



Modeling volatility and conditional correlations between socially responsible investments, gold and oil



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ABSTRACT

Socially responsible investing (SRI) is one of the fastest growing areas of investing. While there is a considerable literature comparing SRI to various benchmarks, very little is known about the volatility dynamics of socially responsible investing. In this paper, multivariate GARCH models are used to model volatilities and conditional correlations between a stock price index comprised of socially responsible companies, oil prices, and gold prices. The dynamic conditional correlation model is found to fit the data the best and used to generate dynamic conditional correlations, hedge ratios and optimal portfolio weights. From a risk management perspective, SRI offers very similar results in terms of dynamic conditional correlations, hedge ratios, and optimal portfolio weights as investing in the S&P 500. For example, SRI investors can expect to pay a similar amount to hedge their investment with oil or gold as investors in the S&P 500 would pay. These results can help investors and portfolio managers make more informed investment decisions.

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1. Introduction

Socially responsible investing (SRI) refers to investing in companies that score well on environmental, social and governance (ESG) factors (e.g. Hoti et al., 2007; SIF, 2010). Typically, companies are screened on various ESG factors and awarded positive values for good social responsible behavior but awarded negative values for bad social responsible behavior. These values are tabulated into scores and then companies are ranked. Examples of screens include community involvement, corporate governance, diversity, employee relations, environment, human rights, and product quality. Companies involved in alcohol, tobacco, firearms, gambling, nuclear power or military weapons are generally excluded.

Socially responsible investing (SRI) is one of the fastest growing areas of investing. According to the Social Investment Forum (SIF) Foundation (2010), at the beginning of 2010, \$3.07 trillion was invested in total assets under professional management in the US that follow SRI strategies. This was an increase of more than 380% from the \$639 billion in 1995. By comparison, over the same time period, all assets under professional management increased 260% from \$7 trillion in 1995 to \$25.2 trillion at the beginning of 2010.

To date, most of the published research has focused on whether or not investing in socially responsible companies generates higher returns than investments in standard equity benchmarks or whether

companies that score higher on ESG screens have higher financial performance than companies that score lower on ESG screens (e.g. Hoti et al., 2007; Mercer, 2007). What is missing from the literature is an understanding of the volatility dynamics of socially responsible investing. Modeling and forecasting volatility is an essential component of modern finance because good estimates of correlation and volatility are needed for derivative pricing, portfolio optimization, risk management, and hedging. To date, however, very little is known about the volatility dynamics of socially responsible investing and the possible correlations between the stock prices of socially responsible companies and other important financial assets like oil and gold. This is important because, historically, commodities like gold or oil have shown low or even negative correlation with equities and are therefore useful for hedging and portfolio diversification. Ibbotson Associates (2006), for example, found that including commodities in the portfolio opportunity set resulted in an increased efficient frontier. This supports the hypothesis that investing across different asset classes is desirable to diversify risk. This brings up interesting questions about what risk management opportunities exist between SRI and popular commodities like gold or oil. For example, what is the hedge ratio between SRI and gold or oil? What is the optimal portfolio weight between SRI and gold or oil? How do these hedge ratios and optimal portfolio weights for SRI compare with those for the S&P 500? Answers to these questions can help investors and portfolio managers make more informed investment decisions.

In this paper, multivariate GARCH models are used to model volatility and dynamic conditional correlations between a stock price index comprised of socially responsible companies, oil prices and gold prices.

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Three multivariate GARCH models (diagonal, constant conditional correlation, dynamic conditional correlation) are compared and contrasted. It is found that the dynamic conditional correlation model fits the data best and this model is then used to construct hedge ratios and optimum portfolio weights.

2. Literature review

To date there have been a number of papers published looking at responsible investment performance (e.g. Mercer, 2007). This section reviews a selection of papers most relevant to the focus of this present paper.

