Sustainable Security Analysis

An analysis of the economic cost of investing in sustainable securities

Professor John Evans, UNSW
Dr Ron Guido, UNSW
Ms Maria Guo, UNSW

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ABSTRACT

This paper examines whether a portfolio of global securities selected only on the basis of their sustainable characteristics exhibit a lower return than the broad global security market and whether the performance can be explained by a sustainable factor. The results are mixed, which may well be a consequence of the small universe considered and the period of analysis, but it does appear that investments that use sustainable filters may not exhibit lower returns than portfolios built without the sustainable filter, although the results do indicate that investors should also take into account other risk factors such as country, industry, size and book to market as well as the sustainability factor.

1. The Sustainable Investment issue

Interest in investments selected for their ethical or sustainable characteristics has seen strong worldwide growth in recent years. The Social Investment Forum (SIF) reports that professionally managed sustainable assets have grown by 36% compared to a 22% rise in other managed assets from 1999 to 2001.[1] One consequence of investing in ethical securities is that, if companies selected on their sustainable characteristics perform better than alternative choices, it would be beneficial to both the investors and the society as it encourages other firms to improve their ethical standards.[2] Conversely, if the performance of such ethical investments is inferior, or costly to investors, then the benefit of such investments may not adequately cover such loss, and would in turn cause pressure for relaxation of standards of ethical behaviour by the corporate community.

Historical research of the impact of adopting a sustainable strategy on investment performance has concentrated on the analysis of the returns of sustainable or ethical mutual funds performances with no clear result. There are several problems with the historical research: firstly, by default, the analysis usually has not controlled for mandate restrictions, secondly, the analysis looked at nominal return only in most instances, ie it did not consider causes of the return, and thirdly, the analysis was looking for value added, whereas it is reasonable to say that if investors found that sustainable investment criteria was unlikely to result in lower returns, then given the other benefits to society, the result would be acceptable.

Our research has therefore controlled for portfolio construction issues, other causes of security performance than sustainability, and concentrated on determining if there was evidence of underperformance.

2. Previous analysis

Past attempts have been made to examine the relationship between sustainable investing and financial return. The analysis can be divided into three distinct categories: Individual Companies, Portfolios and Theoretical Portfolio construction.

Research at the company level typically has tried to identify particular ethical criteria that influence the individual performance of companies. Numerous studies have been done examining the link between the ethical behaviour of a corporate firm and its financial performances. Moskowitz (1972) ranked 67 selected firms in terms of his evaluation of their level of social responsibility, and reported higher than average stock returns for highly ranked firms. Alexander and Bucholtz (1978) found no significant relationship between social responsibility and risk adjusted return on securities using the firms listed in Moskowitz's study. Other studies such as Cochran and Wood (1984) found a positive relationship between corporate social and financial performances. Verschoor (1998) found a significant relationship between strong management commitments to controls that

[1] Social Investment Forum is a US based national non-profit organization promoting the concept, practice and growth of socially responsible investing. (http://www.socialinvest.org/)

[2] See Lewis and Mackenzie (2000)

emphasised ethical and socially responsible behaviour, and favourable corporate financial performance. Herrmans, Akathaporn and McInnes (1993) found UK ethical corporate firms had higher stock market returns, but Spiller (2000) claimed this superior financial performance could be explained by the increasing productivity and loyalty of employees, improvement of customer sales and loyalty, growing supplier commitment and improved environmental quality in an ethical firm. Moore and Robson (2002) found that social performance in the supermarket industry was negatively related to financial performance; however, a positive relationship was found with the lagged three years of financial performance. This study also found that financial performance was positively related to the age and size of the firm, as well as its profitability.

The main criticism of these individual firm studies is their lack of objectivity and rigour. Even if there exists a correlation between socially responsible behaviour and financial performance, it does not prove that the former causes the latter and most have not delved into causality analysis. Griffin & Mahon (1997) summarised the literature that analysed the relationship between corporate social performance (CSP) and corporate financial performance (CFP) over the prior 25 years as shown in Table 2.1.[3]

Table 2.1: Past Literature Findings

The following table lists the literature over the prior 25 years that analysed the relationship between corporate social performance (CSP), which broadly corresponds to our sustainable characteristics, and corporate financial performance (CFP).

Period	Positive relationship	Inconclusive	Negative relationship
1970s	12/17	4/17	1/17
1980s	14/35	5/35	16/35
1990s	7/10		3/10

Research into the performance of ethical portfolios generally has involved measuring the risk and return compared with a benchmark such as the S&P500 broad market index., but there have been problems with the historical analysis. Firstly, the ethical criteria of different investors can vary enormously and secondly, different approaches have been employed to measure the financial performance of ethical assets, and different benchmarks have been used. As well other factors such as the skill of the active fund manager and the period over which performance was measured may all influence the performance evaluation of ethical investments. Mallin, Saadouni and Briston (1995) matched the performance of ethical trusts to non-ethical trusts based on fund size and date of formation. This process eliminated specific characteristics existing in ethical portfolios such as a small firm effect and short life of these funds. Some ethical funds and non-ethical funds outperformed the market, with the majority having positive and significant alphas. However, on a risk-adjusted basis, both ethical and non-ethical funds under performed the market with ethical funds weakly outperforming the non-ethical funds. Gregory, Matatko and Luther (1997) also found that after controlling for a size selection bias in the ethical portfolios, both ethical and non-ethical trust funds under performed the general market. In contrast to Mallin, Saadouni and Briston (1995), they showed ethical funds had a lower alpha than non-ethical funds. Bauer, Koedijk and Otten (2002) applied a multifactor Carhart (1997) model to measure the performance of ethical funds.[4] After controlling for the investment style, the study found little evidence of significant differences in risk-adjusted returns between ethical and conventional funds.

[3] See Griffin and Mahon (1997) for details.

[4] Carhart (1997) model is a four-factor model where size, book to market, momentum and time variation in betas are controlled.

More recently, Edwards and Samant (2003) applied a new risk adjusted factor, the M-Squared factor that adjusted the investment of a mutual fund to the level of risk in an unmanaged benchmark stock market index, and measured the return on the risk matched fund.[5] This method related the level of risk to level of reward, and after risk adjustment, found the Domini Social Index (DSI)[6] portfolio outperformed the market given the same level of risk.

Another recent development in performance measurement suggested by Basso and Funari (2002), is the use of Data Envelopment Analysis (DEA) to evaluate ethical mutual funds.[7] This method permits the comparison on the basis of fund return and risk, and on the basis of investment costs such as subscription costs and redemption fees.

The choice of benchmarks has also been an issue in the analysis. The introduction of the Domini Social Index (DSI)[8] in 1990 offered a benchmark for ethical investments that specifically included an ethical filter in the benchmark construction. Composition of the DSI is only affected by changes in social concerns and by changes in investment policy, rather than responding to a changing market. Statman (2000) found that a DSI portfolio performed as well as the S&P500 index over the period of 1990-1998, while ethical mutual funds under performed both the market and DSI but not worse than conventional mutual funds.

The inconsistencies in the findings can be attributed to the use of different samples from multiple industries or different sources of data, as well as the multiple dimensions used to measure financial performances where researchers have inconsistently used one or only a few measures to assess financial performance.

Another interesting approach has been to construct theoretical portfolios using ethical criteria. Woodall (1986) attempted to quantify the cost of imposing an ethical investment policy by constructing 40 theoretical portfolios that excluded firms that violated ethical criteria. The results found that in general, the portfolios incurred a loss of 4 – 8 basis points from applying the ethical criteria. The most likely cost was in the form of increased industry specific risk, a bias toward smaller firms, and a corresponding reduction in the marketability of shares and gross yield. A more recent study by Geczy, Stambaugh and Levin (2003) constructed optimal portfolios of mutual funds whose objectives included socially responsible investment. For an investor who believed strongly in CAPM and disregarded managerial skills, the cost of the ethical constraint was found to be a few basis points per month, whereas for an investor who supported more sophisticated asset pricing models such as Fama French 3-factor model or Carhart 4-factor model the ethical constraint was more costly. This cost increases even more if investors believe in fund manager stock selection skills.

3. Our Methodology

The methodology we employed involved:

- Obtaining a database of securities that were selected solely for their ethical characteristics
- A process involving specification of hypotheses to be tested that would identify the cost of ethical investing and identify the major drivers of the cost.

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[5] See Modigliani and Modigliani (1997) for more details on the M-Squared factor.

[6] DSI is a well-diversified portfolio of socially screened securities that reflect mainstream social concerns. DSI excludes firms engaged in the manufacture of alcohol or tobacco, gambling, military weapons, nuclear power and business ties to South Africa. DSI was constructed by applying social screens to firms in the S&P500, select firms with exceptional social and financial performance, and adjusts for the potential negative side effects associated with implementation of socially responsible investment.

