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ADBI Working Paper Series

ESG INVESTMENT AND SME GREEN POLICIES

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Abstract

This paper examines the current landscape of environmental, social, and governance (ESG) investing by focusing on environment. We analyze the discrepancies in ESG scoring methodologies among different rating agencies and demonstrate how these inconsistencies can lead to distorted investment decisions. To address this issue, we propose a unified approach based on a net carbon tax, which incorporates both carbon emissions and companies' green efforts. We address how carbon trading, carbon pricing and green bonds differ across various countries. This can lead to distortions in production location because global companies relocate their production units based on tax rates and various fees.

We also explore the potential alignment of carbon tax, green bonds, and carbon pricing mechanisms. We argue that by standardizing the measurement of greenhouse gas emissions, these instruments could converge to provide consistent signals for investors and policymakers. The burdens and consequences of each policy will differ, which will cause the relocation of global companies based on weaker regulation on environments. We also discuss the importance of including small and medium-sized enterprises (SMEs) in emissions reduction efforts and the potential implications of central banks purchasing green bonds. We have also offered key messages for policymakers in Asian countries.

Keywords: environmental, social, and governance (ESG), small and medium-sized enterprises (SMEs), green policies, net carbon tax

JEL Classification: Q56, G11, H23, F18, Q58

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1. PORTFOLIO ALLOCATION CONSIDERING ESG SCORES

Traditionally, investors have focused on two key parameters when making portfolio allocation decisions: the rate of return and the risk. This approach, originally developed by William Sharpe (1964) and Robert Martin, has been the cornerstone of modern portfolio theory. However, the growing importance of sustainability and corporate responsibility has led to the inclusion of environmental, social, and governance (ESG) factors as a third parameter in investment decisions. Our analysis reveals that current ESG investment scoring distorts optimal portfolio allocation because different rating agencies use different criteria for environmental scores. In other words, the same company has different ESG scores depending on the rating agency. The rate of return and risks, however, are all measured by the same metrics: the future profitability, the volatility of these profits, and projected changes in stock prices (Yoshino, Yuyama, and Taghizadeh-Hesary 2023).

$$U(R_t - \beta \sigma_t^2 + \gamma(ESG_t)) \tag{1}$$

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

$$\sigma_t^2 = \alpha_t^2 (\sigma_t^A)^2 + (1 - \alpha_t)^2 \sigma_t^{B^2}$$
(3)

$$ESG_t = \alpha_t ESG_t^A + (1 - \alpha_t) ESG_t^B$$
(4)

$$\frac{\partial U}{\partial \alpha_t} = (R_t^A - R_t^B) - \beta \{ 2\alpha_t (\sigma_t^A)^2 + 2(1 - \alpha_t) (\sigma_t^B)^2 \} + (2 - 4\alpha_t) \sigma_t^{AB} + \gamma (ESG_t^A - ESG_t^B) = 0$$
(5)

Writing equation (5) for the results in equation (1):

$$\alpha_{t} = \frac{\frac{1}{2\beta} (R_{t}^{A} - R_{t}^{B}) - (\sigma_{t}^{B})^{2} - \sigma_{t}^{AB} + \frac{\gamma}{2\beta} (ESG_{t}^{A} - ESG_{t}^{B})}{(\sigma_{t}^{A})^{2} - (\sigma_{t}^{B})^{2} - 2\sigma_{t}^{AB}}$$
(6)

The above equations lay out portfolio analysis if we account for ESG as an additional component along with rate of return and risk. Equation (1) is utility maximization for investors. Traditionally, investors have paid attention to rate of return R_t and risk σ_t^2 ; however, they must now account for the ESG score as well. In this paper, we focus on E, and not S or G—that is, we are considering environmental scores.¹ Equation (2) is the rate of return for an organization distributing its asset into two companies, R_t^A and R_t^B . α_t represents the percentage of the asset allocated to company A, and $(1 - \alpha_t)$ is the percentage of the asset allocated to company B.

Neglecting the cross correlations between assets A and asset B, Equation (3) is a simple version of the risk. Equation (4) is the total ESG score, which consists of α_t times company A and $(1 - \alpha_t)$ times ESG score of company B. Equation (5) is the utility maximization for Equation (1) based on (2), (3), and (4). We then obtain Equation

¹ As is shown in this paper, the environmental component of ESG is relatively easy to assess by measuring the amount of CO₂ and greenhouse gas (GHG) emissions. However, the social and governance aspects are not as easy to compare, because it is difficult to ascertain what kinds of activities in which the company engages are good for society. There could also be many measures to assess whether their governance is good or not. In this paper, we therefore focus on the environmental aspect of ESG.

(6), where α_t is the optimal allocation of total assets to company A and $(1 - \alpha_t)$ is the optimal allocation to company B. This equation shows that α_t depends on the ESG scores of Company A and Company B. This will be further corroborated through our empirical analysis.

