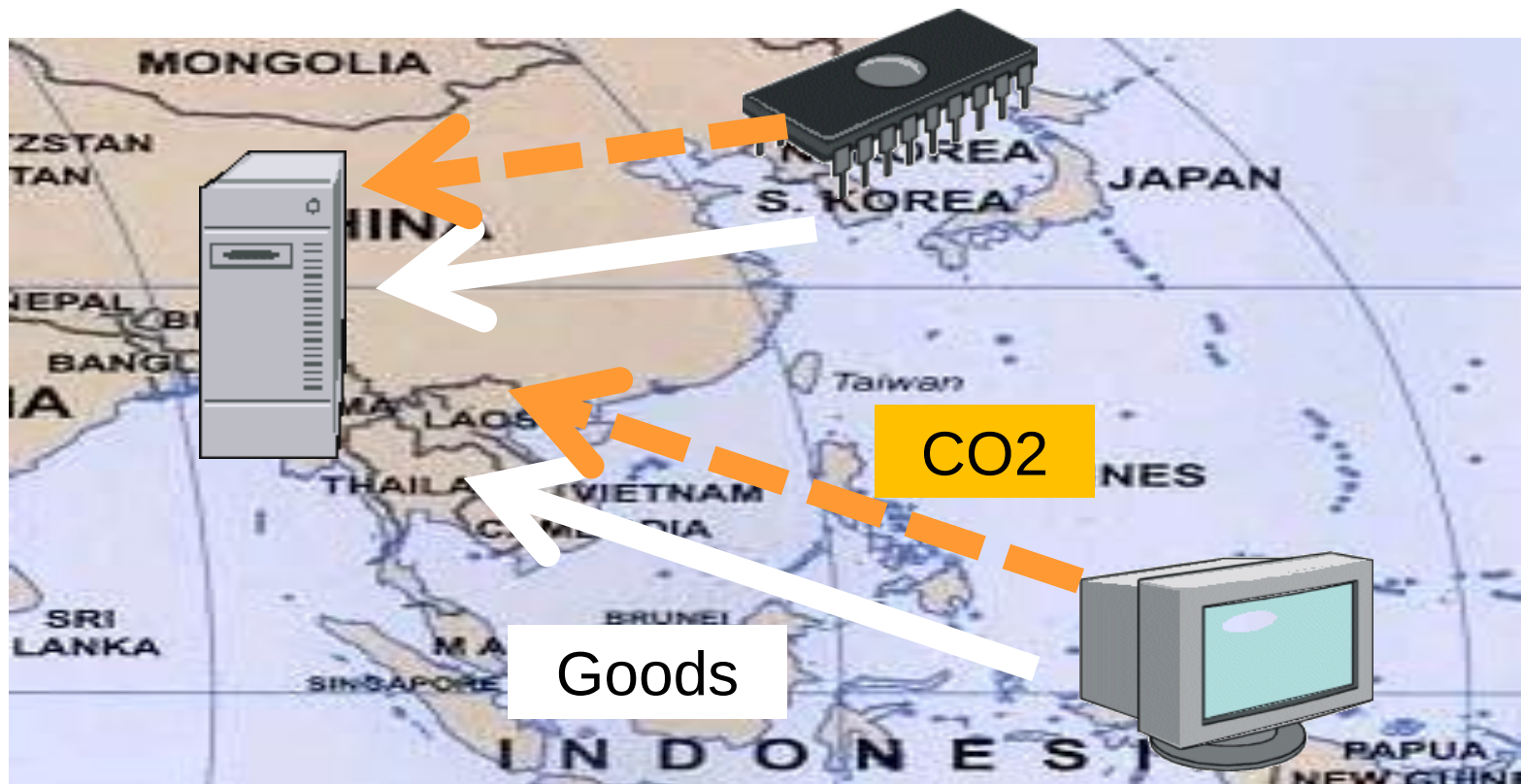


Interdependency of environmental load and international IO structure in the Asia-Pacific region

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Purpose of our research

- Economic Globalization
 - Production process is NOT independent



Purpose of the research

- Who is the real CO2 Emitter?
 1. Fossil energy production criterion
 2. Fossil energy consumption criterion
(= final goods production criterion)
 3. Final goods consumption criterion
- Current major criterion
 - Fossil energy consumption
→ disadvantage for developing countries
 - Developed countries have no responsibility?

