Identifying Asymmetries between Socially Responsible and Conventional Investments
Nicholas Apergis
Northumbria University
Vassilios Babalos
University of Piraeus
Christina Christou
University of Piraeus
Rangan Gupta
University of Pretoria
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Nicholas Apergis
Northumbria University, Newcastle upon Tyne, U.K.
nicholas.apergis@northumbria.ac.uk

Vassilios Babalos
University of Piraeus, Piraeus, Greece and
Technological Educational Institute of Peloponnese, Kalamata, Greece
vbabalos@teikal.gr

Christina Christou
University of Piraeus, Piraeus, Greece, christou@unipi.gr

Rangan Gupta
University of Pretoria, Pretoria, South Africa
Rangan.Gupta@up.ac.za

Abstract

Socially responsible investments have been a popular investment vehicle over the last decade. Employing a standard cointegration methodology along with a novel time-varying quantile cointegration approach, we estimate whether the US Dow Jones Sustainability Index (DJSI) and its conventional counterpart are integrated. The results confirm the presence of an asymmetric long-run relationship between the two indices that is not picked-up by the standard methodology of cointegration. The analysis highlights that the cointegrating relationship is quantile-dependent. These findings place any long-run diversification benefits under scrutiny, while they contain significant implications for international market participants.

Keywords: Socially responsible investments, quantile cointegration, diversification benefits

JEL Classification: C5, G1, Q5
1. Introduction

Socially responsible investing (SRI) has seen a dramatic growth over the last decades as reflected in total assets under management. According to official data, global socially responsible investment markets have grown substantially in just two years, reaching US$21.4 trillion at the start of 2014 from US$13.3 trillion at the end of 2012. This expansion was primarily fueled by institutional investors through the wide adoption of environmental, social, and governance principles in the financial sector, as well as by the actions of major global non-government organizations. In view of the growing popularity of socially responsible investments, academics and researchers are concerned with that investing in socially responsible companies delivers higher returns than investments in conventional equity benchmarks or whether companies that rank higher on environmental, social and governance screens (ESG hereafter) exhibit a higher financial performance than companies that rank lower on ESG screens (Hoti et al., 2007; Mercer, 2007).

Many empirical studies explore the risk-return characteristics of SRI investments through the lens of mutual funds (Nofsinger and Varma, 2014; Leite and Cortez, 2015). By contrast, as in Schroder (2007) we set off to conduct the empirical tests on a widely known SRI index and its conventional counterparts. In this context, the analysis is free of additional issues that need to be addressed, such as transaction costs, the timing activities, and the skill of the fund managers involved.

The major novelty of this study is to explore within the context of a time–varying cointegrating model the presence of a long-run relationship between the Dow Jones Sustainability Index and its conventional counterparts. It is well known that the majority of financial time series display non-linear dynamics and have non-elliptic distributions. In view of these properties, we implement the quantile cointegration methodology, recently proposed by Xiao (2009) that allows time-varying cointegrating parameters.
2. Data description and Methodological approach

Quantile cointegration analysis

Our time series span a time period of fourteen years namely from 1/1/2001 to 31/12-2014 on a daily basis, which exemplifies the need to investigate whether the cointegrating vector remains constant over time. Quantile methodological approaches are capable of capturing asymmetric/non-linear type of behaviors, which implies different responses at different points of the conditional distribution of the DJ Sustainability Index. Therefore, a novelty of our paper is that we investigate the whole conditional distribution of stock prices by estimating quantile cointegrating regressions for a sequence of quantiles. To this direction, we implement the quantile cointegration methodology recently proposed by Xiao (2009), which not only allows us to explore the whole distribution of returns, but it also allows for time-varying cointegration coefficients, which is a key issue in this analysis. Furthermore, the quantile cointegration model by Xiao (2009) can capture systematic influences of conditioning variables on the location, scale and shape of the conditional distribution of emissions. We consider the following cointegrating regression:

\[ P_t = \alpha + \beta_t S_t + \varepsilon_t \]  

where \( S_t \) is the Dow Jones Sustainability Index, \( P_t \) is the Dow Jones Price Index, while the cointegrating coefficient is allowed to be time varying and, thus, quantile dependent. Following Saikkonen (1991), Xiao (2009) suggests adding leads and lags of the dependent variables to deal with the endogeneity of the traditional cointegration model:

\[ P_t = \alpha + \beta_t S_t + \sum_{l=-K}^{K} \pi_l \Delta S_t + \varepsilon_t, \]  

In the above model, the value of cointegrating coefficients is affected by the shocks received in each period, and thus are quantile dependent. The \( \tau \)-th quantile representation yields:

\[ Q_{S_t}(\tau / J_t) = \alpha(\tau) + \beta(\tau) S_t + \sum_{l=-K}^{K} \pi_l (\tau) \Delta S. \]  

Estimation of the parameters in Eq.(3):

\[ \theta = (\alpha(\tau), \beta(\tau), \pi_{-K}(\tau), ..., \pi_K(\tau)), \]  

involves the solution of the following problem:

\[ \hat{\theta}(\tau) = \arg \min_\theta \sum_{t=1}^{T} \rho_t \left( S_t - Q_{S_t}(\tau / J_t) \right), \]  

where \( \rho_t(u) = u(\tau - I(< 0)) \).
If we consider the testing of the hypothesis $H_0: \beta(\tau) = 1$, then we may construct the following Wald statistic:

$$W_T(\tau) = \frac{f_T(F_{\psi}^{-1}(\tau))^2}{\hat{\omega}_\psi^2} \left(\hat{\beta}(\tau) - 1\right)^2 \sum \left(S_t - \bar{S}\right)^2$$

