

Modeling

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Outline of the Presentation

- Objective
- Aggregation Scheme
- Scenario development
- Analysis
- Environmental Impact
- Policy options
- Conclusions

Objective

The objective of the present study was to estimate the economic and environmental impacts of economic integration in six East Asian countries (*Japan, Korea, China, Indonesia, Thailand, and Vietnam*).

Approach to the Analysis

4 Step Process

1. Estimate the economic impact of economic integration in the region
2. Estimate the environmental impacts of the trade agreements
3. Identify the industrial sectors that are the most polluting
4. Apply sector tax to decrease environmental impacts

Aggregation scheme

- The 87 countries in the GTAP framework were aggregated into 14 regions with an emphasis on the countries in the East Asian region.
- 9 individual countries in East Asia: *Japan, Korea, China, Indonesia, Thailand, Vietnam, Malaysia, Philippines, and Singapore* were modeled
- Other countries were aggregated into 5 other regions: *rest of south East Asia as 'other ASEAN', NAFTA, rest of OECD, ROW1 (which includes South Asian countries and Hong Kong), ROW2 (combines the rest of the countries in the world).*

Modelling Approach

- A recursive up-dating procedure was used to forecast the model to three time periods: 2010, 2015, and 2020.
- The macroeconomic variables used to up-date the model were: population, GDP, skilled and unskilled labour, and capital.
- A number of trade liberalization scenarios were analyzed that incorporated economic integration based on: regional cluster, timing of tariff reductions, and degree of tariff reduction.
- Capital in the economic integration scenarios was modified by incorporating the investment in time "t", i.e. I_t , resulting from the trade liberalization shocks along with the baseline capital forecast for $t+1$.

Business as Usual (BAU)

Regional scope	Commodity scope	By 2010	By 2015	By 2020
ASEAN, Whole study region (ASEAN + 3), Other regions	All commodities	Current tariffs	Current tariffs	Current tariffs

Tariff Reductions Under Medium Economic Integration (MEI)

Regional scope	Commodity scope	By 2010	By 2015	By 2020
Within ASEAN, ASEAN with each of Japan, China, and Korea	Agricultural Commodities		40%	80%
	Non-Agricultural Commodities		50%	100%
Whole study region (ASEAN + 3)	Agricultural Commodities			
	Non-Agricultural Commodities			

Tariff Reductions Under Deep Economic Integration (DEI)

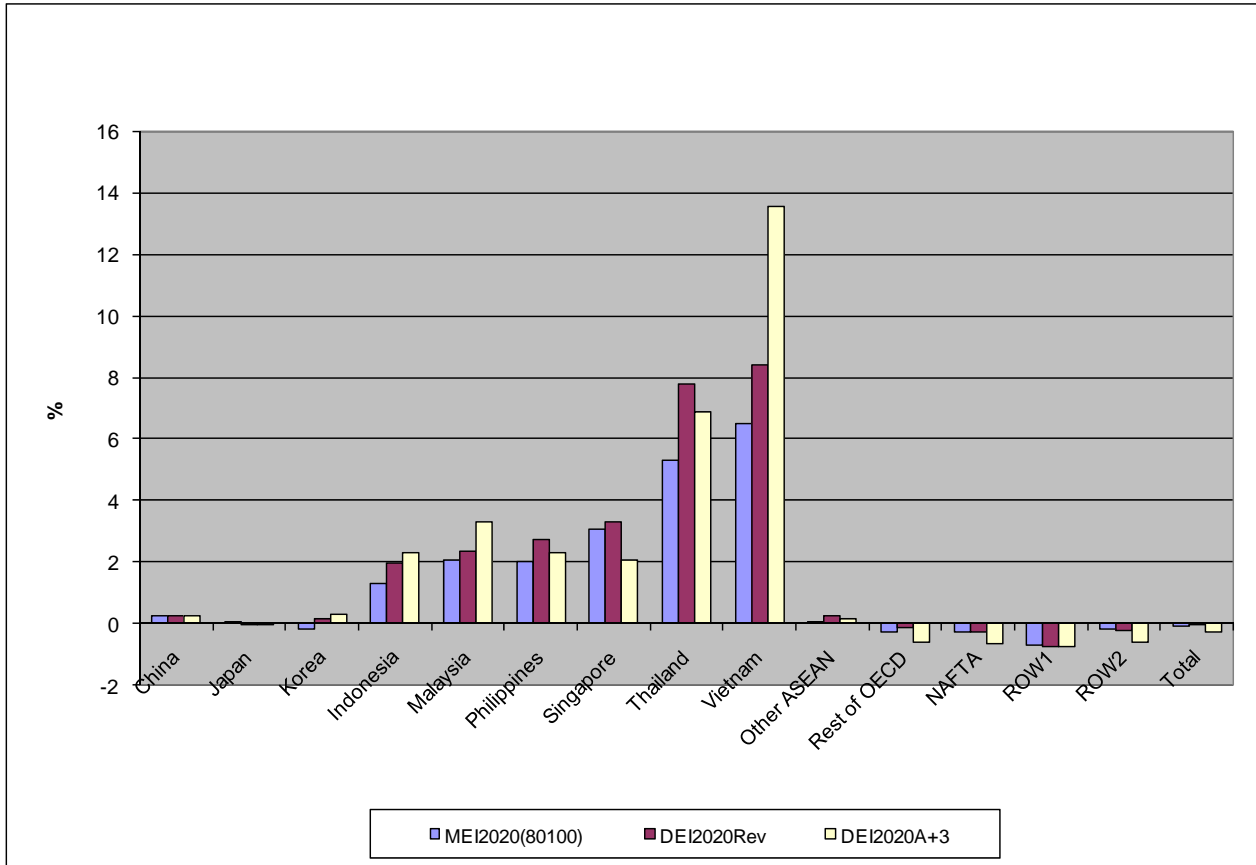
Regional scope	Commodity scope	By 2010	By 2015	By 2020
Within ASEAN, ASEAN with each of Japan, China, and Korea	Agricultural Commodities	40%	80%	
	Non-Agricultural Commodities	50%	100%	
Whole study region (ASEAN + 3)	Agricultural Commodities			80%
	Non-Agricultural Commodities			100%