International IO table

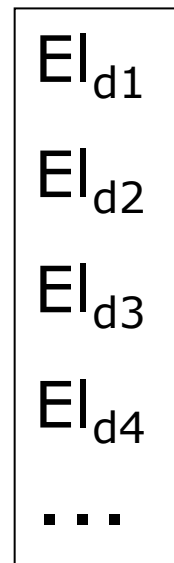
	Intermediate Demand (A)										Final Demand (F)										Export (L)			Statistical Discrepancy	Total Outputs
	Indonesia	Malaysia	Philippines	Singapore	Thailand	China	Taiwan	Korea	Japan	U.S.A.	Indonesia	Malaysia	Philippines	Singapore	Thailand	China	Taiwan	Korea	Japan	U.S.A.	Export to Hong Kong	Export to EU	Export to R.O.W.		
code	(AI)	(AM)	(AP)	(AS)	(AT)	(AC)	(AN)	(AK)	(AJ)	(AU)	(FI)	(FM)	(FP)	(FS)	(FT)	(FC)	(FN)	(FK)	(FJ)	(FU)	(LH)	(LO)	(LW)	(QX)	(XX)
Indonesia	(AI)	A ^{II}	A ^{IM}	A ^{IP}	A ^{IS}	A ^{IT}	A ^{IC}	A ^{IN}	A ^{IK}	A ^{IJ}	F ^{II}	F ^{IM}	F ^{IP}	F ^{IS}	F ^{IT}	F ^{IC}	F ^{IN}	F ^{IK}	F ^{IJ}	F ^{IU}	L ^{IH}	L ^{IO}	L ^{IW}	Q ^I	X ^I
Malaysia	(AM)	A ^{MI}	A ^{MM}	A ^{MP}	A ^{MS}	A ^{MT}	A ^{MC}	A ^{MN}	A ^{MK}	A ^{MJ}	F ^{MI}	F ^{MM}	F ^{MP}	F ^{MS}	F ^{MT}	F ^{MC}	F ^{MN}	F ^{MK}	F ^{MJ}	F ^{MU}	L ^{MH}	L ^{MO}	L ^{MW}	Q ^M	X ^M
Philippines	(AP)	A ^{PI}	A ^{PM}	A ^{PP}	A ^{PS}	A ^{PT}	A ^{PC}	A ^{PN}	A ^{PK}	A ^{PJ}	F ^{PI}	F ^{PM}	F ^{PP}	F ^{PS}	F ^{PT}	F ^{PC}	F ^{PN}	F ^{PK}	F ^{PJ}	F ^{PU}	L ^{PH}	L ^{PO}	L ^{PW}	Q ^P	X ^P
Singapore	(AS)	A ^{SI}	A SM	A ^{SP}	A ^{SS}	A ST	A ^{SC}	A ^{SN}	A ^{SK}	A ^{SJ}	F ^{SI}	F SM	F ^{SP}	F ^{SS}	F ST	F ^{SC}	F ^{SN}	F ^{SK}	F ^{SJ}	F ^{SU}	L ^{SH}	L ^{SO}	L ^{SW}	Q ^S	X ^S
Thailand	(AT)	A ^{TI}	A TM	A ^{TP}	A ^{TS}	A ^{TT}	A ^{TC}	A ^{TN}	A ^{TK}	A ^{TJ}	F ^{TI}	F TM	F ^{TP}	F ^{TS}	F ^{TT}	F ^{TC}	F ^{TN}	F ^{TK}	F ^{TJ}	F ^{TU}	L TH	L ^{TO}	L ^{TW}	Q ^T	X ^T
China	(AC)	A ^{CI}	A ^{CM}	A ^{CP}	A ^{CS}	A ^{CT}	A ^{CC}	A ^{CN}	A ^{CK}	A ^{CJ}	F ^{CI}	F ^{CM}	F ^{CP}	F ^{CS}	F ^{CT}	F ^{CC}	F ^{CN}	F ^{CK}	F ^{CJ}	F ^{CU}	L ^{CH}	L ^{CO}	L ^{CW}	Q ^C	X ^C
