Economic growth, poverty reduction, and living standards in Asia and the Pacific have improved dramatically in recent decades, but the region now faces a diverse range of new and ongoing challenges. The ADBI Series on Asian and Pacific Sustainable Development highlights innovative research and policy guidance for enabling greater socioeconomic progress amid fast-changing conditions. The Series aims to be a forward-looking and impactful source of knowledge for policy makers and scholars interested in building a prosperous, inclusive, resilient, and sustainable Asia and the Pacific.
Strengthening Environmental, Social, and Governance Investment under COVID-19

Edited by
Naoko Nemoto and Lian Liu
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<tr>
<td>ABRR</td>
<td>Annual Business Responsibility Reporting</td>
</tr>
<tr>
<td>ASEAN</td>
<td>Association of Southeast Asian Nations</td>
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<tr>
<td>CFP</td>
<td>corporate financial performance</td>
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<tr>
<td>CGE</td>
<td>computable general equilibrium</td>
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<tr>
<td>COVID-19</td>
<td>novel coronavirus disease</td>
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<td>CPRS</td>
<td>climate policy-relevant sectors</td>
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<td>CSP</td>
<td>corporate social performance</td>
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<td>CSR</td>
<td>corporate social responsibility</td>
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<td>DNEP21</td>
<td>Dynamic New Earth 21</td>
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<td>ESG</td>
<td>environmental, social, and governance</td>
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<td>EV</td>
<td>equivalent variations</td>
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<td>FILP</td>
<td>Fiscal Investment and Loan Program</td>
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<td>GDP</td>
<td>gross domestic product</td>
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<td>GHG</td>
<td>greenhouse gas</td>
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<tr>
<td>GPIF</td>
<td>Government Pension Investment Fund</td>
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<td>GRF</td>
<td>green risk factor</td>
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<td>GSS</td>
<td>green, social, and sustainability</td>
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<td>GTAP</td>
<td>Global Trade Analysis Project</td>
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<td>ICT</td>
<td>information and communication technology</td>
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<td>IFRS</td>
<td>International Financial Reporting Standards</td>
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<td>IO</td>
<td>input–output</td>
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<td>IOSCO</td>
<td>International Organization of Securities Commissions</td>
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<tr>
<td>IT</td>
<td>information technology</td>
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<tr>
<td>JICA</td>
<td>Japan International Cooperation Agency</td>
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<tr>
<td>MCA</td>
<td>Ministry of Corporate Affairs</td>
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<td>MOE</td>
<td>Ministry of Environment</td>
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<td>MSCI</td>
<td>Morgan Stanley Capital International</td>
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<td>P/E</td>
<td>price-to-earnings ratio</td>
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<tr>
<td>PRI</td>
<td>Principles for Responsible Investment</td>
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<tr>
<td>ROA</td>
<td>return on assets</td>
</tr>
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<td>SCJ</td>
<td>stewardship code of Japan</td>
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<tr>
<td>SDG</td>
<td>Sustainable Development Goal</td>
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<td>SEBI</td>
<td>Securities and Exchange Board of India</td>
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<td>SRI</td>
<td>socially responsible</td>
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<tr>
<td>TCFD</td>
<td>Task Force on Climate-related Financial Disclosures</td>
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<tr>
<td>TGIF</td>
<td>transition, green, innovation, and finance</td>
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<tr>
<td>UN</td>
<td>United Nations</td>
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<tr>
<td>US</td>
<td>United States</td>
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<tr>
<td>VPP</td>
<td>virtual power plant</td>
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Preface

Naoko Nemoto

Environmental, social, and governance (ESG) investment is critical for achieving inclusive growth in Asia and reducing the detrimental effects of the coronavirus disease (COVID-19) on income inequality.

ESG investment is a growing phenomenon that focuses on corporate initiatives not reflected in financial figures, specifically environmental, social, and corporate governance factors. In 2020, global ESG investment reached $35.3 trillion, a 50% increase from the value in 2016. In the Asia and Pacific region, the uptake in ESG investment was slow at first, but it has recently shown rapid growth.

ESG investment could support Asian economies in boosting their potential growth. If companies promote environmental protection, employee education, and women's participation, their corporate value will increase, in turn spurring economic growth in a virtuous cycle. Pledges from world leaders to reach carbon neutrality are expected to drive promising changes to sustainable investment in relation to decarbonization, renewable energy, green transport, and more. During 2020–2021, the People’s Republic of China, Japan, the Republic of Korea, and India announced carbon peak and neutrality commitments that will be key drivers for sustainable investment in the region. There have been various regulatory developments, including the adaptation of stewardship codes and setting of guidelines for green bonds and social bonds.

However, ESG investment in Asia is still small, and the concept has not been fully integrated into domestic companies’ core business strategies and investment philosophies. The views of corporate managers and investors are divided on whether ESG initiatives will create economic value. Numerous academic researchers have shed light on the link between ESG factors and the financial performance of corporations, although the results are inconclusive.

This book describes the current situation, the potential benefits of ESG investment, and future challenges. Despite growing business awareness regarding ESG issues and extensive research from academic scholars, connections between practitioners and academics remain limited, and important knowledge is fragmented. The goal of this book is
to bridge this gap by integrating the collective knowledge of researchers and practitioners and linking this knowledge to effective policy and management strategies.

There are many studies on the effects of ESG investments, but few are specific to the situation under COVID-19 and Asia. This book addresses the areas that should be strengthened in the future and what measures should be taken for the sound development of ESG investment in Asia.

As shown by these studies, ESG investment and capital flows into renewable energy and other projects can be important drivers of sustainable growth and recovery from the COVID-19 crisis in Asia. It is urgent to tackle climate risk, but in Asia it is also important to improve social factors such as human rights, education, gender equality, and welfare.

ESG investment could bring resilience to financial markets as investors put more emphasis on the improvement of corporate values in the long term.

This finding could give more incentives to governments to improve the framework of ESG investment, as better disclosure will enhance the market’s functioning and encourage ESG activities by corporations.

We hope this book will contribute to achieving effective sustainable financing and supporting the region in shifting to a greener and safer society.


We would like to thank the speakers and panelists for sharing their research and ideas, deepening discussions, and providing constructive opinions on the papers.

This book could not have been completed without the support and advice of Tetsushi Sonobe, ADBI Dean, and Naoyuki Yoshino, professor emeritus at Keio University and former Dean of ADBI. Peter Morgan, senior consulting economist at ADBI, has been consistently helpful with in-depth reviews and advice. David Hendrickson, communications specialist, and Adam Majoe, publishing and brand consultant, have worked to improve the quality and design of the book. Upalat Korwatanasakul, research fellow at the United Nations University, gave us useful advice on the composition. Yasue Nagai and Lian Liu contributed to the writing and editing of the book. I would like to express my heartfelt gratitude to these people and to ADBI staff.
Environmental, social, and governance (ESG) investment that focuses on firms’ efforts to improve environmental (E), social (S), and governance (G) factors has become a global trend. At the beginning of the coronavirus disease (COVID-19) shock, there were concerns that ESG investment would shrink, but the inflow of money into ESG funds has accelerated.

The International Monetary Fund published a financial stability report in October 2021, and it shows net inflows in sustainable funds increased notably in 2020 compared to traditional funds as the COVID-19 crisis raised investors’ awareness to catastrophic events. In addition, policy makers around the world, including the United States (US) and the People’s Republic of China, have strengthened their responses to climate change, which has affected investors’ attitudes. At the Conference of the Parties to the United Nations Framework Convention on Climate Change in November 2021 (COP26), it was stressed that public expenditure alone will not be sufficient to meet the demands of the climate crisis, and private capital is essential. To mobilize this capital, governments will need to focus on addressing the challenges that emerging markets face in attracting private sector financing.

Although developments in Asia have been delayed compared to Europe and the US, ESG investment in Asia has been growing rapidly. The total investment amount increased to $2,914 billion in 2018 from $1,042 billion in 2014. New issues of green bonds in 2020 in the Asia and Pacific region were valued at $53.2 billion, a twofold increase from the level in 2016. These trends were supported by government initiatives in providing green finance guidelines and requiring listed companies to improve their disclosure of ESG information.

However, there are many problems and challenges ahead. Common issues, which are shared by the US and Europe, include a lack of adequate data, dispersed criteria and disclosure rules, and ineffective regulatory oversight to prevent greenwashing. In Asia, the penetration of ESG investment differs among countries. In some countries, the awareness

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1 Greenwashing is the process of providing misleading information about how a company’s products are more environmentally sound.
of investors and individuals regarding ESG investment is still low. Even in developed markets, information collection and data analysis are in the initial stages. Many companies have not yet fully integrated ESG factors in their core business strategies.

This book describes the opinions and research of policy makers, researchers, and practitioners on the current situation and potential benefits of ESG investment in Asia. There are many studies on the effects of ESG investments, but few are specific to the situation under the COVID-19 pandemic and Asia. The book addresses the areas that should be strengthened in the future, and what measures should be taken for the sound development of ESG investment.

Chapters 1 and 2 outline ESG investment from a macroeconomic perspective and describe its role in fostering sustainable growth and resolving social issues as well as future challenges. Chapter 3 acknowledges the significance of ESG investment, points out that inconsistent evaluation distorts resource allocation, and proposes a policy response. Chapters 4 and 5 focus on stock prices, corporate value, and ESG factors of individual companies with the aim of proving that ESG initiatives lead to higher value of corporate entities. Chapter 6 describes the state of ESG investments in India and the performance of ESG investments. Chapter 7 analyzes the impact of investment mitigating climate change on trade and economic growth in Asia and suggests that the development of ESG investment will lead to post-COVID-19 growth.

Chapter 1, “ESG and Sustainable Investment Anchored by Long-Term Enterprise Value Creation: Behind Japan’s Drive for ESG Investment and Sustainability,” covers the recent trends in ESG and/or sustainable investment and lists critical points from the standpoint of policy makers. The chapter points out that the key attribute of ESG and sustainable investment is to provide incentives and mechanisms to the private sector to improve corporate value in the long term. In order to better use market mechanisms, regulators should ensure the quality of such disclosure is globally consistent, comparable, and with reliable sustainability disclosure frameworks and standards. On this front, a group of five ESG disclosure frameworks and standards bodies came together to announce a shared vision for a comprehensive corporate reporting system on ESG investment and sustainability.

At the same time, further efforts are needed to make such ESG data and ESG evaluation ratings more relevant with the assessment of long-term enterprise value. The chapter points out that ESG investments better withstood the market turmoil triggered by the COVID-19 pandemic, which is also mentioned in Chapter 4 and Chapter 6.

The chapter explains why many relevant initiatives take a climate-first approach, although there are various ESG factors affecting society
and the environment. Lastly, the chapter focuses on the initiative of transition finance, which is a financial tool to incentivize a group of companies with a track record of high carbon emissions toward designing their own credible pathways to carbon neutrality by 2050. As the Asian region has many industries, transition finance could be a useful methodology for consideration.

Chapter 2, “Japan’s Green, Social, and Sustainable Bonds Market: Recent Trends and Future Outlook,” introduces Green, Social, and Sustainable (GSS) bonds and how they could help the government and the private sector in resolving social issues such as aging, natural disasters, and inequality.

It explains the status of the issuance of green bonds, social bonds, and sustainable bonds in the world and in Japan. After COVID-19, the issuance of S-bonds is increasing, contributing to small and medium-sized enterprise finance. Although Japan is lagging Europe in terms of the amount of GSS bonds, it is growing rapidly, supported by the announcement of guidelines by the Ministry of the Environment, subsidies, and investment through public pensions. GSS bonds are a useful tool while tax revenues are sluggish due to the aging population. In order to achieve continuous growth, the authors highlight the importance of education, financial literacy, and wider use of GSS bonds among related parties including financial institutions. GSS bonds can be useful for other Asian countries that will encounter similar challenges similar to Japan’s, such as aging and natural disasters.

Chapter 3, “ESG Investment and the Allocation of Portfolio Assets,” examines whether the current portfolio allocation based on different criteria for ESG among evaluation companies will lead to a distortion of fund distribution. It proves that diversification of ESG investment standards hinders asset optimization. The reasons for the divergence of evaluation depend on the differences in evaluation methods among rating agencies. Some of them use only public information while others use nonpublic information. If a uniform criterion is developed, ESG assessments can be incorporated more properly in selecting the optimal investment portfolio. This conclusion is consistent with Chapter 1, which advocates unifying the disclosure rules of ESG factors and improving accountability of ESG evaluation. The authors suggest that alternative measures such as applying taxation globally based on greenhouse gas (GHG) emissions. Another suggestion includes creating a platform of green ratings that could be used as common and unified criteria for investors.

Chapter 4, “The Resilience of Green Stocks During COVID-19: A Clustering Approach,” discusses the empirical analysis conducted on price, risk, and liquidity of European stocks. The results show that the financial performance of green firms is better than that of non-green and
brown firms under the COVID-19 period. The authors extend standard asset-pricing models by adding a green factor and find climate-related risk is factored in stock pricing.

Empirical studies show that green stocks perform poorly compared to non-green stocks, but green stocks performed better under the COVID-19 crisis. The authors added the green factor to the traditional asset pricing model, proving that the green factor has recently been reflected in the stock prices.

Chapter 1 points out that stock prices with high ESG scores are resilient under the COVID-19 shock. This is because investors value long-term performance. The results of Chapter 4 support this opinion and motivate private companies to promote ESG initiatives and information disclosure. Chapter 4 also builds its own assessments using a cluster approach without using external ESG ratings. One limitation of this method is that it divides companies into green and non-green. As some non-green companies are significantly reducing GHG emissions, it is an issue for future research to reflect on the differences among non-green firms. An improvement in the methodology could help the realization of transition financing advocated by Chapters 1 and 2.

Chapter 5, “ESG Evaluation and Organizational Attractiveness for Prospective Employees: Evidence from Japan,” hypothesizes that firms’ ESG evaluation is related positively to their attractiveness for prospective employees. Although a growing number of research studies have been focusing on the correlation between ESG evaluation and corporate financial performance, this chapter is unique as it indicates ESG evaluation is related to firms’ attractiveness as employers, suggesting that a firm’s high ESG score may provide a competitive advantage in attracting human talent and enhancing corporate value. At a time when corporate success depends on high-level staff, the need for corporate entities to improve ESG evaluation is intensifying. Regarding the impact of an ESG component, the study shows that environmental factors have a significant positive impact on the attractiveness of larger firms, while governance is most relevant for smaller firms.

The results of this study have policy implications. Although ESG investment has gained more support from governments and regulatory authorities, the level of implementation, ESG disclosure, and transparency vary among countries. This finding could give more incentives to governments to improve the framework of ESG investment as better disclosure will support the market’s functioning and enhance ESG activities of corporate entities. This finding is consistent with the messages in Chapter 1 and Chapter 4.

ESG investments have attracted considerable attention both from investors and customers worldwide. These investments largely follow a
triple bottom line approach where financial returns are combined with environmental and social norms.

The study in Chapter 6, “Resurgence of ESG Investments in India: Toward the Making of a Sustainable Economy,” carries out a detailed assessment of ESG development and evolution trajectory in India, maps the legal and regulatory landscape governing ESG investments, and conducts a sustainability evaluation of a select set of corporate entities. It uses a mixed method approach for its assessment. Our findings suggest that ESG-integrated assets have outperformed their counterparts. Companies are found to have done relatively better in policy disclosure and governance parameters of ESG integration compared to environmental and social factors. Mapping of ESG policies and regulations reveals that there has been a gradual widening of scope of ESG policies and the ESG policy environment is characterized by moving away from a voluntary to a mandatory regime. Finally, a sustainability assessment of a select set of corporate entities indicates that in terms of ambitions and practices, a disproportionate emphasis is laid on environmental aspects of sustainability, with only limited focus on social dimensions by Indian corporate entities, both in their declarations and actions.

India’s GHG emissions are second only to those of the People’s Republic of China in Asia. India’s presence in Asia and the global economy is increasing, and the country’s policies and private sector trends are important themes.

The research discussed in Chapter 7, “Global Economic Assessment of Renewable Energy for ESG Investment in Asia Using a Dynamic Global Trade Analysis Project Model,” empirically tests the impact of green energy policies in Asia. The study used a dynamic computable general equilibrium model by applying the Global Trade Analysis Project power database to analyze Japan and other regions in Asia, such as the Association of Southeast Asian Nations (ASEAN), East Asia, South Asia, and the rest of Asia for a 15-year investment policy in the solar and wind power industry. By creating scenarios of capital investment in solar and wind power along with other related sectors of machinery, electronic equipment, and power transmission under higher efficiency for social infrastructure in the transport and service sectors, the authors interpreted critical economic indicators, such as output, external trade, gross domestic product, and welfare change, by comparing the fiscal burden of implementation. They found that production of renewable energy could be stimulated by investment, especially in East Asia, ASEAN, and South Asia. However, social welfare did not improve in proportion with renewable energy, especially in Japan, despite the assumption of higher efficiency of renewable energy in later periods. The
breakdown of external trade in the machinery sector shows that South Asia is the most critical provider of machinery in the renewable energy market. The study is closely linked with Chapters 1, 2, and 6 showing how green projects could support the potential growth of economy in Asia after the COVID-19 crisis.

**Policy Implications**

As shown by these studies, ESG investment offers substantial benefits for investors, companies, and society. This section identifies the key findings and suggests some steps a company can take and recommends ways for policy makers and regulators to further promote it.

ESG investment and capital flows in renewable energy can be an important driver of sustainable growth in Asia and recovery from the COVID-19 crisis.

Policy makers are required to make well-designed plans to attain a better balance of economic growth and environment protection or energy efficiency.

It is urgent to tackle climate risk, but in Asia it is also important to improve social factors such as human rights, education, gender equality, and welfare.

ESG investment could bring resilience to financial markets as investors put more emphasis on the improvement of corporate values in the long term.

This finding could give more incentives to governments to improve the framework of ESG investment as better disclosure will enhance market functions and encourage ESG activities of corporate entities.

The new ESG architecture includes data, disclosure, sustainable finance classification including taxonomy, and proper regulatory oversight.

To achieve optimal capital allocation, a unified and transparent ESG scoring system is necessary.

Another pressing agenda for policy makers is to communicate the benefits of ESG investment to related parties and enhance awareness. All stakeholders including stock investors, debt holders, regulators, and employees could work together to create better rules and guidelines.

Through these efforts, it is expected that ESG investment will play a more vital role in strengthening sustainable growth in Asia.
1

ESG and Sustainable Investment Anchored by Long-Term Enterprise Value Creation: Behind Japan’s Drive for ESG Investment and Sustainability

Satoshi Ikeda

1.1 Environmental, Social, and Governance Investment, Sustainability, and Long-Term Enterprise Value Creation

Ensuring the efficient allocation of capital through financial markets is the primary role of capital market regulators like the Financial Services Agency of Japan. In performing this role, whether a particular capital allocation will genuinely enhance long-term enterprise value of an investee company should be a critical guide for action by regulators. Even with environmental, social, and governance (ESG) investment and/or sustainable investment, the same guiding principle still holds valid. After all, financial materiality is the factor driving investment decisions. Without consideration of financial materiality, capital allocation by the market mechanism may well be inefficient. But it is also true that financial materiality will evolve over time. What appears financially immaterial today can prove to be business-critical in several years. The key attribute of ESG investment and/or sustainable investment is to look through this evolving nature of financial materiality over the long-term horizon. In this way, the concept of long-term enterprise value connects both materiality to the enterprise and materiality to society and the environment. Financial materiality or materiality to enterprise value is determined by whether a certain matter affects either future cash flows
or cost of capital in a significant way. If the answer is positive, that matter is financially material. The problem is that a certain segment of investors are too myopic and prone to ignoring financially material events in the longer time horizon. ESG and sustainability-related matters likely fall into the category of this long-term horizon and so face the risk of being neglected by those investors. Despite this, even simple arithmetic reveals that more than half of total enterprise value comes from future cash flows from 8 years later and beyond, assuming cash flows are constant and cost of capital is 10%. Clearly, there is a strong reason that capital market regulators must rectify this market failure. It is by this act of remediation that ESG investment and/or sustainable investment can be strengthened, being anchored by long-term enterprise value creation.

1.2 Investment Chain: Corporate Governance and Stewardship

The foundation of ESG investment and/or sustainable investment is a well-functioning investment chain comprised of asset owners, asset managers, and corporations with long-term perspectives. In particular,
constructive dialogue (engagement) between institutional investors and investee companies with a view to enhancing long-term enterprise value is an essential ingredient for success. Corporate governance reform in Japan laid the groundwork by outlining a set of disciplines guiding and directing the behavior of institutional investors and corporates alike toward long-term enterprise value creation. As a matter of fact, one of the most adopted ESG investment and/or sustainability investment strategy by Japanese institutional investors is “corporate engagement and shareholder action.” The stewardship code of Japan (SCJ) addresses the issue of the former, while the corporate governance code of Japan is concerned with the latter. Since its inception in 2014, the SCJ has been revised twice. The latest revision in 2020 has made clear that the stewardship responsibility does include “consideration of sustainability (medium- to long-term sustainability including ESG factors),” further accelerating the adoption of ESG investment and/or sustainability investment strategy. The most recent revision of Japan’s corporate governance code requires corporations listed on the “prime” section of the stock exchange to make disclosures of climate-related information aligned with the Task Force on Climate-related Financial Disclosures.

**Figure 1.2: Sustainability Reporting: The Role of Frameworks and Standards**

Information producers

<table>
<thead>
<tr>
<th>Reporters</th>
<th>Software Providers</th>
<th>Auditors</th>
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</thead>
<tbody>
<tr>
<td>Collect, validate, setup internal controls/procedures, involve internal audit, involve external audit, and then publish the information</td>
<td>Software providers and disclosure platforms enable filers to collect and report information</td>
<td>Auditors use standards as criteria against which they provide external assurance, and other related services</td>
</tr>
<tr>
<td>Software providers also help standard setters to build taxonomies and information validation pathways</td>
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Information users

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<tr>
<th>Data Providers</th>
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<th>End Users</th>
<th>Regulators</th>
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<tbody>
<tr>
<td>Data providers aggregate information and make it available through technology tools</td>
<td>Analytics platforms provide ratings and advanced analysis capabilities</td>
<td>Investors and other stakeholders such as civil society, communities, senior executives, employees, customers, governments and suppliers will consume the available data and analysis</td>
<td>Regulators are increasingly interested in sustainability information, with some moving to mandate it in accordance with standards and some using the information for regulatory purposes</td>
</tr>
</tbody>
</table>

Conceptual frameworks

- Disclosure topics
- Disclosure requirements

Underpins all information

* Framework: A set of principles and guidance for “how” a report is structured; Standards: Specific, replicable and detailed requirements for “what” should be reported for each topic.

Strengthening Environmental, Social, and Governance Investment under COVID-19 framework and recommendations. These revisions are expected to further enrich constructive dialogue between institutional investors and corporations toward enhancing long-term enterprise value of an investee company by addressing ESG and/or sustainability risks and opportunities that influence its cash flows and cost of capital.

1.3 Corporate Disclosure and Environmental, Social, and Governance and Sustainability Reporting

Corporate disclosure on ESG and/or sustainability-related information is a critical component for integrating ESG and/or sustainability factors into investment processes by institutional investors, including constructive engagement by institutional investors with investee companies. Underpinning the quality of such disclosure are globally consistent, comparable, and reliable sustainability disclosure frameworks and standards. In fact, such frameworks and standards not only underpin information by reporters, but rather do so with the overall information processing through information producers (e.g., reporters, auditors, software providers) and information users (e.g., data providers, analytics platforms, end users, regulators). On this front, a group of five ESG disclosure frameworks and standards bodies (Sustainability Accounting Standards Board, International Integrated Reporting Framework, CDP [former Carbon Disclosure Project], Climate Disclosure Standards Board, and Global Reporting Initiative) came together to announce a shared vision for a comprehensive corporate reporting system on ESG and/or sustainability and their commitment of collaboration to achieve it. In line with this commitment, they developed and published prototypes of climate-related disclosure standards at the end of 2020. Furthermore, given the growing and urgent demand to improve the global consistency and comparability in sustainability reporting, the trustees of the International Financial Reporting Standards (IFRS) Foundation have been working on the establishment of an international sustainability reporting standards board within the existing governance structure of the foundation. In this context, the International Organization of Securities Commissions (IOSCO), as a group of capital market regulators plays a pivotal role in ensuring global governance for setting sustainability reporting standards that meet the needs of the capital markets. To this end, the IOSCO has engaged with the IFRS Foundation trustees with the aim of establishing a sustainability standards body with a strong governance foundation and encouraging it to provide a consistent and comparable baseline of
sustainability-related information that is material to enterprise value creation, while also providing flexibility for coordination on reporting requirements that capture wider sustainability impacts. In response, the IFRS Foundation trustees agreed that the new board would focus on information that is material to the decisions of investors, lenders and other creditors, reflecting investor focus for enterprise value. This will constitute a critical milestone for guiding investors toward taking longer-term perspectives in their investment decision making.

Figure 1.3: Routes to Collection and Use of Nonfinancial Data

1.4 Influence of Environmental, Social, and Governance Data and Ratings

As the importance of ESG and/or sustainability factors in investment decision making increases, so does the influence of ESG data and ratings. While establishing globally consistent, comparable, and reliable sustainability disclosure standards certainly helps in expanding the provision of corporate disclosure-based ESG and/or sustainability data, there remains the role of ESG data and ratings
providers in processing company disclosure data and alternative datasets to produce decision-useful information for investors. This implies that, on the one hand, ESG data and ratings providers should offer greater clarity on what their processed data and ratings actually measure vis-à-vis ESG and/or sustainability. On the other hand, investors should exercise due diligence over the use of ESG data and ratings in their decision-making processes. At the same time, further efforts will be needed to make such ESG data and ratings more relevant with the assessment of long-term enterprise value. It is reported that ESG investments better withstood the market turmoil triggered by the coronavirus disease (COVID-19) pandemic. However, it must also be acknowledged that, based on the existing academic literature, we cannot yet draw a strong conclusion that investing in companies with better ESG rating scores will lead to better investment performance. So, any linkage between ESG rating scores and enterprise value is not necessarily a proven one even though such narratives sound highly convincing. For example, addressing potential future disruptions by climate change would certainly enhance long-term enterprise value. But whether existing ESG ratings properly capture that is a different question. Also, the assessment of enterprise value is a complex process that requires consideration of multiple elements including ESG factors and non-ESG factors. That being said, the first step we should take is to identify which ESG issue is financially material to a particular corporation and which one is not. In this vein, Khan,
Serafeim, and Yoon (2016) offer very important insight. They use the guidance by the Sustainability Accounting Standards Board to classify sustainability issues as material or immaterial according to industry membership. They find that firms with strong ratings on material sustainability issues have better future performance than firms with inferior ratings on the same issues. In contrast, firms with strong ratings on immaterial issues do not outperform firms with poor ratings on these issues. Finally, firms with strong ratings on material issues and concurrently poor ratings on immaterial issues have the best future performance. They conclude that collectively these results are consistent with materiality guidance being helpful in improving the informativeness of ESG data for investors. In order to be informative for investors, ESG data and ratings will need to be fully aligned with financial materiality and thereby be anchored by the drive for long-term enterprise creation.

1.5 Climate-First Approach and Japan’s Experiences

The discussions so far intend to cover a broad spectrum of ESG and sustainability, focusing their commonalities. But the truth is that ESG and sustainability would include a wide variety of issues each of which would exhibit a certain individuality. Being aware of such commonalities and individualities, many relevant initiatives take a “climate-first” approach. It is envisaged that a deep dive into the most advanced field would create an opportunity for leveraging the experience and broadening the scope of its applicability to other areas of ESG and sustainability. For example, the European Union has been working on developing taxonomies for climate mitigation and adaptation first as other issues such as circular economy and biodiversity would come later. Also, the IFRS Foundation trustees have agreed that the new sustainability reporting standards board will initially focus its efforts on climate-related reporting, while also working toward meeting the information needs of investors on other ESG matters. Japan is not an exception to this trend. In the Japanese context, climate-first started with the promotion of TCFD implementation and led to the establishment of the TCFD Consortium of Japan. The consortium provides a platform for institutional investors and business corporations to engage constructive dialogue on how corporate initiatives to address climate change challenges will lead to enhancing long-term enterprise value. Technically, the enterprise value of a particular company will rise either through increasing its future
earnings (positive cash flows) or through reducing its cost of capital. Whether it is future cash flows or cost of capital, institutional investors must value them in a forward-looking way. In other words, business corporations must convince institutional investors on the prospect of their increasing future earnings and/or declining cost of capital in order to achieve long-term enterprise value creation. The TCFD Consortium of Japan is designed to provide an avenue for such communication between institutional investors and business corporations. In addition, a set of guidelines on such effective communication has been provided by the Consortium itself such as “Guidance on Climate-related Financial Disclosures 2.0” (TCFD Guidance 2.0) and “Guidance for Utilizing Climate-related Information to Promote Green Investment” (Green Investment Guidance). The consortium is a membership organization open to institutional investors, financial institutions, business corporations, and others in Japan who support the initiatives of the TCFD. The strength of the consortium lies in its mission to attract willing entities committed to making the best use of climate-related financial information in the pursuit of long-term enterprise value creation. The number of consortium members is now more than 300, with membership covering major high carbon-emitting companies even in the hard-to-abate sectors. This is partly the result of influence of the Ministry of Economy, Trade and Industry of Japan that sees decarbonization challenges as a matter relevant to its industrial policies. But it is also due to the self-recognition among Japanese companies that decarbonization technologies will be, and should be,
their competitive advantage contributing to their enterprise value creation. This creates an incentive for them to engage with institutional investors and financial institutions for detailing their efforts in seizing opportunities and mitigating risks emanating from climate change. This is also a strong protection against a proliferation of boilerplate disclosures that could be an undesired but likely outcome of making TCFD disclosure mandatory without setting up a proper incentive structure such as the TCFD Consortium of Japan.

