Impact of ASEAN-China free trade agreement in CO$_2$ emission of marine transportation

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Abstract: World Summit and Sustainable Development (WSSD) agreed to link international trade with the environment from two aspects to realize sustainable development, namely, mutual support between trade, environment and development; and mutually beneficial between the multilateral trading system and multilateral environmental agreements. In the ASEAN-China Free Trade Agreement (ACFTA) that has been running since 2010, research was mostly focused on trade aspect. This study aims to evaluate CO$_2$ emission from the marine transportation of trade, before and during ACFTA. The data was taken from the UNCTADSTAT, WITS, CEPII. By using the IATA standard of CO$_2$ emissions i.e. 9.53g/ton-km of sea transport, and 8.95g/ton-km of air transport, the results showed that there was an increase 1.6 time in CO$_2$ emissions from ASEAN-China trade transportation from period 2001-2009 (before ACFTA 2009) to period 2010-2018 during ACFTA.

Keyword: air transport; CO$_2$ emission, sea transport, trade openness.

1. Introduction

Economic integration was expected to expand trade among countries partners, and foreign direct investment [1,2,3], as they remove trade barriers with each other. Economic integration will open trade access between countries to another. As [4] states that economic globalization refer to the increasing internationalization of good and services market, financial system, company and industries. Increased trade among partners could be at the expense of environment quality due to production expand and trade transportation.

World Summit and Sustainable Development (WSSD), has agreed to connect international trade and environment, in two aspects. Firstly, to support each other between trade, environmental and development. Secondly, provide beneficiary both in multilateral trade system, and multilateral environmental agreement. There are some environment agreement in the economic integration related to environment, in order to accommodate WSSD agreement. Government of Republic Indonesia (GOI) has established some regulation related to environment and trade. Regulation to protect marine sustainability can be found in act no 17/2008 about shipping/maritime, and Government regulation no 21/2010 about the protection of maritime environment [5]. Environment agreement in economic integration of Tran Pacific Partnership (TPP) consist of agreement to conducting international environment agreement i.e. ozon layer protection, ocean environment protection from shipping pollution, corporate social responsibility, mechanism of partnership in environment, trade and

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biodiversity, invasion of strange species in the land and ocean, and transition toward low emission economic [6].

Although some regulation to protect the environment has been established, on the other side economic integration increase intensively. Association of Southeast Asia Nation (ASEAN) and China agree to increase the trade openness in 2010 within ASEAN-China Free Trade Agreement (ACFTA). Despite give an advantage in foreign direct investment, this FTA also has increased Indonesia import from China [7, 8], vice versa.

According to [9] ACFTA has made Asia as a center of world industrial mobilization which contribute 15.79%, higher than 4 other continents i.e. Europe (8.75%), USA (7.86%), Australia (0.49%), and Africa (0.30%). Meanwhile, from 10.047 million ton of world volume in 2016, Asia contribute 41%, of which 90% delivered by marine transportation [9] and the rest by air transportation.

Indonesia marine transportation is the dominant trade transportation. Its contribute 1.84% of world container volume, or in 12th world rank, where the first rank was China (contribute 28.4% volume) [5]. During 2014-2017 period, the container volume increase from 11,237,450 TEUs (Twenty-food equivalent unit) to 13,849,762 TEUs [10], increase 7.26% per year. Container transportation, in turn would produce CO₂ emission. According to [10], marine transportation contribute 3% of greenhouse gases. Base on [12] standard, CO₂ emissions from air transport was 985.97g/ton-km, and from sea transport was 9.53g/ton-km. Base on those problem formulation, this study looked into the impact of ACFTA on trade between Indonesia-China and its impact on CO₂ emission of international trade transportation.

2. Methodology
In this present study the data used are secondary data. Data of trade flow (export value and volume) was taken from [13,14,15]. The financial data are expressed in US$ and adjusted for inflation using Consumer Price Index with 2010 basic year. Data of geographic distance (distance from country capital city to capital city) was taken from [16]. Yearly panel data from 2001-2018, in six ASEAN countries plus China, were analyzed using two research approaches. The first is based on descriptive statistics of export and import value average before and after ACFTA (formula 1). The second approach is quantify the trade transportation, which in turn CO₂ emission (formula 2 and 3).

