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Article

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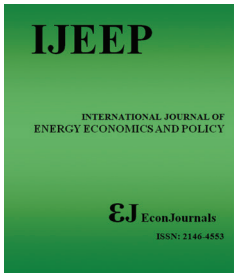

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Sustainable Exports to the European Union from ASEAN Countries: Is There an Impact of Low Carbon Economy?

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ABSTRACT

Trade and climate change are thought to be closely related. Sustainable trade cooperation with European Union (EU) countries is often linked to the issue of climate action and low carbon emissions. This research aims to examine the low carbon economy and the economic distance of ASEAN countries (Indonesia, Malaysia, Philippines, Singapore, Thailand) towards their exports to EU countries. A low carbon economy is measured by the intensity of GHG emissions, analysed from three scopes, namely CO_2 from manufacturing and industrial processes (part of scope-1), CO_2 from electricity consumption (part of scope-2), and CO_2 from waste (part of scope- 3). Data source from emissions database for global atmospheric research (EDGAR) and other sources, 2012-2022. Panel data regression with a gravity model is used in this analysis. The results show the implementation of a low carbon economy in ASEAN, so that in the future there seems to be continued trade between ASEAN countries and the EU. This is proven by the negative influence of carbon emission intensity scope-2, scope-3, and economic distance on increasing ASEAN exports, except scope-1. Low intensity means there is efficient use of resources for the economy, and low economic distance means trade is competitive.

Keywords: Trade, Low-Carbon Economy, Intensity of Carbon Emissions, Economic Distance
JEL Classifications: F1, Q56, Q37, F12

1. INTRODUCTION

The current climate change is a serious problem for all countries in the world because it has the potential to cause serious impacts on the environment, economy, society and human life as a whole. The impacts of climate change can vary, such as extreme temperature variations and rainfall, floods, droughts, and fires. One of the causes of climate change is the use of non-renewable fossil energy which drives an increase in carbon dioxide (CO_2) emissions (Acaroğlu and Güllü, 2022; Zhang et al., 2023). Carbon dioxide is the largest contributor to Green House Gas (GHG) emissions, apart from methane gas (CH4), nitrogen oxide (N_2O) and fluorine gas, which is believed to accelerate climate change and worsen its impacts (Mehmood et al., 2022; Soeder, 2022). Therefore, climate change mitigation requires rapid economic decarbonization (Åhman et al., 2017; Rockström et al., 2017; Semieniuk et al., 2021).

The World Trade Organization (WTO) says that trade and climate change are closely related so that mitigation and adaptation to climate change will require stronger and better international trade cooperation by encouraging the transition to a sustainable, low-carbon economy (WTO, 2022). Many developed countries in the European Union (EU) have implemented low-carbon economic regulations, especially in terms of imports of goods. This was done by the EU in responding to climate change with the Paris Agreement in 2015. This agreement targets the EU to reduce greenhouse gas emissions by at least 40% by 2030, and calls on members to adopt steps to support renewable energy sources, namely to reduce greenhouse gas emissions by 80-95% by 2050 and limiting global warming to bellow 2°C or preferably 1.5°C (Duscha et al., 2019; Potrč et al., 2021). Low-carbon economy is also implemented through increasing investment in the production of various forms of renewable energy, as well as providing

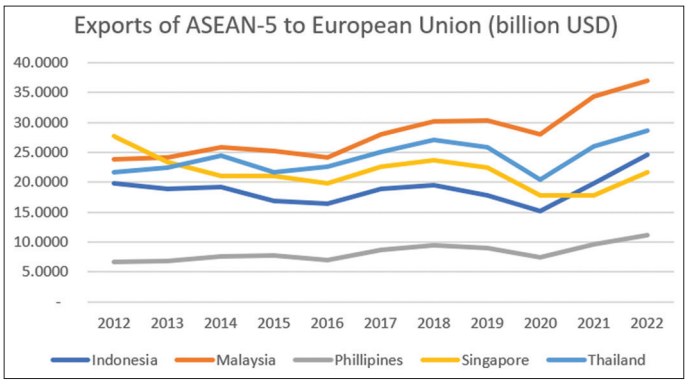
incentives in the form of price subsidies for the newest forms of energy, in order to increase the adoption of renewable energy in EU countries (Adedoyin et al., 2021). This is in line with the 13th Sustainable Development Goals (SDG's), namely the need for Climate Action in implementing climate change measures into policies, strategies and planning.

