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Do Socially Responsible Investment Indexes Outperform Conventional Indexes?

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The question of whether more socially responsible (SR) firms outperform or underperform other conventional firms has been debated in the economic literature. In this study, using the socially responsible investment (SRI) indexes and conventional stock indexes in the US, the UK, and Japan, first and second moments of firm performance distributions are estimated based on the Markov switching model. We find two distinct regimes (bear and bull) in the SRI markets as well as the stock markets for all three countries. These regimes occur with the same timing in both types of market. No statistical difference in means and volatilities generated from the SRI indexes and conventional indexes in either region was found. Furthermore, we find strong comovements between the two indexes in both regimes.

Keywords: Socially responsible investments; Markov switching model; Maximum likelihood estimations; Return and volatilities; Bear and bull market.
JEL: Q56, G15, Q01

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1 Introduction

Socially responsible investment (SRI), an investment strategy intended to pursue both financial performance and the social good, has increasingly gained worldwide attention. The modern roots of the phenomenon can be traced back to the institutional climate of the 1960s. The bullish stock market of the 1990s and the increasing interest of institutional investors such as pension funds in SRI have contributed to the expansion of SRI markets in both the United States and Europe. Indeed, in recent years, the SRI market has expanded to encompass not only the US and Europe, but Asian-Pacific markets such as Japan as well.

The question remains, why is SRI in such vogue? SRI appears to be a product of growing stock markets and increased concern regarding "corporate social responsibility (CSR)," an umbrella term used to describe "positive" behavior by companies. While CSR does not have a universal definition,[1] many see it as the private sector's method of integrating the economic, social, and environmental mandates of their activities. CRS is currently considered the implementation of open and transparent business practices that respect employees, communities, and the environment. Properly implemented, CSR strategies are expected to facilitate company efforts to improve its individual social credibility and presence, to enhance its competitiveness, and to minimize potential liability compensations (Maignan et al., 2002). Therefore, it is possible to rationalize CSR as a means to signal a firm's trustworthiness in providing quality products (Fisman et al., 2006) or to soften competition in product markets (Allen et al., 2009).

If the above argument is true, socially responsible (SR) firms might have the benefit of higher financial performance than non-SR (i.e., conventional) firms. However, one could additionally argue that social and environmental standards restrict the investment universe of SRI funds; and, therefore, SRI indexes underperform conventional strategy indexes. Furthermore, critics of CSR argue that focusing on stakeholder value (including the environment) is a second-best optimum because managerial incentive problems such as agency costs are incorporated in a stakeholder's framework (Tirole, 2001). Similarly, when competition in a product market is intense, CSR sacrifices profits,

[1] See, for example, discussions in McWilliams et al. (2006).

which is not possible. Thus, CSR is not feasible in a competitive economy (Baumol, 1991).

Whether SRI market indexes underperform conventional strategy indexes boils down to an empirical question. In this study, we attempt to examine the hypothesis that pursuing social benefits comes at the expense of economic performance. Our results indicate that the adoption of a social screen does not decrease the efficiency of portfolios when compared to those from an unrestricted universe. Specifically, the results demonstrate that conventional indexes do not outperform SRI indexes. Furthermore, our results have positive implications for SRI. Investors are able to pursue environmental and social goals without a significant sacrifice in terms of risk and return combinations.

The aggregate approach distinguishes this study from the existing SRI literature, which compares individual SR funds and conventional funds by analyzing their financial return and the Sharpe Ratio. In contrast, this study analyzes the difference in means and volatilities generated from indexes in different countries, which is crucial to understanding the comprehensive performance of SRI. Another distinguishing feature of this paper is its use of two dissimilar explicitly modeled economic regimes (as explained below) in comparing the financial aspects of SRI and non-SRI indexes.

In order to assess and analyze the statistical differences between general stock and SRI stock returns, we incorporate the use of the Markov switching (MS) model, which integrates dynamic dependence to capture the nonlinear structure in both a conditional mean and a conditional variance of the stock returns (e.g., Guidolin and Hyde, 2009). The primary reason for using the MS model is the recent finding of two distinct regimes in international equity markets. Although there is no consensus in the literature regarding the identification of two distinctive regimes in the markets, Maheu and McCurdy (2000) demonstrate that the MS approach is useful in identifying them. Ang and Bekaert (2002) and Okimoto (2008) find that the major stock markets can be characterized as having two regimes using the MS model: a “bull market” with a high expected return and a low volatility, and a “bear market” with a low expected return and a high volatility (i.e., booms (bulls) and recessions (bears) in the stock market). If the perceived bull and bear states are ignored, the presence of such regimes gives rise to significant welfare costs (Guidolin and Timmermann, 2005).

Our study contributes to the literature in several ways. While bull and bear markets part in financial tradition, their implications for SRI have not been previously studied. We employ this framework and examine whether the SRI and conventional strategies have similar regime structures. In particular, we address the following questions: (i) Are there two distinct regimes in the SRI market as is found in the conventional strategies? (ii) Are the conventional stock and SRI markets synchronized in the sense of sharing common regimes? (iii) Are the characteristics of the two markets similar in each regime? (iv) Do the two markets comove in each regime? In examining these questions, we carefully compare the SRI and conventional strategies. To make this point clear, let us suppose that as in the first and second questions there were two synchronized distinct regimes in the SRI markets and the conventional stock markets. In this case, even if two markets have similar unconditional expected return and volatility, they could be considerably different as conditional on the regime. Furthermore, even if two markets have comparable characteristics in each regime, they could still behave differently in each regime. Consequently, it is especially instructive to compare the characteristics of the two markets conditional on the regime and to investigate the comovement in each regime as addressed by questions (iii) and (iv).

The outline of the article is as follows. Related studies are reviewed in Section 2. Section 3 discusses our models in order to examine differences between stock and SRI markets. Section 4 describes the sample data used in the US, the UK, and Japan. Section 5 presents empirical evidence and distributional similarities on SRI indexes and the general stock indexes in all three regions. Section 6 provides discussion and conclusions.

2 Background

The empirical literature that examines the statistical differences in the performance of SR firms and conventional firms can be divided into three levels: mutual funds, indexes, and stocks. For the mutual funds and index levels, most of the studies conduct a linear regression analysis to directly investigate whether SRI funds retain higher financial evaluations in the market when compared to conventional financial market data. These studies often compare the returns of the Standard & Poor’s 500 Stock Index (S&P 500 Index) or specific industry data with the SRI index. They typically find that differences depend upon area, year of coverage, and industry (see Sauer (1997), Statman (2000), Labatt and White (2002), Bauer et al. (2005), Renneboog et al. (2008a)). Also, see Benson and Humphrey (2008), Galema et al. (2008), and Renneboog et al. (2008a) for other trends in the research. For example, Bauer et al. (2005) applied a conditional multi-factor model for the US, the UK, and Germany SRIs using monthly data for 1990–2001. They found that the US SRI funds significantly underperform or are insignificantly different from conventional funds, while the UK SRI funds significantly outperform conventional funds. In contrast, the difference in the average alphas is insignificant in Germany. They conclude that there are no significant differences in risk-adjusted returns between the SRI and conventional funds. Similarly, applying the capital asset pricing model and the multi factor model, Renneboog et al. (2008b) additionally find that SRI funds in the US, the UK, and in many continental European and Asian-Pacific countries underperform their domestic benchmarks. However, with several exceptions, the risk-adjusted returns of SRI funds are not statistically different from the performance of conventional funds.

Nonetheless, as discussed above, findings in recent empirical literature demonstrate that there are multiple distinct regimes in the financial market; it is imperative to take into account the potential regime structure in order to properly assess the performance of SRIs in comparison with conventional indexes. In addition, more comprehensive coverage in the sample countries, more disaggregated weekly data, and more years to analyze, are all essential in assessing the performance of SRIs. Our study focuses on these challenges.

Although it is not the focus of this study, it is worth noting that the literature examining CSR issues at the stock level include Kempf and Osthoff (2007), Filbeck et al. (2008), and Lee et al. (2009). Studies at the stock level include two different categories of literature in the environmental economics arena. The first group is based on event studies (see MacKinlay (1997) for detailed explanations of this method). The event study examines whether environmentally-troubled companies suffer from lower financial market evaluations immediately after news is released regarding their environmental issues. Using event study methodology, previous studies have found that stock markets do indeed respond to the disclosure of published environmental news. These studies include Hamilton (1995), Konar and Cohen (1997), and Khanna, Quimio, and Bojilova (1998).

