

Climate Change and Various Green Tools

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Outline

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1, Climate Change and Transitional Finance

Green bond,

Carbon Pricing

ESG Rating

Carbon Tax

2, Distortion of Optimal Portfolio Allocation

3, Measurement of CO₂ → No distortion

Current ESG investment: distort asset allocation

1, Traditional asset allocation :

two-parameter approach

(i) Rate of Return (R), (ii) Risks (σ^2)

2, ESG component is added for the asset allocation

(iii) ESG (Greenness score): multi-factor model

3, ESG criteria is different from one rating agency to another

4, Each Investor changes its' asset allocation based on specific score of ESG given by the rating agency

Table 1: Rating methods provided by major ESG rating agencies

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

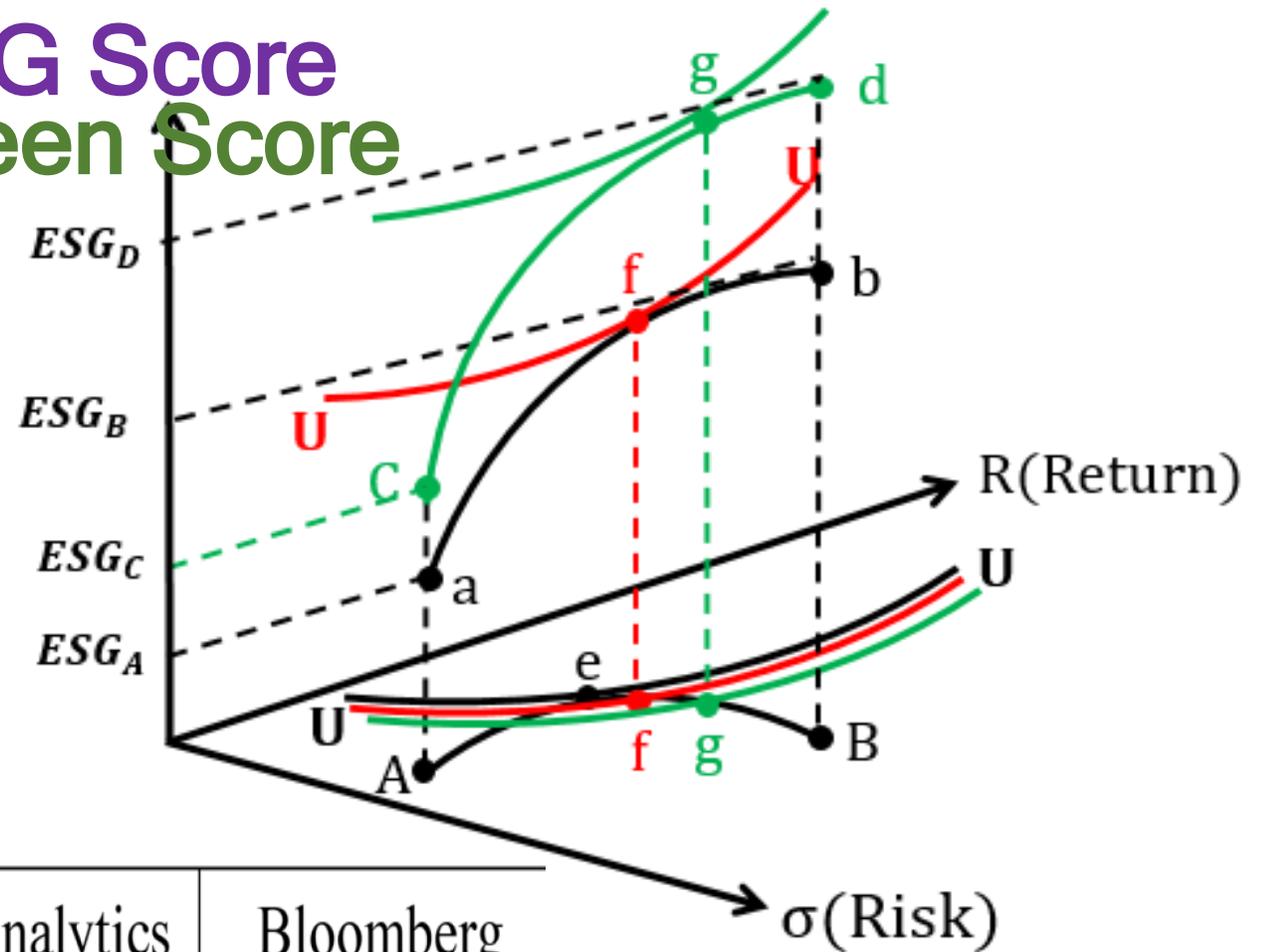
(Source) Created by the authors after processing part of the data of Yoshino and Yuyama (2021), Yuyama (2020), and each rating agency.

