IGES

Institute for Global Environmental Strategies

Towards sustainable development - policy oriented, practical and strategic research on global environmental issues

Accounting national emissions adjusted for trade

How will consumption-based approach make changes in response to climate change

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Embodied Emissions in Traded Goods

- Hidden impacts of traded goods and some indicators, e.g. food miles and carbon footprint;
- Carbon embodied in traded goods which emitted from each upstream stage of the supply chain of a product and used or consumed by the downstream stage or consumer;
- Consumption-based approach applied by decision makers (business leaders, consumers and policy makers) to encourage low-carbon products.

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Implications for Global Climate Change

- Accounting national GHG reduction credits to be recognized in meeting mandatory emissions targets;
- Obtaining recognition for GHG reductions under voluntary programs;
- Accounting GHG emissions to meet internal company targets for public recognition;
- Carbon labelling to inform consumers the carbon contents of products;
- Accounting national responsible emissions to address equity issue, carbon leakage issue and competitiveness issue between importing and exporting countries.

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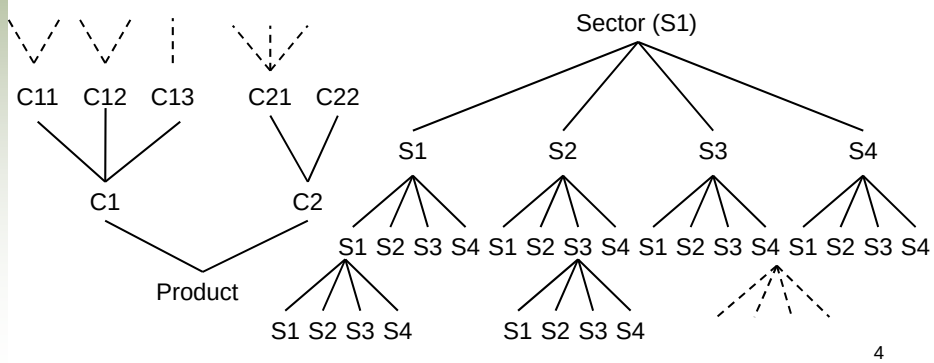
How to account embodied emissions?

Top-down method (input-output analysis), bottom-up method (life-cycle analysis) and hybrid life-cycle analysis.

Life-cycle analysis **Input-output analysis**



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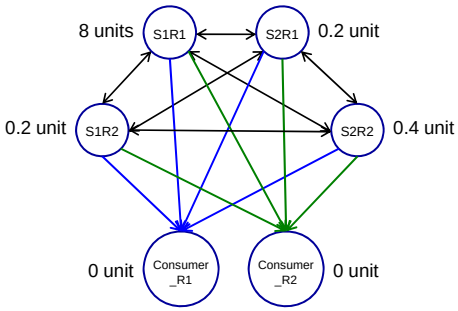
Multilateral Trade System



Three sets of elements

- Countries/regions;
- Sectors;
- Actors (upstream producers vs. downstream consumers).

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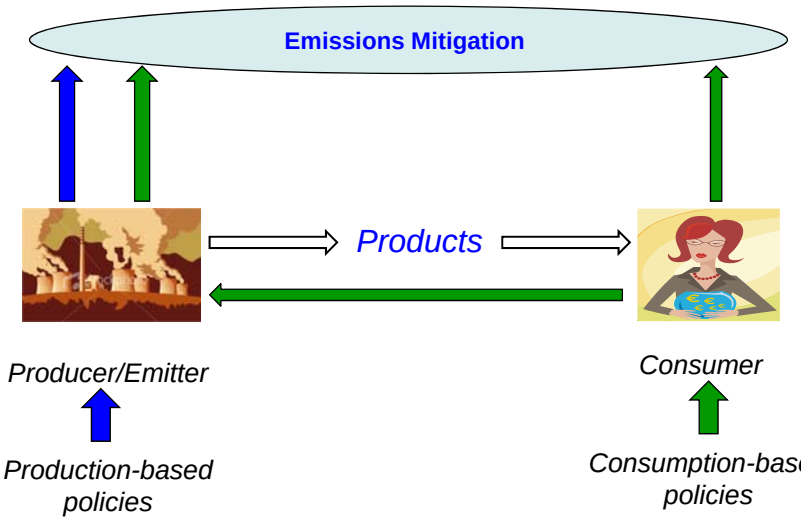
Mechanisms for Pressure vs. Behavioral Change



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Embodied CO_2 in Multilateral Trade System

- Ten countries/regions:

  IDN, MYS, PHL, SGP, THA, CHN, TWN, ROK, JPN, USA

- Multi-regional input-output (MRIO) table 2000 (IDE-JETRO)
- GTAP E-database (2001)