Using annual financial market data in combination with CSR information, the second group uses a statistical approach based on regression analysis for Tobin's q. Konar and Cohen (2001) maintain that event studies cannot analyze long-term trends or any objective measures of a firm's environmental performance that are not tied to a particular date. Hence, they employ Tobin's q, which is defined as the market value of the firm divided by the replacement cost. According to their results, poor environmental performance had a negative effect on the value of the intangible assets of the firm. However, as Hibiki and Managi (2010) empirically demonstrate, analyses of Tobin's q do not distinguish between the impact of performance on investment and on market response, which may in turn produce an outcome that results in misleading conclusions. Although they obtain a result for Tobin's q that is similar to that of Konar and Cohen (2001), they find that the financial market does not value environmental risk and even without market valuation, firms tend to increase their own investments to reduce pollution.

These two groups of studies investigate whether poor environmental performance negatively affects a firm's financial evaluations. In general, these studies find that financial markets do acknowledge environmental information, and that environmentally friendly firms outperform those that are not.

The unique innovation of our study as compared to that of the previous literature is the utilization of state of the art empirical techniques, MS model, to understand the difference between SRI and conventional strategies. As previously discussed, the recent empirical financial literature finds that there are two distinct regimes in the financial market. The goal of this study is to bridge the gap in the literature. We are additionally interested in examining how SRI and conventional strategies differ in financial markets with the two distinct regimes.

3 Model and Estimation Methodology

The analysis of the dynamics of stock returns has been an active research area in past decades. However, characterizing complex nonlinear structures of conditional return is difficult and often ignored in the empirical finance context. The MS model is able to capture general nonlinear structure as a discrete mixture of distributions. In the following subsections, we describe the MS model and derive the likelihood function for obtaining maximum likelihood estimates (MLE).

3.1 The Markov Switching Model

The Markov switching (MS) model is a natural tractable model for processes with switching regimes, and is developed by Hamilton (1989) to describe business cycles in the US economy (see also Managi et al, 2012). The MS model assumes that the process is influenced by an unobserved random variable s_t, which is usually called a state or a regime. This subsection presents a discussion of the framework utilized in this study to analyze the SRI market as well as the stock market.

Let r_{1t} be a return from the stock index (Market 1) at time t, and let r_{2t} be a return from the SRI index (Market 2) at time t. Our univariate model assumes that each return follows a simple MS model, which is defined as:

$$r_{kt} = \mu_k(s_{kt}) + \sigma_k(s_{kt})\varepsilon_{kt}, \text{ for } k = 1,2 \tag{1}$$

where s_{kt} is an unobserved latent variable that reflects the state of Market k and ε_{kt} is an iid standard Normal random variable for each k. The $\mu_k(s_{kt})$ and $\sigma_k(s_{kt})$ are each variable's marginal mean and volatility of regime s_{kt}, respectively. As with Ang and Bekaert (2002) and Okimoto (2008), a two-regime assumption in the general stock and SRI markets is applied. This implies that s_{kt} can only take a value of 1 or 2. Therefore, $\mu_k(s_{kt})$ can be written as:

$$\mu_k(s_{kt}) = \mu_{k1} \cdot I(s_{kt} = 1) + \mu_{k2} \cdot I(s_{kt} = 2), \text{ for } k = 1, 2, \tag{2}$$

where $I(\cdot)$ is an indicator function. Thus, μ_{k1} and μ_{k2} indicate the expected returns of the regimes 1 and 2, respectively. Similarly, $\sigma_k(s_{kt})$ can be expressed as:

$$\sigma_k(s_{kt}) = \sigma_{k1} \cdot I(s_{kt} = 1) + \sigma_{k2} \cdot I(s_{kt} = 2), \text{ for } k = 1, 2, \tag{3}$$

Specifically, both the expected return and the volatility can be different, depending on the state of each market. We do not include the AR term in μ_k, since no strong serial correlation is observed in the data. For simplicity, we also model σ_k as only state dependent, making it easier to interpret and compare the properties of the stock and SRI returns.

This model additionally requires the specification of a stochastic process for s_{kt}, which governs the behavior of the state in the Market k. Hamilton (1989) proposes to model it by employing the Markov chain, which is a simple model that describes the dynamics of a discrete random variable. With this framework, the law of state evolution is governed by the transition probability matrix **P**, where the (i, j) element of **P** indicates $Pr(s_{kt} = i | s_{k,t-1} = j)$. This is not unreasonable since the current economic state is typically the most significant factor in determining subsequent period's economic state. Furthermore, the use of the Markov chain maintains tractability of the model with sufficient flexibility to describe the dynamics of the regimes.

It is relatively straightforward to extend our univariate model (1) to the bivariate model, which consists of both the stock and SRI returns. To this end, let $\mathbf{r}_t$ be a (2×1) vector consisting of two returns at time t as $\mathbf{r}_t = (r_{1t}, r_{2t})'$. Our bivariate two-state MS model can be written as:

$$\mathbf{r}_t = \boldsymbol{\mu}(s_t) + \boldsymbol{\Sigma}^{1/2}(s_t)\boldsymbol{\varepsilon}_t \tag{4}$$

where s_t is an unobserved state variable taking a value of either 1 or 2 as above and $\boldsymbol{\varepsilon}_t$ is an iid bivariate standard Normal random variable. In this bivariate model, $\boldsymbol{\mu}(s_t) = (\mu_1(s_t), \mu_2(s_t))'$ is a vector of each variable's marginal mean given by (2), whereas $\mathbf{\Sigma}(s_t)$ is a variance-covariance matrix, namely:

$$\mathbf{\Sigma}(s_t) = \begin{pmatrix} \sigma_1^2(s_t) & \rho(s_t)\sigma_1(s_t)\sigma_2(s_t) \\ \rho(s_t)\sigma_1(s_t)\sigma_2(s_t) & \sigma_2^2(s_t) \end{pmatrix}$$

Here σ_k for $k = 1, 2$ is given by (3). Similarly, an additional parameter for the correlation between r_{1t} and r_{2t} can be written in the form:

$$\rho(s_t) = \rho_1 \cdot I(s_t = 1) + \rho_2 \cdot I(s_t = 2) .$$

Unlike the marginal model (1), we impose the common regime assumption of $s_t = s_{1t} = s_{2t}$ on the two-state bivariate model (4). Specifically, we assume that the stock and SRI returns share the same regime dynamics, thus maintaining the tractability of the model. This is based on the similarity of the estimated smoothed probability from the marginal model, as we will see in the next section.[2]

To verify the appropriateness of this synchronization assumption, we consider the restricted four-state bivariate MS model following that of Ang and Bekaert (2002). In this model, the value of s_t can be summarized as follows:

$$s_t = \begin{cases} 1 & \text{if} \quad s_{1t} = s_{2t} = 1 \\ 2 & \text{if} \quad s_{1t} = 1, s_{2t} = 2 \\ 3 & \text{if} \quad s_{1t} = 2, s_{2t} = 1 \\ 4 & \text{if} \quad s_{1t} = s_{2t} = 2 \end{cases}.$$

Generally, the four-state MS model for the bivariate system for two regimes of each stock return has a 4×4 transition probability matrix with 10 additional parameters compared to the two-state model (4). To preserve the tractability of the model, we assume that conditional on the stock market regime, the SRI market can be modeled by a simple mixture of normal distributions. Specifically, we model as: $Pr(s_{1t} = 1 | s_{1,t-1} = 1) = p_{11}$, $Pr(s_{1t} = 2 | s_{1,t-1} = 2) = p_{22}$, $Pr(s_{2t} = 1 | s_{1t} = 1) = q_1$, and $Pr(s_{2t} = 2 | s_{1t} = 2) = q_2$. In addition, we also assume that the correlation between the stock and the SRI markets depends only on the stock market regime. Consequently, the restricted four-state bivariate model (4) has only

[2] The smoothed probability is a probability of each regime at any given time evaluated using the estimated model and all observed data.

two additional parameters, but it still allows the stock and SRI regimes to be different.

3.2 Log-likelihood Function

In this subsection, we derive the log-likelihood function $l(\boldsymbol{\theta})$ to implement the maximum likelihood estimation, where $\boldsymbol{\theta} = (\mu_{k1}, \sigma_{k1}, \mu_{k2}, \sigma_{k2})'$ for the univariate model (1), $\boldsymbol{\theta} = (p_{11}, \rho_1, \mu_{11}, \mu_{21}, \sigma_{11}, \sigma_{21}, p_{22}, \rho_2, \mu_{12}, \mu_{22}, \sigma_{12}, \sigma_{22})'$ for the two-state bivariate model (4), and $\boldsymbol{\theta} = (p_{11}, q_1, \rho_1, \mu_{11}, \mu_{21}, \sigma_{11}, \sigma_{21}, p_{22}, q_2, \rho_2, \mu_{12}, \mu_{22}, \sigma_{12}, \sigma_{22})'$ for the four-state bivariate model. In the following, we derive the log-likelihood function for the two-state bivariate model.

