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Green Investing
The Case of India

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Foreword

Thinking Green Technology in a Capitalist Economy

Changes are common, but certain changes are very uncommon. Ecological shift propelled partially by the destructive role of business leaders and corporations is one such very uncommon event that may have far reaching, irreversible, consequences we as humans may not be equipped to deal with. The possibility of extinction of species-being is a scenario far more serious than mere environmental concern that is locally solvable.

In this backdrop, while the matter of difference between social and private costs was well known in economics for a long time, little was done to address the source of the problem. Instead, the problem was displaced to 'solutions' such as emissions trading to incentive producers to produce less pollution. This was like treating the symptom rather than the disease. The universal use of gray technology was hardly affected as a result and the above-mentioned problem of ecological shift could not be turned around. As the gravity of the purported ecological shift becomes clear, recent attempts have shifted gradually toward more basic solutions such as the usage of green technology that are supposed to redress fundamentally the way we produce goods and services. Resultantly, green investment for green technology is one among many long-run solutions being seriously considered now. But it is easier said than done, especially in the context of a globalized capitalist economy. To put the matter bluntly, why should global capitalist firms opening in a competitive market environment substitute gray technologies for green technologies? It cannot be a simple matter of 'consciousness raising' among corporates in this competitive environment where the bottom line is profit. That is, for green technology to have a long-run future in opposition to the current gray technology, it must be profitable for firms to adopt green technology. Green technology in a capitalist economy or green technology with profit is a quite different kind of questioning that the field of economics has only recently begun to think. There is no doubt about the importance of the government's role in research and development of green technology and in proving incentives of various kinds (for example,

tax and credit subsidies) for private firms to adopt green technology. However in a competitive market economy, it will ultimately be the connection of profit to adoption of green technology that will hold the key. Isn't the adoption of green technology risky? Is it cost competitive? How does the stock market view green technology vis a vis gray technology? Can it find a place as a fundamental of the corporations or as a variable of the fundamentals of the corporations? Is green technology vulnerable to business cycles, including financial shocks?

Taking off from the premise that green technology and not gray technology is fundamental for our survival, this book picks up on these questions of the relation of green technology to profit maximizing firms in the context of the stock market, competitive environment, and business cycles. It rethinks and invokes various analytical techniques to try to unpack an array of issues associated with green technology. In the topic it deals with and the way it does so, this intervention is a cutting edge contribution to what is definitely becoming one of the most important researchable areas in economics and beyond.

Kolkata, India Anjan Chakrabarti

About the Authors

Dr. Gagari Chakrabarti completed her Master's, M.Phil., and Doctorate in Economics from the University of Calcutta (India) and is currently working as an Assistant Professor at the prestigious Presidency University (erstwhile Presidency College) in Kolkata, India. Her area of specialization is financial economics including application of econometrics in financial economics. She has several national and international publications to her credit.

Dr. Chitrakalpa Sen is an Assistant Professor in the School of Management, BML Munjal University, Gurgaon, India. An economist by training, Dr. Sen holds an undergraduate degree in Economics and a postgraduate degree in Economics from the University of Calcutta. He did his Ph.D. from the School of Management, West Bengal University of Technology. He has published in a number of national and international peer-reviewed journals, such as *Finance India* and *Journal of Asset Management* and has also authored/co-authored a number of books.

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Chapter 1
Prologue

Abstract Global warming has been the biggest threat humankind has faced in the twentieth century. After the industrial revolution, the amount of greenhouse gas in the atmosphere has increased rapidly, leading to a rise in the atmospheric temperature. If greener production technologies are not adapted, by the end of the century, the global climate may change dramatically, causing worldwide catastrophe. Studies have shown that greener companies outperform the other companies even in terms of financial return. Therefore, from the above discussion, it is evident that investment in green and energy-efficient firms is the most profitable choice for wise investors in time to come.

Keywords Global warming · Climate change · Green investment · Sustainable production

> "Global warming, along with the cutting and burning of forests and other critical habitats, is causing the loss of living species at a level comparable to the extinction event that wiped out the dinosaurs 65 million years ago. That event was believed to have been caused by a giant asteroid. This time it is not an asteroid colliding with the Earth and wreaking havoc: it is us." Al Gore, An Inconvenient Truth: The Planetary Emergency of Global Warming and What We Can Do About It.