Analysis of Results

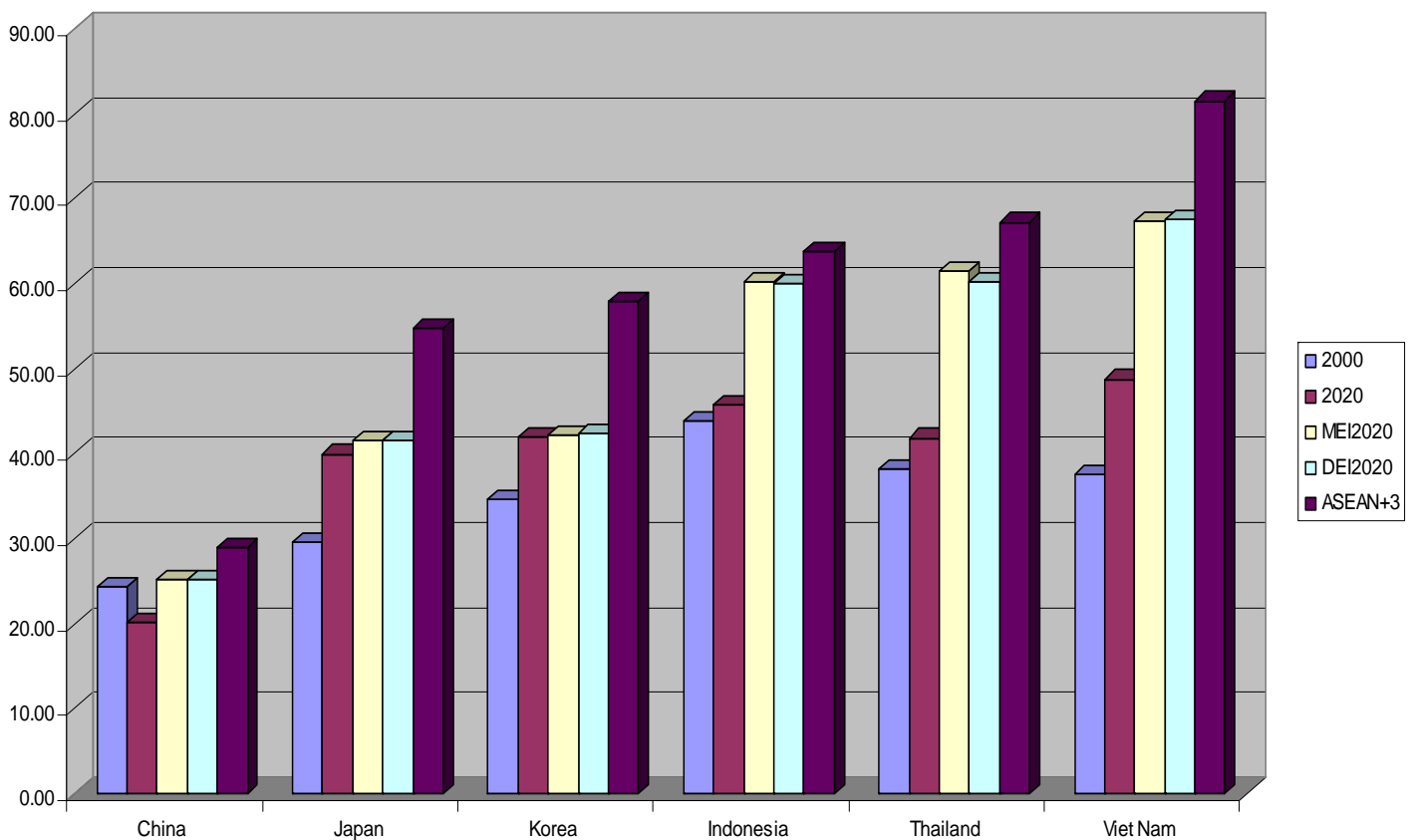
Percentage Change in the real Value of Output during 2000-2020

	2000-10	2010-15	2015-20
1 China	137.68	53.22	54.39
2 Japan	21.39	11.15	11.05
3 Korea	60.08	28.41	29.38
4 Indonesia	68.88	36.27	37.78
5 Malaysia	66.04	33.41	34.07
6 Philippine	54.50	26.23	27.15
7 Singapore	58.88	26.19	25.77
8 Thailand	69.58	33.20	34.62
9 Vietnam	97.43	41.74	40.06
10 Other ASEAN	53.31	26.30	26.28
11 Rest of OECD	24.40	12.91	14.47
12 NAFTA	34.36	16.83	15.60
13 ROW1	71.33	35.20	31.75
14 ROW2	53.63	25.05	24.72
Total	40.59	21.20	22.27

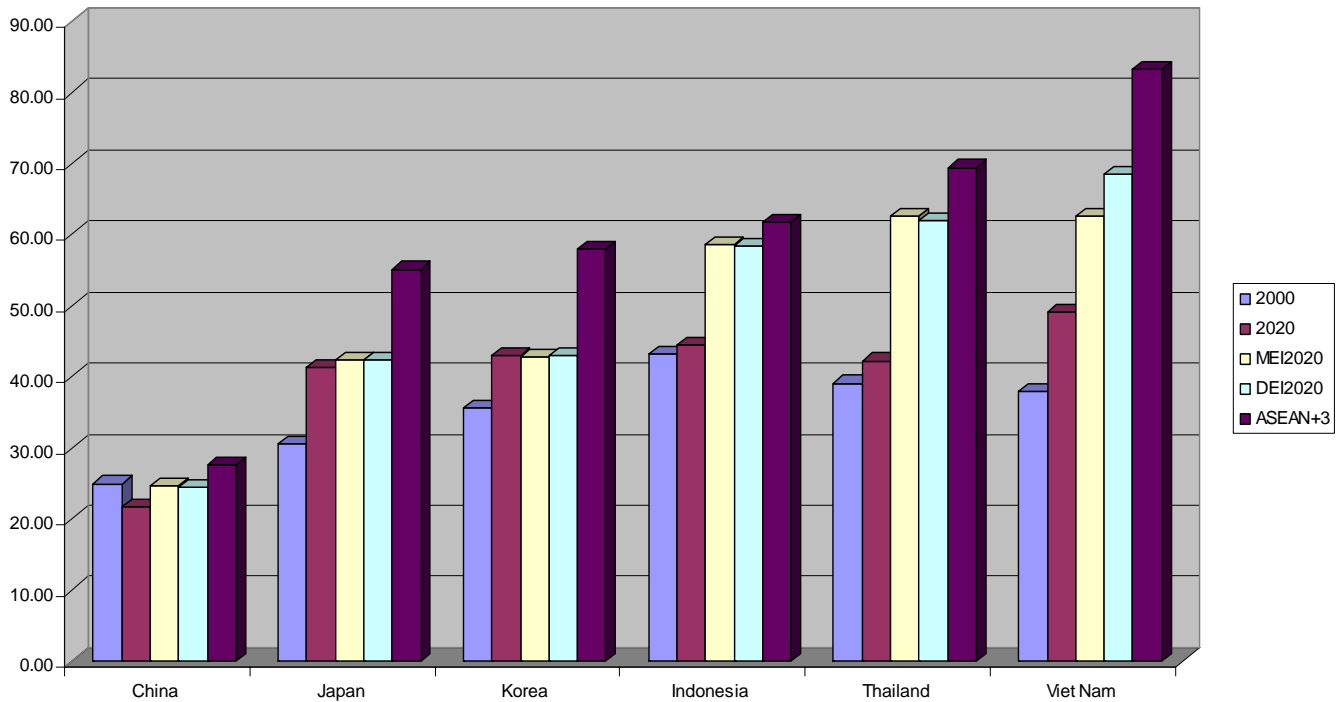
Percentage Change in the real value of output in 2020 between bau and trade scenarios