1.6 Climate Finance: Transition, Green, Innovation, and Finance

Climate finance, that is financing climate-related activities by business corporations, has a few categories. It can be first categorized into two main types: “climate-aligned finance” and “adaptation finance.” The latter is financing for climate adaptation, namely adaptation initiatives promoting the climate resilience of infrastructure as well as of social and economic assets more broadly. The former will be further subcategorized into financing for zero-carbon or near-zero carbon activities (green finance) and that for “transition activities” that contribute to net-zero emissions economy but not currently close to net-zero carbon (transition finance). Among them, transition finance is often excluded from today’s market definitions of sustainable finance, but is a very important component of climate finance that drives business activities towards net zero by 2050. This is because attaining the net zero target requires reduction of carbon emissions in all economic activities and as such each economic entity must initiate efforts immediately to reduce such emissions irrespective of its current emission level. Given this reality, transition finance is a financial tool to incentivize a group of companies with a track record of high carbon emissions toward designing their own credible pathways to carbon neutrality by 2050. In transitioning to it, there are three ways of reducing emissions. The first one is greening the activities. It entails adopting a proven decarbonization technology (e.g., renewable energy) and increasing the share of such adoption in overall economic activities. The second one is innovating the activities. In this case, new technological breakthroughs are expected to enable an innovative way of emissions reduction and such innovation is diffused across the economy. The last one is transitioning the economic activities that cannot yet benefit from proven decarbonization technologies. Put differently, it is driving the hard-to-abate activities as close to near-carbon zero as possible by encouraging the adoption of best available technologies for reducing emissions. Japan’s Climate Innovation
Background of the Study

• The Paris Agreement came into effect in 2020. Globally, a huge amount of investment is needed for low carbonization, particularly in emerging countries in Asia. Finance has an increasingly important role in promoting green in investment as well as companies that are steadily transitioning to address climate change and innovating to drastically reduce greenhouse gases (GHG).

• With regard to sustainable finance, Japan has transition technologies which are already at the implementation stage, but is also in a position to supply long-term innovation technology to combat global warming.

• METI formulated a basic concept and future direction for the supply of public and private capital to these sectors titled “Climate Innovation Finance Plan 2020,” and published it for investors and operational companies in Japan and abroad. Japan will contribute internationally through business innovation by Japanese companies to Asia and other regions were GHG emissions are increasing.

Basic Approach – Simultaneous Promotion of TGIFs for Climate Innovation

To achieve SDGs and the Paris Agreement, it is important to simultaneously promote transition (T), green (G) and innovation (I), and to finance (F) these projects, rather than taking a binary to "green" or “nongreen.”

To this end, we will establish the three foundations: government commitment to address climate change, the proactive disclosure of information by companies, and engagement by suppliers of funds.

Three Key Areas of Climate Innovation

• Green
  - Increase green infrastructure by supporting projects related to green energy, social infrastructure, etc.
  - Supporting further growth of green bonds

• Transition
  - Government commitment to address climate change
  - Companies’ proactive disclosure of information (TCFD disclosure)

• Innovation
  - Companies’ proactive disclosure of information (TCFD disclosure)
  - Nurturing competitive renewable energy industries

Goals

[Achieving goals by simultaneous promotion of TGIF (Illustration)]

Figure 1.6: Climate Initiative Finance Strategy 2020

Source: METI of Japan.
Finance Strategy 2020 is built on these three pillars. It is also called the “TGIF” strategy. T stands for transition, G for green, I for innovation, and F for finance. This concept is the backbone of the Green Growth Strategy of Japan and will be an important building block for Japan’s Sustainable Finance Action Plan.

1.7  Sustainable Finance Strategy: Aligning Self-interest with the Public Good

The Expert Panel on Sustainable Finance, established late last year by the Financial Services Agency of Japan, is requested to make recommendations on three strands. The first is driving sustainable finance by financial institutions. Financial institutions are strongly expected to support their client companies through investment and financing as well as advisory services so that those companies can fully bring out their potential and technological strengths and make progress in transitioning to a carbon neutral socioeconomic system. The second is providing sustainable finance-related investment opportunities through capital and financial markets. By doing so, capital and financial markets will connect a huge amount of financial assets with capital investment needs contributing to a carbon neutrality. The last is promoting disclosures of climate-related information by companies. By visualizing initiatives for decarbonization innovation, it paves the way to financing for viable projects and technologies. As this suggests, the panel commits to working toward designing the financial system in a way that it contributes more to climate-related sustainability. Equally importantly, its underlying recognition is that the motivation for addressing climate-related sustainability is the pursuit of long-term enterprise value creation. A technological innovation for climate mitigation and/or adaptation can potentially invent a new market opportunity that will enhance future cash flows of a corporate. Aligning a business model with climate transition pathways to carbon neutrality by 2050 can increase the resilience of a company against future changes in policies, regulatory action, and consumer behavior, thereby reducing cost of capital. Furthermore, value creation is the foundation of business. In the long run, business profits are ultimately earned from what they are offering for the societal demands. As society evolves with changes in nature and environment, failing to respond to the changing societal demands could be a matter of corporate survival that is fundamental to long-term enterprise value. Despite capitalism’s own vices, the enduring solution to the problem can be realized only by leveraging capitalism’s virtues, that is, the unintended greater social benefits and public good
brought about by individuals acting in their own self-interest. Any economic system depending solely on morality is often fragile. If self-interest and public good can be aligned, it would create a very robust system. Self-interest could be concerned with one’s own growth of wealth, or maybe one’s own survival. Whatever it is, public sector intervention to rectify market failures should focus on coming up with a very convincing narrative to align one’s pursuit of self-interest with sustainability of the society and the environment. The Paris climate accord has changed the rules of the game for business in the way that they must compete for lower carbon emissions in their products and services. In this circumstance, the innovation the TCFD achieved is to frame the story of sustainability as a matter of risks and opportunities for long-term enterprise value and even for corporate survival. In this connection, from a financial regulator’s perspective, a key to the success of sustainable finance lies ultimately with creating proper incentives by institutional investors and financial institutions to protect their own wealth or that of their beneficiaries. By doing so, it would incentivize

![Figure 1.7: Establishment of the Expert Panel on Sustainable Finance](image)

**Figure 1.7: Establishment of the Expert Panel on Sustainable Finance**

Establishment of the Expert Panel on Sustainable Finance

- In order to achieve carbon neutrality by 2050, creating a virtuous cycle between the economy and the environment is an agenda which should be worked on with a whole of government approach.
- Japanese companies have advanced technologies and the potential contributing to a decarbonised society, but have not fully leveraged them.
- To ensure more foreign and domestic investments addressed to the related efforts by Japanese companies, it is important that financial institutions as well as financial and capital markets fulfill their functions appropriately.

<table>
<thead>
<tr>
<th>Investment in Facilities and Business Operations contributing to Decarbonisation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Companies</td>
</tr>
<tr>
<td>Financial Institutions</td>
</tr>
<tr>
<td>Financial and Capital Markets</td>
</tr>
<tr>
<td>Domestic/Foreign funds for growth</td>
</tr>
</tbody>
</table>

- The FSA will establish the Expert Panel on Sustainable Finance compromised of the business, financial, and academic experts with observers from pertinent ministries and agencies.

**Themes (provisional)**

- **Driving Sustainable Finance by financial institutions**
  - Support client companies through investment and financing so that they can use the potential and technological strength and promote the transition to a carbon neutral society
- **Providing investment opportunities for investors through financial and capital markets**
  - Broadly provide investment opportunities and gains contributing to a carbon neutral society
- **Promoting disclosures of climate related information by companies**
  - Visualise initiatives for innovation within companies so that it leads to financing valuable technologies and projects

* Another meeting body is to be established under the Expert Panel to discuss the formulation of practical guidelines concerning social bonds.

Source: Financial Services Agency of Japan.
institutional investors and financial institutions to take initiatives to internalize externalities and to overcome bounded rationality for the benefit of their own self-interest. The recommendations by the expert panel will be consistent with this overall philosophy.

1.8 Ecosystem of Sustainable Finance in the Asia and Pacific Region

For developing and emerging economies, the appetite for economic growth will continue to be strong over the coming decades. As history shows, it is true that economic growth is the most effective way of poverty reduction and human development. Therefore, pursuing economic growth while properly managing the level of ecological footprints will become the primary objective for many developing and emerging economies in order to make sure such economic growth will be sustainable. Against this backdrop, strengthening ESG investment and sustainable investment is a very important concern even for developing and emerging economies. A basic requirement for achieving this is, as in the case of developed economies, to develop a well-functioning investment chain comprised of asset owners, asset managers, and corporations with long-term perspectives, supported by sustainable finance market infrastructure such as sustainability reporting standards for corporations and financial materiality aligned ESG data and ratings. This will act as an anchor for corporate and financial activities to hold on to long-term enterprise value creation and integration of sustainability into their decision making. Developing and emerging economies may well experience a higher rate of economic growth that could likely result in a massive increase in ecological footprints. So a well-designed plan by the government to obtain more economic growth per unit of an ecological footprint will become even more critical. In particular, involving every sector of the economy toward this goal is essential. In doing that for the most pressing sustainability challenge, i.e., climate change, a balanced combination of greening and transitioning economic activities will be a key success factor. Where a proven technology for reducing carbon emissions to zero or near-zero can be applied and replicated, expanding the relative share of its adoption within the economy will be an immediate policy objective. But where no such a technology exists, policy actions must be taken toward: first, increasing the adoption of best available technologies to reduce carbon emissions even if they will not reach a level of zero or near zero emissions; second, demanding a group of high carbon-emitting companies to design their own credible pathways to carbon neutrality; and last but not least, supporting and
facilitating new technological innovations for realizing zero or near-zero carbon emissions. The TGIF strategy is very much valid not only for Japan but also for developing and emerging economies. Japan has close relationships with countries in the Asia and Pacific region in terms of its global value chains. In order to strengthen the resilience of the value chains, creating an ecosystem in Asia for sustainable finance, which addresses environmental and societal sustainability, will be in the shared interest for every Asian and Pacific economy.

1.9 Conclusion

The critical mission of the financial system is to support the proper functioning of the economic system so that sustainable growth can be achieved without disruptions. Due to a sharp acceleration of human activities, however, the economic system has come to face planetary boundaries and as a result has been increasingly required to reinvent itself so as to support sustainable growth. As challenges pertaining to planetary boundaries are mounting, the vision and mission of the financial system also needs to transform itself accordingly in its interaction with the overall economic system. This is the fundamental background behind the recent rise of sustainable finance. The question is whether this trend will change the basic principle of finance. Namely, the long-standing tenet of finance has been to require a return over cost of capital. This has effectively meant demanding a surplus of earnings over costs in business activities and, through the cycle of capital reproduction, driven economic growth as industrialization advances. In my view, this principle of finance will remain intact even under the age of sustainable finance. There are two reasons. One is that economic growth is still necessary for human development around the world. Finance must support it by strongly backing the process of economic reproduction. Another reason is that enhancing sustainability of nature and society calls for transformation of the socioeconomic system, which in turn requires a huge sum of financial resources. In order to fulfill it, the continued reproduction of capital is indispensable. Rather than that, a significant change will occur in the way returns and cost of capital are calculated. Sustainability-related matters will be a risk driver and an earnings driver. So it must feed into the calculation of expected returns. What could hinder the integration of ESG and/or sustainability into the risk-return calculation is short-termism among institutional investors and financial institutions as well as businesses. So rectifying the market failure is a fundamental action by regulators in promoting sustainable finance. What is important is to facilitate a financial assessment
of sustainability-related risks and opportunities to the extent that institutional investors and financial institutions can make a reasonable judgement of their risk-return structure. Everything is not necessarily quantifiable. So we must seek the right combination of quantitative and qualitative data to assist such a judgment process. As discussed above, those data will need to be aligned with financial materiality whether they come directly from corporate disclosures or are processed by data providers. In this regard, there are currently several attempts to develop a sustainability taxonomy, a system of classifying economic activities according to the degree of sustainability. The immediate concern is that such a classification system might end up with inefficient allocation of capital unless the system is sufficiently based on risk-return considerations of sustainability. The economic driver of expanding sustainable business activities must be the desire of pursuing the long-term enterprise value creation. Enterprise value would be impaired by damage caused by negative effects of failing to address sustainability of nature and society. Enterprise value would also be depreciated by failing to adapt to evolving changes in policies, regulation, and consumer preference to address sustainability. These things ought to happen in the long run. So protecting the long-term enterprise value will demand preparedness for these things. Sustainable finance must be the one to encourage concrete actions against this challenge. It is an urgent need to establish such an ecosystem of sustainable finance. If the Asia and Pacific region wishes to thrive on the continued growth of the global economy in the coming decades, coordinated action for creating a sustainable finance ecosystem is vital. Japan is committed to acting on this matter and building the model that can be replicated by other countries.
Reference

2

Japan’s Green, Social, and Sustainability Bond Market: Recent Trends and Future Outlook

Akane Enatsu

2.1 Introduction

Investment concepts that take into account environmental, social, and governance (ESG) factors have become widely used in the world’s financial markets, since the start of the 21st century, especially in Europe and the United States. In Japan, a growing number of investors, issuers, and other market participants have become conscious of the need for sustainable finance since 2015, when international agreements such as the Paris Agreement and the United Nations (UN) Sustainable Development Goals (SDGs) were established. Additionally, Japan’s Government Pension Investment Fund (GPIF), the world’s largest pension fund, became a signatory to the UN’s Principles of Responsible Investment (PRI) around this time (Table 2.1).

This article is focused on green, social, and sustainability (GSS) bonds in sustainable finance markets. We will first look at the issuance and investment in such bonds to date, after which we will discuss the challenges facing the development of the GSS bond market and sustainable finance in Japan.
<table>
<thead>
<tr>
<th>Time</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>1920s</td>
<td>Socially responsible investment concept emerges from Christian churches in United States and United Kingdom</td>
</tr>
<tr>
<td>April 2006</td>
<td>Principles of Responsible Investment advocated as a universal guideline for fulfilling fiduciary responsibility by incorporating environmental, social, and governance (ESG) factors into the investment decision-making process</td>
</tr>
<tr>
<td>January 2014</td>
<td>Green Bond Principles established by a consortium of financial institutions</td>
</tr>
<tr>
<td>February 2014</td>
<td>Japan’s Financial Services Agency (FSA) announced its Stewardship Code</td>
</tr>
<tr>
<td>August 2014</td>
<td>Japan’s Ministry of Economy, Trade and Industry released “Ito Review”</td>
</tr>
<tr>
<td>June 2015</td>
<td>Tokyo Stock Exchange formulated its Corporate Governance Code</td>
</tr>
<tr>
<td>September 2015</td>
<td>Japan’s Government Pension Investment Fund became a signatory to the Principles of Responsible Investment</td>
</tr>
<tr>
<td>September 2015</td>
<td>Sustainable Development Goals (SDGs) adopted at United Nations Summit</td>
</tr>
<tr>
<td>December 2015</td>
<td>Paris Agreement, a new international legal framework on climate change measures, is signed by participants at the 21st Conference of the Parties to the United Nations Framework Convention on Climate Change</td>
</tr>
<tr>
<td>March 2017</td>
<td>Japan’s Ministry of the Environment announced “Green Bond Guidelines, 2017”</td>
</tr>
<tr>
<td>May 2017</td>
<td>Japan’s FSA announced Stewardship Code (revised edition)</td>
</tr>
<tr>
<td>June 2017</td>
<td>International Capital Markets Association (ICMA) announced Social Bond Principles and Sustainability Bond Guidelines</td>
</tr>
<tr>
<td>June 2017</td>
<td>Financial Stability Board’s Task Force on Climate-related Financial Disclosures released final report with its recommendations for climate-related financial disclosures</td>
</tr>
<tr>
<td>November 2017</td>
<td>The Japan Business Federation (Keidanren) revised its Charter of Corporate Behavior with a focus on achieving the SDGs through realization of Society 5.0</td>
</tr>
<tr>
<td>March 2018</td>
<td>European Commission announced action plan for financing sustainable growth</td>
</tr>
<tr>
<td>June 2018</td>
<td>Tokyo Stock Exchange announced Revised Corporate Governance Code</td>
</tr>
<tr>
<td>March 2020</td>
<td>Japan’s Ministry of the Environment announced “Green Bond Guidelines 2020” and “Green Loan and Sustainability-linked Loan Guidelines 2020”</td>
</tr>
<tr>
<td>March 2020</td>
<td>Japan’s FSA finalized Stewardship Code (second revised edition)</td>
</tr>
<tr>
<td>June 2020</td>
<td>ICMA announced Sustainability-Linked Bond Principles</td>
</tr>
<tr>
<td>October 2020</td>
<td>Prime Minister Yoshihide Suga (at that time) announced a policy to achieve real zero greenhouse gas emissions by 2050</td>
</tr>
<tr>
<td>December 2020</td>
<td>ICMA announced Climate Transition Finance Handbook</td>
</tr>
</tbody>
</table>

Note: Bold text indicates initiatives related to Japan.
Source: Nomura Institute of Capital Markets Research.
2.2 Green, Social, and Sustainability Bond Issuance to Date

2.2.1 Global GSS Bond Issuance

The issuance of bonds dedicated to funding efforts to resolve environmental and social issues began in the latter half of the first decade of this century. Initially, these bonds were issued mainly by the public sector. For example, (i) the first green bond is considered to be the Climate Awareness Bond issued by the European Investment Bank in June 2007,\(^1\) (ii) the first social bond was a vaccine bond issued by the International Financial Facility for Immunisation in November 2006 (Munro 2017, IFFIm 2006), and (iii) the world’s first sustainability bond is considered to have been issued in December 2008 by the regional government of the Nord-Pas-de-Calais, a former administrative region in France (now incorporated into the Haut-de-France) in December 2008.\(^2\)

The issuance of GSS bonds has become more common since the mid-2010s, encouraged by the Green Bond Principles established by a consortium of financial institutions in January 2014 and such international agreements as the Sustainable Development Goals (SDGs) and the Paris Agreement, both adopted in 2015. Issuance has continued to increase, supported by an expansion of the issuer base to include private sector financial institutions and nonfinancial corporations. Among the three types of GSS bonds, issuance has focused on green bonds, but issuance of social bonds increased sharply in 2020, as the global coronavirus disease (COVID-19) pandemic focused more attention on social issues. According to Bloomberg statistics, outstanding GSS bonds (excluding municipal bonds in the United States and securitized products) amounted to $1.23 trillion as of end-December 2020 (Figure 2.1, upper left).

Looking at the composition of that global bond outstanding, green bonds account for 72% of the total, social bonds 16%, and sustainability bonds 12%. By country or region, issuers in Europe have been the most active, especially those in France, Germany, and the Netherlands. By issuer sector, financial institutions and government agencies are the leaders. The main issuance currency has been the euro, accounting for more than half of all issuance, followed by the US dollar, at more than a quarter of total issuance. GSS bonds with maturities of 2–5 years and 6–10 years have been dominant, but the average weighted initial maturity

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\(^1\) The first bond to be labeled a “green bond” was issued in 2008 by the World Bank (World Bank 2015).

\(^2\) Based on Bloomberg statistics.
of outstanding issues is about 10.8 years. The outstanding balance of GSS bonds issued by Japanese entities is approximately $43.9 billion, approximately 4% of the global total.

**Figure 2.1: GSS Bonds Issued around the World**

**Issuance trend by bond type**

<table>
<thead>
<tr>
<th>Calendar Year</th>
<th>Green</th>
<th>Social</th>
<th>Sustainability</th>
</tr>
</thead>
<tbody>
<tr>
<td>2008</td>
<td>10</td>
<td>5</td>
<td>45</td>
</tr>
<tr>
<td>2009</td>
<td>15</td>
<td>10</td>
<td>30</td>
</tr>
<tr>
<td>2010</td>
<td>20</td>
<td>15</td>
<td>25</td>
</tr>
<tr>
<td>2011</td>
<td>25</td>
<td>20</td>
<td>15</td>
</tr>
<tr>
<td>2012</td>
<td>30</td>
<td>25</td>
<td>10</td>
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<tr>
<td>2013</td>
<td>35</td>
<td>30</td>
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<tr>
<td>2014</td>
<td>40</td>
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<tr>
<td>2015</td>
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<tr>
<td>2016</td>
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<td>45</td>
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<tr>
<td>2017</td>
<td>55</td>
<td>50</td>
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<tr>
<td>2018</td>
<td>60</td>
<td>55</td>
<td>45</td>
</tr>
<tr>
<td>2019</td>
<td>65</td>
<td>60</td>
<td>50</td>
</tr>
<tr>
<td>2020</td>
<td>70</td>
<td>65</td>
<td>55</td>
</tr>
</tbody>
</table>

**Bonds outstanding by country**

- France: 15%
- Supranational: 12%
- Germany: 10%
- Netherlands: 9%
- United States: 8%
- Japan: 5%
- Other countries: 24%
- Spain, Sweden, and Republic of Korea: 4%
- PRC: 8%

**Bonds outstanding by issuer sector**

- Government Agencies: 18%
- Banks: 15%
- Transportation: 15%
- Power Generation: 9%
- Real Estate: 9%
- Utilities: 9%
- Local Governments: 7%
- Sovereign: 6%
- Supranationals: 12%
- Others: 15%

**Bonds outstanding by currency of denomination**

- EUR: 51%
- USD: 26%
- AUD: 12%
- JPY: 3%
- SEK: 6%
- RMB: 4%

**Bonds outstanding by length of maturity at issuance**

- 1 year: 100
- 2-5 years: 200
- 6-10 years: 300
- 11-20 years: 400
- 21-30 years: 500
- 31+ years: 600

GSS = green, social, and sustainability, AUD = Australian dollar, CAD = Canadian dollar, GBP = British pound, EUR = euro, USD = US dollar, RMB = renminbi, SEK = Swedish krona, JPY = Japanese yen, PRC = People’s Republic of China.

Note: Issuance amount (as of 31 December 2020) is based on green bonds, social bonds, and sustainability bonds defined by Bloomberg. Excluding municipal bonds in the United States and securitized products. Value is on a US dollar basis.

Sources: Bloomberg; Nomura Institute of Capital Markets Research.
2.2.2 GSS Bond Issuance in Japan

The first issuance of a GSS bond by a Japanese entity was a green bond issued overseas by the Development Bank of Japan in September 2014. The first GSS bond to be issued in Japan was a social bond issued by the Japan International Cooperation Agency (JICA) in September 2016. GSS bond issuance by Japanese entities has increased steadily since then. While most of the earliest issues by Japanese entities were made in overseas markets by government agencies and financial institutions, domestic issuance has increased since 2017, underpinned by the Ministry of the Environment’s initiatives in support of green bonds (discussed in Section 2.2.1) (Figure 2.2).

According to Bloomberg data (as of end-December 2020), outstanding GSS bonds from Japanese issuers has expanded to $43.9 billion, of which green bonds account for 49%, social bonds 28%, and sustainability bonds 23%. The breakdown by issuer sector shows government agencies and financial institutions account for more than half. Yen-denominated bonds account for 74% of issuance by Japanese entities, with euro- and US dollar-denominated bonds accounting for 16% and 9%, respectively. Most GSS bonds issued by Japanese issuers have maturities of 5 or 10 years, the norm for bond issues in the Japanese market, with the weighted average maturity about 9.5 years.

GSS bond issuance by Japanese issuers has two noteworthy features. The first feature is the increase in the issuance generated by the Ministry of the Environment’s (MOE) green bond support measures. The main support measures introduced by the MOE are its Pilot Project for Green Bond Issuance that started in fiscal year (FY) 2017 and its Financial Support Programme for Green Bond Issuance (Subsidy Project) launched in FY2018. The pilot project promotes green bond issuance by finding and disseminating examples of issues that align with the Green Bond Guidelines established by the MOE in March 2017 (revised in March 2020) and could therefore be considered models for the issuance of green bonds. The project solicited applications from prospective green bond issuers. The solicited issues to fund projects with potential as green projects were reviewed by the MOE and a contracted party. If found to be compliant with the Green Bond Guidelines, they were selected as models, and information about those issues was widely

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3 The MOE’s Green Bond Guidelines were formulated with due consideration of the need for consistency with the Green Bond Principles issued by the International Capital Markets Association and recognized internationally. By making Japan’s guidelines consistent with the international principles, green bonds issued in Japan can be recognized as such internationally.
Strengthening Environmental, Social, and Governance Investment under COVID-19

As of end-2020, six issues have been selected as model green bond issues (MOE).

Under the Financial Support Programme, the MOE provides subsidies for expenses required by service providers that support

Figure 2.2: GSS Bonds Issued by Japanese Issuers

Issuance trend by bond type

Bonds outstanding by bond type

Sustainability 23%
Green 49%
Social 28%

Bonds outstanding by issuer sector

Bonds outstanding by currency of denomination

GSS = green, social, and sustainability, AUD = Australian dollar, USD = US dollar, JPY = Japanese yen, EUR = euro.

Note: Issuance amount (as of 31 December 2020) is based on green bonds, social bonds, and sustainability bonds defined by Bloomberg. Excluding securitized products. Value is on a US dollar basis.

Sources: Bloomberg; Nomura Institute of Capital Markets Research.

disseminated. As of end-2020, six issues have been selected as model green bond issues (MOE).

Under the Financial Support Programme, the MOE provides subsidies for expenses required by service providers that support
corporates, local governments, and other entities seeking to issue green bonds. The support services covered by MOE subsidies include external reviews and consultations on establishing a green bond framework. If the project to be financed by the bond issuance fulfills the MOE’s criteria for a green project, the issuer’s financial burden of obtaining external evaluations and other required issuance support services can be reduced. As a result, many potential issuers, especially nonfinancial corporates, have begun efforts to issue green bonds, and GSS bond issuance is expanding to a wide variety of private-sector industries. Since 2018, a number of issuers, including nonfinancial private sector companies, have been repeatedly issuing GSS bonds. In addition to the above MOE measures, the increase in GSS bond issuance by private-sector issuers since 2018 may have been stimulated by the November 2017 revision to the Japan Business Federation (Keidanren)’s Charter of Corporate Behavior, which makes delivering on SDGs through the realization of Society 5.0 a core objective of corporate behavior.

The second feature is the scale of continuous issuance by government agencies and the large presence of social bonds. In Japan, the Fiscal Investment and Loan Program (FILP or zaito) reforms implemented in FY2001 require government agencies (zaito agencies) to procure funds from the financial markets in the form of zaito agency bonds as much as possible. As of FY2020, there are 16 zaito agencies issuing zaito agency bonds. Government agencies are tasked with responding to the important policy issues facing the Japanese government. As such, many

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4 As of end-2020, the MOE has sent notifications of its decision to grant the subsidy for 111 projects. (Ministry of the Environment, Green Finance Portal, Financial Support Programme for Green Bond Issuance, etc. [Subsidy Project]), http://greenfinanceportal.env.go.jp/en/bond/promotion_support/issuance_list.html (accessed 31 March 2021).

5 The FILP reform of FY2001 drastically changed the nature of FILP and the way it raised funds from compulsory deposits of postal savings and pension reserves into a funding scheme centered on the issuance of FILP bonds (government bonds). Specific reforms included (1) abolishing the obligation to deposit postal savings and pension funds of the Fund Management Department; (2) continuously reviewing FILP target areas and projects in terms of their complementary role to private business; (3) raising only the amount of funds needed to finance FILP agency projects through market issuance of FILP bonds (government bonds) or zaito agency bonds (Ministry of Finance, Materials Related to FILP Reform [in Japanese]).

6 Zaito agency bonds are publicly offered bonds that are issued in the financial market by zaito agencies (institutions that utilize the FILP, i.e. fiscal loans, industrial investments, government guarantees) and do not have government guarantees on outstanding principal and interest. Introduced in the 2001 FILP reform, these zaito agency bonds function as one of the financing methods for zaito agencies.
are currently working to resolve environmental and social issues. Some have issued green bonds and sustainability bonds, and several have issued social bonds. For example, all JICA agency bonds issued since September 2016 by the Japan International Cooperation Agency (JICA) to fund its official development assistance loan program (projects in line with the Japanese government’s policy of providing development assistance to developing countries based on United Nations and World Bank standards) have been social bonds. Similarly, all bonds issued since August 2018 by the Japan Student Services Organization to fund its Category 2 scholarship loans (interest-bearing loans) for post-secondary Japanese students also have been social bonds, as have been all the bonds issued since July 2019 by the East Nippon Expressway Company to finance the regional revitalization, disaster countermeasures, traffic safety promotion, and environmental conservation activities of its expressway business.

The COVID-19 pandemic that has swept across the globe since February 2020 has led to the issuance of many so-called “COVID-19 bonds” to fund responses to the pandemic. Some of them are issued as “COVID-19 GSS bonds” in accordance with the Social Bond Principles or Sustainability Bond Guidelines of the International Capital Market Association (ICMA). As of end-December 2020, Japanese issuers of COVID-19 GSS bonds include three financial institutions—the Mitsubishi UFJ Financial Group, the Development Bank of Japan, and Chugoku Bank—and retail company, Aeon Mall.7

2.3 Investment in Green, Social, and Sustainability Bonds

2.3.1 Overseas Investors in GSS Bonds

There seem to be no comprehensive statistics on the GSS bond investor base at this moment. However, for instance, the green bond investor base ranges from large mainstream institutional investors to investors specializing in environmental, social, and governance (ESG) and socially responsible investments and retail investors (Table 2.2). Some major institutional investors have disclosed their investment in green bonds, such as Zurich Insurance (total $5 billion, November 2017)

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7 Among three entities, Chugoku Bank has issued social bonds while the other three all issued sustainability bonds.
Pension funds also are an important green bond investor group. The World Bank’s first green bond issuance in 2008 was motivated by Scandinavian pension funds’ demand for fixed income investment products that were used for climate-focused projects. Since then, many pension funds have been proactively investing in green bonds and other GSS bonds.

Table 2.2: Main Types of Investors in Green Bonds and Specific Examples

<table>
<thead>
<tr>
<th>Type</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mainstream institutional investors</td>
<td>Amundi, Aviva, AXA, BlackRock, State Street</td>
</tr>
<tr>
<td>Specialist ESG and responsible investors</td>
<td>Natixis, Mirova, ACTIAM</td>
</tr>
<tr>
<td>Corporate treasury</td>
<td>Barclays, Apple</td>
</tr>
<tr>
<td>Sovereign and municipal governments</td>
<td>Central Bank of Peru, California State Treasurer</td>
</tr>
<tr>
<td>Central Bank of Peru, California State Treasurer</td>
<td>World Bank issuances for retail investors through Merrill Lynch Wealth Managers and Morgan Stanley Wealth Managers. International Finance Corporation (IFC) and SolarCity issuances for retail investors through Incapital</td>
</tr>
</tbody>
</table>

Sources: Climate Bonds Initiative, Investor Appetite; Nomura Institute of Capital Markets Research.

2.3.2 Japanese Investors in GSS Bonds

Japan also has no detailed information on investors in GSS bonds, however the types of investors purchasing GSS bonds is diverse, ranging from institutional insurance companies, banks and investment funds, and other institutional investors to nonfinancial corporates, nonprofit organizations, and retail investors.

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8 Parentheses show targeted investment amounts and date announced. Zurich Insurance’s target is for its impact investing. KfW reached the initial target volume of the portfolio of €2 billion in February 2021. KfW announced that it will continue investing in green bonds and will maintain the portfolio volume at a level of €2–2.5 billion (Zurich Insurance 2017, KfW 2017).
Japan’s largest investor is the Government Pension Investment Fund (GPIF), a government-affiliated entity that manages the national pension system’s pension reserves. The GPIF, which invests through an external investment management company, signed the PRI in September 2015, as noted earlier. In October 2017, the GPIF revised its investment principles to promote investments that take into account ESG factors, including in stocks, bonds, and other asset classes. Later that same month, the GPIF entered into a joint research project on bonds and ESG with the World Bank Group that led to the release in April 2018 of a report titled “Incorporating Environmental, Social and Governance (ESG) Factors into Fixed Income Investment.” Since April 2019, the GPIF has taken the initiative to provide its asset manager with opportunities to invest in GSS bonds issued by several supranational entities, including the World Bank Group.

