Return and risk in Socially Responsible Investment in the Asia Pacific: a dynamic unobserved component CAPM approach with heteroskedastic disturbances

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Research areas: *Asset Pricing Models and Tests, Equities, Portfolio Management and Asset Allocation, Portfolio Performance Evaluation, Risk Management and Financial Engineering, Law, Ethics and Finance,*

Abstract:

This paper analyzes the risk-return performance of Socially Responsible Investment in the Asia Pacific context. The growth of Socially Responsible Investment in the Asia Pacific has resulted in demand from investors and institutions for scientific research on the financial outcomes of Socially Responsible Investment strategies. In response to that, we analyze the performance of the most representative Socially Responsible Investment equity index in the Asia Pacific: the Dow Jones Sustainability Asia Pacific Index. This paper introduces a methodological innovation and applies a state-space Capital Asset Pricing Model in order to allow systematic risk to vary over time. This provides crucial information for carrying out accurate active investment strategies. The main results indicate that there is no risk-adjusted return penalty for investing in the Socially Responsible Investment equity index analyzed and that this index generally shows lower risk levels, thus refuting the principles established by Modern Portfolio Theory.

Keywords: Socially Responsible Investment, Asia Pacific, systematic risk, state-space CAPM.

EFM classification codes: 750, 450, 760, 310.

1. Introduction

Socially Responsible Investment (SRI), also known as 'ethical investment' and 'sustainable investment' (Renneboog et al. 2008a), considers factors such as environmental preservation, respect for human rights and other social issues in addition to the financial ones. Thereby, SRI refers to an investment strategy where investors make investment decisions based on ethical principles. The SRI gives the investors the opportunity to match their investment policy with their ethical values and principles (Domini, 2001). In recent years, SRI has grown significantly and has changed from being a niche market to become a core factor for mainstream investors around the world (Le Maux and Le Saout, 2004; Statman, 2006). During the 21st century the SRI has experienced a high increase. As the EUROSIF (2010) report emphasizes, 'total SRI Assets under Management (AuM) in Europe have reached €5 trillion, as of December 31, 2009, whereas they represented near to €2.7 trillion in 2005. In the USA, SRI has increased from 1200% between 1995 and 2009, giving a current share of about 10% SRI in AuM (EUROSIF, 2010).

The development of SRI in the Asia Pacific, conceiving it as the Japan, Australia, Sotuh-Korea, Taiwan and Singapore, has also been significant which actually represents over €65 billion (EUROSIF, 2010). Most of this amount belongs to the Australian SRI market, which has grown from €41.4 billion in 2007 to €56.5 billion in 2010 (EUROSIF, 2008; 2010). Japan SRI industry has also increased, representing about €4 billion in 2010 (EUROSIF, 2010). The increase in SRI in the Asia Pacific was mainly motivated by the demand from institutional investors, the mainstreaming of environmental, social and governance principles into traditional financial services and by the external pressure from the main NGOs worldwide (EUROSIF, 2010). Another factor that has contributed to the expansion of SRI in this zone refers to the development of SRI equity indexes. SRI equity indexes constitute a tool to enable responsible investors to identify companies that meet globally-recognised Corporate Social Responsibility (CSR) principles. There actually exist some SRI equity indices in the Asia Pacific: the Australian SAM Sustainability Index; the Dow Jones Sustainability Index Japan 40 (DJSI Japan 40); the Dow Jones Sustainability Index Korea (DJSI Korea); the Ethinvest Environmental Index Australia; the Westpac-Monash Eco Index Australia; the Australian Cleantech Index (ACT); and the FTSE4Good Australia 30 Index, among others. These indexes focus on companies belonging to specific countries of the Asia Pacific. However, the Dow Jones Sustainability Asia Pacific Index (DJSI-AP) comprises the leading companies in terms of sustainability from the developed markets in Asia Pacific area.

The aforementioned high increase of SRI, at a global level, has awakened the interest of academicians and practitioners in carrying out researches about SRI performance. This paper seeks to show to investors and portfolio managers the financial outcomes of integrating social and environmental issues into core investment processes in the Asia Pacific. Thus, this research aims to test whether it is possible to do well (investing in an ethical way) while doing good (obtaining return and risk benefits) when carrying out investment strategies in that area. Although most of research in this field is mainly based on measuring the risk-adjusted returns of several SRI assets, investment or pension funds and SRI equity indexes (Fowler and Hope, 2007), the present paper also focuses on risk levels. To do this, we assess the systematic risk associated to the DJSI-AP and is compared with the achieved by its benchmark: i.e. the Dow Jones Global Total Stock Market Index (DJG).

A methodological contribution of this work is the estimation of an extended state-space CAPM to capture the time-varying behaviour of the DJSI-AP systematic risk. This approach mitigates the limitations identified in some of the static econometric techniques and standard models applied by most of the research in this field. Finally, we use daily market data instead of monthly data that frequently is used in similar studies (Schöder, 2007), which will turn the estimates more robust. Due to the use of daily data, we introduce heteroskedasticity in the model, an issue that will bring more reliable an accurate estimate of DSJI-AP systematic risk.

The rest of the paper is organised as follows. The next section analyses the previous literature in the field. Additionally, the missing links on the topic are reviewed and the research hypotheses are shown. The third section introduces the theoretical econometric models applied and shows the sample selection and the description of the data. The results are shown in section four. Finally, conclusions and further discussion are developed in the last section.