Different Evaluation score of ESG by various Rating Agencies

E-scores Environment

Different ESG scores by different Rating agencies

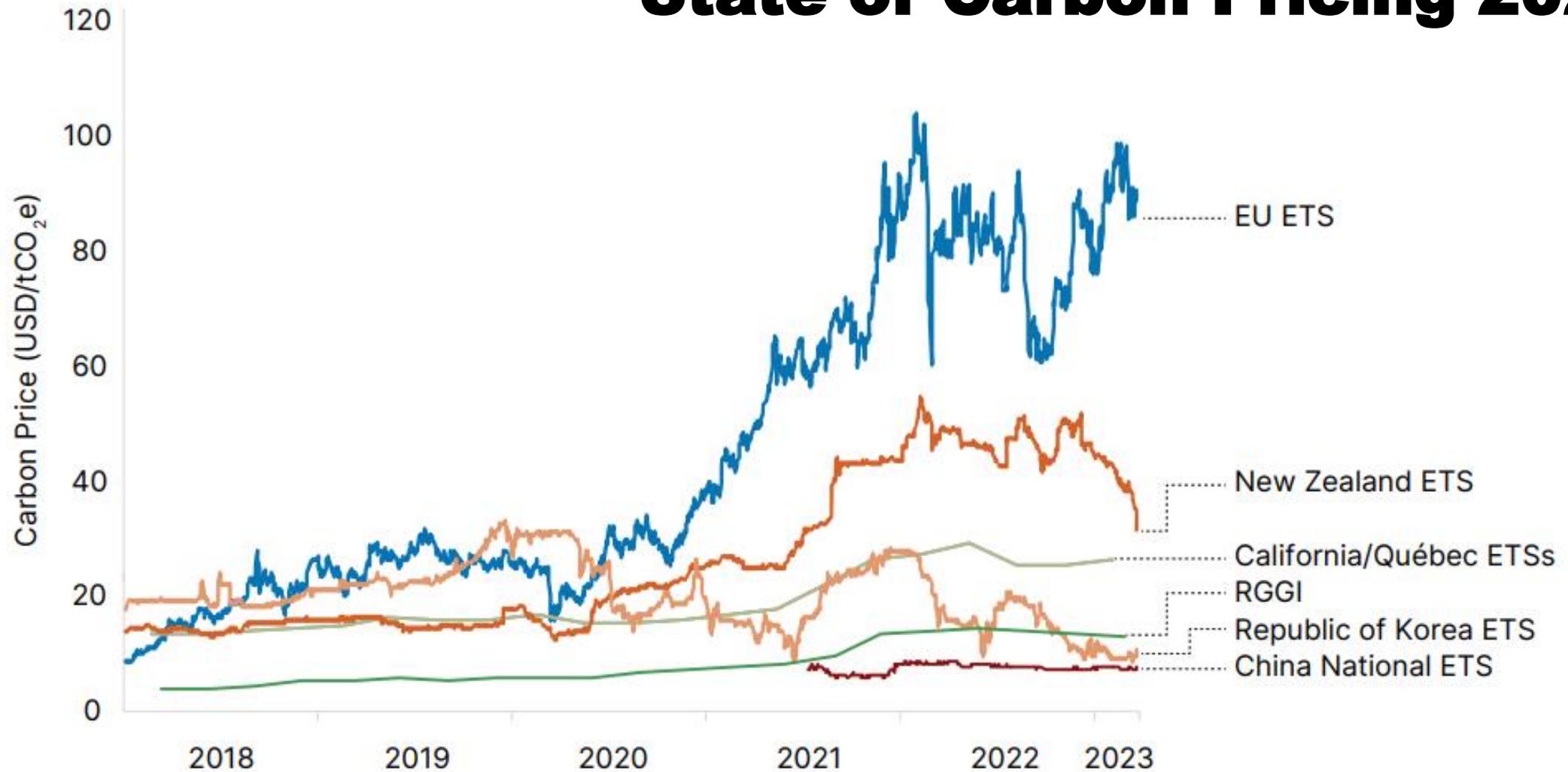
ESG Score
Green Score



ESG Score	RobecoSAM	Sustainalytics	Bloomberg
ESG score of company A	8.6	9.6	2.9
ESG score of company B	1.8	1.3	3.9
Value of α Asset Allocation	0.71	0.74	0.54

(Source) World Bank: State of Carbon Pricing 2023