Other Japanese investors in GSS bonds include Nippon Life Insurance, which has set a target of ¥700 billion for ESG investments, including GSS bonds, in its medium-term management plan for FY2017–2020. The insurer has since disclosed that its investments to date include green bonds issued by the City of Paris, environmentally friendly bonds issued by Transport for London, and Tokyo Green Bonds issued by the Tokyo Metropolitan Government. In addition, Dai-Ichi Life Insurance’s basic ESG investment policy formulated in April 2020 states that ESG factors should be incorporated into its management policies and practices for all assets (target completion by FY2023). The basic policy also mentions that Dai-Ichi Life Insurance in several GSS bonds as part of a theme-based approach to investment.

2.4 Sustainability-related Challenges in Japan

Japan’s financial market, while lagging those in the US and Europe, is seeing a steady increase in GSS bond issuance and diversification of issuers. Looking ahead, the GSS bond market and sustainable finance in Japan could be further developed by advancing the development of financial products and system design with a focus on resolving Japan’s sustainability-related challenges. The main challenges that need to be addressed are: (i) energy-related problems, (ii) natural disasters, (iii) economic disparity and poverty, (iv) a declining population, declining birthrate, and aging population, and (v) the stagnation of regional economies.

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9 Nippon Life Insurance, ESG Investment and Financing.
10 Dai-Ichi Life Insurance, ESG Investment.
2.4.1 Energy-related Problems

Japan has long been heavily dependent on imports for most of its energy sources. The situation has been worsened by the sustained shutdown of nuclear power plants following the Great East Japan Earthquake in March 2011 and the resulting increase in the operation of thermal power plants. This pushed up Japan’s dependence on fossil fuels to 85.5% of the country’s primary energy sources in 2018.

In October 2020, Prime Minister Yoshihide Suga (at that time) announced that his administration would aim to put Japan on a course to achieve greenhouse gas emissions to net zero by 2050. In December 2020, Japan’s Ministry of Economy, Trade and Industry (METI) announced its “Green Growth Strategy Through Achieving Carbon Neutrality.” METI’s strategy emphasizes the importance of transition finance and innovation finance. The plan is to formulate basic transition finance guidelines based on international principles and to create a roadmap for high-emission industries that cannot be decarbonized in a single step.

Transition bonds have been issued in other countries in recent years, but as of December 2020 no Japanese issuer has launched a transition bond. Meanwhile, the International Capital Markets Association released the Climate Transition Finance Handbook in December 2020, and the Japanese government plans to formulate its own basic guidelines for transition finance. As such, we expect to see several Japanese corporates issue transition bonds to fund their efforts to transition toward net-zero carbon emissions.

To ensure that Japan achieves its goal of net zero greenhouse gases by 2050, transition activities by corporations and the transition finance that funds those activities will need to be supported by the Japanese government, financial institutions, industry, academia, and citizens. In particular, support from local economic and community leaders, i.e., local governments and regional banks, will be crucial for small and medium-sized enterprises, which account for 99.7% of all corporations in Japan.

2.4.2 Natural Disasters

Japan contends with a wider variety and greater frequency of natural disasters than most other countries. Japan is often hit by typhoons, heavy snowfalls, floods, landslides, earthquakes, tsunamis, and volcanic eruptions. In the 2020 edition of the World Risk Report, which covers 181 countries and was prepared by an association comprising German support institutions and other organizations, Japan is ranked 10th in
the world in terms of the likelihood of being hit by a natural disaster (Bündnis Entwicklung Hilft 2020). According to the Japanese Cabinet Office, natural disasters in Japan during 1984–2013 caused about $420.9 billion in damage, which is about 17.5% of the damage caused by disasters around the world during that period. Japan’s disaster-related fatalities during this period came to about 29,000, about 1.5% the global total (Cabinet Office 2014).

The cost of post-disaster recovery initiatives is mostly covered by local and national government supplementary budgets. However, the March 2011 Great East Japan Earthquake and other recent natural disasters have contributed to the deterioration of government finances. In addition, as was seen after the Great East Japan Earthquake and the Great Hanshin–Awaji Earthquake that hit in January 1995, it can take a long time for the local economy and social environment to rebound and for disaster victims to return to the lifestyles they enjoyed before the disaster.

Financial products that respond to natural disasters include, for example, (i) social bonds used to fund social projects providing assistance to vulnerable groups, including victims of natural disasters, and (ii) catastrophe (CAT) bonds issued by insurance companies and others to avoid losses related their coverage of damages caused by natural disasters, including earthquakes, typhoons, and infectious disease pandemics. However, considering the recent increase in large-scale natural disasters and the emergence of previously unimaginable risks, such as the global COVID-19 pandemic, development of new financial instruments that can meet future needs stemming from such risks must be continued and accelerated.

2.4.3 Economic Disparity and Poverty

Japan is said to have one of the highest poverty rates among developed countries. There are two types of poverty—absolute poverty and relative poverty. Japan has a high relative poverty rate, which is the proportion of people whose income is less than half the nation’s median income and therefore reflects a wide income gap. According to a survey by the Ministry of Health, Labour and Welfare, Japan’s relative poverty rate was 15.7% in 2018 (Ministry of Health, Labour and Welfare 2020). That rate rose to 48.3% for single-parent households.

Childhood and generational poverty are particularly problematic. The children of low-income families tend to have low academic ability and poor educational backgrounds that lead to unstable employment in the future. As a result, the poverty condition is passed on to the next generation. In Japan, where the government is facing a difficult fiscal situation, the public burden ratio for preschool education and higher
education costs is relatively low compared with that in other member states of the Organization for Economic Co-operation and Development. Conversely, the burden on household finances is relatively heavy.

Sustainable finance–related financial instruments include social bonds used to fund social projects to support poverty. An example of bond issuance targeting poverty by a Japanese issuer is JICA’s social bonds, which are used to fund the agency’s cooperative development projects in developing countries. Meanwhile, social impact bonds include efforts by the Osaka Prefecture to promote the registration of foster parents, and by the City of Sakura, Chiba Prefecture to support employment of the needy (Japan National Advisory Board, The Global Steering Group for Impact Investment 2021).

While there are some examples as noted above, Japan needs to make a greater effort to address economic disparity and the poverty problem. Such an effort will require more organizations applying diverse approaches take up the battle against poverty. This could be aided by the development of a more diverse portfolio of financial instruments, such as social bonds.

### 2.4.4 Declining Population and Birthrate and Aging Population

Japan’s population has been declining since 2008, and the decline in its birthrate and aging of its population are progressing at a faster pace than seen in other countries. From a financial perspective, social security costs are increasing. As a result, national and local government finances are becoming tighter, and it is becoming difficult to generate the financial resources needed to fund areas crucial to shaping the future, such as education, science and technology, as well as the maintenance and renewal of social infrastructure and public facilities, which are in need of rejuvenation nationwide. In Japan, three of the four key social security domains—medical care, long-term care, and childcare—fall under the jurisdiction of local governments, with the lone exception being pensions. This burden is increasing year by year as the birthrate declines and the population ages.

In the medical care area, for example, several Japanese local governments have used social impact bonds to help defray the rising burden of medical expenses in recent years. On the other hand,

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11 Examples of medical care–related social impact bonds in Japan include two issues in 2017—one by Hachioji City in Tokyo Prefecture to fund an increase rate of colorectal cancer screening among city residents, and the other by Kobe City in Hyogo Prefecture to fund a program to preventing severe diabetic nephropathy.
we have yet to see any local government issue a social bond as of end-2020.\textsuperscript{12} In other countries, however, we have several examples of local governments and financial institutions, such as Spain’s Community of Madrid, the Wallonia region in Belgium, and the French local public development bank Société de Financement Local (SFIL), issuing social bonds to fund public hospitals and their regional medical systems.

Of course, from the fiscal discipline perspective, it would be better to generate financial resources without issuing bonds by securing tax revenues and achieve fiscal balance by reducing expenditures. However, with Japan’s birthrate expected to continue falling and its population growing older, it will be difficult to reduce social security costs significantly. If the bond issuance environment is favorable, issuing social bonds may be considered a useful means of securing needed financial resources. At the same time, developing social impact bonds and financial instruments other than social bonds may help alleviate the social issues caused by a shrinking population, declining birthrate, and aging population.

2.4.5 Stagnation of Regional Economies

Population decline is occurring throughout Japan, but its impact is greatest in regions outside the major urban centers. Looking at regional demographics, many regions, especially rural areas, are experiencing population outflows while the Tokyo metropolitan area continues to see an influx. While this trend has been partially alleviated by the COVID-19 problem, it is often pointed out that continued economic stagnation and population outflows from regional areas could cause the disappearance of many local governments in the future.\textsuperscript{13} The Japanese government has been promoting regional revitalization since FY2015 with the aim of creating autonomous and sustainable regional societies that take full advantage of their special characteristics. Furthermore, as the SDGs’

\textsuperscript{12} However, as of end-December 2020, green bonds have been issued by Tokyo Metropolitan Government, Nagano Prefecture and Kanagawa prefectures, and the Japan Finance Organization for Municipalities, a local joint funding organization for local governments. In addition, social bonds have been issued by housing supply corporations established by local governments in Osaka Prefecture and the Tokyo Metropolitan Government.

\textsuperscript{13} According to a study by the Japan Policy Council, if population outflows from regional areas continue, 896 regional municipalities (49.8% of the total number) will see their population of young women (20–39 years of age) decrease by more than 50% by 2040. The study points out that such local governments could cease to exist even if their birth rate rises. (Japan Policy Council Subcommittee on Population Decline 2014).
17 goals are consistent with the goals of Japan’s regional revitalization, the Japanese government has supported the promotion of SDGs in local governments and from FY2018 recognized cities whose local governments have proposed excellent SDG initiatives as “SDGs Future Cities.” This effort, however, has not produced a significant change in population flows.

Regional financial institutions and ESG finance are expected to play key roles in resolving regional issues related to regional revitalization and SDGs. The Cabinet Office has therefore been promoting the evaluation and study of the best methods for using SDGs and ESG finance to resolve regional social issues. In March 2019, the Cabinet Office announced its basic concept for promoting SDGs finance for regional revitalization. This document presents (i) the roles that stakeholders are expected to play to realize an autonomous virtuous cycle and (ii) a plan to build an “SDGs for regional revitalization financial framework” that will begin with a visualization of initiatives by regional businesses to achieve SDGs and then move to promotion of collaboration among regional financial institutions and regional businesses through SDGs, and finally the promotion of cooperation through SDGs among regional financial institutions, institutional investors, major banks, and securities companies.

Meanwhile, the MOE has supported nine regional financial institutions’ efforts to promote ESG finance that contributes to improving regional sustainability and creating regional circular and ecological spheres (Regional CES). Based on the results of that support project, in April 2020 the MOE published a “Practical Guide to Regional ESG Finance” as a guide for regional financial institutions’ efforts in the field of ESG regional finance. Specifically, the guide instructs regional financial institutions on providing financing based on business feasibility assessments that consider ESG factors while also supporting the client’s main business.

As of end-December 2020, these government efforts have contributed to the issuance of GSS bonds by three regional banks—Gunma Bank, the Bank of Nagoya, and Chugoku Bank. On the other hand, Shiga Bank, which in February 2020 became the first Japanese regional financial institution to sign the Principles for Responsible

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14 The concept of regional circular and ecological spheres (Regional CES) aims to maximize the vitality of the local community by creating a self-reliant and decentralized society while making maximum use of local resources such as beautiful natural landscapes, and by complementing and supporting resources in accordance with the characteristics of the local community. This concept was proposed in the “Fifth Basic Environmental Plan” adopted by the Cabinet in April 2018 (MOE 2018).
Banking, has not yet issued a GSS bond, but has been actively engaged in ESG finance by (i) issuing sustainability-linked loans, (ii) underwriting green bonds, and (iii) underwriting and supporting the issuance of GSS private placement bonds.\textsuperscript{15} Looking forward, GSS bonds and other sustainable finance instruments hopefully will be used by regional financial institutions as they play a central role in resolving regional issues.

This chapter has presented some of Japan’s sustainability-related challenges and the areas where those challenges might be addressed using sustainable finance, such as GSS bonds. The development of Japan’s GSS bond market and sustainable finance will depend on governments, corporates, investors, financial institutions, and citizens taking on these sustainability-related challenges and seeking to resolve them through sustainable finance. Although the challenges vary from country to country, Asian countries are neighbors in a relatively small part of the world and will therefore need to work together to solve the environmental and social problems that need to be addressed to realize sustainable economies and societies.

\textsuperscript{15} For SDG private placement bonds, if the company issuing the bond submits an “SDGs Supporting Form” to Shiga Bank, the bank will contribute 0.2\% of the issuance amount to schools and designated public-service promotion corporation in the form of donated goods or funds to cover activity costs. (Shiga Bank 2020).
References


____. 2018. Regional Circular and Ecological Spheres. (in Japanese)


3

ESG Investment and the Allocation of Portfolio Assets

Naoyuki Yoshino and Tomonori Yuyama

3.1 Introduction

Our planet is facing serious environmental problems. In order to achieve a sustainable planet, financial allocation must be changed based on environment, social, and governance (ESG) criteria. Thus, the importance of ESG investment and green investment is widely discussed today. The purpose of this chapter is to show that different rating agencies provide different criteria for ESG investment currently, and how this affects effective ESG and green investment. The theoretical part of the chapter shows the distortion of asset allocation based on which rating agency is consulted by portfolio investors. Empirical analysis uses actual ESG scores of various companies and will show numerically how portfolio allocation is different depending on which rating agencies are selected. The same argument can be applied to green bonds. Some bonds are 90% green (and 10% gray) and other bonds have 80% greenness (and 20% gray). However, both these bonds can be issued as green bonds. Therefore, current green bonds can lead to distorted portfolio allocation in green sectors. This chapter recommends imposing greenness-adjusted greenhouse gas (GHG)

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1 The views expressed in this chapter are based on the personal views of the authors and not the views of the organizations to which they belong. Many parts of this chapter are taken from Yoshino and Yuyama (2021), with permission.

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taxes on emissions of carbons, plastics, etc., by each company to make investors watch after-tax rates of return for their portfolio investment. Another proposal is to establish a single credit rating of each company based on its emissions of pollutants. Otherwise, distorted portfolio allocation can persist.

The structure of the chapter is as follows. Section 3.2 provides an overview of ESG investment, and Section 3.3 describes the various definitions of ESG investment. Section 3.4 discusses green bond investments. Section 3.5 proposes a modified theoretical model of ESG investment and portfolio selection. Section 3.6 discusses the need to impose greenness-adjusted GHG taxation on carbon emissions. The last section concludes and provides policy proposals.

3.2 Environment, Social, and Governance Investment

ESG investment has become an important trend in the field of asset management. Investments that take ESG factors into account are called ESG investments. ESG investments are investments in companies that value these ESG factors and investments that take these factors into account when investing. Our planet is faced with serious environmental problems for a sustainable future unless CO$_2$ and other pollutants are drastically reduced.

The United Nations (UN) set up 17 Sustainable Development Goals (SDGs) with a target to achieve them by 2030. The goal is to “leave no one behind.” The SDGs aim to provide prosperity to the people and the planet for not only the current generation but also future generations. The creation of the SDG targets has been a major factor in the progress of ESG investments. The UN global agenda clarified the importance of the development of green energy and reducing pollutants such as CO$_2$, NOx, and plastics; however, data show that, based on the current mechanism, it is not possible to achieve these goals. If the current trajectory of global fossil fuel use continues, the planet's temperature is likely to rise by 4–6 degrees Celsius above the pre-industrial level. GHG emissions cause climate change, and global warming is now indisputable. In order to reduce GHG emissions, investors are requested to make their investment decisions based not only on the rate of return, but also ESG or “greenness” of companies (Sachs et al. 2019).

In order to increase the rate of return on green investment, a tax should be levied on emissions of CO$_2$, NOx, and plastics, and the revenues can be distributed to green sectors to increase the rate of return and to attract more investors. Taxation on GHGs would be best adjusted by taking into account a company’s efforts to promote greenness such as
planting trees and increasing forestry. Levying taxes on GHGs adjusted by greenness efforts will reduce the after-tax rate of return on various companies and investors can keep watching the rate of return and risks without paying attention to ESG since ESG components are adjusted by the after-tax rate of return.

Another proposal is to establish an accurate and unique credit rating of greenness of each company by measuring the emissions of CO$_2$, NOx, plastics, etc., adjusted by their greenness efforts to grow plants and forests. They will achieve optimal portfolio allocation without paying attention to the different definitions of ESG made by different rating agencies.

Institutional investors use different ESG rating companies, which define the criteria of ESG. Traditionally, investors watched (i) rate of return from investments, and (ii) risks associated with investments. The ESG component is an additional factor that investors must take into account. Investors now make their portfolio allocations by studying three factors: (i) risk, (ii) rate of return, and (iii) ESG. As the criteria of ESG by each ESG rating company are different, their measurements are also different. Different measures of ESG by different rating agencies will distort optimal portfolio investments. Much academic literature has been produced on the importance of green finance and investment in the deployment of renewable energy projects for GHG emissions reduction. However, we could not find any study that developed a model for calculating optimal portfolio allocations for investment in ESG. This chapter shows that the best policy will be to tax emissions of GHGs and pollutants such as CO$_2$, NOx, and plastics globally by adjusting greenness efforts by companies applying the same tax rate, forcing investors to focus on the rate of return and risk after a greenness-adjusted tax. An alternative method to achieve best policies for the environment is to make worldwide unique accurate credit ratings based on net emissions of CO$_2$, N$_2$O, plastics, etc., adjusted by greenness efforts.

3.3 Definitions of Environment, Social, and Governance Investment Depending on Different Rating Agencies

When institutional investors make ESG investments, they often refer to ESG scores provided by ESG rating agencies, and they tend to invest in companies with high ESG scores. The ESG indexes such as Morgan Stanley Capital International and the Financial Times Stock Exchange used by institutional investors are composed of companies with high ESG scores. However, it has been noted that ESG scores for the same companies differ widely from one assessment agency to another, and
that they do not tend to converge (GPIF 2019; Chatterji et al. 2016; Berg, Koelbel, and Rigobon 2020).

The reason for this is that the evaluation methodologies and criteria for ESG scores vary from one evaluating organization to another. Different agencies use their own criteria to evaluate a company’s ESG efforts, assign a score based on the degree of disclosure, use a score based on whether or not the company has an ESG policy, or use a score based on actual ESG activities such as CO₂ reduction judging from performance, and so on. Table 3.1 summarizes selected definitions of ESG components made by evaluating organizations. It raises issues such as whether ESG scores actually reflect ESG activities and outcomes of companies (Chatterji, Levine, and Toffel 2009; Drempetic, Klein, and Zwergel 2019).

The different standards of ESG are not only a problem for ESG rating agencies at the corporate level but also at the regional level such as the European Union (EU), the People’s Republic of China (PRC), and the International Organization for Standardization (ISO). They have been trying to establish separate standards for green finance and other issues (MUFJ Research and Consulting 2020). In particular, the EU has

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**Table 3.1: ESG Scores and Evaluation Methodologies of Major ESG Rating Agencies**

<table>
<thead>
<tr>
<th>ESG Scores</th>
<th>Overview of Rating Methodology</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bloomberg ESG Disclosure Scores</td>
<td>Evaluating by degree of ESG disclosure</td>
</tr>
<tr>
<td>FTSE Russell’s ESG Ratings</td>
<td>Evaluating by ESG risks based on disclosure and commitment to policy development and improvement</td>
</tr>
<tr>
<td>ISS Quality Score</td>
<td>Evaluating governance (board composition, shareholder and takeover defenses, compensation and remuneration, and audit and risk monitoring)</td>
</tr>
<tr>
<td>MSCI ESG Ratings</td>
<td>Evaluating by 37 key ESG issues</td>
</tr>
<tr>
<td>RobecoSAM Corporate Sustainability Assessment</td>
<td>Evaluating by economy, environment, and society. Governance is included in the economy.</td>
</tr>
<tr>
<td>Sustainalytics ESG Risk Ratings</td>
<td>Evaluating by ESG measures, disclosures, and the level of the problem</td>
</tr>
<tr>
<td>Thomson Reuters ESG Scores</td>
<td>Evaluating by 10 categories (environment [resource use, emissions, and innovation], society [employees, human rights, local communities, and product responsibility], and governance [management, shareholders, and CSR strategy]).</td>
</tr>
</tbody>
</table>

Sources: Bloomberg, ESG rating organization websites, Yuyama (2020).
a classification of activities, called the EU Taxonomy, and is said to be a regulation that aims for a strict definition of sustainable economic activity. In the PRC, the National Development and Reform Commission and the People’s Bank of China have also formulated a catalog of green industry guidance, which sets green standards to be applied nationwide and defines green eligibility. However, too many disparate and rigid definitions of what is green and what contributes to ESG in different countries can affect investment activities not only in each country but also at the global level.

Table 3.2: Examples of ESG and SDG-related Standard Development Movements in Different Countries

<table>
<thead>
<tr>
<th>Standard Development Movement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>European Union (EU)</td>
<td>Through the EU Taxonomy, the criteria for classifying economic activity as environmentally compatible or not have been established</td>
</tr>
<tr>
<td>People’s Republic of China</td>
<td>Develop a green industry guidance catalog and green standards to be applied nationally</td>
</tr>
<tr>
<td>International Organization for Standardization (ISO)</td>
<td>Moves to set standards for greenhouse gases, environmental performance, and green finance</td>
</tr>
</tbody>
</table>

ESG = environment, social, and governance, SDG = Sustainable Development Goals.

Figure 3.1 shows a comparison between traditional portfolio investment and investment taking ESG factors into account. The curve denotes the utility curve of investors when they focus only on (i) rate of return, and (ii) risks associated with investment. The curve between A and B denotes the efficiency frontier of two investments A and B in the first quadrant. The optimal portfolio allocation can be achieved at point “e”. When investors have to take ESG factors into account, an additional second quadrant must be added for the allocation of portfolio investments. The third quadrant measures the degree of ESG criteria. Suppose investment in B achieves higher ESG points compared to investment A. Investors have to allocate more to B compared to investment A. The chart shows that the optimal portfolio allocation is not point “e” but has to be point “F” where much more investment is allocated to company B.

However, the degree of ESG differs depending on which ESG scores each investor uses, as is shown in Table 3.1. Point “F” is not a unique
point, but there can be many different patterns of allocations based on
the ESG rating agencies. Therefore, optimal portfolio allocations would
be distorted by the different definitions of consulting companies. A
detailed mathematical explanation is provided in Section 3.5.

### 3.4 Green Bonds

A similar argument can be applied to green bond investment. Table 3.3
shows the Green Bond Principles defined by the International Capital
Market Association (ICMA). In Japan, the Development Bank of Japan
has issued green bonds for the construction of commercial buildings that
reduce CO₂ and are environment friendly. The Japan Housing Finance
Agency has issued green bonds for the construction of environment =
friendly housing. Both of these bonds satisfy the criteria defined by the
ICMA. However, they do not accurately indicate by how much CO₂,
NOx, and other polluting gases are reduced. It can be said that some
green bonds are 80% green and 20% gray, and others 90% green and 10%
gray. But as long as the criteria defined by the ICMA are met, a green
bond can be issued.
Table 3.3: Green Bond Principles 2018

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>(i)</td>
<td>renewable energy</td>
</tr>
<tr>
<td>(ii)</td>
<td>energy efficiency</td>
</tr>
<tr>
<td>(iii)</td>
<td>pollution prevention and control</td>
</tr>
<tr>
<td>(iv)</td>
<td>environmentally sustainable management of living natural resources and land use</td>
</tr>
<tr>
<td>(v)</td>
<td>terrestrial and aquatic biodiversity conservation</td>
</tr>
<tr>
<td>(vi)</td>
<td>clean transportation</td>
</tr>
<tr>
<td>(vii)</td>
<td>sustainable water and wastewater management</td>
</tr>
<tr>
<td>(viii)</td>
<td>climate change adaptation</td>
</tr>
<tr>
<td>(ix)</td>
<td>eco-efficient and/or circular economy adapted products, production technologies and processes</td>
</tr>
<tr>
<td>(x)</td>
<td>green buildings</td>
</tr>
</tbody>
</table>


Figure 3.2 shows the greenness index in the third quadrant. As in the case of ESG investment, investors are now taking greenness into account in addition to the rate of return and risks associated with investments. However, portfolio allocations can be distorted, because green bonds are not always 100% green due to varying definitions of such bonds by consulting companies.
3.5 Theoretical Model of Environment, Social, and Governance Investment and Portfolio Selection

In this section, we modify the conventional portfolio utility function by incorporating the ESG indicator.\(^2\) We set the utility function in equation (1), which includes the three elements; (i) the rate of return, (ii) risk, and (iii) ESG. Traditional portfolio utility function focuses only on (i) the rate of return, and (ii) risk associated with portfolio investment, which excludes the ESG factor. Constraints that the new variable ESG is subject to are presented in equation (4).

\[
U(R_t, \sigma_t^2, ESG_t) = R_t - \beta \sigma_t^2 + \gamma (ESG_t) \tag{1}
\]

s.t. \(R_t = \alpha_t R_t^A + (1 - \alpha_t) R_t^B\) \tag{2}

\[
\sigma_t^2 = \alpha_t^2 (\sigma_t^A)^2 + (1 - \alpha_t)^2 (\sigma_t^B)^2 + 2 \alpha_t (1 - \alpha_t) \sigma_t^{AB} \tag{3}
\]

\[
ESG_t = \alpha_t (ESG_t^A) + (1 - \alpha_t) (ESG_t^B) \tag{4}
\]

ESG levels are described as follows:

\[
ESG_t^A = a_t^1 (CO_2^A_t) + a_t^2 (NO_x^A_t) \tag{4.1}
\]

\[
ESG_t^B = b_t^1 (CO_2^B_t) + b_t^2 (NO_x^B_t) \tag{4.2}
\]

where 1 is the CO\(_2\), and 2 is the NOx emitted by companies A and B in equations (4-1) and (4-2), the coefficients of \((a_t^1, a_t^2)\) and \((b_t^1, b_t^2)\) are different from one consulting company to another.

Substituting equations (2), (3), and (4) into equation (1), we obtain the optimal level of portfolio function, expressed in equation (5).

\[
U = \alpha_t R_t^A + (1 - \alpha_t) R_t^B - \beta \{\alpha_t^2 (\sigma_t^A)^2 + (1 - \alpha_t)^2 (\sigma_t^B)^2 + 2 \alpha_t (1 - \alpha_t) \sigma_t^{AB}\} + \gamma \{\alpha_t (ESG_t^A) + (1 - \alpha_t) (ESG_t^B)\} \tag{5}
\]

---

\(^2\) This part of the discussion is an extension and application to the case of ESG of the theoretical model shown by Yoshino, Taghizadeh-Hesary, and Muntaz (2020).
Obtaining the first-order conditions for the ratio between asset A (share = \( \alpha_t \)) and asset B (share = 1 - \( \alpha_t \)), equation (5) can be shown as follows:

\[
\frac{\partial u}{\partial \alpha_t} = (R_t^A - R_t^B) - \beta \{2\alpha_t(\sigma_t^A)^2 + 2(1 - \alpha_t)(\sigma_t^B)^2\} + (2 - 4\alpha_t)\sigma_t^{AB} + \gamma (ESG_t^A - ESG_t^B) = 0
\]  

(6)

Writing equation (6) for the results in equation (7):

\[
\alpha_t = \frac{1}{2\beta} \frac{(R_t^A - R_t^B) - (\sigma_t^B)^2 - \sigma_t^{AB} + \frac{\gamma}{2\beta} (ESG_t^A - ESG_t^B)}{(\sigma_t^A)^2 - (\sigma_t^B)^2 - 2\sigma_t^{AB}}
\]  

(7)

Equation (7) indicates the share of the allocation to asset A. The last term in the numerator is an additional component that affects the allocation between asset A and asset B. If \( ESG_t^A \) is larger than \( ESG_t^B \), the portfolio allocation to asset A will become more significant, as shown in Figure 3.1. Figure 3.3 shows the traditional portfolio investment, determined by the rate of return and risks. Point “e” is the optimal portfolio allocation where \( \gamma = 0 \) in equation (1). Figure 3.1 shows the case where ESG is included in the utility function, where point “F” becomes the optimal portfolio allocation because asset A shows a higher ESG score compared to asset B.

However, the measure of ESG differs from one ESG rating company to another. Investors select an ESG rating company to allocate their portfolio based on its definition of the ESG. The asset allocation of each investor results in distorted portfolio allocation based on the different weights of \((a_1^t, a_2^t)\) and \((b_1^t, b_2^t)\) as in equations (4-1) and (4-2). Thus, each investor chooses a different portfolio based on the consulting company they chose.

In the second quadrant the ESG score is measured together with the rate of return and risks associated in portfolio investment in the first quadrant in Figure 3.4.
Figure 3.3: Traditional Portfolio Investment Selection Based on Return and Risk

Source: Excerpt from Yoshino and Yuyama (2021).

Figure 3.4: Portfolio Allocation when ESG Factors are Taken into Account

ESG = environment, social, and governance.

Source: Excerpt from Yoshino and Yuyama (2021).
Markowitz (2005) states the following assumptions in the above simple capital asset pricing model: (A1) Transaction costs and other illiquidity can be ignored. (A2) All investors hold mean-variance-efficient portfolios. (A3) All investors hold the same (correct) beliefs about means, variances, and covariances of securities. (A4) Every investor can lend all they have or can borrow all they want at the risk-free rate. Brennan and Lo (2010) claim that the result for two assets as is used in the above model cannot be generalized for many assets, as some assets or portfolios will certainly have negative weights as \( n \to \infty \). Therefore, the above model used in this chapter has to have a limited number of assets rather than an infinite number of assets. DeMiguel, Garlappi, and Uppal (2009) find that naive diversification (1/n allocation to each asset) often beats simple optimal allocation as is used in this model. Even if naive 1/n allocation to each asset were introduced, additional allocation of ESG investment will distort the original allocation of 1/n by the amount of ESG investment. Therefore, a similar argument can be applied to naive 1/n asset allocation explained in this section.

### 3.5.1 Empirical Application of the Theory

Stock prices of two companies are selected to show a theoretical application of the model in the previous section to real data. Company A shows the rate of return as 0.067 (=\( R_A \)) and its risk, which is measured by standard error of stock price (\( \sigma_A \)), as 1.537. Company B shows the rate of return as 0.003 (=\( R_B \)) and its risk as 1.316 (=\( \sigma_B \)). Covariance of these two stocks are –0.087 (=\( \sigma_{AB} \)).