Since the MS model is a special type of mixture model, the log-likelihood function can be easily written as:

$$l(\boldsymbol{\theta}) = \sum_{t=1}^{T} \log\{Pr(s_t = 1|\psi_{t-1}) f(\mathrm{r}_t|\boldsymbol{\theta}, s_t = 1) + Pr(s_t = 2|\psi_{t-1}) f(\mathrm{r}_t|\boldsymbol{\theta}, s_t = 2)\}. \quad (5)$$

where $\psi_{t-1} = \{\mathbf{r}_1, \mathbf{r}_2, \ldots, \mathbf{r}_{t-1}\}$and $f(\cdot)$ is a bivariate Normal density. Thus, the log- likelihood at each time is simply a weighted average of conditional densities of $\mathbf{r}_t$ conditional on each regime, weights being conditional probabilities of each regime given the information available by the beginning of time t. Since $f(\mathbf{r}_t|\boldsymbol{\theta}, s_t = 1)$ and $f(\mathbf{r}_t|\boldsymbol{\theta}, s_t = 2)$ are readily calculated from bivariate Normal density, the essential question is: How we can evaluate $Pr(s_t = 1|\psi_{t-1})$.[3] This can be done sequentially by starting from $Pr(s_1 = 1|\psi_0)$. Since we have no information at time $t = 0$, we can naturally use the stationary probabilities of the Markov chain for $Pr(s_1 = 1|\psi_0)$ and $Pr(s_1 = 2|\psi_0)$. Given these probabilities, we can evaluate the so-called filtered probability of regime 1, $Pr(s_1 = 1|\psi_1)$, as:

$$Pr(s_1 = 1|\psi_1) = \frac{Pr(s_1 = 1|\psi_0) f(\mathrm{r}_1|\theta, s_1 = 1)}{Pr(s_1 = 1|\psi_0) f(\mathrm{r}_1|\theta, s_1 = 1) + Pr(s_1 = 2|\psi_0) f(\mathrm{r}_1|\theta, s_1 = 2)}$$

Thus, the filtered probability of regime 1 at time $t = 1$ is a proportion of the likelihood coming from regime 1 to the entire likelihood. Once the filtered probabilities of each regime at time $t = 1$ are

[3] Note that $Pr(s_t = 1|\psi_{t-1}) + Pr(s_t = 2|\psi_{t-1}) = 1$. Once we are able to calculate $Pr(s_t = 1|\psi_{t-1})$, it is very easy to obtain $Pr(s_t = 2|\psi_{t-1})$.

obtained, the transition probability p_{11} and p_{22} can be used to obtain $Pr(s_2 = 1|\psi_1)$ as follows:

$$Pr(s_2 = 1|\psi_1) = Pr(s_1 = 1|\psi_1) \times p_{11} + Pr(s_1 = 2|\psi_1) \times (1 - p_{22}) .$$

Iterating this procedure, by the time $t = T$, we can obtain a sequence of $Pr(s_t = 1|\psi_{t-1})$ as well as $Pr(s_t = 2|\psi_{t-1})$. Afterwards, we can calculate the log-likelihood function (5) and MLE by maximizing it with respect to $\boldsymbol{\theta}$.

4 Data Description

4.1 The Data Source

SRI markets are growing rapidly around the world. This study is based on weekly stock and SRI index data for the US, UK, and Japanese markets. These countries were selected in consideration of the differences in the style of their SRI funds, index history, and social importance of environmental concerns and equity. The UK implemented the disclosure of social, environmental, and ethical investment policies of funds in July 2000; it was the first country to regulate SRI. However, the size of the SRI market (in scale of SRI flow) is the largest in the US, where it is valued at more than $2.5 trillion. In 2007, the shares of SRI assets were about 11% and 10–15% of the total assets under management in the US and the UK, respectively (SIF, 2007; Eurosif, 2008). Although Japan was one of the first countries to introduce SRI in the Asian-Pacific region, the SRI market in Japan is still in an early stage of development and is only one-thirtieth the size of the US market (Social Investment Forum-Japan, 2008).

The universe of SRI assets can be defined in various ways. The oldest method of SRI uses negative screens. That is, companies operating in socially controversial sectors are excluded from a given investment opportunity set based on ethical and religious values. Positive screening, which identifies firms with positive social performance records, is a more recent development. Most SRI in the US applies both of these screenings. SRI in the UK often applies the best-in-class approach, which relies on the inference that firms within a sector face the same social and environmental challenges and that positive screening within a sector is most appropriate. In Japan, for practical purposes, negative screens do not exist and most investments apply positive screens and best-in-class approaches. Although we are not able to directly assess the effect of social screening constraints in the selection process, the sample countries used in this study include key countries so that the differences between SRI and conventional strategies can be analyzed.[4]

Data was obtained from Bloomberg for the following sample periods: November 2001 to July 2008 for the US, August 2001 to July 2008 for the UK, and June 2003 to July 2008 for Japan. Note that the database adjusts for dividends, transaction costs, management fees, and other expenses in each firm's stock and is therefore ideal for these analyses. The lists of the indexes used in this study are provided in Table 1. For a representation of conventional stock market performances, the S&P 500 Index was employed from the US, the FTSE 100 Indices from the UK, and the Tokyo Stock Price Index (TOPIX) from Japan. These are all high-quality conventional benchmarks of SRI from the different countries. The Dow Jones Sustainability Index (DJSI) Series and the FTSE4Good Index Series (for the US), the FTSE4Good Index Series (for the UK), and the Morningstar Socially Responsible Investment Index (MS-SRI) (for Japan) are used to represent the performance of "socially responsible firms" in the US, the UK, and Japan, respectively. A detailed description of each socially responsible index is provided below. The weekly index prices of these regions are shown in Figure 1. Both the SRI index and the regular index move in a similar manner with very high correlations.

The individual constituents of all of the SRI indexes used in this study are market cap weighted base on the universe of stocks that pass the screens. Based on the appropriate investability screens of that index, individual constituents of the SRI indexes have the same investability weighting

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4 Our analysis comprehensively compares indexes considering heterogeneous regulations and the various meanings of SRI. In addition, our approach might include a critique in which we do not compare "apples to apples" or "oranges to oranges" by comparing the performance of socially responsible stocks to those that are not socially responsible within the same industry. This is because conventional strategy indexes include stocks from multiple stocks from multiple sectors of the economy, whereas SRI indexes may not favor stocks from a particular sector such as tobacco or alcohol. However, the decision that a particular industry is excluded from the SRI basket of industries is also a criteria of SRI itself and, therefore, is a key element of SRI characteristics. Furthermore, the list of firm changes over time and the list of SRI index firms are available for all study periods in all three countries. Finally, whether the SRI indexes outperform conventional indexes is also an important question. Therefore, we focus our analysis on comparing the indexes.

(i.e., weight applied to construct index) as that applied in the non-SRI index. The weighting tends to reflect the common belief that large firms should have bigger effects than small ones. Accordingly, a price change in a stock exerts an influence on the index in proportion to its relative market importance; in other words, a price change in a large, widely held stock has a greater impact on the index than that of a less widely held stock.

The S&P 500 is a market-value-weighted (capitalization-weighted) index of 500 stocks, which are traded on the New York Stock Exchange (NYSE), the American Stock Exchange (AMEX), and the NASDAQ National Market System (NASDAQ). The S&P 500 represents approximately 80% of the total market value of all stocks on the New York Stock Exchange. The FTSE 100 Index is a capitalization-weighted index of the 100 most highly capitalized companies traded on the London Stock Exchange. TOPIX is also a weighted index; the market price of each component stock is multiplied by the number of shares listed.

One might doubt the assumption that the investment strategy of SRI funds differs from the strategy of conventional funds. However, in their analysis of US equity funds and social and environmental standards, Kempf and Osthoff (2008) find that SRI funds have a significantly higher ethical ranking than standard funds in the qualitative criteria of community, diversity, employee relations, environment, human rights, and product. Using our sample, this assumption is checked below in the following.

For the S&P 500 and the DJSI of the US, we identify the July 2008 portfolio weights used in the indexes. For each index, we rank the firms from the largest weight to the lowest weight. The firms of the two indexes are then matched against each other to determine their similarities (see Figure 2). Larger firms, which have a larger weight in the S&P 500, also have a larger weight in the DJSI. Nonetheless, the trend is not linear; and, therefore, some differences in firm size are observed. Consequently, we expect some similarities and differences in the investment strategy of SRI funds and that of conventional funds. Figure 3 shows how often firms in the conventional index are adopted in SRI using the S&P 500 and the DJSI. There is a clear trend that larger firms in the S&P 500 are more likely to be listed in SRI than medium and small firms. This is consistent with the finding by

Vidovic and Khanna (2007) that larger firms tend to participate more in EPA's 33/50 Program. We deduce there might be some potential differences in SRI performance that are driven by the firm size of the listed companies. In this study, we propose to investigate the characteristics of firm size in the indexes to gain a better understanding of SRI. However, we additionally note that the results of the analysis of firm size difference in Section 5.3 might be biased since they are based on the portfolio weights used in July 2008 (i.e., date of most recent weighting), instead of the average weight over the course of the study periods.