ESG Score	Evaluation Criteria Overview
Bloomberg ESG Disclosure Scores	Evaluated based on the degree of disclosure; environmental aspects are evaluated based on the degree of disclosure.
FTSE Russell's ESG Ratings	ESG risks are evaluated based on disclosure, commitment to policy formulation and improvement. In terms of the environment, in addition to disclosure, we evaluate the existence of policies and commitments to improvement.
MSCI ESG Ratings	Evaluated based on 37 key ESG issues. The environment side is also evaluated by setting a key issue.
Sustainalytics' ESG Risk Ratings	Based on ESG measures, information disclosure, and the level of problems. The same is true for the environment.
Thomson Reuters ESG Scores	Based on 10 items: for the Environment factor, resource use, emissions, and innovation; for the Society factor, employees, human rights, local communities, and product responsibility; and for Governance, management, shareholders, and CSR strategy. Regarding the environment, evaluated based on actual carbon emissions and whether there is a policy or not.

Table 1: Rating Methods Provided by	y Various Rating Agencies
-------------------------------------	---------------------------

Source: Created by the authors after processing part of the data of Yoshino and Yuyama (2021), Yuyama (2020), and each rating agency.

To illustrate this, we examine the evaluation criteria of five prominent rating agencies: Bloomberg, FTSE, MSCI, Sustainalytics, and Thomas Reuters (see Table 1). Each of these agencies has developed its own scale and criteria for measuring environmental performance. For example, some rating agencies focus primarily on the degree of disclosure provided by companies, while others place more emphasis on the presence of specific environmental policies or practices. This lack of standardization means that a single company can receive vastly different environmental scores depending on which agency is performing the evaluation.

Figure 1 shows traditional portfolio allocation with the addition of the environmental or green score as a vertical axis. The horizontal axis is the rate of return and risk. The black line, AB, is the portfolio frontier. U is the traditional risk-return-based utility maximization. The intersection of U and AB, E, is the maximized welfare point—that is, the optimal portfolio allocation that maximizes the rate of return based on risk.

Consider a scenario in which different agencies provide different ratings. If we account for two rating agencies on the vertical axis, one rating agency would evaluate the ESG score according to the black line *ab* while the other would evaluate the same companies along the green line *cd*. The new utility function considers not only the rate of return and the risks, but also the greenness or ESG score. In this case, the optimal portfolio allocation will change from point E to either F or G, depending on the rating agency. Consider the data in the table. We analyzed three rating agencies—Robeco-SAM, Sustainalytics, and Bloomberg—and two hypothetical companies, Company A and Company B. The three rating agencies assign different scores to the companies depending on their individual criteria. If we make our asset allocation decision based on the rating by Rebeco SAM, then we would allocate 71% to Company A and 29% to Company B. This allocation split would, however, change to 74% and 26% with Sustainalytics, and to 54% and 46% with Bloomberg.



Figure 1: Different ESG Scores by Different Rating Agencies

Table 2: Empirical Analysi	s of the	Relationship	Between	ESG Scores a	and
Risk/Return (Y	oshino,	Yuyama and	Hesary (2	(023))	

Japan's Nikkei 225 as of 30 December 2021							
	Pan	el 1: Depen	dent Variabl	e: Stock Re	turn 2021		
			ESG Sco	pre			
	bld2021	ble2021	bls2021	blg2021	blep2021	blsp2021	blgp2021
ESG score	0.004* (0.051)	0.003** (0.046)	0.002 (0.330)	0.003 (0.161)	-0.000 (0.939)	-0.001 (0.577)	0.001 (0.264)
Control variables							
Total assets	-0.000 (0.796)	-0.000 (0.932)	-0.000 (0.831)	-0.000 (0.758)	-0.000 (0.700)	-0.000 (0.718)	-0.000 (0.795)
ROA	0.008 (0.211)	0.008 (0.186)	0.008 (0.223)	0.007 (0.244)	0.008 (0.213)	0.008 (0.220)	0.008 (0.244)
Equity ratio	-0.003** (0.047)	-0.003** (0.031)	-0.003* (0.058)	-0.002* (0.100)	-0.003* (0.056)	-0.003* (0.068)	-0.003* (0.059)
Constant	0.028 (0.821)	0.138* (0.079)	0.188** (0.020)	–0.033 (0.871)	0.280*** (0.007)	0.298 (0.000)	0.223 (0.007)
Observations	223	223	223	223	195	195	195
	Panel 2: Dependent Variable: Stock Volatility 2021						
	ESG Score						
	bld2021	ble2021	bls2021	blg2021	blep2021	blsp2021	blgp2021
ESG score	-6.984* (0.074)	-3.473 (0.115)	-4.302 (0.269)	-6.426 (0.124)	-3.192 (0.102)	-1.689 (0.361)	-2.223 (0.252)
Control variables							
Total assets	0.000 (0.540)	0.000 (0.648)	0.000 (0.553)	0.000 (0.489)	0.000 (0.721)	0.000 (0.647)	0.000 (0.767)
ROA	32.320* (0.003)	31.726* (0.004)	32.584** (0.003)	33.244** (0.002)	31.574** (0.008)	31.209 (0.009)	32.519 (0.006)
Equity ratio	6.510**	6.861*	6.334**	5.668**	6.276**	7.118**	6.667**