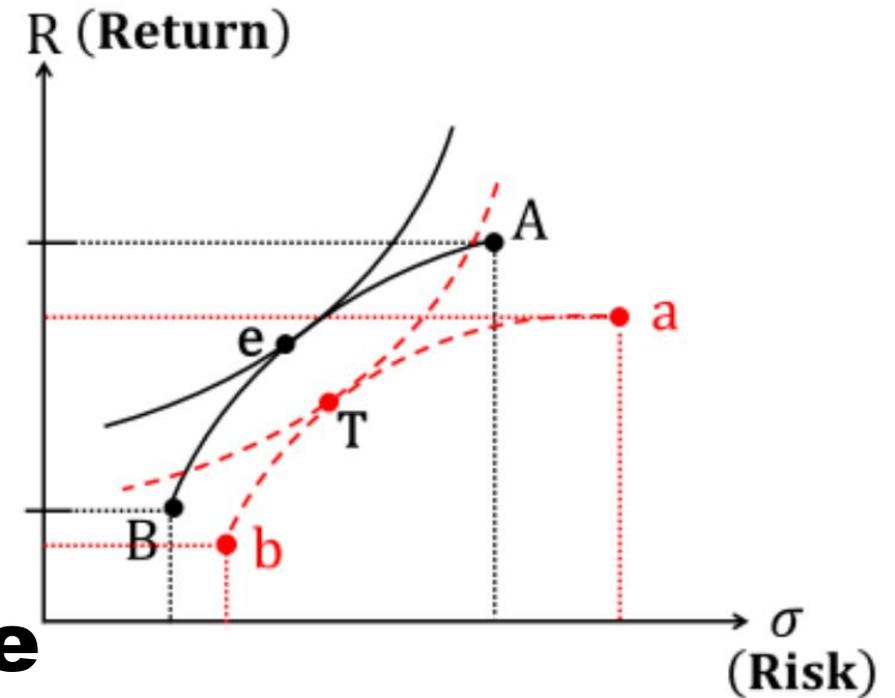
FIGURE 1
PRICE EVOLUTION IN SELECTED ETSs FROM 2018 TO 2023



Note: Based on data from ICAP Allowance Price Explorer. Prices for the RGGI initiative and for California and Québec CaT, come from the primary market, whereas for the other systems the prices reflect the secondary market

Net Carbon Tax

= Carbon -- Greenness Efforts
TAX (planting trees)
(setting up solar power)