4.2 Dow Jones Sustainability Index Series

The Dow Jones Sustainability Indices (DJSI) were established to track the performance of companies that lead the field in terms of corporate sustainability. The global Dow Jones Sustainability World Indices (DJSI World) consist of one composite index and five narrower, subset indexes that exclude companies that generate revenue from alcohol, tobacco, gambling, armaments, or firearms industries. This set of indexes was first published September 8, 1999.

All indexes of the DJSI family are assessed according to the same "Corporate Sustainability Assessment" and respective criteria. DJSI United States is used to represent the sample in this study. The methodology is based on the application of criteria to assess the opportunities and risks deriving from economic, environmental, and social dimensions for each of the eligible companies in the DJSI investable stocks universe. These criteria consist of both general criteria applicable to all industries and specific criteria applicable to companies in a particular sector. The criteria are derived following the identification of global and industry challenges.

4.3 FTSE4Good Index Series

The FTSE4Good Index Series includes four tradable and five benchmark indexes, representing global, European, US, Japan (benchmark only), and UK markets managed by the FTSE4Good Policy Committee (FTSE, 2005; FTSE, 2006). The FTSE4Good benchmark indexes include all companies in the broad market index, or starting universe that meet the FTSE4Good criteria. Tradable indexes cover the largest 50 or 100 companies in the benchmark index as measured by their market capitalization.

Companies are eligible for the appropriate FTSE4Good index or Tradable Index if they are currently constituents of the FTSE All-World Developed Index, FTSE All-World North America Index, FTSE All-World Developed Europe Index, FTSE All-Share Index, or the FTSE All-World Developed Japan Index (for FTSE4Good Global, USA, Europe, UK, and Japan, respectively). The FTSE4Good UK and Europe tradable indexes consist of the largest 50 companies in the relevant FTSE4Good Benchmark Index, by full market value at each periodic review. The FTSE4Good USA consists of the largest 100 companies in the relevant FTSE4Good Benchmark Index, by full market values.

4.4 Morningstar Socially Responsible Investment (SRI) Index Series

The MS-SRI index was developed by Morningstar Japan K.K. It is Japan's first stock price index to focus on CSR (Morningstar, 2003). Morningstar Japan selects the top 150 publicly listed companies in terms of their CSR activities and calculates an index based on stock prices.

The MS-SRI index, which was introduced in 2003, is filtered by five criteria: governance, accountability, markets, working environment, and social contribution. Based on questionnaires sent out to about 3,600 listed companies, candidates for index inclusion are narrowed down to 200–300 companies. These 200–300 companies are filtered by what they call "quantitative" screening, in which each company is scored according to the five criteria mentioned above.

5 Empirical Results

In this section, we report the empirical results. First, we show the index comparison and then we show more specific analyses using weighted data in the indexes.

5.1 Results of the Univariate Model

We fit the univariate MS model (1) to stock index return and SRI index return for each country. Table

2 reports the estimation results of the univariate model. As can be seen below, each country shares similar market structures for both returns, and several observations should be emphasized.

First, as Ang and Bekaert (2001) and Okimoto (2008) demonstrate, the results of each country's stock return confirm the two distinct regimes, a bear market with volatile and a low expected return (regime 1) and a bull market with both a stable and a high expected return (regime 2). In particular, the test results for equivalence of mean and volatility across regimes reported in Table 3 indicate that these differences are statistically significant for all cases except for that of the Japanese expected return. Second, the results of SRI return for each country also indicate the existence of two similar regimes in the SRI market. As can be seen from Table 3, the existence of these two distinct regimes is also supported by the hypothesis tests. Third, the two distinct regimes found in both stock and SRI markets are comparable, suggesting that no characteristic difference exists between these two markets. For example, the US stock bear (bull) market has an expected return of −0.321 (0.229) with volatility 2.649 (1.441), while the two US SRI bear (bull) markets have an expected return of −0.331 and −0.368 (0.180 and 179) with a volatility of 2.704 and 2.908 (1.414 and 1.488). These similarities are formally tested using the bivariate model shown below.

To explore the similarity of market structures between the stock and SRI returns from another perspective, Figure 4 shows the smoothed probability of a bear regime (regime 1) for both markets and for each country. We note that a low probability of being in regime 1 implies that the market is in regime 2. As can be seen, their regime classifications appear to be almost identical, indicating the synchronization of the stock and SRI markets.

In sum, the results of our marginal model seem clear. We find two distinct regimes for all three countries in both the stock and the SRI markets. In addition, our results indicate remarkable similarities between the characteristics of the stock and SRI returns. These points are examined more carefully by estimating the bivariate models in the following subsection.

5.2 Results of the Bivariate Models

Given the results of smoothed probability in the previous subsection, we have a solid rationale to assume the regime classification in the stock and the SRI market to be identical. Therefore, we estimate the bivariate two-state MS model (4) to more formally compare the characteristics of the stock and SRI returns. After that, by estimating the restricted bivariate four-state MS model, we verify the acceptability of the common regime assumption.

The parameter estimates of the two-state bivariate model are shown in Table 4. As is demonstrated in the univariate model, the estimation results indicate the existence of bear regimes with volatile and low-expected return and bull regimes with stable and high expected returns. This is not surprising given the synchronization of the stock and SRI markets confirmed above. The differences between these two regimes are examined by testing the equivalence for the parameters across these two regimes. The results are reported in Table 5. As expected from the same test based on the univariate model, the differences in expected return and volatility are significant for all cases. Thus, our finding of two distinct regimes is strongly supported by the hypothesis tests.

Regarding the comovement of the stock and SRI markets, the results are more remarkable. The correlation between the stock and SRI returns are estimated as more than 0.96 for all cases, meaning that they essentially move together regardless of the country or the regime. In addition to the high correlation, the mean and volatility of the stock and SRI returns are very similar for all cases as the univariate model. For example, the estimation results for the US stock and DJSI pairs indicate that the US stock bear (bull) market has an expected return of −0.302 (0.104) with a volatility of 2.678 (1.474), while the US DJSI bear (bull) market has an expected return of −0.315 (0.170) with a volatility of 2.714 (1.413). To formally compare these characteristics, we conduct tests for equivalence between the parameters within each regime for the stock and SRI returns. The results shown in Table 6 illustrate the similar characteristics of the stock and SRI returns with insignificant results for all cases except the bull regime volatility for the US stock and DJSI pair and the bear regime volatility for the US stock and FTSE4Good US pair and the UK stock and FTSE4Good UK pair.

The findings to this point are based on the common regime assumption. To check the appropriateness of this assumption, we estimate the restricted bivariate four-state MS model. Table 7 reports the estimation results of the restricted four-state model. As can be seen from the fifth column, the probability of the bear (bull) regime for the SRI returns conditional on the bear (bull) stock markets is estimated to be 1 for all cases except the UK and Japanese bull regimes. In addition, the estimates for the UK and Japanese bull regimes are 0.993 and 0.969, respectively, which is not significantly different from 1. These results clearly demonstrate the synchronization of the stock and SRI markets. Furthermore, the negligible improvement from adding two extra parameters to the log-likelihood provides strong evidence in favor of the common regime assumption.

In summary, our empirical findings provide clear answers to the questions stated in the introduction. We find two distinct regimes for all three countries in the SRI markets as well as in the stock market. In addition, the synchronization of the stock and SRI markets is clearly supported by the comparison between the two-state bivariate model and the four-state bivariate model. Furthermore, the characteristics of stock and SRI markets are almost identical in the bull regime. Although there is some difference in the bear regime volatility for the US and the UK, the expected return is still comparable, in particular, in the bear regime. Lastly, the estimated correlations indicate strong comovement between the stock and SRI returns in each regime for all countries.

By formally comparing SRI with their respective matched conventional indexes, we are not able to identify the difference attributed to SRI. Although our results are in line with previous studies showing that SRI funds are not significantly different from conventional funds, our results support this result more robustly by applying an innovative new empirical finance method. Thus, in all of the results in these three regions, adding social screening constraints during the selection process does not create or destroy any extra financial return.

In the bear market, with low expected return and high volatility, we find that volatility in SRI funds is significantly lower than conventional fund volatility for the UK. This is consistent with both the analysis and the facts that the SR attributes smooth allocation decisions (see SIF, 2001, 2003). During the stock market downturn in 2001, the return of all US mutual funds decreased by 94%, while the return of US SRI dropped by only 54% (SIF, 2001). Thus, SR investors are less likely to move investments from one fund to another than conventional investors (SIF, 2003). Generally, investors are unwilling to change funds because of the higher search cost for investigating other funds (Huang et al., 2007). The cost for SRI investors might be higher than that of conventional investors because the SRI investors also want to investigate non-financial factors in choosing a fund. Therefore, they might be less willing to withdraw money from the fund.