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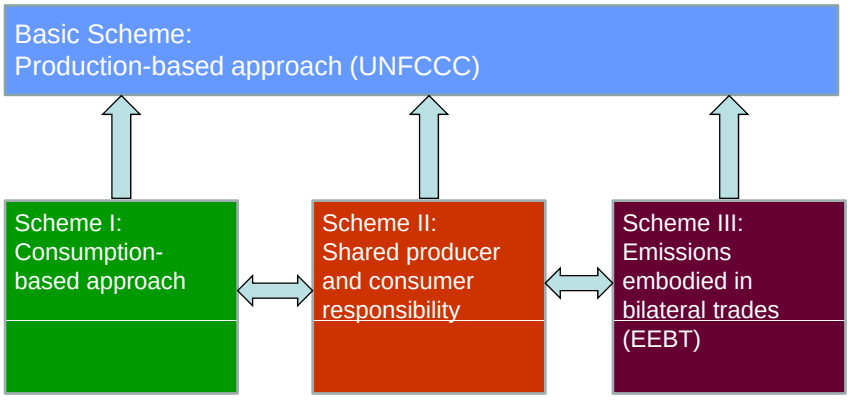
Accounting Schemes



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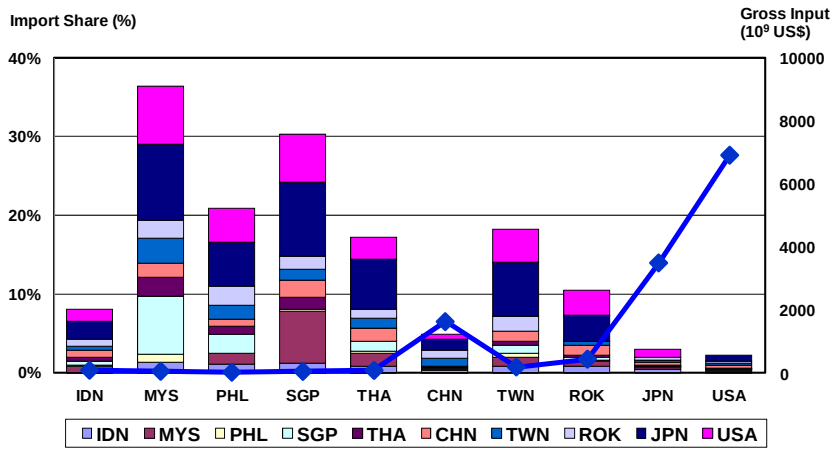
Origin and Share of Imports in Intermediate Inputs (2000)



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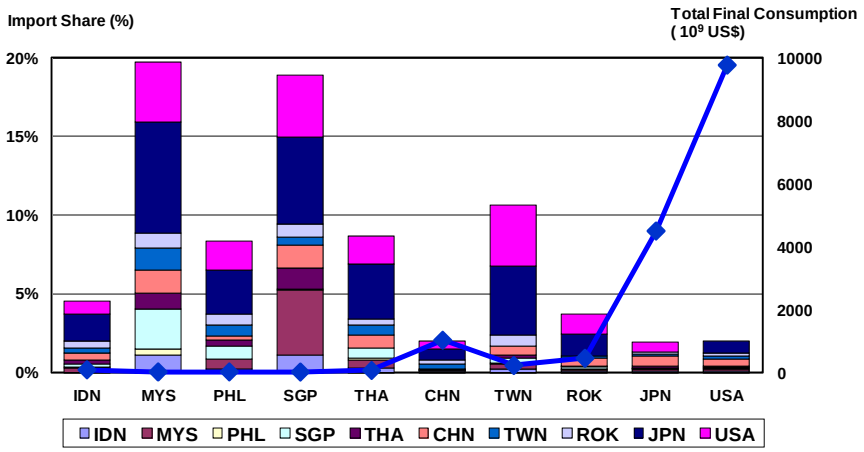
Source: The author complied based on MRIO (IDE-JETRO).

Origin and Share of Imports in Final Consumption (2000)