Taiwan	(AN)	A ^{NI}	A ^{NM}	A ^{NP}	A ^{NS}	A ^{NT}	A ^{NC}	A ^{NN}	A ^{NK}	A ^{NJ}	F ^{NI}	F ^{NM}	F ^{NP}	F ^{NS}	F ^{NT}	F ^{NC}	F ^{NN}	F ^{NK}	F ^{NJ}	F ^{NU}	L ^{NH}	L ^{NO}	L ^{NW}	Q ^N	X ^N
Korea	(AK)	A ^{KI}	A ^{KM}	A ^{KP}	A ^{KS}	A ^{KT}	A ^{KC}	A ^{KN}	A ^{KK}	A ^{KJ}	F ^{KI}	F ^{KM}	F ^{KP}	F ^{KS}	F ^{KT}	F ^{KC}	F ^{KN}	F ^{KK}	F ^{KJ}	F ^{KU}	L ^{KH}	L ^{KO}	L ^{KW}	Q ^K	X ^K
Japan	(AJ)	A ^{JI}	A ^{JM}	A ^{JP}	A ^{JS}	A ^{JT}	A ^{JC}	A ^{JN}	A ^{JK}	A ^{JJ}	F ^{JI}	F ^{JM}	F ^{JP}	F ^{JS}	F ^{JT}	F ^{JC}	F ^{JN}	F ^{JK}	F ^{JJ}	F ^{JU}	L ^{JH}	L ^{JO}	L ^{JW}	Q ^J	X ^J
U.S.A.	(AU)	A ^{UI}	A ^{UM}	A ^{UP}	A ^{US}	A ^{UT}	A ^{UC}	A ^{UN}	A ^{UK}	A ^{UJ}	F ^{UI}	F ^{UM}	F ^{UP}	F ^{US}	F ^{UT}	F ^{UC}	F ^{UN}	F ^{UK}	F ^{UJ}	F ^{UU}	L ^{UH}	L ^{UO}	L ^{UW}	Q ^U	X ^U
Freight and Insurance(BF)		BA ^I	BA ^M	BA ^P	BA ^S	BA ^T	BA ^C	BA ^N	BA ^K	BA ^J	BA ^I	BA ^M	BA ^P	BA ^S	BA ^T	BA ^C	BA ^N	BA ^K	BA ^J	BA ^I	BA ^I	BA ^M	BA ^P	BA ^S	BA ^T
Import from Hong Kor(CH)		A ^{HI}	A ^{HM}	A ^{HP}	A ^{HS}	A ^{HT}	A ^{HC}	A ^{HN}	A ^{HK}	A ^{HJ}	F ^{HI}	F ^{HM}	F ^{HP}	F ^{HS}	F ^{HT}	F ^{HC}	F ^{HN}	F ^{HK}	F ^{HJ}	F ^{HU}					
Import from EU (CO)		A ^{OI}	A ^{OM}	A ^{OP}	A ^{OS}	A ^{OT}	A ^{OC}	A ^{ON}	A ^{OK}	A ^{OJ}	F ^{OI}	F ^{OM}	F ^{OP}	F ^{OS}	F ^{OT}	F ^{OC}	F ^{ON}	F ^{OK}	F ^{OJ}	F ^{OU}					
Import from the R.O.W.(CW)		A ^{WI}	A ^{WM}	A ^{WP}	A ^{WS}	A ^{WT}	A ^{WC}	A ^{WN}	A ^{WK}	A ^{WJ}	F ^{WI}	F ^{WM}	F ^{WP}	F ^{WS}	F ^{WT}	F ^{WC}	F ^{WN}	F ^{WK}	F ^{WJ}	F ^{WU}					
Duties and Import Commodity Taxes (DT)		DA ^I	DA ^M	DA ^P	DA ^S	DA ^T	DA ^C	DA ^N	DA ^K	DA ^J	DF ^I	DF ^M	DF ^P	DF ^S	DF ^T	DF ^C	DF ^N	DF ^K	DF ^J	DF ^U					
Value Added (VV)		V ^I	V ^M	V ^P	V ^S	V ^T	V ^C	V ^N	V ^K	V ^J															
Total Inputs (XX)		X ^I	X ^M	X ^P	X ^S	X ^T	X ^C	X ^N	X ^K	X ^J	X ^I	X ^M	X ^P	X ^S	X ^T	X ^C	X ^N	X ^K	X ^J	X ^U					