[7] See Basso and Funari (2002) for more details on DEA

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A unique set of data has been obtained for global stocks that are selected for their satisfactory grading with respect to internal policies, social policy, economic policy and environmental policy by Ethibell, a research organisation that specialises in the screening and selection of sustainable securities for fund managers.

Ethibell selected the securities in the analysis for their sustainable universe of international securities based on Ethibell's assessment of the corporation's practise and attitude to:[9]

- Internal social policy (terms of employment, working conditions, industrial relations)
- External social policy (societal impact, communication, human rights policies, social investments, developing countries policy)
- Economic policy (economic potential, policies to customers, shareholders, authorities, suppliers)
- Environmental policy (strategy, management process, production policy and products developed)

Our analysis involved examination of four hypotheses:

H_1: The inclusion of sustainable securities in an already diversified portfolio improves the risk and return ratio, ie by implication, there is something unique about the ethical securities

H_2: The improvement in the risk and return ratio for the universe of portfolios is related to an 'ethical' factor in the ethical securities, ie there is a unique factor involved

H_3: The performance of sustainable assets cannot be accounted for by other known risk factors such as country, industry, size and book to market factors, ie there is no other explanation

H_4: Sustainable investments do not significantly cost investors.

To test the hypotheses we have used two different styles of empirical analysis. Firstly, a spanning analysis has been used. The rejection of spanning implies that the mean-variance frontier of the benchmark assets is shifted outwards by the inclusion of the ethical assets.[10] The advantage of this methodology lies in the lack of dependence on model specification.

Secondly, we carried out a Fama French (1993) 3-factor model analysis. The purpose for this analysis was to examine whether the performance of the sustainable securities was significant when other risk factors such as size and book to market are controlled for.[11] An important contribution from this analysis is the ability to examine the sign of alpha via an inequality test.[12]

The empirical analysis are carried out under the Generalised Methods of Moments (GMM) framework, where disturbances are not assumed to be normally distributed or independent and identically distributed. Test statistics utilised in this research have been adjusted for heteroscedasticity and serial correlation, and small sample biases are also adjusted for by carrying out bootstrapping procedures.

4 Summary statistics

Data was provided in the form of the list of stocks selected by Ethibell, their total returns in local currency whilst held in the portfolio, corresponding MSCI sector and industry group total returns, and currency values relative to the USD. There were in total 109 stocks in the universe, however in this research we only used 97 stocks due to insufficient data for the remainder for a sufficiently long period. Additional information on stock prices in terms of USD, market value, price to book ratio, country of operation, as well as industry sector were obtained from DataStream for a period of 60 months (July 1998 to June 2003). All analysis was carried out in USD.

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[9] For more details on the selection criteria, please see Appendix A and http://www.ethibel.be.

[10] See Huberman and Kandel (1987) for more details.

[11] See Fama and French (1993) for more details.

[12] See Richardson, Richardson and Smith (1992) for more details.

Table 4.1 reports the summary statistics and indicates that the returns of the sustainable securities were not normally distributed with a slight skewed distribution to the left.[13] For the purpose of comparison, summary statistics are also provided for MSCI country indices and MSCI sector indices in Table 4.2.

Table 4.1 Summary Statistics for Sustainable Securities

Ethical Securities Returns (%)	
Mean	0.0052
Standard Error	0.0090
Median	0.0058
Sharpe Ratio	0.0317
Standard Deviation	0.0690
Kurtosis	-0.7208
Skewness	-0.1782
Minimum	-0.1474
Maximum	0.1250
Confidence Level (95.0%)	0.0178

Table 4.2 Summary Statistics for Benchmarks

Returns (%)	MSCI Country Indices Returns	MSCI Sector Indices Returns
Mean	-0.0029	-0.0073
Standard Error	0.0068	0.0196
Median	-0.0065	-0.0426
Sharpe Ratio	-0.1125	-0.0687
Standard Deviation	0.0526	0.1512
Kurtosis	-0.2772	0.3687
Skewness	0.0120	0.2278
Confidence Level (95.0%)	0.0136	0.0391

The summary statistics show that the average returns of the sustainable assets were greater than both the country and sector benchmarks. The Sharpe Ratio of the ethical portfolio constructed by market capitalisation weighting of the ethical assets is also greater than the Sharpe Ratio for the MSCI portfolios, which implies that the ethical portfolio offers greater reward to variability. However, none of the average returns are significantly different to zero.

To examine in more detail how these sustainable securities performed, the stocks were also grouped into portfolios for their respective countries and respective sectors. Descriptive statistics for market capitalisation weighted portfolios of the ethical securities based on their industry sector membership are reported in Table 4.3, and based on their country in Table 4.5 with MSCI industry group and country group comparative statistics shown in Tables 4.4 and 4.6.

Nearly all sector-based portfolios of ethical stocks outperformed their respective benchmark sector.

[13] Skewness is defined as a measure of the lack of symmetry in a distribution. A normal distribution has a value near zero; a positive skew has a positive value higher than zero; a negative skew has a negative value. Kurtosis is defined as a measure of the degree of peakedness in the distribution. Normal distributions have a value near zero; flat distributions have a negative value; peaked distributions have a positive value.

Table 4.3 Sector grouped Sustainable Securities

Mkt Cap Weighted	HealthCare	Industrials	Energy	Materials	Cons. Disc.	Cons. Stpl.	Financials	IT	Telecom	Utilities
Mean	0.0072	0.0026	0.0088	-0.0019	0.0019	0.0026	0.0008	0.0061	-0.0059	0.0012
Standard Error	0.0067	0.0072	0.0085	0.0091	0.0090	0.0058	0.0074	0.0166	0.0137	0.0080
Median	0.0076	-0.0031	0.0047	0.0031	0.0069	0.0059	-0.0012	0.0082	-0.0115	-0.0013
Sharpe Ratio	0.0807	-0.0071	0.0881	-0.0708	-0.0164	-0.0091	-0.0378	0.0236	-0.0840	-0.0286
Standard Deviation	0.0522	0.0554	0.0656	0.0701	0.0694	0.0451	0.0576	0.1286	0.1064	0.0623
Sample Variance	0.0027	0.0031	0.0043	0.0049	0.0048	0.0020	0.0033	0.0165	0.0113	0.0039
Kurtosis	0.1892	0.5613	-0.6430	0.3476	-0.2173	0.0958	0.9171	-0.2212	-0.0343	-0.0542
Skewness	-0.3823	-0.1797	-0.0902	0.2960	-0.0797	0.2147	-0.2122	-0.3681	-0.1072	0.1986
Range	0.2519	0.2936	0.2691	0.3407	0.3199	0.2057	0.3107	0.5811	0.4951	0.2970
Minimum	-0.1385	-0.1744	-0.1434	-0.1529	-0.1542	-0.0804	-0.1615	-0.3075	-0.2771	-0.1411
Maximum	0.1134	0.1192	0.1257	0.1878	0.1657	0.1253	0.1492	0.2736	0.2181	0.1559

Table 4.4 MSCI Sector Indices

	HealthCare	Industrials	Energy	Materials	Cons. Dis.	Cons. Stpl.	Financials	IT	Telecom	Utilities
Mean	0.0010	-0.0019	0.0029	-0.0011	-0.0025	-0.0010	-0.0008	-0.0034	-0.0072	-0.0010
Standard Error	0.0056	0.0068	0.0076	0.0081	0.0080	0.0054	0.0080	0.0152	0.0101	0.0054
Median	0.0028	-0.0057	-0.0007	-0.0043	-0.0066	-0.0001	0.0030	0.0016	-0.0032	0.0004
Sharpe Ratio	-0.0470	-0.0924	-0.0017	-0.0661	-0.0891	-0.0974	-0.0623	-0.0544	-0.1309	-0.0958
Standard Deviation	0.0434	0.0530	0.0587	0.0624	0.0622	0.0416	0.0620	0.1178	0.0780	0.0418
Sample Variance	0.0019	0.0028	0.0034	0.0039	0.0039	0.0017	0.0038	0.0139	0.0061	0.0018
Kurtosis	-0.6429	0.3882	1.1471	0.5305	-0.1934	0.4917	1.9694	-0.6479	-0.0207	0.3868
Skewness	-0.2521	-0.2433	0.0458	-0.0106	-0.2747	-0.1195	-0.6148	-0.2336	-0.0367	-0.3323
Range	0.1712	0.2597	0.3206	0.3216	0.2848	0.2225	0.3613	0.5091	0.4034	0.2040
Minimum	-0.0865	-0.1434	-0.1767	-0.1522	-0.1573	-0.1026	-0.2229	-0.2950	-0.1982	-0.1219
Maximum	0.0848	0.1162	0.1439	0.1694	0.1275	0.1199	0.1384	0.2141	0.2053	0.0821