	ESG Score						
	bld2021	ble2021	bls2021	blg2021	blep2021	blsp2021	blgp2021
ESG score	-6.984*	–3.473	-4.302	-6.426	-3.192	-1.689	-2.223
	(0.074)	(0.115)	(0.269)	(0.124)	(0.102)	(0.361)	(0.252)
Control variables							
Total assets	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	(0.540)	(0.648)	(0.553)	(0.489)	(0.721)	(0.647)	(0.767)
ROA	32.320*	31.726*	32.584**	33.244**	31.574**	31.209	32.519
	(0.003)	(0.004)	(0.003)	(0.002)	(0.008)	(0.009)	(0.006)
Equity ratio	6.510**	6.861*	6.334**	5.668**	6.276**	7.118**	6.667**
	(0.011)	(0.008)	(0.013)	(0.028)	(0.032)	(0.016)	(0.023)
Constant	327.761	128.131	91.275	511.782	209.148	54.832	78.085
	(0.131)	(0.352)	(0.517)	(0.151)	(0.256)	(0.706)	(0.597)
Observations	223	223	223	223	195	195	195

Empirically, the same results are shown with Table 2 (Yoshino, Yuyama, and Taghizadeh-Hesary 2023). The two panels capture the correlation of ESG scores with the rate of return and risk, respectively. Refer to Panel 1. We observe that, out of the seven cases examined, only two showed a positive correlation between ESG scores and returns, while the other five showed no significant correlation. Similarly, in Panel 2, only one out of seven cases showed a positive correlation between ESG scores and risk, with the remaining six showing no significant correlation. The results underscore the lack of consistency in how ESG scores are measured by different agencies and the resulting lack of correlation between ESG scores, rate of return, and risk.

2. CARBON TAXES TO REGAIN OPTIMAL PORTFOLIO ALLOCATION

To address the distortions created by inconsistent ESG scoring, we propose the implementation of a net carbon tax system. This approach would provide a more objective and standardized measure of a company's environmental impact, which could then be directly incorporated into investment decision-making processes. Mathematically, the net carbon tax would be calculated as follows:

Net Carbon Tax = Carbon Tax – Greenness Efforts

This equation helps us calculate the net carbon emissions of each company after accounting for its greenness efforts such as planting trees or setting up solar power panels on their factories. This net carbon tax would then be incorporated into rate of return calculations as follows:

Company A's return after carbon tax:
$$R_A = R_A - Carbon Tax TA$$

Risks after carbon tax: σ_A

Company B's return after carbon tax: $R_B = R_B - Carbon Tax TB$

Risks after carbon tax: σ_B

We also compute the risk associated with the after-tax rate of return. Equations (11) and (12) show the after-tax rate of return of Company A and Company B.

$$\tilde{R}_t^A = R_t^A - T_t^A \tag{11}$$

$$\tilde{R}_t^B = R_t^B - T_t^B \tag{12}$$

Equations (13) and (14) show the optimal rate of return and risk, respectively.

$$\tilde{R}_t = \tilde{\alpha}_t \tilde{R}_t^A + (1 - \tilde{\alpha}_t) \tilde{R}_t^B$$
(13)

$$\tilde{\sigma}_t^2 = \tilde{\alpha}_t^2 (\tilde{\sigma}_t^A)^2 + (1 - \tilde{\alpha}_t)^2 (\tilde{\sigma}_t^B)^2 + 2\tilde{\alpha}_t (1 - \tilde{\alpha}_t) \tilde{\sigma}_t^{AB}$$
(14)

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

$$\tilde{\alpha}_t = \frac{\frac{1}{2\beta} (\tilde{R}_t^A - \tilde{R}_t^B) - (\tilde{\sigma}_t^B)^2 - \tilde{\sigma}_t^{AB}}{(\tilde{\sigma}_t^A)^2 - (\tilde{\sigma}_t^B)^2 - 2\tilde{\sigma}_t^{AB}}$$
(16)

Next, to find the optimal asset allocation between Companies A and B, we obtain first order differentiation of the utility function for $\tilde{\alpha}_t$ (Equation 15). Solving for this, we get Equation (16). Investors evidently do not need to consider ESG as an additional item, as in Equation (16). Instead, they maximize their utility based only on the rate of return and the risk after tax. In other words, once we consider the net carbon tax of each company and measure the after-tax rate of return and after-tax risks, we obtain the optimal portfolio allocation, $\tilde{\alpha}_t$, which does not depend on ESG scores, because they are already accounted for by the carbon tax (Yoshino, Yuyama and Tagizadeh-Hesary (2023)).