(I-A)⁻¹

Direct environmental load

- Direct environmental load (goods prod. criterion)
- $DEL = \Sigma (\text{Output} \times \text{Energy coefficient})$
- $DCL = \Sigma (\text{Output} \times \text{Energy coefficient} \times \text{Carbon coefficient})$

	Intermediate Demand (A)										Final Demand (F)										Export (L)						
	Indonesia	Malaysia	Philippines	Singapore	Thailand	China	Taiwan	Korea	Japan	U.S.A.	Indonesia	Malaysia	Philippines	Singapore	Thailand	China	Taiwan	Korea	Japan	U.S.A.	Export to Hong Kong	Export to EU	Export to R.O.W.	Statistical Discrepancy	Total		
code	(AI)	(AM)	(AP)	(AS)	(AT)	(AC)	(AN)	(AK)	(AJ)	(AU)	(FI)	(FM)	(FP)	(FS)	(FT)	(FC)	(FN)	(FK)	(FJ)	(FU)	(LH)	(LO)	(LW)	(Q)	(XX)		
Indonesia	(AI)	A ^I	A ^M	A ^P	A ^S	A ^T	A ^C	A ^N	A ^K	A ^J	F ^I	F ^M	F ^P	F ^S	F ^T	F ^C	F ^N	F ^K	F ^J	F ^U	L ^H	L ^O	L ^W	Q ^X	X ^I		
Malaysia	(AM)	A ^M	A ^M	A ^M	A ^M	A ^M	A ^M	A ^M	A ^M	A ^M	F ^M	F ^M	F ^M	F ^M	F ^M	F ^M	F ^M	F ^M	F ^M	F ^M	L ^M	L ^M	L ^M	Q ^M	X ^M		
Philippines	(AP)	A ^P	A ^P	A ^P	A ^P	A ^P	A ^P	A ^P	A ^P	A ^P	F ^P	F ^P	F ^P	F ^P	F ^P	F ^P	F ^P	F ^P	F ^P	F ^P	L ^P	L ^P	L ^P	Q ^P	X ^P		
Singapore	(AS)	A ^S	A ^S	A ^S	A ^S	A ^S	A ^S	A ^S	A ^S	A ^S	F ^S	F ^S	F ^S	F ^S	F ^S	F ^S	F ^S	F ^S	F ^S	F ^S	L ^S	L ^S	L ^S	Q ^S	X ^S		
Thailand	(AT)	A ^T	A ^T	A ^T	A ^T	A ^T	A ^T	A ^T	A ^T	A ^T	F ^T	F ^T	F ^T	F ^T	F ^T	F ^T	F ^T	F ^T	F ^T	F ^T	L ^T	L ^T	L ^T	Q ^T	X ^T		
China	(AC)	A ^C	A ^C	A ^C	A ^C	A ^C	A ^C	A ^C	A ^C	A ^C	F ^C	F ^C	F ^C	F ^C	F ^C	F ^C	F ^C	F ^C	F ^C	F ^C	L ^C	L ^C	L ^C	Q ^C	X ^C		
Taiwan	(AN)	A ^N	A ^N	A ^N	A ^N	A ^N	A ^N	A ^N	A ^N	A ^N	F ^N	F ^N	F ^N	F ^N	F ^N	F ^N	F ^N	F ^N	F ^N	F ^N	L ^N	L ^N	L ^N	Q ^N	X ^N		
Korea	(AK)	A ^K	A ^K	A ^K	A ^K	A ^K	A ^K	A ^K	A ^K	A ^K	F ^K	F ^K	F ^K	F ^K	F ^K	F ^K	F ^K	F ^K	F ^K	F ^K	L ^K	L ^K	L ^K	Q ^K	X ^K		
Japan	(AJ)	A ^J	A ^J	A ^J	A ^J	A ^J	A ^J	A ^J	A ^J	A ^J	F ^J	F ^J	F ^J	F ^J	F ^J	F ^J	F ^J	F ^J	F ^J	F ^J	L ^J	L ^J	L ^J	Q ^J	X ^J		
U.S.A.	(AU)	A ^U	A ^U	A ^U	A ^U	A ^U	A ^U	A ^U	A ^U	A ^U	F ^U	F ^U	F ^U	F ^U	F ^U	F ^U	F ^U	F ^U	F ^U	F ^U	L ^U	L ^U	L ^U	Q ^U	X ^U		
Freight and Insurance	(BF)	BA ^I	BA ^M	BA ^P	BA ^S	BA ^T	BA ^C	BA ^N	BA ^K	BA ^J	BF ^I	BF ^M	BF ^P	BF ^S	BF ^T	BF ^C	BF ^N	BF ^K	BF ^J	BF ^U							
Import from Hong Kor	(CH)	A ^H	A ^H	A ^H	A ^H	A ^H	A ^H	A ^H	A ^H	A ^H	F ^H	F ^H	F ^H	F ^H	F ^H	F ^H	F ^H	F ^H	F ^H	F ^H	L ^H	L ^H	L ^H	Q ^H	X ^H		
Import from EU	(CO)	A ^O	A ^O	A ^O	A ^O	A ^O	A ^O	A ^O	A ^O	A ^O	F ^O	F ^O	F ^O	F ^O	F ^O	F ^O	F ^O	F ^O	F ^O	F ^O	L ^O	L ^O	L ^O	Q ^O	X ^O		
Import from the R.O.	(CW)	A ^W	A ^W	A ^W	A ^W	A ^W	A ^W	A ^W	A ^W	A ^W	F ^W	F ^W	F ^W	F ^W	F ^W	F ^W	F ^W	F ^W	F ^W	F ^W	L ^W	L ^W	L ^W	Q ^W	X ^W		
Duties and Import Commodity Taxes	(DT)	DA ^I	DA ^M	DA ^P	DA ^S	DA ^T	DA ^C	DA ^N	DA ^K	DA ^J	DF ^I	DF ^M	DF ^P	DF ^S	DF ^T	DF ^C	DF ^N	DF ^K	DF ^J	DF ^U							
Value Added	(VV)	V ^I	V ^M	V ^P	V ^S	V ^T	V ^C	V ^N	V ^K	V ^J																	
Total Inputs	(XX)	X ^I	X ^M	X ^P	X ^S	X ^T	X ^C	X ^N	X ^K	X ^J																	



Indirect environmental load

- Direct and indirect environmental load
(final goods consumption criterion)
 - $DEL = \Sigma (\text{Induced Output} \times \text{Energy coefficient})$
 - $DCL = \Sigma (\text{Induced Output} \times \text{Energy coefficient} \times \text{Carbon coefficient})$

