.39	3.81	2.75	5.25	0.45	0.00
DFCCX US Equity	1.62	6.10	3.76	2.99	-0.08	0.50
DFCUX US Equity	2.09	5.29	2.53	3.14	-0.09	0.50
DFESX US Equity	2.33	6.77	2.90	3.76	0.13	0.33
DFUEX US Equity	2.10	5.41	2.58	3.09	-0.11	0.50
DOMAX US Equity	1.59	5.51	3.47	3.32	-0.26	0.50
DOMIX US Equity	1.53	5.53	3.61	3.30	-0.22	0.50
DRTCX US Equity	0.54	4.70	8.69	3.60	-0.44	0.04
DRTHX US Equity	0.53	4.68	8.89	3.60	-0.43	0.04
DSEFX US Equity	0.73	4.42	6.03	3.11	-0.06	0.50
DSFRX US Equity	1.34	3.80	2.84	3.53	0.14	0.40
DTCAX US Equity	0.49	4.71	9.64	3.62	-0.45	0.04
DTCCX US Equity	0.41	4.69	11.40	3.65	-0.45	0.03
EGOAX US Equity	1.62	4.34	2.68	3.13	-0.31	0.50
EGOCX US Equity	1.55	4.33	2.79	3.14	-0.31	0.50
EGOIX US Equity	1.65	4.34	2.63	3.17	-0.29	0.50
FOGRX US Equity	1.26	4.57	3.62	3.68	-0.14	0.14
MMSCX US Equity	1.84	5.21	2.82	2.86	-0.14	0.50
MMSIX US Equity	1.89	5.22	2.76	2.83	-0.15	0.50
NBSLX US Equity	1.79	4.52	2.53	2.89	-0.31	0.50
NBSRX US Equity	1.09	4.20	3.87	2.97	-0.18	0.50
NBSTX US Equity	1.07	4.21	3.93	2.97	-0.19	0.50
SCECX US Equity	1.93	5.50	2.85	5.00	0.58	0.01
SEECX US Equity	1.63	4.12	2.53	3.54	0.14	0.44
SEEKX US Equity	1.73	4.29	2.48	3.44	0.09	0.50
SNTCX US Equity	1.31	5.30	4.04	3.51	0.06	0.50
SNTKX US Equity	1.29	5.30	4.12	3.52	0.05	0.50
SRIAX US Equity	1.82	6.27	3.45	2.67	-0.25	0.50
SRICX US Equity	1.75	6.28	3.59	2.69	-0.25	0.50
SRIDX US Equity	1.83	6.28	3.42	2.69	-0.25	0.50
SRIGX US Equity	1.83	6.28	3.42	2.69	-0.25	0.50
TPIAX US Equity	-0.23	9.96	-43.10	35.80	-5.17	0.00
TPICX US Equity	1.10	5.37	4.90	3.76	-0.46	0.11
TPLNX US Equity	1.65	10.65	6.47	69.11	6.75	0.00
TRDFX US Equity	0.91	5.00	5.49	4.88	0.45	0.00
TSVCX US Equity	1.37	4.76	3.46	3.84	0.02	0.17
VFTNX US Equity	1.44	3.87	2.70	3.82	0.24	0.09
VFTSX US Equity	0.74	4.75	6.39	3.39	-0.17	0.40

Table 4. 8 Summary statistics of non-socially responsible mutual funds in the bear market