2. Background: literature review and hypotheses

Research about SRI performance dates back to the 1970s (Moskowitz, 1972), and has growth significantly during the recent decades. The general hypothesis in these works is that the SRI (e.g. equity index or fund, among others) should underperform the market and other well-diversified portfolios. Among the principal reasons that could explain this effect is that SRI portfolios are subsets of the market portfolio (Le Maux and Le Saout, 2004). As indicated by the proposals of the Modern Portfolio Theory (MPT), the social and environmental screening processes reduce the investment universe, which leads to a reduction in the risk-adjusted returns (Renneboog et al. 2008a; Lee et al. 2010). Most of research in this field is focused on measuring the financial performance associated to several SRI funds. Some studies have analysed the differences in risk-adjusted returns between SRI and conventional investment funds (Luther et al. 1992; Hamilton et al. 1993; Luther and Matatko, 1994; White, 1995). These papers use simple regressions of SRI investment funds' return against some market indexes' return in order to show if the SRI funds out or under-performance the traditional benchmarks. In general, these works do not usually evidence out or under-performance of SRI funds compared with the traditional ones. However, these results should be carefully interpreted, because they do not consider the transaction costs of investment funds. They also do not take into account the ability of the portfolio managers to produce an outstanding performance (Schröder, 2007), that could interferes with the SRI screening processes.

Later works have tried to mitigate these shortcomings by analysing SRI and conventional funds of similar characteristics applying the 'matching approach' (Gregory et al. 1997; Statman, 2000; Stone et al. 2001; Kreander et al. 2002; Michelson et al. 2004; Bauer et al. 2005). Although there are several studies showing a significant out-performance (Derwall et al. 2005) and under-performance (Geczy et al. 2005) of SRI funds, they generally conclude that SRI and conventional funds show a similar performance in their return-risk levels. The most recent research in the field shows mixed results about the performance of SRI and conventional funds (Barnett and Salomon, 2006). Benson et al. (2006) did not find any significant differences in the performance associated to SRI and conventional funds portfolios. Similarly, Bauer et al. (2007) conclude that investing in ethical mutual funds does not lead to returns that are significantly different from those delivered by conventional mutual funds, corroborating previous research on SRI mutual fund performance. However, Renneboog et al. (2008b) find some weak evidence that social screening processes may adversely affect SRI funds return levels. Derwall and Koedijk (2009) show that SRI fixed-income funds in the US out-performed traditional funds. Finally, Lee et al. (2010) indicate that the return levels of US SRI and conventional funds were similar, but the systematic risk of SRI funds was lower than in conventional ones (mainly due to the negative relationship between screening intensity and total fund risk).

The literature also contains some papers which analyse the risk-return associated with SRI equity indexes, which constitute a tool to enable responsible investors to identify companies that meet globally-recognised Corporate Social Responsibility (CSR) or sustainability principles. This is a consequence of the significant growth in the number of SRI equity indexes during the last decade. The Dow Jones Sustainability indexes and the FTSE4Good indexes are the main references in the field (see Schöder, 2007 for a complete review of SRI equity indexes). Kurtz and DiBartolomeo (1996) and Sauer (1997) examine the Domini 400 Social Index and conclude that investing in this SRI equity index does not necessary have an adverse impact on investment performance. Furthermore, Sauer (1997) states that investors can choose SRI in accordance with their value systems and beliefs, without being forced to sacrifice financial performance. Likewise, DiBartolomeo and Kurtz (1999) do not find evidence of meaningful differences in the returns relative to the DSI and the Standard and Poor's 500 (S&P 500). Although the results of Statman (2000) work suggest that the DSI performed better than its benchmark (S&P 500) during the 1990-98 period, mainly due to the presence of higher raw returns and risk-adjusted returns in the SRI equity index compared to those obtained by the S&P500 Index, the difference was not statistically significant. Later works like the proposed by Garz et al. (2002), focused on the Dow Jones Stoxx Sustainability Index (DJSI-Stoxx), indicate that it can pay to take the sustainability factor into account when carrying out the investment strategies. This is due to that the DJSI-Stoxx return levels, even after risk adjustment, were higher than the obtained by its benchmark (the Dow Jones Stoxx Index). A few years later, Statman (2006) get back with the analysis of the DSI (between May 1990 and April 2004) and find that its returns were generally higher than those of the S&P 500 Index. However, he reaches similar conclusions to that obtained in his previous research (Statman, 2000), indicating that the return differences between the SRI and the conventional index were non significant. Further research on the topic, like the proposed by Schröder (2007), which analyses 29 SRI equity indices around the world, confirms the results obtained in previous works, indicating that investing in SRI equity indexes does not impose additional costs in terms of lower returns to the investors. In general, these works evidence that the hypothesis that returns of the SRI equity indexes are equal to those of conventional stock exchange indexes cannot be rejected. Finally, a more recent work (Collison et al. 2008) examines the financial performance of the FTSE4Good indexes. They conclude that these indexes outperformed their benchmarks over the period running from 1996 to 2005. Additionally, they indicate that most of this outperformance was due to risk differences between the FTSE4Good indices and their benchmarks.

