Are openness to trade and regional integration good for the environment? Evidence from ASEAN+3 region

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ABSTRACT

Using a 26-year panel data set from 1990 to 2015, this paper aims to investigate the effects of openness to trade and regional integration among ASEAN+3 countries. With the application of fixed-effects model, trade, foreign direct investment, and regional environmental agreements beneficially affect the environment in this region, indicated by the reduction in carbon and greenhouse gas emission and forest gain. The empirical evidence supports intra-regional incentives for more trade liberalization and deep integration. Positive effects of trade and integration on economic development and environmental protection are realized through technological transfer from leading innovator countries to less developed nations.

Keywords
Trade opening, regional integration, pollution reduction, ASEAN+3, environmental agreements.

INTRODUCTION

Climate change and the increasing environmental degradation have called for global attention to investigate the complexity of rapid economic growth, globalization and the environment. Research on the impacts of trade on the environment has been limited. Regional trade agreements grow tremendously; in some countries, deeper integration in policy standards is also on the rise. The Association of South East Asian Nations (ASEAN) is an example of trade liberalization and regional cooperation in tackling environmental problems. While increasing intra-regional trade, regional environmental agreements are significantly put forth, e.g. the ASEAN Agreement on Transboundary Haze Pollution. It remains a question whether trade liberalization and collective efforts in reducing pollution are significant in this region.

METHODOLOGY

Theoretical framework

The trade effects on the environment are classified in three main types: scale, composition and technique effects (World Trade Organization, 2009). The scale effects have negative externalities to the environment through the increasing scale of economic activities related to trade opening. The composition effects are the way trade may affect the relative size of the various sectors that make up a country's production, which can be negative or positive to the environment. The technique effects relate to how technological improvements may be utilized in greening the production of goods and services, thus improve the environmental situations.

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The three effects of trade on the environment usually intertwine depending on a country's industrial structure, environmental regulations and multilateral environmental standards in trade agreements. The contradicting nature of the scale and technique effects indicates the non-linear relationship between environmental damage and income. The environmental Kuznets curve represents this relationship – the inverted U-shaped curve in which pollution first rises with economic growth up to a cut-off point then reduces as incomes continue to increase (Stern, 2004). Empirical research works found that trade opening has a net positive effect on CO2 and SO2 emissions, i.e. more environmental damage (Frankel and Rose, 2005; Ab-Rahim and Xin-Di, 2016). With respect to environmental agreements, Grossman and Krueger (1991) examined the environmental effects of North American Free Trade Agreements (NAFTA) and found positive technique effects. They explained that trade contributes directly to pollution reduction through access to climate-friendly technology and indirectly though rising incomes and consequent higher demand for environmental abatement.

There has been little research on the environmental impacts of trade in some ASEAN countries, yet none addresses the greenhouse gas (GHG) emissions nor includes regional environmental agreements. This paper aims to analyze the impacts of regional trade and cooperation on the environment in the free trade area of ASEAN+3 region, i.e. 10 ASEAN member states, China, Japan and Republic of Korea, during 1990-2015. The inclusion of three countries sharing trade agreements helps to extend the data set and accounts for the technique effects of trade because these nations are leading innovators in environmentally-friendly technologies.

The following hypotheses are investigated:

- Increased openness via trade and foreign direct investment (FDI) will increase the environmental damage in ASEAN+3 region.
- Environmental agreements among ASEAN countries are significant to pollution reduction.
- Deep integration through environmental agreements helps to reduce the negative environmental impacts of trade.

Data descriptions

The dataset consists of country-level data of ASEAN+3 regions, including 10 member states (Brunei Darussalam, Cambodia, Indonesia, Lao PRD, Malaysia, Myanmar, The Philippines, Singapore, Thailand and Vietnam) plus three partner countries sharing a regional agreement with ASEAN (China, Japan and Republic of Korea) from 1990 to 2015. Data sources are World Development Indicators by World Bank, Food and Agricultural Organizations (FAO), United Nations and ASEAN Organization.