Optimal portfolio allocation can be achieved by taxing on carbon emission

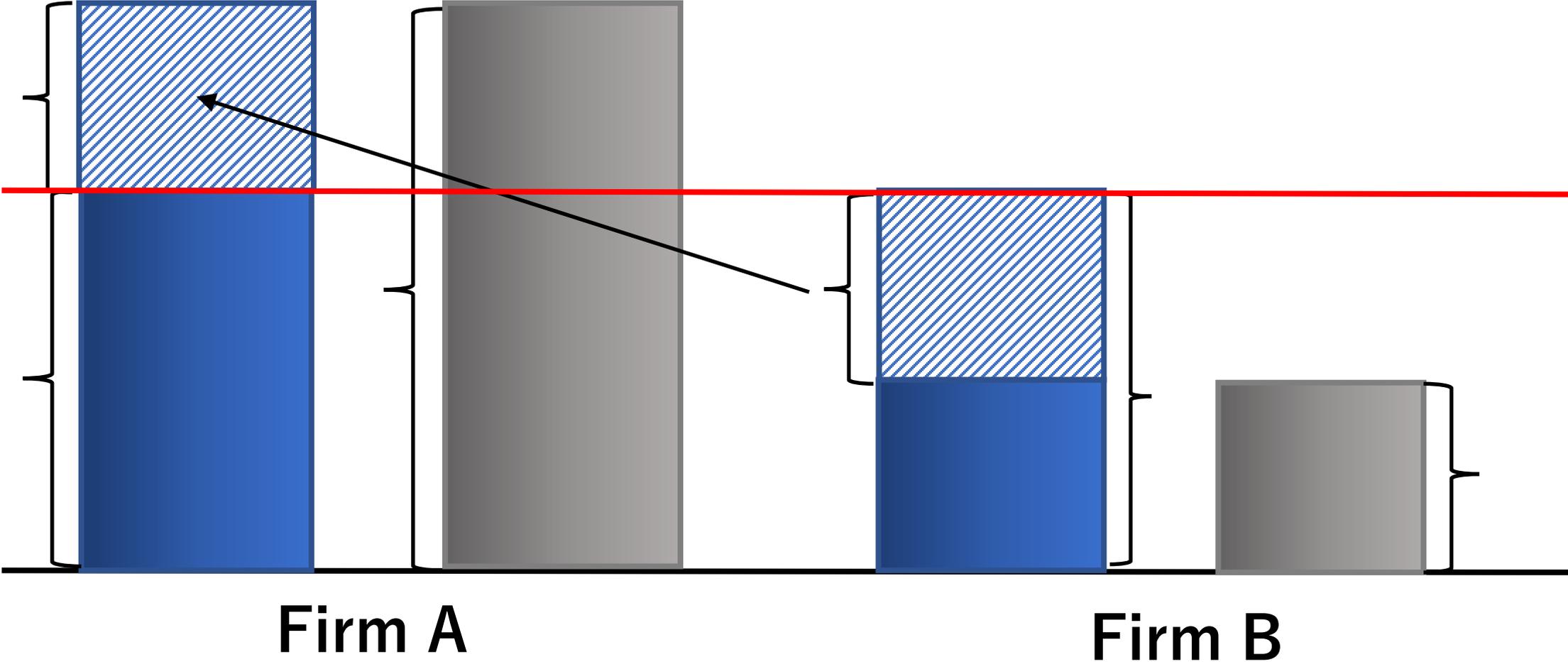
Company A's return after carbon tax: $\underline{R}_A = R_A - (\text{Carbon Tax } TA)$

Risks After Carbon Tax: $\underline{\sigma}_A$

Company B's return after carbon tax: $\underline{R}_B = R_B - (\text{Carbon Tax } TB)$