Most of the works in this field use static econometric techniques like computing the Sharpe and Treynor ratios (Sauer, 1997; Statman, 2000, 2006; Schröder, 2007) or estimating the traditional/extended multifactor CAPM (DiBartolomeo and Kurtz, 1999; Garz et al. 2002). The first set of studies may present biased risk-adjusted returns because those techniques can be manipulated by strategies that can change the shape of probability distribution of SRI indexes' returns (Henriksson and Merton, 1981; Dybvig and Ingersoll, 1982; Bernardo and Ledoit, 2000; Spurgin, 2001). The latter works may lead to obtain erroneous conclusions because, as demonstrated by many works in financial-econometrics literature (Bos and Newbold, 1984; Harvey, 1990; Ferson and Harvey, 1991; Brooks et al. 1992; Holmes and Faff, 2004), the CAPM imposes the stability of the beta parameter, an aspect that is not in line with financial data, which frequently are non stationary. Lee et al. (2010) introduce some methodological advances in the field, allowing the systematic risk of SRI funds to vary over time. However, the sample considered in that research is divided into three periods where the beta parameter is re-estimated in each one. Thus, the systematic risk of the funds is stable in each period. In our work, the use of the state-space CAPM will allow us to capture the daily time-varying stochastic behaviour of the DJSI-AP systematic risk, which is very useful information to establish active investment strategies and, thus overcoming the methodological limitations identified in previous works.

Having analysed the previous research on the topic, we propose the following hypotheses to be tested:

H1: The SRI equity index considered (DJSI-AP) show lower risk-adjusted return levels than its benchmark (DJG)

H2: The SRI equity index analysed (DJSI-AP) was riskier than its benchmark (DJG).

Non-rejection of H1 will indicate that there is a return disadvantage from investing in the SRI equity index considered (DJSI-AP). Additionally, non-rejection of H2 will confirm the principles established by the MPT, which indicate that SRI is riskier than conventional investment approaches. On the other hand, rejection of H1 may indicate that taking CSR issues when investing in the Asia Pacific is not associated with a risk-adjusted penalty. Furthermore, rejection of H2 may suggest that investors who invest in the DJSI-AP experienced lower risk levels in their portfolios than their counterparts who do not invest in an equity index screened by CSR criteria (i.e. the DJG).

3. Method and sample

3.1 Econometric model

We start from the traditional CAPM, which assumes that the relationship between risk and return of some assets is given by:

$$r_{i,t} = \alpha_i + \beta_i \, r_{m,t} + \varepsilon_{i,t} \qquad (1)$$

where $r_{i,t}$ is the continuously compounded excess return of stock *i* in period *t*; $r_{m,t}$ is the continuously compounded excess return of the market benchmark in period *t*; and β_i is the systematic risk of stock *i*. The error term $\varepsilon_{i,t}$ determines the non-systematic risk of stock *i* and is modelled on a homoskedastic white noise process; and α_i parameter is known in the literature as Jensen's Alpha (Jensen, 1968). In our work and as indicated by Schröder (2007), it is not necessary to include additional factors in the CAPM equation, as when analysing the performance of SRI funds. This is because the SRI equity indexes are, in general, only restructured two or three times per year, there is no active portfolio managed (unlike the conventional portfolio management model applied by funds managers), and their investment universe can be very well approximated by their benchmarks. Thus, factors such as market timing (Admati and Ross, 1985), public information of portfolio management style (Ferson and Schadt, 1996) and the performance of other benchmarks need not be considered in the present analysis.

Later works question the stability over time of the β_i parameter (Blume, 1971; Collins et al., 1987; Harvey 1989; Lee and Rahman, 1990; Ferson and Harvey 1991, 1993; Holmes and Faff, 2004; Benson et al., 2007), arguing that the return series of stocks are not stationary (Bos and Newbold, 1984; Brooks et al., 1992; Faff et al., 1992; Groenewold and Fraser, 1999). Several alternative models have been proposed where the beta coefficient follows a dynamic process. Thus, Fabozzi and Francis (1977) and

Faff and Brooks (1998) define a beta parameter consisting of one constant component and another variable one, with the latter remaining in function of the market conditions. Moreover, Schwert and Seguin (1990) implement a dynamic beta model defined according to market volatility. Other authors (Yu, 2002; Li, 2003 and Koopman et al., 2004) propose stochastic volatility models to allow beta vary over time, while Bollerslev et al. (1988) use GARCH models. Fridman (1994) and Huang (2000) use Markov Switching regression models. Other works (Jagannathan and Wang, 1996; Ferson and Harvey, 1999; Lettau and Ludvigson, 2001) propose conditional CAPM models, where the beta coefficient is the function of several state variables.

In addition, other authors use the state-space specification of the CAPM (Black et al., 1992; Wells, 1994; Groenewold and Fraser, 1999; McKenzie et al., 2000; Mamaysky et al., 2007, 2008; Holmes and Faff, 2008; Adrian and Franzoni, 2009). This model has been applied to several markets across the world, and provides a more accurate estimate of the systematic risk when using daily market data than that given by other models mentioned above (Wells, 1994; Brooks et al., 1998; Faff et al., 2000). The present research follows this approach, and proposes a modified state-space CAPM to estimate recursively the dynamics of the beta coefficient with the use of the Kalman filter algorithm. Thus, given the market model by equation (1), and re-expressing it in a state-space specification, we obtain equations (2) and (3).

$$\text{Observation equation: } r_{i,t} = \beta_{i,t}\, r_{m,t} + \varepsilon_{i,t} \tag{2}$$

$$\text{State equation: } \beta_{i,t} = \overline{\beta}_i + \phi_i \left(\beta_{i,t-1} - \overline{\beta}_i\right) + \eta_{i,t} \tag{3}$$

where $0 \le |\phi_i| \le 1$ represents the constant transition parameter; $\overline{\beta}_i$ can be interpreted as the mean beta over the entire sample. The error terms for the observation equation ($\varepsilon_{i,t}$) and state equation ($\eta_{i,t}$) are assumed to be Gaussian, with $E[\varepsilon_{i,t}\varepsilon_{i,\tau}] = \delta_{t,\tau}\sigma^2_{\varepsilon,i}$ and