Country	Carbon tax
Bangladesh	0
India	0
Indonesia	2.1
Japan	1.91
Republic of Korea	0
Singapore	18.44 ^a
Thailand	5.5 ^b
United States	0

Table 3: Carbon Tax Rates (in USD/tCO2e) 2023-2024

^a Assuming a currency conversion rate: 1 USD = 1.36 SGD.

^b Proposed implementation in 2025.

Source: Organization for Economic Co-operation and Development (OECD 2022), ADB (2022), World Bank, Ellerbeck (2022), Government of Singapore (2024), Thai Development Research Institute (2024).

We evaluated the carbon tax rate for six countries (Table 3). As can be seen, there is no unified carbon tax rate or carbon definitions across countries. The paper proposes instituting a unified carbon tax rate by focusing on CO_2 emissions.

3. DIVERSIFIED CARBON PRICING

Carbon pricing is another measure which has been proposed to tackle global warming. As shown in Table 4, current carbon pricing mechanisms vary significantly across different regions, which leads to inconsistent incentives for companies operating in multiple jurisdictions.

This differentiated carbon pricing is a result of the different carbon caps (or CO_2 emissions limits) implemented in various regions. This mechanism can be illustrated through a simple two-firm model (Figure 2). Consider Firm A, which exceeds its allocated CO_2 emissions ceiling, and Firm B, which operates below its emissions limit. In a carbon trading system, Firm B can sell its unused emission allowances (represented by the area below the red emissions ceiling) to Firm A, which requires additional allowances to cover its excess emissions. This trading activity generates the carbon price. The stringency of the emissions cap directly influences the carbon price. As the cap becomes more restrictive (represented by the lower emissions ceiling in the bottom figure), the supply of available allowances decreases, which results in higher carbon prices. Conversely, a more lenient cap (represented by a higher emissions ceiling) increases the supply of allowances, which leads to lower carbon prices.

Country	Carbon Price
People's Republic of China	12.57
India	0 ^a
Indonesia	0.61
Japan	20.9 ^b
Republic of Korea	6.3
Kazakhstan	1.06
EU	61.3
Germany	48.37
United States	21.03 ^c

Table 4: Carbon Price (USD/tCO2e)

^a An ETS system is being discussed but has not yet been implemented in India.

^b J-credit price in 2023.

^c Regional Greenhouse Gas Initiative clearing price as of 5 June.

Source: OECD (2022), World Bank Carbon Pricing Dashboard, Nomura Research Institute (2023), Regional Greenhouse Gas Initiative database



Figure 2: Impact of Emissions Limits on Carbon Pricing

4. GREEN BONDS

The Green Bond Principles (GBP), initially published in 2018 by the International Capital Market Association and subsequently revised in 2022, provide a framework for issuing green bonds. These principles outline ten eligible categories for green bond issuance, including renewable energy and energy efficiency (e.g., energy-efficient buildings). However, the current implementation of these principles reveals the

significant challenges of quantifying the environmental impact of green projects. For instance, in a field study conducted in Japan, the author interviewed construction companies responsible for green buildings in Tokyo. When guestioned about the specific reduction in CO₂ emissions compared to traditional buildings, the companies acknowledged lower carbon emissions but were unable to provide precise figures, such as whether the reduction was 20% or 30%. This lack of specificity extends to other green bond categories, such as renewable energy projects. The actual reduction in CO₂ emissions from solar or wind power installations can vary significantly depending on factors such equipment efficiency environmental as and conditions (e.g., wind strength or sunshine intensity). While the GBP provide clear criteria for green bond issuance, they do not establish a standardized method for quantifying reductions in greenhouse gas (GHG) emissions. Consequently, the credit ratings of green bonds are not directly tied to their environmental impact as measured by GHG emissions reductions.

5. PROPOSED SOLUTION TO COPE WITH DIVERSITIES

To address this issue, this paper proposes a unified approach that aligns credit rating, carbon tax, green bonds, and carbon pricing mechanisms based on a standardized measurement of CO_2 emissions. The proposed framework would function as follows:

- 1. Green credit rating: The system would be based on the quantity of CO₂ or GHG emissions. Companies with very low emissions would receive the highest rating (AAA), with ratings decreasing as emissions increase.
- Carbon tax: The tax would be calculated by multiplying the tax rate by the amount of GHG emissions. As emissions increase, the tax burden would increase proportionally.
- 3. Green bonds: The credit rating of green bonds would be directly tied to the issuing company's GHG emissions. Companies with minimal emissions would receive the highest rating (AAA), with ratings declining as emissions increase.
- 4. Carbon pricing: By setting appropriate emissions ceilings, carbon pricing can be aligned with the carbon tax rate. This alignment ensures that the economic incentives across different policy instruments are consistent.

