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Do Socially Responsible Firms Disclosure to Signal?

Mari Sakudo

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1-7-10-703 Iidabashi, Chiyoda-ku, Tokyo 102-0072, Japan

Abstract

An increasing number of investors incorporate companies' CSR information into their financial decisions. This study empirically examines the signaling theory in the context of CSR disclosures using rich information on firms' CSR activities and climate-related costs of large Japanese firms by a machine learning method. According to the results, Japanese firms disclose their sustainability information to signal their superior performance rather than greenwashing. While many investors and policy makers focus more on climate risks following the COVID-19 pandemic, this empirical evidence remains the same before and after the crisis.

Mari Sakudo
TCER
and
University of Tsukuba
Faculty of Engineering, Information and Systems
1-1-1 Tennodai, Tsukuba, Ibaraki
marisakudo@gmail.com

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Abstract

An increasing number of investors incorporate companies' CSR information into their financial decisions. This study empirically examines the signaling theory in the context of CSR disclosures using rich information on firms' CSR activities and climate-related costs of large Japanese firms by a machine learning method. According to the results, Japanese firms disclose their sustainability information to signal their superior performance rather than greenwashing. While many investors and policy makers focus more on climate risks following the COVID-19 pandemic, this empirical evidence remains the same before and after the crisis.

[1]I thank participants at the Nonparametric Statistical Analysis and Bayesian Statistics Conference in March 2023 for their comments.

1. Introduction

A number of investors have incorporated firms' corporate social responsibility (CSR) information into their strategic financial decisions (PRI, 2020). Together with that sustainable finance has been increasing in recent years, information about the impacts of firms' activities on climate-related risks and sustainability is needed for stakeholders including investors. However, such disclosure information by companies is difficult to compare, because the disclosures are, in many cases, voluntary. While environmental, social and governance (ESG) rating institutions provide the information to evaluate firms' ESG performance, recent researches document divergence of the ESG ratings by the providers (for example, Berg et al., 2022). Thus, as we cannot simply rely on ESG ratings, our understanding of the underlying mechanism behind firms' ESG information disclosure is vital for achieving sustainability goals.

To understand firms' voluntary disclosure of sustainability information, a stream of the existing literature empirically examines the relationship between a firm's CSR performance and CSR information disclosure. Some studies provide evidence of positive associations (for example, Clarkson et al., 2008; Mahoney et al., 2013) suggested by "voluntary disclosure theory", in which a firm has an incentive to voluntarily disclose its CSR information in order to show its good sustainability performance. On the other hand,

the findings in other researches are negative as predicted by "socio-political theory" (for example, Patten, 2002; Cho and Patten, 2007) where a company with poor sustainability performance is more exposed to public pressure in the social and political environment and is likely to provide CSR disclosure.

Although there exist researches that attempt to address the mixed empirical findings and to provide some interesting insights, they do not discuss and incorporate costs of information disclosures in their analyses. First, this paper departs from the literature by considering the CSR disclosure costs, in addition to the association between CSR performance and disclosure based on the hypothesis derived from the signaling theory (Spence, 1973). In the context of CSR disclosure, the signaling theory suggests that, firms which participate in socially responsible activities and/or offer high-quality socially responsible products may disclose their CSR information to signal to potential investors and customers. Provided that disclosing information is costly, it would be less costly or more beneficial to the firm actually taking part in CSR activities. In that case, in addition to that the CSR information disclosure would be positively associated with actual CSR activities, there would be negative relationship between the costs and CSR performance. I use the fact of the latter association as well as the former in my analyses.

Second, the existing studies use limited information on CSR activities, although there exist abundant CSR actions and climate-change and sustainability related information for firms. Using only limited CSR information may also be a reason for the disagreement of empirical findings in the literature. This study overcomes this shortcoming by using rich information on firms' CSR-related activities and using a machine learning method of random forests.

Furthermore, other disadvantages of the existing studies are that sample sizes of the data used are, in most cases, too small for the robustness of their findings, along with the measurement issues. This study uses larger data set of about 1600 Japanese firms compared to the existing researches. Using the data of Japanese firms in from year 2015 to year 2022, the results indicate positive relationships between CSR disclosure and performance and negative relationships between the costs and performance, implying the findings are consistent with the predictions from the signaling theory. Those relationships remains the same overtime, suggesting that there is no difference before and after Covid-19 crisis although the pandemic event raised the public awareness of climate risks and ESG issues (J.P. Morgan, 2020).

The remainder of the paper proceeds as follows: Section 2 explains the hypotheses to be examine, the data set, and the estimation method. Section 3 presents estimation results, and the final section concludes.

2. Hypothesis, Data and Estimation Method

2.1. Hypothesis

In this study, I apply the signaling theory by Spence (1973) to the situation of firms' CSR activities and their information disclosure. Firms that are active in CSR activities use CSR disclosure to signal and create competitive advantage (Porter and Kramer, 2006). The signaling theory suggests that (1) positive relationships between CSR disclosure and CSR performance, and (2) negative relationships between CSR performance and costs. I investigate these relationships in the analyses.