We anticipate that SRI and conventional indexes react differently to the state of the market (i.e., bull or bear). This is because there is an additional variable in that money inflows decrease faster for conventional stocks but not in SRI during the stock market downturn (see SIF, 2001, 2003).

5.3 Difference in Firm Scale

The literature in event studies indicates that news does matter in the financial markets. Why then are we not able to observe a statistically significant difference between SRI and the conventional indexes? One reason might be that the news reported in newspapers, among other media, might be biased toward large firms in general. A comparison of the results of large and small firms included in the SRI is provided in this sub-section. The SRI data is divided into three categories of large, medium, and small firms. Note that the composition of the SRIs in this study is all free-float market-capitalization weighted. Free-float is defined as the total number of shares outstanding less the block ownership. The weighting of the components is based on the free-float portion of the total number of shares outstanding. Therefore, as analyzed below, the weight used in SRI is the same as firm size in the financial markets.

In the following analysis, we show the results of three groups by weight of SRI in the US (i.e., DJSI) in comparison with the same size group for the S&P 500. That is, for example, the large firm group in DJSI is compared to that of the S&P 500 by applying the same technique as above. Regardless of the size of the firms, the estimation and test results in Tables 8 and 9 show the existence of two distinct regimes as aggregated data. Regarding the comparison, Table 10 reports the test results of equivalence between the parameters for the stock and the SRI returns in each firm size. Statistically significant results are particularly shown for the bull market. At the large and medium firm level, we find expected returns in SRI to be significantly lower than that of the S&P 500 in the bull regime. This indicates that, in contrast to the aggregated case, the adoption of a selection screen for SRI might decrease the expected returns of the portfolios compared to those from the conventional index. However, the SRI's variance is significantly smaller than that of the S&P 500 for these large and medium firms. Therefore, the larger SR firms tend to reduce risk at the expense of smaller returns. Conversely, the smaller SR firms obtain higher expected returns than conventional firms without any significant increase in the variance in the bull market.

We also directly compare larger SR firms and smaller SR firms for a robustness check (see Tables 11 and 12 for the results). Volatilities are found to be lower in larger firms for both regimes, which support the view that larger SR firms have smaller volatilities, as shown in Table 8. This is not surprising, as small firms tend to be more volatile than large firms. The differences in expected return are marginally insignificant but larger SR firms have a smaller (larger) return than smaller SR firms in the bull (bear) market, which also supports the view in Table 8. Nonetheless, we need to note that industry bias and firm size can be more formally tested in alternative methods, such as a matching portfolio analysis (Nakajima, 2011). Although we do not consider these aspects in this study, controlling these variables might produce different results in our dataset.

Summarizing the differences in firm size, we find statistically significant changes in SR firm performance where the results of aggregated SRI in the above subsection are not statistically significant because larger and smaller firms offset the return and volatilities of each other. This is in line with well-known results for the broad market.

6 Discussion and Conclusion

For a decade now, economists have been analyzing whether socially responsible (SR) firms enjoy higher financial performance than conventional firms (e.g., Becchetti and Ciciretti, 2009). However, previous studies focus on specific environmental evaluations in order to analyze the financial market. In their results, poor environmental performance is negatively affected in the market. In contrast, considering both expected returns and volatilities, we are interested in how socially responsible firms, in general, perform in the stock market.

SRI currently represents a significant part of overall investment funds. To obtain a comprehensive picture of the market, this study uses data from key SRI indexes, including the Dow Jones Sustainability Index Series, the FTSE4Good Index Series, and the Morningstar Socially Responsible Investment Index to represent the performance of "socially responsible firms" in the US, the UK, and Japan, respectively.

We argue that there is no difference in the characteristics between SR indexes and conventional indexes. Using the general stock indexes and SRI indexes in three countries, we estimate the first and second moments of index performance distributions based on the Markov switching model. We find two distinct regimes (bear and bull) in both the SRI markets and the stock markets for all countries. In addition, the hypothesis that two regimes appear with the same timing in both markets is accepted. In other words, we confirm that SRI and non-SRI markets share common regimes at all times. It is also found that there are no statistical differences in the means and volatilities generated from the general stock indexes and SRI indexes in all regions. Furthermore, we find strong evidence of comovements between two indexes in each regime. These results are important because to control the risks the market faces in SR aspects, portfolio managers have to take into account the relative performance of SRI and non-SRI indexes.

Finally, we also examine the difference in performance based on the firm size for the US stock and SRI markets. We find that smaller socially responsible firms receive more return and larger socially responsible firms have smaller volatilities in particular regimes.

Theoretically, the adoption of any selection screen decreases the mean-variance efficiency of the portfolios compared to those from an unrestricted universe. Our results do not show the measurable reduction of the efficiency in the portfolios. One might wonder why event studies and Tobin's q employed by such as Konar and Cohen (2001) (though there are critiques of their analyses as discussed in Section 2) show seemingly contradictory results of our expected returns. These studies find that stock markets respond to the disclosure of published environmental news, and that poor environmental performance has a negative effect on the value of the intangible assets of firms.

Although we are not able to identify the reasons, one explanation might be related to the quality of screening. That is, although the selection of the SRI Index is expected to reflect the disclosure of published environmental and ethical news applied in their studies, the firms' responses to SRI survey questions are not public information and more abstract (including the qualitative criteria of community, diversity, employee relations, environment, human rights, and product) so that environmental performance or specific news such as TRI might not be reflected (or might be obscured) in the selection process of the SRI. Considering the positive results of pro-environmental activity in the literature, this is plausible. For example, the US *Newsweek* magazine, in July 2008, launched a CSR and corporate profits in the same position on the global 500 companies selected. However, the simple correlation between the ranking of DJSI and CSR presented in that 2008

Newsweek is only 0.183.

Another possibility might be that although environmental performance is positively evaluated, ethical performance may be negatively evaluated; and, therefore, the net effect can be negligible. However, because the broader empirical literature shows that there is a positive relation between corporate governance and a firm's value (see Gompers et al., 2003), and corporate governance screening has some overlap with ethical screening, this may be unlikely. Further research needs to analyze this puzzle of the relationship between SR firms and economic performance.

Nevertheless, our results do not provide pessimistic financial implications for SRI. This is because the long-run financial consequences of being socially responsible in investing are as good as other conventional businesses. Therefore, the hypothesis that pursuing social benefit comes at the expense of economic performance is rejected in all regions. With the introduction of SRI indexes and the accompanying empirical evidence of SRI, the debate on being socially responsible in investing is good advanced corporate practice. To encourage further diversification of asset allocation to SRI, it is important to provide additional research from another perspective with more detailed information for environmental and ethical scores. Despite the fact that bull and bear states are exogenously determined in this study rather than driven by some economic variable as in Guidolin and Timmermann (2005), it might be important to consider associations with economic variables such as interest rate spreads, inflation rates, money stocks, aggregate output, unemployment rates, and nominal effective exchange rates.

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Table 1: SRI and Conventional Funds in This Study

	SRI funds	Conventional funds
US	Dow Jones Sustainability Index (DJSI) Series FTSE4Good Index Series	Standard & Poor's 500 Stock Index (S&P500 Index)
UK	FTSE4Good Index Series	FTSE 100 Indices
Japan	Morningstar Socially Responsible Investment Index (MS-SRI)	Tokyo Stock Price Index (TOPIX)

Table 2: Estimation results of marginal models

			p	μ	σ	Log-likelihood
US-Stock	Regime 1	Estimate	0.993	-0.321	2.649	-706.7
		Std error	0.008	0.244	0.174	
	Regime 2	Estimate	0.993	0.229	1.441	
		Std error	0.006	0.099	0.076	
US-SRI	Regime 1	Estimate	0.993	-0.331	2.704	-700.8
(DJSI)		Std error	0.008	0.253	0.185	
	Regime 2	Estimate	0.993	0.180	1.414	
		Std error	0.006	0.097	0.079	
US-SRI	Regime 1	Estimate	0.991	-0.380	2.908	-718.7
(FTSE4)		Std error	0.010	0.276	0.205	
	Regime 2	Estimate	0.993	0.179	1.488	
		Std error	0.005	0.107	0.074	
UK-Stock	Regime 1	Estimate	0.979	-0.368	2.789	-747.3
		Std error	0.015	0.222	0.183	
	Regime 2	Estimate	0.979	0.271	1.271	
		Std error	0.011	0.090	0.079	
UK-SRI	Regime 1	Estimate	0.980	-0.390	2.719	-741.4
		Std error	0.017	0.241	0.197	
	Regime 2	Estimate	0.979	0.269	1.245	
		Std error	0.013	0.093	0.088	
JP-Stock	Regime 1	Estimate	0.915	-0.576	3.112	-609.9
		Std error	0.080	0.577	0.329	
	Regime 2	Estimate	0.957	0.511	1.901	
		Std error	0.043	0.223	0.175	
JP-SRI	Regime 1	Estimate	0.967	-0.129	3.020	-614.5
		Std error	0.043	0.357	0.280	
	Regime 2	Estimate	0.971	0.377	1.877	
		Std error	0.032	0.207	0.221	

Note: Regime 1 is a bear market with volatile and low expected return, and regime 2 is a bull market with stable and high expected return. Hereafter in the Tables, Stock indicates general stock index return. SRI indicates SRI index return.