The latter half of the last century has probably been the most important for humankind. Technological development progressed like never before, at an unprecedented rate; things that were only true in Star Trek movies or science fiction novels were made into reality. Personal computers got smaller and thinner, World Wide Web literally granted the individual access to the information available to the entire world, the advent of cellular phones changed the way the whole world interacts, and many previously life-threatening diseases are eradicated, thanks to the advances in health care. However, basking in this glory, we often fail to recognize a potentially fatal threat that has probably grown bigger at the same rate if not faster as technological advancement, that is the threat of environmental sustainability. The biggest threat to the environment in the last few decades has been that of an ever-increasing carbon signature on earth which led to global

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warming. The amount of greenhouse gas on earth has been on an ever-increasing trend. In 2012, the actual greenhouse gas emission has already overshot the target by a massive 1 billion tons.[1] The gap is continually increasing. As a result, the weather is shifting drastically all over the world. In the USA, the summer days are becoming hotter, and in India, monsoon is delayed, East and Southeast Asia is ravaged by recurring hurricanes, and the winter days in the Northern Hemisphere is swept by increasingly intense snowstorms. Without adequate preventive measures, the human-induced damage on the environment will keep on increasing and the earth will reach the tipping point by 2020, when nothing we do will be enough to reverse the faster upward trend in the global temperature (www.UN.org).

At this juncture, it is of particular importance for the firms to make themselves amenable to greener corporate and production policies. A not-so environment-friendly firm imposes significant negative externality on the economy. As a result, the private cost of production and the social cost of production significantly diverge. The excess cost is borne by the society itself. Therefore, from the society's perspective, it is only beneficial to encourage more green technologies. However, from a firm's perspective, a "gray" or environment-unfriendly production technology may prove more profitable. After all, there are not many visionary entrepreneurs who think in really long run and keep sustainability in account. However, with the environmental threat, the awareness is higher than ever. This is slowly but steadily causing a greater tilt toward the greener investment machineries. With increasingly more emphasis on the green technologies, it only makes sense for the firms to go green. Even giants such as Morgan Stanley and Goldman Sachs started owning stakes in green energy projects and set up carbon trading desks (Campbell and Nicholson 2013). Although a tad late, the governments are also gradually realizing the emphasis on green technologies. During the last economic crisis, the G20 countries all went for "green stimulus package" where a proposed 20 % of the fiscal stimulus to be spent on clean technologies.

One common excuse often given by firms is that greener technologies are more expensive and therefore are not profitable to use in the production process. However, with the technological progress, green technologies are getting cheaper day by day and that excuse often sounds ludicrous. In the recent years, the green stocks have come out to be a lucrative investment alternative to investors. With cheaper price tag, green technologies are possible to be made available to public at a more competitive price vis-à-vis the conventional technologies. It increases revenue, creates profit, and captures new market. It is the stuff every firm's dreams are made of. With more and more emphasis on clean and renewable technology, prices of the green stocks are pushing higher and green companies are poised at a better position than its competitors. The green technology era is being compared to the rise of telecommunications in the 1980s and is often dubbed as "mother of all markets." The green technology investment would surge to $226 billion by 2016 (Maxwell 2009) and is poised to surpass even the information technology boom.

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[1] *Source* http://digitaljournal.com/article/361682.

Moving to a green and clean technology is inevitability and a structural shift waiting to happen. How soon it happens depends on how soon the importance of green technologies is realized. The discussion so far, some can argue, has been only a normative perspective on why green technologies will thrive, and therefore, more green investments should be made. On a positive side, the importance of green investment can also be established with empirical evidences which will reinforce the arguments above.

Conventionally, the stock valuations of a company are dependent on price-earning ratios, net profits, and debt obligations. However, recent studies show that being energy efficient plays a significant role in pushing the stock prices up. A study by Griffin and Sun (2012) has shown that stock prices rise significantly when a company voluntarily discloses its emission information. The study took 272 companies for 2000–2010 and analyzed their stock price movements from 2 days before to 2 days after the voluntarily emission disclosure. The results suggest that for large companies, this disclosure causes a 0.5 % increase in stock prices, while for the smaller companies, the impact is more profound, about a 2.32 % increase.

The above evidences point toward the fact that investors are increasingly taking energy efficiency into long-term consideration and prefer to invest in an environment-friendly company as low-carbon growth is being considered to be fundamental in determining long-term carbon growth (Carbon Disclosure project 2011). Therefore, it will be only beneficial for the companies to adapt greener and cleaner technologies.

The Carbon Disclosure Project (CDP) conducts emission-based study with 500 largest companies in the world by their market capitalization included in the FTSE Global Equity Index Series, otherwise known as the Global 500. In this study, the companies are sent a questionnaire asking for their carbon strategies. The results from 2013 (CDP 2013) reveal that companies with low-carbon growth, i.e., companies in the Carbon Performance Leadership Index (CPLI), outperform the other companies even in terms of financial return. The result shows that the CPLI companies earn a significantly higher return than the other Global 500 companies and the gap between the returns has significantly increased, especially in the last 2 years.[2]

However, the findings in the CDP 2013 revealed that the big emitters are still not doing enough to reduce their carbon footprint and their emission decisions are often guided by monetary incentives which remain causes of worry.