ESG scores of these two companies are different by the ESG rating agencies as is summarized in Table 3.4.

<table>
<thead>
<tr>
<th>ESG Score</th>
<th>Optimal Portfolio without ESG Considerations</th>
<th>Rating Agency (I)</th>
<th>Rating Agency (II)</th>
<th>Rating Agency (III)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ESG Score of Company A</td>
<td>–</td>
<td>8.6</td>
<td>9.6</td>
<td>2.9</td>
</tr>
<tr>
<td>ESG Score of Company B</td>
<td>–</td>
<td>1.8</td>
<td>1.3</td>
<td>3.9</td>
</tr>
<tr>
<td>Value of ( \alpha )</td>
<td>0.57</td>
<td>0.71</td>
<td>0.74</td>
<td>0.54</td>
</tr>
</tbody>
</table>

ESG = environment, social, and governance. Each ESG score is converted to a 10-point scale for comparison. Source: Author’s calculations, based on each company’s 2019 actual stock returns, standard deviation, covariance, and ESG score from Bloomberg data, assuming that \( \beta = 0.015 \), and \( \gamma = 0.0005 \), according to the equation (7).
The optimal portfolio allocation is different for scores based on three different rating agencies, as shown in Table 3.4. Values of $\alpha$ (where $\alpha$ denotes allocation of portfolio between two assets A and B, equation (7)) are different from one agency to another. The allocation of assets between A and B changes depending on which rating agency’s ESG score is used for the portfolio allocation. The higher the ESG score, the higher the $\alpha$, and thus the higher the investment allocation. For example, since rating agency (II) gives the highest ESG score for Company A, investors following this rating will have the highest allocation to Company A based on Table 3.4. On the other hand, rating agency (III)'s score is lower for Company A than for Company B, resulting in a smaller investment allocation. If we do not take into account the ESG score, the investment allocation to Company A is 0.57. The example shown here proves the validity of the theoretical model developed in Section 3.5. In this empirical analysis, even a small variation in the weight of greenness factor or ESG factor will make a big difference in portfolio asset allocation as is shown in Table 3.4.

3.6 Greenness-adjusted Greenhouse Gas Taxation, Green Credit Rating, and Optimal Portfolio Allocation for Environment, Social, and Governance Investment

3.6.1 Greenness-adjusted GHG Taxation

A standard global greenness-adjusted GHG tax (taxing CO$_2$ and NOx) will give us a new rate of return on assets A and B, presented in this subsection. Greenness-adjusted GHG tax is to levy tax based on CO$_2$ and NOx emissions, however, it is adjusted by the efforts of each company to plant trees and invest in forests. It will provide efforts made by each company to increase green activities. Tax rates can be adjusted based on the progress of pollution reduction. If the pollution reduction is slow compared to the target, the global tax rate can be adjusted by the same rate.

$$U(\bar{R}_t, \sigma_t^2) = \bar{R}_t - \beta \sigma_t^2$$  \hspace{1cm} (8)

---

3 This part of the discussion is also an extension and application to the case of ESG of the theoretical model shown by Yoshino, Taghizadeh-Hesary, and Mumtaz (2020).
\[ T^A_t = \frac{t_1(CO^A_2 t) + t_2(NO^A_{X t})}{Y^A_t} - \text{Greenness}^A \] (9)

\[ T^B_t = \frac{t_1(CO^B_2 t) + t_2(NO^B_{X t})}{Y^B_t} - \text{Greenness}^B \] (10)

Equation (8) shows the new utility function of investors based on the “after-tax rate of return” and “after-tax risk.” In equations (9) and (10), \( T^A_t \) and \( T^B_t \) denote the GHG tax rate charged to companies A and B, respectively. \( Y^A_t \) and \( Y^B_t \) are the total outputs of companies A and B, respectively. \( t_1 \) and \( t_2 \) show the tax rate on CO\(_2\) and NO\(_x\), which have the same rates globally. The tax rate on CO\(_2\) is the same for companies A and B, and the tax rate of NO\(_x\) is the same for companies A and B. These rates need to be the same globally to avoid distortion of investments between different countries.

\[ \tilde{R}^A_t = R^A_t - T^A_t \] (11)

\[ \tilde{R}^B_t = R^B_t - T^B_t \] (12)

Equations (11) and (12) show the “after-tax rate of return” of company A and company B. The optimal allocation of assets between company A and B is computed as equations (13) and (14) that show the optimal rate of return and risk, respectively:

\[ \tilde{R}_t = \tilde{\alpha}_t \tilde{R}^A_t + (1 - \tilde{\alpha}_t)\tilde{R}^B_t \] (13)

\[ \tilde{\sigma}_t^2 = \tilde{\alpha}_t^2 (\tilde{\sigma}^A_t)^2 + (1 - \tilde{\alpha}_t)^2 (\tilde{\sigma}^B_t)^2 + 2\tilde{\alpha}_t (1 - \tilde{\alpha}_t)\tilde{\sigma}^{AB}_t \] (14)

Next, to find the optimal portfolio allocation ratio between asset A and asset B, we obtain the first-order condition of the utility function for \( \tilde{\alpha} \):

\[
\frac{\partial U}{\partial \tilde{\alpha}_t} = (\tilde{R}^A_t - \tilde{R}^B_t) - \beta \{2\tilde{\alpha}_t(\tilde{\sigma}^A_t)^2 + 2(1 - \tilde{\alpha}_t)(\tilde{\sigma}^B_t)^2\} + (2 - 4\tilde{\alpha}_t)\tilde{\sigma}^{AB}_t = 0
\] (15)

Finally, we obtain the optimal level of portfolio allocation as in equation (15):
\[ \tilde{\alpha}_t = \frac{1}{2\beta} \left( \hat{R}_t^A - \hat{R}_t^B - (\hat{\sigma}_t^B)^2 - \hat{\sigma}_t^{AB} \right) \]  

(16)

Evidently, as in equation (16), investors do not need to consider ESG as an additional item, as shown in equation (7). Instead, investors maximize their utility based only on the rate of return and the risk after tax. The optimal portfolio allocation is as shown in equation (16). \( \tilde{\alpha}_t \) indicates the optimal portfolio as shown in Figure 3.5 by point \( f \). \( f \) is the optimal point after the adoption of the international GHG taxation scheme.

**Figure 3.5: International Greenness-adjusted GHG Taxation Scheme**

GHG = greenhouse gas.

Source: Excerpt from Yoshino and Yuyama (2021).

### 3.6.2 Green Credit Rating

Another way is to base a credit rating of a company on its greenness, which is a comparable measure of its GHG emissions. If company A’s GHG emissions are zero, it is rated AAA, but a company with large emissions would be rated BB or lower. An accurate measuring of GHGs will provide an accurate green credit rating of each company to investors.
Table 3.5 shows an example of green credit ratings based on emissions of CO$_2$, NOx, and plastics. These ratings will facilitate investors to decide on investment in green projects by watching a single green credit rating without being concerned about different criteria.

\[
U(R_t, \sigma_t^2, Green_t) = R_t - \beta \sigma_t^2 + \gamma (Green_t)
\]  
\[
\text{s.t. } R_t = \alpha_t R_t^A + (1 - \alpha_t) R_t^B
\]  
\[
\sigma_t^2 = \alpha_t^2 (\sigma_t^A)^2 + (1 - \alpha_t)^2 (\sigma_t^B)^2 + 2\alpha_t (1 - \alpha_t) \sigma_t^{AB}
\]  
\[
Green_t = \alpha_t (Green_t^A) + (1 - \alpha_t) (Green_t^B)
\]

Where greenness index is based on the following two equations.

\[
Green_t^A = a_t^1 (CO_2^A t) + a_t^2 (NO_x^A t)
\]  
\[
Green_t^B = b_t^1 (CO_2^B t) + b_t^2 (NO_x^B t)
\]

Optimal portfolio allocation now depends not only on rate of return and risks but also on greenness index $Green_t^A$ and $Green_t^B$.

\[
\alpha_t = \frac{1}{2\beta} \frac{(R_t^A - R_t^B) - (\sigma_t^B)^2 - \sigma_t^{AB} + \frac{\gamma}{2\beta} (Green_t^A - Green_t^B)}{(\sigma_t^A)^2 - (\sigma_t^B)^2 - 2\sigma_t^{AB}}
\]

Unique value of $\alpha_t$ is obtained from a single green credit rating.
3.7 Conclusion and Policy Implications

ESG and green investment are important policy objectives that must be achieved for sustainable environment and sustainable growth. However, each ESG rating agency has its own criterion for measuring ESG. Some rating agencies use qualitative measures and their focus points are different from one another. Thus, which rating agency each investor uses leads to a different portfolio allocation. This chapter has shown how optimal portfolio allocation can be distorted depending on which rating agency is chosen as a consulting company.

Specifically, a lack of global standardized criteria for the measurement of ESG causes distortions in investors’ portfolio allocations. To achieve clean energy and environment-related ESG factors, we recommend the adoption of international greenness-adjusted GHG taxation systems and the credit rating of each company based on greenness-adjusted GHG emissions to be used by investors.

We recommend starting such a system in regions where economic cooperation and economic integration exist, like the European Union or the Association of Southeast Asian Nations. Another policy proposal is to make a global green credit rating of companies based on their emissions of pollutants such as CO₂, NOx, and plastics, which will drive investors toward optimal portfolio allocation.
References


The Resilience of Green Stocks During COVID-19: A Clustering Approach

Giovanni Maria Bonagura, Luca D’Amico, Alessio Iacopino, Lorenzo Prosperi, and Lea Zicchino

4.1 Introduction

The coronavirus disease (COVID-19) pandemic forced governments to impose social distancing and lockdown measures leading to a collapse in the price of risky assets and spikes in market volatility in anticipation of the fall in economic activity globally. The drop in equity prices was the fastest ever, while the contraction when the lowest point was reached was half the size of that observed during the subprime crisis in 2008–2009 (IMF 2020). However, there is growing evidence that sustainable and more generally environmental, social, and governance (ESG) asset classes have been more resilient to the shock. According to Brière (2020), 62% of large-cap ESG funds outperformed the Morgan Stanley Capital International (MSCI) world index in March 2020. According to Ferriani and Natoli (2020), investors have especially demanded low-ESG risk equity funds and, surprisingly, particularly those with low environmental (instead of social or governance) risk. Compositional effects might explain this result. By construction, ESG funds tend to overweight sectors that have been less exposed to the recent shock, such as health care and technology, and underweight those that have been most impacted, such as transport, energy, and materials. However, according to their analysis, other confounding factors, such as exposure to sectors or regions hit hardest by the crisis or market size, do not completely explain larger inflows into ESG funds. Pastor and Vorsatz (2020) analyze actively-managed equity mutual funds in the United States market during the COVID-19 crisis and they also find that more sustainable funds (according to Morningstar classification),
and particularly those that are more environmentally sustainable and those that employ exclusion criteria in their investment process, received relatively more net inflows than less sustainable funds within the same style group. These findings are not specific to the COVID-19 crisis; Nofsinger and Varma (2014) showed that socially responsible mutual funds outperformed during other market crises at the cost of underperforming during noncrisis periods. In Figure 4.1 we plot monthly net flows of European equity mutual funds from January 2018 to May 2020 for funds classified as ESG and/or green or which claim to have investment strategies based on ESG and/or green factors and other funds. Over the sample period, ESG and/or green funds flows were more stable than traditional funds even if the former have been only recently introduced. This is relevant especially when markets collapse, as during the last quarter of 2018 and after the outbreak of COVID-19. While traditional funds suffered high outflows in February and hit a low in March 2020 (–€112 billion), ESG-labeled funds were not dramatically impacted; indeed, data do not show massive divestments from ESG-labeled funds. Albuquerque et al. (2020) focus on stock performance rather than fund flows and find that firms with higher environmental and social ratings had significantly higher returns, lower return volatility, and higher operating profit margins during the first quarter of 2020. Other explanations for the better performance of sustainable assets during market crisis point toward market segmentation (investors with different characteristics and strategies can invest separately in the ESG and conventional exchange traded fund market segments) or loyalty effects (firms invest in ESG policies to create a more loyal customer base and consequently a less price-elastic demand). Albuquerque et al. (2020) find support for the loyalty theory.

In this chapter we focus on equity performances of green firms. While mutual fund performance during the COVID-19 crisis is largely documented, there is limited evidence on how stocks, and in particular those in the European market, behaved. Moreover, identifying green firms is not an easy task because ESG disclosure by firms might be not fully reliable (i.e., green washing).\(^1\)

Many papers rely on environmental scores produced by different data providers to identify green firms. However, Berg, Koelbel, and Rigobon (2020) document the large divergence between ESG ratings across agencies. Some papers identify green firms by taking the best performers according to these scores, i.e., by selecting firms whose score is above a certain threshold. However, the choice of the threshold, like specific percentiles of the score distribution (as in Alessi, Ossola, and Panzica 2020; Görgen et al. 2019; Albuquerque et al. 2020) can be subjective and impose an a-priori on the size of the green cluster.

In this chapter, for each calendar year we identify a green cluster of firms among European Union listed companies using a comprehensive database from January 2005 to July 2020 of environmental information at date and/or firm level from Refinitiv. For each firm we collected data on emissions intensity (emissions/total revenue) and four environmental scores (environmental pillar score, emissions score, resource use score, environmental innovation score) constructed by Refinitiv. Different from previous studies, our objective is to let the data speak for itself by identifying green firms with clustering techniques, instead of creating an aggregate score and selecting the best performer based on this score. Clustering techniques seek to partition observations in a dataset into...
distinct groups so that the observations within each group are quite similar to each other, while observations in different groups are different from each other. This approach has several advantages. First, we do not need to take a stance on the relative importance of different indicators in selecting green firms as the procedure might assign more relevance to some variables to identify specific clusters. Second, the cluster size might change from year to year according to the distribution of the environmental variables among listed firms. We claim therefore that this approach involves less subjective choices in the identification of green firms. We find quite a large number of green firms. Moreover, green firms are generally bigger than non-green and brown firms (i.e., firms in sectors with large emissions levels), maybe because larger firms have more incentives and/or resources to disclose environmental data. Furthermore, the sectoral distribution of green firms is quite heterogeneous and they are not necessarily concentrated in low emitting sectors.

We then evaluate the financial performance of the three clusters (green, non-green, and brown) over the full sample period, from January 2006 to July 2020 and around the COVID-19 crisis. When considering stock performance, we find that green firms offered a lower return to stockholders than non-green firms over the full sample period. As suggested by Bolton and Kacperczyk (2020b), investors have only recently become aware of the urgency of climate change. Consequently, we also evaluate the financial performance splitting the sample in two subperiods, before and after the Paris Agreement (before and after 2013), and we find the same result. This is consistent with the view that green firms offer lower compensation because they are a hedge against climate risk. However, green firms outperformed brown firms over the same period. During the market stress induced by the COVID-19 crisis, green firms performed better than both brown and non-green firms, in line with recent literature (Albuquerque et al. 2020). We also investigate the performance in terms of risk-adjusted returns in a rolling window setup. On average, we find superior risk-adjusted performances of green firms over the full sample although after 2013 differences among clusters tend to disappear, except during the COVID-19 crisis when green firms outperformed again. We also proxy the liquidity of the stocks in our database with their bid-ask spread over the mid-price and find that green firms are more liquid than the other two clusters, and the difference in liquidity increases in March 2020.

To investigate whether green firms perform generally better in periods of market stress (Nofsinger and Varma (2014), as in Alessi, Ossola, and Panzica (2020) we calculate a green risk factor (GRF) as the difference between the returns of the green and the brown portfolios. We find that this factor is negatively correlated with the Fama and
French market risk premium and is generally positive during periods of market correction. Moreover, we estimate a standard capital asset pricing model and a three-factor model using the return on the green, non-green, and brown portfolios as dependent variable. Consistently we find that the green portfolio has a beta below 1 (i.e., they are defensive stocks), while the other two groups have a beta well above 1 (cyclical stocks).

To get a better understanding of the evidence that climate risk is priced in stocks, we extend the standard three-factor model of Fama and French (1993) by including the GRF. We find that this factor is significant for around 30% of the firms at a 10% significance level, in line with the other well-established factors in the literature (High Minus Low and Small Minus Big). We also find that green firms have generally positive exposure to the GRF while the opposite holds for brown firms. However, there are firms whose exposure to the factor is not aligned with cluster identification, suggesting that markets consider these firms greener (or browner) in comparison with the environmental information that the firms produce.

The rest of the chapter is organized as follows. Section 4.2 describes the dataset. Section 4.3 is devoted to explaining the methodology: the clustering approach identifying green firms, the measure of financial performance we used in our analysis, and the extended asset pricing model. Section 4.4 describes the results of the clustering procedure and the relative performance of the green cluster of firms over the full sample period, the COVID-19 crisis, and the pre- and post-Paris Agreement periods. Section 4.5 concludes.

4.2 Data

Our sample consists of companies listed on the STOXX Europe Total Market Index in July 2020, with the exclusion of financial and real estate companies, i.e., companies with NACE 1-digit level equal to K or L. In order to identify green firms, we collect ESG data from Refinitiv;
in particular, we focus on an emissions intensity measure and various environmental scores: sales-to-emissions ratio, environmental pillar score, emissions score, resource use score, and environmental innovation score. The inverse of the emissions intensity (i.e., sales-to-emissions ratio) has been included for two reasons. First, it is an indicator widely used in the literature to identify best performers in terms of emissions policy. Second, unlike the Refinitiv scores that are industry-specific and measure the relative performance of a firm within its own sector, emissions intensity is an absolute measure. Furthermore, in Figure 4.2 we present the indicators’ correlation HeatMap; it is worth noticing that the sales-to-emissions indicator is not necessarily correlated with the other environmental indicators and this is true over the years. In Table A4 in the Appendix we provide summary statistics for each environmental indicator mentioned above.

In this chapter, brown firms are not identified using our clustering procedure, but as firms that belong to sectors that are more exposed to climate risk, independently from their relative ranking based on

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3 See Appendix A for a detailed description of the scores.

4 Note that, as explained in the Refinitiv’s ESG methodology guide, in order to calculate the environmental category scores, the industry group is used as the benchmark. In addition, some indicators are industry-specific, thus they are not relevant for some sectors; in this case they are excluded from the calculation.
the environmental data considered. Following Alessi et al. (2020), the first step of our analysis consists in selecting for each year only the securities that do not belong to the sectors defined as climate policy-relevant sectors (CPRS) according to their associated NACE 2-digit level. Based on Eurostat data, in Table 4.1 we identify the CPRS as those which, in descending order by level of greenhouse gas (GHG) emissions, contributed to 85% of total GHG emissions between 2008 and 2018; the firms which operate in the CPRS are labeled as “brown.” In other words, we exclude the possibility that brown firms are identified as green. While this hypothesis might look subjective, given that some brown firms are largely investing to diversify their core business and in adaption technologies, it is reasonable to assume that these sectors are highly affected by transition risk (e.g., carbon pricing policies).

### Table 4.1: European Union Climate Policy Relevant Sectors with their Relative Contribution to Total GHG Emissions, Based on Eurostat Data

<table>
<thead>
<tr>
<th>NACE 2-Digit Level</th>
<th>% of Total GHG Emissions (2008–2018)</th>
<th>Cumulative %</th>
</tr>
</thead>
<tbody>
<tr>
<td>D35 – Electricity, gas, steam and air conditioning supply</td>
<td>31.5</td>
<td>31.5</td>
</tr>
<tr>
<td>A01 – Crop and animal production, hunting and related service activities</td>
<td>13.4</td>
<td>44.9</td>
</tr>
<tr>
<td>H49 – Land transport and transport via pipelines</td>
<td>5.5</td>
<td>50.3</td>
</tr>
<tr>
<td>C23 – Manufacture of other nonmetallic mineral products</td>
<td>5.5</td>
<td>55.8</td>
</tr>
<tr>
<td>C24 – Manufacture of basic metals</td>
<td>4.9</td>
<td>60.7</td>
</tr>
<tr>
<td>E37–E39 – Sewerage, waste management, remediation activities</td>
<td>4.6</td>
<td>65.3</td>
</tr>
<tr>
<td>C20 – Manufacture of chemicals and chemical products</td>
<td>4.3</td>
<td>69.6</td>
</tr>
<tr>
<td>H51 – Air transport</td>
<td>4.0</td>
<td>73.6</td>
</tr>
<tr>
<td>C19 – Manufacture of coke and refined petroleum products</td>
<td>4.0</td>
<td>77.6</td>
</tr>
<tr>
<td>H50 – Water transport</td>
<td>3.3</td>
<td>80.9</td>
</tr>
<tr>
<td>B05–B09 – Mining and quarrying</td>
<td>2.3</td>
<td>83.3</td>
</tr>
<tr>
<td>F41–F43 – Construction</td>
<td>1.8</td>
<td>85.0</td>
</tr>
</tbody>
</table>

GHG = greenhouse gas.
Source: Prometeia calculation on Refinitiv’s data.
In identifying green firms, a crucial aspect is how to treat missing data. Indeed, a large number of firms do not report any environmental information, especially at the beginning of the sample period. Our approach is to penalize non-reporting firms compared to reporting firms. Then, when a firm presents missing data for an indicator, we replace it with the minimum value observed for the indicator in each specific year minus an arbitrary value.

Moreover, due to the presence of outliers and indicators with different scales, we standardize the data calculating the rank of each Refinitiv indicator every year, effectively minimizing distortions in the clustering procedure.5 One of the main contributions of this study is the clustering technique for the identification of green firms, which is described in the next section.

4.3 Methodology

4.3.1 Clustering Methodology

As mentioned in the introduction, to avoid bias in the choice of the green firms, we adopt a data-driven approach. In this work, we propose an innovative approach that identifies a time-varying number of green firms using unsupervised learning clustering techniques. In particular, we apply the K-means algorithm with squared Euclidean distance as a dissimilarity measure in order to find homogenous groups of firms, according to the environmental indicators mentioned before. Therefore, we want to solve this optimization problem:

$$\min_{C_{1,t}, \ldots, C_{1,t}} \left( \sum_{k=1}^{K} W(C_{k,t}) \right)$$

with

$$W(C_{k,t}) = \frac{1}{|C_{k,t}|} \sum_{i,j \in C_{k,t}} \sum_{j=1}^{p} (x_{i,j,t} - x_{i',j,t})^2$$

where $x_{i,j,t}$ is firm $i$ rank on feature $j$ at time $t$. $W(C_{k,t})$ is a measure of dissimilarity between the observations within the $k$th cluster (i.e. within-cluster variation), defined as the summation of all of the $k$th pairwise squared Euclidean distances between the observations, divided by the

---

5 Since data are standardized using the rank function, the choice of arbitrary value does not affect the clustering results.
kth total number of observations. The K-means algorithm allows us to solve this problem such that the total within-cluster variation \( \sum_{k=1}^{K} W(C_k, t) \) is minimized.

This type of algorithm requires the number of clusters that we expect in the data as input; given that the main aim of this procedure is to avoid arbitrary choices, the optimal number of clusters is estimated from the data. The identification problem of the optimal number of clusters is not an easy task: as a matter of fact a vast number of tests have been introduced in the literature to solve this problem, but there is no consensus about which is the most appropriate to use. For this reason we decide not to rely on a specific test but instead consider the results of different tests, as implemented in Malika et al. (2014). Finally, to aggregate the results of different tests we take the median reported number of clusters in each year. As a result, we find an optimal number of clusters, constant over time, equal to three. In order to assign different labels to the clusters obtained for each year, we assume that the one with the highest average of the medians of each ranked Refinitiv indicator should be labeled “green” and the other two clusters form a unique one called “not green.” This classification allows us to build three different market-value weighted portfolios (green, not green, and brown) for each month, based on the previous year’s classification. This is because, as environmental information is collected and disclosed yearly, we assume that during any given year an investor can only consider the previous year information. We then define the GRF as the difference between the monthly returns on the green and the brown portfolios.

### 4.3.2 Financial Performance Indicators

For each portfolio, we calculate monthly US dollars returns from January 2006 to June 2020, a risk adjusted score and the bid-ask spread over the mid-price

\[
\text{BDSKPM}_{i,t} = 100 \times \frac{p_{i,t}^A - p_{i,t}^B}{p_{i,t}^A + p_{i,t}^B} \frac{1}{2}
\]

Then we evaluate the performance of the portfolios, based on these indicators, considering two different time spans: the full-sample period and the COVID-19 months.

The risk-adjusted score, which brings together various risk-adjusted measures in a single indicator, allows an immediate comparison between portfolios by assessing the overall risk-return profile more completely.
For each listed company we consider risk and return indicators calculated on a rolling window of 260 days. Risk indicators include the Sharpe Ratio (Sharpe 1994), Information Ratio (Goodwin 1998), Appraisal Ratio (Treynor and Black 1973), K3 (Kaplan and Knowles 2004), Sortino Ratio (Sortino and Price 1994), and Treynor Ratio (Treynor 1965). For each firm, we determine an aggregate score by averaging the rank of the firm according to each indicator. The score values range from 0 (minimum performance) to 100 (maximum performance). Finally, for each portfolio we calculate the overall score as the market-value weighted average.

4.3.3 Asset Pricing with the Green Risk Factor

We then study the role of climate risk in equity prices by extending the standard asset pricing model by including the green risk factor as in Alessi, Ossola, and Panzica (2020) and Görgen et al. (2019). In particular, for each firm we estimate the following regression

$$R_{i,t} = \alpha_i + \beta_i^M MRP_t + \beta_i^H HML_t + \beta_i^S SMB_t + \beta_i^G GRF_t + \epsilon_{i,t}$$

where $R_{i,t}$ represents the monthly excess return of firm $i$ while $MRP_t$, $SMB_t$, and $HML_t$ are respectively the market risk premium and the two factors introduced by Fama and French (1993), while $GRF_t$ is the green risk factor.

The panel data of firms’ returns is unbalanced and some firms have a relatively short history of data that might produce inaccurate results. For this reason, when computing summary statistics of the exposure across groups of firms we underweight firms whose estimation results might be less reliable. We follow the approach proposed in Gagliardini, Ossola, and Scaillet (2016), where the weights are used in the second step of the procedure for risk premia estimation. In short, giving weights increase the statistical precision of the estimation of the beta and overcomes the issue of the small sample size relative to the full sample.

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The three factors for the European market in US dollars together with the risk free rate are taken from the Fama and French website.
4.4 Results

4.4.1 Clustering Results

Figure 4.8 shows the boxplot of the indicators’ rank divided into groups. The first thing to notice is that our methodology produces three clusters with different characteristics. In the initial period, green firms have higher scores in all indicators than non-green firms, while firms with missing values (nontransparent firms) are at the bottom of the graph. However, over the rest of the period, the positive correlation between green firms and the sales-to-emissions ratio disappears: we find more homogeneity in emission intensity between green and non-green firms. Indeed, starting from 2017, non-green firms show a higher value in the sales-to-emissions ratio, while all the other indicators are higher for green firms. Figure 4.9 shows the sectoral distribution of green, non-green (included nontransparent), and brown portfolios. In the graph we show the most relevant sectors in terms of market value, ordered counter clockwise according to their emissions level (the sector in the north part of the radar corresponds to the highest emitting sector). We find that green firms do not necessarily belong to sectors with relatively lower emissions. In Figure 4.3a we present the evolution of the number of firms included in each cluster. First, it can be noted that the number of green firms increases over time, along with increasing environmental disclosure by firms. Second, the green and brown portfolios have on average in the sample considered, a similar number of constituents. It should be noted that although our procedure does not allow for an a-priori classification and therefore there is no guarantee about the stability of the number of firms in each cluster, our green cluster is stable over time, presenting an average turnover of around 88%. As already mentioned, a widely adopted approach in the literature is to identify green firms by selecting those above a certain threshold. The choice of the threshold, like specific percentiles of the distribution, can be subjective, and impose an a-priori on the size of the green cluster. Our approach shows that it is difficult to identify ex ante a unique suitable threshold, since the number of green companies in our sample varies over time. In particular, the share of green firms spans from 9.6% to 24.2% in the sample considered. In Figure 4.3b we show the evolution of the average market value in each cluster over the average market value among all firms. Values above (below) one for a specific cluster or year show that on average firms in this cluster are bigger (smaller) compared to the entire market in the year considered. It is clear that green firms are generally bigger than non-green and brown
firms. This could be also explained by the fact that larger firms are better at disclosing a large amount of non-financial information and therefore receive higher scores.

4.4.2 Performance Results

In Figure 4.4a we present the monthly cumulative returns of the green, non-green, and brown portfolios starting from 2006. The three portfolios diverge from 2010, with the brown portfolio underperforming the other two. Moreover, the green portfolio underperforms the non-green portfolio from 2013, in anticipation of the Paris Agreement, which occurred in 2015. The underperformance of green firms with respect to non-green firms is in line with the main findings in the literature (Alessi, Ossola, and Panzica 2020, Bolton and Kacperczyk 2020a, Bolton and Kacperczyk 2020b, Görgen et al. 2019).

The intuition behind this finding is that investors are already demanding compensation for their exposure to climate risk. However, this interpretation appears in contrast with the finding that green firms outperform CPRS firms that are supposed to be more exposed to climate risk. According to Görgen et al. (2019), if firms surprise markets by performing relatively worse on environmental issues, by becoming...
browner, investors discount these firms. Pastor, Stambaugh, and Taylor (2019) model ESG preferences and their impact on asset prices. Investors vary in their ESG preference and invest in a long-short green-brown portfolio. In their model, the greener the asset, the lower the returns. They also introduce an ESG factor that represents a shift in investor demand, and show that positive realizations increase green asset prices even though brown assets earn higher expected returns. Our result is consistent with this view: with increasing environmental awareness green firms are those that performed relatively better than brown firms that are “stuck” in more climate intensive sectors. Moreover, according to our data, green firms are becoming relatively greener over time since the average rank of the indicators increased in the full sample. In Table 4.2 we present summary statistics of returns over the full sample period and the pre- and post-Paris Agreement periods. The overperformance of non-green versus both green and brown portfolios is especially evident in the post-Paris Agreement period.

<table>
<thead>
<tr>
<th>Portfolio</th>
<th>Pre 2013</th>
<th>Post 2013</th>
<th>2006–2020</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>Std. Dev.</td>
<td>t-stat.</td>
</tr>
<tr>
<td>Green</td>
<td>10.29</td>
<td>28.62</td>
<td>0.95</td>
</tr>
<tr>
<td>Brown</td>
<td>6.34</td>
<td>33.95</td>
<td>0.49</td>
</tr>
<tr>
<td>Non-green</td>
<td>12.08</td>
<td>41.10</td>
<td>0.78</td>
</tr>
</tbody>
</table>

Source: Prometeia calculation on Refinitiv’s data.