International trade cooperation between EU countries and ASEAN countries (The Association of South East Asia Nations) shows good performance. ASEAN as a whole represents the EU's third largest trading partner outside Europe (after China and the US) with goods trade of more than €271.8 billion in 2020, whereas the EU is ASEAN's third largest trading partner, with exports accounting for 10% of total exports (https://www.eeas.europa.eu/asean/european-union-and-asean_en?s=47). Figure 1 depicts the development of ASEAN-5 (Indonesia, Malaysia, Philippines, Singapore, Thailand) exports to the European Union, which fell before the pandemic, but rose again after 2020.

ASEAN is a region experiencing rapid economic and population growth with high energy dependence as well as a significant increase in energy consumption and pollution emissions in the last few decades (Chontanawat, 2020). The increasing evolutionary challenges have caused the ASEAN region to also experience increasing ecological events and climate change through rising temperatures (Wu et al., 2021), which is caused by increasing emissions of carbon dioxide and greenhouse gases (Hui et al., 2022; Kabir et al., 2023). Therefore, several goods that are not environmentally friendly originating from countries in ASEAN are refused entry to EU countries. For example, restrictions on palm oil imports from Indonesia and Malaysia implemented by several EU countries. EU countries limit themselves in importing palm oil from Indonesia and Malaysia due to issues of deforestation, forest burning and slaughter of wildlife in palm oil plantation areas (Hinkes, 2020; Rifin et al., 2020). The existence of these restrictions has affected the performance of exports of goods from ASEAN countries to the EU, although total exports of ASEAN-5 countries to the EU are still increasing.

Apart from the issue of deforestation, the EU has also implemented the carbon border tax, which is an integral part of the EU's broader climate change policy changes (Aylor et al., 2020). Imposing this tax in order to meet its ambitious climate targets by 2030, and achieve net zero emissions by 2050, the EU must increase barriers efforts in the manufacturing industry, buildings and transport sectors.

Figure 1: Exports of ASEAN-5 to European Union



Source: Trading economics

2. LITERATURE REVIEW

The restrictions made above are an initial step in implementing a low-carbon economy in EU countries (Bellora and Fontagné, 2023; Sapir, 2021). Mathematically, trade barriers to exports from countries of origin outside the EU are expressed as follows:

$$EX_{ij} = F\,(Brr_{ij}) \quad (1)$$

EX_{ij} is the exports from origin countries i to destination countries at the year j. Brr_{ij} is a trade barrier for origin countries from destination countries at the year j. Based on the relevant studies above, the carbon emission (CE_{ij}) can be a trade barrier for origin countries.

$$EX_{ij} = F\,(CE_{ij}) \quad (2)$$

CO_2 emissions are pollutants that come from burning fossil energy and manufacturing, which is the largest contributor to GHG emissions (Yoro and Daramola, 2020). According to the 2022 Emissions Database for Global Atmospheric Research (EDGAR), global GHG emissions consist of CO_2 emissions resulting from burning fossil fuels (71.6%); CH4 (methane gas) contributed 21% to total emissions, while the remainder consisted of N_2O (nitrogen oxide) at 4.8% and fluorine gas at 2.6% (Crippa et al., 2021). The world resources institute (WRI) and the World Business Council for Sustainable Development (WBCSD) explain that GHG emissions are divided into three categories, namely the scope-1 is direct emissions from sources and assets controlled by companies; the scope-1 is indirect emissions from electricity; and scope-3 is indirect emissions in the production value chain (Nguyen et al., 2023):

Scope-1: Direct GHG emissions, are GHG emissions that occur directly from sources owned by the company, including:

- Stationery combustion or stationary combustion which includes all fuel and heating sources that produce GHG emissions.
- Mobile combustion or burning of vehicles which includes carbon projects originating from all types of vehicles owned by the company.
- Fugitive emissions or leak emissions which include leakage of GHG emissions from certain sources such as air conditioning or refrigerators.
- Process emissions which include GHG emissions originating from manufacturing processes and any industry.

Scope-2: Electricity indirect GHG emissions, are indirect GHG emissions related to the purchase of electricity, steam, heating or cooling, which are purchased and consumed by the company. Purchased electricity is defined as electricity purchased or otherwise brought within the company's organizational boundaries. These emissions occur physically in the facilities where electricity is generated.