The dependent variables are log of carbon emission (CO2) per capita and greenhouse gas (GHG) emission per capita,

both of which represent air quality, and forest percentage of land area which is an indicator of deforestation. CO2 and GHG emissions per capita in ASEAN+3 are much higher than the world average which explains why it ranks as the top developing pollution-intensive region. The main regressors are indicators of openness, i.e. trade and FDI as of GDP, both of which increases in all countries throughout the period. The main control variables are per capita GDP and GDP squared (in log form) due to the non-linear relationship of income and environmental damage. Policy control variables are dummies for environmental agreements participation in the ASEAN Transboundary Haze Control Agreement (Haze Control), Kyoto Protocol on GHG reduction and Montreal Protocol on substances that deplete the ozone layer. Other control variables are included depending on the respective dependent variables, which are log of energy intensity for CO2 and GHG emissions estimation; urban population share, agricultural land percentage and population growth for forest coverage estimation. Figure 1 visualizes the average carbon emissions by country against trade and income per capita.

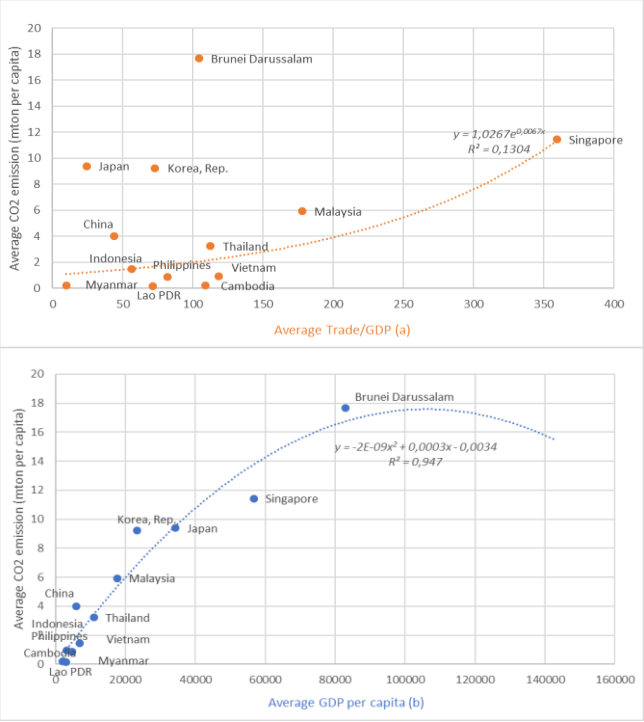

Figure 1. CO2 emissions against trade (a) and income per capita (b). Source: World Bank.

Methodology

The estimation follows the model:

$$E_{it} = \beta_0 + \beta_1 Trade_{it} + \beta_2 FDI_{it} + \beta_3 lnGDP_{it} + \beta_4 lnGDP^2_{it} + \beta_5 X_{it} + \varepsilon_{it}$$

in which E_{it} denotes the environmental indicators of country i in year t. The main independent variables of interest are trade and FDI; income is controlled for in a non-linear fashion. X_{it} indicates environmental agreements dummies and other control variables. The leading paper by Frankel and Rose (2005) uses instrumental variables for trade and income per capita to account for the simultaneity problem because of the two-way link between intra-regional trade and income. However, regarding the ASEAN+3 region, intra-regional trade comprises of only 25% of total trade (ASEAN Secretariat, 2015) and thus their correlation in the data set is not significant. This regional characteristic makes instrumental variables model irrelevant. Considering the time-invariant characteristics among ASEAN+3 countries, Hausman test is carried out to consider between fixed or random effects models (Balgati, 2008). The difference is significant; therefore, the fixed-effects model is used with both country and time effects to control for any impact of external shocks. With regards to econometric issues, cluster options are included to deal with serial correlation and heteroskedasticity. Lagged FDI is used to correct for unit roots problem.

The large variation of incomes among these countries, i.e. the "development gap", gives an incentive to analyze the effects of trade and regional integration separately. The identification of "developed" countries is based on World Bank's definition of income groups, in which countries with approximately $12,500 or more are considered high-income. In this research, high-income countries are "developed" nations while middle or low-income countries are "less developed" nations.

RESULTS

The estimation of each environmental indicator, namely CO2 emissions, GHG emissions and forest percentage is executed across all panels and in two sub-panels. The results are contrasted between two scenarios – without and with environmental agreements.

