Trade and Environment:

The Case of ACFTA for Countries in Greater Mekong Sub-region

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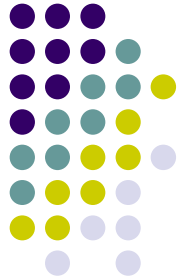
Outlines

- Research Objectives
- Literature Review on Trade and Environment
- Methodology
- Key Findings
- Further Research

Research Objective

- To understand relationships between trade and environment
- To examine overall trend and structure of trade in GMS as well as their comparative advantage
- To assess the impacts of trade (via FTA) on environment in the Greater Mekong Sub-region (GMS)

Literature Review on Trade and Environment



A. Environmental regulations and competitiveness

Theoretical Conceptualization: Incorporate environmental cost into the production function and estimate impacts it has on competitiveness.

$$Production\ Cost = f(L, K, ECC)$$

Theoretical Prediction: Environmental policies can affect production costs and thus competitiveness.

Empirical Studies:

Studies that support theoretical prediction

- Siebert (1974), Pething (1976) and McGuire (1982): strict environmental standards weaken a country's competitive position in pollution intensive industries and diminish exports.
- Lucas, Wheeler and Hettige (1992): Lower income countries specialize in pollution-intensive activities.
- Low and Yeats (1992): The South exports relatively dirty products and the North exports relatively clean products.

Studies that NOT support theoretical prediction

- OECD (1993), Tobey (1990), Walter (1973): abatement cost in developed countries range between 1 to 3 percent of total cost and thus effects of env. regulations is insignificant.
- Berman and Bui (1998): stringent env. regulations stimulate companies to use more advanced technology in production, encourage innovation and R&D toward environmental friendliness and thus raise productivities and firm's performance.

B. Relocation of dirty industries OR Pollution heaven hypothesis

Theoretical Conceptualization:

- Expands classical standard two-factor trade model by treating pollution as a production factor.
- Pollution abundance or scarcity is determined by environmental policies

Theoretical Prediction:

- Pollution abundant country, which is usually developing countries tends to have comparative advantage in pollution-intensive activities

➔ Attract more investment from developed countries in these sectors (relocation of industries).

Empirical Studies:

Studies that SUPPORT pollution heaven hypothesis

- Low and Yeats (1992): developing countries have a stronger tendency to develop RCA in polluting industries.
- Handerson (1996): a significant reduction of polluting plants in counties that has stricter env. regulations to counties with loose regulations.
- Xing and Kolstad (1998): the laxity of environmental regulations in a host country is a significant determinant of FDI from US for heavily polluting industries.
- Some more supportive evidences from Kahn (1997), Gray (1997)

Studies that NOT support pollution heaven hypothesis

- Duerksen et al. (1980): host countries, which received the most FDI in pollution-intensive sectors were industrial countries (not LDCs).
- Repetto (1995): Only 5 percent of FDI from US to developing and transitional economies went into pollution-intensive industries.
- Walter (1982): although there exists a large amount of overseas production in pollution-intensive industries, there is little evidence that it has been influenced by differing ECC.

C. Trade Liberalization and Environment

- Trade liberalization is likely to increase trade, expand economic activities and thus affect environmental quality.

- The impact of trade liberalization can be decomposed into THREE interacting components (Grossman and Krueger, 1991) :

  - ✓ *Composition effect*
  - ✓ *Scale effect*
  - ✓ *Technique effect*

- *The Composition Effect*:

  - ✓ Arises from change in specialization when trade is opened.

  - ✓ The net effect on the local environment: Positive if expanding export sectors are less polluting on average than contracting import-competing sectors and negative if the opposite relation holds.

- *The Scale effect*:

  - ✓ Arises from enhanced economic activities due to trade liberalisation.

  - ✓ Scale effect is always negative.

- *The Technique Effect*:

  - ✓ Occur when producers introduce cleaner production techniques with lower emissions intensity leading to reduction in pollution per unit of output.

  - ✓ Technique effect is usually positive.

- *The Net impact of trade liberalisation on environment:*

  - Positive if (composition eff. + technique eff.) > scale effect

  - Negative if (composition eff. + technique eff.) < scale effect

Empirical Studies:

Trade liberalization with POSITIVE environmental consequences

Grossman and Krueger (1991, 1993), Birdsall and Wheeler (1992), Antweiler et al. (1998), and Tsai (1999): trade liberalization may improve environmental conditions and quality.