code	Intermediate Demand (A)										Final Demand (F)										Export (L)				Total Outputs
	Indonesia (AI)	Malaysia (AM)	Philippines (AP)	Singapore (AS)	Thailand (AT)	China (AC)	Taiwan (AN)	Korea (AK)	Japan (AJ)	U.S.A. (AU)	Indonesia (FI)	Malaysia (FM)	Philippines (FP)	Singapore (FS)	Thailand (FT)	China (FC)	Taiwan (FN)	Korea (FK)	Japan (FJ)	U.S.A. (FU)	Export to Hong Kong (LH)	Export to EU (LO)	Export to R.O.W. (LW)	Statistical Discrepancy (QX)	
Indonesia (AI)	A ^{II}	A ^{IM}	A ^{IP}	A ^{IS}	A ^{IT}	A ^{IC}	A ^{IN}	A ^{IK}	A ^{IJ}	A ^{IU}	F ^{II}	F ^{IM}	F ^{IP}	F ^{IS}	F ^{IT}	F ^{IC}	F ^{IN}	F ^{IK}	F ^{IJ}	F ^{IU}	L ^{HI}	L ^{IO}	L ^{IW}	Q ^I	X ^I
Malaysia (AM)	A ^{MI}	A ^{MM}	A ^{MP}	A ^{MS}	A ^{MT}	A ^{MC}	A ^{MN}	A ^{MK}	A ^{MJ}	A ^{MU}	F ^{MI}	F ^{MM}	F ^{MP}	F ^{MS}	F ^{MT}	F ^{MC}	F ^{MN}	F ^{MK}	F ^{MJ}	F ^{MU}	L ^{MH}	L ^{MO}	L ^{MW}	Q ^M	X ^M
Philippines (AP)	A ^{PI}	A ^{PM}	A ^{PP}	A ^{PS}	A ^{PT}	A ^{PC}	A ^{PN}	A ^{PK}	A ^{PJ}	A ^{PU}	F ^{PI}	F ^{PM}	F ^{PP}	F ^{PS}	F ^{PT}	F ^{PC}	F ^{PN}	F ^{PK}	F ^{PJ}	F ^{PU}	L ^{PH}	L ^{PO}	L ^{PW}	Q ^P	X ^P
Singapore (AS)	A ^{SI}	A SM	A ^{SP}	A ^{SS}	A ST	A ^{SC}	A ^{SN}	A ^{SK}	A ^{SJ}	A ^{SU}	F ^{SI}	F SM	F ^{SP}	F ^{SS}	F ST	F ^{SC}	F ^{SN}	F ^{SK}	F ^{SJ}	F ^{SU}	L ^{SH}	L ^{SO}	L ^{SW}	Q ^S	X ^S
Thailand (AT)	A ^{TI}	A TM	A ^{TP}	A ^{TS}	A ^{TT}	A ^{TC}	A ^{TN}	A ^{TK}	A ^{TJ}	A ^{TU}	F ^{TI}	F TM	F ^{TP}	F ^{TS}	F ^{TT}	F ^{TC}	F ^{TN}	F ^{TK}	F ^{TJ}	F ^{TU}	L TH	L ^{TO}	L ^{TW}	Q ^T	X ^T
China (AC)	A ^{CI}	A ^{CM}	A ^{CP}	A ^{CS}	A ^{CT}	A ^{CU}	A ^{CN}	A ^{CK}	A ^{CJ}	A ^{CU}	F ^{CI}	F ^{CM}	F ^{CP}	F ^{CS}	F ^{CT}	F ^{CC}	F ^{CN}	F ^{CK}	F ^{CJ}	F ^{CU}	L ^{CH}	L ^{CO}	L ^{CW}	Q ^C	X ^C
Taiwan (AN)	A ^{NI}	A ^{NM}	A ^{NP}	A ^{NS}	A ^{NT}	A ^{NC}	A ^{NN}	A ^{NK}	A ^{NJ}	A ^{NU}	F ^{NI}	F ^{NM}	F ^{NP}	F ^{NS}	F ^{NT}	F ^{NC}	F ^{NN}	F ^{NK}	F ^{NJ}	F ^{NU}	L ^{NH}	L ^{NO}	L ^{NW}	Q ^N	X ^N
Korea (AK)	A ^{KI}	A ^{KM}	A ^{KP}	A ^{KS}	A ^{KT}	A ^{KC}	A ^{KN}	A ^{KK}	A ^{KJ}	A ^{KU}	F ^{KI}	F ^{KM}	F ^{KP}	F ^{KS}	F ^{KT}	F ^{KC}	F ^{KN}	F ^{KK}	F ^{KJ}	F ^{KU}	L ^{KH}	L ^{KO}	L ^{KW}	Q ^K	X ^K
Japan (AJ)	A ^{JI}	A ^{JM}	A ^{JP}	A ^{JS}	A ^{JT}	A ^{JC}	A ^{JN}	A ^{JK}	A ^{JJ}	A ^{JU}	F ^{JI}	F ^{JM}	F ^{JP}	F ^{JS}	F ^{JT}	F ^{JC}	F ^{JN}	F ^{JK}	F ^{JJ}	F ^{JU}	L ^{JH}	L ^{JO}	L ^{JW}	Q ^J	X ^J
U.S.A. (AU)	A ^{UI}	A ^{UM}	A ^{UP}	A ^{US}	A ^{UT}	A ^{UC}	A ^{UN}	A ^{UK}	A ^{UJ}	A ^{UU}	F ^{UI}	F ^{UM}	F ^{UP}	F ^{US}	F ^{UT}	F ^{UC}	F ^{UN}	F ^{UK}	F ^{UJ}	F ^{UU}	L ^{UH}	L ^{UO}	L ^{UW}	Q ^U	X ^U
Freight and Insurance (BF)	BA ^I	BA ^M	BA ^P	BA ^S	BA ^T	BA ^C	BA ^N	BA ^K	BA ^J	BA ^U	BF ^I	BF ^M	BF ^P	BF ^S	BF ^T	BF ^C	BF ^N	BF ^K	BF ^J	BF ^U					
Import from Hong Kor (CH)	A ^{HI}	A ^{HM}	A ^{HP}	A ^{HS}	A ^{HT}	A ^{HC}	A ^{HN}	A ^{HK}	A ^{HJ}	A ^{HU}	F ^{HI}	F ^{HM}	F ^{HP}	F ^{HS}	F ^{HT}	F ^{HC}	F ^{HN}	F ^{HK}	F ^{HJ}	F ^{HU}					
Import from EU (CO)	A ^{OI}	A ^{OM}	A ^{OP}	A ^{OS}	A ^{OT}	A ^{OC}	A ^{ON}	A ^{OK}	A ^{OJ}	A ^{OU}	F ^{OI}	F ^{OM}	F ^{OP}	F ^{OS}	F ^{OT}	F ^{OC}	F ^{ON}	F ^{OK}	F ^{OJ}	F ^{OU}					
Import from the R.O.W. (CW)	A ^{WI}	A ^{WM}	A ^{WP}	A ^{WS}	A ^{WT}	A ^{WC}	A ^{WN}	A ^{WK}	A ^{WJ}	A ^{WU}	F ^{WI}	F ^{WM}	F ^{WP}	F ^{WS}	F ^{WT}	F ^{WC}	F ^{WN}	F ^{WK}	F ^{WJ}	F ^{WU}					
Duties and Import Commodity Taxes (DT)	DA ^I	DA ^M	DA ^P	DA ^S	DA ^T	DA ^C	DA ^N	DA ^K	DA ^J	DA ^U	DF ^I	DF ^M	DF ^P	DF ^S	DF ^T	DF ^C	DF ^N	DF ^K	DF ^J	DF ^U					
Value Added (VV)	V ^I	V ^M	V ^P	V ^S	V ^T	V ^C	V ^N	V ^K	V ^J	V ^U															
Total Inputs (XX)	X ^I	X ^M	X ^P	X ^S	X ^T	X ^C	X ^N	X ^K	X ^J	X ^U															