EXPORT SHARE(%) AMONG TEN REGIONS



IMPORT SHARE (%) AMONG TEN REGIONS



Top six sectors in output share in BAU 2020

China	Japan	Korea	Indonesia	Thailand	Vietnam
Machinery and equipment nec	Motor vehicles and parts	Machinery and equipment nec	Electronic equipment	Electronic equipment	Mineral products nec
Chemical, rubber, plastic products	Chemical, rubber, plastic products	Electronic equipment	Textiles	Machinery and equipment nec	Leather products
Electronic equipment	Electronic equipment	Chemical, rubber, plastic products	Chemical, rubber, plastic products	Motor vehicles and parts	Paddy rice
Textiles	Machinery and equipment nec	Ferrous metals	Paper products, publishing	Textiles	Oil
Mineral products nec	Ferrous metals	Motor vehicles and parts	Machinery and equipment nec	Chemical, rubber, plastic products	Food products nec
Manufactures nec	Paper products, publishing	Petroleum, coal products	Motor vehicles and parts	Wearing apparel	Machinery and equipment nec

Top six sectors export share(%) in BAU

BAU2000	2000	China		Japan		Korea
Electronic equipment		17.64	Machinery & equip.	26.06	Electronic equip.	28.26
Machinery & equip.		15.05	Electronic equip.	20.86	Machinery & equip.	11.59
Manufactures nec		11.07	Motor vehicles & parts	17.84	Chemical, rubber, plastic	10.24
Wearing apparel		9.69	Chemical, rubber, plastic	9.22	Motor vehicles & parts	8.83
Leather Products		8.33	Transport equip. nec	3.73	Textile	7.69
Chemical, rubber, plastic products		6.31	Ferrous metals	3.30	Transport equip. nec	5.48
		Indon.		Thail.		Viet.
Electronic equipment		12.41	Electronic equip.	24.08	Leather Products	17.58
Wood products		8.72	Machinery & equip.	12.30	Oil	13.91
Chemical, rubber, plastic products		7.51	Chemical, rubber, plastic products	8.91	Wearing apparel	10.29
Wearing apparel		6.81	Food products nec	6.81	Food products nec	8.83
Textile		6.48	Manufactures nec	4.28	Machinery & equip.	5.14
Machinery & equip.		5.51	Textile	4.07	Crops nec	5.10

Top six sectors export share(%) in ASEAN+3 2020

ASEAN+3	China		Japan		Korea
Electronic equip.	27.95	Machinery & equip.	23.73	Electronic equip.	25.55
Machinery & equip.	19.26	Motor Vehicle	15.82	Machinery & equip.	15.46
Manufactures nec	12.06	Chemical, rubber, plastic products	12.64	Chemical, rubber, plastic products	9.05
Wearing apparel	6.85	Electronic equip.	11.12	Textile	8.91
Chemical, rubber, plastic products	6.82	Ferrous metals	8.46	Motor vehicles and parts	8.58
Textile	5.51	Metals nec	4.63	Ferrous metals	6.89
	Indon		Thail.		Viet.
Electronic equipment	19.49	Electronic equipment	36.18	Chemical, rubber, plastic products	25.90
Textile	10.48	Machinery & equip.	19.11	Leather products	18.87
Chemical, rubber, plastic products	10.07	Chemical, rubber, plastic products	13.20	Oil	14.97
Machinery & equip.	7.65	Sugar	5.07	Wearing apparel	8.82
Paper and paper products	6.55	Motor vehicles and parts	3.52	Textile	6.71
Coal	5.37	Textile	3.33	Machinery & equip.	6.56

ECONOMIC INTEGRATION AND EXPORTS

- The share of the top six sectors differs depending upon the trade agreement phase across the countries.
- Some new sectors have entered the top six sectors due to the trade agreement scenarios when compared to BAU.
- The percentage shares of the top sectors fluctuate but the sectors themselves remain constant from BAU to ASEAN+3.
 - All six countries have three of six sectors shares have gone down
 - Thailand, electronic equipment and manufacturing equipment share have increased by 1.5 fold.
 - Vietnam, two new additional sectors are on the list, which cover almost 32% of the export share.

ECONOMIC INTEGRATION.....