Therefore, from the above discussion, it is evident that investment in green and energy-efficient firms is the most profitable choice for wise investors in time to come. The alignment between social choice of green technology and the investors' choice of gray technology will be automatically achieved when the green firms are more profitable than the gray ones, in the Indian context. This study tries to answer that very question of investment-worthiness of green instruments. There has been very little research done in this area, especially in the Indian context, and this research

[2] Global 500 Climate Change Report 2013.

attempts to fill in that gap. For that purpose, the authors will develop five different portfolios consisting of 100 % green, 75 % green–25 % gray, 50 % green–50 % gray, 25 % green–75 % gray, and 100 % gray stocks. The research questions are the following:

1. *Do green portfolios possess relatively less own-risk as compared to their gray counterpart*?
2. *How effective the green portfolios are to avoid market risk*?
3. *Are the green portfolios inherently less unstable*?
4. *Do the green portfolios have a higher probability of surviving financial crisis*?
5. *Are the performances of the green backed by their fundamentals?*
6. *Is there any particular technical trading strategy ensuring a consistently above-average return from these portfolios?*

The study will take the following trajectory:

Chapter 2 starts with a review of the green indices available throughout the globe. Then, the study constructs the "pure" green, "pure" gray, and "hybrid" portfolios in Indian market. A stochastic dominance approach is taken in order to compare the own-risk-adjusted return across the portfolios. Next, the study examines any possible volatility and return transmission from the market to the individual portfolios. Apart from the volatility transmission channel, the study also considers the nature and degree of association between individual portfolio returns and the market return using a conditional correlation and empirical survivor function approach. However, the instability may not essentially be external and be internal in nature. For that purpose, any possible presence of deterministic chaos in the five constructed portfolios is examined. The next section delves deeper and examines the survival potential of green instruments during a financial crisis. The last section of Chap. 2 considers individual stocks constituting the green, semi-green, and gray portfolios, rather than the portfolios themselves, and explores possible factors affecting the probability of avoiding crisis for such stocks.

Chapter 3 introduces the concept of trading rules in financial market and reviews some oft-used trading rules. Then, the study makes use of a momentum-based trading rule to examine the investment-worthiness of the green, part green, and gray portfolios.

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Chapter 2
Greens—The Obvious Choice Over the Grays?

Abstract This chapter delves into an individual decision-making problem that bears significant social implications. While tagging along less-carbon investment path through increased investment in "green" projects is socially desirable in the modern era, its implementation is not so easy. The policy-makers, however, would sit comfortably if the imperative choice of the new "green" financial products turns out to be, in fact, obvious. This study explores specifically this issue in the context of an emerging market through examining whether given a choice between green and non-green projects, greens become the optimal choice of a rational investor. As is revealed by the study, the green (either completely or partially) portfolios dominate the available alternative gray portfolios. The green portfolios turn out to be the global minimum variance portfolio, and they dominate the gray in terms of the own-risk as well as the market risk. Even the probabilities of surviving crises are higher, and hence, hazard ratios are lower for the green portfolios. Thus, green is preferred to gray and more green is better than less green. Hence, following less-carbon investment path is the most rational and obvious choice for the investors in the Indian market.

Keywords Green investment · Green portfolios · Stochastic dominance · Empirical survivor function · Survival analysis · Hazard ratio

2.1 The Green Indexes

In today's world, the environmental issues in business and investment are gaining increasing significance, particularly in the context of the emerging financial markets. Apart from its visible, adverse environmental impact, growing investment in polluting industries is potentially hazardous due to its associated negative externalities and the resulting market failure that render the efficient market hypothesis and hence the traditional asset-pricing theory useless. The urgency of a drive toward attaining a low-carbon growth path is thus obvious, and this imperative is particularly strong in the context of the emerging markets. Implementation of low-carbon investment strategies, however, requires a proper definition and understanding of

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emission landscape across business and its impact on sustainable growth. Some stock markets all over the world have already taken initiatives to ensure a credible information mechanism for the investors through developing "green" indexes where carbon performances can be objectively quantified. Some of these indexes, coming from the developed as well as the emerging market are worth-mentioning.