To investigate the performance of green firms compared to brown firms during the COVID-19 crisis and before then we calculate a GRF as in Alessi, Ossola, and Panzica (2020) as the difference between the green and brown portfolios (Figure 4.4b). Our result shows that in March 2020 this factor is positive (7%), implying green firms performed better than brown firms.

Actually, green firms performed better than the market as well in the same period (6%). Moreover, we check whether green firms perform generally better in period of market stress (Nofsinger and Varma 2014) and find that the GRF is on average positive (4.5%). Finally, the factor is negatively correlated with the Fama and French Market risk premium (−0.36).
When considering risk-adjusted performance we find that the green portfolio yields a better risk-adjusted average score than the non-green and brown portfolios especially before 2013. As we show in Figure 4.5a the gap is clear from 2005 to 2013, and in particular in 2009 and 2011, when Europe experienced the effects of the subprime and sovereign debt crises, and then it becomes a bit fuzzier. The gap increases in 2015, when the score of the brown portfolio drops because of the 2014–2016 oil glut. Then, the performance of the brown portfolio starts to improve until the COVID-19 crisis, which is characterized by the better performance of the green firms.

Furthermore, we verify whether green firms are more liquid than brown firms. To this end, we use the bid-ask spread over the mid-price (BDSKPM) as our liquidity measure (Sarr and Lybek 2002). Figure 4.5b indicates that there is a clear gap between our three clusters, indeed the bid-ask spread of green firms is lower than that of brown and non-green firms.
firms throughout the whole sample period. In line with previous results, we find that BDSKPM of all the three clusters increased in crisis periods (i.e., the subprime crisis, the sovereign debt crisis, and the COVID-19 crisis). However, the magnitude of the increase of the BDSKPM of green firms was lower than the other two clusters. In particular during the COVID-19 crisis, the BDSKPM of brown and non-green firms jumped from, respectively, 0.076 and 0.09 in February 2020, to 0.15 and 0.18 in March 2020; meanwhile for the green firms it increased from 0.04 in February 2020 to 0.08 in March 2020. In other words, during the COVID-19 crisis the liquidity gap between green firms and the others has further increased. This evidence supports the hypothesis that the demand for green securities increased during the crisis relatively to the other clusters.

Our preliminary results suggest that the green portfolio is more resilient than the non-green and brown portfolios. In Tables 4.3 to 4.6 we show the betas of the excess return of those portfolios, estimated using a standard capital asset pricing model and a three-factor model. First, we find a statistical significance for the market risk premium for all portfolios in both models. We also find that the green portfolio has a beta lower than 1, with respect to the market (defensive stocks),
and lower than non-green and brown portfolios, which have a beta well above 1 (cyclical stocks). This implies that green firms have lower exposure to systematic risk than brown and non-green firms, leading to better performance during market collapses.

4.4.3 Asset Pricing with Green Risk Factor

In Figure 4.6 we show the histogram with the frequency distribution of $\beta_i^G$, the exposure to the GRF. As shown in Table 4.5, we find that the GRF is highly significant. More specifically, it is significant for 25% (32%) of the firms in the sample, at a 5% (10%) significance level, not far from the other well-established factors in the literature (HML and SMB). Firms with positive (negative) $\beta_i^G$ should have larger (smaller) returns when the GRF increases, meaning that they benefit (lose) when climate risk deteriorates. According to our estimates, exposure to GRF is quite heterogeneous. Moreover, the results are in line with the sectoral classification. In Figure 4.7 we represent the sectoral (NACE2-level) weighted average of the exposure to the GRF across firms. In particular, in the left panel we present the top 14 sectors according to the weighted average beta and on the right panel the bottom 14 sectors.

![Figure 4.6: Frequency Distribution of the Beta Green Risk Factor](image-url)
We find that high emitting sectors exhibit negative betas, while low emitters have generally positive betas. Confirmation of this is shown in Table 4.6, which represents clusters’ betas: the weighted mean is positive for the stable-green cluster,\(^7\) while it is around zero and negative for the non-green and brown clusters, respectively. This means that on average stable green firms are benefiting from increasing climate risk, measured by the GRF, while the opposite holds for brown firms. However, not all green firms have a positive beta (around 76% in the stable-green cluster), and there are brown firms that have positive exposure (approximately 35%). This might suggest that markets identify potential environmental weakness and/or strengths of firms that are not correctly measured by the environmental data and key performance indicators considered in this analysis.

### Table 4.3: CAPM Estimates on Different Portfolio Excess Returns

<table>
<thead>
<tr>
<th></th>
<th>Green</th>
<th>Brown</th>
<th>Non-green</th>
</tr>
</thead>
<tbody>
<tr>
<td>MRP</td>
<td>0.905***</td>
<td>1.086***</td>
<td>1.065***</td>
</tr>
<tr>
<td></td>
<td>(0.020)</td>
<td>(0.029)</td>
<td>(0.027)</td>
</tr>
<tr>
<td>Constant</td>
<td>0.380***</td>
<td>0.013</td>
<td>0.646***</td>
</tr>
<tr>
<td></td>
<td>(0.107)</td>
<td>(0.159)</td>
<td>(0.145)</td>
</tr>
<tr>
<td>Observations</td>
<td>174</td>
<td>174</td>
<td>174</td>
</tr>
<tr>
<td>R2</td>
<td>0.925</td>
<td>0.890</td>
<td>0.904</td>
</tr>
<tr>
<td>Adjusted R(^2)</td>
<td>0.925</td>
<td>0.890</td>
<td>0.903</td>
</tr>
<tr>
<td>Residual Std. Error (df = 172)</td>
<td>1.412</td>
<td>2.088</td>
<td>1.907</td>
</tr>
<tr>
<td>F Statistic (df = 1; 172)</td>
<td>2,122.159***</td>
<td>1,397.150***</td>
<td>1,611.612***</td>
</tr>
</tbody>
</table>

CAPM = capital asset pricing model, MRP = market risk premium.
Note: *p<0.1; **p<0.05; ***p<0.01.
Source: Prometeia calculation on Refinitiv’s data.

\(^7\) We define as “stable-green” the firms that, considering only the timespan where they were effectively listed, are labeled green in more than 50% of the years.
### Table 4.4: Fama–French Three-factor Model Estimates on Different Portfolio Excess Returns

<table>
<thead>
<tr>
<th>Dependent Variable</th>
<th>Green</th>
<th>Brown</th>
<th>Non-green</th>
</tr>
</thead>
<tbody>
<tr>
<td>MRP</td>
<td>0.984***</td>
<td>1.095***</td>
<td>1.123***</td>
</tr>
<tr>
<td></td>
<td>(0.019)</td>
<td>(0.033)</td>
<td>(0.023)</td>
</tr>
<tr>
<td>SMB</td>
<td>-0.116**</td>
<td>0.161*</td>
<td>0.592***</td>
</tr>
<tr>
<td></td>
<td>(0.049)</td>
<td>(0.085)</td>
<td>(0.057)</td>
</tr>
<tr>
<td>HML</td>
<td>-0.355***</td>
<td>-0.052</td>
<td>-0.297***</td>
</tr>
<tr>
<td></td>
<td>(0.044)</td>
<td>(0.076)</td>
<td>(0.051)</td>
</tr>
<tr>
<td>Constant</td>
<td>0.272***</td>
<td>-0.019</td>
<td>0.496***</td>
</tr>
<tr>
<td></td>
<td>(0.092)</td>
<td>(0.160)</td>
<td>(0.108)</td>
</tr>
<tr>
<td>Observations</td>
<td>174</td>
<td>174</td>
<td>174</td>
</tr>
<tr>
<td>R²</td>
<td>0.947</td>
<td>0.893</td>
<td>0.949</td>
</tr>
<tr>
<td>Adjusted R²</td>
<td>0.946</td>
<td>0.891</td>
<td>0.948</td>
</tr>
<tr>
<td>Residual Std. Error (df = 172)</td>
<td>1.196</td>
<td>2.075</td>
<td>1.401</td>
</tr>
<tr>
<td>F Statistic (df = 1; 172)</td>
<td>1,008.113***</td>
<td>473.244***</td>
<td>1,044.288***</td>
</tr>
</tbody>
</table>

MRP = market risk premium, SMB = small minus big, HML = high minus low.
Note: *p<0.1; **p<0.05; ***p<0.01.
Source: Prometeia calculation on Refinitiv’s data.

### Table 4.5: Percentage of Companies that Present Significant Risk Factors for Different Levels of Significance (%)

<table>
<thead>
<tr>
<th>Risk Factors</th>
<th>alpha = 5%</th>
<th>alpha = 10%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>4.8</td>
<td>13.8</td>
</tr>
<tr>
<td>MRP</td>
<td>99.6</td>
<td>99.7</td>
</tr>
<tr>
<td>SMB</td>
<td>53.9</td>
<td>60.6</td>
</tr>
<tr>
<td>HML</td>
<td>43.4</td>
<td>50.9</td>
</tr>
<tr>
<td>GRF</td>
<td>25.4</td>
<td>32.4</td>
</tr>
</tbody>
</table>

GRF = green risk factor, MRP = market risk premium, SMB = small minus big, HML = high minus low.
Source: Prometeia calculation on Refinitiv’s data.
Table 4.6: Statistics of Green Risk Factor’s Betas in Different Clusters

<table>
<thead>
<tr>
<th>Risk Factors</th>
<th>Mean</th>
<th>Std. Dev.</th>
<th>% significant</th>
<th>% positive</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brown</td>
<td>-0.27</td>
<td>0.56</td>
<td>42.61</td>
<td>34.64</td>
</tr>
<tr>
<td>Non-green</td>
<td>0.09</td>
<td>0.35</td>
<td>17.08</td>
<td>62.60</td>
</tr>
<tr>
<td>Stable green</td>
<td>0.18</td>
<td>0.24</td>
<td>36.97</td>
<td>75.77</td>
</tr>
</tbody>
</table>

Source: Prometeia calculation on Refinitiv’s data.

4.5 Conclusions

We identify green firms among listed companies in the European Union using a comprehensive database of environmental information at the time and/or firm level. Unlike other studies based on subjective criteria for the choice of green firms, we propose an innovative approach that identifies a time-varying number of green firms using unsupervised learning techniques. This is the main contribution of our study to the existing literature. We then defined a pricing factor related to climate risk, calculated as the difference between the return on a portfolio of green and brown firms.

In line with recent studies, we find that green firms have underperformed non-green firms, i.e., investors are willing to buy green securities even if they yield lower returns (although they have higher returns than brown firms). However, focusing on the COVID-19 crisis period, we find that green firms outperformed the whole market, since they had higher returns than both brown and non-green firms. In addition, we find that during the COVID-19 crisis green firms also had higher risk-adjusted return. Finally, we find that green firms are more liquid than brown and non-green firms and this gap increased during the COVID-19 crisis. Overall, our results are consistent with recent contributions suggesting that green firms perform generally better in periods of market stress, in particular during the COVID-19 market collapse.

We then study the role of climate risk in equity prices by estimating an extended standard asset pricing model on single stocks by including the GRF. For the European Union stock market, our findings confirm that this factor is relevant when introduced in standard asset pricing models. Indeed, it has significance levels not far from other well-known factors in the literature (HML and SMB). We also find that generally green firms have positive exposure to the GRF (they benefit when the market concern...
on climate risk increases), while the opposite holds for brown firms. However, we also find that there is a significant fraction of firms whose exposure to the GRF is not consistent with cluster classification. This suggests that market prices might incorporate additional information on climate exposure of firms that are not correctly measured by the environmental data used to identify the clusters of firms.

More can be done to extend this approach and refine these results. First, in this chapter we clustered firms using only five different indicators, and by relying heavily on the environmental scores produced by Refinitiv. An alternative approach could be to cluster firms directly using the key performance indicators used in the analysis, thus considering a larger set of information and without relying on the aggregation method used by data providers in creating the scores. Second, we find that green firms are usually bigger (in terms of market value) than non-green and brown firms. This might be explained by the fact that big firms are better equipped to disclose a large amount of information and therefore they receive higher scores. To account for this bias a potential solution could be to apply clustering techniques to separate green firms in two separate groups: large cap and small-mid cap firms and take the union of these two sets. Another potential criticism is related to the definition of brown firms, which are identified as firms that belong to the CPRS. However, not all brown firms are the same. Brown activities are still needed in the transition to a greener economy and some of these firms could have started investment plans to reduce their emissions or to diversify their activity. A way to overcome this criticism would be to apply the clustering procedure to CPRS firms and identify “truly brown” firms as the worst performers among the clusters identified by the algorithm. Finally, we find that not all green firms have positive exposure to the GRF (and similarly for brown firms), suggesting that market prices might incorporate additional information on climate exposure that is not incorporated in our data. Integrating this information in our procedure would require running clustering techniques in two steps by integrating exposure to the GRF for each firm in the database.
Figure 4.7: Sectoral (NACE 2-digit level) Weighted Average of the Exposure to the Green Risk Factor across Firms

**Beta’s weighted-mean > 0**
- manufacture of paper and paper products (0.9%)
- repair of computers and personal and household goods (0%)
- programming and broadcasting activities (0%)
- accommodation (0.6%)
- advertising and market research (0.1%)
- manufacture of motor vehicles, trailers and semi-trailers (0.3%)
- creative, arts and entertainment activities (0.1%)
- motion picture, video and television programme production, sound recording and music publishing activities (0%)
- sewerage (4.6%)
- manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials (0.2%)
- employment activities (0.1%)
- air transport (4%)
- manufacture of furniture (0.1%)
- wholesale and retail trade and repair of motor vehicles and motorcycles (0.4%)

**Beta’s weighted-mean < 0**
- office administrative, office support and other business support activities (0.2%)
- water collection, treatment and supply (0.2%)
- electricity, gas, steam and air conditioning supply (31.5%)
- land transport and transport via pipelines (5.5%)
- printing and reproduction of recorded media (0.1%)
- waste collection, treatment and disposal activities; materials recovery (4.6%)
- crop and animal production, hunting and related service activities (13.4%)
- fishing and aquaculture (0.2%)
- manufacture of basic metals (4.9%)
- manufacture of coke and refined petroleum products (4%)
- mining support service activities (2.3%)
- mining of metal ores (2.3%)
- mining of coal and lignite (2.3%)
- extraction of crude petroleum and natural gas (2.3%)

Source: Prometeia calculation on Refinitiv’s data.
Figure 4.8: Boxplot of the Environmental Indicators’ Rank, Divided in Clusters

Notes: sal_em corresponds to the sales-to-emissions ratio, E_Sc to the Environmental Pillar Score, EM_Sc to the Emission Score, Env_In_Sc to the Environmental Innovation Score and Res_Sc to the Resource Use Score.

Source: Prometeia calculation on Refinitiv’s data.
Figure 4.9: Sectoral Distribution of Green, Non-green (included non-transparent), and Brown Portfolios

Notes: For each portfolio are considered the four largest sectors, in terms of market value, ordered counter clockwise in terms of emissions level (the sector in the north part of the radar corresponds to the highest emitting sector).

B06 – Extraction of crude petroleum and natural gas; C10 – Manufacture of food products; C11 – Manufacture of beverages; C19 – Manufacture of coke and refined petroleum products; C20 – Manufacture of chemicals and chemical products; C21 – Manufacture of basic pharmaceutical products and pharmaceutical preparations; C26 – Manufacture of computer, electronic and optical products; C28 – Manufacture of machinery and equipment n.e.c.; C29 – Manufacture of motor vehicles, trailers and semi-trailers; C32 – Other manufacturing; D35 – Electricity, gas, steam and air conditioning supply; G47 – Retail trade, except of motor vehicles and motorcycles; J61 – Telecommunications.

Source: Prometeia calculation on Refinitiv’s data.
References


Appendix

Refinitiv environmental indicators as defined by Refinitiv:

- **Sales-to-Emissions Ratio**: Net sales or revenue in US dollars divided by total \( CO_2 \) and \( CO_2 \) equivalents emissions in tonnes.
- **Environmental Pillar Score**: The environmental pillar measures a company’s impact on living and non-living natural systems, including the air, land, and water, as well as complete ecosystems. It reflects how well a company uses best management practices to avoid environmental risks and capitalize on environmental opportunities in order to generate long term shareholder value.
- **Emissions Score**: Emissions category score measures a company’s commitment and effectiveness toward reducing environmental emissions in the production and operational processes.
- **Resource Use Score**: Resource use category score reflects a company’s performance and capacity to reduce the use of materials, energy or water, and to find more eco-efficient solutions by improving supply chain management.
- **Environmental Innovation Score**: Environmental innovation category score reflects a company’s capacity to reduce the environmental costs and burdens for its customers, and thereby create new market opportunities through new environmental technologies and processes or eco-designed products.
Table A4: Summary Statistics of Refinitiv’s Environmental Indicators

<table>
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<tr>
<th>Year</th>
<th>Sales-to-Emissions Ratio</th>
<th>Environmental Pillar Score</th>
<th>Resource Use Score</th>
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<td>2005</td>
<td>0 2.4 15.8 127 42.5 3,001.6</td>
<td>0 4 23.5 29.5 50.7 91.9</td>
<td>0 0 8.2 18.1 32.9 56.5</td>
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<td>2006</td>
<td>0 3.2 16.6 109.6 47.8 2,957.1</td>
<td>0 5 26.7 31.1 52.7 95</td>
<td>0 0 8.8 17.3 34.9 57.7</td>
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<td>2007</td>
<td>0 3.7 20.2 98.8 50.1 3,460.2</td>
<td>0 18.1 40.2 40.6 61.4 96.9</td>
<td>0 0 9.2 17.9 35.5 58.1</td>
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<td>2008</td>
<td>0 3.3 19.1 106.7 50.6 4,673.5</td>
<td>0 27.2 49.6 48.7 73.3 96.7</td>
<td>0 0 9.5 18.2 36.1 59.3</td>
</tr>
<tr>
<td>2009</td>
<td>0 3.8 19.1 113.8 54.4 4,229.8</td>
<td>0 29.7 54.6 51.5 75 96.9</td>
<td>0 0 9.7 18.5 36.5 60.5</td>
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<tr>
<td>2010</td>
<td>0 4.6 20.2 100.3 56.4 2,974.9</td>
<td>0 32.3 56.2 52.9 75.6 96.9</td>
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<td>2011</td>
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<tr>
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<td>0 33.2 56 53.1 74.8 98.2</td>
<td>0 0 11.8 21.4 41.5 70.5</td>
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Table A4  continued

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<th>Med.</th>
<th>Mean</th>
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<td>99.8</td>
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Source: Prometeia calculation on Refinitiv’s data.
ESG Evaluation and Organizational Attractiveness for Prospective Employees: Evidence from Japan

Lian Liu and Naoko Nemoto

5.1 Introduction

This study tests the hypothesis that corporations with high environmental, social, and governance (ESG) evaluation have competitive advantages in attracting a larger pool of candidates and improving corporate value.

Recently, an increasing number of investors have incorporated nonfinancial factors measured by ESG issues into their investment decision making (World Bank 2018). ESG investment has expanded and reached $30.68 trillion in the five major markets in 2018, increasing from $18.23 trillion in 2014 (Global Sustainable Investment Alliance 2018). Since the coronavirus disease (COVID-19) shock in early 2020, the inflow of funds into ESG investment has further accelerated (IIF 2020).¹ Reasons for the increase in the investment balance are as follows: (i) implementation of the Principles of Responsible Investment (PRI)² under the leadership of the United Nations, which has been supported by more than 3,000 investors; (ii) adoption of the Sustainable Development Goals by 193 member countries of the United Nations in 2015 and subsequent policy responses; (iii) increased awareness of climate change risks in the wake of the Paris Agreement (2015) and

¹ The net increase of funds which have incorporated ESG factors reached $1.3 trillion during January to November 2020, increased by 1.5 times from the level in 2019.

² The PRI were launched in 2006 to encourage investors to incorporate ESG issues into investment practices through six principles.
other factors; and (iv) increased interest in unemployment, economic inequality, and sustainable growth of companies due to pandemic risks (Yuyama 2020). When factoring in ESG investments, investors often refer to the scoring of ESG evaluation companies and regard their assessment as the benchmark. Morgan Stanley Capital International (MSCI), FTSE Russell, and Sustainalytics are known as market leaders (World Bank 2018).

A similar concept to ESG evaluation is corporate social performance (CSP), which represents a company’s efforts in line with corporate social responsibility (CSR). CSR comprises a company’s discretionary multidimensional activities related to social, environmental, ethical, and economic performance of the business (McWilliams et al. 2006). The concept of CSR has a long and vast body of literature (Mosca and Civera 2017). ESG factors are chosen to evaluate a company’s CSR-based behavior from the perspective of investment decisions.

As the majority of ESG investment expects monetary returns as well as social returns, an increasing number of empirical research studies have explored the link between ESG evaluation and corporate financial performance. The results are inconclusive, while 60% of the existing literature shows there is positive link between ESG evaluation and corporate financial performance (Friede, Busch, and Bassen 2015). One reason for the continued debate relates to the variety of methodologies in which ESG factors are evaluated (Suto and Takehara 2016). In addition, limited research has been conducted to further explicate the transmission channels between ESG evaluation and corporate financial performance (Yuyama 2020).

To date, some research has shed light on how ESG factors are linked to corporations’ competitive advantage and long-term corporate values (Brammer and Pavelin 2006; Hur, Kim, and Woo 2013; Melo and Garrido-Morgado 2012). Ibuki (2003) points out that corporate CSR initiatives not only reduce corporate risk, but also improve their competitive position. As examples of a concrete effect, “superiority in transaction,

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3 MSCI Inc., is an American finance company headquartered in New York City and serving as a global provider of equity, fixed income, hedge fund stock market indexes, multi-asset portfolio analysis tools, and ESG-related products.

4 FTSE Russell is the trading name of the London Stock Exchange Group subsidiaries FTSE. International Ltd. The division provides equity index, as well as other indices and ESG products.

5 Sustainalytics is a subsidiary of Morningstar that rates the sustainability of listed companies based on their environmental, social, and corporate governance performance.
improvement of employee loyalty, improvement of enterprise brand value” are named.

The perception of corporate managers and investors are divided on whether ESG initiatives will create economic value. According to a McKinsey 2019 survey targeting top corporate managers and investors, 57% agreed that ESG factors contribute to increased corporate value, showing a small increase from 54% in 2009 (McKinsey 2020).

Given the inconclusiveness of existing literature, market perception, and limited analysis to explore the linkage of ESG and corporate value, the relationship between ESG and corporate attractiveness as an employer represents an interesting research theme. Attracting and retaining superior human resources can provide an organization with a competitive advantage and sustainable growth (Wright et al. 1995).

This study shows ESG evaluation is related to firms’ attractiveness to potential employees, suggesting that a firm’s high ESG scores may provide a competitive advantage in attracting human talent and enhancing corporate value. This result is supported by the existing theories, namely signaling theory and social identity theory. Prior literature suggested that because applicants have incomplete information about an organization, they interpret ESG information they receive as signals about the organization’s working conditions and sustainable management (Cheng, Ioannou, and Serafeim 2014). Additionally, social identity theory suggests that people classify themselves into social categories based on various factors such as the organization they work for, and that membership in these social categories influences an individual’s self-concept (Dutton, Dukerich, and Harquail 1994).

The empirical analysis is based on panel regression models with a data set of the top 300 companies in Japan in terms of market capitalization during 2016–2019. As a proxy of attractiveness as employers, we use Employment Brand Ranking based on the survey targeting university and graduate school students who are hunting for jobs. Regarding ESG evaluation, we use CSR scoring of Toyo Keizai, which is widely used in Japan. The study divides the target companies in two groups in terms of market capitalization and applies the model to each group. The coefficient significance of each component is different depending on the group of firms. E (environment) factor has a significant positive impact on attractiveness for employer in the group of firms with larger size, while G (governance) has a significant impact in the group of firms with smaller size.

In Japan, the penetration of ESG investment is lagging that of Europe and the United States, but the recent increase is remarkable. The amount outstanding of ESG investment has increased 2.5 times in 2 years from
On the other hand, there is still little empirical research on the effectiveness of ESG investment, especially the link between ESG evaluation and corporate value. Some corporate managers and investors hold cautious views toward ESG investment as they believe the effectiveness of ESG investments has not been fully verified. The results of this study have implications for the strategies of corporate management and policymakers. Improving ESG evaluation will support the organizations to appeal to potential employee, and secure sustainable growth. The findings could also be useful for investors who adopt ESG factors in decision making.

This study aims to contribute to the previous literature in four aspects. First, it presents an analysis of the linkage between ESG evaluation and attractiveness for potential applicants in Japan, which has not been verified by previous research. Second, compared to previous research (Turban and Greening 1997), the data sample has been expanded, and more variables that may affect the attractiveness of companies are factored in the model. Third, this study shows a mechanism that higher ESG evaluation can attract high-quality human resources and potentially improve corporate value. Fourth, it analyzes which ESG component has a significant impact on corporate attractiveness.

The remainder of this study is structured as follows. Section 5.2 reviews the relevant literature and discusses the research hypothesis. Section 5.3 explains the data and the methodology. Section 5.4 presents the empirical results and the robustness check. Finally, Section 5.5 discusses implications for the development of ESG investment and provide avenues for future research.

5.2 Related Literature and Research Hypothesis

5.2.1 Relationship between ESG Performance and Financial Performance

ESG investment has attracted a growing interest from research scholars over the past decades. Most of those studies have focused on analyzing the relation between ESG and corporate financial performance (Suto and Takehara 2016; Zhao et al. 2018; Su, Liu, and Teng 2010; Beck, Frost, and Jones 2018). The majority of the results identify positive correlation, although some are insignificant or negative (Margolis and Walsh 2003;
Van Beurden and Gossling 2008). Based on the research of Margolis and Walsh (2003), which reviews 127 studies between 1972 and 2002, the relationship between ESG and financial performance could be positive (109 studies), negative (seven studies), or insignificant (28 studies). Friede, Busch, and Bassen (2015) reviewed more than 2,200 existing research studies and found 60% of the literature related with corporate equity shows there is positive link between ESG evaluation and corporate financial performance.

In Japan, limited empirical research has been conducted on this issue and results are mixed. Yuyama, Shirasu, and Soichiro (2019) investigated the link between stock price returns and ESG disclosure scores of Japanese firms, which shows no significant relationship between the two factors except in 2017. Suto and Takehara (2016) identified that higher CSP is related with lower market-based risk measures of Japanese firms such as historical volatility of stock returns, while the effects of corporate financial performance (CFP) on a firm’s profitability are mixed.

One reason for the continued debate relates to the variety of methodologies in which ESG factors are evaluated (Suto and Takehara 2016). In addition, the results depend on specific situation and time horizons (Yuyama 2020). ESG activities may have a positive association with financial performance in certain environments, but a negative association or no association in other environments (Carroll and Shabana 2010). Besides, ESG activities often involve a long-term process and take years to fully develop and pay off financially. Yet, most related research is based on a short time horizon, which may explain the mixed results. Brammer and Millington (2008) investigate the link between CSP and CFP and claimed that the firms with both unusually high and low CSP have stronger financial performance than other firms, with unusually poor social performers doing best in the short run and unusually good social performers doing best over a longer time. In support of their arguments, they presented the empirical model and collection the data of from 537 firms’ annual reports that were registered in the London Stock Exchange in 1999.

5.2.2 Mechanism and Channels to Link ESG Evaluation and Financial Performance

The transmission channels that link ESG evaluation with corporate financial performance are yet to be debated. Prior literature explained the linkage based on the stakeholder’s theory. Jensen (2001) indicates companies with high ESG evaluation have an advantage in strategic management of various stakeholders, which is a vital component for the efficient creation of long-term firm value. A strand of literature
(Gregory, Tharyan, and Whittaker 2014) argues that companies with a strong ESG profile establish a competitive edge due to the more efficient use of resources, or better innovation management, which helps generate abnormal returns and ultimately leads to higher corporate value. Another strand of literature (El Ghoul et al. 2011; Jo and Na 2012; Oikonomou, Brooks, and Pavelin 2012) suggests that companies with strong ESG characteristics typically have better risk management, so they suffer less from severe incidents such as fraud, embezzlement and corruption, that can adversely impact the value of the company.

5.2.3 Relationship between ESG Evaluation, Corporate Attractiveness as Employers, and Corporate Brand

Turban et. al (1997) noted that firms engaging in CSR would have more positive reputations and would be perceived as more attractive employers by potential applicants, thereby providing those companies with a competitive advantage over their rivals. This study is based on data of 160 firms in the United States. They use polls by students in the strategic management course (n = 75) as a proxy of attractiveness. To estimate a model of firms’ attractiveness, firms’ profitability, and size are controlled.

Other research has focused on analyzing the relationship between ESG evaluation and nonfinancial values such as corporate brand. Some of them use brand fidelity and Fortune ranking as proxy measures of the corporate brand (Hoeffler and Keller 2002; Gardberg and Fombrun 2006; Melo and Garrido-Morgado 2012). The majority of studies reveal a positive relationship between ESG evaluation and corporate brand. Gardberg and Fombrun (2006) conclude that ESG activities are stimulants for increasing brand reputation in the minds of customers, thus making them an important factor for building a corporate brand.

This chapter explores the mechanism where ESG evaluation could affect corporate values by influencing corporate ability to attract and retain human talent. Another contribution of this study is that it utilizes larger and unbiased samples and incorporates recent data about when ESG investment gained momentum. The study also investigates the impact of each ESG component over corporates attractiveness.

5.2.4 Research Hypothesis

Based on the prior reference, this chapter derives the following hypotheses to detect the link between ESG evaluation, corporates attractiveness as employers, and corporate value:
**Hypothesis 1: A positive relationship exists between ESG evaluation and corporate attractiveness as employers.**

This hypothesis is supported by the existing theories, namely signaling theory (Fisman et al. 2006) and social identity theory (Dutton Dukerich, and Harquail). This result is consistent with the results of existing surveys. According to Deloitte’s millennial survey, the millennium generation places priority on ESG factors as the purpose of business. For instance, 32% of respondents believe the business should achieve improvement of society, while 27% say the business should be generating profits. The survey also shows those who perceive their workplace is engaged in environmental protection and other ESG issues tend to have high motivation and loyalty to the company (Deloitte 2019).

**Hypothesis 2: A positive relationship exists between corporate attractiveness as employers and corporate value.**

Attracting and retaining superior human resources can provide an organization with a sustained competitive advantage and sustainable growth (Wright et al. 2017). With the current labor shortage in some sectors and the projected shortage amid an aging society, attracting top-quality young applicants is becoming increasingly important for organizational success in Japan and other countries. This study verifies this hypothesis by estimating the effects of corporate attractiveness on Tobin’s Q, which is a proxy of corporate value.