- The top six sectors in both exports and imports are common in most cases. This is due to intra industry trade.
- Shares are sensitive to high tariff reduction in Thailand and Vietnam.
- In China, Japan, and Korea, the changes in the sectoral performance of exports and imports are insignificant except for a few cases.
 - For example ---- Electrical equipment for China
 - Ferrous for Japan and Korea

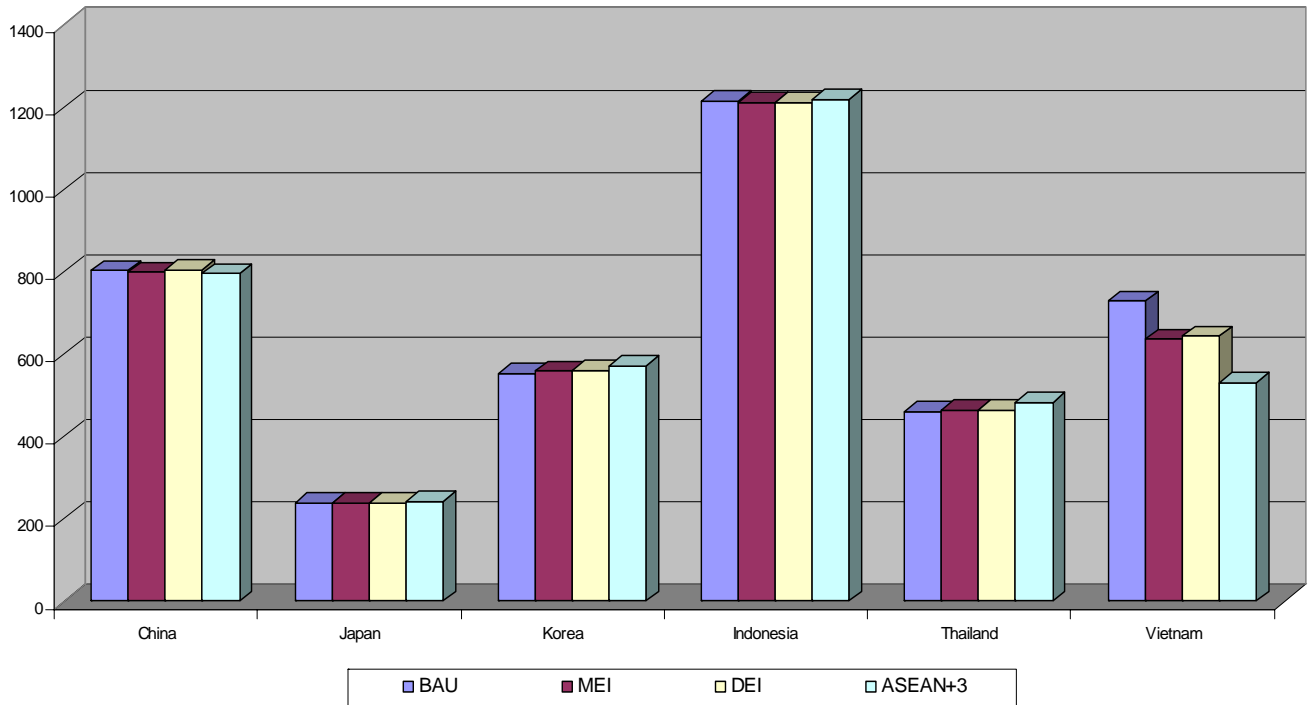
Summary

- **Japan:**
 - DEI 2020 has negative output growth
 - MEI 2020 and ASEAN+3 have positive output growth
- **Korea:**
 - MEI has negative output growth
 - DEI 2020 and ASEAN +3 have positive industrial output growth
- **China:**
 - MEI, DEI, and ASEAN+3 all have positive industrial output growth
- **Other Agreement Countries**
 - All benefit with increased industrial output growth
- **Non-Agreement Countries**
 - Have decreased industrial output growth