$E[\eta_{i,t}\eta_{i,\tau}] = \delta_{t,\tau}\sigma^2_{\eta,i}$ where $\delta_{t,\tau} = 1$ if $t = \tau$ and 0 otherwise. $\varepsilon_{i,t}$ and $\eta_{i,t}$ are mutually independent, so that $E[\varepsilon_{i,t}\eta_{i,\tau}] = 0$ for all t and τ. The state equation (3) describes the dynamic process of $\beta_{i,t}$ in terms of an AR(1) stationary process, including three of the most common stochastic specifications used in the literature (Moonis and Shah, 2003; Yao and Gao, 2004). If $\phi_i = 1$, the beta coefficient follows a random walk process given by:

$$\beta^{RW}_{i,t} = \beta^{RW}_{i,t-1} + \eta_{i,t} \quad (4)$$

used in Sunder (1980), Simonds et al. (1986), Lie et al. (2000) and Li (2003), among others. If, on the other hand, $\phi_i = 0$, the beta coefficient follows a random coefficient process given by:

$$\beta^{RC}_{i,t} = \overline{\beta}_i + \eta_{i,t} \quad (5)$$

(see Fabozzi and Francis, 1978; Simonds et al., 1986; Brooks et al., 1992; Wells, 1994; Faff et al., 2000 among others), where the $\overline{\beta}_i$ parameter is the mean beta over the entire sample. Finally, if $0 < |\phi_i| < 1$, the beta coefficient follows an AR(1) stationary process, which can be expressed as:

$$\beta^{MR}_{i,t} = \overline{\beta}_i + \varphi_i \left(\beta^{MR}_{i,t-1} - \overline{\beta}_i\right) + \eta_{it} \quad (6)$$

where $\overline{\beta}_i$ is the mean beta for the entire sample; and ϕ_i as the 'speed parameter', which measures how fast the time-varying beta returns its mean (see Ohlson and Rosenberg, 1982; Bos and Newbold, 1984; Collins et al., 1987; Faff et al., 1992; Brooks et al., 1998; Groenewold and Fraser, 1999; among others).

The unknown parameters of the system are estimated by numerical optimisation on the following likelihood function (Harvey, 1990):

$$\log L_i(\boldsymbol{\theta}_i) = -\frac{T}{2}\log(2\pi) - \frac{1}{2}\sum_{t=1}^{T}\log f_{i,t}(\boldsymbol{\theta}_i) - \frac{1}{2}\sum_{t=1}^{T}\frac{\nu_{i,t}^2(\boldsymbol{\theta}_i)}{f_{i,t}(\boldsymbol{\theta}_i)} \quad (7)$$

where $\boldsymbol{\theta}_i = \left(\overline{\beta}_i, \phi_i, \sigma_{\varepsilon,i}^2, \sigma_{\eta,i}^2\right)'$ is the hyper-parameter vector of the model; $\nu_{i,t}(\boldsymbol{\theta}_i) = r_{i,t} - E[r_{i,t}\,|\boldsymbol{\theta}_i, r_{i,1},....,r_{i,t-1}, r_{m,1},....,r_{m,t}]$ are the 1 step predictive residuals; and $f_{i,t}(\boldsymbol{\theta}_i) = Var(\nu_{i,t}(\boldsymbol{\theta}_i))$. The values of $E[r_{i,t}\,|\boldsymbol{\theta}_i, r_{i,1},....,r_{i,t-1}, r_{m,1},....,r_{m,t}]$ and $Var(\nu_{i,t}(\boldsymbol{\theta}_i))$ are computed by the recursive algorithm known as Kalman Filter. Several initial values must be established for parameter $\beta_{i,0}$ in addition to the components of $\boldsymbol{\theta}_i$ vector. According with Wells (1996), $\beta_{i,0} = 0$ has been assumed when estimating the MR and RW models. The initial value of $\overline{\beta}_i$ for RC and MR processes are simply set by using the OLS estimates (see Equation 1) from the entire sample. Furthermore, the initial value of ϕ_i involved in the MR model is set to be $\phi_i = 0.5$. Finally, the initial values for the remaining coefficients of the hyper-parameter vector $\left(\sigma_{\varepsilon,i}^2, \sigma_{\eta,i}^2\right)$ for the three models have been set to e^{-1}. A sensitivity analysis for the initial values of these two latter parameters did not significantly change the results.

The homoskedastic specification of $\varepsilon_{i,t}$ might be incompatible with the abundant empirical evidence in favour of conditional heteroskedasticity in daily financial time series (see, for instance, Bollerslev et al., 1992). For this reason we assume that $\varepsilon_{i,t}$ are conditional heteroskedastic following a GARCH process:[1]

$$\hat{\varepsilon}_{i,t}\,|\Omega_{i,t-1} \sim \mathrm{N}\left(0, \sigma_{\varepsilon,i,t}^2\right) \text{ with } \Omega_{i,t-1} = \left\{r_{i,1}\ ,\ ....\ , r_{i,t-1}\right\}\text{, so that}$$

$$\sigma_{\varepsilon,i,t}^2 = \omega_i + \alpha_{i,1}\hat{\varepsilon}_{i,t-1}^2 + \gamma_{i,1}\sigma_{\varepsilon,i,t-1}^2 \text{ with } \alpha_{i,1}\ ,\ \gamma_{i,1} \geq 0 \text{ and } \alpha_{i,1}+\gamma_{i,1}<1 \quad (8)$$

[1] Other GARCH specifications (EGARCH, TARCH, components GARCH) were considered, but they do not change significantly the results.