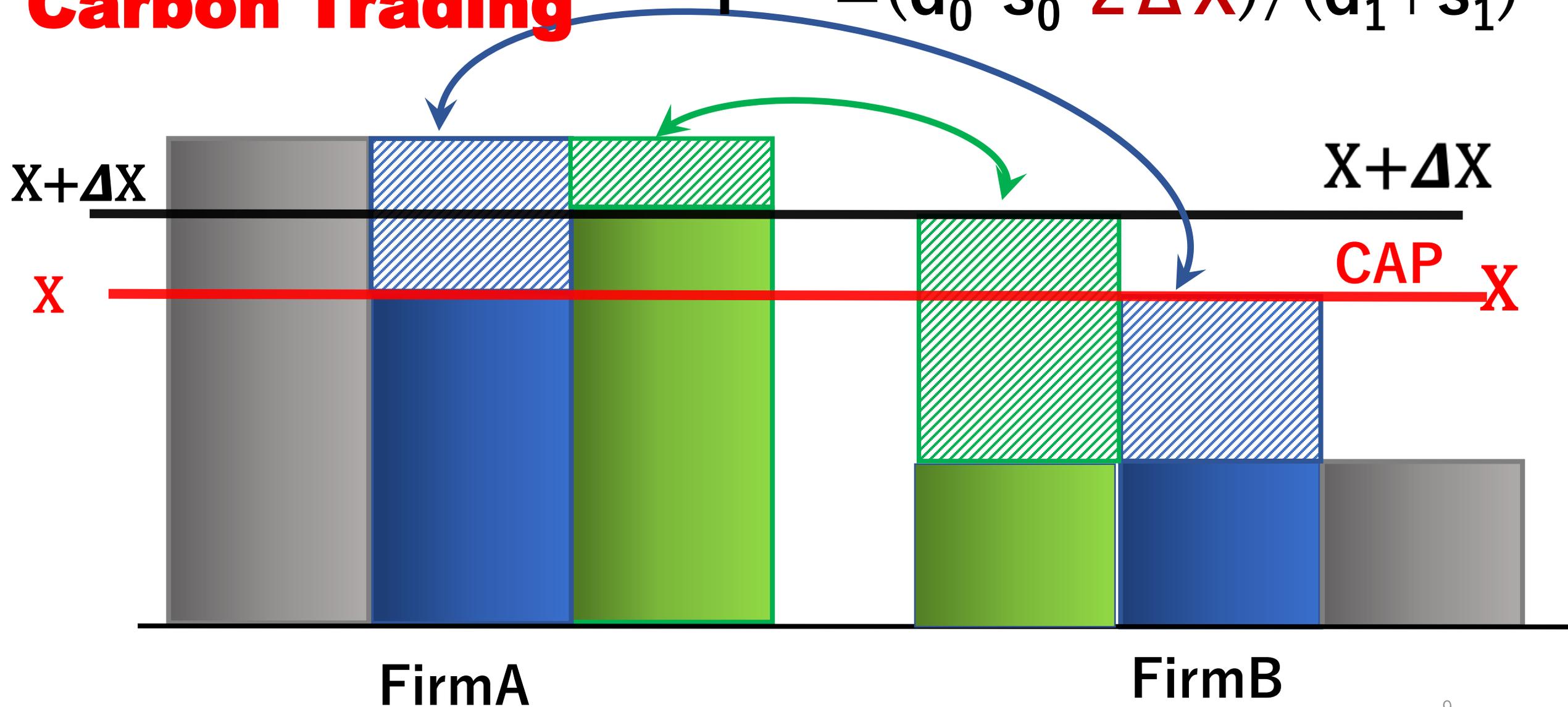
Risk After Carbon Tax: $\underline{\sigma}_B$

Carbon Trading and Carbon Pricing



Carbon Pricing Carbon Trading

$$P^X = (d_0 - s_0) / (d_1 + s_1)$$
$$P^{\Delta X} = (d_0 - s_0 - 2\Delta X) / (d_1 + s_1)$$



June 2018

Green Bond Principles

Voluntary Process Guidelines for Issuing Green Bonds

International Capital Market Association

ICMA Paris Representative Office

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Green Bond Principles (GBP) 2018

(i) renewable energy	Green Bond Ratings have to be based on GHG emissions
(ii) energy efficiency	
(iii) pollution prevention and control	
(iv) environmentally sustainable management of living natural resources and land use	
(v) terrestrial and aquatic biodiversity conservation	
(vi) clean transportation	
(vii) sustainable water and wastewater management	
(viii) climate change adaptation	
(iX) eco-efficient and/or circular economy adapted products, production technologies and processes	
(X) green buildings which meet regional, national or internationally recognized standards or certifications.	

Source: *The Green Bond Principles: Voluntary Process Guidelines for Issuing Green Bonds*, ICMA, June 2018

Green Credit Rating	Carbon Tax	Green Bond	Carbon Pricing
$\theta \times \{0.8(\text{CO}_2) + 0.2(\text{N}_2\text{O})\}$	$t \times \{0.8(\mathbf{CO}_2) + 0.2(\mathbf{N}_2\mathbf{O})\}$	$\theta \times \{0.8(\mathbf{CO}_2) + 0.2(\mathbf{N}_2\mathbf{O})\}$	$P = \frac{(d_0 - S_0) - 2\Delta X}{(d_1 + S_1)}$ $P = \{0.8(\mathbf{CO}_2) + 0.2(\mathbf{N}_2\mathbf{O})\}$