Table 4.5 Country grouped Sustainable Securities

Mkt Cap Weighted	DKK	BEF	FIM	DEM	GBP	ITL	CHF	ESP	NOK	FRF	SEK	NLG	JPY	AUD	NZD	USD	CAD
Mean	0.0028	-0.0030	0.0134	-0.0036	0.0001	-0.0007	-0.0095	-0.0020	0.0021	-0.0014	0.0046	-0.0115	0.0066	0.0081	0.0143	0.0067	0.0086
Standard Error	0.0102	0.0128	0.0211	0.0119	0.0050	0.0138	0.0167	0.0126	0.0143	0.0085	0.0114	0.0137	0.0107	0.0081	0.0116	0.0100	0.0084
Median	0.0050	0.0088	0.0342	-0.0085	0.0010	-0.0027	-0.0087	-0.0037	0.0195	0.0007	0.0054	-0.0126	0.0010	0.0076	0.0069	0.0137	0.0170
Sharpe Ratio	-0.0028	-0.0610	0.0637	-0.0723	-0.0741	-0.0350	-0.0968	-0.0510	-0.0081	-0.0662	0.0183	-0.1372	0.0427	0.0808	0.1251	0.0472	0.0853
Standard Deviation	0.0789	0.0993	0.1638	0.0922	0.0389	0.1070	0.1294	0.0974	0.1111	0.0661	0.0879	0.1062	0.0831	0.0631	0.0902	0.0776	0.0653
Sample Variance	0.0062	0.0099	0.0268	0.0085	0.0015	0.0114	0.0167	0.0095	0.0123	0.0044	0.0077	0.0113	0.0069	0.0040	0.0081	0.0060	0.0043
Kurtosis	1.5358	3.1957	-0.2770	-0.0886	0.7557	0.7046	2.2079	0.7828	-0.1564	0.2633	0.1193	1.4750	2.1192	0.0303	0.8697	-0.2538	4.9779
Skewness	-0.6042	-0.9369	-0.3019	0.2924	-0.0884	0.4044	-0.1815	0.2220	-0.4186	-0.3046	0.0693	-0.1532	0.6993	-0.3243	-0.0008	-0.4990	-0.9331
Range	0.4495	0.6126	0.7245	0.4242	0.2002	0.5600	0.7977	0.5223	0.4741	0.3243	0.4555	0.6319	0.4822	0.3057	0.4577	0.3468	0.4522
Minimum	-0.2525	-0.3787	-0.4013	-0.2049	-0.1046	-0.2388	-0.4418	-0.2590	-0.2850	-0.1875	-0.2094	-0.3162	-0.1730	-0.1587	-0.2151	-0.2049	-0.2689
Maximum	0.1969	0.2339	0.3232	0.2192	0.0956	0.3212	0.3559	0.2633	0.1891	0.1368	0.2461	0.3157	0.3092	0.1470	0.2426	0.1419	0.1832

Table 4.6 MSCI Country Indices

	USA	Japan	UK	Canada	Den-mark	Belgium	Australia	Germany	Spain	Nether-lands	Italy	Finland	Norway	Switzer-land	Sweden	New Zealand	France
Mean	-0.0023	-0.0041	-0.0057	0.0013	-0.0017	-0.0073	0.0031	-0.0095	-0.0040	-0.0091	-0.0035	0.0059	-0.0049	-0.0049	-0.0059	-0.0017	-0.0032
Standard Error	0.0070	0.0087	0.0061	0.0093	0.0084	0.0091	0.0074	0.0104	0.0100	0.0091	0.0087	0.0180	0.0109	0.0077	0.0130	0.0107	0.0089
Median	-0.0062	-0.0110	-0.0098	0.0057	0.0102	-0.0060	0.0079	-0.0033	0.0032	-0.0101	0.0004	0.0131	-0.0151	0.0001	-0.0056	0.0062	-0.0048
Sharpe Ratio	-0.0984	-0.1061	-0.1832	-0.0244	-0.0717	-0.1456	0.0017	-0.1550	-0.0901	-0.1719	-0.0961	0.0207	-0.0935	-0.1317	-0.0888	-0.0570	-0.0899
Standard Deviation	0.0540	0.0672	0.0474	0.0723	0.0653	0.0708	0.0575	0.0807	0.0777	0.0706	0.0678	0.1391	0.0844	0.0599	0.1003	0.0827	0.0691
Sample Variance	0.0029	0.0045	0.0022	0.0052	0.0043	0.0050	0.0033	0.0065	0.0060	0.0050	0.0046	0.0193	0.0071	0.0036	0.0101	0.0068	0.0048
Kurtosis	-0.7996	1.0727	0.0053	0.7927	-0.0906	1.3769	-0.2810	0.5555	1.6420	1.5160	-0.2090	0.1005	3.0362	1.4663	-0.2899	0.5178	0.0389
Skewness	0.0164	0.9516	-0.2134	-0.6348	-0.5284	-0.4653	-0.2347	-0.2595	0.0158	-0.7461	-0.1962	-0.1019	-0.8419	-0.0752	-0.1414	-0.4582	-0.1461
Range	0.2237	0.3351	0.2338	0.3792	0.3011	0.3853	0.2480	0.4303	0.4687	0.3738	0.2801	0.6824	0.5309	0.3453	0.4421	0.4308	0.3412
Minimum	-0.1062	-0.1130	-0.1321	-0.2195	-0.1827	-0.2221	-0.1263	-0.2275	-0.2324	-0.2540	-0.1531	-0.3556	-0.3344	-0.1604	-0.2487	-0.2327	-0.1899
Maximum	0.1175	0.2221	0.1017	0.1597	0.1185	0.1632	0.1217	0.2027	0.2363	0.1198	0.1270	0.3268	0.1966	0.1849	0.1934	0.1981	0.1513

When the average returns of the country grouped ethical securities are compared to their benchmarks, 15 out of 17 countries out-performed the benchmarks, and based on the Sharpe Ratio, all ethical country portfolios had greater return per unit of risk than their country benchmarks. Although these results may seem interesting, we cannot place much emphasis on the comparisons, since the ethical assets portfolios consisted of a limited number of stocks, which may be biased, and in particular may exhibit stock specific issues.
Additionally, ethical securities were also grouped into portfolios by decile market size and price to book ratio. Size 1 consists the smallest market size ethical stocks and size 10 consists of the largest market size stocks.

Table 4.7 Size grouped Sustainable Securities

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Mkt Cap Weighted	Size 1	Size 2	Size 3	Size 4	Size 5	Size 6	Size 7	Size 8	Size 9	Size 10
Mean	-0.0091	-0.0035	-0.0132	-0.0094	0.0002	0.0035	0.0014	0.0001	-0.0002	0.0113
Mean Size	896.81	1846.90	4191.12	5879.32	8216.24	10047.87	13160.02	20610.52	45874.85	132284.03
Standard Error	0.0083	0.0090	0.0101	0.0081	0.0070	0.0073	0.0064	0.0082	0.0096	0.0118
Median	0.0041	0.0035	-0.0138	-0.0120	0.0062	0.0034	0.0043	0.0057	0.0007	0.0156
Sharpe Ratio	-0.1884	-0.0930	-0.2080	-0.1983	-0.0518	0.0084	-0.0320	-0.0453	-0.0431	0.0910
Standard Deviation	0.0644	0.0701	0.0781	0.0624	0.0544	0.0569	0.0500	0.0637	0.0744	0.0915
Sample Variance	0.0042	0.0049	0.0061	0.0039	0.0030	0.0032	0.0025	0.0041	0.0055	0.0084
Kurtosis	1.6968	0.9340	1.4805	0.1577	0.2693	1.9683	0.3562	0.4915	0.1264	0.0867
Skewness	-0.6464	-0.4521	-0.6211	-0.1351	-0.2442	-0.2542	-0.0960	-0.2442	-0.0496	-0.4369
Range	0.3847	0.3539	0.4366	0.3185	0.2761	0.3456	0.2505	0.3017	0.3335	0.4225
Minimum	-0.2196	-0.2076	-0.2822	-0.1875	-0.1525	-0.1735	-0.1040	-0.1524	-0.1805	-0.2461
Maximum	0.1651	0.1464	0.1543	0.1311	0.1237	0.1721	0.1466	0.1493	0.1531	0.1764

Table 4.7 shows that there is an apparent trend for the larger market capitalisation stocks to have positive returns over the period whilst the lower capitalised stocks have a negative return, with all stocks exhibiting negative skewness. This trend may be explained by the particular time period under study, where small firms suffered more from the Dot Com crash than larger firms in 1998 to 2003.
Similarly, sustainable securities were also ranked on price to book ratio, and then formed into decile portfolios, with P/B 1 the smallest average ratio and P/B 10 the largest average ratio.