This approach will bring us more reliable beta estimates because it considers the unconditional leptokurtosis of $\varepsilon_{i,t}$ distribution, an aspect that will reduce the influence of outliers on the estimation of the beta coefficients. We estimate the parameters of the model using a two-step procedure. In the first step, the model defined by Equations (2) and (3) under the assumptions made by Equations (4), (5) and (6), is estimated by the maximum likelihood function (Equation 7). Then, the residuals of the observation equation are obtained $\hat{\varepsilon}_{i,t} = r_{it} - \hat{\alpha}_i - \hat{\beta}_{it} r_{mt}$ and the variance parameters (ω_i, $\alpha_{i,1}$, $\gamma_{i,1}$) are estimated using the maximum likelihood method. Then, the conditional variances $\left\{\hat{\sigma}^2_{\varepsilon,i,t}; t = 1,...,T\right\}$ are computed: ($\hat{\sigma}^2_{\varepsilon,i,t} = \hat{\omega}_i + \hat{\alpha}_{i,1}\hat{\varepsilon}^2_{i,t-1} + \hat{\gamma}_{i,1}\hat{\sigma}^2_{\varepsilon,i,t-1}$). Using these estimated variances, the CAPM model (2)-(7) is re-estimated assuming that the variance of the observation equation disturbance ($\varepsilon_{i,t}$) is $\hat{\sigma}^2_{\varepsilon,i,t}$. These two steps are iterated until there is convergence of the variance parameters (ω_i, $\alpha_{i,1}$,$\gamma_{i,1}$).

3.1 Sample: descriptive analysis

This research analyses the performance of the DJSI-AP and its benchmark (DJG). Refer to the Appendix for a complete review of technical details and screening criteria applied by the DJSI-AP. The information about historical closing prices for the stock indexes considered, plus other relevant information, has been provided by Dow Jones Indexes, Dow Jones Sustainability Indexes and SAM group. The sample considers all financial data available for the DJSI-AP, from 2nd January 2004 to 29th October 2010. A total of 1781 continuously compounded daily excess returns on the risk-free asset ($r_{i,t}$ for the DJSI-AP and $r_{m,t}$ for the DJG) have been computed according to next expression.

$$r_{i,t} = \ln(p_{i,t}) - \ln(p_{i,t-1}) - r_t^{\ell} \qquad (9)$$

where $p_{i,t}$ is the closing price of the stock index *i* adjusted by dividends and capital increases on day *t*; ln is the natural logarithm; and r_t^{ℓ} is the return of the risk-free asset on day *t*. We consider the return of the US Treasury Bill at one month as a proxy of the risk-free asset. We compute the return of the US Treasure Bill at one day in order to obtain the continuously compounded daily excess returns for the two analysed indexes.

Table 1 shows the main descriptive statistics of excess returns for all the considered indexes. Throughout the sample, both indexes show a negative average daily excess return. The greatest mean daily looses are associated to the DJSI-AP (-0.0087%), while the DJG show the lowest mean daily losses (0.0008%). The level of risk, measured by the standard deviation of excess daily returns, is lower in the DJG (0.0112) than in the DJSI-AP (0.0149). Both indexes analysed show high levels of leptokurtosis and negative asymmetry. These aspects involve that the return series are non-normally distributed (also in accordance with the J-B test). Furthermore, the ARCH tests suggest that the return series present a high degree of heteroskedasticity, a common effect in high-frequently observed financial data.

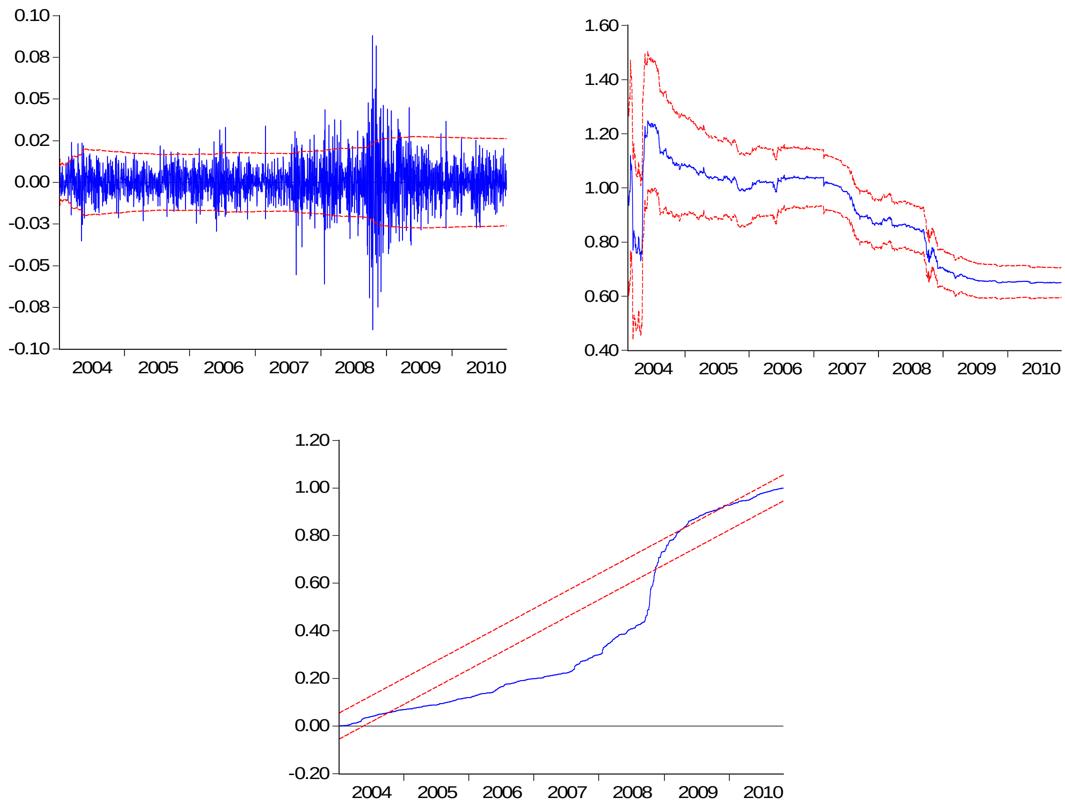
Table 1. Daily continuously compounded excess returns descriptive statistics and CAPM estimates.