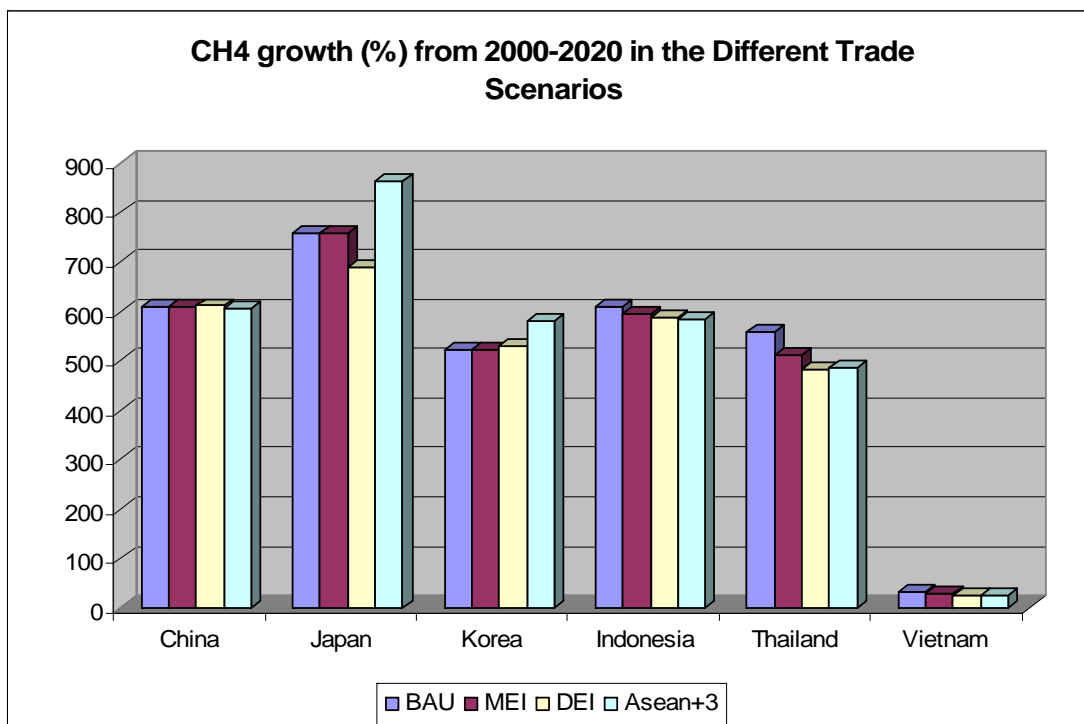
Environmental Impact

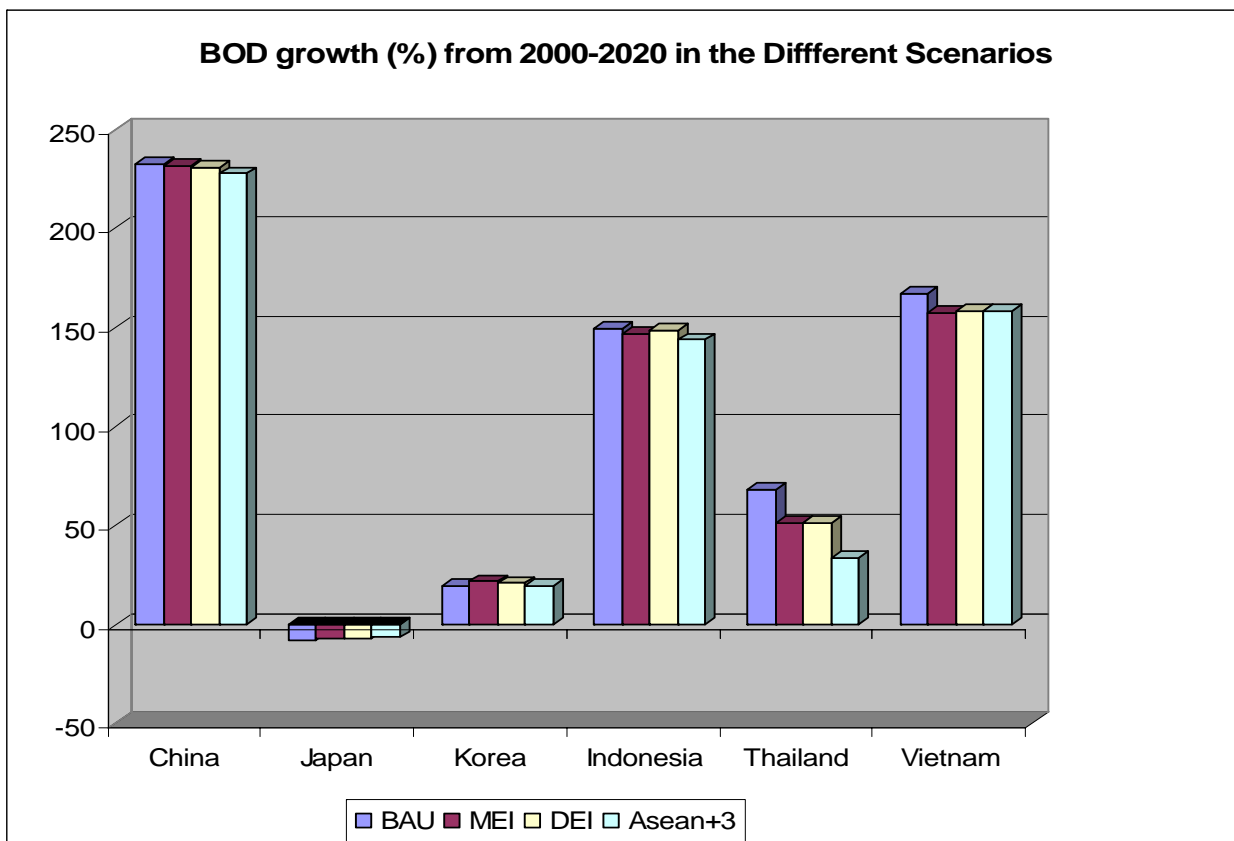
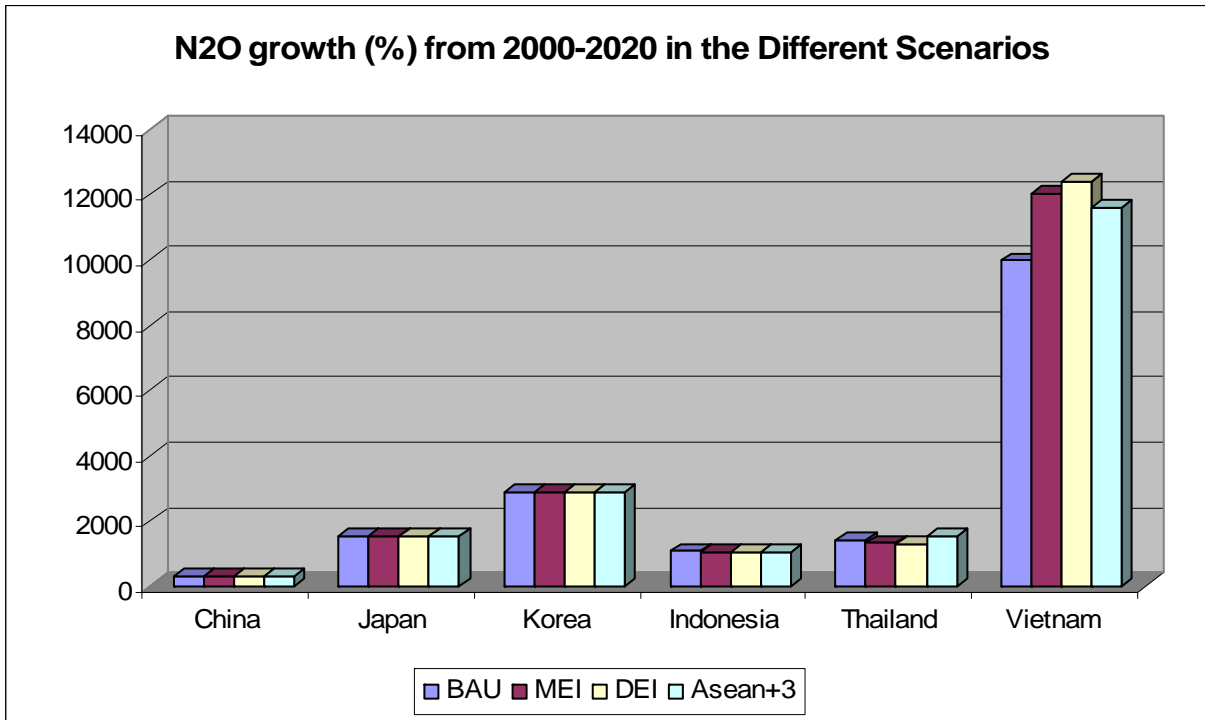
- 4 Environmental indicators were used: BOD, CO₂, N₂O, and CH₄
- Environmental coefficients were derived per unit output for each sector for the year 2000.
- They were then updated to the year 2010, 2015, and 2020.
- Updated coefficients were applied to estimate the volume of pollution in each scenario cases during the respective time periods.