VARIABLES	(1) lnCO2	(2) lnCO2	(3) lnGHG	(4) lnGHG
Trade	-0.001*	-0.002*	0.004*	0.005*
L.FDI	-0.011**	-0.010**	-0.006	-0.005
lnGDP	5.978***	5.407***	2.444	2.897**
lnGDP2	-0.302***	-0.254***	-0.092	-0.120
lnEnergy	0.799***	0.892***	0.599**	0.571**
Haze Control		-0.033		-0.217**
Kyoto Protocol		0.033		-0.016
Montreal Protocol		0.298		-0.079
Constant	-29.76***	-28.77***	-14.11*	-15.83**
Observations	275	275	275	275
R-squared	0.778	0.804	0.555	0.603

*** p<0.01, ** p<0.05, * p<0.1

Table 1. Estimation of CO2 and GHG emissions across all panels (OLS)

VARIABLES	lnCO2		lnGHG	
	(5) Less Developed	(6) Developed	(7) Less Developed	(8) Developed
Trade	-0.00068	-0.0035*	0.0047***	0.00445
L.FDI	-0.00183	-0.00583*	-0.0233	-0.0103*
lnGDP	-0.187	7.360**	0.206	-4.000
lnGDP2	0.0980	-0.337**	0.0453	0.213
lnEnergy	0.646*	0.716***	0.755*	0.366
Haze Control	0.107	-0.205*	-0.0536	-0.408***
Kyoto Protocol	-0.123	-0.00172	0.00629	-0.0425
Montreal Protocol	0.335	0.112	-0.0264	0.316
Constant	-6.999	-38.42***	-5.189	19.66
Observations	166	109	166	109
R-squared	0.852	0.822	0.744	0.602

*** p<0.01, ** p<0.05, * p<0.1

Table 2. Estimation of CO2 and GHG emissions in two sub-panels (OLS)

Table 1 and 2 show the estimation results of carbon and greenhouse gas emissions across all panels and in two sub-panels. Among all countries, trade and FDI have significant negative effects on CO2 emissions, which rejects the first hypothesis. Income is also significant, following the inverted U-shaped curve as the signs switches. In contrast, trade is significantly positive to GHG emissions while income per capita is not significant. Energy intensity

significantly increases both pollutants. The inclusion policy variables amplifies the effects of trade and FDI while reduces the impact of income. The ASEAN Haze Control significantly reduces GHG emissions across panels. Comparing the two sub-panels, the independent variables are mostly significant to carbon emissions among developed countries. However, the bad effect of trade on GHG emissions is significant only in less developed countries. The ASEAN Haze Control benefits developed countries significantly on both pollutants. The R-squared values are higher in the CO2 estimation and GHG one with 80.4% and 60.3% respectively.

Table 3 shows the estimation of forest coverage, in which the R-squared value is much lower than the previous estimation. The reasons can be the natural condition factors and the large difference in forest coverage among nations. In all panels, trade is significantly positive to forest percentage while FDI shows the opposite effect. The ASEAN Haze Control significantly contributes to forest gain across panels and in the less-developed country panels. Population growth and urban population share are significantly positive in less-developed and developed countries respectively.

VARIABLES Forest coverage	(9) All	(10) All	(11) Less Developed	(12) Developed
Trade	0.026*	0.033*	0.068*	-0.015
L.FDI	-0.15*	-0.14*	-0.15*	0.052
lnGDP	-11.38*	-9.86	-81.95	-37.54*
lnGDP2	0.80	0.48	5.57	1.94*
Population Growth	0.75	0.66	4.58**	-0.06
Urban Share	0.09	0.046	-0.23	0.17*
Agricultural Land	0.34	0.43	0.53	0.15
Haze Control		2.45*	4.40**	-1.06
Kyoto Protocol		0.01	-4.17	-0.51
Montreal Protocol		-2.35	-0.66	-0.56
Constant	71.02	87.51	321.6	224.1**
Observations	288	264	172	116
R-squared	0.122	0.198	0.449	0.601

*** p<0.01, ** p<0.05, * p<0.1

Table 3. Estimation of forest coverage across all panels and in two sub-panels (OLS)

DISCUSSION AND POLICY IMPLICATIONS

The results from the panel data analysis show the significant benefits of regional integration on all environmental indicators. The share of trade in GDP helps to decrease CO2 emissions in developed countries and increase forest percentage in less developed, but increase GHG emissions in all panels. The role of FDI is also significant in reducing CO2 emissions across panels and GHG emissions among developed countries, however, it may result in deforestation in the all-country analysis. Overall, it can be inferred that openness to trade and foreign direct investment, together with deep integration, are beneficial to the environment in ASEAN+3 region.