Index	Mean	Std. Dev.	Skewness	Kurtosis	J-B	ARCH (7)
DJSI-AP	-0.0087%	0.0149	-0.2387	8.8736	2575.584***	119.7599***
DJG	-0.0008%	0.0112	-0.3373	8.5880	5938.802***	132.7732***
Market Model estimates	α_i	β_i	**Adjusted R^2**	**AIC**	**BIC**	$Ho: \beta_i = 1$
	-0.0003 (0.0003)	0.6502*** (0.0275)	0.2375	-4.8330	-4.8269	160.7825 (0.0000)

*** Significant at 1%, ** Significant at 5%, * Significant at 10%. The table shows the descriptive statistics of the indexes' daily continuously compounded excess returns. Additionally, the table gives the estimates from the CAPM model defined by equation (1), where $r_{i,t}$ is the excess return of the DJSI-AP in period *t* and $r_{m,t}$ is the excess return of the DJG in period *t*. J-B refers to the estimated values of the Jarque-Bera normality test. The ARCH test is based on the analysis of the residuals of a random walk model fitted to the continuously compounded excess returns series of both indexes. The number of lags of the ARCH test is determined by the natural logarithm of the number of observations; Ln (1781) = 7.48. AIC and BIC refer to the Akaike's Information Criterion and to the Bayesian Information Criterion values for the CAPM. Finally, the low part of the last column contains the value of the Wald test about the $\beta_i = 1$ restriction (p-values are shown in parentheses). Acceptance of this hypothesis will indicate that there were non significant differences in the risk levels experienced by the DJSI-AP and the DJG.

Table 1 also shows the parameters estimated for CAPM (i.e. market model) defined by equation (1) with the use of the OLS algorithm for the DJSI-AP. The α_i parameter is not significantly different from zero, an aspect that is in line with the Sharpe (1964) and Lintner (1965) suggestions. This seems to indicate that the risk-adjusted return associated to the DJSI-AP was not statistical different from the achieved by the DJG. However, the estimated value of β_i parameters is significantly different from 0 (at 1% significance level). Additionally, the beta coefficient turned out significantly different from one, which indicates differences in the risk levels between both considered indexes. The beta estimate ($\beta_i < 1$) indicates that the DJSI-AP experienced lower risk levels than the achieved by its benchmark (DJG). However, beta estimate is constant over the entire sample, as imposed by the CAPM (see equation 2). With the aim of testing the robustness model estimated and the stability of beta over time we compute the recursive residuals, coefficients and the CUSUM of squares test of the CAPM. Figure 1 shows graphical description of these measures.

Figure 1. Robustness of CAPM and beta stability tests



The upper left graph shows the recursive residuals of the CAPM estimated according to equation (1). Blue lines represent the recursive residuals and dashed red lines refer to confidence intervals. Upper right graph shows the recursive coefficients of the CAPM. Blue lines are the recursive coefficients and red dashed lines show the confidence intervals. The latter figure shows the graphical representation of the CUSUM of squares test of the beta parameter estimated by the CAPM. Blue lines refer to CUSUM of squares of beta parameter and red dashed lines are the confidence intervals (at 95% level).

The information derived from Figure 1 suggests that the CAPM estimated in this section does not provide a reliable measure of beta parameter associated to the DJSI-AP. This is mainly due to that the DJSI-AP beta seems not to be constant over time. Both recursive residuals and coefficients indicate that there are structural changes in the evolution of the β_i parameter. Furthermore, the CUSUM of squares test reject the stability hypothesis of DJSI-AP beta parameter. All of these ideas tell us about the need of considering dynamic models to estimate the DJSI-AP systematic risk, thus confirming the suitability of the state-space CAPM proposed in this research to do that task.

4. Results

In this section we provide evidence of the time-varying behaviour of the DJSI-AP beta, a crucial aspect to be considered in order to test the working hypotheses. Table 2 shows the estimates of the state-space CAPM defined by equations (2) to (8). Firstly, the estimates show that the three models considered (RW, RC and MR) to explain the evolution of DJSI-AP beta parameter are better fitted to the data than the traditional CAPM estimated in the previous section. This is due to that the values of AIC and BIC criterions are all lower than those shown by the standard CAPM. Moving deep into the data we identify that, according with AIC and BIC criterions, the risk dynamics of the DJSI-AP is better explained by the mean reverting model (MR). This is confirmed by the significance of the constant transition parameter ϕ_i at 1% level. According with the value of the ϕ_i parameter estimated for the MR model (0.55), it seems that the DJSI-AP beta follows a dynamic process that returns very fast to its mean, which implies a high noisy beta series (see Figure 2).