2.2. Data and Estimation Method

The data used consist of large Japanese firms from the data set that are constructed from the CSR surveys by Tokyokeizai company in year 2016-2022. The data set includes information regarding firms' CSR and environment related activities. The analyses in this paper pay particular attention to climate-related and environmental information. As the CSR disclosure variables, I used the information about the issuance

of integrated reports and environmental accounting disclosure. As for CSR performance measures, I use many CSR and environment related activities and climate related cost information. I control for firm sizes and industry classifications in the estimation. The summary statistics in year 2022, for example, is in Table A.1 in the appendix. The summary statistics indicate that 32 percent of firms issue integrated reports as in Figure 1, and 28 percent document environmental accounting in year 2022 as in Figure 2.[2]

[2] The summary statistics in other years are abbreviated.

Figure 1. Integrated Report in year 2022

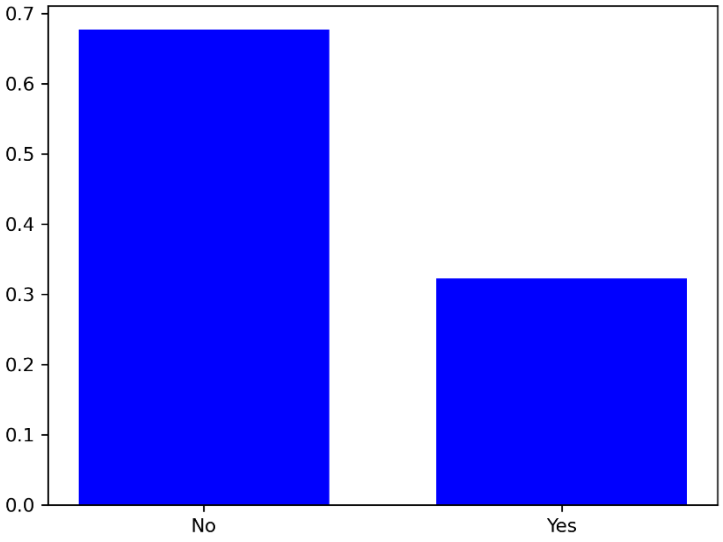
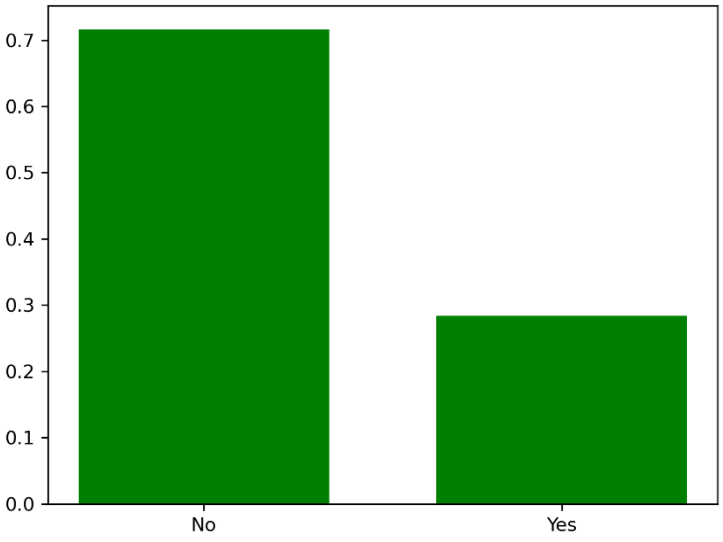


Figure 2. Environmental Accounting in year 2022



There is abundance of potential CSR measures and CSR costs to evaluate firms' sustainability performance. In contrast to the existing literature, this paper uses a lot of sustainability measures such as the amount of costs for environment conservation, whether to adopt environmental management systems, quantities of greenhouse gas emissions, NOx/SOx emission quantities, quantity of water used, quantity of water wasted, whether to purchase green materials, and so on. To utilize the important information, this study uses random forests for estimation. The number of feature variables used is 52. In the estimation setting, the maximum number of features is 10, the number of estimators is 1000, and Gini index is used.

3. Estimation Results

Figure 3 presents the SHAP values in the case of integrated reporting in year 2022. The mean SHAP values are also in Figure A.1 of the appendix. The results imply that firms are more likely to release integrated reports if they behave environmentally friendly such as adopting environment management systems, holding environment departments, measuring scope 3 greenhouse gas emissions, and so on . The firms are also less likely to release integrated reports if they incur larger costs for environmental conservation, or if their waste/energy used etc. are larger. These results are consistent with

the predicted signs by the signaling theory. In Figure 4, results regarding environmental accounting in year 2022 also indicate that the tendency is similar to that for integrated reporting, supporting the signaling hypothesis. The mean SHAP values are in Figure A.2 of the appendix, too.