$(I-A)^{-1}$

EI_{did1}

EI_{did2}

EI_{did3}

EI_{did4}

...

Energy & CO2 trade matrix

- Environmental load matrix
 - Amount of environmental load
 - From which country To which country
- CO2 from fossil energy consumption
 - Consumption of “Coal+ Petroleum+ Natural gas”
 - CO2 emissions from manufacturing process like cement industry are not considered
 - Other GHG like NH4, N2O, NF6, or HFC are not considered

Energy & CO2 trade matrix

- Columns: regions that generated final demand
- Rows: the regions that consumed energy
- ①—②: “Trade Balance” for Energy or CO2 emission

	In	Ma	Ph
Indonesia	21.0	0.1	0.1
Malaysia	0.0	6.3	① 0.1
Philippines	0.0	② 0.1	6.7

① Malaysia's energy consumption induced by Philippine's final demand

② Philippine's energy consumption induced by Malaysia's final demand

Fossil fuel and CO2 emission

Ton/TOE	CO2	Carbon
Coal	4.018	1.096
Petroleum	3.313	0.903
Natural Gas	2.317	0.632

- CO2 Emissions
 - Energy consumption × CO2 coefficient

Embodied Energy Transaction in 1985

(Unit: million TOE)

	In	Ma	Ph	Si	Th	Ch	Ta	Ko	JPN	USA	ROW	Total
Indonesia	21.0	0.1	0.1	0.2	0.0	0.1	0.0	0.1	1.2	0.8	1.3	25.0
Malaysia	0.0	6.3	0.1	0.3	0.1	0.1	0.0	0.1	0.4	1.3	2.7	11.5
Philippines	0.0	0.1	6.7	0.0	0.0	0.0	0.0	0.0	0.3	0.7	1.0	8.9
Singapore	0.2	0.3	0.0	2.2	0.1	0.0	0.0	0.0	0.4	0.5	3.8	7.6
Thailand	0.0	0.1	0.0	0.0	11.2	0.1	0.0	0.0	0.3	0.4	2.6	14.7
China	0.4	0.5	0.4	1.1	0.5	367.6	0.1	0.1	7.1	6.2	27.3	411.2
Taiwan	0.1	0.1	0.0	0.1	0.1	0.3	12.1	0.1	0.9	4.9	4.0	22.8
Korea	0.1	0.1	0.1	0.1	0.1	0.0	0.1	22.3	1.3	3.6	7.0	34.6
Japan	0.8	0.5	0.1	0.5	0.6	4.0	0.8	1.4	241.4	16.1	25.0	291.2
USA	0.8	0.7	0.3	0.7	0.4	2.3	1.29	2.1	9.4	1,343.9	104.1	1,466.1
Total	23.4	8.7	7.7	5.3	13.0	374.6	14.4	26.2	262.7	1,378.5	178.9	2,293.5