Ticker	Mean	Std.	Cov	Kurtosis	Skewness	JB Test
NTHFX US Equity	-2.96	6.83	-2.30	2.63	-0.41	0.50
ICTEX US Equity	-3.48	7.69	-2.21	2.44	-0.52	0.36
CALEX US Equity	-2.70	5.46	-2.03	2.67	-0.83	0.10
VALUX US Equity	-3.78	6.82	-1.80	2.93	-0.72	0.17
VGEQX US Equity	-3.16	6.90	-2.19	2.48	-0.42	0.50
TMFSX US Equity	-3.76	4.25	-1.13	2.74	-0.81	0.11
RSGRX US Equity	-3.17	6.06	-1.92	2.41	-0.37	0.50
VMNIX US Equity	-5.55	10.93	-1.97	3.77	-0.87	0.07
MJFOX US Equity	-3.11	6.18	-1.99	3.05	-0.07	0.50
EGLBX US Equity	-3.44	7.59	-2.20	2.80	-0.54	0.42
NITRX US Equity	-3.61	8.16	-2.26	3.67	-0.74	0.11
NIENX US Equity	-3.61	8.15	-2.26	3.67	-0.74	0.12
STCAX US Equity	-2.53	6.26	-2.48	2.52	-0.58	0.29
STCIX US Equity	-2.56	6.25	-2.45	2.56	-0.59	0.28
SCQGX US Equity	-2.20	5.50	-2.50	2.83	-0.78	0.13
ETGIX US Equity	-4.13	11.89	-2.88	2.33	-0.12	0.50
EMGIX US Equity	-4.17	11.87	-2.84	2.33	-0.12	0.50
EGWAX US Equity	-3.07	7.20	-2.35	3.06	-0.67	0.22
ATGCX US Equity	-3.77	7.47	-1.98	2.72	-0.49	0.50
GICPX US Equity	-2.99	7.21	-2.41	2.76	-0.64	0.25
VGPMX US Equity	-3.25	13.69	-4.21	3.94	-0.94	0.05
CHTTX US Equity	-3.30	7.87	-2.39	4.26	-0.98	0.04
OAKEX US Equity	-4.43	7.93	-1.79	3.99	-0.97	0.05
THPGX US Equity	-4.41	6.02	-1.37	2.55	-0.59	0.28
CBMDX US Equity	-3.61	7.17	-1.98	2.31	-0.32	0.50
EWEAX US Equity	-2.98	8.15	-2.74	3.85	-0.97	0.05
PISZX US Equity	-3.79	6.90	-1.82	2.91	-0.56	0.40
PISAX US Equity	-3.82	6.90	-1.81	2.88	-0.55	0.41
SIEIX US Equity	-3.78	7.43	-1.96	3.02	-0.57	0.38
SIIIX US Equity	-3.81	7.43	-1.95	2.99	-0.57	0.39
MGINX US Equity	-3.85	7.81	-2.03	3.14	-0.69	0.20
WINTGRO US Equity	-3.30	8.65	-2.62	3.73	-0.70	0.13
WESCX US Equity	-3.95	7.82	-1.98	2.83	-0.82	0.11
PXWEX US Equity	-4.27	7.62	-1.78	3.46	-0.90	0.08
SCMVX US Equity	-5.05	8.78	-1.74	2.32	-0.64	0.17
THPGX US Equity	-4.41	6.02	-1.37	2.55	-0.59	0.28
DVGIX US Equity	-3.19	5.71	-1.79	3.05	-0.70	0.20
HBGIX US Equity	-2.85	5.88	-2.06	3.92	-0.98	0.05
NBMTX US Equity	-2.93	6.27	-2.14	2.75	-0.29	0.50

Table 4. 9 Summary statistics of non-socially responsible mutual funds in the bull market

Ticker	Mean	Std.	Cov	Kurtosis	Skewness	JB Test
NTHFX US Equity	0.61	4.51	7.34	2.93	-0.25	0.41
ICTEX US Equity	0.80	7.00	8.78	3.99	-0.30	0.03
CALEX US Equity	0.97	4.12	4.27	4.18	-0.05	0.02
VALUX US Equity	1.53	5.86	3.83	3.53	-0.07	0.35
VGEQX US Equity	0.52	5.69	11.03	4.30	-0.53	0.00
TMFSX US Equity	1.24	3.77	3.05	4.00	-0.17	0.04
RSGRX US Equity	0.76	4.79	6.35	2.99	-0.59	0.02
VMNIX US Equity	1.65	6.68	4.05	5.09	0.35	0.00
MJFOX US Equity	0.52	5.29	10.14	3.19	0.23	0.42
EGLBX US Equity	0.93	5.05	5.41	3.57	-0.41	0.05
NITRX US Equity	0.75	4.84	6.46	3.64	-0.20	0.13
NIENX US Equity	0.74	4.83	6.55	3.62	-0.19	0.15
STCAX US Equity	0.76	4.26	5.60	3.55	0.11	0.28
STCIX US Equity	0.72	4.26	5.89	3.56	0.11	0.28
SCQGX US Equity	0.39	4.82	12.42	3.65	-0.42	0.04
ETGIX US Equity	1.55	8.26	5.33	5.08	0.30	0.00
EMGIX US Equity	1.50	8.26	5.49	5.07	0.30	0.00
EGWAX US Equity	1.17	6.30	5.37	3.63	0.02	0.23
ATGCX US Equity	1.13	4.67	4.14	2.88	-0.25	0.39
GICPX US Equity	0.58	5.53	9.47	3.33	-0.34	0.13
VGPMX US Equity	1.87	7.90	4.22	2.95	-0.19	0.50
CHTTX US Equity	1.73	5.72	3.31	3.47	0.07	0.44
OAKEX US Equity	1.72	5.17	3.01	5.08	0.10	0.00
THPGX US Equity	1.21	5.10	4.20	3.67	-0.09	0.18
CBMDX US Equity	1.64	4.46	2.73	3.30	-0.28	0.24
EWEAX US Equity	1.21	6.25	5.16	3.90	-0.22	0.04
PISZX US Equity	0.95	4.60	4.85	3.66	-0.21	0.12
PISAX US Equity	0.93	4.60	4.95	3.65	-0.20	0.12
SIEIX US Equity	0.83	4.92	5.94	3.24	-0.30	0.22
SIIIX US Equity	0.80	4.93	6.15	3.24	-0.30	0.23
MGINX US Equity	0.86	4.93	5.72	3.18	-0.08	0.50
WINTGRO US Equity	0.75	5.04	6.75	3.61	-0.26	0.10
WESCX US Equity	0.98	6.90	7.05	4.10	0.07	0.03
PXWEX US Equity	1.13	5.56	4.90	6.48	0.84	0.00
SCMVX US Equity	2.08	7.25	3.48	3.63	-0.06	0.22
THPGX US Equity	1.21	5.10	4.20	3.67	-0.09	0.18
DVGIX US Equity	0.58	4.40	7.63	3.22	-0.44	0.07
HBGIX US Equity	0.75	4.20	5.59	2.93	-0.26	0.36
NBMTX US Equity	0.82	6.70	8.22	5.96	-0.22	0.00