Figure 3. Integrated Report in year 2022: SHAP value

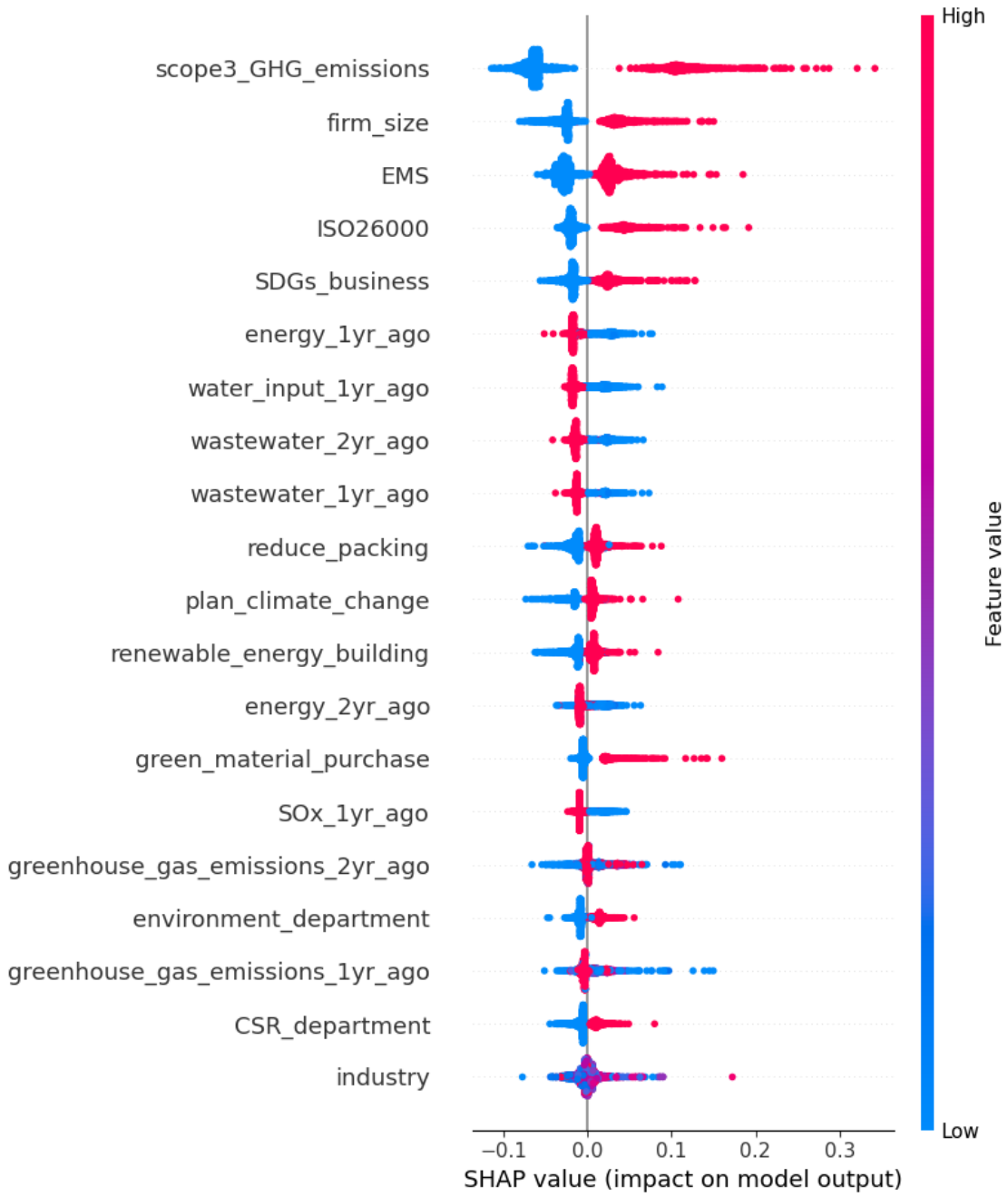
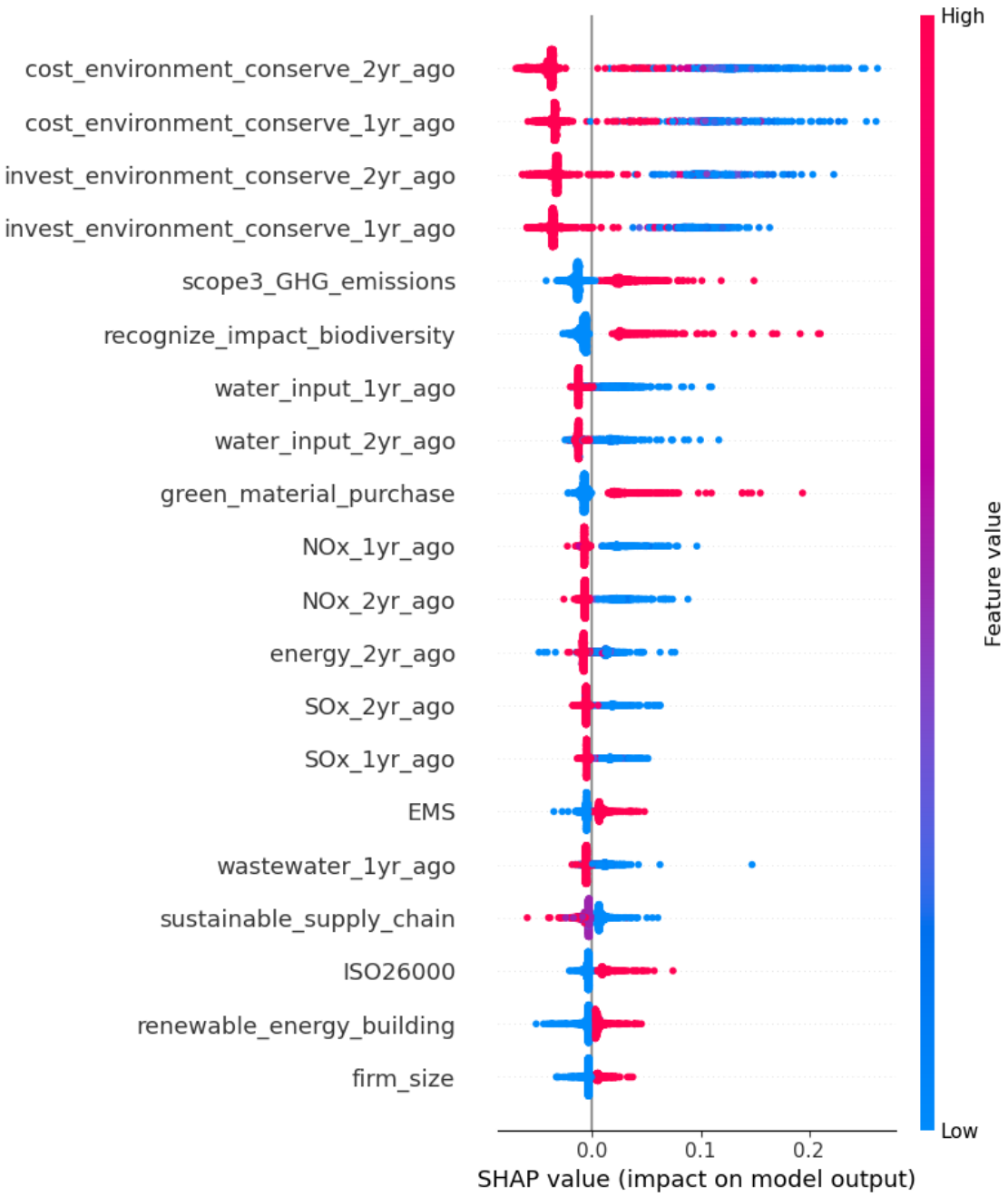