This result rejects the hypothesis that increasing trade leads to higher pollution as prior research works found in certain ASEAN countries. With recently rising concerns about pollution, the environmental awareness and efforts to reduce pollution take effects among ASEAN+3 region. Air pollution in mega cities within China, Indonesia or Vietnam directly poses recognizable threats to human health, coupled with the increasing environmental understanding through education in ASEAN nations (ASEAN Secretariat, 2015), induces the public demand for a cleaner environment. The proximity to leading innovators in climate-friendly technology such as Korea in energy storage and Japan in green transportation (Fankhauser et al., 2017) helps ASEAN countries reap the technological spillovers at a lower cost. With the rapid spread of technology transfer, developing countries in ASEAN+3 region have advantageous grounds to catch up and increase their competitiveness in the "green race", which accelerates the transition to a more sustainable economic development instead of the "grow now, pay later" approach of dirty industrialization. These optimistic outlooks of ASEAN+3 in green growth would not be possible without trade liberalization and integration whose impacts fit the technique effects in the theoretical framework. Additionally, if these countries progress with the sustainability transition, the positive composition effects related to the gradual contraction of heavily-polluted sectors will further benefit the environment.

The significance of ASEAN Transboundary Haze Control Agreement supports the second and third hypotheses, proving the importance of regional cooperation in tackling environmental issues. Figure 2 shows the GHG emission map before and after the agreement entered into force.

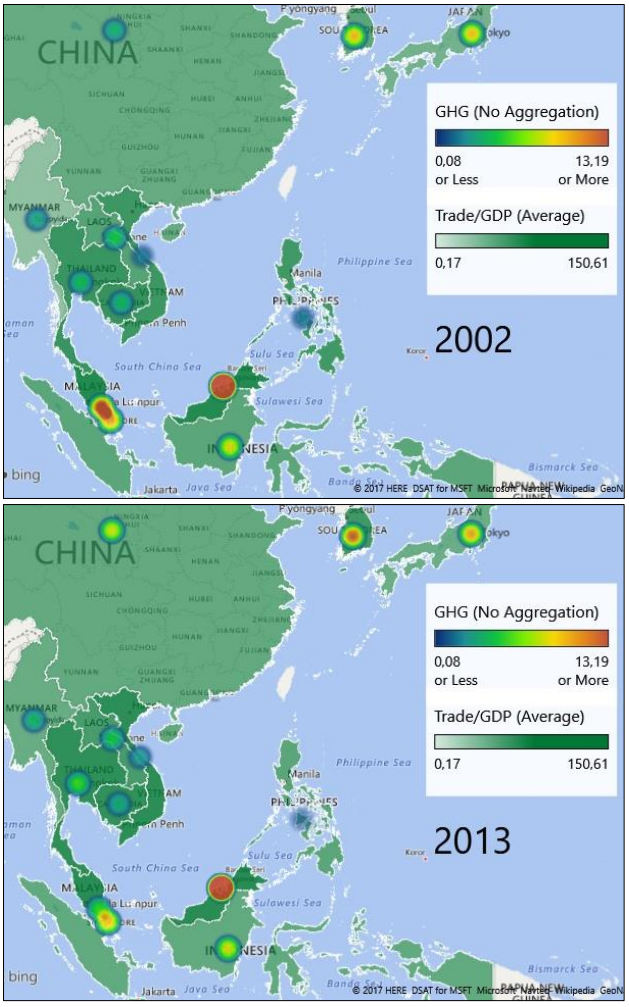

Figure 2. Greenhouse gas emissions and share of trade in ASEAN+3 (2002 and 2013). Source: FAO & World Bank.

