Green Investing: Impact of Pro Environmental Preferences on Stock Market Valuations During Turbulent Periods

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Abstract:

The study addresses the growing popularity and need of green investing. Green investing have been shown to churn lesser yields and underperform general market portfolios. Rapid growth of green bonds, green funds and green theme indices worldwide indicate towards the growing segment within investment community. The ethical screens lead to crunching of investable universe as a result such funds are expected to lose on diversification benefits. The study attempts to investigate the performance of green and non-green portfolios during the crisis and validate the differential impact of crisis on their demand. It further examines the impact of market cycles on the returns of portfolios. The period is classified into pre-crisis, crisis and post-crisis period. Asset pricing models believed to explain the returns on well diversified market portfolio have been applied on constructed green and non-green portfolios to measure the abnormal return. Green portfolios are noticed to be picking pace and outperforming market after the crisis surpassed. Indian investors are not penalizing companies for their green initiatives and such initiatives are believed to drive demand for the stock.

Keywords: Portfolio Performance Evaluation, Green Investment, Socially Responsible Investing (SRI)

JEL Classification: G11, G15, G23

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1. INTRODUCTION

The risk emanating out of climate change is burgeoning. Green innovation is probably the best way to mitigate climate risks and to reduce the cost in future for the firms. It comprises of technological improvements that help reduce company's carbon footprint, reduce their GHG emission levels, impart positive impact in the environment and strengthen environmental management. This innovation arguably leads to reduction in cost of raising funds as it make the business and its profitability sustainable. Various sectors and business leadership contribute in accomplishing sustainable goals looking from reference to the Australasian region as highlighted by De Silva et al (2020).

Green initiatives have positive effect on social, financial and environmental outcomes of the firm. They improve company's ecological reputation, social acceptance and market share as environmentally sensitive consumers increase demand for its offerings. Such claims are often met with contention and scepticism as they challenge the assumption and theories claiming that environmental initiatives and social good don't stand tall with economic prosperity (Bansal, 2005). Green financing and optimal allocation of funds is the only way to deal with it.

The consciousness around climate change and issues like destruction of natural resources, rising temperatures, pollution, disturbed eco system has risen profusely among investors, companies and government. Such climate changes are conspicuously impacting the living conditions negatively. Green innovations improve company's ecological reputation, social acceptance and market share as environmentally sensitive consumers increase demand for company's offerings. Fundamentally contrasting theoretical arguments and empirical evidences have surfaced up as one looks up on the literature. Recent studies vouch on the aspect of market not penalizing on investing considering socially responsible factors. Seminal works on green phenomenon in markets by White (1996) suggests towards the existence of causal relationship between corporate environmental performance and green funds' performance.

This paper extend the research work on the investor valuation of green companies by systematically reviewing the literature on the green fund performance and testing the performance of synthetically constructing portfolios. Section 2 outlines a theoretical framework developed establishing the hypothesized linkages; Section 3 reviews the literature relevant for developing testing methodology; Section 4 lays down the hypotheses and methodology; Section 5 summarises the findings; Section 6 concludes with a discussion of social importance of study and future scope of the same.

2. THEORETICAL FRAMEWORK

Socially responsible investing consists of making investment decisions on the basis of performance measured on non-pecuniary factors like carbon emissions, waste management, work place safety norms, social diversity, consumer protection, human rights, employee autonomy, governance and accountability, governance management structure, employee relations, and executive pay in addition to the financial performance. The concept and its impact on perceived financial performance is widely contested among academicians for four decades with few research works studying the differential impact of various CSR dimensions. "Environmental CSR" is a

disaggregated aspect of CSR and is becoming a central part of it with increasing threat and opportunity in the domain.

Environmentally conscious investors align their morals and beliefs with investment choices by applying various screening approaches. A few investors might resort to pure play i.e. invest in companies that produce renewable products or fuel-efficient technology while others who are averse to loosing on diversification benefits invest in companies having waste management practices in place, recycling and efficient usage of resources reducing wastages. For some it involves investing in companies that are industry leaders in employing environment efficient practices within industries usually considered as polluting.

Environmental management affects environmental performance, which on becoming public knowledge is further evaluated because environment performance affects the financial performance as it impacts the market share and costs. The model is synthesized as shown in figure 1. It suggests that curating mechanism that minimize harmful environmental impact from operations lead to market gains and cost savings. Green certified products and general public awareness around company initiatives impact market share and contribution margin positively. Green innovation improves productivity further helps in establishing distinct advantage for the company among industry peers by positioning itself as low cost manufacturer. Environmental management also helps company avoids impact of externalities like environmental liability. Cost benefits are also being driven as firm is able to tackle physical risk, legal risk and transitional risks well by pre-empting the actions to mitigate climate change. The threats posed by climate change and associated risks are emphasized in Tripathi and Jham (2020). Public awareness on eco-harmful actions of the companies lead to green investors boycotting, in an investment sense, unreformed firms with polluting technologies. This raises the cost of capital for such firms as risk sharing opportunities decreases and investors expect higher return for assuming higher risk.
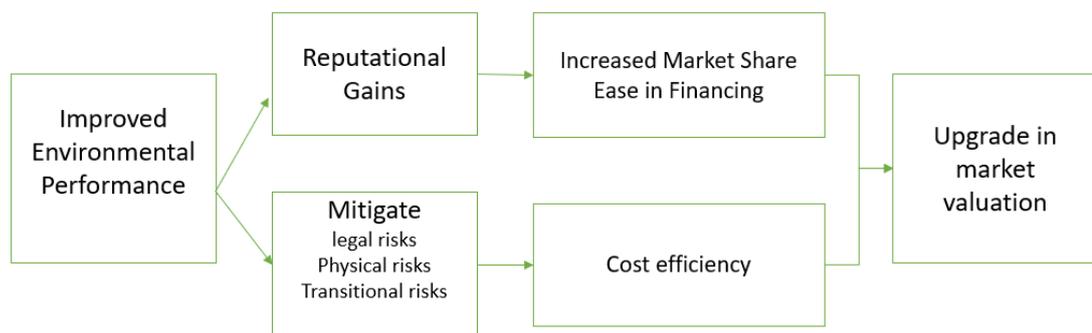
Figure 1: Conceptual Model on Corporate Environmental Performance and Market Valuation