CO2 GROWTH (%) FROM 2000 TO 2020 IN DIFFERENT SCENARIOS



CH4 growth (%) from 2000-2020 in the Different Trade Scenarios





CO2 intensive sectors for six countries

China	Japan	Korea	Indonesia	Thailand	Vietnam
Coal	Mineral products nec	Mineral products nec	Oil	Petroleum, coal products	Metals nec
Oil	Machinery and equipment nec	Textiles	Petroleum, coal products	Mineral products nec	Manufactures nec
Gas	Paper products, publishing	Motor vehicles and parts	Machinery and equipment nec	Machinery and equipment nec	Petroleum, coal products
Ferrous metals	Chemical, rubber, plastic products	Transport equipment nec	Manufactures nec	Forestry	Mineral products nec
Mineral products nec	Textiles	Chemical, rubber, plastic products	Ferrous metals	Chemical, rubber, plastic products	Electronic equipment
chemical, rubber and plastic	Ferrous metals	Paper products, publishing	Electronic equipment	Minerals nec	Paper products, publishing

CH4 intensive sectors for six countries

China	Japan	Korea	Indonesia	Thailand	Vietnam
Coal	Paddy rice	Paddy rice	Animal products nec	Bovine cattle, sheep and goats, horses	Paddy rice
Paddy rice	Animal products	Animal products	Bovine cattle, sheep and goats, horses	Paddy rice	Gas
Animal products	coal	raw milk	Paddy rice	Sugar cane, sugar beet	Animal products nec
cereal grains	raw milk	coal	cereal grains	Gas	Sugar cane, sugar beet
Gas	Gas	Bovine cattle, sheep and goats, horses	Gas	Animal products nec	Raw milk

N2O intensive sectors for six countries

China	Japan	Korea	Indonesia	Thailand	Vietnam
Crops nec	transport nec	transport nec	paddy rice	Sugar cane, sugar beet	Transport nec
paddy rice	chemical rubber and plastic	chemical rubber and plastic	cereal grains	Bovine cattle, sheep and goats, horses	Sugar cane, sugar beet
transport nec	animal products	animal products	vegetable fruits and nuts	Plant-based fibers	Animal products nec
vegetable fruits and nuts	raw milk	raw milk	transport nec	Transport nec	Crops nec
Cereal grains nec	vegetable fruits and nuts	paddy rice	plant based fibre	Paddy rice	Vegetables, fruit, nuts
Plant-based fibers	paddy rice	vegetable fruits and nuts	animal products	Vegetables, fruit, nuts	Paddy rice

BOD intensive sectors for six countries

China	Japan	Korea	Indonesia	Thailand	Vietnam
Textiles	Chemical, rubber, plastic products	Animal products nec	Leather products	Animal products nec	Fishing
Food products nec	Ferrous metals	Bovine cattle, sheep and goats, horses	Wood products	Food products nec	Sugar
Vegetable oils and fats	Petroleum and coal tar products	Paper products, publishing	Bovine cattle, sheep and goats, horses	Gas	Chemical, rubber, plastic products
Chemical, rubber, plastic products	Wearing apparel	Textiles	Vegetable oils and fats	Bovine cattle, sheep and goats, horses	Textile
Animal products nec	Paper products, publishing	Chemical, rubber, plastic products	Textiles	Crops nec	Leather products
Electronic equipment	Bovine cattle, sheep and goats, horses	Ferrous metals	Beverages and tobacco products	Wool, silk-worm cocoons	Manufacturing nec

Decomposition of pollution changes

- Environmental effects of trade policy changes can be decomposed into three effects (Strutt and Anderson 1998)
- Activity (scale effect)
- Composition
- Technology

CO2 Decomposition

- The activity effect is positive for all countries. This effect is primarily responsible for the increase in pollution across countries. It defines that the scale of output has increased.
- The positive technology effect for all countries implies that our CO2 coefficients are increasing at a decreasing rate.
- Developing countries, including Korea, have negative composition effect across the scenarios (except Vietnam). This effect decreases the total pollution effect.
- Japan's composition effect is positive throughout. This implies that the CO2 intensive industries are expanding.

BOD Decomposition

- All the countries have negative technology effect.
- This is due to the fact that the BOD coefficient decreases between 2010-15 and 2015-20.
- Composition and activity effect are positive for Japan in all trade scenarios.
- Composition and activity effects are positive for Indonesia in all trade scenarios, except for the composition effect in ASEAN+3 where it is negative.
- Rest of the countries have negative composition effects. The pollution intensive industries are expanding in Indonesia and Japan.
- The sectoral allocation of ACT in terms of BOD and CO₂ is mixed for Japan

Summary

- East Asian free trade agreement will increase the output growth of the countries included in the agreement. Other countries in the world will have a marginal decrease in output growth.
- Vietnam will achieve the highest growth followed by Thailand.
- Lowest positive growth is obtained by Japan and Korea.
- China will be a gainer in all trade agreement phases, but the gain is not significant.
- ASEAN+3 is the most favourable of all of the trade agreements.
- The total export and import share increased marginally in BAU, but it increased significantly (relatively low for China, Japan and Korea) for all the countries during the agreement phases.
- Overall, it is observed that if the economy moves to economic integration there will be an increase in industrial output growth and exports and imports.

Summary

- The impact of economic integration on the environment is not significant.
- The CO2 growth in MEI 2020 and DEI 2020 across the countries increases only marginally compared to BAU 2020, except in Vietnam.
- Other GHGs emissions are in the same range as BAU 2020.
- BOD growth does not vary dramatically from BAU 2020.
- ASEAN +3 agreement is growth inducing and pollution reducing in terms of BOD.
- The overall GHG emission within the region will decline by 28027 Gg of CO2 and 5144 Gg of CH4 in the ASEAN+3 scenario.
- Overall, economic integration is not dramatically unfavorable to the environment, except for a few specific sectors across the countries.