Table 3: Tests for equivalence of mean and volatility across regimes

Country		Mean of Stock	Mean of SRI	Volatility of Stock	Volatility of SRI
US-DJSI	Wald stat	4.271	3.310	43.59	44.72
	P-value	0.039	0.069	0.000	0.000
US-FTSE4	Wald stat	-	3.433	-	48.84
	P-value	-	0.064	-	0.000
UK	Wald stat	7.048	6.351	66.35	57.03
	P-value	0.008	0.012	0.000	0.000
JP	Wald stat	2.420	1.274	16.01	14.32
	P-value	0.120	0.259	0.000	0.000

Note: US-DJSI and US-FTSE4 indicate each of DJSI and FTSE4 is applied as SRI in US, respectively. The standard errors in the Wald tests do not consider autocorrelation and hetroschedasticity. However, autocorrelation is very weak and MS model capture hetroschedasticity.

Table 4: Estimation results of the two-state bivariate MS model

			p	ρ	μ_{Stock}	μ_{SRI}	σ_{Stock}	σ_{SRI}	log-likelihood
US-DJSI	Regime 1	Estimates	0.994	0.979	-0.302	-0.315	2.678	2.714	-885.1
		Std error	0.008	0.004	0.104	0.105	0.169	0.173	
	Regime 2	Estimates	0.993	0.971	0.201	0.170	1.474	1.413	
		Std error	0.006	0.004	0.094	0.089	0.071	0.069	
US-FTSE4	Regime 1	Estimates	0.994	0.985	-0.377	-0.421	2.696	2.900	-865.4
		Std error	0.007	0.003	0.127	0.129	0.187	0.204	
	Regime 2	Estimates	0.993	0.976	0.230	0.198	1.476	1.493	
		Std error	0.005	0.003	0.086	0.092	0.067	0.067	
UK	Regime 1	Estimates	0.988	0.996	-0.243	-0.267	2.617	2.571	-637.6
		Std error	0.009	0.001	0.185	0.183	0.136	0.133	
	Regime 2	Estimates	0.983	0.996	0.240	0.228	1.307	1.296	
		Std error	0.011	0.001	0.098	0.098	0.079	0.082	
JP	Regime 1	Estimates	0.902	0.983	-0.488	-0.452	3.058	3.107	-771.4
		Std error	0.075	0.004	0.406	0.401	0.265	0.271	
	Regime 2	Estimates	0.949	0.982	0.497	0.484	1.915	1.945	
		Std error	0.037	0.004	0.176	0.177	0.139	0.143	

Table 5: Tests for equivalence between parameters across regimes

Country		Correlation	Mean of Stock	Mean of SRI	Volatility of Stock	Volatility of SRI
US-DJSI	Wald stat	2.627	26.318	26.002	41.265	47.265
	P-value	0.105	0.000	0.000	0.000	0.000
US-FTSE4	Wald stat	4.9735	4.482	4.0282	42.7088	49.6703
	P-value	0.0257	0.0343	0.0447	0	0
UK	Wald stat	0.023	5.051	5.407	74.18	72.09
	P-value	0.880	0.025	0.020	0.000	0.000
JP	Wald stat	0.03	4.427	4.044	15.83	15.37
	P-value	0.8732	0.035	0.044	0.000	0.000

Table 6: Tests for equivalence of mean and volatility within regimes

Country		Mean of Regime 1	Mean of Regime 2	Volatility of Regime 1	Volatility of Regime 2
US-DJSI	Wald stat	0.068	1.622	0.486	5.760
	P-value	0.794	0.203	0.486	0.016
US-FTSE4	Wald stat	0.765	1.993	17.167	0.592
	P-value	0.382	0.158	0.000	0.442
UK	Wald stat	1.669	1.333	5.613	1.082
	P-value	0.196	0.248	0.018	0.298
JP	Wald stat	0.307	0.176	0.638	0.929
	P-value	0.580	0.675	0.424	0.335

Table 7: Estimation results of the four-state bivariate MS model

			p	q	ρ	μ_{Stock}	μ_{SRI}	σ_{Stock}	σ_{SRI}	log-likelihood
US-DJSI	Regime 1	Estimates	0.994	1.000	0.979	-0.302	-0.315	2.678	2.714	-885.1
		Std error	0.028	1.009	0.007	0.406	0.153	1.296	1.630	
	Regime 2	Estimates	0.993	1.000	0.971	0.201	0.170	1.474	1.413	
		Std error	0.018	0.994	0.046	0.418	0.502	0.313	0.473	
US-FTSE4	Regime 1	Estimates	0.994	1.000	0.985	-0.378	-0.421	2.696	2.900	-865.4
		Std error	0.020	1.029	0.009	0.120	0.040	0.241	0.045	
	Regime 2	Estimates	0.993	1.000	0.976	0.230	0.198	1.477	1.493	
		Std error	0.008	0.948	0.003	0.225	0.109	0.095	0.126	
UK	Regime 1	Estimates	0.980	1.000	0.996	-0.337	-0.368	2.597	2.545	-637.2
		Std error	0.084	0.943	0.010	0.045	0.079	0.050	0.029	
	Regime 2	Estimates	0.980	0.993	0.996	0.281	0.272	1.352	1.342	
		Std error	0.031	0.027	0.002	0.049	0.028	0.012	0.041	
JP	Regime 1	Estimates	0.919	1.000	0.988	-0.480	-0.418	3.100	3.097	-767.5
		Std error	0.165	1.814	0.087	0.004	0.077	0.280	0.074	
	Regime 2	Estimates	0.960	0.969	0.981	0.483	0.468	1.907	1.950	
		Std error	0.188	0.050	0.035	0.006	0.041	0.173	0.002	

Table 8: Estimation results of the two-state bivariate MS model

			p	ρ	μ_{Stock}	μ_{SRI}	σ_{Stock}	σ_{SRI}	log-likelihood
Large	Regime 1	Estimates	0.992	0.948	-0.152	-0.253	2.415	2.532	-1015.6
		Std error	0.010	0.011	0.233	0.246	0.172	0.179	
	Regime 2	Estimates	0.992	0.938	0.379	0.306	1.564	1.430	
		Std error	0.007	0.009	0.094	0.089	0.075	0.070	
Medium	Regime 1	Estimates	0.990	0.954	-0.203	-0.204	2.694	2.366	-1062.3
		Std error	0.013	0.010	0.210	0.150	0.206	0.172	
	Regime 2	Estimates	0.992	0.916	0.381	0.309	1.621	1.461	
		Std error	0.007	0.012	0.111	0.100	0.080	0.072	
Small	Regime 1	Estimates	0.986	0.924	-0.426	-0.431	2.856	3.212	-1252.7
		Std error	0.013	0.014	0.216	0.238	0.204	0.237	
	Regime 2	Estimates	0.992	0.923	0.252	0.363	1.722	1.751	
		Std error	0.006	0.011	0.112	0.117	0.086	0.088	

Table 9: Tests for equivalence between parameters across regimes

Size		Correlation	Mean of Stock	Mean of SRI	Volatility of Stock	Volatility of SRI
Large	Wald stat	0.4211	4.4591	4.4595	21.5461	33.7888
	P-value	0.5164	0.0347	0.0347	0	0
Medium	Wald stat	4.5432	9.766	12.876	25.02	24.73
	P-value	0.0331	0.002	0.000	0.000	0.000
Small	Wald stat	0.0019	7.993	9.120	27.784	36.149
	P-value	0.965	0.005	0.003	0.000	0.000

Table 10: Tests for equivalence of mean and volatility within regimes

Size		Mean of Regime 1	Mean of Regime 2	Volatility of Regime 1	Volatility of Regime 2
Large	Wald stat	1.649	4.482	2.439	14.923
	P-value	0.199	0.034	0.118	0.000
Medium	Wald stat	0.000	3.122	16.604	15.320
	P-value	0.997	0.077	0.000	0.000
Small	Wald stat	0.002	5.267	9.074	0.366
	P-value	0.965	0.022	0.003	0.545