3. LITERATURE REVIEW

Green Investing and socially responsible investing is becoming a global phenomenon and the investment approaches have interested many financial researchers to take cognizance of the same and investigate further. The performance of socially responsible stocks and such funds with respect to conventional funds is in itself a matter of long-standing controversy. Literature provides mixed results as a fair share of studies provide empirical evidences of such funds outperforming general market funds and others providing evidences towards underperformance of such funds while majority of studies concluding neutral performance i.e. return differential being insignificant. The correlation between exhibiting good environmental behaviour and market performance is observed to be varying from positive to negative at different magnitudes.

Market Reactions towards Company Specific Environmental News

Theoretical model built across adding an arm of environmental management in operations transcends into higher perceived firm valuation (Klassen and Mc Laughlin 1996). The market reaction to adverse environmental events has been observed to be negative while cumulative abnormal return has been observed to be significantly positive (Lott, Karpoff & Rankine, 1999). Flammer (2013) conducted event study methodology to assess market reaction post issuance of green bonds and CAR computed was 0.67% suggesting the significantly optimistic value creation. Several research studies indicated that large firms provide more environmental disclosures and investors values them more in comparison to smaller ones in environmentally sensitive industries (Siddique et al., 2020; Brammer & Pavelin, 2008)

Superior Returns Attributing to Ethical Screening

Actively managed funds i.e. picking stocks on basis of green branding of companies and short selling the stocks of companies scoring low on green parameters lead to abnormally high returns. (Kempf and Osthoff, 2007; Hamilton et al., 1993; Derwall et al., 2005). Kempf and Osthoff (2007) devised long-short strategy using best in class approach and the portfolio constructed significantly outperformed the market consistently. Construction of such funds and active management lead to high transaction costs. The meta-analysis conducted by Orlitzky et al (2003) validated the structural basis underlying the relationship between corporate social and financial performance indicating the reputation building as significant moderating variable. Hill et al. (2007) observed ethical fund market outperformed in Europe and USA in long term while providing mixed returns in the medium and short term. High systematic and unsystematic risk noticed in socially responsible portfolios along with them providing relatively high compensation towards non diversification as per Tripathi and Bhandari (2014). Varma and Nofsinger (2014) observed the performance in period of turmoil and find empirical evidences towards less riskiness of firms with SRI factors.

Neutral Returns Attributing to Ethical Screening

Various studies have reported insignificant differences between ethically screened funds, firms and indices with respect to conventional funds and indices. Market does not penalize for screening based upon ESG parameters as no performance difference could be detected by Goldreyer and Diltz(1995), Bello (2005). The transition towards

indifferent performance of such funds has happened only gradually as observed in Bauer et al. (2005).

Inferior Returns Attributing to Ethical Screening

Imposing ESG parameters and other non-financial peculiar parameters for screening purpose put constraints on investible universe and can lead to negative performance of funds (Grossman and Sharpe 1986, Hamilton et al. 1993). SRI funds classified on basis of various sustainability themes underperform the benchmark while the one based upon governance parameter outperformed the same (Galema et al., 2012). White (1995) noticed that green mutual funds market in US underperformed conventional market index benchmark and Domini index values. Worokinasih et al. (2020) tests the hypotheses that corporate governance practises and disclosures pertaining to CSR influences firm value of listed mining companies in Indonesia. It is concluded that disclosures have no positive influence on firm's value measured by Tobin's Q and PB value.

Performance Difference between Socially Responsible Investing and Green Investing

The firms with focus on environmental parameters can have stark underlying differences in their characteristics when compared to the ones focusing on all sustainability parameters. Those differences are reflective pervasively in all their operations, technologies installed and internal checks. Companies going green are capital intensive with no robust business model while the ones attaining holistic sustainability are more profitable (Lesser et al, 2014). Market valuation of greening relies on the industry climate and specific government policies in the particular sector. Green funds are more market sensitive and heavily exposed to small cap stocks, when compared with SRI and general market funds (Climent and Soriano, 2011). After controlling for market risk, size effect, value effect and momentum the difference in return is statistically insignificant between green and socially responsible funds.

Market Valuations of Green Bond Market

There is considerable amount of research happening around issuance of green bonds lately for it is a recent phenomenon. Flammer (2013) examined the effectiveness of issuing green bonds in yielding improvements in long term financial and environmental performance of the firm. The study disregarded the theory of green washing and confirms long term value creation in all aspects on rightfully deploying the proceeds as the baseline results are more pronounced for companies issuing green labelled bonds and belong to industries where environment is pertinent to company's profitability. Zerbib (2019) finds a significant negative premium at 2 basis points for green bonds. The premium is significantly affected by ratings and sector as negative premium is even more pronounced for financial bonds and low-rated bonds.