\[
\text{Trade average: } \frac{\sum_{i}X_{\text{value}}}{T} \tag{1}
\]

\[
\text{CO}_2 \text{ emission air transportation: } X_{\text{volume}} \times GD \times E_{\text{air}} \tag{2}
\]

\[
\text{CO}_2 \text{ emission sea transportation: } X_{\text{volume}} \times GD \times E_{\text{sea}} \tag{3}
\]

Where:
- \(X_{\text{value}}\) : value of export (US$)
- \(M_{\text{value}}\) : value of import (US$)
- \(X_{\text{volume}}\) : volume of export (Ton)
- \(GD\) : geographic distance capital to capital (km)
- \(E_{\text{air}}\) : CO₂ emission from air transport (985.97g/ton-km)
- \(E_{\text{sea}}\) : CO₂ emission from sea transport (9.53g/ton-km)
- \(i\) : year t (i: 1-9 refer to 2001-2009 before ACFTA; 1-9 refer to 2010-2018 during ACFTA)

3. Result and Discussion
Figure 1 presents the contribution of each country in ASEAN-China trade before FTA and during FTA (free trade agreement). Trade value is reflected by export value. The contribution to trade, of most ASEAN countries decrease during ACFTA, except Viet-Nam and Cambodia which are increase 1% respectively. China gain from ACFTA by increasing their export contribution from 31% before ACFTA, to 40% during ACFTA. This finding supported by [17], which was found that under period 2010-2013 the leader of trade was China.
Although during ACFTA, some countries reduce their contribution, the value of export of all countries relatively increase as depicted in figure 2. At the beginning of ACFTA, all countries get beneficiary from export. The finding provide that besides open trade access, FTA also facilitate a country to participate in global value chain (GVC) [18]. In GVC, industries import input and export the output. In turn global value chain would create added value in industrial and services sectors [19].

Since 2013, export from Indonesia was decrease, following by Malaysia and Thailand, until 2016. Meanwhile Cambodia, Viet Nam and China export always increase until 2018. The different experiences of different countries suggest that there have been change in competitiveness [3,20,21,22]. China product in the most competitive among the ACFTA countries. Figure 1 and figure 2 also explain that gain from FTA was disproportionately distributed among countries member. This finding relevant with research finding conducted by [23,24] that globalization has positive impact on economic growth, but not proportionally distributed among the members.
The average value of trade provides the evidence that the degree of trade was higher during ACFTA (2010-2018) compared with post-ACFTA (2001-2009) period (figure 3). The average export value post ACFTA (total of 6 countries) was US$ 171.23 Billion. During ACFTA, the value increase to US$ 386.28 Billion, or increase by 126%. The increasing trade volume after the 2010 ACFTA, had followed by increasing of marine transportation, since 90% of international trade delivered by marine transportation [9]. Marine transportation derive air pollutants emission from sea-based activities and port activities [25]. There are many greenhouse gases emission from marine transportation, and the highest emission is carbon dioxide (CO₂) [25,26,27]. As mention before that CO₂ emissions from air transport was 985.97g/ton-km, and from sea transport was 9.53g/ton-km [12], then the CO₂ emission can be calculated using formula 2 and formula 3.

The average CO₂ emission from trade transportation was higher during ACFTA (2010-2018) compared with post-ACFTA (2001-2009) period (figure 40). The average trade transportation emission CO₂ post ACFTA (total of 6 countries) was 38,387,421 ton per year. During ACFTA, the emission increase to 101,151,573 ton per year. Base on the equation of emission $CO₂\text{ emission} = 10^7t^{0.7978}$
(where: \( t = \) year; \( t \) for 2001 = 1 and \( t \) for 2018 = 18 etc.), in the next 5 year the trade transportation emission of CO\(_2\) in ACFTA region will reach 122,429,019 ton per year.

### 4. Conclusion

Every country member of ACFTA, gain from increasing their export, although the gain was disproportionately distributed. The highest export gain, goes to China. Trade value during ACFTA (2010-2018) was multifold 1.6 time of post ACFTA (2001-2009). This trade increase followed by CO\(_2\) emission from trade transportation which increase from 38,387,421 post ACFTA to 101,151,573 ton per year during ACFTA, and increase 0.8% per year.

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Acknowledgments
We thank to UNCTADSTAT, WITS, and CEPII, for the data provided of this research. We are also grateful to our colleagues from Program Study of Economics, Faculty of Economics and management, who provided technical assistance in this research.