Table 4.8 Price to Book grouped Sustainable Securities

Mkt Cap Weighted	P/B 1	P/B 2	P/B 3	P/B 4	P/B 5	P/B 6	P/B 7	P/B 8	P/B 9	P/B 10
Mean	-0.0273	-0.0194	-0.0055	0.0002	0.0022	-0.0003	-0.0047	-0.0035	0.0171	0.0141
Average Portfolio P/B	-0.3741	1.2899	1.5918	1.9401	2.3023	2.8771	3.7984	5.4000	8.0085	15.6816
Standard Error	0.0144	0.0092	0.0093	0.0095	0.0080	0.0086	0.0131	0.0129	0.0097	0.0105
Median	-0.0198	-0.0159	-0.0009	-0.0043	0.0030	0.0089	0.0071	0.0009	0.0124	0.0085
Sharpe Ratio	-0.2717	-0.3142	-0.1180	-0.0378	-0.0135	-0.0497	-0.0762	-0.0654	0.1875	0.1360
Standard Deviation	0.1117	0.0715	0.0720	0.0738	0.0623	0.0667	0.1011	0.0996	0.0753	0.0812
Sample Variance	0.0125	0.0051	0.0052	0.0054	0.0039	0.0044	0.0102	0.0099	0.0057	0.0066
Kurtosis	0.0163	1.2849	1.8566	0.1034	-0.2862	2.2107	-0.0160	1.5196	1.3451	-0.1186

Skewness	-0.1654	-0.3865	-0.2803	0.0074	-0.1694	-0.1475	-0.2683	-0.6713	-0.4445	0.1338
Range	0.5407	0.4167	0.4166	0.3479	0.2772	0.3975	0.4443	0.5744	0.4130	0.3720
Minimum	-0.3426	-0.2299	-0.2135	-0.1795	-0.1504	-0.1840	-0.2163	-0.3532	-0.2436	-0.1640
Maximum	0.1980	0.1868	0.2031	0.1683	0.1268	0.2135	0.2280	0.2212	0.1694	0.2080

Table 4.8 shows that there is no discernable trend on a price to book basis which indicates that the sustainable stocks as a whole do not have a bias to a particular price to book ratio, however it does seems that larger price to book ratio portfolios (P/B 6 to P/B 10) generally have higher average returns and higher Sharpe ratios. Conversely, lower price to book ratio portfolios (P/B 1 to P/B 5) have on average lower returns and lower Sharpe ratios.

5. Spanning Analysis

Spanning refers to whether a sub set of securities (the benchmark) provides the same mean-variance investment opportunity set as the investment opportunity set generated from a larger set of assets. If the mean-variance frontier of the benchmark assets plus the additional assets coincides with the frontier of the benchmark assets, then the benchmark assets are said to *span* all assets. This implies that no mean-variance investor can benefit from adding the new assets to the portfolio of benchmark assets.

The most commonly used test procedures for spanning analysis are the Likelihood Ratio (LR), the Wald (W) and the Lagrange Multiplier (LM) tests. These are all asymptotic tests, depend on large samples, and are developed within the framework of Maximum Likelihood estimation. We also used a multivariate test of spanning based under the framework of Hansen's (1982) Generalised Methods of Moments (GMM). The purpose for this was to carry out a statistical analysis not assuming that errors were normally distributed, homoscedastic or serially uncorrelated.

Table 5.1 lists the number of sustainable securities that reject the null hypothesis under spanning against MSCI country indices, and compares the number of stocks rejected and the total number of stocks listed beside each country, as well as the percentage of stocks being rejected for each relevant country. Table 5.1 shows a mixed result with several stocks strongly rejecting spanning, indicating these assets would add diversification benefits to the investment portfolio.

Table 5.1: Individual Assets Against MSCI Country Indices

The 17 countries included in the study are: Denmark, Belgium, Finland, Germany, UK, Italy, Switzerland, Spain, Norway, France, Sweden, Netherlands, Japan, Australia, New Zealand, US and Canada. The figures in brackets beside the countries are the number of sustainable securities selected for the country of interest. The number of rejections is the number of sustainable securities that rejected the null hypothesis of spanning. The percentage is the number of rejections divided by the total number of stocks in that country.

Country	Number of Rejections	Percentage
DKK (4)	0	0.00%
BEF (4)	0	0.00%
FIM (2)	0	0.00%
DEM (15)	2	13.33%
GBP (10)	5	50.00%
ITL (2)	0	0.00%
CHF (3)	1	33.33%
ESP (2)	0	0.00%
NOK (1)	0	0.00%
FRF (3)	2	66.67%
SEK (1)	0	0.00%
NLG (2)	1	50.00%
JPY (11)	2	18.18%
AUD (3)	0	0.00%

NZD (1)	1	100.00%
USD (27)	10	37.04%
CAD (6)	3	50.00%

Table 5.2 lists the number of sustainable securities that reject the null hypothesis under spanning against MSCI global sector indices as benchmark portfolios, and compares the number of stocks rejected and the total number of stocks listed beside each industry sector, as well as the percentage of stocks being rejected for each relevant sector. It similarly shows a mixed result with some stocks rejecting spanning while others do not.

Table 5.2: Individual Assets Against MSCI Global Sector Indices

The 10 MSCI global sectors included in the study are: Consumer Discretionary, Consumer Staples, Energy, Financials, Health Care, Industrials, Information Technology, Materials, telecommunications and Utilities. The figures in brackets beside the sectors are the number of sustainable securities selected for the sector of interest. The number of rejections is the number of sustainable securities that rejected the null hypothesis of spanning. The percentage is the number of rejections divided by the total number of stocks in that sector.

Industry	Number of Rejections	Percentage
Consumer Disc (16)	4	25.00%
Consumer Staples (11)	6	54.55%
Energy (2)	1	50.00%
Financials (13)	4	30.77%
Health Care (9)	2	22.22%
Industrials (17)	3	17.65%
Info Technology (14)	4	28.57%
Materials (8)	1	12.50%
Telecommunication (3)	0	0.00%
Utilities (4)	1	25.00%

Table 5.3 provides four test statistics to interpret the results of the spanning analysis by grouping ethical assets into country portfolios. All four test statistics, the Lagrange Multiplier (LM), Likelihood Ratio (LR), Wald (W) and the Wald test under GMM adjusted for serial correlation using Newey West errors (Wa) strongly reject the null hypothesis of spanning. The results imply that under both frameworks of normality (LM, LR and W) and non-normality (Wa), the inclusion of ethical securities seems to improve the mean-variance efficiency of the investment opportunity for an investor

These results seem to present strong evidence in favour of Hypothesis 1, that overall, ethical investments do improve the investment opportunity globally.

Table 5.3: General Spanning Test for Country Grouped Portfolios

The table presents four mean-variance spanning tests on sustainable securities grouped on the basis of countries using the MSCI country indices as benchmark assets.

STATISTICS		P-VALUE
LM	68.5142 ***	0.0004
LR	102.3134 ***	0.0000
W	163.3067 ***	0.0000
Wa	350.5024 ***	0.0000

***, **, and * indicates significance at the 1%, 5% and 10% level, respectively.

Although the general spanning test supports Hypothesis 1, it is nevertheless interesting to examine whether the rejection of spanning exists when the tests are conducted on a country-by-country basis as this may be an indicator of whether Hypothesis 2 is accepted or rejected

as, if there is an ethical factor uniformly present in these stocks, we should see that all countries reject the spanning test. Table 5.4 presents the test statistics for all 17 countries, Denmark, Belgium, Finland, Germany, UK, Italy, Switzerland, Spain, Norway, France, Sweden, Netherlands, Japan, Australia, New Zealand, US, and Canada. The number of stocks used in each country-spanning test is also provided in brackets.

Table 5.4: Country Grouped Portfolios

The table presents four mean-variance spanning tests on sustainable securities grouped on the basis of countries using the MSCI country indices as benchmark assets.