The key to this unified approach is the accurate measurement of total GHG emissions for each company.² In Yokohama City, Japan, CO_2 and temperature measuring devices are used extensively in schools. If similar tools, costing about \$60, are installed in small businesses, large buildings, and other places, it would be possible to measure and record CO_2 emissions in real time, allowing for the computation of monthly averages for each company or building. In the realm of corporate GHG emissions accounting, emissions are typically categorized into Scope 1, 2, and 3 as defined by the GHG Protocol (see Table 5).

² In this paper, we only focused on CO₂ emissions, which contribute about 80% to the effect of global warming. Other GHGs, such as NOX, are also harmful, but they are not as easy to measure and they make up less than 20% of the contribution to global warming. Accurately speaking, a GHG tax could be defined as:

GHG Tax = $w_1x(CO2)+W_2x(NOX)+w_3x(H_2O)+...$

where w_1 , w_2 , w_3 are the weight of emission of each GHG toward global warming. For example, w_1 should be set about 0.8 since CO₂ emissions contribute about 80% of global warming.

			GHG Er	nissions (in 000) tCO2e)
	Country	Company	Scope 1 ^a	Scope 2 ^b	Scope 3 ^c
	Japan	Cosmo Oil	7,287	243	71,748
		Idemitsu Kosan	13,858	553	122,324
S		Inpex	6,839	69	84,926
Ğ	India	Indian Oil Corporation	20,210	630	301,500
pu		Bharat Petroleum	10,242	715	141,175
)il a		Hindustan Petroleum	3,342	637	116,301
0	United States	ExxonMobil	92,000	6,000	540,000
		Phillips 66	24,800	6,400	354,000
		Valero Energy	24,800	4,900	NA
	Japan	Daiichi Sankyo	86	24	2,122
		Takeda Pharmaceutical	316	0	4,462
als		Chugai Pharmaceutical	48	3	1,137
utio	India	Sun Pharma	67	353	357
ace		Dr Reddy's Lab	302	166	470
arm		Cipla	38	187	NA
Phé	United States	Johnson & Johnson	320	123	6,866
		Eli Lily & Co	182	345	NA
		Merck & Co	1,236	227	4,594
	Japan	Toyota	2,370	2,870	570,490
		Honda	1,090	2,730	284,410
s		Nissan Motors	661	1,435	118,828
mobile	India	Mahindra and Mahindra	59	202	80,214
		Suzuki	420	720	19,860
uto		Tata Motors	60	266	3,141
∢	United States	General Motors		2,700	241,000
		Ford	1,108	1,355	384,120
		Stellantis	1,400	1,700	457,600

	Table	5:	Scope	e 1,	2,	and	3	Emissions
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^a Scope 1 emissions are direct GHG emissions that occur from sources that are controlled or owned by an organization (e.g., emissions associated with fuel combustion in boilers, furnaces, vehicles).

^c Scope 3 emissions are the result of activities from assets not owned or controlled by the reporting organization, but that the organization indirectly affects in its value chain. An organization's value chain consists of both upstream and downstream activities. Scope 3 emissions include all sources not within the boundaries of Scope 1 and Scope 2 for the organization. The GHG Protocol defines 15 categories of Scope 3 emissions, Although not all categories will be relevant to all organizations.

Source: Companies' ESG disclosures.

^b Scope 2 emissions are indirect GHG emissions associated with the purchase of electricity, steam, heat, or cooling. Although Scope 2 emissions physically occur at the facility where they are generated, they are accounted for in an organization's GHG inventory because they are a result of the organization's energy use. This table captures marketbased Scope 2 emissions—that is, emissions calculated based on a specific purchase contract or agreement for energy. Unlike the location-based method, where everyone on the grid is treated as an average customer, the market-based method focuses on the individual organization and its contractual activity in the energy marketplace.

While this comprehensive framework provides a holistic view of a company's carbon footprint, it presents significant challenges for accurate measurement and subsequent taxation. Scope 2-and particularly Scope 3-emissions are notoriously difficult to quantify due to their indirect nature and the complexity of global supply chains. Moreover, the current system, which holds companies accountable for emissions across all three scopes, can lead to inefficiencies in carbon pricing and taxation. Indeed, it may result in multiple layers of taxation on the same emissions as they move through the value chain, potentially distorting economic incentives and complicating compliance efforts. To address these challenges, we propose a simplified approach that focuses solely on taxing Scope 1 emissions. This method would require companies to pay taxes only on the direct emissions produced in their operations. The oil and gas used by the company would be taxed at the production stage itself. Under this system, energy providers would be taxed for the emissions produced in generating outputs (their Scope 1 emissions), rather than end-users being taxed for their energy consumption (their Scope 2 Similarly, emissions). emissions from the production of raw materials would be taxed at the point of production, not at the point of use by downstream manufacturers. This approach simplifies the administrative burden of emissions accounting and taxation while maintaining comprehensive coverage of all emissions. It aligns incentives more directly with the ability to control and reduce emissions, thus potentially leading to more effective and targeted mitigation strategies (see Figure 3).