Embodied Energy Transaction in 2000

(Unit: million TOE)

	In	Ma	Ph	Si	Th	Ch	Ta	Ko	Japan	USA	ROW	Total
Indonesia	61.5	0.8	0.4	0.7	0.7	1.7	0.9	1.4	5.3	6.5	17.8	97.7
Malaysia	0.4	17.4	0.4	1.6	0.6	1.6	0.8	0.7	3.9	7.7	16.7	51.8
Philippines	0.0	0.1	14.0	0.0	0.1	0.2	0.2	0.2	1.0	2.3	3.7	21.9
Singapore	0.2	0.5	0.3	6.1	0.3	0.8	0.4	0.3	0.7	1.6	10.7	21.8
Thailand	0.2	0.4	0.2	0.4	33.5	0.8	0.4	0.3	2.5	4.0	13.5	56.1
China	1.2	1.3	0.5	1.4	1.6	650.9	2.6	5.2	27.6	52.4	105.1	849.7
Taiwan	0.2	0.3	0.2	0.2	0.4	4.0	40.5	0.4	2.3	5.7	16.0	70.3
Korea	0.6	0.4	0.4	0.3	0.4	5.6	1.1	103.0	5.3	8.3	30.0	155.3
Japan	0.4	0.6	0.2	0.6	0.7	2.4	1.5	1.4	274.7	10.0	20.6	313.1
USA	0.6	0.9	0.5	0.9	0.9	4.1	3.2	3.8	13.4	1,658.6	161.7	1,848.6
Total	65.3	22.6	17.1	12.2	39.2	672.2	51.6	116.6	336.8	1,757.0	395.8	3,486.4

Embodied CO2 Transaction in 1985

(Unit: million Ton)

	In	Ma	Ph	Si	Th	Ch	Ta	Ko	JPN	USA	ROW	Total
Indonesia	64.9	0.2	0.2	0.6	0.1	0.4	0.1	0.2	3.5	2.4	3.9	76.4
Malaysia	0.1	20.0	0.3	1.0	0.2	0.2	0.1	0.3	1.4	4.1	8.2	35.9
Philippines	0.0	0.3	22.9	0.1	0.1	0.1	0.1	0.1	1.0	2.4	3.5	30.6
Singapore	0.6	1.0	0.0	7.3	0.5	0.1	0.1	0.1	1.3	1.8	12.5	25.3
Thailand	0.0	0.2	0.0	0.1	35.7	0.2	0.1	0.1	0.8	1.3	8.6	47.2
China	1.7	2.0	1.5	4.1	1.8	1,403.0	0.2	0.3	27.0	23.6	104.0	1,569.2
Taiwan	0.4	0.3	0.1	0.4	0.3	1.2	42.3	0.4	3.1	17.2	14.0	79.6
Korea	0.4	0.3	0.2	0.3	0.2	0.1	0.2	78.2	4.5	13.0	24.8	122.1
Japan	2.7	1.6	0.3	1.7	2.0	14.1	2.7	4.9	810.9	55.6	85.9	982.5
USA	2.5	2.2	0.9	2.3	1.2	7.5	4.2	6.7	30.6	4,427.6	332.3	4,818.0
Total	73.3	28.2	26.4	17.9	42.1	1,426.9	50.0	91.3	884.0	4,548.9	597.7	7,786.8

Embodied CO2 Transaction in 2000

(Unit: million Ton)

	In	Ma	Ph	Si	Th	Ch	Ta	Ko	JPN	USA	ROW	Total
Indonesia	184.1	2.3	1.2	2.1	2.0	5.0	2.8	3.9	15.9	19.4	52.9	291.6
Malaysia	1.1	46.8	1.1	4.6	1.8	4.5	2.3	2.1	11.4	22.5	48.0	146.2
Philippines	0.1	0.3	49.1	0.2	0.3	0.8	0.5	0.5	3.4	8.0	12.9	76.0
Singapore	0.5	1.8	1.1	19.7	1.0	2.5	1.2	0.9	2.4	5.1	35.0	71.2
Thailand	0.7	1.2	0.5	1.2	103.7	2.5	1.2	0.9	7.8	12.6	42.0	174.3
China	4.6	4.8	1.9	5.3	6.2	2,466.4	9.9	19.5	104.3	198.5	399.4	3,220.8
Taiwan	0.8	1.1	0.6	0.6	1.3	14.2	143.0	1.5	8.3	20.1	56.2	247.7
Korea	1.9	1.2	1.3	1.0	1.3	19.5	4.0	356.2	18.3	28.7	103.3	536.8
Japan	1.3	2.1	0.8	1.9	2.4	8.4	5.1	4.9	919.1	34.1	70.4	1,050.6
USA	1.9	2.8	1.6	2.9	3.0	13.1	10.4	12.0	43.0	5,448.3	518.5	6,057.5
Total	197.1	64.5	59.2	39.5	122.9	2,537.0	180.3	402.6	1,133.8	5,797.2	1,338.7	11,872.8