Table 11: Estimation results of the two-state bivariate MS model

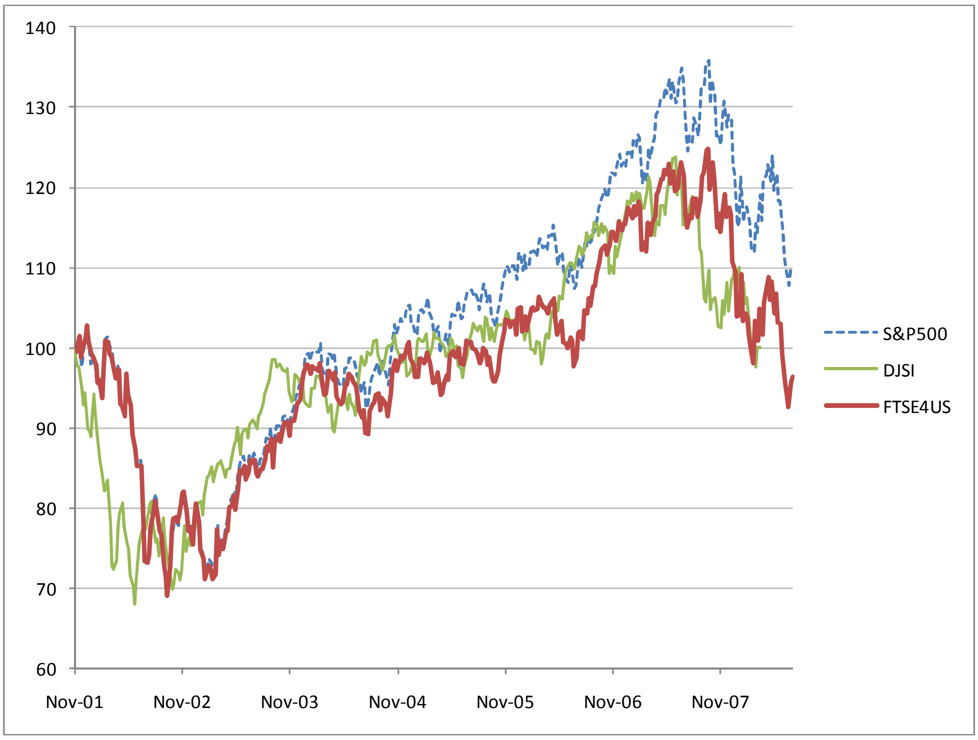
			p	ρ	μ_L	μ_S	σ_L	σ_S	log-likelihood
L&S	Regime 1	Estimates	0.987	0.860	-0.234	-0.465	2.579	3.182	-1174.3
		Std error	0.013	0.028	0.154	0.180	0.237	0.255	
	Regime 2	Estimates	0.992	0.824	0.313	0.410	1.395	1.743	
		Std error	0.006	0.022	0.111	0.128	0.067	0.086	

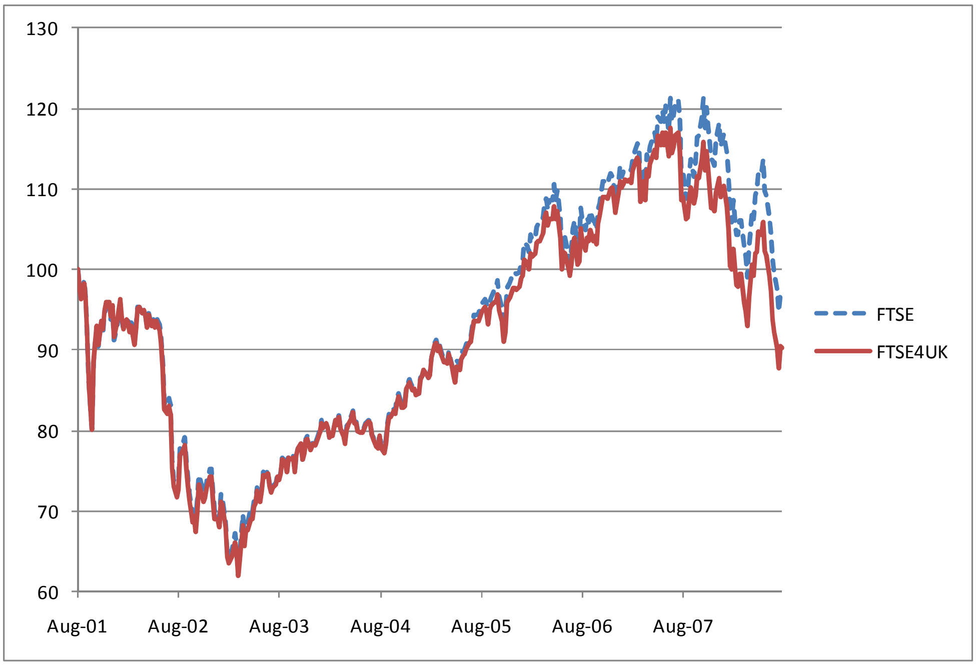
Note: L&S is large and small size.

Table 12: Tests for equivalence of mean and volatility within regime

Size		Mean of Regime 1	Mean of Regime 2	Volatility of Regime 1	Volatility of Regime 2
L&S	Wald stat	2.509	2.113	17.336	24.218
	P-value	0.113	0.146	0.000	0.000

Figure 1: Weekly Index Prices of SRI and Conventional Funds






220
200
180
160
140
120
100
80
Jun-03
Dec-03
Jun-04
Dec-04
Jun-05
Dec-05
Jun-06
Dec-06
Jun-07
Dec-07
Jun-08
TOPICX
MS-SRI

Figure 2: Ranking Comparison of SRI and Conventional Indices

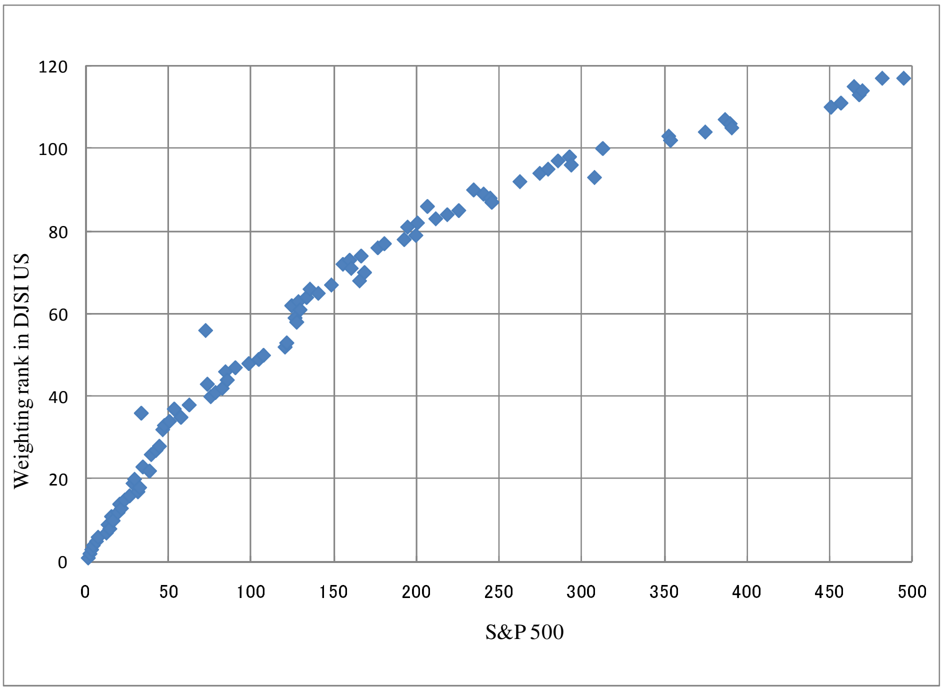
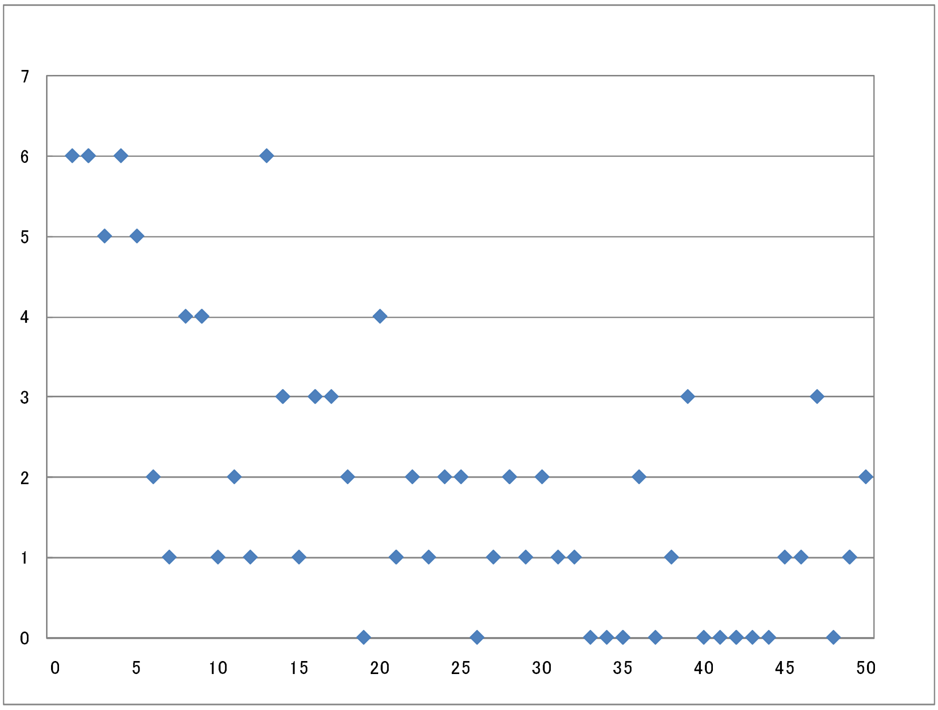
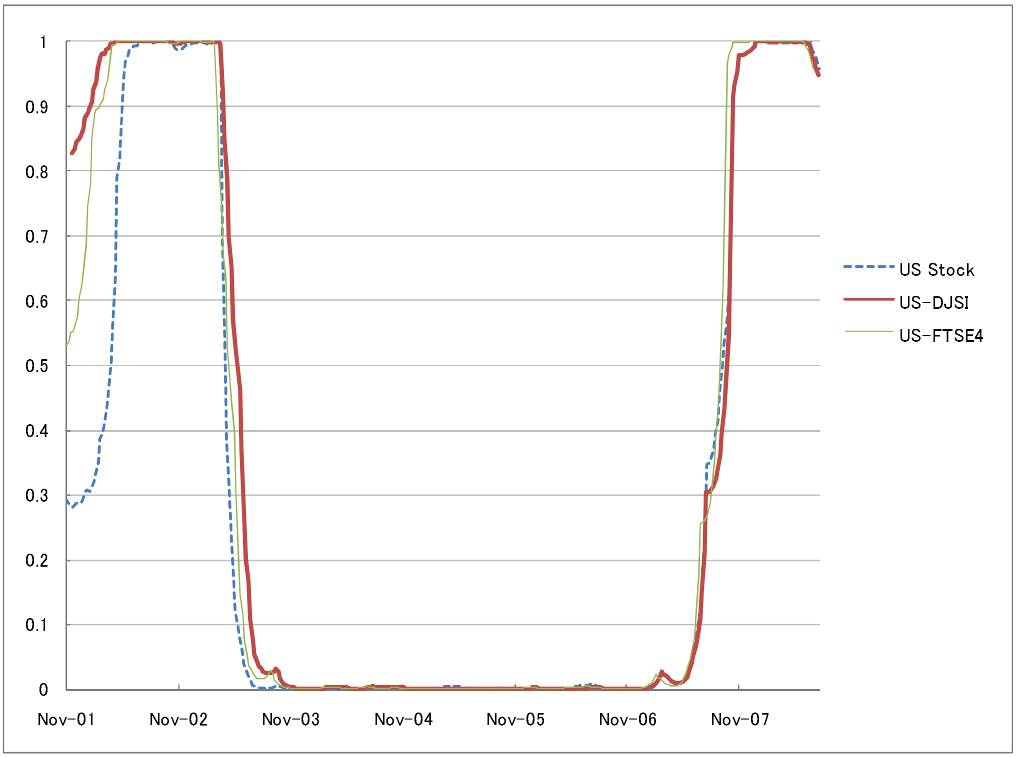