4. RESEARCH GAP AND OBJECTIVES OF THE STUDY

It is observed that only few research works have studied the differential impact of various CSR dimensions. One might expect differences in financial performance and market valuation across firms practicing different aspects of social responsibility as practicing some aspects might lead to better productivity and lower cost while other might not have a direct impact on the cost but such acts help in building the reputation and optimism among the stakeholders. The research question arises that if inclusion of such non-pecuniary motives while investing and construction of portfolios have a considerable positive impact on market valuations and if such initiatives by companies act as an intangible asset building onto their reputation. The underlying drive behind sustainability theme-based investing lies in expectations of superior risk adjusted returns from socially responsible, eco-friendly and ethical firms. The study seeks to investigate green and non-green portfolios performance during the pre and post crisis and validate the differential impact of crisis. Following are the objectives:

1. To investigate the impact of crises on green portfolios vis-à-vis general stock portfolios.
2. To analyze if financial crises impacted green portfolios differently than non-green portfolios.
3. To examine the impact of market cycles on the performance of green and non-green portfolios.

4. HYPOTHESES OF THE STUDY

The following hypotheses have been formulated:

H01 Performance of green and non-green portfolios is similar on basis of various risk-adjusted measures during crisis period.

H02 Abnormal return, if any, is not significant for stocks of green portfolios during crisis period.

H03 Abnormal return, if any, is not significant for stocks of green portfolios in post crisis period.

H04 Abnormal returns in green portfolios do not significantly exceed returns of their non-green portfolios during crisis period.

H05 Abnormal returns in green portfolios do not significantly exceed returns of their non-green portfolios during post crisis period.

H06 The global financial crisis has no impact on green portfolio, green blue chip portfolio, socially responsible green stocks portfolio and general stock portfolio.

H07 Abnormal returns in green portfolios do not significantly exceed returns of their non-green portfolios in bull market phase.

H08 Abnormal returns in green portfolios do not significantly exceed returns of their non-green portfolios in bear market phase.

## 5. RESEARCH DESIGN AND METHODOLOGY

The study seeks to differentiate the performance of green and non-green portfolios during crisis and non-crisis period. It further assesses the difference in performance of such stocks in various market cycles. Thereby it constructs and evaluates performances of following portfolios: green blue chip, green non blue chip, non-green blue chip stocks, green socially responsible, green non socially responsible, non-green socially responsible stocks, green socially responsible blue chip stocks, non-green socially responsible blue chip stocks during pre-crisis, crisis and post-crisis period from April 2006 to March 2018. S&P BSE 500 is used as the proxy for market portfolio. The construction of portfolios and study period is consistent with Tripathi and Jham (2020). The portfolios have been arrived at by taking intersecting constituents of S&P BSE Greenex, Sensex and ESG indices. Green blue chip portfolio comprises of all intersecting constituents of BSE Greenex and Sensex whereas all the intersecting constituents of BSE Greenex and ESG form part of green-socially responsible portfolio. Likewise Green-non socially responsible portfolio comprises of all constituents of Greenex excluding the intersecting constituents of BSE Greenex and ESG indices. All the portfolios are constructed on the similar lines. Prowess database is used to fetch monthly closing share prices of companies.

Identifying Structural Breaks

To investigate the impact of crises on portfolios and analyse if financial crises impacted their performance, it is imperative to identify the period before, during and after crisis. To identify those periods, trend in market price movement needs to be analysed.

To identify structural breaks, monthly closing price data of S&P BSE 500 index is plotted against the time trend as depicted in figure 1.

Figure 1: Trend of S&P BSE 500 index values
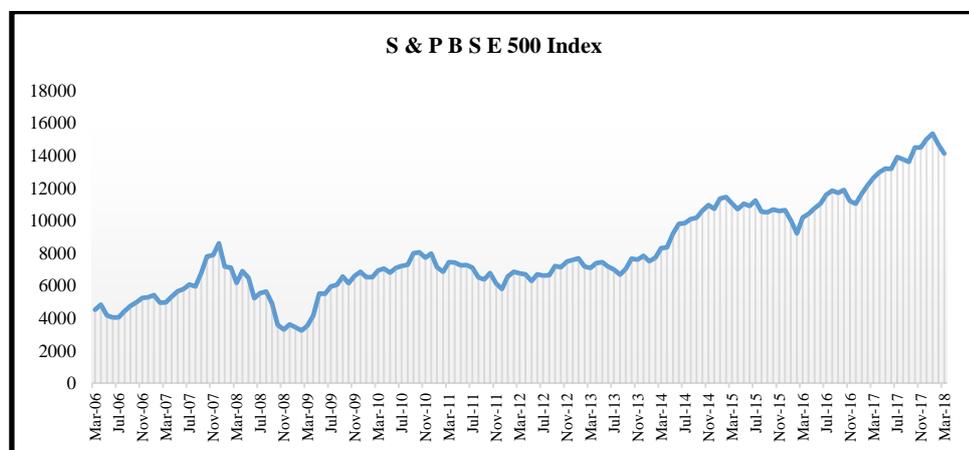
Three breaks identified to be occurring in S&P BSE 500 index values and further smoothened to suit the requirements of the study are as follows:

April 2006 - March 2008 – Pre-crises period

April 2008 - March 2009 – Crises period

April 2009- March 2018 – Post-crises period

Methodology

Descriptive analysis is conducted for each of the portfolios separately across three periods to identify the change in performance throughout the period. Risk adjusted returns are computed applying well known risk return ratios. Paired t-test is applied to test significant differences during pre-crises, crises and post-crises period. Capital asset pricing model (CAPM) based time series regression run across 3 periods to evaluate abnormal returns and investigate the change in trend of green investing. Deviation in abnormal returns is examined for relevant portfolio pairs using CAPM. The study further deploys the Carhart (1997) four-factor model to investigate the presence of alphas after considering market, size, and book-to market equity and 1-year momentum factor. Following model is applied on monthly return data:

$$R_{i,t} - R_{f,t} = \alpha_i + \beta_{1i} (R_{m,t} - R_{f,t}) + \beta_{2i} SMB_t + \beta_{3i}HML_t + \beta_{4i}WML_t + \epsilon_{it} \ (1)$$

Where R_{it} is return on portfolio in month t, R_{ft} is the risk free rate for month t , R_{mt} is market return, SMB_t assesses size spread in market. HML_t indicates market wide value difference, WML_t depicts the market return difference in winning stocks and losing stocks during the period t, β_{1i} measures market sensitivity of portfolio, and β_{2i} , β_{3i} and β_{4i} measure the sensitivity towards aforementioned factors. α_i is abnormal return of the portfolio i after providing for four factor and ϵ_{it} indicates the idiosyncrasies.

The market cycle is identified on the basis of average monthly return on market portfolio. The months pertaining to which returns on market portfolio exceeding average monthly market return are classified in bull phase while the ones pertaining to which market return was less than its average are classified in bear phase. Out of 144 months, 70 months fell under bull period while remaining under bear period.

FINDINGS

Average Monthly Return

Descriptive analysis depicted in table 1 shows that during pre-crisis period, non-green socially responsible blue chip portfolio provided the highest monthly average return of 2.12%. All the portfolios provided negative returns during crises period. Non-green blue chip stocks provided least negative monthly returns while green non-socially responsible portfolio providing highest monthly average return of 2.5% post crises period.

Among the 3 i.e. green blue chip stock portfolio, green non-blue chip and non-green blue chip portfolios, it is noticed that non green counterpart had higher returns during pre-crisis and crisis period while green non-blue chip & green blue chip stock portfolio emerging as a better performer post crises period as both the green portfolios provided higher average returns to non-green blue chip. Green socially responsible portfolio had least returns across all the periods when compared to its counterparts.

Table 1 Descriptive Analysis across structural breaks

	Pre Crises period	Crises	Post Crises period
Average	Apr 2006 - Mar 2008	Apr 2008 - Mar 2009	Apr 2009- Mar 2018
Green-blue chip	1.706	-2.803	1.928
Green-non blue chip	0.737	-1.988	2.223
Non Green-blue chip	1.919	-0.959	1.826
Green-socially responsible	1.197	-2.374	1.856
Green non-socially responsible	1.307	-2.492	2.525
Non-green socially responsible	1.550	-2.367	2.259
Green-socially responsible blue chip	1.393	-2.713	1.969
Non Green-socially responsible blue chip	2.120	-2.574	2.140
Market portfolio	1.632	-3.817	1.451
Standard Deviation			
Green-blue chip	6.767	11.149	6.171
Green-non blue chip	7.837	12.295	6.140
Non Green-blue chip	7.040	11.133	5.549
Green-socially responsible	7.132	11.423	6.398
Green non-socially responsible	7.540	12.049	5.553
Non-green socially responsible	7.286	12.089	5.992
Green-socially responsible blue chip	6.788	11.385	6.406
Non Green-socially responsible blue chip	7.280	12.755	6.433
Market portfolio	8.211	12.064	5.807
Coefficient of variation			
Green-blue chip	3.965	-3.978	3.200
Green-non blue chip	10.636	-6.184	2.762
Non Green-blue chip	3.669	-11.615	3.039
Green-socially responsible	5.956	-4.812	3.447
Green non-socially responsible	5.770	-4.835	2.199
Non-green socially responsible	4.701	-5.107	2.652
Green-socially responsible blue chip	4.872	-4.196	3.254
Non Green-socially responsible blue chip	3.433	-4.956	3.006
Market portfolio	5.033	-3.161	4.003
Sharpe Ratio			
Green-blue chip	0.168	-0.304	0.219
Green-non blue chip	0.021	-0.209	0.268
Non Green-blue chip	0.191	-0.139	0.225

Green-socially responsible	0.088	-0.259	0.200
Green non-socially responsible	0.097	-0.255	0.350
Non-green socially responsible	0.134	-0.244	0.280
Green-socially responsible blue chip	0.121	-0.290	0.217
Non Green-socially responsible blue chip	0.213	-0.248	0.243
Market portfolio	0.129	-0.365	0.150
Jensen alpha			
Green-blue chip	0.281	0.594	0.459
Green-non blue chip	-0.816	1.787	0.797
Non Green-blue chip	0.488	2.307	0.452
Green-socially responsible	-0.278	1.143	0.355
Green non-socially responsible	-0.214	1.219	1.187
Non-green socially responsible	0.055	1.384	0.813
Green-socially responsible blue chip	-0.036	0.777	0.474
Non Green-socially responsible blue chip	0.632	1.391	0.643
Market portfolio	0.002	0.000	0.000
Treynor Ratio			
Green-blue chip	1.405	-3.746	1.320
Green-non blue chip	0.177	-2.598	1.692
Non Green-blue chip	1.656	-1.766	1.367
Green-socially responsible	0.731	-3.177	1.207
Green non-socially responsible	0.818	-3.154	2.234
Non-green socially responsible	1.120	-2.998	1.688
Green-socially responsible blue chip	1.011	-3.563	1.323
Non Green-socially responsible blue chip	1.786	-3.057	1.482
Market portfolio	1.059	-4.403	0.872
Information Ratio			
Green-blue chip	0.203	0.261	0.350
Green-non blue chip	-0.443	0.619	0.738
Non Green-blue chip	0.217	0.650	1.389
Green-socially responsible	-0.220	0.563	0.635
Green non-socially responsible	-0.133	0.475	0.531
Non-green socially responsible	0.041	0.624	0.873
Green-socially responsible blue chip	-0.028	0.353	0.397
Non Green-socially responsible blue chip	0.412	0.518	0.698