Strategic Environmental Policy -Tax Options

3 different options :

- Multiple sector tax
- Electricity tax
- Coal and Oil tax

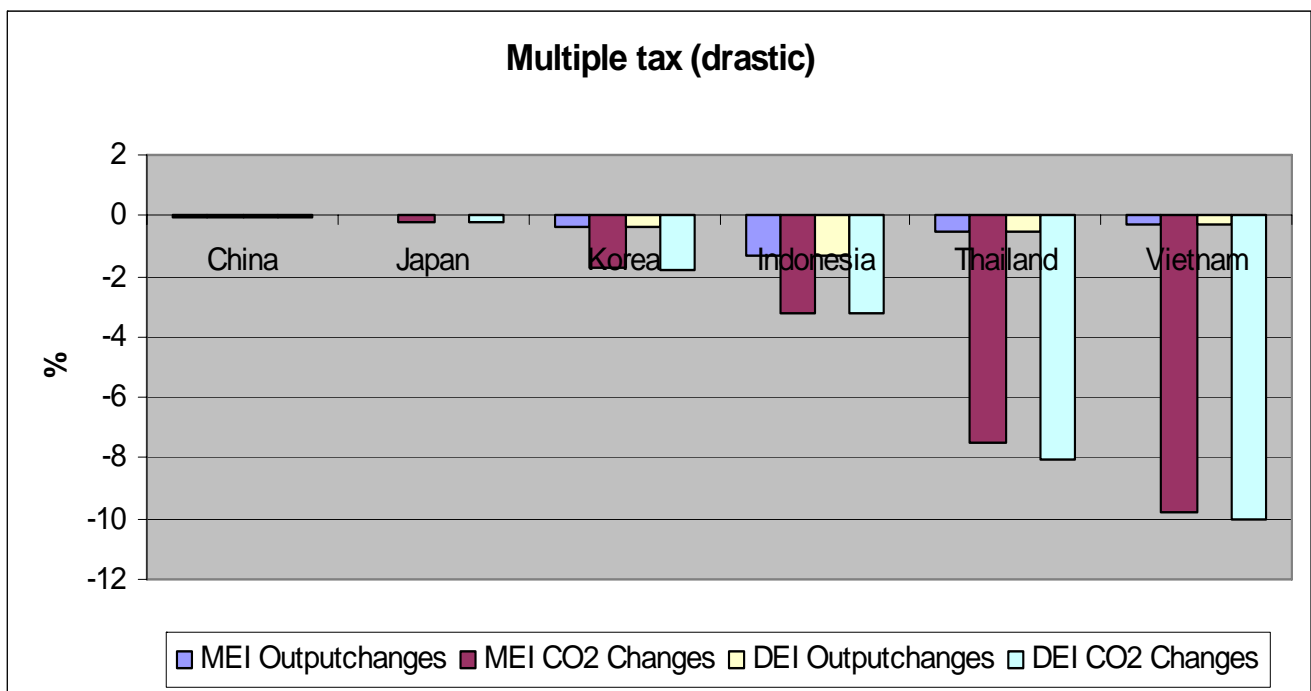
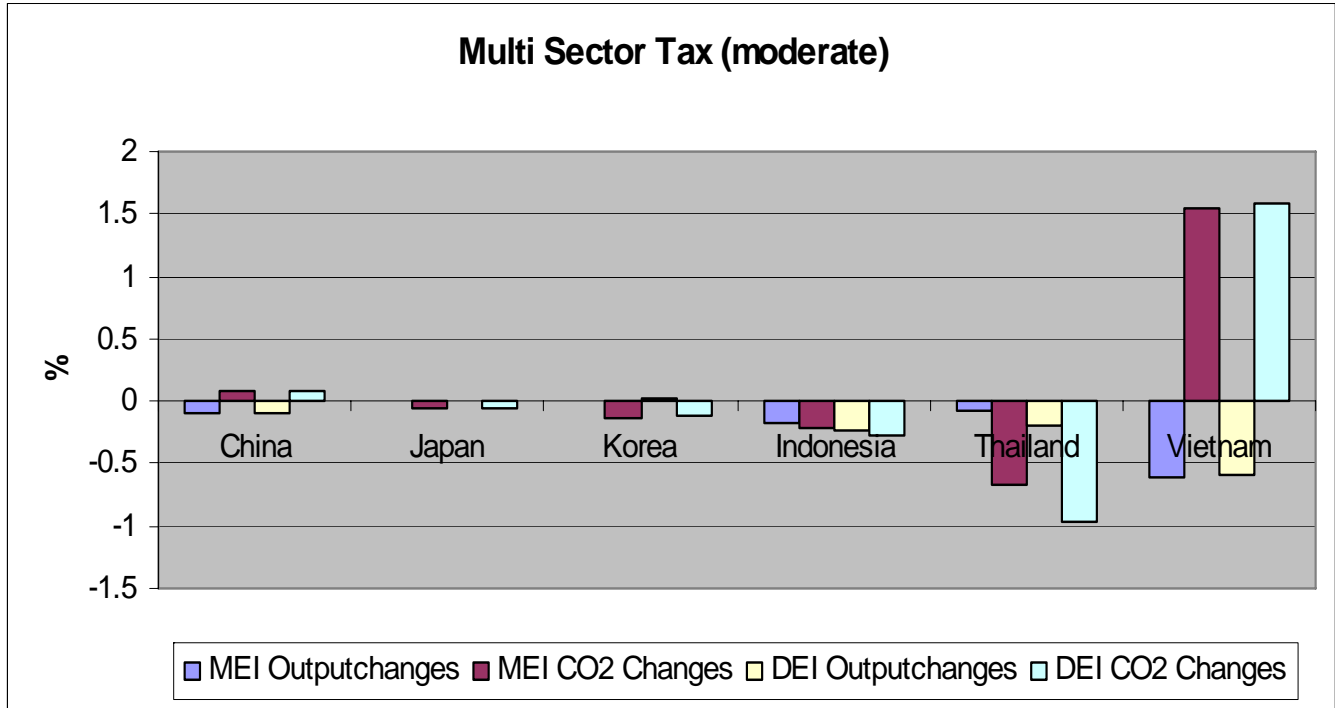
The weight of the tax was determined based on the additional pollution (%) generated by each trade scenario.