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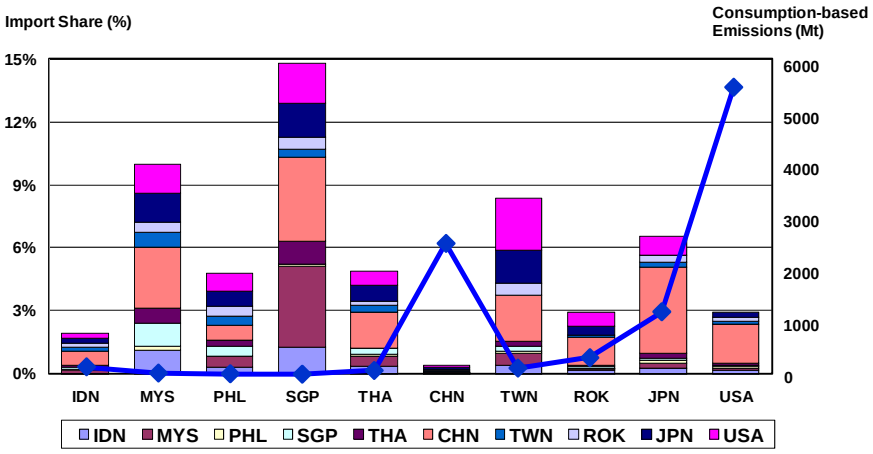
Source: The author complied based on MRIO (IDE-JETRO).

Origin and Share of Emissions Embodied in Final Consumption - Scheme I (2000)



Source: The author's calculation.

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National Accounting Based on Scheme I

Country /Region	Consumption-based Emissions (Mt)	Production-based Emissions (Mt)	Difference (Mt)	Percentage of Difference
IDN	190	235	-45	-19.2%
MYS	70	89	-19	-21.6%
PHL	56	60	-4	-6.7%
SGP	47	43	4	10.1%
THA	119	125	-6	-4.9%
CHN	2572	2834	-262	-9.2%
TWN	165	174	-10	-5.7%
ROK	366	365	1	0.3%
JPN	1253	1125	128	11.4%
USA	5586	5373	212	4.0%
Total	10422	10422	0	0

Source: The author's calculation.

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National Accounting Based on Scheme II

Country /Region	Emissions Based on Shared Responsibility (Mt)	Production-based Emissions (Mt)	Difference (Mt)	Percentage of Difference
IDN	226	235	-9	-4.0%
MYS	79	89	-10	-10.7%
PHL	59	60	-1	-2.1%
SGP	45	43	2	4.4%
THA	124	125	-1	-1.0%
CHN	2770	2834	-63	-2.2%
TWN	168	174	-6	-3.6%
ROK	363	365	-2	-0.5%
JPN	1160	1125	35	3.1%
USA	5429	5373	56	1.0%
Total	10422	10422	0	0

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Source: The author's calculation.

National Accounting Based on Scheme III

Country /Region	Emissions based on EEBT (Mt)	Production-based Emissions (Mt)	Difference (Mt)	Percentage of Difference
IDN	191	235	-44	-18.9%
MYS	76	89	-13	-14.2%
PHL	58	60	-2	-4.0%
SGP	53	43	10	23.7%
THA	122	125	-3	-2.2%
CHN	2569	2834	-265	-9.3%
TWN	172	174	-2	-1.2%
ROK	373	365	8	2.3%
JPN	1250	1125	125	11.2%
USA	5558	5373	185	3.4%
Total	10422	10422	0	0

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Source: The author's calculation.

Trade Deficit in Carbon Emissions

Country/ Region	Trade Deficit/Mt CO2 (Scheme I)	Trade Deficit/Mt CO2 (Scheme II)	Trade Deficit/Mt CO2 (Scheme III)
IDN	9	28	44
MYS	8	6	13
PHL	4	4	2
SGP	-1	-3	-10
THA	5	2	3
CHN	162	72	265
TWN	2	4	2
ROK	7	0	-9
JPN	-57	-47	-125
USA	-139	-66	-185

Source: The author's calculation.

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Ranking of Sectoral Carbon Intensity in Production

(emissions per unit sectoral output)

	IDN	MYS	PHL	SGP	THA	CHN	TWN	ROK	JPN	USA
S1	9	7	8	10	6	5	3	2	4	1
S2	7	9	8	10	4	6	2	1	5	3
S3	5	9	8	10	3	2	7	1	6	4
S4	2	9	3	10	7	4	1	6	5	8
S5	4	8	7	9	2	6	10	1	3	5
S6	4	10	2	1	9	5	3	7	8	6
S7	3	1	4	9	8	2	6	5	7	10
S8	7	3	6	10	5	2	1	4	9	8
S9	3	4	5	10	8	7	1	2	6	9
S10	7	3	6	10	5	2	8	1	9	4
S11	3	4	1	10	6	5	7	2	9	8
S12	1	8	6	9	2	3	4	7	10	5
S13	2	1	5	8	6	4	7	10	9	3
S14	1	8	6	9	2	3	4	7	10	5
S15	1	8	2	10	4	3	6	5	9	7
S16	1	5	8	10	4	2	3	9	7	6
S17	2	3	10	9	5	1	4	6	8	7
S18	6	2	10	8	7	1	5	3	9	4
S19	1	3	10	9	4	8	5	2	6	7
S20	3	5	8	1	6	2	7	9	10	4
S21	2	1	3	10	6	7	4	5	8	9
S22	1	4	3	10	5	7	6	2	9	8
S23	4	7	2	10	9	3	6	1	5	8
S24	5	7	4	10	9	1	6	2	3	8

First; Second; Third.