Sharpe Ratio, Treynor Ratio and Jensen Alpha

All portfolios outperform market during post crisis period in terms of Sharpe ratio. Portfolio non-green blue chip provided highest risk adjusted return during crisis period. Non-green blue chip had significantly high magnitude of Sharpe ratio during pre-crisis and crisis period while emerges as a loser in post crisis period as green non blue chip stocks. Green socially responsible portfolio had least Sharpe ratio across all the periods among its counterparts.

Treynor ratio is high for non-green portfolios in pre-crisis and crisis period while the return is highest for green portfolios in post-crisis period. Green non-socially responsible portfolio have highest value followed by green non-blue chip and non-green socially responsible portfolio in post crisis period.

In pre-crisis and crisis period non green portfolios provided high alphas. Non-green blue chip and non-green socially responsible portfolio outperformed their green counterparts in both the periods but the reversal took place post crisis period. In post crisis period green portfolios provided relatively high abnormal return. Green non-socially responsible portfolio carry the highest monthly abnormal return followed by green non-blue chip portfolio. All green portfolios have low compensation towards unsystematic risk partially due to high magnitude of unsystematic risk in the denominator as can be seen from information ratio benchmark.

Monthly Return Difference across Portfolios

Table 2 reports the results of paired t-test applied on the monthly returns of various portfolios during pre-crisis, crisis and post-crisis period. In pre-crises period green non-blue chip –non green socially responsible blue chip provide significantly different returns. The latter outperforms the former by providing monthly average excess return of 1.384% at 10% significance level. During crises period beginning from April 2006 to March 2009. Green non-blue chip and non-green blue chip portfolios with different investment approach all together, both outperformed market portfolio by 1.829% and 2.858% at 10% and 5% significance respectively. Green socially responsible portfolio and non-green socially responsible portfolio also outperformed market portfolio by 1.443% and 1.45% respectively. Post-crises period observes significant differential returns across various portfolio pairs. Green blue chip stocks, green non-blue chip and non-green blue chip outperformed market portfolio by 0.478%, 0.773% and 0.375%.

Portfolio Performance applying CAPM

Portfolio performance applying CAPM is depicted in table 3 reporting alpha and beta coefficient with t statistic in parenthesis. All the green and non-green portfolios have significant market exposure. During the crisis, green non-blue chip portfolio, non-green blue chip and non-green socially responsible portfolio provided monthly abnormal return of 1.7%, 2.31%, and 1.38% respectively. Green non-socially responsible portfolio is providing the highest alpha of 1.18% while green socially responsible portfolio providing the least with 0.356% during post crisis period. The trend in monthly average abnormal return of green and socially responsible portfolios signifies the increased demand in post-crisis period.

Table 2 Comparative Performance Results of T-Test across structural breaks

Paired portfolios	Pre Crises Period		Crises Period		Post Crises Period	
	Differential mean	T Value	Differential mean	T Value	Differential mean	T Value
Green blue chip-Market portfolio	0.075	0.148	1.014	1.375	0.478	2.91***
Green non blue chip – Non green socially responsible blue chip	-1.384	-1.948*	0.585	0.483	0.083	0.259
Green non blue chip-Market portfolio	-0.895	-1.495	1.829	2.191*	0.773	3.31***
Non green blue chip – Green non socially responsible	0.612	0.895	1.534	1.042	-0.699	-2.4**
Non green blue chip – non green socially responsible	0.369	0.632	1.409	1.149	-0.433	-2.3**
Non green blue chip-Market portfolio	0.287	0.606	2.858	2.56**	0.375	2.24**
Non green socially responsible - green non socially responsible	-0.109	-0.162	0.118	0.133	-0.669	-2.25**
Green socially responsible – Non green socially responsible	-0.352	-0.65	-0.007	-0.007	-0.403	-2.07**
Green socially responsible - Market portfolio	-0.434	-0.8	1.443	2.282**	0.405	2.3**
Green non socially responsible - Market portfolio	-0.325	-0.599	1.325	1.778	1.074	4.62***
Non green socially responsible - Market portfolio	-0.082	-0.197	1.45	2.257**	0.808	5.3***
green socially responsible blue chip portfolio - Market portfolio	-0.238	-0.37	1.103	1.609	0.518	2.71***
non-green socially responsible blue chip portfolio - market portfolio	0.489	1.176	1.243	1.586	0.69	3.5***

*significant at 10%, ** significant at 5%, *** significant at 10

Table 3 Single factor regression run on portfolios constructed across structural breaks