There are two measures:

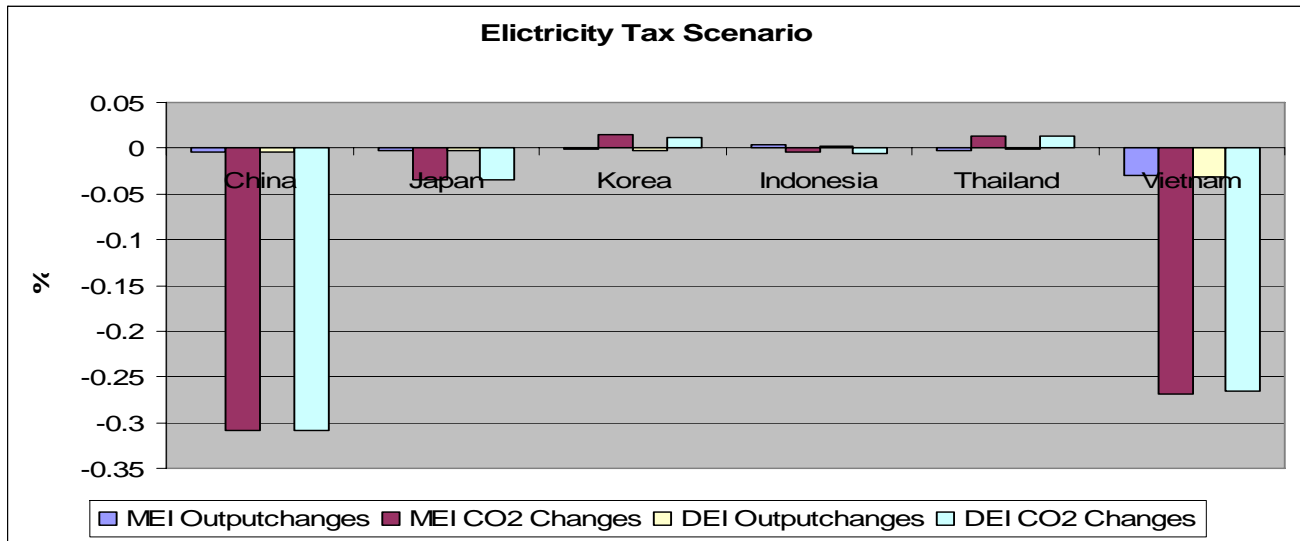
- Moderate: compared to BAU 2020
- Drastic: compared to BAU 2010

Tax are applied to both DEI and MEI Scenarios

Multiple Sector Tax Options

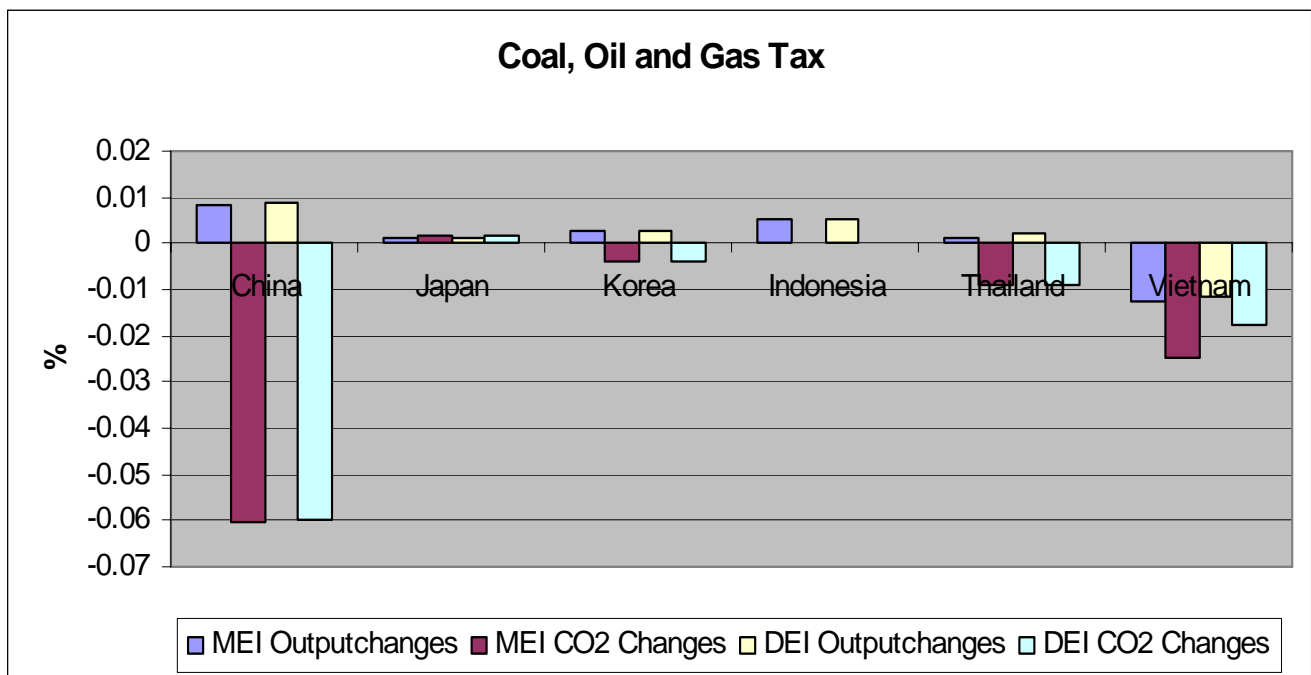


Electricity TAX



- Electricity tax is showing a major change in CO2 for all countries.
- Though output is only reduced marginally for the sector itself and total output, the reduction of CO2 is drastic especially for China and Vietnam.

Coal, Oil and Gas Tax



Conclusion

- East Asian economic integration will increase industrial output growth
- ASEAN+3 is favourable for all the agreement countries compared to other scenarios.
- Vietnam is estimated to achieve the highest industrial growth followed by Thailand.
- The effect of economic integration on the environment is moderate.
- The pollution growth of the trade scenarios are not significantly different from the BAU growth rate except for Vietnam.
- Overall total CO₂ and CH₄ emissions in the region (six countries) will be declining if ASEAN+3 materializes.
- Overall, economic integration is not unfavorable to the environment except for a few specific sectors across the countries.
- Among all the tax scenarios, the electricity tax is the most beneficial for all countries.

Limitation

Data gaps in updating the environmental coefficients.....

Future Research

- Dynamic general equilibrium model should be utilized in the analysis.
- More detailed investigation of the environmental coefficients over time.
- Economic integration scenarios should be enhanced to incorporate existing and negotiated tariff reductions.

Thank you