The color scale is based on the world average of GHG emissions per capita (6.49) in 2012. Countries with yellow or red colors emit greenhouse gas at a concerning rate. In 2002, before the ASEAN Haze Control Agreement, GHG per capita is much higher than the world average in Singapore, Malaysia, and Brunei. After ten years of

adherence, the emissions decrease considerably in these countries as demonstrated by the color change (Brunei also reduces GHG per capita by 8%, but still much larger than the world average). The Philippines follows a similar trend while the region of Myanmar, Lao, Cambodia, Vietnam, and Thailand experienced slight increases in GHG, partly resulted from the negative impacts of trade growth with darker green shades. The emissions in countries without agreement participation, i.e. China, Korea and Japan rose noticeably. This gives incentives for deeper integration in ASEAN+3 region and exemplifies a successful case of impactful regional environmental agreements.

Multilateral environmental agreements, e.g. Kyoto and Montreal Protocol, however, are not regionally significant. Though legally binding, these may not be consistently complied with due to the differences in resources, laxed monitoring and evaluation. Regional agreements are reached among a small group of parties whose commitments can be more easily assessed and cooperated. ASEAN member states hold the Conference of the Parties (COP) to the Haze Control Agreement and meet back-to-back at least once a year to coordinate on the progress of the parties' commitment (ASEAN Secretariat, 2015).

With respect to deforestation issues, the result show that FDI may lead to forest loss. One plausible explanation for this phenomenon is the practice of land grabbing across Southeast Asian forests as a large amount of land acquisition is associated with FDI projects (ASEAN Secretariat, 2015). Despite the environmental consequences, governments in least developed countries such as Cambodia, Laos, and Myanmar generally welcome these investments. Therefore, the role of government in land management and channeling FDI is crucial to the effects of openness on deforestation.

With the evidence of trade opening and regional integration benefiting the environment, policy makers are advised to take advantage of knowledge spillovers in climate-friendly technology and progressively transit to green growth. Investing in clean renewable energy, high-value low-carbon goods production and energy efficiency is key to reap the positive effects of trade openness and economic development at no expense of the environment. Moreover, the development gap is more of an opportunity than a challenge for developing ASEAN nations. Technology transfer from leading innovators in smart carbon-friendly technologies can be localized to improve carbon efficiency. The home markets of climate-friendly goods can be expanded through FDI from developed countries. The governments, however, should take cautions in allowing FDI project development to prevent negative consequences to the environment and the socioeconomic conditions. Finally, deep integration in pollution reduction and climate change mitigation is effective. Collective commitments from all parties are required for the successful implementation of regional environmental agreements.

CONCLUSION

The ASEAN region is forecast to grow by 5% annually and become the fifth biggest economy by 2020. With the increasing trend in intra-regional trade, the creation of ASEAN Economic Community (AEC) 2015 and the AEC Blueprint 2025, member states show commitments to deep integration more than ever for the regional economic prosperity (ASEAN Secretariat, 2015). The challenge is the quality of growth rather than quantity, whether countries can follow sustainable growth strategies for the long-term benefits or compromise the short-run economic benefits at the expense of the environment. Regional cooperation needs to prioritize the long-run benefits of the region. Technological spillovers to developing countries is one way to eradicate poverty and build capacity to take advantage of trade opening. Environmental regulations should be clearly planned, extensively standardized and closely monitored across ASEAN+3 countries to reduce pollution and fight climate change. More regional environmental agreements concerning shared issues such forest fires and land grabbing need mutual commitments.

This paper is among recent growing research on the environmental impacts of trade and regional integration, and one of few studies investigating this topic in ASEAN+3 region. Further studies following this paper can be the extension of regional scale to the Asian Pacific Economic Cooperation (APEC), the investigation of other environmental indicators such as nitrogen dioxide (NOx) or sulfur dioxide (SOx), more in-depth analysis of trade impacts on the environment in separate sectors such as transportation, construction, energy production, etc. to contribute to the gap in the literature on this topic.

ROLE OF THE STUDENT

Hang Dang was a bachelor student working under the supervision of Rob Bolder and Andrea Ascani when the research in this report was performed. The research question, research design, result processing, policy recommendations, conclusion and completion are solely done by the student as part of her bachelor thesis.

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