Energy and CO2 Trade Balance

- Total Energy Consumption & CO2 emission
 - TOP 3: USA, China, and Japan
 - China's growth is prominent
- Japan and USA
 - 1985: goods producer and goods consumer
= EC and CO2 for other countries
& Inducing other countries EC and CO2
 - 2000: mainly goods consumer
Inducing other countries EC and CO2

Energy and CO2 Trade Balance

- China
 - 1985 : 10.6% of EE is for foreign demand
 - 2000: “Factory in the Word”
23.4% of EE is for foreign demand
 - (2000: Japan: 12.2%, USA: 10.3%)
- Korea
 - 1985: mainly to USA
35.5% of EE is for foreign demand
 - 2000: to USA, China and Japan
33.6% of EE is for foreign demand

Land & Water Trade Balance

- Land & Water
 - only for agriculture and livestock industry
- Land
 - 1985, 2000
- Water
 - 2000

Embodied Land Transaction in 1985

(Unit: 1000 ha)

	In	Ma	Ph	Si	Th	Ch	Ta	Ko	JPN	USA	ROW	Total
Indonesia	35,876	44	20	43	15	134	35	71	631	995	1,814	39,679
Malaysia	24	3,758	18	112	23	75	46	209	859	322	519	5,963
Philippines	2	7	9,610	9	4	24	13	22	440	415	363	10,910
Singapore	0	0	0	3	0	0	0	0	0	1	1	5
Thailand	36	558	11	133	14,675	221	98	213	856	937	2,840	20,577
China	765	487	165	484	238	456,375	22	36	9,077	3,522	24,726	495,897
Taiwan	8	33	9	36	5	7	7,127	41	900	368	343	8,877
Korea	0	1	2	1	0	0	1	2,030	76	34	73	2,220
Japan	2	2	3	2	2	9	5	6	5,694	78	76	5,879
USA	434	182	134	152	191	1,815	1,929	2,270	14,154	365,846	44,289	431,399
Total	37,147	5,072	9,973	974	15,154	458,661	9,277	4,899	32,687	372,519	75,042	1,021,405

Embodied Land Transaction in 2000

(Unit: 1000 ha)

	In	Ma	Ph	Si	Th	Ch	Ta	Ko	JPN	USA	ROW	Total
Indonesia	37,209	198	55	107	105	389	167	212	1,348	1,684	3,302	44,777
Malaysia	62	3,426	48	342	66	285	132	124	756	571	2,078	7,890
Philippines	10	11	10,695	7	8	58	15	71	510	335	431	12,150
Singapore	0	0	0	1	0	0	0	0	0	0	0	0
Thailand	160	215	51	89	12,390	202	197	137	1,312	1,345	3,947	20,045
China	692	643	245	369	459	495,997	437	2,900	13,525	9,054	24,337	548,658
Taiwan	5	12	5	9	14	49	7,712	20	291	127	272	8,515
Korea	1	1	1	1	1	9	3	1,812	64	17	63	1,973
Japan	1	2	1	2	2	7	6	8	5,137	29	64	5,258
USA	621	236	397	170	532	2,278	2,964	2,243	15,811	345,063	44,084	414,398
Total	38,761	4,743	11,498	1,95	13,576	499,275	11,632	7,527	38,753	358,226	78,578	1,063,665

Embodied Water Transaction in 2000

(Unit: billion ton)

	In	Ma	Ph	Si	Th	Ch	Ta	Ko	JPN	USA	ROW	Total
Indonesia	628	3	1	2	2	7	3	4	23	28	56	756
Malaysia	0	24	0	2	0	2	1	1	5	4	15	56
Philippines	0	0	186	0	0	1	0	1	9	6	7	211
Singapore	0	0	0	0	0	0	0	0	0	0	0	0
Thailand	7	9	2	4	511	8	8	6	54	56	163	827
China	5	5	2	3	4	3,859	3	23	105	70	189	4,268
Taiwan	0	0	0	0	0	1	118	0	4	2	4	130
Korea	0	0	0	0	0	0	0	82	3	1	3	89
Japan	0	0	0	0	0	1	1	1	540	3	7	552
USA	3	1	2	1	3	11	14	11	75	1,647	210	1,977
Total	644	43	193	12	520	3,890	148	128	819	1,817	654	8,868

Land Trade Balance

- Total land usage:
 - China and USA are prominently large
- USA is a land exporter
 - Induced mainly by Japan, China, Korea and Taiwan
- China is another land exporter
 - Induced mainly by Japan, USA and Korea
- Japan & Korea are land importers
 - Japan: use 7.4 times larger
 - Korea: use 3.8 times larger

Water Trade Balance

- China
 - Total Consumption is extremely large
 - Export to USA, Japan and Korea
- Japan: huge water importer
 - Mainly from China, USA, Thailand and Indonesia
 - Use 1.5 times larger
- Korea
 - Mainly from China
 - Use 1.4 times larger

Challenges

- Renew the data
 - 2005 IO table will be published
- Water
 - Water demand for manufacturing
- TFA / EPA & environmental load
 - If trades should increase, how trade of CO₂, land and water will change.