Table 4. 10 Abnormal returns of socially responsible mutual funds using regime-switching and single regime Models

Ticker	Regime 1	Regime 2	SR Model
AHRAX US Equity	0.07	0.02	0.02
AHSRX US Equity	0.06***	0.07***	0.08***
DFCCX US Equity	0.18***	-0.75**	0.30**
DFCUX US Equity	0.23	-0.10***	0.00***
DFESX US Equity	0.68	0.21	1.60
DFUEX US Equity	0.33***	-0.14***	-0.07***
DOMAX US Equity	-0.56***	-0.33**	-0.05**
DOMIX US Equity	-0.60	-0.39***	-0.16***
DRTCX US Equity	0.30	-0.21**	-0.05
DRTHX US Equity	0.29***	-0.20***	-0.03***
DSEFX US Equity	-0.03**	0.00***	0.07
DSFRX US Equity	-0.01***	-0.02***	0.07
DTCAX US Equity	0.26**	-0.25	-0.09
DTCCX US Equity	0.21***	-0.30***	-0.14***
EGOAX US Equity	-0.07	-0.17***	-0.23***
EGOCX US Equity	-0.12***	-0.23***	-0.28***
EGOIX US Equity	-0.04	-0.14	-0.20**
FOGRX US Equity	0.28***	0.42***	0.51***
MMSCX US Equity	-0.05	0.08	-0.31
MMSIX US Equity	-0.02***	0.12**	-0.28
NBSLX US Equity	0.18**	-0.04	-0.11
NBSRX US Equity	0.19***	0.32***	0.41***
NBSTX US Equity	0.17	0.30***	0.40***
SCECX US Equity	0.41***	0.17***	0.19***
SEECX US Equity	0.11	0.16	0.208
SEEKX US Equity	0.10***	0.12***	0.17***
SNTCX US Equity	0.33**	-0.57***	0.43
SNTKX US Equity	0.30***	-0.59***	0.40
SRIAX US Equity	0.21**	-0.39	0.68
SRICX US Equity	0.12******	-0.46***	0.61***
SRIDX US Equity	0.20**	-0.38***	0.70
SRIGX US Equity	0.20***	-0.38***	0.70
TPIAX US Equity	1.14***	-2.14**	-0.60
TPICX US Equity	-0.03***	-0.76***	0.18***
TPLNX US Equity	0.71***	1.00	0.93
TRDFX US Equity	0.38***	-0.04**	-0.02***
TSVCX US Equity	0.65***	0.01**	-0.04
VFTNX US Equity	0.11****	-0.04***	-0.10***
VFTSX US Equity	0.10***	-0.05**	-0.07

*** and ** mean that estimated parameters are statistically significant at 1% and 5% significance level

Table 4. 11 Abnormal returns of Non-Socially responsible mutual funds using regime-switching and single regime models