S.no	Portfolio	Pre crisis		During crisis		Post crisis	
		Alpha	beta	Alpha	Beta	Alpha	Beta
1	Green blue chip	0.292 (0.769)	0.795 16.9***	0.594 (0.805)	0.905 (15.1)***	0.459 (2.765)	1.021 (36.1)***
2	Green non blue chip	-0.779 (-1.326)	0.891 (12.2)***	1.786 (1.9)*	0.990 (13.12)***	0.797 (3.366)	0.972 (24.07)***
3	Non green blue chip	0.470 (1.214)	0.827 (17.34)***	2.307 (2.1)*	0.875 (9.44)***	0.451 (2.7)***	0.913 (32.9)***
4	Green social responsible	-0.248 (-0.527)	0.824 (14.20)***	1.140 (1.738)	0.931 (17.5)***	0.356 (2.1)***	1.057 (35.2)***
5	Green non-social responsible	-0.187 (-0.364)	0.869 (13.76)***	1.220 (1.469)	0.976 (14.5)***	1.186 (5.2)***	0.871 (22.7)***
6	Non -green social responsible	0.063 (0.177)	0.863 (19.56)***	1.388 (1.93)*	0.986 (17.0)***	0.812 (5.2)***	0.996 (37.7)***
7	Green social responsible blue chip	0.007 (0.013)	0.768 (11.78)***	0.778 (1.09)	0.926 (16.1)***	0.475 (2.47)**	1.050 (32.1)***
8	Non green social responsible blue chip	0.635 (1.783)*	0.862 (19.63)***	1.391 (1.599)	1.033 (14.7)***	0.641 (3.2)***	1.055 (31.8)***

*significant at 10%, ** significant at 5%, *** significant at 1%

Abnormal Return Differential across Portfolios Pairs

Table 4 shows that none of the green and non-green portfolios performed better than other in the pre-crisis and crisis period. During post crises period, green blue chip stock portfolio behaves more volatile in comparison to non-green blue chip. Green non-socially responsible portfolio outperforms green socially responsible portfolio and green blue chip stock in post crisis period at 1% significance level. Consistent underperformance of green socially responsible portfolio and green blue chip stock portfolio noticed.

Table 4 Single factor regression run on differenced portfolios during post crisis period

Portfolio	Alpha	Beta
Green blue chip - green non blue chip (1 - 2)	-0.338 (-1.154)	0.049 (0.987)
Green blue chip –non green blue chip (1 - 3)	0.008 (0.037)	0.108 (2.84)***
Green socially responsible – green non socially responsible (4 - 5)	-0.830 (-2.9)***	0.185 (3.851)***
Green socially responsible –non green socially responsible (4 - 6)	-0.456 (-2.34)**	0.061 (1.839)*
Green socially responsible blue chip- non green socially responsible blue chip (7 - 8)	-0.167 (-0.6)	-0.006 (-0.12)
Green non socially responsible-green blue chip (5 – 1)	0.727 (2.8)***	-0.150 (-3.5)***
Green non socially responsible- non green socially responsible (5 - 6)	0.374 (1.394)	-0.124 (-2.71)***
green non blue chip - non green blue chip (2 - 3)	0.346 (1.134)	0.059 (1.134)

*significant at 10%, ** significant at 5%, *** significant at 1%

Investigating Performance of Portfolios in Bull and Bear Periods

Mean monthly abnormal return across portfolios in bull and bear period is evaluated using single factor regression model and is depicted in Table 5. It is observed that green non-blue chip, green non-socially responsible portfolio and non-green socially responsible portfolio are providing significant abnormal return while all the portfolios have significant beta in bull period. Table 6 depicts the result of single factor regression model applied on portfolios in bear period. Portfolio green non-socially responsible is providing abnormal return of approximately 1.5% at 1% significance and non-green socially responsible portfolio is providing abnormal return at 10% significance while all the portfolios have significant beta in bear period as well.

Table 5 Market factor regression applied for portfolios in bull period

Portfolios	Alpha	Beta	Adjusted R²
Green blue chip	0.770 (1.574)	0.844 (13.323)***	0.719
Green non blue chip	1.711 (3.205)***	0.777 (11.246)***	0.645
Non green blue chip	0.500 (1.501)	0.872 (20.24)***	0.856
Green social responsible	0.916 (1.890)*	0.869 (13.853)***	0.735
Green non- social responsible	1.853 (3.784)***	0.688 (10.854)***	0.629
Non -green social responsible	1.076 (3.042)***	0.885 (19.329)***	0.844
Green social responsible blue chip	0.832 (1.506)	0.844 (11.807)***	0.667
Non green social responsible blue chip	0.264 (0.658)	1.035 (19.962)***	0.852

*significant at 10%, ** significant at 5%, *** significant at 1%

Table 6 Market factor regression run for portfolios in bear period

Portfolios	Alpha	Beta	Adjusted R²
Green blue chip	0.490 (1.647)	0.919 (20.870)***	0.856
Green non blue chip	0.251 (0.736)	0.929 (18.392)***	0.822
Non green blue chip	0.106 (0.289)	0.757 (13.983)***	0.727
Green social responsible	-0.127 (-0.463)	0.888 (21.798)***	0.867
Green non- social responsible	1.463 (3.991)***	1.003 (18.475)***	0.823
Non -green social responsible	0.470 (1.862)*	0.917 (24.545)***	0.892
Green social responsible blue chip	0.502 (1.576)	0.943 (19.990)***	0.845
Non green social responsible blue chip	0.190 (0.497)	0.868 (15.362)***	0.763