### 5.3 Data and Methodology

#### 5.3.1 Data

**Dependent Variable: Attractiveness as Employers (Employment Brand Ranking)**

The data in this analysis span from 2016–2019 on a yearly basis. To test Hypothesis 1 and measure corporate attractiveness as employers, this study uses the employment brand ranking created by the Bunka Broadcasting Career Partners Employment Information Research Institute, one of the most famous employment information companies in Japan. This institute has conducted “employment brand surveys” during October and March and published the results in April and August since 2001. More than 20,000 university and graduate students who are registered on the employment information site responded. The employment ranking is made based on the result of the poll. The top 300 companies are regularly announced on its official site and

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7 Employment brand ranking is accessible from this site: https://www.careerpartners.co.jp/laboratory/employ/
Toyo Keizai magazines, which are widely read among businesspersons. We used the survey results published in the latter half of the year, as students vote after attending the firm briefings or interviews and it could be a more accurate assessment. In this research, the employment brand ranking is split into a 7-point scale, with 1 meaning that the companies are ranked 1 to 50, while 7 meaning that the companies are ranked beyond 300.

**Dependent Variable: Tobin’s Q**

To verify Hypothesis 2, this study uses Tobin’s Q ratio as a proxy for corporate value based on prior literature (Cho 1998; Davies, Hillier, and McColgan 2005). First, Tobin’s Q ratio is always considered as a long-term and forward-looking performance measure. It is in line with the attributes of ESG evaluation, that are more likely to pay off in the long run. Second, as a market-based measure, Tobin’s Q ratio minimizes the effects of any possible distortion in financial performance, resulting from firms’ reporting incentives and accounting choices (Servaes and Tamayo 2013; Cho and Tsang 2020). As such, we estimate Tobin’s Q ratio using the formula below:

\[
Q_{ratio} = \frac{Cap}{Asset} \tag{1}
\]

Where, \(Cap\) represents market capitalization of the company, while \(Asset\) represents total assets.

**Independent Variable: ESG Evaluation**

To measure ESG evaluation for Japanese firms, the study uses the Toyo Keizai CSR Corporate Ranking created by Toyo Keizai. The CSR ranking evaluates the four dimensions of corporate CSR-based behavior: environment, human resource utilization, social contribution, and corporate governance.\(^8\) They research CSR through questionnaire

---

\(^8\) The first dimension, environmental performance, covers the performance on environmental organization and information disclosure, and environmental performance. The second dimension, human source utilization, covers the performance on utilization of diverse human resources, human rights, labor issues, employment of persons with disabilities, personnel and evaluation system, work-life balance, and wages and leave systems. The third dimension, social contribution, covers the performance on social contribution business department, social contribution activity spending, community participation activities, educational/academic support activities, culture/arts/sports support activities, international exchange participation activities, great east Japan earthquake and other reconstruction support. Finally, the fourth dimension, corporate governance, covers the performance on corporate governance, legal compliance, and internal control. Evaluations are carried out on a company-wide, all-industry uniform basis.
surveys of companies and give them a rating and a score out of 100, with a higher score indicating better ranking. The survey was launched in 2001 and is conducted once a year. The 2019 survey covered 1,501 companies including 1,456 listed and 145 unlisted companies. This study chooses the CSR ranking as they have the greatest coverage of Japanese companies except for Bloomberg, have a long history of research, are infiltrating the Japanese market, and are supervised by researchers which ensures independence. The total number of firm-years for the sample is reduced to around 780 due to the lack of employment brand ranking or financial data.

It should be noted that the CSR ranking is evaluated by Toyo Keizai and is not the same as the performance of CSR or ESG. In some items, the point is added if there is disclosure of the company, and not because of the superiority or inferiority of the number.

**Control Variable**

Drawing on the literature that examines the drivers of corporate attractiveness and corporate brand, the control variables are corporate size (market capitalization), return on assets (ROA), revenue growth, price-to-earnings ratio (P/E), and industry classification. We use the natural logarithm of market capitalization (in millions of yen) as a proxy for firm size. Larger firms tend to be more visible to the public and ordinary people could hold more information regarding the activities of larger firms, so larger firms should be expected to obtain a better reputation than smaller rivals (Brammer and Pavelin 2006).

Strong financial performance has been widely proved to help a firm establish a good reputation, since it generally signals an effective corporate strategy, good management, good resource allocations, and so on (Roberts and Dowling 2002; Sabaté and Puente 2003). Revenue growth is used to capture how fast a business is expanding. ROA and P/E ratio are used to capture corporate profitability and market-based performance, respectively. We expect a positive relationship between corporate size, ROA, revenue growth, and corporate attractiveness.

Existing literature suggests that the industry sector is a mediating player between corporate brand and ESG factors as each sector would have different industry-specific stakeholder pressures and responses on ESG strategy (Brammer and Pavelin 2006; Melo and Garrido-Morgado 2012). For instance, environmental performance tends to have a negative impact on reputation in certain sectors, but not in the chemicals, consumer products, resources, and transport sectors. As such, we control industry factors using a dummy based on the Global Industry Classification Standards. The year dummy is included as a control variable because financial market conditions and business cycle may impact the attractiveness of specific corporate sectors.
The primary source of financial statement data is Capital IQ provided by S&P Global.

5.3.2 Methodology

Using the data sets explained in Section 5.3.1, a twofold approach is implemented. First, we developed the following panel data regression model to estimate corporate attractiveness (corporate employment brand ranking):

\[
\text{Ranking}_{it} = \alpha_0 + \alpha_1 \text{ESG}_{it} + \alpha_2 X_{it} + \alpha_3 \gamma_t + \mu_{it} \tag{2}
\]

Where, \( i \) and \( t \) denote the firms and time indices, respectively. The residuals are \( \varepsilon_{it} = \gamma_t + \mu_{it} \), where \( \gamma_t \) represents the unobserved time specific effect, while \( \mu_{it} \) represents the random error term. \( \alpha_0 \) represents constant terms. \( \text{Ranking}_{it} \) denotes employment brand ranking, as a reflection of corporate attractiveness for employer. \( \text{CSR}_{it} \) denotes corporate CSR ranking. The variable is lagged by 4 months to mitigate against endogeneity concerns. To examine the impact of different aspects of ESG (environment, human resource utilization, social contribution, and corporate governance) on corporate attractiveness, we estimate separate models by replacing \( \text{CSR}_{it} \) with \( E_{it}, S1_{it}, S2_{it}, G_{it} \), respectively. Here, \( E_{it} \) denotes environment. \( S1_{it} \) denotes human resource utilization. \( S2_{it} \) denotes social contribution. \( G_{it} \) stands for corporate governance.

\( X_{it} \) is a vector of control variables for equation (2). Our primary control variables in our model are market capitalization, ROA, revenue growth, P/E, and industry dummy.

Second, we developed the following regression model to explore the link between corporate value and corporate attractiveness as employers.

\[
\text{Q ratio}_{it} = \alpha_0 + \alpha_1 \text{Ranking}_{it} + \alpha_2 Y_{it} + \alpha_3 \gamma_t + \mu_{it} \tag{3}
\]

\( \text{Q ratio}_{it} \) denotes Tobin’s Q ratio. \( \text{CSR}_{it} \) denotes corporate CSR ranking. \( \text{Ranking}_{it} \) represents employment brand ranking, as a reflection of corporate attractiveness for employer. \( Y_{it} \) is an array of control variables for equation (3), which comprise total asset, financial leverage measured by corporate debt as a percentage of equity, ROA, revenue growth rate, and industry dummy.

First, company size is widely recognized as an essential factor affecting corporate financial performance because larger firms have greater bargaining power over suppliers and buyers, and thus could positively affect corporate value (Waddock and Graves 1997; Cho...
and Tsang 2020). Second, financial leverage is one of the tools a company can use to make the best financing and investment decisions. Stable and optimal capital structure contributes to better financial performance. Therefore, we include it as the control variable. Third, sales growth rate represents growth potential of firm. Finally, ROA is included in the regression model to control the effect of firms’ current profitability.

5.3.3 Descriptive Statistics and Correlation of Variables

Table 5.1 reports the descriptive statistics of main variables employed in this study. The corporate ESG scores range from 20 to 100 points.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Obs.</th>
<th>Mean</th>
<th>Median</th>
<th>Std. Dev.</th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ranking&lt;sup&gt;a&lt;/sup&gt;</td>
<td>1,056</td>
<td>4.381</td>
<td>5</td>
<td>2.201</td>
<td>1</td>
<td>7</td>
</tr>
<tr>
<td>Q Ratio&lt;sup&gt;b&lt;/sup&gt;</td>
<td>1,032</td>
<td>0.888</td>
<td>0.545</td>
<td>0.969</td>
<td>0</td>
<td>9.359</td>
</tr>
<tr>
<td>ESG&lt;sup&gt;c&lt;/sup&gt;</td>
<td>703</td>
<td>75.513</td>
<td>87.65</td>
<td>12.672</td>
<td>20</td>
<td>100</td>
</tr>
<tr>
<td>E</td>
<td>749</td>
<td>83.555</td>
<td>87.7</td>
<td>13.099</td>
<td>20</td>
<td>100</td>
</tr>
<tr>
<td>S1&lt;sup&gt;c&lt;/sup&gt;</td>
<td>781</td>
<td>82.992</td>
<td>84.5</td>
<td>10.441</td>
<td>20</td>
<td>100</td>
</tr>
<tr>
<td>S2&lt;sup&gt;c&lt;/sup&gt;</td>
<td>791</td>
<td>81.635</td>
<td>85.2</td>
<td>13.067</td>
<td>20</td>
<td>100</td>
</tr>
<tr>
<td>G&lt;sup&gt;c&lt;/sup&gt;</td>
<td>755</td>
<td>90.119</td>
<td>92.7</td>
<td>8.279</td>
<td>20</td>
<td>100</td>
</tr>
<tr>
<td>Ln(cap)&lt;sup&gt;d&lt;/sup&gt;</td>
<td>1,042</td>
<td>13.244</td>
<td>13.367</td>
<td>1.587</td>
<td>3.802</td>
<td>16.883</td>
</tr>
<tr>
<td>Ln(asset)&lt;sup&gt;e&lt;/sup&gt;</td>
<td>1,041</td>
<td>13.863</td>
<td>13.688</td>
<td>1.890</td>
<td>3.753</td>
<td>20.138</td>
</tr>
<tr>
<td>ROA&lt;sup&gt;f&lt;/sup&gt;</td>
<td>913</td>
<td>5.203</td>
<td>4.5</td>
<td>4.075</td>
<td>-28.479</td>
<td>21.580</td>
</tr>
<tr>
<td>Debt&lt;sup&gt;g&lt;/sup&gt;</td>
<td>1,042</td>
<td>0.875</td>
<td>0.372</td>
<td>2.062</td>
<td>-0.270</td>
<td>28.285</td>
</tr>
<tr>
<td>P/E&lt;sup&gt;h&lt;/sup&gt;</td>
<td>973</td>
<td>22.534</td>
<td>16.844</td>
<td>20.940</td>
<td>3.500</td>
<td>218.594</td>
</tr>
<tr>
<td>Growth&lt;sup&gt;i&lt;/sup&gt;</td>
<td>1,024</td>
<td>3.299</td>
<td>2.522</td>
<td>10.287</td>
<td>-35.034</td>
<td>115.844</td>
</tr>
</tbody>
</table>

Notes:
<sup>a</sup> Employment ranking
<sup>b</sup> Tobin’s Q ratio
<sup>c</sup> ESG aggregate score; E, S1, S2, and G represent environmental, human resource utilization, social, and governance scores, respectively.
<sup>d</sup> Market capitalization
<sup>e</sup> Total asset
<sup>f</sup> Return on asset
<sup>g</sup> Corporate debt as a ratio of corporate equity
<sup>h</sup> Price-to-earnings ratio
<sup>i</sup> Yearly revenue growth

Source: Authors.
Table 5.2 displays Pearson correlations between the main variables. As expected, ESG evaluation scores provide initial evidence on the negative implication of ESG on corporate attractiveness as employers. Based on the Pearson correlation coefficients matrix, most of the correlations are less than 0.5, which offers evidence that our estimate will not suffer from multicollinearity. However, each component of ESG and ESG aggregate score show a higher correlation.

**Table 5.2: Pearson Correlation Matrix**

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>11</th>
<th>12</th>
<th>13</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Q ratio</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Ranking</td>
<td>0.086</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>ROA</td>
<td>0.769</td>
<td>0.203</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>P/E</td>
<td>0.302</td>
<td>–0.004</td>
<td>0.019</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Growth</td>
<td>0.009</td>
<td>–0.077</td>
<td>0.112</td>
<td>–0.123</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Ln(asset)</td>
<td>–0.445</td>
<td>–0.366</td>
<td>–0.464</td>
<td>–0.177</td>
<td>0.112</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Ln(cap)</td>
<td>0.186</td>
<td>–0.311</td>
<td>0.113</td>
<td>–0.018</td>
<td>0.156</td>
<td>0.696</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Debt</td>
<td>–0.363</td>
<td>–0.132</td>
<td>–0.443</td>
<td>–0.073</td>
<td>0.040</td>
<td>0.451</td>
<td>0.014</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>ESG</td>
<td>–0.014</td>
<td>–0.250</td>
<td>–0.042</td>
<td>0.027</td>
<td>0.053</td>
<td>0.190</td>
<td>0.209</td>
<td>0.051</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>E</td>
<td>–0.168</td>
<td>–0.187</td>
<td>–0.096</td>
<td>–0.107</td>
<td>0.041</td>
<td>0.313</td>
<td>0.323</td>
<td>–0.007</td>
<td>0.423</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>S1</td>
<td>–0.057</td>
<td>–0.190</td>
<td>–0.056</td>
<td>–0.006</td>
<td>0.048</td>
<td>0.165</td>
<td>0.175</td>
<td>0.028</td>
<td>0.815</td>
<td>0.605</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>S2</td>
<td>–0.115</td>
<td>–0.217</td>
<td>–0.069</td>
<td>–0.061</td>
<td>0.044</td>
<td>0.329</td>
<td>0.386</td>
<td>–0.039</td>
<td>0.527</td>
<td>0.757</td>
<td>0.675</td>
<td>1</td>
</tr>
<tr>
<td>13</td>
<td>G</td>
<td>–0.114</td>
<td>–0.063</td>
<td>–0.027</td>
<td>–0.049</td>
<td>–0.025</td>
<td>–0.012</td>
<td>0.000</td>
<td>–0.066</td>
<td>0.473</td>
<td>0.551</td>
<td>0.640</td>
<td>0.666</td>
</tr>
</tbody>
</table>

Note: All the variables use the same abbreviations throughout the chapter. Refer to Table 5.1. Source: Authors.

### 5.4 Empirical Analysis

#### 5.4.1 Empirical Results

The results from the estimation of equation (2) are provided in Table 5.3.

The overall evaluation of ESG has significant negative signs, which suggests that higher ESG evaluation is associated with higher student brand ranking, namely higher attractiveness as employers.

To assess the effect of each ESG component, we replace the overall ESG scores with E (environment), S1 (human resource utilization), S2 (social contribution), and G (corporate governance). All components
have significant negative signs, suggesting each component is associated with attractiveness as employers. It shows corporations with high ESG evaluation have competitive advantages in attracting a larger pool of candidates. The result is striking in two ways. First, ESG evaluation seems to have a more significant impact on organizational attractiveness than other financial indicators including revenue growth and P/E ratio. Second, coefficient of E (environment) is significant with higher confidence level, compared to that of S1 (human resource utilization). This is contrary to expectations that work-life balance, wages, and leave systems are more essential factors in choosing the workplace. Our findings suggest potential applicants place emphasis on evaluation of corporate commitment to environmental protection, conserving and managing resources, good relations with society, and fair and transparent management when choosing the firm.

The coefficients of the control variables accord largely with prior studies and are also in alignment with the findings in the related literature. To conserve space, Table 5.3 does not include the coefficients associated with the time dummies and industry dummies.

**Responding to the Endogeneity Issue**

In general, analysis of the relationship between a company’s attractiveness and ESG evaluation may cause endogeneity issues. Companies that are popular among students have good name recognition and good profit margins. These factors are associated with higher capital expenditures to improve ESG factors. In order to alleviate the problem of endogeneity, we applied 1-year lagged value of ESG evaluation as an instrument. In addition, we applied a fixed effect model for removing enterprise-specific factors which potentially affect a dependent variable. Table 5.4 shows the results of this analysis. The overall evaluation of ESG has significant negative signs, which suggests that higher ESG evaluation is associated with higher student brand ranking using the fixed effect model. The effect of each component, E (environment) and S1 (human resource utilization) has significant negative signs, suggesting E and S1 are associated with popularity among students.

**Results of Subgroups**

We applied the model to subgroups, which are divided based on the market capitalization. The coefficient significance of each component is different depending on the group. For the group of larger firms, environment has a significant impact on corporate attractiveness as an employer, while for the group of smaller firms, governance is significant. The prior literature indicates that corporate governance is the most critical factor affecting corporate value in Japan (Kato 2000). Companies with weak corporate governance tend to cause serious scandals and
misconduct, which lead to a significant decline in corporate value (GPIF 2018). Smaller companies have relatively insufficient resources and internal architecture to develop corporate governance, and a prospective employee is expected to value governance assessments that mostly affect corporate value. On the other hand, for larger companies, it is interpreted that the environmental factor is more important under the assumption that the governance system is in place to some extent.

Table 5.3: Ordinary Least Squares Regression Results on Attractiveness for Employees

<table>
<thead>
<tr>
<th></th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
<th>(5)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ROA</td>
<td>0.0774***</td>
<td>0.0821***</td>
<td>0.0734***</td>
<td>0.0652***</td>
<td>0.0895***</td>
</tr>
<tr>
<td></td>
<td>(0.0248)</td>
<td>(0.0229)</td>
<td>(0.0231)</td>
<td>(0.0241)</td>
<td>(0.0231)</td>
</tr>
<tr>
<td>Ln(cap)</td>
<td>-0.716***</td>
<td>-0.748***</td>
<td>-0.748***</td>
<td>-0.753***</td>
<td>-0.798***</td>
</tr>
<tr>
<td></td>
<td>(0.0769)</td>
<td>(0.0690)</td>
<td>(0.0721)</td>
<td>(0.0726)</td>
<td>(0.0696)</td>
</tr>
<tr>
<td>Growth</td>
<td>-0.00465</td>
<td>-0.00423</td>
<td>-0.00458</td>
<td>-0.00561</td>
<td>-0.00681</td>
</tr>
<tr>
<td></td>
<td>(0.00721)</td>
<td>(0.00650)</td>
<td>(0.00649)</td>
<td>(0.00652)</td>
<td>(0.00715)</td>
</tr>
<tr>
<td>P/E</td>
<td>-0.00185</td>
<td>-0.000207</td>
<td>-0.00159</td>
<td>-0.000879</td>
<td>-0.00196</td>
</tr>
<tr>
<td></td>
<td>(0.00421)</td>
<td>(0.00397)</td>
<td>(0.00405)</td>
<td>(0.00413)</td>
<td>(0.00412)</td>
</tr>
<tr>
<td>ESG</td>
<td>-0.0284***</td>
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<tr>
<td></td>
<td>(0.00986)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>S1</td>
<td></td>
<td>-0.0143*</td>
<td></td>
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<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.00736)</td>
<td></td>
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<tr>
<td>S2</td>
<td></td>
<td></td>
<td>-0.0131**</td>
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</tr>
<tr>
<td></td>
<td></td>
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<td>(0.00640)</td>
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</tr>
<tr>
<td>E</td>
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<td>-0.0181***</td>
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<td></td>
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<td></td>
<td></td>
<td>(0.00617)</td>
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</tr>
<tr>
<td>G</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>-0.0175**</td>
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<td>(0.00845)</td>
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<tr>
<td>Constant</td>
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<td>16.32***</td>
<td>18.56***</td>
<td>16.84***</td>
<td>17.59***</td>
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<td></td>
<td>(1.908)</td>
<td>(1.439)</td>
<td>(1.554)</td>
<td>(1.420)</td>
<td>(1.574)</td>
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<td>Time effect</td>
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<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
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<tr>
<td>Industry dummy</td>
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<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
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<td>Observations</td>
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<td>695</td>
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<td>665</td>
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<td>0.529</td>
<td>0.458</td>
<td>0.459</td>
<td>0.476</td>
<td>0.462</td>
</tr>
</tbody>
</table>

Notes: 1. Standard errors in parentheses. 2. *, ** and *** mean significance at 10%, 5%, and 1% levels, respectively, and standard errors. 3. S1: human source utilization, S2: social contribution, E: Environment, G: Corporate Governance. All the variables use the same abbreviations throughout the chapter. Refer to Table 5.1.

Source: Authors.
### Table 5.4: Fixed-effect Regression Results on Attractiveness for Employees

<table>
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<tr>
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<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
<th>(5)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ROA</td>
<td>0.127***</td>
<td>0.112***</td>
<td>0.103***</td>
<td>0.102***</td>
<td>0.124***</td>
</tr>
<tr>
<td></td>
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<td>(0.0255)</td>
<td>(0.0256)</td>
<td>(0.0268)</td>
<td>(0.0258)</td>
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<tr>
<td>Ln(cap)</td>
<td>−0.788***</td>
<td>−0.772***</td>
<td>−0.777***</td>
<td>−0.842***</td>
<td>−0.841***</td>
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<td>(0.0812)</td>
<td>(0.0821)</td>
<td>(0.0786)</td>
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<td>(0.00678)</td>
<td>(0.00674)</td>
<td>(0.00680)</td>
</tr>
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<td>18.23***</td>
<td>17.44***</td>
<td>19.17***</td>
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<td>0.497</td>
<td>0.492</td>
<td>0.520</td>
<td>0.494</td>
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Notes: 1. Standard errors in parentheses. 2. *, ** and *** mean significance at 10%, 5%, and 1% levels, respectively, and standard errors. All the variables use the same abbreviations throughout the chapter. Refer to Table 5.1.
Source: Authors.
### Table 5.5: Fixed-effect Regression Results on Attractiveness for Employees (Larger Group)

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</tr>
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<td>0.117***</td>
<td>0.105***</td>
<td>0.119***</td>
<td>0.144***</td>
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<td>(0.0307)</td>
<td>(0.0303)</td>
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<tr>
<td>Ln(cap)</td>
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<td>−0.936***</td>
<td>−1.025***</td>
<td>−1.001***</td>
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<tr>
<td></td>
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<td>(0.180)</td>
<td>(0.173)</td>
<td>(0.171)</td>
<td>(0.179)</td>
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<td>Growth</td>
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<td></td>
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<td>(0.00701)</td>
<td>(0.00699)</td>
<td>(0.00719)</td>
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<td>Yes</td>
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</tr>
<tr>
<td>Industry dummy</td>
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<td>R-squared</td>
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<td>0.617</td>
<td>0.623</td>
<td>0.640</td>
<td>0.631</td>
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Notes: 1. Standard errors in parentheses. 2. *, ** and *** mean significance at 10%, 5%, and 1% levels, respectively, and standard errors. All the variables use the same abbreviations throughout the chapter. Refer to Table 5.1.

Source: Authors.
Table 5.6: Fixed-effect Regression Results on Attractiveness for Employees (Smaller Group)

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<td>0.115**</td>
<td>0.105**</td>
<td>0.0929**</td>
<td>0.0826</td>
<td>0.116***</td>
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<td>(0.0434)</td>
<td>(0.0444)</td>
<td>(0.0503)</td>
<td>(0.0442)</td>
</tr>
<tr>
<td>Ln(cap)</td>
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<td>-0.600***</td>
<td>-0.638***</td>
<td>-0.766***</td>
<td>-0.692***</td>
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<td></td>
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<td>(0.197)</td>
<td>(0.209)</td>
<td>(0.218)</td>
<td>(0.202)</td>
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<td>Growth</td>
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<td>-0.0245</td>
<td>-0.0284</td>
<td>-0.0225</td>
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<td>(0.00647)</td>
<td>(0.00683)</td>
<td>(0.00654)</td>
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<tr>
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<tr>
<td>L.E</td>
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<td></td>
<td>(0.0117)</td>
<td></td>
</tr>
<tr>
<td>L.G</td>
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<td></td>
<td></td>
<td></td>
<td>-0.0350**</td>
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<tr>
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<td>17.95***</td>
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<td>(2.859)</td>
<td>(2.787)</td>
<td>(2.967)</td>
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<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Industry dummy</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
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<td>257</td>
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<td>245</td>
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<td>R-squared</td>
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<td>0.385</td>
<td>0.382</td>
<td>0.405</td>
<td>0.398</td>
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</table>

Notes: 1. Standard errors in parentheses. 2. *, ** and *** mean significance at 10%, 5%, and 1% levels, respectively, and standard errors. All the variables use the same abbreviations throughout the chapter. Refer to Table 5.1.
Source: Authors.
The result from equation (3) is provided in Table 5.7. It shows a significant negative relationship between Tobin’s Q ratio and employment ranking, implying that attracting and retaining superior human resources can provide organization with a sustained competitive advantage and improve corporate value.

### Table 5.7: Ordinary Least Squares Regression Results on Corporate Value

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<tr>
<td></td>
<td>(0.0200)</td>
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<tr>
<td>Debt</td>
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<tr>
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<td>(0.0297)</td>
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<tr>
<td>Growth</td>
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<tr>
<td></td>
<td>(0.00213)</td>
</tr>
<tr>
<td>Ranking</td>
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</tr>
<tr>
<td></td>
<td>(0.0121)</td>
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<tr>
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<td>Industry dummy</td>
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<td>Observations</td>
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</tr>
<tr>
<td>R-squared</td>
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Notes: Standard errors in parentheses. *, ** and, *** mean significance at 10%, 5%, and 1% levels, respectively, and standard errors. All the variables use the same abbreviations throughout the chapter. Refer to Table 5.1.

Source: Authors.

### 5.4.2 Robustness Check

This study chooses the linear probability model following prior studies. This method is convenient and easier to interpret (Angrist and Pischeke 2008). On the other hand, there is an argument that the ordered probit model would be more appropriate if the number of dependent variables
is limited. To confirm validity of the estimated results, we applied the ordered probit model. From the results reported in Table 5.8, we confirm the relationships between ESG evaluations and corporate attractiveness are similar with the results using OLS.

Table 5.8: Ordered Probit Model Regression Results

<table>
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<tr>
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</tr>
</thead>
<tbody>
<tr>
<td>ROA</td>
<td>0.0711***</td>
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<td>0.0451***</td>
<td>0.0405**</td>
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<td>(0.0159)</td>
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</tr>
<tr>
<td>Ln(cap)</td>
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</tr>
<tr>
<td>Growth</td>
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<td>(0.00513)</td>
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<td></td>
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<td>(0.00403)</td>
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</tr>
<tr>
<td>G</td>
<td></td>
<td></td>
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<td>-0.0117**</td>
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<tr>
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<td></td>
<td></td>
<td></td>
<td>(0.00557)</td>
<td></td>
</tr>
</tbody>
</table>

| Time effect | Yes | Yes | Yes | Yes | Yes |
| Industry dummy | Yes | Yes | Yes | Yes | Yes |
| Observations  | 376  | 689  | 695  | 663  | 665  |
| LogLik        | -574.7 | -1082 | -1091 | -1030 | -1044 |

Notes: Standard errors in parentheses. *, **, and *** mean significance at 10%, 5%, and 1% levels, respectively, and standard errors. All the variables use the same abbreviations throughout the chapter. Refer to Table 5.1. Source: Authors.
5.5 Conclusion

This study addresses the scarcity of research that examines the linkage between ESG evaluation and corporate value with a focus on corporations’ attractiveness as employers. The empirical results show ESG evaluation is related to firms’ attractiveness as employers, suggesting that a firm’s high ESG scores may provide a competitive advantage in attracting human talent, which could provide a sustainable competitive advantage.

The coefficient significance of each component is different depending on the group of firms. E (environment) factor has a significant positive impact on attractiveness for employers in the larger firm group, while G (governance) is most relevant for the smaller firm group.

The results of this study have implications for the strategies of corporate management. Improving ESG evaluation will support the organizations to appeal to potential employees and secure sustainable growth. The findings could also be useful for investors who adopt ESG factors in decision making. In the Japanese firm context, the need to improve ESG evaluation and attract qualified talent is more critical, given the diminishing supply of the younger labor force and labor shortages in some industries such as information technology, construction, services, medical, and welfare. Corporations can do this by signaling to potential employees in advertisements that they offer a work environment conducive to ESG activities such as environmental protection, diversity, transparent corporate governance, and by providing a culture that reinforces individual workers’ identities of social contribution.

The results of this study have policy implications. Although ESG investment has gained more support from governments and regulatory authorities, the level of implementation, ESG disclosure, and transparency are diverse among countries. This finding could give more incentives to governments to improve the framework of ESG investment as better disclosure will support market function and enhance ESG activities of the corporations.

Finally, we address the limitations of the study. The study covers top-tier Japanese firms from 2016 to 2019. An extension of the sample could explore the research perspective. Investing the link between ESG evaluation and other factors related with competitive advantage such as loyalty of employees is another topic for research.
References


(Y In Japanese)


(Y In Japanese)

6

Resurgence of ESG Investments in India: Toward the Making of a Sustainable Economy

Gopal K. Sarangi

6.1 Introduction

There has been a transformation in the investment flow, pattern, and structure with a specific thrust on the sustainability of investments and environmental, social, and governance (ESG) investments in recent years. This has been both a global as well as a domestic phenomenon spreading across several economies in the world. It is increasingly realized that investors are going beyond the conventional norms of financial statements of business units and laying more emphasis on ESG investments (Bhavani and Sharma 2019). Traditional financial metrics to weigh investments are found to be increasingly inadequate and to fall short of the rising demand of investors and customers to go beyond monetary measures. It is also realized that conventional investments always have pursued a narrow self-interest and often have left adverse environmental and social footprints (D’Souza 2020), and hence need to be revisited. Similarly, it is echoed that nonfinancial measures such as ESG factors are placed high on the agenda when it comes to decision making by investors (Inderst and Stewart 2018).

Emphasis is increasingly laid on sustainability of investments and adherence to ESG norms in the investment decision-making processes and investment analyses. Under these forms of investments, there always exist a dichotomy between simple profit maximization and ESG-integrated profit maximization options. Historically, ESG investments, often connoted as socially responsible investments have experienced rapid growth starting from the early 21st century.
More precisely, the genesis of ESG investments could be traced back to 2004 with initial initiatives led by the United Nations (UN) in this regard. Incorporating ESG factors is argued to have salutary effects on business entities in terms of enhancing their efficiency, productivity, and supporting their long-term risk management. The literature points out that ESG-integrated corporate entities are found to have generated more profits than non-ESG-integrated corporate houses (Korwatanasakul and Majoe 2019). While a focus on financial investments could result in windfall short-term gains, however, emphasis on ESG investments could enhance business sustainability over the long run. Such investments largely follow a triple bottom line approach where financial returns are combined with environmental and social norms. While environment and social factors are important, at the same time it is crucial to see how they are integrated with business governance.