- Grossman and Krueger (1991, 1993):
  - ✓ NAFTA will generate more income growth to level that environmental quality is needed ➔ good for environment.
  - ✓ Pollution in Mexico will reduce as this country specialize in labor-intensive industry and agriculture sectors.
- Antweiler et al. (1998):
  - ✓ Trade liberalization results in pollution reduction
  - ✓ If trade liberalization raises GDP per capita by 1 percent, then pollution concentration falls by about 1 percent.

Trade liberalization with NAGATIVE environmental consequence

- Copeland and Taylor (1994):
  - ✓ Free trade lowers pollution level in human-capital rich country (the North), BUT increase pollution in the South.
  - ✓ Worldwide pollution increase.
- Cole et al. (1998):
  - ✓ Examine how Uruguay Round of trade negotiation impacts on air pollutants.
  - ✓ Most developing and transition economies will experience an increase in emissions of all air pollutants
  - ✓ Most pollutants were predicted decrease in developed countries.

Methodology

Trade-Environment Matrix: to track how change in trade affect environment measured by pollution emission

- First, construct trade matrix depicting trends in trade
- Second, use pollution intensity level released by physical volume of output (by Industrial Pollution Project System study by Hettige et al. (1995)).
- Third, classify trading commodities into three categories:
  - Most polluting sector
  - Moderately polluting sector
  - Least polluting sector

  based on the amount of pollution released by their production

Table 1: Summary of Pollution Intensity Classification, by Sector

	Category 1 **Most polluting sectors**	*Category 2* **Moderately polluting sectors**	*Category 3* **Least polluting sectors**
Definition	ToxTot ≥ 1500 pounds/USD million	500 pnds/USD million < ToxTot < 1500 pounds/USD million	ToxTot ≤ 500 pounds/ USD million
Sectors (ISIC)	Industrial chemicals (351) Non-ferrous metals (372) Iron and steel (371) Leather products (323) Pulp and paper (341) Petroleum refineries (353) Other chemicals (352) Plastic products (356) Fabricated metal products (381) Furniture, except metal (332)	Pottery, china, earthenware (361) Electrical machinery (383) Rubber products (355) Other non-metallic mineral products (369) Textiles (321) Transport equipment (384) Other manufactured products (390) Misc. petroleum and coal products (354) Non-electrical machinery (382)	Professional & scientific equipment (385) Footwear, except rubber or plastic (324) Printing and publishing (342) Wood products, except furniture (331) Glass and products (362) Tobacco (314) Food products (311) Beverages (313) Wearing apparel, except footwear (322)
Section (HS)	Metals (HS 71-83) Chemicals (HS 28-38) Plastics (HS 39) Pulp and paper (HS 47-49) Hides and leather (HS 41-43)	Machinery and electrical appliances (HS 84-85) Mineral products (HS 25-27) Textiles and apparel (HS 50-63) Rubber products (HS 40) Vehicles (HS 86-89) Misc. manufactured articles (HS 93-96)	Vegetable products (HS 6-14) Wood and wood articles (44-46) Optical, precision and musical instruments (HS 90-92), Stone/ cement/ceramics (HS 68-70) Prepared foodstuffs (HS 15-24) Footwear (HS 64-67)

Sample of Trade-Environmental Matrix

Description	2001	2004	2007	2001	2004	2007	2001	2004	2007
	Value (in USD billion)			*Share (%)*			*EPI* (in million pounds)*		
Most polluted sector									
Moderately polluted sector									
Least Polluted Sector									
All Commodities									

This allows us to assess the level of pollution emission corresponding to trade value = environmental impacts

* Estimated Pollution Intensity

Key Findings

Overview of Trade in the GMS

Trade in the GMS can be characterized as followings:

- Rapid growth at 27% per annum during 2000-07
- Deeper integration and FTA are the major factors to this development
- High level of trade concentration
- High level of intra-industry trade
- Trade is primarily based on comparative advantage

Trade between China and GMS5*

(In USD billion)

Year	Total Trade			GMS5 Exports to China			GMS5 Imports from China		
	Value	Share (%)	% Δ	Value	Share (%)	% Δ	Value	Share (%)	% Δ
2000	9.98		-	5.50	-	-	4.48	-	-
2001	10.79	-	8	5.90	-	7	4.89	-	9
2002	13.02	-	21	6.89	-	17	6.14	-	25
2003	18.80	-	44	10.49	-	52	8.31	-	35
2004	25.82	2	37	14.27	11	36	11.55	9	39
2005	31.91	2	24	16.87	11	18	15.04	9	30
2006	40.09	2	26	20.79	12	23	19.30	11	28
2007	53.01	-	32	26.37	-	27	26.63	-	38