Figure 3: Proposed Taxation Mechanism

With this fundamental data, all four criteria—carbon pricing, carbon tax, green bond ratings, and emissions ceilings—can be harmonized, which results in a more coherent and effective system for incentivizing emissions reductions (as shown in Table 6). Similarly, green banking lacks clarity about where to lend, so banks often hire credit rating agencies to help reallocate their lending portfolios. As previously shown, measuring GHG emissions can unify credit ratings, green bonds, and carbon pricing into a single metric, which would allow banks to use any of these instruments for portfolio reallocation. The tax rate (*t*) must be adapted to support transition to net zero emissions. The concept has gained significant traction in recent years, with many countries and organizations setting targets for 2030 or 2050. The emissions thresholds and tax rates can be adjusted over time to reflect increasingly ambitious climate goals.

			Scone 1	Emissions per Million USD Pevenue/	Green		
	Countr		GHG	Sales/Incom	Bond	Credit	Carbon
	У	Company Name	Emissions	е	Rating	Rating	Тах
	Japan	Cosmo Oil	7,287	420	С	С	t*7287
		Idemitsu Kosan	13,858	236	В	В	t*13858
0&G		Inpex	6,839	476	С	С	t*6839
	India	Indian Oil Corporation	20,210	179	BB	BB	t*20210
		Bharat Petroleum	10,242	160	BBB	BBB	t*10242
0		Hindustan Petroleum	3,342	60	AA	AA	t*3342
	US	ExxonMobil	92,000	267	С	С	t*92000
		Phillips 66	24,800	168	BBB	BBB	t*24800
		Valero Energy	24,800	171	BB	BB	t*24800
	Japan	Daiichi Sankyo Co Ltd	86	11	AAA	AAA	t*86
uticals		Takeda Pharmaceutical Co Ltd	316	12	AAA	AAA	t*316
	India	Chugai Pharmaceutical Co Ltd	48	7	AAA	AAA	t*48
		Sun Pharma	67	13	AAA	AAA	t*67
ace		Dr Reddy's Lab	302	101	А	А	t*302
arm		Cipla	38	14	AAA	AAA	t*38
Ph	US	Johnson & Johnson	320	4	AAA	AAA	t*320
		Eli Lily & Co	182	5	AAA	AAA	t*182
		Merck & Co	1,236	21	AAA	AAA	t*1236
	Japan	Toyota	2,370	10	AAA	AAA	t*2370
		Honda	1,090	10	AAA	AAA	t*1090
S		Nissan Motors	661	10	AAA	AAA	t*661
ives	India	Mahindra and Mahindra	59	6	AAA	AAA	t*59
mot		Suzuki	420	31	AAA	AAA	t*420
uto		Tata Motors	60	8	AAA	AAA	t*60
∢	US	General Motors	2,700	16	AAA	AAA	t*2700
		Ford	1,108	6	AAA	AAA	t*1108
		Stellantis	1,400	7	AAA	AAA	t*1400

Table 6: Examples of Credit Scoring, GHG tax, and Green Bonds Based on GHG Emissions

Source: Author's calculations based on companies' financial and sustainability reports.

6. GREEN POLICY FOR SMALL AND MEDIUM-SIZED ENTERPRISES

Small and medium-sized enterprises (SMEs) play a crucial role in global economic activity and, consequently, in global emissions. According to studies by the Organisation for Economic Co-operation and Development, SMEs account for more than 50% of CO_2 emissions in many countries. However, these businesses often lack the resources and expertise to measure and reduce their emissions effectively. As shown in Figure 4, large businesses face considerable pressure to adhere to environmental standards due to their exposure to financial markets and scrutiny from investors. These companies issue stocks and bonds, which makes them susceptible to investor sentiment regarding environmental performance. Corporate rating agencies also exert additional pressure by potentially downgrading credit ratings for businesses that fail to meet environmental standards. Conversely, SMEs face fewer external pressures to reduce their environmental impact, which is based on several factors. SMEs often lack the financial resources necessary to invest in CO_2 -reduction technologies or practices and typically do not have the capacity

to develop advanced emissions-reduction technologies independently. Unlike large businesses, SMEs generally do not issue stocks or corporate bonds, which insulates them from investor scrutiny regarding environmental performance. Instead, they predominantly rely on borrowing from smaller banks and money lenders.