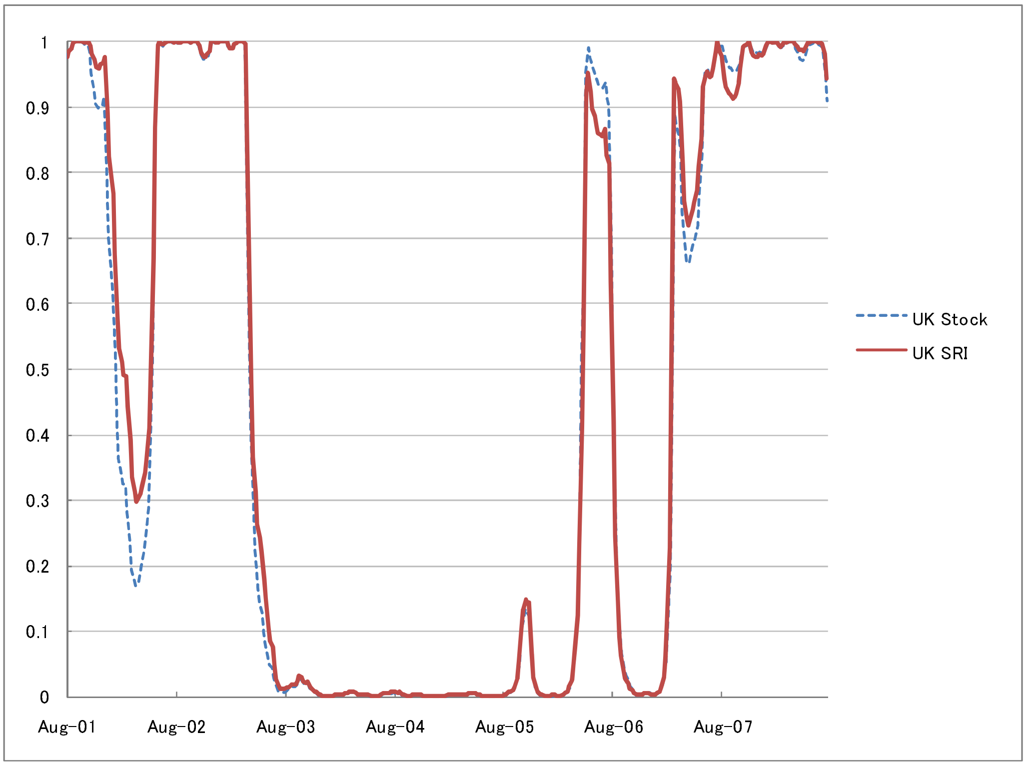
Figure 3: How Often SR firms are Listed in Conventional Funds: Share of Listed Firms of SRI in Conventional Funds

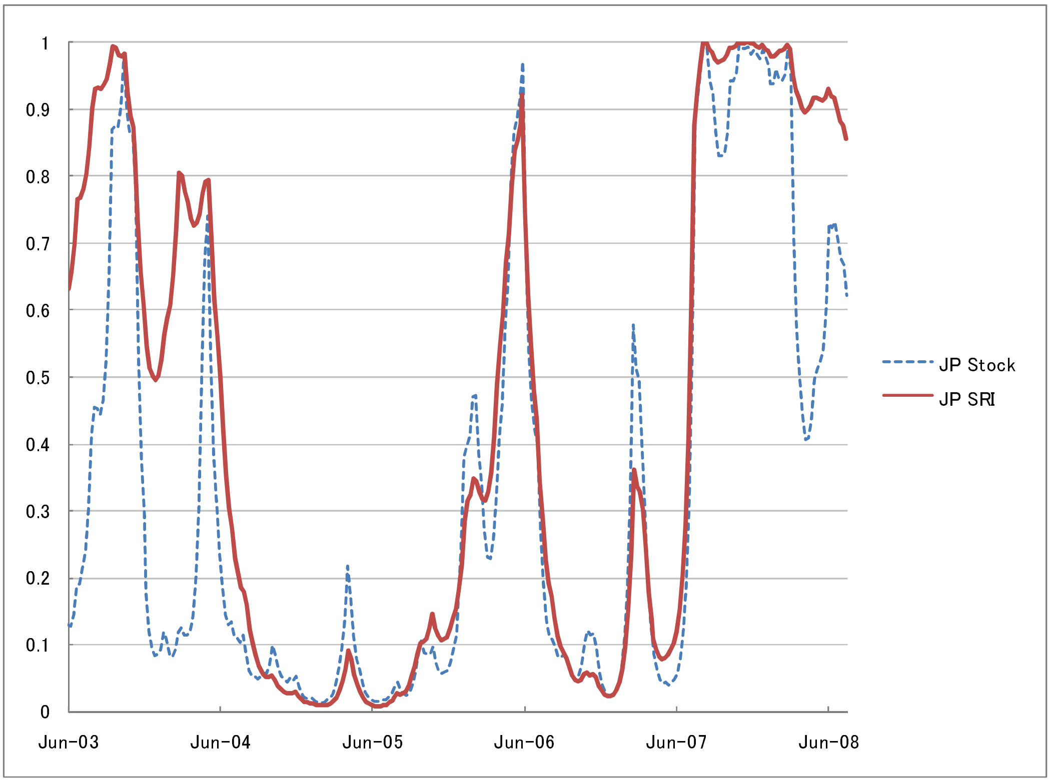


Note: Vertical axis is the number of SRI firms listed in DJSI in each 10 firms of S&P500. Horizontal axis is the ranking order of each 10 firms in S&P500.

Figure 4: Smoothed probability of bear regime (regime 1)






1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
Jun-03
Jun-04
Jun-05
Jun-06
Jun-07
Jun-08
JP Stock
JP SRI