Figure 4. Environmental Accounting in year 2022: SHAP value



I also conduct the similar estimation using data in other years (2016-2021) to look into whether the estimation results differ over time. Specifically, I check whether there is a change in the sign of the relationship between variables following Covid-19 crisis, because it is reported that investors and policy decision makers renewed their focus on climate change and sustainability after the experience of Covid-19 pandemic (for example, J.P. Morgan, 2020). Figure 5 shows the results for integrated reportings in year 2015. Although the ordering and magnitudes of the impacts of feature variables differ across years, the results in year 2015 also support the signaling hypothesis. In other words, no findings of the change in firms' CSR disclosure behavior are observed. According to the results in Figure 6, the same applies to environmental accounting in year 2015.

Figure 5. Integrated Report in year 2015: SHAP value

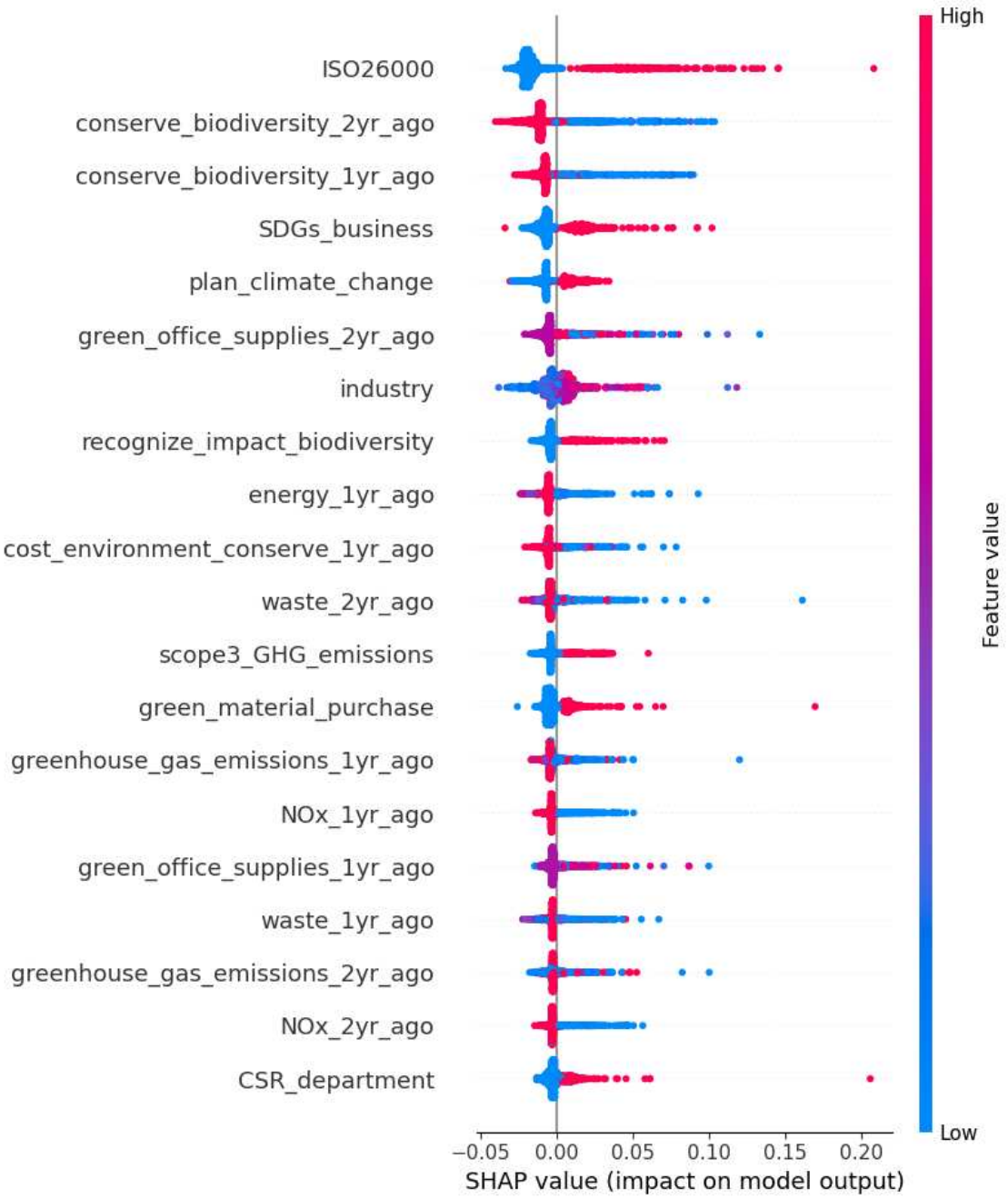
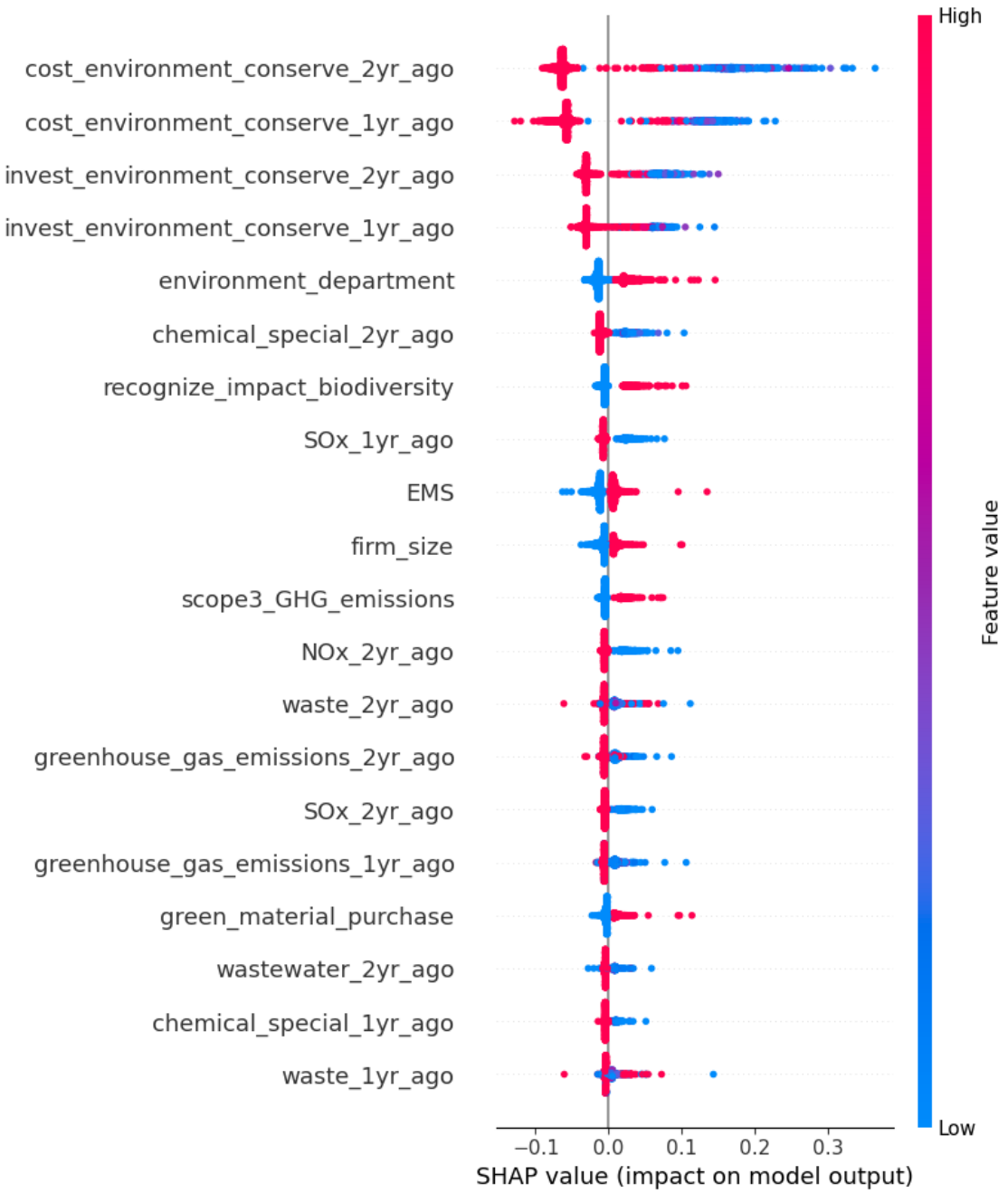


Figure 6. Environmental Accounting in year 2015: SHAP value



4. Conclusion

In this study, I used data from Japanese surveys and examined whether the signaling theory is supported. In other words, I investigated whether there are positive/negative associations between firms' CSR performance and CSR disclosures/costs. This study adopted a machine learning method of random forests to dealt with abundance of potential sustainability and climate-risk related activities by companies. I found that the empirical findings are consistent with the sign predictions from the signaling theory. The results should, however, be interpreted with caution, because there would be more potential sustainability performance such as social aspects and/or labor issues. The results using a broader range of sustainability performance would be in the future research.