- Lower sectoral carbon intensity: Japan, USA and Singapore;
- Higher sectoral carbon intensity: Indonesia, ROK, China and Taiwan.

Source: The author compiled based on GTAP E-database and Asian IO tables (IDE-JETRO)

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Ranking of Sectoral Carbon Intensity in Consumption
(emissions per unit final consumption)

	IDN	MYS	PHL	SGP	THA	CHN	TWN	ROK	JPN	USA
S1	8	5	9	10	6	1	4	3	7	2
S2	9	7	10	6	5	1	4	3	8	2
S3	7	4	9	6	5	2	8	1	10	3
S4	3	6	4	10	9	1	2	7	5	8
S5	5	7	9	6	2	4	10	1	3	8
S6	5	10	2	1	8	3	4	7	9	6
S7	4	2	5	3	7	1	8	6	10	9
S8	5	2	9	7	4	1	6	3	10	8
S9	2	4	7	8	5	1	3	6	10	9
S10	2	3	6	5	7	1	9	4	10	8
S11	2	3	4	9	6	1	7	5	10	8
S12	2	4	7	6	3	1	5	9	10	8
S13	2	1	9	5	7	3	6	8	10	4
S14	2	5	8	6	3	1	4	9	10	7
S15	1	5	3	9	4	2	7	6	10	8
S16	2	4	6	7	5	1	3	8	10	9
S17	2	4	8	5	3	1	6	7	10	9
S18	2	4	3	6	7	1	8	5	10	9
S19	2	3	8	6	5	1	7	4	10	9
S20	3	6	7	1	5	2	8	9	10	4
S21	2	3	6	8	4	1	5	7	10	9
S22	1	5	3	10	6	2	7	4	9	8
S23	2	5	6	4	3	1	9	7	10	8
S24	2	4	8	5	3	1	10	6	9	7

First; Second; Third.

- Lower sectoral carbon multiplier: Japan, Taiwan, USA and Singapore;
- Higher sectoral carbon multiplier: China, Indonesia and Malaysia.

Source: The author's calculation.

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Findings (1)

- Emissions embodied in trade was not negligible, representing 3%, 2% and 6% of total emissions from ten countries/regions based on Scheme I, II and III, respectively, and varied from one country to another ranging from (0.3%, 15%), (1%, 7%) and (2%, 37%) for China and SGP based on three schemes.
- Change in accounting schemes indicates significant changes in current national inventories, ranging from (-262Mt, 212Mt), (-63Mt, 56Mt) and (-265Mt, 185Mt) for China and USA based on three schemes, respectively; or (-21.6%, 11.4%), (-10.7%, 3.1%) in Malaysia and Japan based on Scheme I and II, and (-18.9%, 11.2%) in Indonesia and Japan based on Scheme III.

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Findings (2)

- From production perspective, Japan, Singapore and USA had lower sectoral carbon intensity, while Indonesia, ROK, China and Taiwan had higher sectoral carbon intensity among ten countries.
- From consumption perspective, 1 US$ expenditure on like goods made in Japan, Taiwan, USA and Singapore is less contributing to the global climate change than spending on those made in China, Indonesia and Malaysia.
- From trade perspective, USA, Japan and ROK had trade deficit in terms of embodied carbon while other countries had trade surplus.

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Policy Implications (1)

- Carbon leakage is happening in a non negligible way and needs to be addressed properly. A shift of policies addressing the impacts of production-side to aiming at both production-side and consumption-side should be considered by the UNFCCC and could produce more opportunities to mitigate global warming.
- Many cases (e.g. Wal Mart and border carbon adjustment in California) already demonstrate that important roles could be played by demand-side pressures under buyer's market mechanism to reduce environmental pressures. However this has yet been made full use of by policy-makers, especially in developing countries. Lack of consumption-based accounting system and indicators is one of the barriers.

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Policy Implications (2)

- If border carbon adjustment is legitimate under the international trade regime, consumption-based accounting and allocation of national responsibility for global climate change should also be applied accordingly.
- Without properly being informed about the environmental impacts of what they consume, consumers could not act properly. Information disclosure on the carbon content and energy content in a normalized way (e.g. labelling schemes) is important and consumption-based approach should be promoted.
- To promote a holistic management of the eco-efficiency of a (cross-border) supply chain, it is necessary for each actor (country) in the supply chain from the top upstream producer down to the end consumers, recyclers and waste management to play a role. Shared producer and consumer responsibility method could work effective to allocate their responsibilities.

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Thank you very much for your attention!

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