*significant at 10%, ** significant at 5%, *** significant at 1%

Abnormal return difference across portfolios in bull and bear period

Table 7 Regression run on differenced portfolio pairs in bull and bear period

	Portfolios	Alpha	Beta	Adjusted R^2
Bull Period	**2 – 3**	1.211 (1.968)*	-0.095 (-1.194)	0.006
	4 – 5	-0.936 (-1.697)*	0.182 (2.543)**	0.073
	5 – 6	0.777 (1.52)	-0.197 (-2.978)***	0.102
	7 – 8	0.569 (1.222)	-0.191 (-3.163)***	0.115
Bear Period	**1 - 3**	0.384 (1.098)	0.163 (3.143)***	0.108
	2 - 3	0.145 (0.274)	0.172 (2.199)**	0.050
	4 – 5	-1.590 (-3.657)***	-0.115 (-1.791)*	0.029
	4 – 6	-0.597 (-1.849)*	-0.030 (-0.617)	-0.009
	5 - 6	0.993 (2.670)***	0.086 (1.558)	0.019
	4 -7	-0.630 (-3.095)***	-0.056 (-1.855)*	0.032

*significant at 10%, ** significant at 5%, *** significant at 1%

Market factor regression is run on differenced portfolios for bull and bear periods separately and results are depicted in Table 7. It is observed that green non-blue chip portfolio outperformed the non-green counterpart by 1.211% monthly abnormal return. Green non-socially responsible stocks outperformed stocks of sustainable companies in a bull period. Green socially responsible portfolio and non-green socially responsible portfolio are observed to be more volatile and possess high market. bull period. Green socially responsible portfolio and non-green socially responsible portfolio are observed to be more volatile and possess high market.

Monthly Abnormal Return using Carhart Four-Factor Model

Table 8 and 9 depict the results of multi factor regression run on portfolios constructed in bull and bear periods respectively. All the 5 green portfolios provide abnormal return in bull period after considering the influence of Fama and French (1993) three factors and momentum factor with 1% significance level. Of all portfolios green non-socially responsible portfolio provides the highest return in bull periods followed by green non-blue chip portfolio and green socially responsible blue chip portfolio. Portfolios are less

volatile to market changes as each of them have market beta less than 1. Green non-socially responsible portfolio is the defensive portfolio followed by green non-blue chip portfolio and green socially responsible blue chip portfolio. All those portfolios consisting blue chip stocks have significant negative exposure towards SMB factor. The multi factor regression in bear periods provide quite contrasting results. 2 green portfolios i.e. green non-socially responsible portfolio and green socially responsible blue chip portfolio provide abnormal return in bear period (table 9). Green non-socially responsible portfolio provided 1.63% monthly abnormal return in bear period. All portfolios are exhibit high volatility in bear period.

Table 8 Multi Factor Regression Run on Portfolios Constructed in Bull Period

Portfolios	Alpha	β_1	β_2	β_3	β_4	Adjusted R^2
Green blue chip	1.412 (2.99)***	0.751 (11.85)***	-0.219 (-3.01)***	-0.025 (-0.45)	-0.152 (-3.25)***	0.775
Green non blue chip	1.940 (3.54)***	0.677 (9.191)***	-0.057 (-0.678)	0.090 (1.366)	-0.142 (-2.61)**	0.676
Non green blue chip	0.805 (2.41)**	0.830 (18.43)***	-0.157 (-3.03)***	-0.003 (-0.086)	-0.059 (-1.77)*	0.873
Green social responsible	1.343 (2.97)***	0.737 (12.15)***	-0.210 (-3.01)***	0.109 (2.01)**	-0.177 (-3.96)***	0.801
Green non- social responsible	2.344 (4.61)***	0.666 (9.72)***	0.002 (0.02)	-0.136 (-2.2)**	-0.089 (-1.75)*	0.653
Non -green social responsible	1.435 (4.132)***	0.805 (17.22)***	-0.037 (0.686)	0.010 (0.23)	-0.138 (-4)***	0.870
Green social responsible blue chip	1.570 (2.99)***	0.718 (10.17)***	-0.220 (-2.72)***	-0.007 (-0.104)	-0.205 (-3.94)***	0.740
Non green social responsible blue chip	0.769 (1.985)*	0.947 (18.16)***	-0.141 (-2.35)**	-0.003 (-0.073)	-0.145 -(3.78)***	0.880

*significant at 10%, ** significant at 5%, *** significant at 1%

Table 9 Multi factor regression run on portfolios constructed in bear period

Portfolios	Alpha	β_1	β_2	β_3	β_4	Adjusted R^2
Green blue chip	0.554 (1.64)	0.953 (20.1)***	-0.102 (-1.62)	-0.023 (-0.524)	0.016 (0.339)	0.857
Green non blue chip	0.566 (1.465)	0.921 (16.9)***	-0.048 (-0.66)	0.054 (1.062)	-0.082 (-1.493)	0.823
Non green blue chip	0.141 (0.350)	0.814 (14.3)***	-0.149 (-1.979)*	-0.068 (-1.279)	0.035 (0.605)	0.743

Green social responsible	0.069	0.892	-0.067	0.040	-0.031	0.865
	(0.218)	(20.1)***	(-1.137)	(0.971)	(-0.691)	
Green non-social responsible	1.630	1.034	-0.096	-0.040	-0.033	0.822
	(3.89)***	(17.5)***	(-1.226)	(-0.734)	(-0.555)	
Non -green social responsible	0.454	0.919	0.003	-0.011	0.001	0.887
	(1.549)	(22.2)***	(0.048)	(-0.295)	(0.024)	
Green social responsible blue chip	0.657	0.954	-0.059	0.008	-0.029	0.841
	(1.785)*	(18.4)***	(-0.867)	(0.173)	(-0.554)	
Non green social responsible blue chip	0.493	0.903	-0.126	-0.037	-0.071	0.766
	(1.144)	(14.8)***	(-1.563)	(-0.655)	(-1.157)	

*significant at 10%, ** significant at 5%, *** significant at 1%

Alpha Difference across Portfolios using Carhart Four-Factor Model

Carhart four factor regression is run on differenced portfolios for bull and bear periods separately. Table 10 depicts that neither of the portfolio pairs yielded different abnormal return during bull cycle. Green non-blue chip portfolio outperforms non-green blue chip at 10% significance and is more defensive to it in terms of market beta. Green non-socially responsible portfolio is outperforming green socially responsible portfolio by 1.56% during bear period.