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Appendix

Table A.1. Summary Statistics in year 2022

	mean	std	min	max
integrated_report	0.32	0.47	0.0	1.0
environmental_accounting	0.28	0.45	0.0	1.0
firm_size	0.40	0.49	0.0	1.0
CSR_department	0.34	0.47	0.0	1.0
CSR_officer	0.07	0.25	0.0	1.0
ISO26000	0.29	0.45	0.0	1.0
sustainable_supply_chain	1.70	0.78	1.0	4.0
environment_department	0.36	0.48	0.0	1.0
environment_director	0.06	0.23	0.0	1.0
invest_environment_conserve_2yr_ago	6063.65	28207.72	0.0	1146614.0
invest_environment_conserve_1yr_ago	7031.50	32131.76	0.0	1301896.0
cost_environment_conserve_2yr_ago	13382.13	54311.59	0.0	1978088.0
cost_environment_conserve_1yr_ago	11345.60	43512.37	0.0	1754724.0
energy_2yr_ago	213029828.63	3146706960.88	149.0	129884000000.0
energy_1yr_ago	232023127.82	3305795916.40	147.0	136455000000.0
water_input_2yr_ago	177610975.31	1679216124.35	0.0	50584856000.0
water_input_1yr_ago	188018887.09	1724883423.45	0.0	51257901000.0
greenhouse_gas_emissions_2yr_ago	963134.93	3121515.84	6.0	74000000.0
greenhouse_gas_emissions_1yr_ago	966122.68	3185440.37	0.0	83000000.0
chemical_special_2yr_ago	2087.36	16035.33	0.0	653581.0
chemical_special_1yr_ago	2246.29	16871.57	0.0	693188.0
waste_2yr_ago	77365.82	214306.69	0.0	6856528.0

waste_1yr_ago	83397.50	217314.78	0.0	6123779.0
wastewater_2yr_ago	201810913.11	1678632024.21	0.0	50584770000.0
wastewater_1yr_ago	211648127.53	1724317096.83	0.0	51257802000.0
NOx_2yr_ago	56496.01	508558.74	0.0	21000000.0
NOx_1yr_ago	68771.83	605375.11	0.0	25000000.0
SOx_2yr_ago	29130.64	266354.05	0.0	11000000.0
SOx_1yr_ago	35440.98	314769.52	0.0	13000000.0
scope3_GHG_emissions	0.34	0.47	0.0	1.0
EMS	0.50	0.50	0.0	1.0
green_office_supplies_2yr_ago	70.89	16.05	0.0	100.0
green_office_supplies_1yr_ago	69.62	15.97	0.0	100.0
green_purchase	0.14	0.35	0.0	1.0
green_material_purchase	0.26	0.44	0.0	1.0
ISO14020_environmental_label	0.02	0.15	0.0	1.0
ecomark_environmental_label	36.52	14.98	0.0	100.0
possibility_environmental_pollution	0.24	0.43	0.0	1.0
violate_environmental_law_2yr_ago	0.04	0.19	0.0	1.0
violate_environmental_law_1yr_ago	0.04	0.20	0.0	1.0
accident_possible_environment_problem_2yr_ago	0.04	0.20	0.0	1.0
accident_possible_environment_problem_1yr_ago	0.04	0.20	0.0	1.0
complaint_environment_problem_2yr_ago	0.05	0.21	0.0	1.0
complaint_environment_problem_1yr_ago	0.05	0.21	0.0	1.0
plan_climate_change	0.68	0.47	0.0	1.0
renewable_energy_building	0.57	0.49	0.0	1.0
recognize_impact_biodiversity	0.25	0.43	0.0	1.0
conserve_biodiversity_2yr_ago	177.11	564.56	0.0	11687.0
conserve_biodiversity_1yr_ago	177.38	575.17	0.0	16062.0
SDGs_business	0.42	0.49	0.0	1.0

plastic_waste_reduction	0.45	0.50	0.0	1.0
reduce_packing	0.54	0.50	0.0	1.0
carbon_offset_goods	0.11	0.31	0.0	1.0

Note. The sample size is 1702.