Figure 4: Green Finance Policies for Small and Medium-Sized Enterprises

As a result, SMEs continue to emit CO_2 without significant incentives or capacity to improve their environmental performance. To address this issue, we propose implementing a simplified net carbon tax system for SMEs, starting with very low rates (around 0.0001%) to minimize initial financial burden. This would incentivize SMEs to reduce carbon emissions. In addition, government support must be provided for technology transfer from large corporations to SMEs, which would enable them to adopt more environmentally friendly practices. This could be achieved by providing financial incentives to large businesses for technology transfer and using carbon tax revenues to subsidize the transfer of CO_2 reduction technologies to SMEs. If the subsidies are provided by the government, large businesses would have strong incentives to transfer their technologies to reduce CO_2 emissions. The government could use funds raised through a carbon tax or the issuance of sovereign green bonds to finance the transfer of GHG reduction technologies from advanced companies to SMEs. However, these funds cannot be generated through carbon trading (i.e., carbon pricing) or carbon credit rating.

7. SMALL SHARE OF GREEN BONDS OUT OF TOTAL ISSUE OF BONDS

The growing focus on green finance has led to discussions about the potential role of central banks in promoting sustainable economic practices. One proposal that has gained attention is the idea of central banks purchasing green bonds as part of their monetary policy operations. The eligible Green Projects categories include, but are not limited to, those listed (in no specific order) in Table 7.

Table 7: Eligible Green Project Categories

S. No	Project Type	Description
1	Renewable energy	Including production, transmission, appliances, and products
2	Energy efficiency	In, for example, new and refurbished buildings, energy storage, district heating, smart grids, appliances, and products
3	Pollution prevention and control	Including reduction of air emissions, GHG control, soil remediation, waste prevention, waste reduction, waste recycling, and energy/emissions-efficient waste to energy
4	Environmentally sustainable management of living natural resources and land use	Including environmentally sustainable agriculture; environmentally sustainable animal husbandry; climate smart farm inputs such as biological crop protection or drip-irrigation; environmentally sustainable fishery and aquaculture; environmentally sustainable forestry, including afforestation or reforestation; and preservation or restoration of natural landscapes
5	Terrestrial and aquatic biodiversity conservation	Including the protection of coastal, marine, and watershed environments
6	Clean transportation	Including electric, hybrid, public, rail, non-motorized, multi-modal transportation, infrastructure for clean energy vehicles, and reduction of harmful emissions
7	Sustainable water and wastewater management	Including sustainable infrastructure for clean and/or drinking water, wastewater treatment, sustainable urban drainage systems and river training, and other forms of flooding mitigation
8	Climate change adaptation	Including efforts to make infrastructure more resilient to the impacts of climate change, as well as information support systems, such as climate observation and early warning systems
9	Circular economy adapted products, production technologies and processes and/or certified eco-efficient products	Including the design and introduction of reusable, recyclable, and refurbished materials, components and products; circular tools and services
10	Green buildings	Buildings that meet regional, national, or internationally recognized standards or certifications for environmental performance

However, our analysis suggests that this approach may have unintended consequences and potentially overstep the traditional boundaries of monetary policy. As shown in Table 8, certain countries have started issuing green bonds, but they form a very small percentage of the overall bond market. We argue that central bank purchases of green bonds could distort market pricing mechanisms and lead to the inefficient allocation of capital. This is because such purchases would effectively allocate additional money to specific sectors (i.e., green projects), a decision that traditionally falls under the purview of fiscal policy and democratic processes. This practice could potentially compromise the neutrality and independence of central banks, which are crucial for maintaining price stability and the integrity of the financial system.

Country	Green Bond Market as a % of Overall Bond Market		
People's Republic of China	1.17%		
India	0.3% ^a		
Indonesia	2% ^b		
Philippines	2% ^c		
Thailand	0.3%		

Table 8: Green Bonds as a Percentage of Overall Bond Market

^a Accounts for sovereign bonds only.

^b Indicates green bonds as a percentage of overall fixed income issuance.

^c Accounts for sovereign bonds only.

Source: Author's calculations based on data from Zhang, Ziying, and Wang (2024); Dill and Hussain 2023; Gandhi (2023); International Finance Corporation (2024); Government of Philippines (2023); Government of Thailand (2024).

8. COMPARISON OF CARBON FINANCE INSTRUMENTS: BURDENS AND RECIPIENTS

This section examines the distribution of financial burdens and the recipients of funds across various carbon finance instruments, including carbon credit ratings, carbon taxation, carbon pricing, and both private and public green bonds.

Carbon credit ratings impose an indirect financial burden on the private sector through potential impacts on cost of capital and reputation. However, they do not generate direct financial flows.

Carbon taxes place a direct financial burden on the private sector, with funds collected by the government. This represents a transfer from private entities to the government.

In **carbon pricing systems** (e.g., cap-and-trade), the financial burden is initially borne by the private sector. However, unlike carbon taxes, the funds generally circulate within the private sector as companies trade emissions allowances.

Private green bonds involve a flow of funds from private investors to private issuers. While they create a financial obligation for the issuer, they also provide access to capital for green projects. A lower rating could imply a higher interest burden on the issuer.