Abramson and Chung (2000) create two separate portfolios (1) a rebalancing portfolio that ranks companies on relative yield and relative market capitalization to revenues and (2) a buy and hold portfolio based on the Domini Social Index. Over the period 1990 to 2000 they find that SRI investment strategies can provide slightly higher Sharpe ratios compared to an appropriate benchmark. Barnett and Salomon (2006) use stakeholder theory and modern portfolio theory to develop and test a curvilinear relationship between social responsibility and financial performance of mutual funds. Using data from 1972 to 2000 they find evidence to support a U shaped relationship between social responsibility and financial performance of mutual funds. As ESG screening increases, portfolio diversification decreases and risk adjusted returns decrease. After an inflection point, ESG screening leads to better managed more efficient firms being selected and portfolio performance (risk adjusted returns) improves. Bauer et al. (2006) using data from 1992 to 2003 look at the risk adjusted returns of Australian ethical mutual funds relative to conventional mutual funds. Using a four factor model, they find that the risk adjusted returns of ethical mutual funds to be similar to the risk adjusted returns on conventional mutual funds. Bauer et al. (2005) study German, UK and US ethical mutual funds over the 1990 to 2001 period. Using a multi-factor model, they find no evidence of significant differences in risk-adjusted returns between ethical and conventional funds. Becchetti and Ciciretti (2009) compare the performance of a large sample of socially responsible stocks (SR) with a control sample (CS). They find that SR stocks have on average significantly lower returns and unconditional variance than CS stocks when controlling for industry effects. They also find that socially responsible stocks are less risky than stocks in the control sample. Bello (2005) compares the performance of SRI funds with conventional funds over the period 1994 to 2001 but finds no statistically significant difference in risk adjusted returns when controlling for characteristics like size and diversification. Benson et al. (2006) using data from 1994 to 2003 also examine the performance of SRI funds with conventional funds and find no statistically significant difference between the two even when stock picking skills were accounted for but there was a small difference in industry allocation between the two groups of funds. Brammer et al. (2006) using data from 1997 to 2002 find that environmental and community indicators are negatively correlated with stock returns while the employment indicator is weakly positively correlated with stock returns. There is some evidence to support the hypothesis that expenditure on ESG is destructive to shareholder value. Chong et al. (2006) compare the performance of the socially responsible Domini Social Equity Fund with the socially irresponsible Vice fund over the period 2002 to 2005. Both funds are benchmarked to the S&P 500 and the authors find that the Vice fund has higher risk adjusted returns. Core et al. (2006) examine the impact that shareholder rights have on abnormal stock returns over the period 1990 to 1999. They find that shareholder rights are not the source of abnormal stock returns. Cortez et al. (2012) investigate the style and performance of US and European global socially responsible funds. They find that European socially responsible funds do not show significant performance differences relative to conventional and socially responsible benchmarks while U.S. and Austrian funds show underperformance. They also find that socially responsible funds are strongly exposed to small cap and growth stocks. Derwall

et al. (2005) use Innovest eco-efficiency data from 1995 to 2003 to analyze the difference between portfolios that score high on eco-efficiency with portfolios that score low on eco-efficiency. They find evidence that stocks that perform well on environmental factors produce better portfolio returns. Geczy et al. (2005) find that the cost to investors of investing in SRI over the period 1963 to 2001 depends upon the pricing model used (CAPM vs four factor model) and how much money is invested in SRI initiatives. Gompers et al. (2003) examine the relationship between stock market performance and corporate governance over the period 1990 to 1999. They find evidence of a strong correlation between stock market performance and corporate governance although the source of the correlation is not clear. Hong and Kacperczyk (2009) find that over the period 1965 to 2004 “sin” stocks or those associated with vices are underpriced and that the source of under pricing might be due to social norms. Managi et al. (2012) estimate Markov Switching models on SRI indexes for the US, UK and Japan. They find two distinct regimes (bear and bull) in the SRI markets as well as the stock markets for all the 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. Opler and Sokobin (1995) investigate whether governance activism creates shareholder value. Using data from 1991 to 1993, they find that firms that appear on the Council of Institutional Investor list experience improvements in financial performance in the years after appearing on the list. Orlitzky et al. (2003) conduct a meta analysis on the relationship between corporate social performance (CSP) and corporate financial performance (CFP). They find evidence that there is a positive relationship between CSP and CFP but the strength of the relationship depends upon factors like firm reputation and the disclosure of CSP. Renneboog et al. (2008) find that in many European and Asian-Pacific countries, SRI funds underperform domestic benchmarks. In many cases, the risk adjusted returns are not statistically different from the performance of conventional funds. Schröder (2004) finds that while most SRI funds underperform their benchmarks the differences are not statistically significant. Shank et al. (2005) compare the performance of SRI portfolios (nice) with non-SRI portfolios (naughty) over the period 1993 to 2003 and finds that nice portfolios outperformed naughty portfolios. Smith (1996) presents a case study of the actions of CalPERS covering the period 1987 to 1993. He finds that a statistically significant increase in shareholder wealth can be realized when activism is successful in changing a company's governance structure. Statman (2000) finds that the risk adjusted returns of the Domini Social Index are higher than those of the S&P 500 over the period 1990 to 1998. SRI mutual funds tend to underperform the Domini Social Index and the S&P 500 although SRI mutual funds outperform conventional mutual funds. Statman (2006) compares four SRI indexes with the S&P 500 and finds that while the correlations between SRI indexes and the S&P 500 are very high the returns of the SRI indexes generally outperform that of the S&P 500. Van de Velde et al. (2005) using data from 2000 to 2003 find that a high sustainability ranking is correlated with higher firm performance and portfolio performance.

3. The empirical model

As discussed in the survey by Bauwens et al. (2006) multivariate GARCH (MGARCH) models have been extensively used in empirical finance to analyze correlations and volatility dynamics between equities, commodities and exchange rates. Hoti et al. (2005, 2007) estimate univariate GARCH(1,1) models to model time varying risks for a number of different SRI indexes and find that GARCH(1,1) models adequately capture the volatility dynamics in SRI indexes. They do not, however, investigate the dynamic correlation between SRI indexes and other asset classes. In this paper, three multivariate models (diagonal, constant conditional correlation, dynamic conditional correlation) are used to model the volatility dynamics and conditional correlations between SRI, gold

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