Figure A.1. Integrated Report in year 2022: mean SHAP value

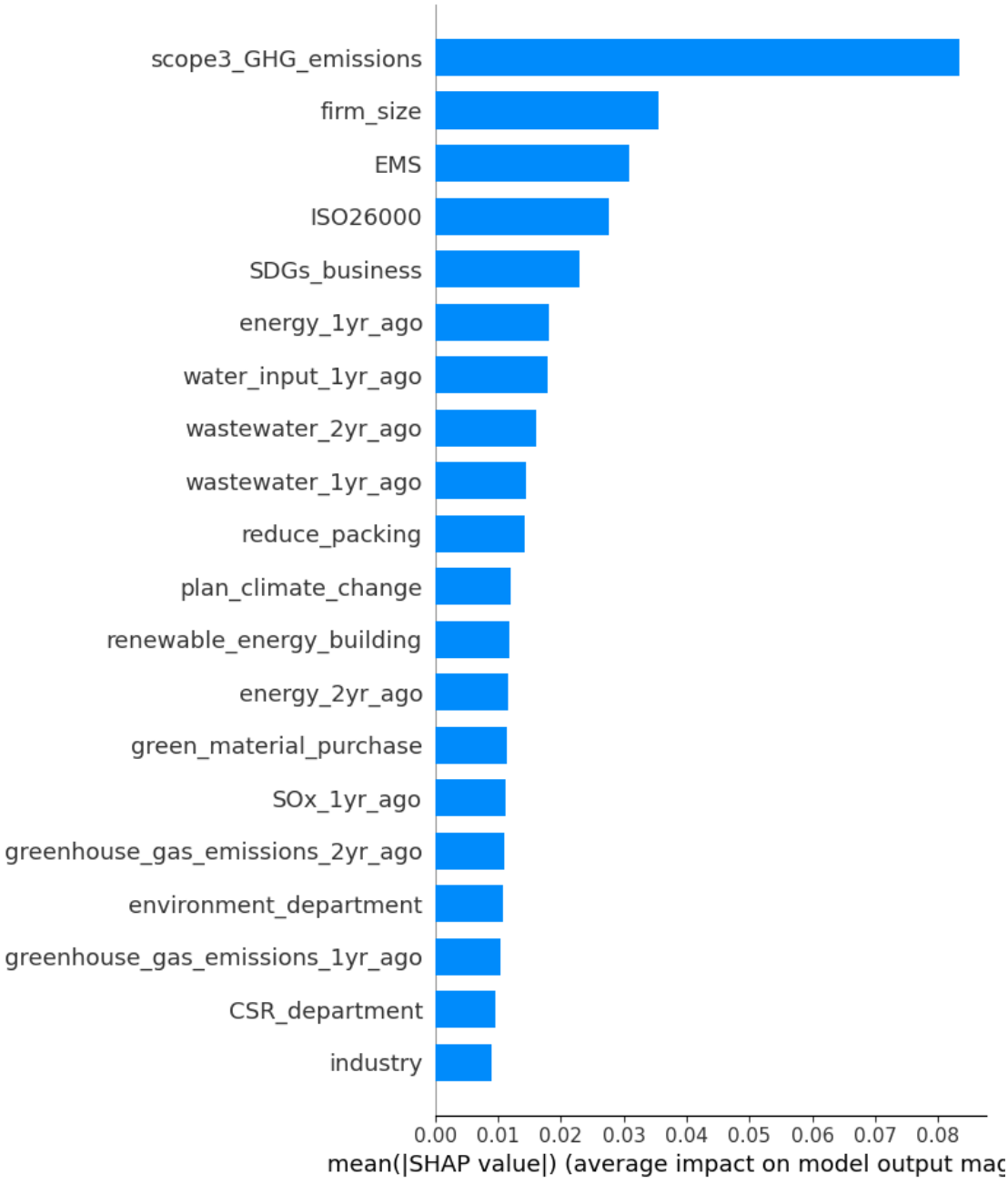

Figure A.2. Environmental Accounting in year 2022: mean SHAP value