Country	LM	LR	W	Wa
DKK (4)	6.1617	6.3431	6.5324	4.7681
	(0.6291)	(0.6089)	(0.5878)	(0.7821)
BEF (4)	5.3922	5.5188	5.6493	6.5893
	(0.7149)	(0.7010)	(0.6864)	(0.5815)
FIM (2)	3.4483	3.5380	3.6310	2.3585
	(0.4858)	(0.4721)	(0.4582)	(0.6701)
DEM (15)	24.0660	28.0609	33.1384	93.9955 ***
	(0.7690)	(0.5672)	(0.3166)	(0.0000)
GBP (10)	33.5116 **	43.0876 ***	57.3522 ***	159.5996 ***
	(0.0296)	(0.0020)	(0.0000)	(0.0005)
ITL (2)	1.6761	1.6880	1.7001	3.6971
	(0.7951)	(0.7929)	(0.7907)	(0.4485)
CHF (3)	16.0964 **	18.7152 ***	21.9369 ***	68.5541 ***
	(0.0132)	(0.0047)	(0.0012)	(0.0000)
ESP (2)	0.6884	0.6924	0.6963	0.0467
	(0.9527)	(0.9523)	(0.9518)	(0.9997)
NOK (1)	6.4290 **	6.8002 **	7.2006 **	5.9309 **
	(0.0402)	(0.0334)	(0.0273)	(0.0495)
FRF (3)	13.8806 **	15.4078 **	17.1893 ***	3.9277
	(0.0310)	(0.0173)	(0.0086)	(0.6865)
SEK (1)	5.2556 *	5.5001 *	5.7601 *	6.4294 **
	(0.0722)	(0.0639)	(0.0561)	(0.0402)
NLG (2)	16.2411 ***	18.9389 ***	22.2687 ***	26.2767 ***
	(0.0027)	(0.0008)	(0.0002)	(0.0000)
JPY (11)	30.5172	38.6404 **	50.3839 ***	49.4628 ***
	(0.1064)	(0.0155)	(0.0005)	(0.0007)
AUD (3)	7.2434	7.6662	8.1245	2.0988
	(0.2989)	(0.2636)	(0.2291)	(0.9104)
NZD (1)	4.2570	4.4155	4.5821	12.0022 ***
	(0.1190)	(0.1099)	(0.1012)	(0.0025)
USD (27)	81.2604 ***	141.1185 ***	287.0093 ***	14174.2814 ***
	(0.0096)	(0.0000)	(0.0000)	(0.0000)
CAD (6)	15.6217	16.7676	18.0316	30.1365 ***
	(0.2092)	(0.1585)	(0.1147)	(0.0027)

***, **, and * indicates significance at the 1%, 5% and 10% level, respectively.

Table 5.4 does not provide evidence to accept Hypothesis 2, as not all 17 countries uniformly reject spanning. This means that there appears to be a country bias in the results.

Sustainable securities have also been grouped into portfolios by industry sector and tested against the MSCI country indices for spanning. Table 5.5 sets out the results. Like the country spanning results, all four test statistics strongly reject the null hypothesis of spanning. This again implies that under both frameworks using either normality assumptions or non-normality assumptions, the inclusion of ethical securities improves the mean-variance efficiency of the investment opportunity set for an investor. These results also provide support for Hypothesis 1, that overall, ethical investments do improve the investment opportunity globally.

Although the general spanning test does support Hypothesis 1, it is again important to examine whether the strong rejection of spanning holds uniformly for the 10 individual

industry sectors. Table 5.6 presents the test statistics for all 10 sectors and the number of stocks available in each sector portfolios is also provided.

Table 5.5: General Spanning Test for Sector Grouped Portfolios

The table presents four mean-variance spanning tests on sustainable securities grouped on the basis of sectors as the test assets, using the MSCI sector indices as benchmark assets.

ANALYTICAL TEST STATISTICS		P-VALUE
LM	45.7012 ***	0.0009
LR	60.9312 ***	0.0000
W	85.1241 ***	0.0000
Wa	189.6283 ***	0.0000

***, **, and * indicates significance at the 1%, 5% and 10% level, respectively.

Table 5.6 does not provide support for Hypothesis 2, as not all sectors consistently rejected spanning. If there is an ethical factor existing in these stocks, we should see that all sectors reject the spanning test uniformly. This means the industry sector factor dominates the presence of an ethical factor, and hence the evidence cannot support the hypothesis that there is a common ethical factor among the selected ethical securities.

Table 5.6: Sector Grouped Portfolios

Sectors	LM	LR	W	Wa
Consumer Discretionary (Da, auto, hotel, media, retail) (16)	44.7124 * (0.0671)	57.8297 *** (0.0034)	77.3825 *** (0.0000)	571.5368 *** (0.0000)
Consumer Staples (food, drugs, household) (11)	46.6257 *** (0.0016)	65.4481 *** (0.0000)	98.4101 *** (0.0000)	118.4734 *** (0.0000)
Energy (2)	6.4376 (0.1688)	6.7403 (0.1503)	7.0640 (0.1325)	3.4589 (0.4842)
Financials (13)	41.8336 ** (0.0255)	52.2263 *** (0.0017)	66.6581 *** (0.0000)	177.4508 *** (0.0000)
Health Care (9)	27.8307 * (0.0647)	34.9209 *** (0.0097)	44.9500 *** (0.0004)	40.4509 *** (0.0018)
Industrials (17)	54.3803 ** (0.0147)	79.2229 *** (0.0000)	125.7357 *** (0.0000)	187.5158 *** (0.0000)
Information Technology (14)	41.8243 ** (0.0450)	53.3122 *** (0.0027)	70.0897 *** (0.0000)	156.7757 *** (0.0000)
Materials (8)	13.2148 (0.6570)	14.2858 (0.5774)	15.4925 (0.4889)	16.7212 (0.4039)
Telecommunication (3)	5.9050 (0.4339)	6.1884 (0.4024)	6.4911 (0.3705)	3.1525 (0.7895)
Utilities (4)	13.4792 * (0.0964)	14.8099 * (0.0629)	16.3428 ** (0.0377)	6.9560 (0.5414)

***, **, and * indicates significance at the 1%, 5% and 10% level, respectively.

Overall, by observing the results provided by test statistics under the traditional assumption of normality as well as under the GMM framework, the results are inconsistent and depend on how the ethical stocks are grouped. The significance of mean-variance efficiency should not depend on how these stocks are grouped, which suggests that the benefits from investing in these ethical securities could be driven by the country or industry/sector factors. *Although the results show that the inclusion of ethical assets does improve the investment opportunity set of a global investor, it could not be ascertained whether this was due to the sustainability attributes of these securities.*

6.Factor Analysis

To test Hypothesis 3,we examined whether the performance of sustainable assets could be accounted for by other determinable risk factors. This was achieved by utilising a Fama French (1993) 3-factor model. In constructing these factor models a series of testing procedures were adopted including the MLE tests developed by Gibbons Ross and Shanken (1989), and the GMM based test statistics of MacKinlay and Richardson (1991). In addition, an inequality test based on the results of Kodde and Palm (1986) was also applied to test the sign of the ethical assets' abnormal returns generated by these factor models.

We followed the methodology of Fama and French (1993), and Black, Jensen and Scholes (1972) in identifying five common risk factors in the returns on stocks and bonds, which included: the overall market factor, SMB, HML and 2 bond market factors, viz, maturity and default risk. Following Fama and French (1993), our analysis did not include negative book equity firms, and only firms with ordinary common equity were included in the tests. The intersection of these 2 sets of portfolios resulted in the formation of 6 portfolios (Small Value, Medium Value, Big Value, Small Growth, Medium Growth and Big Growth) for each of the 17 markets (a total of 102 portfolios every month), which were tracked over the period of July 1998 through June 2003. These portfolios then formed the basis of the factor mimicking portfolios, SMB and HML. With the domestic excess market returns SMB and HML portfolios formed, global factors were constructed by value weighting each of the domestic risk factors according to their MSCI country index market value. Three types of test statistics were utilised in this factor analysis. These were the finite sample GRS test introduced by Gibbons, Ross and Shanken (1989), the Wald test under the GMM framework by MacKinlay and Richardson (1991), using small sample corrected p-values by bootstrapping the test statistic as shown in Fisher and Sim (1995), and an alpha inequality test outlined in Boudoukh, Richardson and Smith (1993).

The Fama and French 3-factor model tests the hypothesis that alpha is significantly different to zero. However, in response to Hypothesis 4 our objective is to investigate whether the alpha is not significantly negative. Hence, an inequality alpha test is applied following the procedure outlined in Wolak (1989), and Boudoukh, Richardson and Smith (1993).[14]

Table 6.1 lists the number of sustainable securities that rejected the null hypothesis that abnormal performance is not significantly different from zero when using domestic factors. It also compares the number of stocks rejected and the total number of stocks listed beside each country, as well as the percentage of stocks being rejected for each relevant country.

Table 6.1 Countries Against Domestic Fama French Factors

The percentage is the number of rejections divided by the total number of stocks in that country.

Country	Number of Rejections	Percentage
DKK (4)	1	25.00%
BEF (4)	3	75.00%
FIM (2)	0	0.00%
DEM (15)	5	33.33%
GBP (10)	2	20.00%
ITL (2)	1	0.00%
CHF (3)	0	0.00%
ESP (2)	0	0.00%
NOK (1)	0	0.00%
FRF (3)	0	0.00%
SEK (1)	0	0.00%
NLG (2)	1	50.00%
JPY (11)	1	9.09%
AUD (3)	0	0.00%
NZD (1)	0	0.00%

[14] See Boudoukh, Richardson and Smith (1993) for derivation details.