Table 10 Multi Factor Regression Run on Difference Portfolios in Bull Period

Period	Portfolios	Alpha	β_1	β_2	β_3	β_4	Adjusted R^2
Bull Period	1 – 3	0.606	-0.080	-0.063	-0.022	-0.093	0.013
		(1.283)	(-1.250)	(-0.857)	(-0.388)	(-1.98)*	
	2 – 3	1.135	-0.153	0.099	0.093	-0.083	0.050
		(1.755)*	(-1.760)*	(0.995)	(1.202)	(-1.298)	
Bear Period	1 – 3	0.412	0.138	0.047	0.045	-0.018	0.089
		(1.025)	(2.442)**	(0.628)	(0.844)	(-0.323)	
	4 – 5	-1.561	-0.142	0.029	0.081	0.002	0.012
		(-3.1)***	(-2.02)**	(0.313)	(1.228)	(0.030)	
	5 – 6	1.176	0.115	-0.098	-0.029	-0.034	0.007
		(2.76)***	(1.919)*	(-1.239)	(-0.519)	(-0.562)	
	4 – 7	-0.588	-0.062	-0.007	0.032	-0.002	0.006
		(-2.51)***	(-1.87)*	(-0.164)	(1.031)	(-0.057)	

*significant at 10%, ** significant at 5%, *** significant at 1%

CONCLUSION

This study extends the existing literature and empirical evidences pertaining to impact on market valuation of companies greening their operations and performance of such stocks over a period of time. Based on research literature, the theoretical model proposes that environmental performance of a company affects its financial performance and henceforth market performance. Environmentally conscious investors are aligning their beliefs with investment choices by investing in financial assets whose proceeds are invested in green projects like mitigation and adaptation towards climate change, promoting responsible environmental attitude. Recognition of are physical, legal and transitional financial risks has led to the emergence of the concept of investing in green funds and green bonds.

Findings of the study indicate towards increasing green investing trend as market valuation for green portfolios are noticed to have gone up as one move from pre-crisis to crisis and through post-crisis period. Mean monthly returns comparison among green blue-chip portfolio, green non-blue chip portfolio and non-green blue chip portfolios, has shown that non green counterpart had higher returns during pre-crisis and crisis period while green non-blue chip portfolio & green blue chip portfolio emerged as better performers post crises period. Non-green socially responsible portfolio outperformed green non-socially responsible portfolio during pre and crisis period while green non-socially responsible portfolio outperforming in the third structural break. In pre-crisis and crisis period, non-green portfolios provided high alphas but the reversal took place post crisis period. The observations lead to rejection of H01.

Results of paired difference t test indicates non-green blue chip provided significantly high monthly return w.r.t. green blue-chip portfolio during crisis while in post-crises period all green and non-green portfolios outperformed market with maximum differential returns exhibited by green non -socially responsible stocks. The argument of increasing trend of green investing is further validated by results of single factor model. Three green portfolios i.e. green non-blue chip portfolio, green socially responsible portfolio and green non-socially responsible portfolio underperformed the expectations in pre-crisis period but the underperformance is not found to be empirically significant while in post crisis period, portfolios green non-socially responsible, non-green socially responsible, non-green socially responsible blue chip portfolio, green socially responsible blue chip portfolio, non-green blue chip and green socially responsible portfolio outdid the expectations at 1% significance. These evidences imply the trend reversal in favour of green investing post crises and leads to rejection of H06. Observations for crisis period does not support the argument of green portfolios performing more defensive when compared to non-green portfolios. Therefore, H02 and H04 cannot be rejected. Results from market factor model indicate that in post crisis period green non-socially responsible portfolios yield significantly higher abnormal return. Observations made from post crisis period lead to rejection of H03 and H05.

In booming market phase, green non-socially responsible, non-green social responsible portfolio and green non blue chip stocks exhibited significant alphas. At 10% significance level, green non blue-chip stocks and green non-socially responsible outperformed their non-green counterpart in terms of abnormal return. As per Carhart

four factor regression results, all green portfolios along with a non-green socially responsible portfolio churn significant abnormal return. The abnormal returns of green non-blue-chip portfolio exceed that of non-green blue chip significantly. These results lead to rejection of H07. The pre and post crisis analysis clearly marks the inception of green investing and its increasing trend. Performance results of green non-socially responsible against non-green socially responsible portfolio during crisis and post crisis period indicate that Indian investors does not penalize green stocks and value the, relatively more than stocks of companies scoring high on all the dimensions of sustainability.

Social and Managerial Impact of the study

The study has relevant implications for corporations, investors, policy makers, regulators and fund management companies. The transition towards green investing noticed in the study, is encouraging for companies to add environmental management in their daily operations. They should capitalize on the movement by investing in R&D and streamlining eco-friendly operations. Green innovation is capturing cognizance from around the world. The movement is expected to be more pronounced with time providing opportunities for investors to revalue firms considering their environmental performance and rebalance their portfolios. The investors and asset management companies must take necessary precautions while screening companies on sustainability parameter as confirming to all dimensions can result in loss of diversification benefits. Differential impact of greening the operations on investors' perceptions can further be studied to anticipate market reactions and extend the literature by providing additional evidence.

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