One of the crucial ingredients of sustainable investment is in terms of transparent ESG reporting and disclosure of information. While in many countries ESG reporting and disclosure have a legal standing, in many instances they are voluntary in nature. Reporting and disclosure of information are crucial for investors and customers to understand a corporate house’s long-term business and investment strategies and assess its sustainability quotient. This information becomes crucial for investors to manage their investment risks and understand the company’s strategy and purpose (PwC 2020). In fact, many scoring and rating systems have evolved in the past to understand the ESG performance of companies in varying degrees and forms across countries.

A multitude of factors have contributed to such transformation in investment style and pattern and have made it imperative to integrate sustainability elements within the conventional financial investment systems. It has been observed recently that corporations have become victims of poor governance systems resulting in poor societal and environmental outcomes. Global examples of high-profile imprudent material ESG incidents such as the Deepwater Horizon oil spill case in the Gulf of Mexico, the Volkswagen breach of environmental norms case, and Facebook’s data privacy disclosure case are examples of such poor governance systems and structures, which reiterate the need to integrate ESG factors into the investment decision-making processes (UN 2020). The resurgence of ESG investments was further accelerated with the global financial crisis of 2007–2008, which has forcefully put forward the imperative to place measures beyond the existing traditional financial statements and reporting structures of business units and corporations and devising alternative approaches to the conventional monetary approach. In fact, the financial crisis of 2008 ushered a new era for ESG investment globally by questioning and revisiting conventional financial
investment patterns and mechanisms by integrating ESG principles in the investment domain. New investment options and instruments were introduced building on the notion of ESG and catering to the overarching societal and environmental goals.

Increasing perils of environmental and climate-related crises have emerged as compelling factors for countries to mobilize private investors as important stakeholders in achieving the UN Sustainable Development Goals (SDGs) by incorporating ESG factors in the investment processes and investment decision-making systems. Business entities are expected to play a pivotal role and have significant responsibilities in taking appropriate measures for minimizing the mounting environmental and societal crises. In fact, growing environmental and climate concerns such as the increasing greenhouse gas (GHG) emissions, sea level rise, increasing frequency of heat waves, and unmanageable waste generation, are posing threats for the sustenance of any economy. For instance, India is known as one of the most vulnerable countries to climate change and natural disasters (Eckstein et al. 2019). Similarly, a host of social factors such as violation of human rights and labor rights, rising cases of child labor, gender inequality, and occupational health and safety concerns have reiterated the importance of adhering to ESG principles in the investment decision-making processes. It is asserted that consumers and investors are increasingly informed about the adverse impacts of exploitative labor practices, poor working and health conditions, and poor environmental management standards and practices of corporate entities, and demand that corporate entities tighten environmental standards and social policies and get motivated for responsible business behavior and practices (Bansal and Gangopadhyay 2003; Ervin et al. 2012; Khanna and Speir 2013).

Further, there have been global thrusts laid on ESG investments as is evident in various global declarations and global forums. The UN has taken leadership in this arena. Several key UN initiatives clearly demonstrate the importance assigned to ESG-integrated investments at the global scale. Initiatives such as the Principles for Responsible Investment (PRI), the UN Global Compact, and the UN Environment Programme Finance Initiatives are evident of such thrusts laid on ESG investments for sustainable global transformation. More importantly, the declaration of the SDGs is a testament of such global thrusts on ESG investments and sustainability of investments. In addition, it is reported that the SDGs place private investors in the central position in arresting and minimizing the growing environmental and social problems (Nemoto and Liu 2020). Several of these goals are expected to be met through private investments and hence ESG investments can be a game changer in meeting the SDGs (Korwatanasakul 2020). It is argued that
the challenges identified through the SDGs cannot be met through public financing sources alone, rather they require active support and participation of private investors. The UN’s projections reveal that achieving SDGs for developing countries requires an investment of $3.9 trillion annually and it is expected that there would be substantial investment flowing from impact investors to meet such a gigantic size of the investment.

The drive toward ESG investments also has been spurred by a strong link between ESG investments and macroeconomic variables. Studies have also pointed out the macroeconomic benefits of such transformation in the investment environment with increasing recognition of ESG factors as crucial elements of an investment pattern. For instance, it is posited that ESG-embedded investments would result in minimizing default risk, hence reducing the cost of sovereign borrowing of countries (Nemoto and Liu 2020).

Globally, ESG investments are gathering momentum and pace and have been fast increasing in recent years. For instance, the number of PRI signatories within the UN is a clear evidence of global recognition and thrust laid on sustainable investments. Latest statistics suggest that the number of signatories have increased to 7,000 spreading across 135 countries. Regionally, the US and Europe steer such sustainable investments and are ahead in the curve compared to other countries; however, some Asian countries like Japan and Malaysia are surging ahead too. It is further expected that Asia—emerging as a leading global leader in the coming decades—should play a prominent role in the sustainable development agenda.

Globally, ESG investments have soared to new high to $34.7 trillion in 2018 in five major markets. ESG investments have grown 36% since 2016 and continue to surge ahead (GSIA 2018). The United States and Europe continue to be the largest contributors, and within Asia and the Pacific region, Australia, Japan, and New Zealand are major contributors with rapidly increasing shares. It is worth highlighting that ESG investments have experienced a dramatic rise even during the coronavirus (COVID-19) pandemic. Globally, equity funds with ESG mandates have experienced a record jump to $168 billion in 2020, almost close to triple of what it was in 2019 (Jethmalani 2021). Brandt and Srimurthy (2021) highlight that a comparison of socially responsible (SRI) and/or ESG equity funds with non-SRI and/or ESG funds reveals that SRI and/or ESG equity funds have performed 4% better than their counterpart non-SRI and/or ESG funds on a continuous basis over the last 4 years. Historically, in terms of assets, ESG investments started with equity investment, with a recent focus on bond markets.
Although ESG investment is at a very nascent stage in India, it is increasingly getting traction in the country. A recent push is primarily reinforced with a thrust on climate friendly investments and a focus on private sector investment for green energy in the country. The Economic Survey 2020–21 (Government of India 2021) explicitly recognizes the need to integrate climate and financial policies and identifies a host of measures driving ESG investments in the country. However, ESG research in the Indian context has received scant attention so far. There is a dearth of scholarly literature in this space, although some efforts have been undertaken in the larger umbrella of sustainability of corporate sector. In this context, this chapter will examine the following set of research questions.

- Assess the ESG status, evolution, and development trajectory in the country
- Map the legal, regulatory, and institutional landscape governing ESG investment in the country
- Present an analysis of the performance of corporate entities with sustainability integrated features

The chapter uses various secondary data and information for analysis. A sustainability analysis of a dozen corporate entities is carried out to assess the key features of the sustainability character and thrusts of these entities. A framework is proposed to capture the drivers of the sustainability of Indian corporate entities and their dynamic nature and character. Both qualitative and quantitative techniques are used for analysis.

The chapter is structured as follows. Section 6.2 maps the global ESG investment scenario. Section 6.3 offers a nuanced understanding of ESG developments in India. The legal and institutional landscape of ESG investments in India is presented in Section 6.4. Section 6.5 presents a sustainability analysis of a dozen Indian corporate bodies, and Section 6.6 concludes the chapter.

6.2 Mounting Environment, Social, and Governance Investments: Global Scenario

Globally, ESG investments have received momentum as a mechanism attracting both investors and consumers. There are at least three major direct drivers of such a rise in ESG investments. First, it is increasingly recognized that integrating ESG factors could generate salutary effects on investor risks and returns. Second, an important consideration is about the aspirations from the beneficiaries and clients about the
transparency of their money being invested and the role ESG can play in meeting these aspirations. The third factor is connected with the increasing legal framework for ESG investments and legal imperatives for such investments in various countries across the world.

It has been observed that there has been increasing interest in ESG integration in the investment decision-making processes worldwide, with an annual growth rate of 24%. Geographically, the United States and Europe are the largest contributors (Korwatanasakul 2020). Although ESG integration is yet to be accelerated in Asia; however, it is found that there has been surging demand for ESG investments in Asian countries. Countries like Japan are the front runners, and several other countries are picking up their ESG investments. The Global Sustainable Investment Alliance reports that “do good” investment is fast rising globally and is considered by investors as a lucrative business option. Recent information drawn from the Morgan Stanley Capital International (MSCI) indices reveals that information technology (IT) as a sector has become the leader in integrating ESG in the investment decision-making processes, followed by the health care and financial sectors (Bhatt 2020). The declaration of the UN SDGs has further reinforced the need to drive investments in a more sustainable manner. Some estimates suggest that climate commitments enshrined in the Paris Agreement and goals set in the SDGs require approximately $7 trillion per year. Importantly, it is expected that a substantial chunk of this investment is expected to be mobilized through private finance and by private investors. Available information shows that the value of ESG investments globally has doubled in the last 4 years and touched a new high of $40.5 trillion in 2020. Even ESG-integrated investment indices have outperformed their peers during the COVID-19 period, which clearly implies an increasing appetite for such investments among investors and business houses.

In fact, the UN has assigned primacy to ESG investments and has taken several noteworthy initiatives in this sphere, starting from 2004. A network of ESG investors has been institutionalized through the UN’s PRI. Latest information reveals that the number of signatories in the PRI has increased to 7000 spreading across 135 countries (Figure 6.1). A host of other related initiatives have been undertaken by the UN to make signatories to act as drivers of change such as Climate Action 100+, which specifically aims at ensuring 167 largest corporate GHG emitters to take proactive actions on climate change. More than 500 investors having investment assets of $47 trillion under this scheme, are targeting to achieve net-zero emissions transition. Under this action, benchmarks are constructed for companies based on many sustainability indicators such as ambition, target and goal, decarbonization strategy, capital alignment, climate support policy, governance, transition, and reporting. Similarly,
the PRI are actively encouraging governments to integrate climate change in the COVID-19 recovery process too. Related sustainability initiatives such as the “UN Convened Net-Zero Asset Owners Alliance” launched in 2019 focuses on a variety of activities such as monitoring, reporting, verification, and engagement with asset owners, managers, and corporate entities. Similar initiatives have been taken by forming the “Net Zero Asset Managers Initiative,” which is committed to extend support to the net-zero emissions goals of 2050. Under this initiative, $9 trillion of assets have been committed to achieve the stated goals and 30 signatories have joined this global initiative. Similar efforts to drive ESG investments have been undertaken through the Sustainable Stock Exchange promoted by the United Nations Conference on Trade and Development. The primary goal of such a global platform is to improve the performance of stock exchanges in terms of sustainable investment. As a result of these initiatives, there have been significant improvements in the disclosure of companies with regard to the environmental and social impacts of their activities and investments. In addition, to aid policy makers in the process, the UN has developed ESG policy toolkits to support policy makers of different countries in their effort to streamline ESG policy making. Apart from the UN, several other initiatives are worth noting. For instance RE100, a global initiative is designed to encourage business entities to commit to become green and procure 100% of their energy from renewables. Close to 300 corporate houses have joined this initiative so far, driving the transition toward sustainable sourcing of energy.

In addition, the Global Reporting Initiative has been undertaken to bring transparency and increase the impact of corporate entities by setting global standards and sharing the sustainability reporting

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**Figure 6.1: Number of Signatories and Number of Asset Owners**

<table>
<thead>
<tr>
<th>Year</th>
<th>Number of Signatories</th>
<th>Assets under management ($ trillion)</th>
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information with larger stakeholders such as investors, policy makers, civil society organizations, and labor organizations. It has created one of the largest networks of 10,000 Global Reporting Initiative reporters spread over 100 countries to enhance the sustainability reporting among the countries.

Studies also have reported that there has been a dramatic surge in investment assets with ESG-embedded features. Latest available information shows that SRI and/or ESG equity funds have almost doubled in 2020 and similarly SRI and/or ESG bonds have experienced a 100% increase too. Importantly, there has been a better return on equity and bonds having ESG-embedded features compared to their peers. In terms of sectors, technology, telecommunications, and health care are the areas that attract most of the ESG equity and bond funds. It can be elicited from Figure 6.2 that SRI and/or ESG funds have continuously outperformed their counterpart non-SRI and/or ESG funds in the last 6 years. Importantly, the trend continues even during the pandemic.

It can be drawn from the above that there has been clear emphasis laid at the global scale to promote and accelerate ESG investments. The UN has taken special initiatives on ESG investments and the declaration of the SDGs reflect the need and priority that should be emphasized in ESG. Importantly, a comparison of ESG-integrated assets found them to be better performers compared to their non-ESG counterparts.

Figure 6.2: Comparative Performance of SRI/ESG Funds versus Non-SRI/ESG Funds

- Cumulative monthly performance (%) for SRI/ESG and all Emerging Markets Equity Funds, 2014–YTD

EM = emerging market, ESG = environmental, social, and governance, SRI = socially responsible.
Source: Brandt and Srimurthy (2021).
6.3 Environmental, Social, and Governance Investment Landscape in India

Considering India’s development priorities, integration of ESG elements in the investment process becomes crucial to address the persisting societal conundrums and increasing environmental and climate threats (Government of India 2021). This is in tune with meeting the country’s SDGs. Studies point out that meeting the SDGs in India requires an annual investment of $0.6 trillion (IIC 2020). The current thrust on climate change and focus on upscaling green energy investments points to the country’s focus on and need for ESG investments. Even global commitments made by the country such as reducing carbon emissions by 30% by 2050 and procuring 40% of the energy from non-fossil fuel sources by 2030 are clear indications of the country’s focus and imperative to integrate ESG factors in the investment process. The Government of India is increasingly realizing the importance of ESG integration in business processes and has been actively promoting it through various reforms and regulations, since the last decade. Latest developments in this sphere are evident in the 2020–21 Economic Survey released recently, which emphatically points out the need to streamline financing for sustainable development (Government of India 2021).

It is worth noting some of the sustainability initiatives undertaken by India’s corporate leaders. One such initiative is the participation of Indian corporations in the RE100\(^1\) global movement, which urges corporate entities to go green. This is also in tune with the business value proposition of business entities in India, as industrial electricity consumption in India constitutes more than 40% of the total electricity consumption (Sarangi and Taghizadeh-Hesary 2021). Many Indian corporate houses such as Infosys, Mahindra and Mahindra, Dalmia Cement, and Tata Motors have become part of RE100 and have voluntarily committed to source their energy from renewable sources (Mudaliar and Telang 2020). For instance, the Dalmia company has committed to go complete renewable by 2030. Businesses in India have realized the imperative to seize the opportunity to tap renewables and more and more corporate entities are adopting this. Similarly, under corporate renewable power purchase agreements, many Indian corporate entities are doing exceedingly well. India ranks as the second largest market as far as corporate renewable power purchase agreements are concerned. Several Indian corporate entities have found a place

\(^1\) RE100 is a commonly used term representing Renewable Energy 100 group.
in the Dow Jones Sustainability Index, for example, Mahindra and Mahindra, Godrej Consumer Products, Infosys, Tata Motors, Glenmark, Havells India, M&M Financial Services, Hindalco Industries, Tata Steel, Tech Mahindra, and Wipro. Similarly, a host of voluntary initiatives have also been undertaken by several Indian companies. For instance, several cement companies in India have undertaken initiatives in a waste-to-energy system, where electricity produced through this process would eventually reduce their reliance on fossil fuels. A quick mapping of these sustainability initiatives of Indian corporate entities reveals that many of them are doing well in terms of reducing their carbon footprint by integrating green energy in their operations and adopting energy efficiency principles.

Indian corporate entities are increasingly integrating ESG factors in their business decision-making processes. For instance, asset management companies such as Axis Mutual Fund, ICICI Prudential, and Aditya Birla Sun Life have launched ESG-integrated schemes (Jethmalani 2021) and are increasingly adopting ESG norms in their investment decision-making processes. Information revealed by the National Stock Exchange shows that ESG-indexed companies have fared well compared to non-ESG indexed companies.

A study carried out an evaluation of 50 listed companies in India revealed some interesting facets of ESG performance by Indian companies (NSE 2020). For instance, it found that companies have performed comparatively better in terms of policy disclosure compared to other ESG factors such as governance, environmental, and social factors. Within ESG factors, governance factors have emerged as the most prominent factor compared to environmental and social factors. Social factors received the least priority by corporate entities. Further, out of these 50 companies, the top three industries are found to be automobiles, chemicals, and consumer goods, whereas metals and mining emerges as the bottom listed industries in terms of performance (Figure 6.3).

A comparison made between the MSCI India ESG Leaders Index with its counterpart sector peers reveals that ESG-integrated indices have performed well compared to their peers (MSCI 2021) (Figure 6.4). More importantly, performance of ESG-integrated indices continues to perform better even during the COVID-19 pandemic. Several key corporate entities such as Asian Paints, Axis Bank, Bharti Airtel, HCL Tech, HDFC, HUL, Infosys, Nestle India, Reliance Industries, and TCS are positioned high in the MSCI India ESG Leaders Index. Within various ESG factors, governance is emerging as a major contributor to the ESG performance of Indian corporations. A sectoral comparison of ESG performance indices reveals that the IT sector has emerged
as a leader with 26% weightage, followed by energy (close to 25% weightage). Hence, the IT and energy sectors are effectively integrating ESG factors in their investment plans and decision-making processes in a much better way compared to other sectors (Bhatt 2020).
Another related area which has experienced some development is impact investment in India. Available information reveals that impact investors collectively could raise a capital of $11 billion in the last decade (2010–2020), covering more than 550 for-profit enterprises impacting about 500 million beneficiaries (IIC 2020). The beneficiaries are largely from low-income communities. The key sectors attracting such investors are agriculture, health, education, energy, and technology.

It can be summed up that (i) there is an increasing appetite for ESG-integrated assets and (ii) performance of ESG-integrated investments stand better compared to their counterparts, even during the COVID-19 pandemic. Companies are found to have done relatively better in policy disclosure and governance parameters compared to environmental and social factors. Within all factors, social factors have received the least priority.

6.4 Legal and Institutional Framework

Governing Environmental, Social, and Governance Investments in India

Although ESG investments in India are at a budding stage, a host of policy and regulatory initiatives have been undertaken to drive ESG investments in India. Institutionally, the Ministry of Corporate Affairs (MCA) assumed the stellar role in promoting sustainable investments in India and has developed policies and guidelines from time to time for corporations to imbibe the PRI. The efforts of the MCA are supported by the capital market regulator, the Securities and Exchange Board of India (SEBI) through its regulations on the matters of ESG investment in India. In fact, both the MCA and SEBI work together to implement the guidelines and regulations related to ESG investments in India. In addition, the Impact Investor Council, an industry representative body, was formed to drive impact investments in India and to represent the impact investors in the country.

One of the first initiatives in this direction were the “Voluntary Guidelines on Corporate Social Responsibility” published in 2009 by the MCA to integrate sustainability in business practices and business decision-making processes. Six core elements were identified as key sustainability practices to be adopted by business entities. Around that time in 2010, the Department of Public Enterprises came up with corporate social responsibility (CSR) guidelines designed to encourage central public sector enterprises to promote CSR activities. This was followed by guidelines issued by the MCA as “National Voluntary Guidelines on Social, Environmental and Economic Responsibilities of Business, 2011,” spelling out the importance of environmental, social,
and economic responsibilities of corporate entities and the need to integrate them in business practices and investments decision-making processes.

This was followed by the promulgation of the New Corporate and Social Responsibility Rule 2014 prescribed under the Companies Act 2013, which emphasized the need for ESG investments and adoption of ESG strategy. It mandated the need to spend a minimum of 2% of the profits of corporate entities on various socially desirable sectors. A study carried out a detailed mapping of CSR rules by Indian firms and revealed that expenses under CSR heads are largely made on social sectors covering education, health care, community development, protecting the environment, protecting the gender equality, and skill development, among others (Bansal, Khanna, and Jain 2017).

The next development in this respect was the announcement of the “National Voluntary Guidelines for Responsible Financing” in 2015, which are specifically designed to encourage the financial sector to adhere to the principles of sustainable business practices. These guidelines spelt out eight specific principles integrating various aspects of ESG to be adopted by financial sector enterprises and five key implementation modalities. Further development in this space was the declaration of the “National Guidelines on Responsible Business Conduct–2019.” The purpose of these guidelines is to support business enterprises to imbibe the principles of responsible conduct and responsible business behavior. In addition to this, a dedicated committee was constituted in 2020 to develop the format for the Annual Business Responsibility Reporting (ABRR) under the guidelines. A fresh reporting structure called the “Business Responsibility and Sustainability Report” was proposed to effectively capture the nonfinancial parameters of both listed and unlisted companies. The committee also proposed using the information captured through the format for constructing sustainability indices.

Besides the above, SEBI has published multiple circulars on various aspects of sustainability investment in the country and reporting structure of such investments. For instance, the circular issued in 2012 mandates 100 listed companies to follow a proper reporting structure of their business through the ABRR format. The ABRR structure intended corporate entities to adopt the principles in the National Voluntary Guidelines declared by the MCA in 2011. The ABRR structure was extended to 500 listed companies in 2015–2016, and further extended to 1,000 listed companies in 2019. In addition, necessary regulations have also been created to facilitate green bonds or social impact bonds. For instance, SEBI promulgated the Green Bond Guidelines in 2017, which allow listing of green bonds on India’s stock exchanges. The latest available information shows that issuance of global green bonds touched
$1 trillion in 2020. A further development in this direction is the proposal to institutionalize the Social Stock Exchange within the purview of SEBI to mobilize capital through social enterprises (Government of India 2021). SEBI set up a working group in 2019 in this regard to propose the reporting structure as well as disclosure requirements related to various aspects of ESG investments such as financial, governance, social impacts, social audit, etc. A detailed mapping of the policy and regulatory framework governing ESG investment in India is presented in Figure 6.5.

In addition to the guidelines and principles, a host of other initiatives have been undertaken by the Government of India to mainstream ESG policy making. For instance, the Reserve Bank of India in 2015 notified the inclusion of lending to social infrastructure and small-scale renewables within its priority sector lending. This was given further impetus by doubling the loan limit to these sectors to INR300 million in 2020. Besides, India has also joined various global initiatives such as the European Commission-led International Platform on Sustainable
Finance in 2019 as a founding member. The platform serves as a forum for driving environmentally sustainable finance.

An assessment of policy and legal pronouncements around ESG investing in India unravels some interesting patterns and trajectories. First, the scope of policies has evolved over the years in tune with a growing emphasis on ESG-integrated investments. Second, policies and regulations become stringent over time, moving gradually from voluntary regimes to mandatory regimes. Third, emphasis is laid on reporting and disclosure of information by corporate entities.

6.5 Analyzing the Sustainability Initiatives of Corporate Entities: Some Observations

An assessment of a dozen Indian corporate entities reveals some interesting facets of sustainability initiatives undertaken by these firms. The common feature of the chosen entities is that most of these are found in various ESG-integrated corporate indices databases and are found to have some ESG features.

A quick mapping of sustainability initiatives undertaken by these entities shows that these entities can be structured around four major action points. First, many of them have spelt out sustainability strategies, which are largely their vision statements to adopt various sustainability goals in future. Second, most of them are members of various national and international business coalitions, which essentially offer ideas about their commitment for achieving sustainable development in business practices and business behavior. The third element is about key sustainability targets and goals, where corporate entities have laid down their specific sustainability plans for the future based on key sustainability parameters. Finally, the fourth action point is about the sustainability practices being adopted and followed. A detailed mapping of sustainability strategies of these corporate entities reveals that in most cases, the strategy statements involve offering mechanisms of integrating ESG factors in the business practices and operations. A deep dive into the business coalition membership of these corporations indicates that they are part of various forums and platforms such as their own industry groups and associations having sustainability implications or could be other external sustainability forums and platforms. For instance, Tata Steel is part of the World Steel Signatory Charter, ACC and Ambuja are part of the Cement Sustainability Initiative (which is part of the World Business Council for Sustainable Development), and Dalmia is part of RE100 and EP100.\(^2\) In many cases, corporations have voluntarily joined

\(^2\) EP100 is a corporate group committed to climate change.
various forums without any mandatory compliance. For instance, many of them are part of World Business Council for Sustainable Development and some of them are part of RE100. Interesting findings emerge when sustainability ambitions are mapped in a detailed manner. Ambitions are primarily dominated by key environmental sustainability goals such as the reduction of GHG emissions, enhancing energy efficiency, procurement of green energy, efficient use of water, waste management, waste recycling, among others (Figure 6.6). However, it is also clear from the initiatives undertaken by Indian corporations that the social sector has been one of the neglected sectors in India and has not been mainstreamed, although some efforts at the CSR level have been made in this sector. This also clearly reiterates the findings of other studies such as National Stock Exchange (2020). Finally, information of adoption of sustainability practices indicates some visible progress particularly in the domain of renewable energy procurement and attaining the energy efficiency goals and effective management of waste.

![Figure 6.6: Sustainability Agenda of Corporate Entities in India](chart)

Source: Constructed by author.

Drawing from the literature, a review of ESG investment trends and analysis carried out in this section proposes a framework that captures the dynamic nature of sustainability behavior and drivers of sustainability initiatives by companies. It can be elicted from the framework that sustainability performance of corporate entities are
functions of multiple factors, grouped into internal as well as external factors. Depending on the strength of these drivers, sustainability of corporations will accordingly be shaped and characterized (Figure 6.7).

### 6.6 Conclusion

ESG investments have attracted wide attention both from investors and customers. These investments largely follow a triple bottom line approach where financial returns are combined with environmental and social norms. Many factors such as rising environmental and climate threats, combined with increasing social conundrums, and the need to drive the economy on a sustainable trajectory have evolved as compelling factors for accelerating ESG investments. In addition, companies are also striving hard to map their goals with the declarations. This study in this context carries out a detailed assessment of ESG development trajectory in India, maps the legal and regulatory landscape governing ESG investments, and conducts a sustainability evaluation of a select of corporate entities. It employs a mixed method approach for its assessment.

The findings are worth highlighting. It emerges from the study that there is an increasing appetite for ESG-integrated assets in India. This is visible from many mutual fund companies increasing interest in such assets. The performance of ESG-integrated investments in the country perform better compared to their counterparts, even during the
COVID-19 pandemic. Companies are found to have performed relatively better in policy disclosure and governance parameters compared to environmental and social factors. Within all factors, social factors have received the least priority.

An assessment of policy and legal pronouncements around ESG investing in India unravels some interesting patterns and trajectories. First, the scope of policies has widened over the years in tune with the emphasis laid on ESG investments. Second, evolution of policies is characterized by the gradual movement from voluntary regimes to mandatory regimes; and third, recent emphasis is more laid on reporting and disclosure of information by corporate entities.

The evaluation of sustainability initiatives of a select set of corporate entities indicates that ambitions are primarily dominated by key environmental sustainability goals such as the reduction of GHG emissions, enhancing energy efficiency, procurement of green energy, efficient use of water, waste management, and waste recycling, without assigning equal priority to social sector component of ESG investments. This is also clearly in line with the findings of other studies such as the National Stock Exchange (2020). In addition to the above, information on the adoption of sustainability practices indicates some visible progress made particularly in the domain of renewable energy procurement and attaining the energy efficiency goals and effective management waste.

Finally, the proposed framework captures the dynamic nature of sustainability behavior and drivers of corporate entities. It shows that sustainability performance of corporate entities are functions of multiple factors, grouped into internal as well as external factors. Depending on the strength of these drivers, the sustainability of corporate entities will accordingly be shaped and characterized.
References


7

Global Economic Assessment of Renewable Energy for ESG Investment in Asia Using a Dynamic Global Trade Analysis Project Model

Michael C. Huang, Ming-Huan Liou, Hajime Tanaka, and Nagisa Shiiba

7.1 Introduction

In 2020, Japan announced it would promote the implementation of the policy recommendations of the Ocean Panel, aimed at achieving net-zero greenhouse gas emissions by 2050 for a carbon-neutral society. Energy is considered to be the main source of wealth creation and the key to economic development, as well as for improving the quality of life. Supporters of alternative energy sources have long argued that there is wealth to be created through smart investments in renewable energy, and the use of affordable clean energy was included for the first time in the Sustainable Development Goals proposed by the United Nations in 2015 (Sharma 2011). A cleaner climate-resilient pathway, which is based on the deployment of more ambitious renewable energy efficiency measures (solar and wind), would bring the global temperature increase to less than 1.5°C above pre-industrial levels. It would also be within the range of scenarios presented in the Intergovernmental Panel on Climate Change Special Report on Global Warming (IRENA 2019).

According to the Renewable Energy 2020 Global Status Report (REN21 2020), new global investment in renewable energy was $301.7 billion, up 5% from 2018, and more than three times the traditional generation capacity from coal and nuclear energy. Notably,
developing and emerging economies have outpaced developed economies in renewable energy capacity investments. Forward-thinking Asian countries are developing ambitious renewable energy targets that require considerable expertise and capital investment. Increasing investment in offshore wind power and establishing appropriate market designs will be key to accelerating the installation of global wind power capacity. Meanwhile, research and development will make technology actualization in array cable voltage, foundation design, technology, and hybrid solutions, leading to cost reduction of offshore wind power market competitiveness. Under such trends and support, the development of offshore wind is highly expected in the Asia and Pacific region.

Meanwhile, the solar power market has witnessed significant expansion of corporate purchases, with self-consumption becoming an important driver for newly distributed systems, while the installed capacity has increased more than ever. The industry is facing fierce competition coupled with policy uncertainty, with extremely low winning bids in some auctions and thin margins for developers and manufacturers, while competition and price pressures are driving efficient manufacturing and continued innovation. Meanwhile, the global wind power market is growing substantially each year, with offshore wind accounting for 10% of new installations. It is estimated that at least 102 countries have implemented some form of commercial wind capacity, representing 5.9% of global electricity generation.

The pandemic has substantially changed the structure of the global economy from a supply chain system driven by massive production and consumption to effectual demand through information and communication technology (ICT). Despite the severely worsened efficiency in transportation and logistics, the use of electronic equipment for communication and business services continues to stimulate the platform economy. Growing dependence on electronic equipment and e-commerce in the post coronavirus disease (COVID-19) era also implies that various systems and reforms should be established to cope with changes in social structure as well as new service platforms under well-connected infrastructure.

Governments are using various means to increase support for renewable energy. Community opinion is an important factor in the adoption of renewables, but it is only one part of the social acceptance of renewables. Many complex factors can influence public response to local and regional renewable energy projects, including health and environmental impacts, the distribution of economic costs and benefits, and the fairness of the consent process.

Moreover, reforms are required in the operation side of both the energy and financial sectors to overcome these challenges, suggesting
newly designated renewable energy policies for investment incentives (Karltorp 2016). Accordingly, promoting a blue financing framework could serve as a platform to boost ocean renewable energy under the scope of a blue economy (Yoshioka et al. 2020). In the proposed scheme, the provision of incentives for private investment with public donations is expected to ensure the conservation of marine ecosystems and ocean resources, in line with economic growth. These measures include the conservation of marine ecosystems through the promotion of environment-friendly industries and the development of marine energy, such as tidal power and offshore wind power.