USD (27)	9	33.33%
CAD (6)	4	66.67%

To examine the characteristics of abnormal returns in each of the 17 countries, domestic Fama French risk factors were formed and regressed against the sustainable securities in the relevant country. The results of these tests are listed in Table 6.2

Table 6.2: Domestic Fama French Risk Analysis For Each Country

Currency	GRS	GMM	Empirical P-value	Inequality Wald Test
DKK (4)	0.8285	8.0990 *	0.9580	1.0674e-004
	(0.5128)	(0.0800)		(0.8629)
BEF (4)	1.1836	675.4834 ***	0.1800	0.0013
	(0.3282)	(0.0000)		(0.9480)
FIM (2)	1.2665	0.1112	0.7990	1.4590e-005
	(0.2896)	(0.9459)		(0.5925)
DEM (15)	0.5479	347.2886 ***	0.8510	2.7659e-004
	(0.8974)	(0.0000)		(1.0000)
GBP (10)	0.5025	28.8871 ***	0.9200	7.0337e-004
	(0.8800)	(0.0013)		(0.9989)
ITL (2)	0.6430	12.1308 ***	0.6530	7.7518e-005
	(0.5295)	(0.0023)		(0.7864)
CHF (3)	0.3112	0.5868	0.6960	0.0028
	(0.8172)	(0.8995)		(0.9516)
ESP (2)	0.2961	1.4102	0.6730	2.1696e-004
	(0.7449)	(0.4941)		(0.6750)
NOK (1)	0.5897	1.0684	0.5040	1.0993e-005
	(0.4457)	(0.3013)		(0.4827)
FRF (3)	0.3388	4.3873	0.3850	1.2595e-005
	(0.7974)	(0.2226)		(0.7707)
SEK (1)	0.6077	0.5694	0.6250	2.8159e-005
	(0.4388)	(0.4505)		(0.4780)
NLG (2)	0.2329	4.0172	0.6300	1.1646e-004
	(0.7930)	(0.1342)		(0.6257)
JPY (11)	0.5349	13.6667	0.9010	1.5657e-004
	(0.8697)	(0.2520)		(1.0000)
AUD (3)	0.2939	3.3947	0.5860	2.9414e-005
	(0.8296)	(0.3347)		(0.9103)
NZD (1)	1.0254	0.6100	0.6710	7.5590e-005
	(0.3155)	(0.4348)		(0.5253)
USD (27)	1.0071	175.0936 ***	0.9950	0.0011
	(0.4883)	(0.0000)		(1.0000)
CAD (6)	0.6315	364.2287 ***	0.7130	3.4377e-005
	(0.7043)	(0.0000)		(0.9897)

***, **, and * indicates significance at the 1%, 5% and 10% level, respectively.

It can be seen from Table 6.2 that under the GRS test, alphas are not significantly different to zero across all 17 countries. These results do not then support Hypothesis 3 since the inability to find significant alphas indicates that the factor portfolios have accounted for the majority of the sustainable returns. Although the GRS test statistic does give a good indication of the significance of alphas under finite samples, it relies however, on the assumption that disturbances are normally distributed.

The statistics for the inequality alpha test are provided in Table 6.2. From Table 6.2, the inequality test statistics across all 17 countries cannot reject the null hypothesis, which implies the investment of sustainable securities would not significantly cost investors. This

finding provides strong support for Hypothesis 4. Although the study does find strong evidence for Hypothesis 4, it is however based on domestic Fama French risk factors. To provide a more convincing argument to account for market integration effects, Fama French factor analysis was also carried out using global risk factors. Table 6.3 sets out the number of sustainable securities that reject the null hypothesis that abnormal performance is not significantly different from zero. It also compares the number of stocks rejected when using global risk factors with the total number of stocks listed beside each country, as well as the percentage of stocks being rejected for each relevant country. A joint test of significance of alphas was also carried out across all countries under the global Fama French risk factors, and the results are shown in Table 6.4. Both the GRS and GMM test statistics cannot reject the hypothesis that alpha is insignificantly different to zero, nor can the inequality test. These results again reject Hypothesis 3 but support Hypothesis 4, as the performance of sustainable securities are generally explained by the Size and Book to market risk factor, but at the same time, these insignificant abnormal performances would not cost investors for the inclusion of sustainable investments.

Table 6.3: Countries Against Global Fama French Factors

Country	Number of Rejections	Percentage
All Countries (17)	3	17.65%
DKK (4)	3	75.00%
BEF (4)	2	50.00%
FIM (2)	0	0.00%
DEM (15)	1	6.67%
GBP (10)	1	10.00%
ITL (2)	0	0.00%
CHF (3)	0	0.00%
ESP (2)	0	0.00%
NOK (1)	0	0.00%
FRF (3)	0	0.00%
SEK (1)	0	0.00%
NLG (2)	1	50.00%
JPY (11)	1	9.09%
AUD (3)	0	0.00%
NZD (1)	0	0.00%
USD (27)	7	25.93%
CAD (6)	2	33.33%

Table 6.4: Joint Test of Alphas Under Global Fama French Factors (Countries)

Assets	GRS	GMM	Empirical P-value	Inequality Wald Test
All Countries (17)	1.0802 (0.4025)	26.0179 * (0.0741)	0.9650	1.6537e-004 (1.0000)

***, **, and * indicates significance at the 1%, 5% and 10% level, respectively.

Similar to the spanning analysis carried out earlier, a global factor analysis was also carried out on individual country portfolios. It should be noted that by grouping sustainable securities into country portfolios for the factor analysis, this also controls for the country risk factor in addition to the size and book to market risk factors. These results are presented in Table 6.5., where it can be seen that under the GRS test, only Finland is able to find a significant alpha out of 17 countries. The other 16 countries cannot reject the hypothesis that alpha is insignificantly different from zero. However, the GMM test statistic for Finland is very small, implying it is unable to reject the null hypothesis, and the empirical p-value for Finland also cannot reject the null. Together, they indicate that the test statistic offered under

the GRS test may be biased and inaccurate due to the normality distribution assumption. Overall, Hypothesis 4 is once again supported since these results show that under the global risk factors, the joint test of alphas is insignificant both an aggregate portfolio.

Table 6.5: Global Fama French Risk Analysis For Each Country

Currency	GRS	GMM	Empirical P-value	Inequality Wald Test
DKK (4)	0.7615	11.0433 **	0.9580	2.1361e-004
	(0.5548)	(0.0261)		(0.9761)
BEF (4)	1.3738	118.6087 ***	0.6080	0.0039
	(0.2550)	(0.0000)		(0.8777)
FIM (2)	3.2183	0.6213	0.7770	6.8821e-005
	(0.0474)	(0.7330)		(0.6258)
DEM (15)	0.7656	19.3530	0.8870	0.0029
	(0.70614)	(0.1982)		(1.0000)
GBP (10)	0.4514	19.5294 **	0.9490	0.0011
	(0.9126)	(0.0340)		(0.9988)
ITL (2)	0.6280	1.9123	0.6730	9.2646e-006
	(0.5373)	(0.3844)		(0.5018)
CHF (3)	0.1771	0.3339	0.7540	0.0126
	(0.9115)	(0.9535)		(0.9496)
ESP (2)	0.2619	1.7976	0.6560	1.7412e-004
	(0.7705)	(0.4071)		(0.6251)
NOK (1)	0.2122	0.2205	0.7170	6.6875e-006
	(0.6468)	(0.6386)		(0.4870)
FRF (3)	0.2466	2.3450	0.4320	2.1113e-004
	(0.8634)	(0.5040)		(0.7796)
SEK (1)	0.0021	0.0025	0.9670	7.8145e-008
	(0.9634)	(0.9599)		(0.4809)
NLG (2)	0.5505	7.9405 **	0.3680	4.0539e-005
	(0.5797)	(0.0189)		(0.6354)
JPY (11)	0.7299	9.1656	0.9550	2.5928e-004
	(0.7046)	(0.6066)		(1.0000)
AUD (3)	0.4036	1.5036	0.8010	2.2386e-005
	(0.7510)	(0.6814)		(0.7823)
NZD (1)	1.5703	0.9021	0.6800	1.2453e-004
	(0.2152)	(0.3422)		(0.5114)
USD (27)	1.0575	127.5316 ***	0.9940	0.0025
	(0.4362)	(0.0000)		(1.0000)
CAD (6)	0.5014	16.4604 **	0.9280	1.5445e-004
	(0.8045)	(0.0115)		(0.9934)

***, **, and * indicates significance at the 1%, 5% and 10% level, respectively.

As well as the global factor analysis carried out on individual countries, analysis for individual sectors was carried out to be consistent with the spanning tests. The results of the factor analysis are listed in Table 6.6, where the number of rejections per sector is shown.