Table 2. Unobserved component CAPM estimates of DJSI-AP

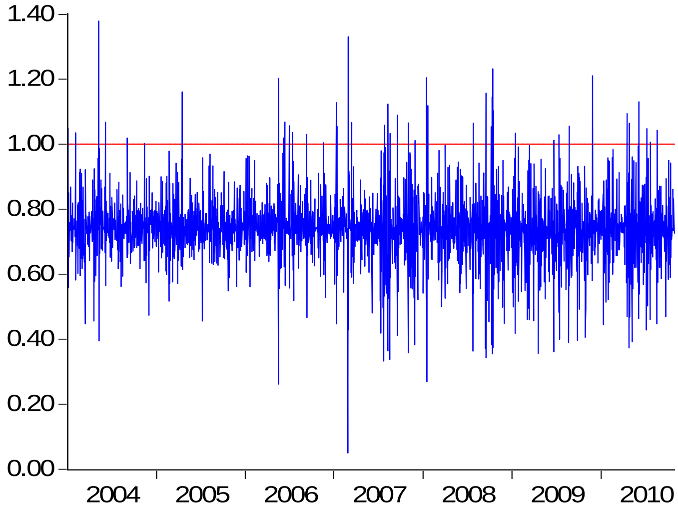
Model	α_i	$\sigma^2_{\varepsilon,i}$	$\sigma^2_{\eta,i}$	$\bar{\beta}_i$	$\lvert\phi_i\rvert$	Log L	AIC	BIC
MR	-0.0023 (0.0051)	0.0002	0.0001	0.7424*** (0.0334)	0.5525*** (0.1811)	-5521.746	**-6.1997**	**-6.1883**
RC	-0.0043 (0.0033)	0.0015	0.0008	0.7271*** (0.0342)	n.a.	-5517.848	-6.1964	-6.1872
RW	-0.0032 (0.0023)	0.0210	0.0112	n.a.	n.a.	-5503.676	-6.1816	-6.11754

*** Significant at 1%, ** Significant at 5%, * Significant at 10%. The table gives the estimates from the state-space CAPM defined by equations (2) to (8), where $r_{i,t}$ is the excess return of the DJSI-AP in period *t* and $r_{m,t}$ is the excess return of the DJG in period *t*. Variance $\sigma^2_{\varepsilon,i}$ correspond to the unconditional variance of the error terms ($\varepsilon_{i,t}$). The values in parentheses refer to the standard errors. The last two columns show the AIC and BIC criterions values. The model chosen by the AIC and BIC criterions is shown in bold. The fields with 'n.a.' refer to non-applicable values.

Table 2 indicates that all the Jensen's alphas (α_i) estimated by the state-space CAPM are non-significant. Thus, the estimated risk-adjusted returns of the DJSI-AP seem not to be different than those obtained by its benchmark (DJG). This finding is in line with results obtained by previous research (Sauer, 1997; DiBartolomeo and Kurtz, 1999; Garz et al., 2002; Statman, 2006; Schröder, 2007). That consideration indicates that investing in the SRI equity index analysed (DJSI-AP) do not impose additional costs that will affect negatively to the market returns obtained by the investors. Thereby, the DJSI-AP CSR screening process seems not to have an adverse impact to its return levels when are compared by those obtained by its benchmark (DJG), which is not screened on a social and environmental basis (Sauer, 1997). This result is in line with those obtained by Statman (2000; 2006), who appoint that SRI investors do well, i.e. investing in an ethical way, while not merely good, i.e. obtaining non-significant differences in the return levels compared by conventional investment strategies. Ours findings do not support the pre-conceived idea that SRI screening must be deemed a cost generator and an additional burden on financial performance of the investment processes (Garz et al., 2002). All of these considerations lead us to reject the first working hypothesis (H1).

Figure 2 shows the point time-varying systematic risk estimated for the DJSI-AP by the winner model (MR). This is crucial information to test second hypothesis proposed in this research (H2). Additionally, beta equal to one, which indicates similar risk levels between the DJSI-AP and the DJG, is also shown. In general, the point estimates of the DJSI-AP systematic risk present values below 1 in almost all the considered sample. This indicates that the DJSI-AP risk levels are quite lower than those shown by its benchmarks (DJG). These results contradict the usual perception that SRI necessarily results riskier than conventional investment strategies (Sauer, 1997). Our results extend this idea to SRI strategies in the Asia Pacific area.

Figure 2. Time-varying systematic risk estimated by the state-space CAPM of DJSI-AP for the winner model (MR)



This figure shows the DJSI-AP systematic risk (blue line) estimated by the state-space CAPM for the winner model (MR). Beta equal to one is also shown (red line), which indicates similar risk levels between the DJSI-AP and the DJG.

It is noticeable to note that a merely application of the standard CAPM, usually applied in similar studies (see Section 2) will lead us to reject the H2 hypothesis (see Table 2), showing the lower risk levels experienced by the DJSI-AP. Thus, we could erroneously conclude that a passive investment strategy on the DJSI-AP will result in similar risk-adjusted returns and lower risk levels (compared with investing in the DJG). However, the results shown in Figure 2 indicate that, although in almost the sample the DJSI-AP was less risky than its benchmark, there are some periods during the sample where the H2 hypothesis can not be rejected. These periods are when the beta parameter is above one, which indicates that the SRI equity index considered was riskier than its benchmark. This consideration have a significant impact on active investment strategies, because the dynamic model proposed in this research allow investors to asses the risk associated to the SRI equity index in a more accurate way and thus modifying their portfolio composition in order to optimize its performance.