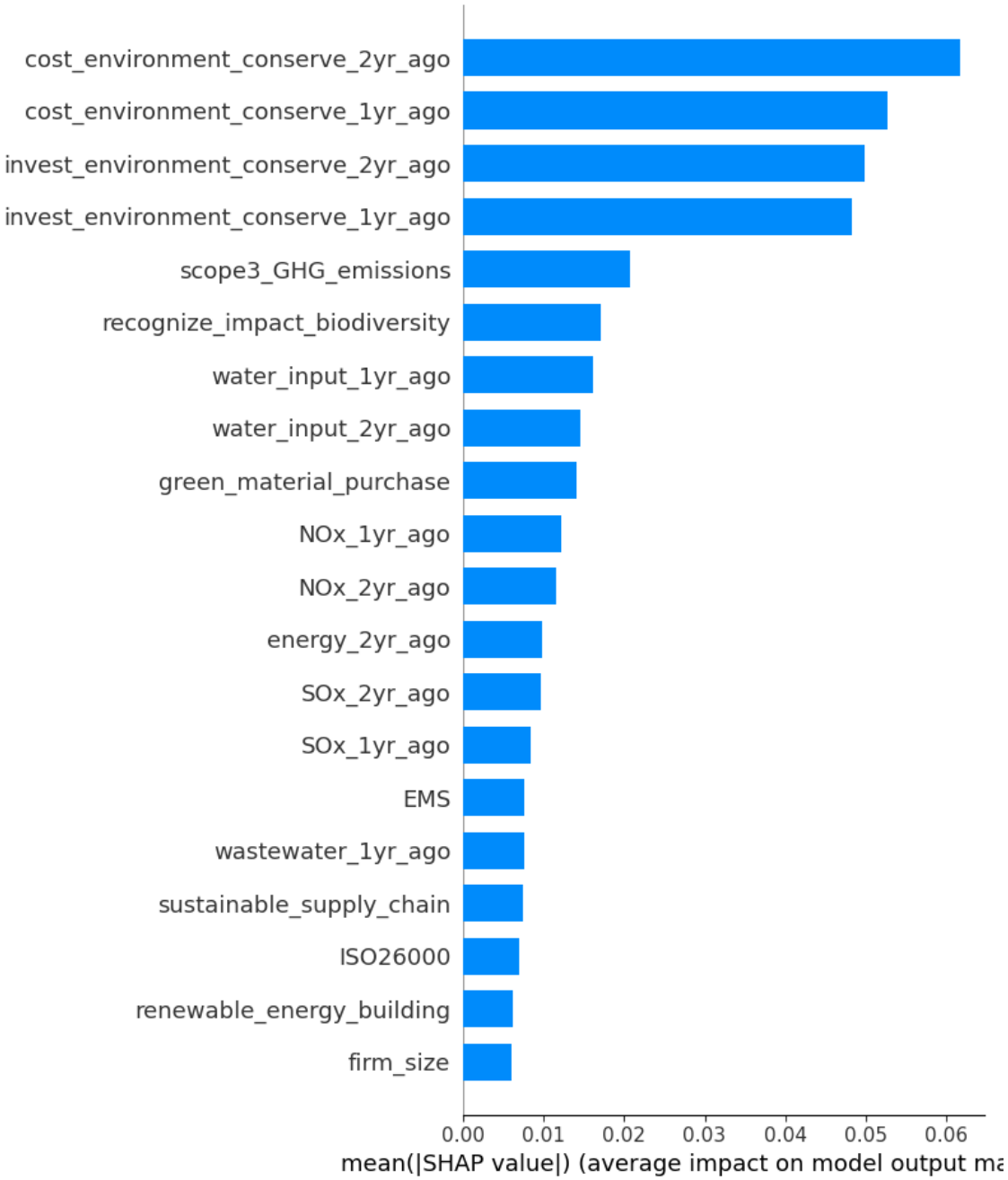

Figure A.3. Integrated Report in year 2015: mean SHAP value

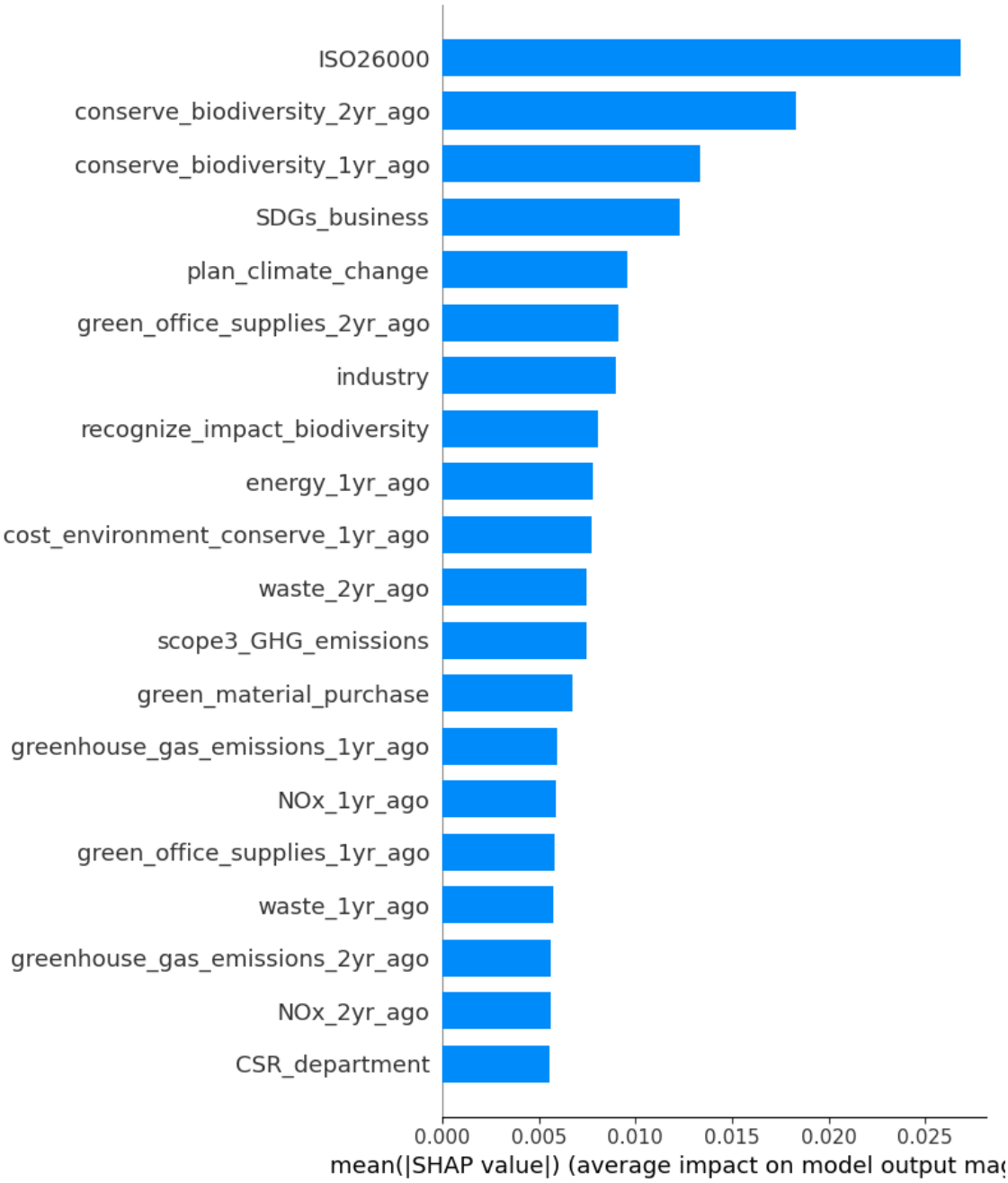

Figure A.4. Environmental Accounting in year 2015: mean SHAP value