Ticker	Regime 1	Regime 2	SR Model
NTHFX US Equity	0.32***	0.00	0.24**
ICTEX US Equity	-0.29***	-0.27***	-0.04***
CALEX US Equity	0.62***	0.28***	0.35***
VALUX US Equity	-0.40***	0.32***	0.41***
VGEQX US Equity	-0.21**	-0.14	-0.01
TMFSX US Equity	-1.40***	0.61***	0.52***
RSGRX US Equity	-0.29***	0.09***	0.10***
VMNIX US Equity	-1.03***	0.62	0.83
MJFOX US Equity	-0.03***	0.17**	-0.12**
EGLBX US Equity	0.42***	0.11***	0.38***
NITRX US Equity	0.39***	-0.01***	0.17***
NIENX US Equity	0.39***	-0.03***	0.15***
STCAX US Equity	0.38***	0.11	0.26**
STCIX US Equity	0.35***	0.07***	0.22***
SCQGX US Equity	0.51***	-0.18***	0.04***
ETGIX US Equity	1.45***	0.53***	0.95***
EMGIX US Equity	1.40	0.49	0.91
EGWAX US Equity	0.12***	0.22***	0.33***
ATGCX US Equity	0.05***	0.26***	0.13***
GICPX US Equity	0.18***	-0.30***	-0.12***
VGPMX US Equity	1.35***	0.99***	1.83**
CHTTX US Equity	0.49***	0.45***	0.75***
OAKEX US Equity	-0.83	0.70	0.79
THPGX US Equity	-0.97	0.26***	0.27***
CBMDX US Equity	0.31**	0.67	0.54
EWEAX US Equity	0.69***	0.12****	0.23***
PISZX US Equity	-0.30	0.18**	0.32
PISAX US Equity	-0.33***	0.16***	0.30***
SIEIX US Equity	0.09**	0.05	0.20***
SIIIX US Equity	0.05***	0.02***	0.17***
MGINX US Equity	-0.34**	0.20	0.28
WINTGRO US Equity	0.37***	-0.15	0.19
WESCX US Equity	-0.02	-0.12	-0.10
PXWEX US Equity	0.14***	0.00***	0.02***
SCMVX US Equity	-0.23***	0.32	0.45
THPGX US Equity	-0.97	0.26	0.27
DVGIX US Equity	-0.03	-0.02	-0.03
HBGIX US Equity	0.26***	0.12***	0.18***
NBMTX US Equity	-0.04***	0.18	0.28

*** and ** mean that estimated parameters are statistically significant at 1% and 5% significance level.

Table 4. 12 summary of estimated regression statistics of regime-switching and single regime models

	Fund In Bear Market		Fund In Bull Market		Fund In Single Regime	
Item	**Mean (1)**	**MAD (2)**	**Mean (3)**	**MAD (4)**	**Mean (5)**	**MAD (6)**
Socially Responsible Mutual funds						
α_M	0.1790	0.2009	-0.1551	0.2998	0.1489	0.3096
β_{ME_M}	1.0297	0.1459	1.0321	0.0976	1.0077	0.1174
β_{SMB_M}	0.1212	0.2366	0.0522	0.2402	0.0698	0.2399
β_{HML_M}	-0.0411	0.1351	0.0682	0.1542	0.0206	0.1051
Non-Socially Responsible Mutual funds						
α_M	0.0675	0.4559	0.1879	0.2135	0.3237	0.2474
β_{ME_M}	1.2390	0.2046	0.9550	0.1073	1.0072	0.0982
β_{SMB_M}	-0.0218	0.3568	0.1760	0.2423	0.1303	0.2383
β_{HML_M}	-0.1922	0.2182	0.0931	0.1761	0.0512	0.1701

Note: MAD stands for the mean absolute deviation;

$\beta_{ME_M,}\beta_{SMB_M}$ and β_{HML_M} represent the coefficient of market factor, size factor and book-to-market ratio factor, respectively.

Table 4. 13 Number of significant abnormal returns under regime-switching and single regime models

	In-sample		
	Bear Market	**Bull Market**	**Single Regime**
Socially Responsible Mutual funds	29	30	21
Non-Socially Responsible Mutual funds	32	24	26

Table 4. 14 p-values of abnormal returns of socially and non-socially responsible mutual funds

Two-sample T-Test		
Bear Market	Bull Market	Single Regime
0.3170	9.17E-05**	0.0254**

Note: ** Significant at the 5% level. *** Significant at the 1% level. The alternative hypothesis of the two-sample t-test for abnormal return in the bear market is that the difference between the abnormal returns of socially and non-socially responsible mutual funds is different; the alternative hypothesis in the bull market and the single regime is that the abnormal return of non-socially responsible mutual funds is higher than that of socially responsible mutual funds. For the out of sample test, the alternative hypothesis of the two sample t-test is that the abnormal return of socially responsible mutual funds is higher than that of non-socially responsible mutual funds.

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