5. Concluding remarks

This work seeks to extend research about financial performance of SRI equity indexes to the Asia Pacific context. More specifically, this research aims to test whether ethical investing strategies could give investors any financial benefits compared to the conventional investment approaches which do not consider social and ethical issues, in the Asia Pacific area. To that aim, we analyse the performance of the Dow Jones Sustainability Asia Pacific Index (DJSI-AP), which is screened by CSR criteria, and we compare it with the obtained by its benchmark: the Dow Jones Global Total Stock Market Index (DJG). Although DJSI-AP risk-adjusted returns are analysed, we also focus on its risk levels, an issue that most of literature of SRI equity indexes has not paid much attention.

Main results indicate that there were non-significant differences between the risk-adjusted returns obtained by the SRI equity index considered and its benchmark. This suggests that investing in the DJSI-AP does not necessarily have a negative impact on portfolio performance. This finding does not support the extended preconceived idea that CSR screens restrict the investment universe, and thus investors are left with firms that may be more volatile and have less return potential. Thereby, this research supports that CSR criteria could serve as a loyalty builder and stakeholder integration, which might mitigate the possible negative effects of carrying out SRI in the Asia Pacific markets. The results of this research does not support the principles established by the Modern Portfolio Theory (MPT), which suggests about some negative financial consequences of investing in SRI assets.

On the other hand, our results indicate that the risk levels associated to the DJSI-AP were in general lower than those obtained by its benchmark (DJG). This is in line with the idea that SRI are less risky than conventional investment processes due to actual savings of possible future risks associated with environmental disasters recovery costs or the penalties related to environmental regulation violations, among others. These considerations do not support the frequently voiced hypothesis of a risk disadvantage of investing in SRI equity indexes, and is also extended to the Asia Pacific area. Thereby, investors have financial incentives to invest in the DJSI-AP and also satisfying their moral claims, personal convictions and ethical principles. However, it is very important to note that the econometric model proposed in this work allows identifying some periods where the DJSI-AP turns riskier than its benchmark. This aspect has important implications for active portfolio management processes because brings portfolio managers and investors relevant information for adjusting the portfolio risk levels in the Asia Pacific through the SRI equity index analysed. Proved the more suitability of the model proposed in this research, it is further recommended to extend it to traditional SRI equity indexes previously analysed in the field.

6. Appendix

Dow Jones Sustainability Asia Pacific Index technical details and Corporate Social Responsibility screening criteria

The Dow Jones Sustainability Indexes (DJSI) is the mainstream family of SRI equity indexes that apply CSR screening criteria worldwide. The DJSI, created in 1999, were the first global indexes to track the financial performance of leading sustainability-driven companies around the globe. There are several SRI equity indexes belonging to the DJSI family. Among those, the Dow Jones Sustainability Asia Pacific Index (DJSI-AP) comprises the leading companies in terms of sustainability from the developed markets in Asia Pacific. The DJSI-AP tracks the financial performance of the top 20% in terms of sustainability of the 600 biggest companies in the developed Asia Pacific markets as listed in the Dow Jones Global Total Stock Market Index.

The DJSI-AP is reviewed annually and quarterly to ensure that the index composition accurately represents the leading sustainability companies in each of the DJSI sectors within the investable universe. The annual review methodology selects these leading sustainability companies from the investable stocks universe. The resulting changes to the index composition are announced on the annual review date in the first week of September and implemented, after the official closing prices have been determined, on the third Friday of September. The DJSI-AP annual review process starts by classifying the companies of their investable stock universe to one of the DJSI sectors. Then, all the companies are screened on a CSR basis according with Sustainable Asset Management (SAM) corporate sustainability assessment method[2]. This process examines, in general, the following criteria in each corporate dimension:

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[2] Refer to http://www.sam-group.com/htmle/main.cfm and http://www.sustainability-indexes.com/default.html for further information.

- Economic:
    - Codes of conduct, compliance, corruption and bribery.
    - Corporate governance.
    - Risk and crisis management, industry specific criteria.
- Environment:
    - Environmental reporting, industry specific criteria.
- Social:
    - Corporate citizenship, philanthropy, labour practice indicators.
    - Human capital development, social reporting.
    - Talent attraction and retention, industry specific criteria.

Each company assessed is assigned a corporate sustainability performance score. Next, companies are ranked according to their corporate sustainability score within their DJSI sectors. Only those DJSI sectors where the highest ranked company globally has a corporate sustainability performance score of at least one-fifth of the maximum score are eligible for the DJSI-AP. All other sectors, and their associated companies, are deemed ineligible and are eliminated from the review process. From each eligible DJSI sector, only companies with a corporate sustainability performance score of at least half of the highest ranked company globally in the same sector are eligible for the DJSI-AP. The target selection for each eligible DJSI sector is 20% of the companies in the investable universe in that group. In a first step, the top 15% of the eligible companies in each DJSI sector, by corporate sustainability performance ranking, are selected for the DJSI-AP. In a second step, the eligible current DJSI Asia Pacific component companies ranked in the buffer zone between the top 15% and the top 25% of the eligible companies, by corporate sustainability performance ranking, are selected for the index.

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