**GMS5 refers to Cambodia, Laos, Myanmar, Thailand and Vietnam*
Source: Global Trade Atlas and UN Comtrade

Export Structure of GMS5 to China

HS Code	Description	2001	2004	2007	2001	2004	2007
		Value (in USD m.)			*Share (%)*		
84	Machinery and mechanical appliances	975.1	2,846.9	7,251.6	16.5%	19.9%	27.5%
85	Electrical machinery	918.3	2,984.6	5,818.3	15.6%	20.9%	22.1%
27	Mineral fuels and oils	1,071.9	2,426.7	2,506.0	18.2%	17.0%	9.5%
40	Rubber	465.8	1,155.0	2,297.1	7.9%	8.1%	8.7%
39	Plastics	666.4	1,223.7	1,641.3	11.3%	8.6%	6.2%
29	Organic chemicals	104.8	344.1	1,357.4	1.8%	2.4%	5.1%
44	Wood and articles of wood	244.3	456.5	762.2	4.1%	3.2%	2.9%
07	Edible vegetables	139.7	326.8	649.6	2.4%	2.3%	2.5%
26	Ores, slag and ash	33.5	130.3	436.0	0.6%	0.9%	1.7%
08	Edible fruit	130.1	214.6	369.7	2.2%	1.5%	1.4%
Total top 10 imports items		4,750.4	12,109	23,089	80.5%	84.8%	87.5%
Others		1,150	2,162	3,283	19.5%	15.2%	12.5%
All Commodities		5,901	14,272	26,373	100%	100%	100%

Source: Global Trade Atlas 2007

Export Structure of China to GMS5

HS Code	Description	2001	2004	2007	2001	2004	2007
		Value (in USD m.)			*Share (%)*		
84	Machinery and mechanical appliances	998.5	1,973.5	4,803.5	20.4%	17.1%	18.0%
85	Electrical machinery	730.3	1,718.4	4,091.8	14.9%	14.9%	15.4%
72	Iron and steel	205.5	1,231.7	3,611.5	4.2%	10.7%	13.6%
87	Vehicles	528.1	330.3	1,054.7	10.8%	2.9%	4.0%
27	Mineral fuels and oils	303.0	797.2	997.3	6.2%	6.9%	3.7%
73	Articles of iron or steel	95.2	232.1	771.2	1.9%	2.0%	2.9%
52	Cotton	149.5	406.7	739.2	3.1%	3.5%	2.8%
60	fabrics	56.2	219.4	677.9	1.1%	1.9%	2.5%
29	Organic chemicals	130.3	229.7	646.8	2.7%	2.0%	2.4%
31	Fertilizers	86.9	486.9	588.7	1.8%	4.2%	2.2%
Total top 10 imports items		3,283.9	3,283.9	17,982	67.1%	66.0%	67.5%
Others		1,608.3	1,608.3	8,651.8	32.9%	34.0%	32.5%
All Commodities		4,892.3	4,892.3	26,634	100.0%	100.0%	100.0%

Source: Global Trade Atlas 2007

Trade-Environmental Matrix in the GMS

Description	2001	2004	2007	2001	2004	2007	2001	2004	2007
	Value (in USD billion)			*Share (%)*			*EPI* (in million pounds)*		
Most polluted sector	2.37	6.10	13.44	21.93	23.62	25.36	17.89	50.53	118.5
Moderately polluted sector	6.97	16.67	34.03	64.58	64.53	64.20	4.57	10.68	21.14
Least Polluted Sector	1.46	3.06	5.53	13.52	11.85	10.44	0.30	0.64	1.21
All Commodities	10.79	25.82	53.01	100	100	100	23	62	141

* Estimated Pollution Intensity

Source: Author's calculation based on trade data from Global Trade Atlas

Environmental Assessment from Trade-Environment Matrix suggests the followings:

- About USD 13.44 bn. or 25% of trade fall into most polluted sector. trade in this sector has increased over time at faster pace than other sectors
- The environmental consequences in term of pollution intensity is huge (85% of total pollution intensity).
- China is the main producer of total regional pollution (70%)
- 65% of intra-GMS trade fall into moderately polluting sector with significantly low pollution intensity level. China and the GMS5 have traded with each other at similar volume

- Although trade in natural resource products tends to cause lower level of pollution, it has implications for other aspects of environmental degradation.
- For example, greater trade in wood products significantly contribute to loss of forest. This causes many environmental problems i.e. land degradation, flooding and landslide, loss of biodiversity, and global warming.
- ASEAN-China FTA is likely to increase GMS-wide trade and so does pollution intensity level
- Analysis of RCA and trade structure indicates that China specialize and export most polluting sector and is likely to remain the main producer and exporter

Future Research

- Quantifying the impacts of trade liberalization in the GMS on environment
- Trade in natural resource products and resource sustainability