Table 6.6: Sectors Against Global Fama French Factors

Industry	Number of Rejections	Percentage
Consumer Disc (16)	11	68.75%
Consumer Staples (11)	3	27.27%
Energy (2)	0	00.00%
Financials (13)	1	7.69%
Health Care (9)	1	11.11%
Industrials (17)	3	17.65%
Info Technology (14)	5	35.71%
Materials (8)	4	50.00%

Telecommunication (3)	0	0.00%
Utilities (4)	1	25.00%

As before, a joint test of the significance of alphas is carried out for all sectors under the global Fama French risk factors, and the results are shown in Table 6.7. The GRS test statistics cannot reject the null hypothesis, whereas the GMM test did show a strong rejection. The empirical p-value observed supports the GRS statistic, which suggests the GMM test statistic may suffer from small sample bias, and should be disregarded. For the inequality test, it also showed that there is a high probability alphas are insignificantly different from zero, again supporting Hypothesis 4.

Consistent with the factor analysis on countries, a global factor analysis was also carried out on individual sectors, so that it in addition to the global risk factors of size and book to market, the industry sector risk is also controlled. These results are presented in Table 6.8.

Table 6.7: Joint Test of Alphas Under Global Fama French Factors (Sectors)

Assets	GRS	GMM	Empirical P-value	Inequality Wald Test
All Sectors (10)	0.7885	621.5074 ***	0.3710	1.2188e-004
	(0.6396)	(0.0000)		(1.0000)

***, **, and * indicates significance at the 1%, 5% and 10% level, respectively.

Table 6.8: Global Fama French Risk Analysis For Each Sector

Currency	GRS	GMM	Empirical P-value	Inequality Wald Test
Consumer Discretionary (Da,	1	1581.1 ***	0.9000	0.0069
auto, hotel, media, retail) (16)	(0.5000)	(0.0000)		(1.0000)
Consumer Staples (food, drugs,	1.1913	32.4520 ***	0.7630	4.3311e-004
household) (11)	(0.3183)	(0.0006)		(1.0000)
Energy (2)	0.5278	2.0070	0.6990	3.7607e-006
	(0.5928)	(0.3666)		(0.7802)
Financials (13)	0.6932	46.4114 ***	0.7520	8.3015e-004
	(0.7597)	(0.0000)		(1.0000)
Health Care (9)	0.2575	11.8390	0.7310	0.0021
	(0.9829)	(0.2225)		(0.9999)
Industrials (17)	0.4699	35.3412 ***	0.9390	0.0062
	(0.9531)	(0.0056)		(1.0000)
Information Technology (14)	0.6404	262.1524 ***	0.8360	0.0013
	(0.8167)	(0.0000)		(1.0000)
Materials (8)	0.9494	398.0765 ***	0.6870	0.0190
	(0.4853)	(0.0000)		(0.9996)
Telecommunication (3)	0.1911	0.1662	0.8940	4.6794e-004
	(0.9020)	(0.9829)		(0.8477)
Utilities (4)	0.4676	6.9504	0.9410	0.0054
	(0.7592)	(0.1385)		(0.9257)

***, **, and * indicates significance at the 1%, 5% and 10% level, respectively.

The results demonstrate that after the application of the Fama French 3-factor model, using both global and domestic risk factors, the out performance of ethical assets does not appear significant. This is consistent with the empirical findings reported earlier, in which the country and sector groupings tend to explain the performance in the ethical assets. The results of inequality tests of implied alphas also shows that abnormal returns are never

significantly negative, indicating that although ethical investments may not be significantly out performing, they do not indicate inferior investments.
The results obtained show that under the GRS test, all 10 sectors reject the hypothesis that alpha is significantly different from zero. Although the GMM test statistic is inconclusive with respect to the null hypothesis, the empirical p-values again indicate insignificance. Together, they indicate that the test statistic offered under the GMM Wald test may be inaccurate due to the small sampling biases. Overall, Hypothesis 3 is once again rejected, since abnormal performances are not significant in the presence of size and book to market risk factors, whilst Hypothesis 4 is strongly.
It has been shown that by bootstrapping, the small sample bias in the test statistics is accounted for and results in finding insignificant alphas. It would be even more accurate to obtain the finite sample distribution of these test statistics since the sample period is small. Therefore, to adjust for small samples, a bootstrapping procedure is also carried out for spanning under the GMM framework.

Table 6.9: Bootstrap Results for Spanning Analysis

Currency	Wa	Wa (Empirical)
DKK (4)	4.7681	(0.9700)
	(0.7821)	
BEF (4)	6.5893	(0.8400)
	(0.5815)	
FIM (2)	2.3585	(0.6700)
	(0.6701)	
DEM (15)	93.9955 ***	(0.9800)
	(0.0000)	
GBP (10)	159.5996 ***	(0.6200)
	(0.0000)	
ITL (2)	3.6971	(0.8200)
	(0.4485)	
CHF (3)	68.5541 ***	(0.0500)
	(0.0000)	
ESP (2)	0.0467	(0.9900)
	(0.9997)	
NOK (1)	5.9309 *	(0.6600)
	(0.0515)	
FRF (3)	3.9277	(0.8700)
	(0.6865)	
SEK (1)	6.4294 **	(0.8600)
	(0.0402)	
NLG (2)	26.2767 ***	(0.1000)
	(0.0000)	
JPY (11)	49.4628 ***	(0.9700)
	(0.0007)	
AUD (3)	2.0988	(0.9800)
	(0.9104)	
NZD (1)	12.0022 ***	(0.6100)
	(0.0025)	
USD (27)	14174.2814 ***	(0.6300)
	(0.0000)	
CAD (6)	30.1365 ***	(0.8500)
	(0.0027)	

***, **, and * indicates significance at the 1%, 5% and 10% level, respectively.

The finite sample version of GMM Wald Statistics under Spanning is carried out by generating a distribution under the null hypothesis that alpha is equal to zero by bootstrapping the estimates of the alphas and the betas for each test assets, and storing the calculated test statistics after each iteration in order to generate the empirical distribution.

The empirical p-values are then computed. To illustrate, Table 6.9 provides a comparison of the Wald adjusted statistic with asymptotic p values, and the Wald adjusted statistics with empirical p values generated by bootstrapping. The results from bootstrapping support the findings from the factor analysis. The p-values of GMM Wald Statistics are very high after the adjustment of small sample bias, which implies that the earlier results under asymptotic properties may be distorted. This strong evidence suggests that the ethical investments do not improve the mean-variance efficiency of an already diversified investment opportunity. The results from spanning and factor analyses both show the abnormal performances of ethical assets are not significant after risk factors are controlled.

7. Conclusions

The objective was to establish whether investment in sustainable securities would induce significant economic cost for investors. By using a spanning analysis as well as a Fama French factor analysis on both a global and domestic country basis, there are four key findings from the tests undertaken to resolve the research problem.

First, on the global basis, diversification benefits can be obtained if ethical securities are included in an already globally diversified investment portfolio. The study showed that the combination of all sustainable securities with the broad market indices, improves the mean-variance efficiency of the aggregate portfolio, implying that further diversification benefit can be obtained by investing sustainable securities. This lends support for the hypothesis that the inclusion of ethical securities significantly improves the investment opportunity set of an investor. Second, the improvement of mean-variance efficiency is not caused by the common 'ethical' factor. A possible explanation for this is that ethical characteristics could be dominated by other risk factors such as country and industry sector, and no real benefit could be realised if investors select purely on the ethical characteristics. This result rejects the hypothesis that the improvement of mean-variance frontier of benchmark assets is caused by the common 'ethical' factor among the selected ethical securities, and suggests that the earlier improvement of mean-variance efficiency may be subjected to country and sector biases rather than ethical characteristics.

Third, the abnormal performances of sustainable securities are not significant when other risk factors such as size and book to market ratio are taken into account. The results are similar both on a global basis and on a domestic country basis. These results show strong evidence to reject the hypothesis that sustainability cannot be accounted for by other known risk factors such as country, industry, size and book to market factors.

Fourth, investing in sustainable securities will not significantly cost the economic wealth of investors. The results present strong evidence under the inequality test, that alpha is not significantly negative. This implies that sustainable securities are not inferior investment assets, and will not suffer a significant financial cost. The results are consistent with the hypothesis that investors would not be significantly disadvantaged when investing in sustainable securities.

Overall, this study would suggest that:

- Sustainable securities do not have an expected return cost to investors
- When constructing portfolios, investors do need to consider risk factors other than just "ethical " issues

This research also has a number of practical applications for pension funds and other institutional investors. Pension funds in particular, have obligations to members to make investments that do not offer compensating expected return for risk. The findings from this research implies that investors can now feel assured that sustainable securities are not inferior investments, and should not significantly under perform the broader market, but securities should not be selected on sustainable characteristics alone.