Public green bonds, like private ones, involve private investors. However, the funds are directed to the government, like traditional government bonds. This allows the public sector to finance green initiatives through market mechanisms

Carbon Credit Rating	Carbon Tax	Carbon Pricing	Private Green Bonds	Public Green Bonds
Within private	Collected by government	Within private	Within private	Collected by government
Fund supply \rightarrow recipients	Private → government	Excess supply \rightarrow Lower supply	Private investor \rightarrow private issuer	Private investor \rightarrow government

Table 9: Comparison of Carbon Finance Instruments

This comparison reveals that while all instruments ultimately place the financial burden on the private sector, they differ significantly in how funds are channeled. Carbon taxes and public green bonds direct funds to the government, which potentially allows for broader public investment in climate initiatives. If the government would like to pursue various environmental policies in each country, financing is needed for each policy. In that case, a carbon tax and sovereign green bonds could create new sources of revenue for the government. In contrast, carbon pricing and private green bonds keep funds within the private sector, which could lead to more market-driven solutions.

9. IMPLICATIONS FOR POLICYMAKERS IN ASIA

Asian companies face unique challenges in reducing carbon emissions, stemming from the region's rapid economic growth, energy-intensive industries, and developmental priorities. First, many Asian economies, particularly in Southeast and South Asia, are still heavily reliant on coal and other fossil fuels for power generation, which makes the transition to low-carbon alternatives more challenging and costly. Second, a significant portion of Asian industry comprises energy-intensive sectors like chemical production, steel, and cement, which are difficult to decarbonize (Das and Bayne 2023). Third, the prevalence of SMEs in Asia, often lacking resources for green transitions, poses a unique challenge (United Nations Development Program 2024). Finally, the diverse regulatory landscapes across Asian countries create complexities for companies operating across borders. Existing policies have often fallen short in addressing these challenges. Carbon pricing mechanisms, where implemented, have often been set too low or have insufficient coverage to drive significant change (ADB 2023). Inconsistencies in ESG scoring methods have led to confusion and potential greenwashing in the region.

The policies proposed in this paper offer tailored solutions to the unique challenges faced by Asian companies in reducing carbon emissions. The unified approach based on a net carbon tax addresses the issue of the diverse regulatory landscapes across Asian countries, thus providing a more consistent framework for companies operating across borders. This approach also considers both carbon emissions and companies' green particularly relevant for Asian firms in energy-intensive efforts. which is sectors that are actively investing in cleaner technologies. A global carbon tax must be introduced, including in countries that presently lack carbon taxes (e.g., India, Bangladesh). An International Monetary Fund (2021) study indicated that the average global carbon price must reach \$75 a ton by 2030. Carbon taxes are determined by factors such as the carbon content of fuels, the point of application in the economic system, and the intended use of tax revenues. Their effectiveness depends on how they influence fossil fuel demand, promote clean energy adoption, and integrate into broader fiscal and environmental policies. This paper asserts that the carbon tax must be decided in accordance with the net zero transition goals over the medium to long term. The standardization of measurements of GHG emissions could provide clearer signals for Asian investors and policymakers, thus reducing confusion and potential greenwashing in the region's rapidly growing green finance market. Importantly, the emphasis on including SMEs in efforts to reduce emissions addresses a critical gap in existing policies and acknowledges the significant role these enterprises play in Asian economies.

10. CONCLUSIONS

This paper has examined the current challenges in ESG investing, particularly regarding environmental scoring, and proposed a unified approach based on a net carbon tax system. By standardizing the measurement and evaluation of companies' environmental impact, this approach has the potential to improve the efficiency and effectiveness of green finance initiatives significantly. Unifying the measurement and rating approach across countries also has the benefit of avoiding distortion of production locations and providing consistent signals for investors and policymakers. Our key findings and recommendations include:

- 1. The current ESG scoring system leads to inconsistent evaluations and potentially distorted investment decisions.
- 2. A net carbon tax approach provides a more objective and standardized measure of environmental impact.
- 3. This approach can be aligned with other green finance instruments, such as green bonds and carbon pricing mechanisms, to create a more coherent framework for sustainable finance.
- 4. The inclusion of SMEs in emissions reduction efforts is crucial for comprehensive climate action.
- 5. Central banks should be discouraged from issuing or investing in green bond markets.
- 6. While all instruments ultimately place the financial burden on the private sector, they differ significantly in how funds are channeled. A carbon tax and sovereign green bonds could help create new sources of revenue for the government.

By adopting these recommendations, policymakers and financial market participants can create a more effective and transparent system for promoting sustainable economic practices and addressing the urgent challenge of climate change. Ultimately, the transition to a sustainable, low-carbon economy will require coordinated action from governments, financial institutions, businesses, and individuals. The unified approach proposed in this paper aims to provide a clear and consistent framework to guide these efforts and accelerate progress towards our shared environmental goals.

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