Despite the significant benefits of renewable energy as an important source of power generation, its adoption in Asia, especially in Japan, remains low. The Energy Mix Plan announced by Japan’s Ministry of Economy, Trade and Industry in July 2015 advocates for renewable energy to play a leading role as a major source of electricity while reducing CO$_2$ emissions (METI 2019). In European countries such as Scotland, the transition to 100% renewable energy in the power grid is currently underway, and offshore wind, a large-scale natural resource, is expected to play a leading role. In addition to the environmental benefits of increasing the share of offshore wind power, the economic benefits are also drawing attention, and according to the Global Trade Analysis Project (GTAP) database, wind power development in Japan lags the average investment in Europe (Table 7.1).

<table>
<thead>
<tr>
<th>Country</th>
<th>East Asia</th>
<th>ASEAN</th>
<th>South Asia</th>
<th>Rest of Asia</th>
<th>Europe</th>
<th>Rest of the World</th>
</tr>
</thead>
<tbody>
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<tr>
<td>Europe</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Rest of the World</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
</tbody>
</table>

ASEAN = Association of Southeast Asian Nations.
Source: Global Trade Analysis Project (GTAP) Database 10.

In this regard, environmental, social, and governance (ESG) finance is becoming a key component of global investment decisions to help economies thrive under sustainability. ESG investments encompass a wide range of measures that are drawing the attention of policy makers, investors, and the public in promoting sustainable labor practices and corporate operations (Nemoto and Morgan 2020). A systematic examination of ESG issues is likely to lead to more complete investment
analysis and better-informed investment decisions (Hayat and Orsagh 2015).

For ESG decision-making prospects, quantitative analysis for microscope data acquisition is indispensable as a reference. Rather than the firm-level approach, the objective of this study is to investigate the potential economic impact of investments in solar and wind power installations. Employing the dynamic GTAP model, we could assess the impact on global supply chains, including the machinery and electronics sectors. A 15-year dynamic analysis is expected to visualize the transition of associated industries with key indicators in Japan and other regions in Asia, including East Asia, the Association of Southeast Asian Nations (ASEAN), South Asia, and Rest of Asia, on their economic features and the performance scenarios of the time periods. We hope that the economic evaluation of renewable energy investments could provide a comprehensive perspective on ESG investments.

The study proceeds as follows. After the literature review in Section 7.2, the methodology in Section 7.3 introduces the scope of the GTAP model, parameter settings, and scenarios. The simulation results, including economic indicators, are interpreted in Section 7.4, followed by the concluding remarks, research limitations, and future perspectives in Section 7.5.

7.2 Literature Review

7.2.1 Development of Potential Renewable Energy

Environmental problems triggered by greenhouse gas emissions from fossil fuels have escalated focus on renewable energy substantially. Meanwhile, the operation of solar photovoltaics in the Kyushu area of Japan has been facing overcapacity problems due to the unbalanced supply and storage system (Huang and Kim 2021). A steady supply of renewable energy would be more desirable, making wind power a great market opportunity. Although a feed-in tariff system was enacted in Japan in 2012, wind power has not been aggressively developed because of the high levy and lack of local consensus. The current status and potential of wind power energy in Japan can be categorized into onshore, fixed offshore, and floating offshore wind power (Nakanishi, Saito, and Yokoyama 2016).

With the restructuring of the domestic energy system, the circumstances surrounding wind power are changing. Discussions are underway to ensure that the nation's power grid can accept large volumes of renewable energy. In addition, deep offshore wind is a
formidable and interesting area to help rebuild affected areas. There are several obstacles to the promotion of wind power in Japan, including the Environmental Assessment Law for both onshore and offshore power generation. Developers are required to prepare materials for assessment in a short period of time. These new initiatives in Japan are expected to revolutionize wind power generation worldwide. Innovations such as deep-ocean wind power are considered to change Japan’s energy system for earthquake recovery (Arakawa and Ueda 2012).

The input–output (IO) and computable general equilibrium (CGE) analyses are widely used for estimating the economic impact of renewable energy (Garrett-Peltier 2017; Bhattacharya et al. 2016; Babatunde, Begum, and Said 2017). In the case of the growing offshore wind power industry in Scotland, the potential economic impact arising from both the construction and operation of planned increases in offshore wind capacity between 2018 and 2025, increased both employment and gross value added, depending on the magnitude and timing of the change. The cost-effectiveness assessment could greatly assist stakeholder surveys conducted in the European wind power industry (Connolly 2020).

### 7.2.2 Cost and Economic Benefits of Renewable Energy

Prior to the launch of the renewable energy investment project, in general, investor attention primarily focused on the cost of installation, as well as the reasons for the recent rise and expected future evolution. Apart from location selection, the capacity and hours of operation could be the determinant factors for cost-benefit evaluation of offshore wind farms. In the case of wind farms in Denmark, the benefits are estimated in terms of investment returns, which have been demonstrated using data from the local electricity market and distribution. Trade-offs between selling hydrogen directly to customers and regenerating electricity using hydrogen as a storage medium during periods of rising electricity value have been explored (Hou et al. 2017). Considering these synergies, offshore wind power is a smart grid system under a virtual power plant (VPP) system with increased operating reserves, and it is possible to enhance the amount of electricity generated and stored.

In order to provide additional insights into renewable energy research in Japan, a renewable energy IO table was developed by Nakano, Arai, and Washizu (2017, 2018). The 2011 renewable IO table helped analyze the energy complex of generation and consumption for achieving an optimal energy mix to reduce dependence on nuclear power plants to below 5% within 10 years, considering cost-effective policy incentives. The simulation results showed that renewable energy
could gradually replace nuclear power through capital utilization subsidies. In the direction of nuclear phase-out, the introduction of a VPP could reduce the financial costs of wind power by 13%, solar power by 8%, and social costs by 36% (Huang and Kim 2021).

In line with growing global demand, the cost of power generation has increased by more than 20% in the last 3 years, primarily driven by higher prices for certain strategic raw materials. However, the competitiveness of wind power investments against other technologies has remained constant. Production costs are expected to decline in the long term, but whether this will be sufficient to offset rising input prices depends on the application of new materials, remote control devices, research and development of offshore wind turbines and substructures, the adoption of advanced siting and forecasting techniques, access to appropriate financing, and long-term legal stability. These process-wide factors suggest that investments should take into account the supply chain and its transmission system, as well as socioeconomic impacts.

Research directions have been proposed to improve the reliability of economic evaluations and mitigate inconsistencies. Solar power consumption has been increasing exponentially in the last decade or so, and if similar growth continues over the next decade, the sun will become the world’s primary energy source. However, there are several obstacles to continued growth, including political interference by companies in the fossil fuel industry. Nevertheless, solar power is the fastest growing energy source and is currently the most profitable energy investment (Philips 2018). Comparisons between concentrated solar power and other forms of renewable energy generation are determined by carefully considering time-varying effects and flexibility, and advocating that economic indicators are important for policy and investment decisions (Dowling, Zheng, and Zavala 2017).

### 7.2.3 Quantitative Approach of ESG Investment

It is challenging for investors to quantify the value of ESG to investment performance, and we found that using a 25% screening filter added value, especially by reducing tail risk, the deviation from the non-screened universe was significant. The results were not statistically significant. Overall, the authors found that incorporating ESG information contributes to better decision making in any investment approach, and that the optimal composition depends on the fund manager’s preferences and willingness to deviate from the unscreened benchmark (Verheyden, Eccles, and Feiner 2016). A critical obstacle to the
use of ESG information is the lack of reporting standards. Among the various forms of ESG investments, negative screening is considered the least beneficial and is driven by product and ethical considerations. Full integration and engagement are considered more beneficial and are driven by their relevance to investment performance (Amir and Serafeim 2018).

Empirically, less risk brings lower returns, but it is evident that stock performance is more volatile than peer group performance, that different industries are affected distinctively by ESG factors, and that ESG companies generate higher returns (Kumar et al. 2016). Empirical approaches to measure historical returns, betas, Sharpe ratios, Sortino ratios, conditional value-at-risk, skewness, and Omega ratios of ESG and non-ESG-integrated emerging market indices have the potential to contribute to significant outperformance based on ESG integration. Studies suggest that the inclusion of ESG emerging market equities in institutional portfolios may provide institutional investors with higher returns and lower downside risk opportunities than non-ESG equity investments (Sherwood and Pollard 2018).

Both growth and value-oriented investors use a variety of approaches when considering ESG issues across asset classes. However, empirical evidence showing that ESG considerations negatively impact financial performance remains misleading. For investment professionals, a key tenet of the ESG issue debate is that systematic consideration allows for a more complete investment analysis and better-informed investment decisions (Hayat and Orsagh 2015).

Investment managers use financial figures to assess the quality of their portfolios, which requires appropriate estimates of market value assets from price transactions. The positive relationship between ESG criteria and corporate financial performance has stabilized over time, differentiating between promising portfolios and younger asset classes of ESG investments, such as non-portfolio, geographic, emerging market, corporate bonds, and green real estate (Friede, Busch, and Bassen 2015). The results indicate that sectors classified as green industries have a promising growth potential. However, criteria and indices for ESG investment are not common, especially for small and medium-sized firms in emerging economies. Visuals have enabled equity managers to analyze not only financial insights, but also social and environmental information that cannot be reconstructed simply by using the ESG criteria (Arjaliès and Bansal 2018). In the context of global market volatility, the potential of the renewable energy industry can be a useful indicator of ESG investment.
7.3 Methodology

7.3.1 GTAP Model

In recent years, technical advances in environmental policies targeting specific generation technologies such as electro-fuels, power, and renewable energy have led to detailed CGE modeling of the electricity sector. This modeling requires individual generation technologies, and researchers using the GTAP database have decompounded the electricity sector (Hertel 1996).

Since the 1990s, the Research Institute of Innovative Technology for the Earth has been developing the Dynamic New Earth 21 (DNE21+) model, which applied a recursive CGE model based on the GTAP-E database. The DNE21 model aims to present a dynamic optimized energy system to clarify the significance of research, development, and demonstration of environmental issues (Beckman, Hertel, and Tyner 2011). The latest version of the energy economic model for this assessment includes additional renewable energy sources such as onshore and offshore wind power, residential and mega solar power, storage batteries for power system stabilization, and innovative nuclear power systems under development, although the parameter of energy price change was not specifically emphasized in the model scope.

The GTAP-Power database is an extension of the power details in the GTAP 10 database, which includes transmission and distribution, nuclear, coal, gas, hydro, wind, oil, solar, and other power sectors. Gas, oil, and hydro were further distinguished on the basis of baseload and peak loads. The bottom-up data are power generation, and the levelized input costs for each technology and region are estimated to be as close as possible to the original data, but are consistent with the original GTAP database. The initial version of the GTAP-Power database has considerable limitations, such as a lack of regional coverage of input cost data and discrepancies between available data and aggregate total power.

Nevertheless, such a database remains the most suitable for global economic analysis with adequate provision of technology parameters under plausible investment scenarios (Peters 2016). While empirical studies have not yet been grounded with a dynamic analysis of the impact of offshore wind power investment and its supply chain composition, we applied a dynamic CGE model using the GTAP-Power database to demonstrate a global impact assessment of offshore wind farm investment in Japan. Details of the model can be found in Hertel (1996), Huang and Masuda (2020), and Huang, Liou, and Iwaki (2020).
The setting of the policy shock and parameters will be introduced in the
following sections.

7.3.2 Scenarios

Policy Setting
We aggregated 16 sectors and seven regions sourced from 75 sectors and
141 regions in the GTAP database for global dynamic policy simulations.
The macroeconomic benchmark setting consisted of four periods: (i) 2014–2015 (only 1 year for the base run), (ii) 2015–2020, (iii) 2020–2025, and (iv) 2025–2030. Except for the annual data applied for the first
period (2014–2015), macroeconomic data were accumulated for labor
endowment, population, and gross domestic product (GDP) growth to
accommodate GTAP modeling input requirements (Table 7.2). The
data were sourced from the International Labour Organization, the
International Monetary Fund, the Center d’Études Prospectives et
d’Informations Internationales, the Asian Productivity Organization,
and the Total Economy Database. Regarding the capture of sectoral
productivity improvement parameters, we calibrated the total factor
productivity from the Asian Productivity Organization and the Total
Economy Database only in the 2014–2015 period to differentiate the
base run among various economic conditions.

<table>
<thead>
<tr>
<th>Period</th>
<th>Region</th>
<th>Labor Endowment</th>
<th>Population Growth</th>
<th>Accumulated GDP</th>
<th>TFP Growth</th>
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continued on next page
### Table 7.2 continued

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<th>Population Growth</th>
<th>Accumulated GDP</th>
<th>TFP Growth</th>
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<td>3.41</td>
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</tbody>
</table>

*ASEAN = Association of Southeast Asian Nations, GDP = gross domestic product, ROW = Rest of the World, TFP = total factor productivity.*

*Note: Growth rate on skilled and unskilled individuals is assumed to be the same. REAL Data: 2020–2030.*

*Sources: Databases of the International Labour Organization, the International Monetary Fund, the Center d’Études Prospectives et d’Informations Internationales, the Asian Productivity Organization, and the Total Economy Database.*

### Investment and Efficiency Improvement

The exogenous policy shock assumed in this dynamic model is investment in wind and solar power installation, as well as other supplementary sectors such as power transmission, machinery, and electronic equipment. Based on estimates from the Japan Wind Power Association in 2019, investment in offshore wind farms is estimated to reach ¥5.1–5.7 trillion by 2030. In addition, along with the advancements in power transmission, storage, and VPP systems (Huang and Kim 2021), we assumed a 10%–30% efficiency improvement in the intermediate input of wind energy life-applicable sectors of power transmission. We estimate 90% and 50% of direct investment in the capital-use subsidy for the wind and solar power sectors, respectively, as well as a 3% capital-use subsidy for power transmission, machinery, and electronic...
equipment for complete installation. The simulation does not indicate the specific year for 2015–2030, but could be regarded as the policy consequences in 1–15 years (Table 7.3).

### 7.4 Simulation Results

Employing a dynamic CGE model, the policy shocks of capital investment on wind power (WIN), solar power (SOL), machinery (MCH), electronic equipment (EEC), and power transmission (ETS) would generate a new equilibrium for all the conditions in the four periods. Accordingly, we provided indicators of output, import breakdown of trading partners, GDP growth, and equivalent variation for welfare analysis. Given the circumstances, the current renewable energy installation only provides very few precise parameters. In contrast, this study’s preliminary simulation results could provide the trend of economic indicators and policy implications for stakeholders such as investors, policymakers, and academia. We provide our findings accordingly.

#### 7.4.1 Sectoral Output Change

The sectoral output change shows that the output is displayed as a change comparing the business-as-usual path. With the investment in the three periods in Asian regions, the renewable energy sectors have been stimulated significantly (Figure 7.1). For Japan, the output of wind power increased by 26.6% in the 1–5-year period and remained at 19.4% in the 10–15-year period; solar power was at a high output level of 24.5% in the 10–15-year period. A similar trend could be identified in East Asia, ASEAN, and Rest of Asia. In ASEAN, the output growth of wind and solar

<table>
<thead>
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<th>Sector</th>
<th>1–5 years</th>
<th>5–10 years</th>
<th>10–15 years</th>
</tr>
</thead>
<tbody>
<tr>
<td>Offshore wind power</td>
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<td>90</td>
<td>90</td>
</tr>
<tr>
<td>Solar power</td>
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<td>50</td>
<td>50</td>
</tr>
<tr>
<td>Power transmission, Machinery, Electronic equipment</td>
<td>3</td>
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<td>3</td>
</tr>
<tr>
<td>Power transmission, transport, and service</td>
<td>10</td>
<td>20</td>
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</tr>
</tbody>
</table>

Source: Capital-use subsidy, efficiency estimated by the authors.
power reached 850.6% and 144.1%, respectively, in the 5–10-year period. However, the total share of power generation from renewable energy of solar and wind may remain very limited, given their extremely low initial. Nevertheless, it is notable that the growth in all regions could be sustained for 10–15 years, implying that technology actualization in the transmission, transportation, and service sectors might become another

**Figure 7.1: Output Change (°)**

ASEAN = Association of Southeast Asian Nations, AGR = agriculture, FOD = food manufacturing, ENG = energy, MAN = manufacturing, STL = steel, EEC = electronic equipment, MCH = machinery, TEQ = transport equipment, ELY = electricity, FIR = thermal power, ETS = power transmission, SOL = solar power, WIN = wind power, SHP = shipping, TRS = transport, SRV = services.

Notes: ASEAN: SOL (22.2%, 144.1%, 554.7), WIN (141.4%, 850.6%, 316.1%); Rest of Asia: SOL (27.5%, 42.3%, 61.4%), WIN (55.3%, 37.1%, 14.8%).

Source: Authors’ simulation.
pull for power supply by renewable energy. The investment shows a great impact of ESG on environmental factors owing to a substantial reduction in CO$_2$ emissions.

It was interesting to see the notable output growth of electronic equipment, machinery, manufacturing (MAN), steel (STL), transport equipment (TEQ), and shipping (SHP) in East Asia and South Asia, although some sectors were not selected as targets for investment. Such spillover effects could be attributed to the fact that the two regions have been important players in the supply chain of the aforementioned sectors, and thus the investment shock showed a boost in these sectors, especially for South Asia in the 5–10-year period. Conversely, Rest of Asia, mainly central and middle Asia, have been less involved in the global production network, revealing a negative impact.

### 7.4.2 Change Production Network

The development of renewable energy in the solar and wind power industries requires various components to assemble the system. Based on the IO table’s current classification or GTAP database, it remains challenging to distinguish specific parts of a wind turbine and photovoltaic from others. Similar to other countries in Asia, production of wind turbines and other parts depend on the global supply chain. The change in the breakdown of trade partners in the target sectors of machinery (Figure 7.2) and electronic equipment (Figure 7.3) may thus enable us to identify trends in the formation of the production network.

**Machinery Sector**

The simulation results of the transition of the machinery production network showed a similar trend in the Asian regions. In all Asian regions, except for South Asia, exports rose in the 1–5-year period. In the 5–10-year period, exports in South Asia and East Asia grew substantially, while it declined in Japan and ASEAN. In the 10–15-year period, export growth remained strong for East and South Asia; for Japan and ASEAN, the growth of exports was primarily driven by European partners and the rest of the world. It is interesting to see that the transition of South Asia in the machinery sector becomes highly connected with Japan, East Asia, and the ASEAN regions, implying the potential of becoming the hub of production networks.
Figure 7.2: Breakdown of Import Partners in Machinery Sector

Japan (1–5 years)

Japan (5–10 years)

Japan (10–15 years)

East Asia (1–5 years)

East Asia (5–10 years)

East Asia (10–15 years)

continued on next page
Figure 7.2 continued
ASEAN = Association of Southeast Asian Nations, E. Asia = East Asia, R. Asia = Rest of Asia, ROW = Rest of World, S. Asia = South Asia.

Source: Authors’ simulation.
Figure 7.3: Breakdown of Import Partners in Electronic Equipment Sector
Figure 7.3 continued

ASEAN (1–5 years)  
ASEAN (5–10 years)  
ASEAN (10–15 years)  

South Asia (1–5 years)  
South Asia (5–10 years)  
South Asia (10–15 years)  

continued on next page
Figure 7.3 continued

ASEAN = Association of Southeast Asian Nations, E. Asia = East Asia, R. Asia = Rest of Asia, ROW = Rest of World, S. Asia = South Asia.

Source: Authors’ simulation.
Electronic Equipment Sector
The trend of electronic equipment production was similar to that of the machinery sector. The supply chain of electronic equipment not only indicates the importance of the production destination, but also provides insights into ICT implementation for the overall society under the current COVID-19 situation. South Asia was the only region that registered a decline in exports in the 1–5-year period, but in the 5–10-year and the 5–15-year periods, the vibrant growth in exports also implied ICT implementation in society. For East Asia, the breakdown of trading partners also demonstrated a structural change cointegrating with South Asia in the global supply chain.

7.4.3 GDP Change and Welfare Analysis
We wrap up all the simulation results into the most aggregated indicators by considering the accumulated GDP growth and the equivalent variations (EV) to evaluate the welfare change contributed by the 15-year investment plan for wind, solar power industries, and other associated sectors (Figure 7.4).

![Figure 7.4: Welfare and GDP Growth](image)

ASEAN = Association of Southeast Asian Nations, EV = equivalent variations, GDP = gross domestic product.

Source: Authors’ simulation.

With regard to Japan, the accumulated GDP growth reached 3.1% in the 5–10-year period, but dropped to 2.0% in the 10–15-year period; the accumulated EV showed a decreasing trend. The EV shows the
same trend as GDP growth estimates, which is high in 2020–2025 and then declines in 2030. The significant decrease in output and welfare may require more contemplation for policy design and supplementary provision to strengthen its effectiveness. The EV in East Asia showed a significant growth, driven by the People’s Republic of China and the Republic of Korea, with GDP increasing significantly from 7.1% to 15.6%.

Conversely, the performance of GDP in ASEAN was even worse than that in Japan, although the EV increased steadily. The remarkable output growth in South Asia appeared as a sharp rise in GDP growth rates from 8.8% to 21.8%. However, the declining welfare implied that South Asia remains a factory for the world rather than a consumption market. GDP growth in Rest of Asia also showed a decreasing trend, given its role out of the production network. However, the gradual increase in EV could indicate an improvement in the power supply from renewable energy sources.

The interpretation of EV indicates that social welfare changes result from price fluctuations and volume of consumption, as well as macroeconomic factors such as population growth and labor endowment. Therefore, demographic changes in Japan may result in lower economic performance, while emerging Asia could take greater opportunities. To further interpret the cost-effectiveness of investment for renewable energy and other associated industries, we examine another indicator by showing the ratio of welfare change and investment volume (Table 7.4).

<table>
<thead>
<tr>
<th>Region</th>
<th>1–5 years</th>
<th>5–10 years</th>
<th>10–15 years</th>
</tr>
</thead>
<tbody>
<tr>
<td>Japan</td>
<td>4.0</td>
<td>-12.3</td>
<td>-11.5</td>
</tr>
<tr>
<td>East Asia</td>
<td>14.3</td>
<td>11.0</td>
<td>10.4</td>
</tr>
<tr>
<td>ASEAN</td>
<td>0.2</td>
<td>3.4</td>
<td>0.5</td>
</tr>
<tr>
<td>South Asia</td>
<td>72.7</td>
<td>-46.9</td>
<td>-11.7</td>
</tr>
<tr>
<td>Rest of Asia</td>
<td>-1.4</td>
<td>4.8</td>
<td>7.6</td>
</tr>
</tbody>
</table>

**Table 7.4: Ratio of Welfare and Investment**

ASEAN = Association of Southeast Asian Nations.
Source: Authors.
The positive ratio indicates that investment in East Asia and ASEAN could be cost-effective and safer. As indicated previously, the negative prospect of investment in Japan may be attributed to the shrinking population and other economic constraints. Similarly, the drastic indicator in South Asia also implied a structural change in the 5–10-year period, and the risks should be carefully considered. Lastly, the increasing ratio in Rest of Asia provided a later forecast of the growing investment target.

7.5 Discussion and Concluding Remarks

7.5.1 Policy Implications

The global assessment provided a comprehensive prospect as a reference for ESG investment, which could be useful when micro data are unavailable. The visualized indicators presented through the simulation results enable policymakers and investors to understand sectoral interdependence in a wider scope. The study used a dynamic CGE model by applying the GTAP power database to analyze a 15-year investment policy in the solar, wind power, and other related industries. The research presented a pioneering methodology of using a dynamic analysis with the GTAP database to comprehensively and quantitatively examine global economic issues with comprehensible policy implications.


While reviewing the simulation results, we interpreted key economic indicators such as output, external trade, GDP, and welfare change. We found that renewable energy sectors could be significantly stimulated with steady growth for 1–15 years. Meanwhile, supplementary sectors such as machinery and electronic equipment showed notable growth in East Asia and South Asia. Amid the COVID-19 global pandemic, the new living and working styles would demand a resilient power supply with the provision of a platform for ICT contributed by machinery and equipment. Investment in renewable energy power and related sectors will accelerate the global transition.

Cost-effectiveness Reference for ESG Investment

South Asia may gradually become another important supplier for the machinery and electronic equipment industry, but welfare analysis showed that the goal of the consumption market remained distant, compared with the relatively mature market in the East Asian region. We also found that the constraint for Japan’s performance is due to
the aging society and shrinking population, whereas it remains a safer market for renewable energy investment in the short term. We may need more empirical evidence that advanced technology could help Japan overcome demographic difficulties and spillover effects in the global supply chain. East Asia and ASEAN could be relatively safer destinations for renewable energy investment, given the positive ratio of welfare and investment. For a long-term investment perspective of 5–15 years, Rest of Asia may be a potential choice.

7.5.2 Research Limitations

GTAP Model Scope
Despite the holistic approach contributed by the dynamic GTAP analysis, several constraints, such as the model scope, research and development parameter calibration, and assumptions, require further evidence-based investigation. While making a global impact assessment, the single total factor productivity growth for all sectors and regions may be oversimplified. In addition, to highlight the impact of policy shocks, investment is assumed to be an exogenous factor so that the budget crowding-out effect is eliminated. Moreover, the lack of a specific sector for the renewable energy sector in the GTAP database classification is another limitation for such applications.

Legal, Social, and Environmental Concerns
Undoubtedly, offshore wind farm planning and solar power installments require an extensive range of legal and social settlements to conclude a regulatory operation. This study’s scenario setting is based on numerical approaches with economic consequences while disregarding legal, social, and environmental concerns. However, such an approach can be modified and applied to the model scope by including additional parameters.

7.5.3 Future Perspectives

Multinational Analysis
This study primarily focuses on the impact of an investment policy shock on Japan. The investigation could have been more comprehensive by implementing multinational policy shocks, given that global investment in the offshore wind power industry has been made simultaneously. Based on this extension, the interdependence of production networks may provide more insights.
Carbon Neutrality
A stable power supply is an essential feature of carbon emissions reduction for offshore wind power to replace primary power generation sources, such as thermal power plants. This dynamic GTAP model has a high potential to link CO₂ emissions to carbon net-zero society goals. Through this extension, the quantified reduction impact could be a vital reference for designing concrete references for ESG investment.
References


Huang, M. C., M. Liou, and Y. Iwaki. 2020. The Impact of R&D and Innovation on Global Supply Chain Transition: GTAP Analysis on


### Table A7.1: Sector Classification

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Sector</th>
<th>GTAP classification</th>
</tr>
</thead>
<tbody>
<tr>
<td>AGR</td>
<td>Agriculture</td>
<td>Paddy Rice; Wheat; Cereal Grains n.e.c.; Vegetables, Fruit, Nuts; Oil Seeds; Sugarcane, Sugar Beet; Plant-based Fibers; Crops n.e.c.; Fishing, Cattle, Sheep, Goats, Horses; Animal Products n.e.c.; Raw Milk; Wool, Silkworm Cocoons; Forestry</td>
</tr>
<tr>
<td>FOD</td>
<td>Food manufacture</td>
<td>Cattle, Sheep, Goats, Horses; Meat products n.e.c.; Vegetable oils and fats; Dairy Products; Processed Rice; Sugar; Food Products n.e.c.; Beverages and Tobacco Products</td>
</tr>
<tr>
<td>ENG</td>
<td>Energy</td>
<td>Coal; Oil; Gas; Minerals n.e.c.; Petroleum, Coal Products; Gas Manufacture, Distribution</td>
</tr>
<tr>
<td>MAN</td>
<td>Manufacture</td>
<td>Textiles; Apparel; Leather Products; Wood Products; Paper Products, Publishing; Chemical Products; Basic Pharmaceutical Products; Rubber and Plastic Products; Manufactures n.e.c.</td>
</tr>
<tr>
<td>STL</td>
<td>Steel</td>
<td>Mineral Products n.e.c.; Ferrous Metal; Metals n.e.c.; Metal Products</td>
</tr>
<tr>
<td>EEC</td>
<td>Electronic equipment</td>
<td>Computer, Electronic and Optic; Electrical Equipment</td>
</tr>
<tr>
<td>MCH</td>
<td>Machinery</td>
<td>Machinery and equipment n.e.c.</td>
</tr>
<tr>
<td>TEQ</td>
<td>Transport equipment</td>
<td>Motor vehicles and parts; Transport equipment n.e.c.</td>
</tr>
<tr>
<td>ELY</td>
<td>Electricity</td>
<td>Nuclear base load; Gas base load; Hydro base load; Oil base load; Other base load; Gas peak load; Hydro peak load; Oil peak load;</td>
</tr>
<tr>
<td>FIR</td>
<td>Thermal power</td>
<td>Coal base load</td>
</tr>
<tr>
<td>ETS</td>
<td>Power transmission</td>
<td>Electricity transmission</td>
</tr>
<tr>
<td>SOL</td>
<td>Solar power</td>
<td>Solar peak load</td>
</tr>
<tr>
<td>WIN</td>
<td>Wind power</td>
<td>Wind base load</td>
</tr>
<tr>
<td>SHP</td>
<td>Shipping</td>
<td>Water Transport</td>
</tr>
<tr>
<td>TRS</td>
<td>Transport</td>
<td>Transport n.e.c.; Air transport; Warehousing and Support Activity; Communication</td>
</tr>
<tr>
<td>SRV</td>
<td>Service</td>
<td>Water; Construction; Trade; Accommodation, Food and Services; Financial Services n.e.c.; Insurance; Real Estate Activities; Business Services n.e.c.; Recreational and Other Service; Public Administration; Education; Human Health and Social Work; Dwellings</td>
</tr>
</tbody>
</table>

Source: GTAP 10 database.
While greater public and private investment is needed to support economic recovery in the wake of the coronavirus disease (COVID-19), the longer-term outlook for economies depends on new capital flows that consider the advancement of sustainable growth, environmental conservation, and human rights and safety. Environmental, social, and governance (ESG) investment has been increasing steadily, even during the pandemic, and can play a pivotal role in solving environmental and social problems by altering the use of private funds. However, major obstacles to its onward growth include unclear and dispersed criteria for sustainable investment, a lack of corporate disclosure, and incomplete methodologies for assessing nonfinancial information.

*Strengthening Environmental, Social, and Governance Investment Under COVID-19* investigates the conditions needed to promote ESG investment and offers insights on leveraging ESG factors to accelerate sustainable economic development in Asia. The book includes timely discussions on ESG investment’s role in building a sustainable society under crisis, the effectiveness of ESG scoring, and the future direction of ESG regulation and policy frameworks after the COVID-19 pandemic.

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