The European market offers a good number of green indexes, either in isolation or in collaboration with other developed or emerging markets. FTSE's Environmental Market Classification System and Indices provide the world's first comprehensive global classification system for environmental markets. Environmental market companies are defined as providing products and services that deliver solutions to environmental challenges and include environmental technology, also sometimes referred to as "clean tech." The classification system defines environmental market companies and allocates each to the subsector whose definition most closely describes the nature of its business. There are currently six sectors and twenty-four subsectors. The *Low Carbon 100 Europe® Index* is a free-float market capitalization-based index that considers the performance of the hundred largest European companies having the lowest carbon (CO_2) intensity in their respective sectors or homogeneous subsectors. The sustainability index *CEE Responsible Investment Universe* (*CEERIUS*) is a capitalization-weighted price index which is composed of the leading socially committed and ecologically viable companies whose stocks are traded on stock exchanges in the region of Central, Eastern, and Southeastern Europe. The *Euronext FAS IAS®* Index considers those companies whose employees are most represented in share ownership and enables investors, fund managers, and issuers to assess market performances and compare them with those of other listed companies. The *FTSE KLD Global Climate 100 Index* is designed to provide investors with access to investment in the top 100 globally listed companies, whose activities demonstrate the greatest potential for mitigating the immediate and long-term causes of climate change. The *FTSE KLD Global Sustainability* (*GSI*) *Index Series* intends to provide investors with robust index solutions through which they could identify and invest in companies that are committed to long-term environmental, social, and governance sustainability. Various regional sustainability indexes are developed accordingly by considering companies from North America, Europe, and Asia-Pacific regions that are top-ranked in terms of these sustainability criteria. The FTSE Group has collaborated with the Bolsas Mercados Españoles (BME) to introduce the *FTSE4Good IBEX Index*. This index includes those companies from the BME's IBEX 35 Index and the FTSE Spain All Cap Index that meet good standards of practice in corporate social responsibility. These companies seek to ensure sustainable business environment, intend to build up and maintain positive relationships with stakeholders, and endeavor upholding and supporting universal human rights. The *FTSE4Good Index Series* considers four tradable and five benchmark indices, representing global, European, US, Japan (benchmark only), and UK markets. The FTSE4Good benchmark indices include all companies in the broad market index or those that meet the FTSE4Good criteria. *FTSE4Good Environmental Leaders Europe 40 Index* identifies leading European companies with healthy environmental practices. These forty companies belong to

the FTSE4Good Index Series and are the top forty companies among those that have obtained the "best practice" environmental rating of 5. The *FTSE4Good Australia 30 Index* intends to provide investors the access to Australian companies that are actively meeting good standards of practice in corporate responsibility. While the FTSE is most active in developing sustainability indexes, there are a few more in the European markets. The *DAXglobal® Alternative Energy Index* is a sector-based global index where investors have the opportunity to invest in the fast-growing and potentially dynamic "alternative energy" sector. The index considers for inclusion in it stocks of only those companies that generate more than 50 % of their revenue in any of the segments of the alternative energy sector such as natural gas, solar power, wind power, ethanol, geothermal, or hydro batteries. The *DAXglobal® Sarasin Sustainability Germany Index* is composed of the one hundred biggest and most liquid German companies based on free-float and market capitalization. Companies are selected according to market capitalization and the average daily trading turnover, and then, they are verified in compliance with the Sarasin Sustainability Matrix®. The *DAXglobal® Sarasin Sustainability Switzerland Index* is composed of the fifty biggest and most liquid Swiss companies based on free-float and market capitalization. The selection of the constituents takes place according to market capitalization and the average daily trading turnover. Thereafter, these companies are verified in compliance with the Sarasin Sustainability Matrix®. Other European markets have adopted similar measures to develop green indexes. The *OMX GES Ethical Index* is one such attempt where the index consisted of all listed companies in Stockholm, Oslo, Helsinki, and Copenhagen, with the exception of those companies that comply with the ethical criteria of the GES Global Ethical Standard and GES Controversial that are based on international standards on environment, human rights, and corruption. Companies with production and/or sales of weapons, tobacco, alcohol, pornography, and gambling are not included. The OMXS30 Ethical Index is ethical version of the OMXS30 Index, and the index family includes OMX GES Ethical Nordic Index, OMX GES Ethical Norway Index, OMX GES Ethical Sweden Index, OMX GES Ethical Denmark Index, OMX GES Ethical Finland Index, and OMX GES OMXS30 Ethical Index. The Austrian stock market has developed a market capitalization-weighted index called the *VBV-Österreichischer Nachhaltigkeits index or the VÖNIX*. The index is comprised of stocks of those Austrian companies, which are best in terms of social and environmental achievements.

The US market has developed a number of indexes to identify clean and sustainable companies. A few of these may be mentioned in this study. The *NASDAQ Clean Edge US Index* (*CLEN*) is a modified market capitalization-weighted index that considers the best and most active clean energy, publicly traded US companies. The companies included in this index come from the business segments such as manufacturing, development, distribution, and installation of emerging clean energy technologies such as solar photovoltaics, biofuels, and advanced batteries. The five major subsectors that this index encompasses are renewable electricity generation, renewable fuels, energy storage and conversion, energy intelligence, and advanced energy-related materials. The second green US index is the *NASDAQ OMX® Clean Edge® Global Wind Energy Index* which is a modified