(4)

where, $\hat{\beta}(\tau)$ the estimator of $\beta(\tau)$ given by Eq. (3), $f(\cdot)$ and $F(\cdot)$ the p.d.f. and c.d.f. of $\{\varepsilon_t\}$, $f(F_{\psi}^{-1}(\tau))$ a consistent nonparametric estimator of $f(F_{\psi}^{-1}(\tau))$ (Bofinger, 1975; Chamberlain, 1994), and $\hat{\omega}_\psi^2$ a consistent estimator of the long-run variance of $\psi_T(\varepsilon_{\tau\tau}) = \tau - I(\varepsilon_{\tau\tau} < 0)$ with $\varepsilon_{\tau\tau} = \varepsilon_t - F_{\psi}^{-1}(\tau)$. Xiao (2009) shows that $W_T(\tau)$ follows asymptotically the chi-square distribution, while he suggests a formal test for the constancy of the cointegrating coefficients. Specifically, he shows that the varying-coefficient behavior can be tested using the Kolmogoroff-Smirnoff statistic $\max_{\tau} |\hat{V}_T(\tau)|$, where $\hat{V}_T(\tau) = T(\hat{\beta}(\tau) - \bar{\beta})$, $\hat{\beta}(\tau)$ is the quantile estimator from (3), and $\bar{\beta}$ is a T-consistent estimator of $\beta$. The $\max_{\tau} |\hat{V}_T(\tau)|$ statistic has a non-standard asymptotic distribution, while critical values are calculated by bootstrap methodologies.

3. Empirical analysis

First, before moving to cointegration analysis we must determine whether the employed series are stationary. To this end standard unit root tests with and without beaks indicated that the series are I(1). These results are available upon request from the authors.

We start off with the standard cointegration technique of Engle and Granger (1987). The obtained p-value of this test was 0.55, which indicated clear evidence against cointegration – possibly due to structural breaks and nonlinearity in the relationship between the two stock prices, and in turn, requires a time-varying approach. This motivated us to look into the quantile cointegration next. Table 1 reports the findings of quantile cointegration for a range of quantiles, including the estimated values of constants, cointegrating coefficients, the Wald, sup $|Vn(s)|$ and sup $|Yn|$ tests.

Notice that the p-value for the constant terms investigates the null of zero with student-t tests, while the counterpart for the Wald test tests the null that the coefficient equals one. The sup $|Yn|$ test provides an overall viewpoint of the long-run relationship.
between the two variables. The results provide supportive evidence that the two variables display a long-run equilibrium relationship across all selected quantiles, since the null hypothesis of quantile cointegration is not rejected. Moreover, the quantile-varying cointegrating coefficients are further confirmed strongly by the sup $|V_n(s)|$ test, implying that the cointegration model with constant coefficients is subject to misspecification. These findings confirm Xiao (2009) that the presence of time-varying cointegrating coefficients is the major factor causing conventional cointegration methodologies to lack the ability to uncover the long-run relationship across variables suggested by economic theory.

Next, we investigate the long-run relationship between the two variables in each specific quantile. The estimated values for intercepts and cointegrating coefficients differ across various quantiles. The results in Table 1 stress the estimated values of the coefficients and their corresponding Wald tests, which determine the impact of the Sustainability Index on the DJ price index in each quantile. The findings highlight that the estimates are less than one across all quantiles and statistically significant, while the corresponding Wald tests reject the unit-coefficient null at 1%. The positive $\beta$ coefficients imply that across all quantiles, the inclusion of the Dow-Jones Index firms in a sustainability index provides a bonus to their stock prices, probably to higher reputational gains associated with the reputation they share as reliable indicators for sustainability performance. Furthermore, the evidence through the Wald tests, i.e. the $\beta$ coefficients are less than one across all quantiles, highlights that although the impact of the sustainability index participation is positive, the rewards are proportionately less, indicating that market participants do not get sufficient reward, since they already demonstrate an exceptionally high financial performance. In other words, firm performance moderates the effects of status gains out of the participation in the Sustainability Index. Although investors often have uncertainty about how to assess such effects, the indicators of current and expected firm performance help them evaluate the value of status signals. These results contribute to the manner the formation of investors’ perceptions build, especially aligned with how Wall Street investors and market analysts may form their expectations differently from that of the more general society (Lamin and Zaheer, 2012).
Table 2: Quantiles cointegration results

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<tr>
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</table>

\[ \sup_{\tau} \tilde{V}_{T}(\tau) = 1377.7 \] [\text{p-value} = 0.00]

\((CV1, CV5, CV10) = (919.992, 665.991, 557.318)\)

\[ \sup_{\tau} |\tilde{V}_{T}(\tau)| = 0.682 \] [\text{p-value} = 0.79]
4. Conclusions

This paper investigated the presence of a long-run asymmetric equilibrium relationship between the US Dow Jones Sustainability Index and its conventional counterpart. Employing the time-varying cointegrating model of Xiao (2009), it documented a long-run relationship between the selected indices that varies across various quantiles of the returns distribution, while standard cointegration techniques provided evidence against cointegration. The implications for investors are that any long-run diversification benefits are doubtful, but formal testing is still needed.

References