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Appendix A

Ethibell selection criteria

Internal Social Policy

THEMES AND TOPICS Societal impact of the company's core activities, products and services	**APPRECIATION (What is appreciated?)** Impact on the quality of the society	**INDICATOR (What is assessed?)** Positive or negative impact of the company's activities on the quality of the society development Measures to reduce the negative/improve the positive impact
Strategy		
Principles	The degree to which a company's personnel policy is formalised and the scope and quality of the principles	Comprehensiveness and quality of the policy statement
Reporting	The degree to which a company releases information on its social policy	Frequency, quantity and quality of information
Employment		
Employment stability	The degree to which a company creates and maintains employment	Evolution of employment compared to the industry, measures to avoid dismissals
Job Content		
Training and education	The degree to which a company demonstrates efforts to broaden the skills of its workforce	Quantitative (% of employees involved, training hours per employee) and qualitative training efforts (functional, multifunctional, employability)
Job enrichment and career development	The efforts demonstrated by a company for the personal development of its employees	Presence of systems of internal promotion, evaluation talks, individual career plans
Communication and consultation	The degree to which a company supports open and two-way communication with its employees	Presence of (formal) communication channels and consultative bodies
Equal opportunities - Principles	The degree to which a company has formalised its equopps policy and to which it integrates the policy in its business principles.	Absence or presence of a formalised policy, its quality in terms of scope, depth (non- or anti-discrimination) and area of application.
Equal opportunities - Initiatives	The degree to which a company demonstrates efforts to promote equopps.	Presence of equopps initiatives and involvement of employees
Realisations	The degree to which a company realises a reduction of inequalities (in comparison to the community where it is active).	The average employment rate of disadvantaged groups and its evolution (as provided by trade unions, industry associations etc.).
Terms of Employment		

Sustainable security analysis

Remuneration policy	The degree to which a company's remuneration policy is considered as internally fair and equitable	The presence of systems of job classification and performance appraisal
Flexibility	The degree to which the organisation of flexibility takes into account the needs and expectations of the employees	Systems of flexible organisation, involvement of employees when organising flexibility
Quality of contracts	The degree to which a company offers qualitatively good employment	Quality of contracts (temporary contracts, systematic use of overtime and temporary unemployment, …)
Working Conditions		
Health & Safety - Policy	The degree to which a company emphasises the importance of its H&S policy	Presence of a formal policy concerning health and safety, and its quality
Physical Health and Safety – Initiatives or achievements	The degree to which a company demonstrates efforts to create good physical working conditions or realises a reduction of labour accidents	Presence of H&S initiatives, safety measures, and involvement of employees Or Frequency and evolution of labour accidents
Mental Health and Safety – Initiatives or achievements	The degree to which a company demonstrates efforts to cope pro-actively with work pressure Or to create a supportive working environment (climate)	Presence of initiatives concerning mental health and stress: stress management, reduction of work pressure, employee lifestyle counselling, psychological assistance, prevention of harassment… Or evaluation of work pressure by employees' representatives
Industrial relations		
Consultation and negotiation	The degree to which employee/trade union(s) representatives are recognised as a dialogue partner	Presence of formal consultation bodies and the evaluation of the social dialogue by trade unions
Conflicts	Presence of social conflicts	Number, content and nature of conflicts

Environmental Policy

THEMES AND TOPICS	**APPRECIATION (What is appreciated?)**	**INDICATOR (What is assessed?)**
Strategy		
Principles	The degree to which a company has formalised its environmental policy, the quality of the formal environmental principles, and degree to which the environmental policy is integrated in the entire company activities	Comprehensiveness, scope and quality of the (public) environmental policy
Public commitment	The degree to which the company Enters into the dialogue with environmental stakeholders And/or co-operates with environmental initiatives that surpass the company level (the nature of this cooperation)	Memberships of activist or campaign groups, lobbying, infringements, anticipation on future legislation, membership of co-operation platforms (qualitative and quantitative), quantity and quality of the stakeholders communication

	And/or behave towards legal requirements	
Publications in the field of environment	The extent to which the public is informed about the company's environmental responsibility	Quality of the publications
Management		
Environmental management system (EMS)	The existence, quality and external certification of an EMS	Comprehensiveness (environmental impacts that are dealt with), completeness (presence of the elements inventory, target and objectives, programs and feedback), field of application (part of the company where the system is implemented) or Number of ISO14001 or EMAS or equivalent certified plants
Involvement of employees	The degree to which the employees are involved in the development and the realisation of the environmental policy	Attention paid to environmental matters in training and communication Passive/active involvement
Environmental responsibilities and instruments.	The degree to which the environmental responsibility is integrated in the hierarchical structure of the company	Hierarchical level of the highest placed person(s) with environmental responsibilities and supportive staff
Production		
Measures to reduce the environmental impact: input	Degree to which a company does or has done efforts to reduce the use of energy and raw materials	Measures are evaluated against the background of the state of the technology (BAT), the situation in the industry and the achieved results
Measures to reduce the environmental impact: output	Degree to which a company does or has done efforts to reduce the emissions into air, water and soil	Measures are evaluated against the background of the state of the technology (BAT), the situation in the industry and the achieved results A separate evaluation is made for every environmental compartment. The global rating for the topic is the rounded off average of the separate scores.
Measures to reduce the environmental impact: waste	Degree to which a company does or has done efforts to reduce the quantity and the harmfulness produced waste and to guarantee the use of environmentally friendly waste treatment methods	Measures are evaluated against the background of the state of the technology (BAT), the situation in the industry and the achieved results
Environmental conditions imposed on suppliers and subcontractors	Degree to which a company does efforts to reduce the environmental impact of the supply chain	Conditions imposed to suppliers and subcontractors
Products		
Environmental impact	Degree and nature of the environmental impact of products	Environmental impact during the entire lifecycle
Measures to reduce the environmental impact of products	Degree to which a company does efforts to reduce the adverse environmental impact of its products or to reduce or avoid	Environmentally inspired adaptation of product design (eco-design), research aimed at the development of environmentally friendlier products,

	adverse environmental effects connected to the use and end of life of the products	elements of product stewardship management, advice to customers on how to use products in a more environmental-friendly way

External Social Policy

THEMES AND TOPICS	**APPRECIATION (What is appreciated?)**	**INDICATOR (What is assessed?)**
Communication with stakeholders	The degree to which the company is transparent for stakeholders about its societal impacts and is freely engaged in stakeholder dialogue	
Human rights		
Strategy	Degree to which a company has a formal policy on human rights and the scope and quality of the principles	Global issue: Quality of the policy framework addressing human rights Human Resources issue: Completeness of the Human Rights and/or Human Resources policy
Management and/or Realisations	Degree to which a company distinguishes itself (in a positive or negative sense) in the field of respect for human rights	Non-compliance, condemnations, realisations, initiatives Responsibilities for and support systems for human rights (reporting, monitoring, training, external verification ...)
Sourcing principles and practices	Degree to which a company does efforts to avoid violations of international conventions on human and labour rights by its suppliers and subcontractors	Sensitive sourcing from developing countries (eg. toys, footwear, textile), Formal conditions imposed on suppliers addressing human rights, Presence of monitoring and verification systems
Social investments	Degree to which a company supports external societal initiatives with money, people or logistic support, Societal impact of supported projects (Social investment in developing countries is included)	Nature of the supported initiatives Value of the support
Socio-economic relations with developing countries	Degree to which company activities contribute to the realisation of sustainable trade relations and to the local socio-economic development	Negative reports (eg. pricing policy, bio-piracy), Positive impacts (eg. fair trade involvement, joint ventures, local market development, local workforce, transfer of knowledge)

Economic Policy

THEMES AND TOPICS	**APPRECIATION (What is appreciated?)**	**INDICATOR (What is assessed?)**
Economic Potential		

Value creating Potential	The degree to which a company guarantees its growth and existence by creating value	EBITDA/EBIT/Operational profit as % of turnover and share of net profit retained by the company (average over last 3 years)
Economic Risks		
Internal control procedures	The degree to which a company disposes of internal procedures to cope with internal and external risks to safeguard its assets	Presence of a policy, organisation and action plans
Clients		
Quality control	The degree to which a company is able to offer quality products	The presence of quality certificates (ISO 9000, EFQM, TQM), awards and quality management systems
Customers: communication	The degree to which a company pays attention to customer relations	Presence of instruments to establish a dialogue with customers: complaint management, satisfaction, surveys, ... Quality of product information provided to customers
Corporate Governance		
Board of Directors	The degree to which the Board of Directors safeguards the interests of all shareholders	Composition and organisation of the Board of Directors
Reporting	The degree to which all shareholders dispose in time of all relevant information	Quality of financial information and reporting concerning Corporate Governance
Suppliers		
Relations with suppliers	The degree to which a company respects the rights of its suppliers	Absence of abuse and the engagement in co-operative relationships
Business ethics		
Code of ethics	The degree to which a company's business ethics (code, mission statement, key values) are formalised and the scope and quality of the principles	Comprehensiveness and quality of the code of conduct
Management system or achievements	The system the company has established for implementing the code, the way the company complies with economic legislation	Seriousness/absence of infringements, initiatives aimed at applying the system, checking and remedying non-compliance