Measure: Amount of CO₂ and N₂O Emissions
0.8x(CO₂)+0.2x(N₂O)
80% 20%

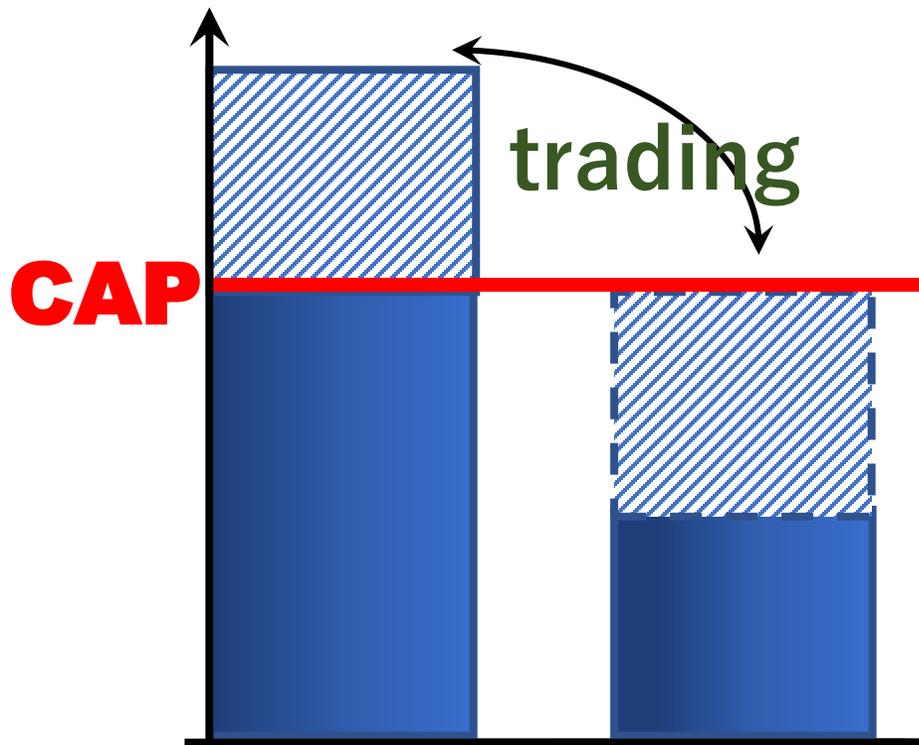
Examples of **Credit Scoring, GHG Tax and Green Bonds** based on GHG emissions

Green Credit Rating	CO₂ Emission	N₂O Emission	Green Credit Rating	GHG Tax	Green Bond Scoring
AAA	0.0	0.0	0.0	0.0	0.0
AA	2.1	1.5	1.98	1.98	1.98
A	4.2	3.2	4.00	4.00	4.00
BBB	7.0	6.4	6.88	6.88	6.88
BB	8.3	7.0	8.04	8.04	8.04
B	9.1	8.7	9.02	9.02	9.02
C	10.0	10.0	10.0	10.0	10.0
Global Warming	Weight 80%	Weight 20%	Based on GHG	0.8tax(CO₂)+ 0.2tax(N₂O)	Based on GHG

1, Carbon Trading & Carbon Pricing

$$P = (d_0 - s_0 - 2\Delta X) / (d_1 + s_1)$$

Carbon Price



2, Carbon Credit Rating

Rating	CO ₂ Emission Credit Scoring
AAA	0.0
AA	2.1
A	4.2
BBB	7.0
BB	8.3
B	9.1
C	10.0

3, Carbon Tax

$$t \times \text{CO}_2$$

t = tax rate

4, Green Bonds

Transition to Net Zero

CAP: adjustment
Scoring: adjusted
Tax rate: adjusted

All the schools at Yokohama City (West of Tokyo) Primary Schools and Secondary Schools measure **CO₂** Emissions



Diversified ESG Evaluation by Rating Agencies and Net Carbon Tax to Regain Optimal Portfolio Allocation*

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Thank you for your attention

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