Scope-3: Other indirect GHG emissions, includes all carbon emissions that do not fall within the limits of scopes-1 and scope-2. These emissions are also referred to as value chain emissions, because they often represent the majority of an organization's total GHG emissions. Greenhouse Gas Protocol (https://ghgprotocol.org/ghg-protocol-cities) groups scope-3 emissions into 15 categories from upstream and downstream activities of organizations. Upstream activity emissions come from business travel, employee travel, waste generation, purchased goods and services, transportation and distribution, fuel and energy related activities, capital goods, and upstream leased assets. The organization's downstream activity emissions include investment, downstream distribution and transportation, processing of products sold, franchising, downstream rental assets, use of products sold, and discontinuation of products at the end of their useful life.

Reducing carbon emissions includes increasing renewable energy in the energy mix, improving industrial processes, providing energy efficiency incentives, and improving solid waste management (Di Leva and Shi, 2017; Rajaeifar et al., 2017). In economic activities, the implementation of a low-carbon economy is represented by fundamental changes in the current production and consumption of fossil fuel energy (Araújo and De Medeiros, 2021; Li and Sun, 2018). A low-carbon economy is an economic development model that aims to reduce negative impacts on the environment, especially in terms of energy consumption, pollution and GHG emissions which contribute to climate change. A low carbon economy is a low carbon economic activity that aims to create economic output by adjusting the energy mix and increasing energy efficiency (Nevskaya et al., 2023; Oh et al., 2023). Low carbon emissions indicate low fossil energy consumption. This low carbon economy can be measured by the intensity of fossil energy consumption which produces output for economic activities (e.g. GDP, Manufacturing value-added, etc.).

$$ICE_{ij} = \frac{Carbon\,emission_{ij}}{GDP_{ij}} \quad (3)$$

ICE_{ij} calculates the intensity of carbon emissions in country i in year j. Carbon intensity expresses the efficiency of resource utilization and carbon emission efficiency in economic development while reflecting the level of production technology efficiency of a country or region to a certain extent (Xu et al., 2024; Yan et al., 2017). Carbon emission intensity refers to the amount of carbon dioxide emitted per unit of GDP (Ang and Su, 2016; Chen et al., 2019; Dong et al., 2018). Therefore, the less CO_2 emitted per unit of GDP, the lower the intensity, and the more efficient the use of resources, and vice versa. Carbon intensity is one of the most important indicators because it provides detailed information regarding future energy strategies and CO_2 emission reduction policies (Zhang et al., 2017).

Furthermore, starting from the Gravity Model which states that trade flows between two countries are directly correlated with the economic potential of both countries, with the economic size of each country and the geographical distance between them (Golovko and Sahin, 2021), then the intensity of carbon emissions can be considered as economic size in this model. The gravity model, originally proposed by Jan Tinbergen in 1962 (De Benedictis and Salvatici, 2011), is widely used as a benchmark for measuring trade flows between two countries, which assumes that trade flows between two countries are positively related to the size of their economies, and inversely proportional to the distance between the two countries (Osabuohien et al., 2019). Walter Isard (1954) developed the Gravity model for the 1st time, where G is a constant, F means trade flows (Exports, or imports), D means distance, and M means the economic dimensions of the country being measured:

$$F_{ij} = G.\frac{M_i M_j}{D_{ij}} \quad (4)$$

Or, in general terms for the country of origin:

$$Ex_{ij} = F\,(M_i\, M_j, D_{ij}) \quad (5)$$

Distance can be applied to economic distance, which is defined as the difference in resources of the destination country compared to the origin country. Economic distance refers to how similar the economic system and metrics are between the home and foreign countries. This could result from differences in terms of macro-economic indicators such as per capita gross domestic product (GDP), economic growth rates, inflation, unemployment rate, rich–poor differences, and access to natural resources (Le, 2017). The greater the difference in resources between the two economies, the more difficult it will be to succeed. One way to measure the difference is by GDP per capita. Countries with the same GDP per capita have a greater chance of success (Liu et al., 2020). Economic distance also reflects differences in factor costs and technological capabilities between host and home countries (Tsang and Yip, 2007). The economic distance between two countries is a free trade agreement, has an impact on increasing employment opportunities, and provides comparative advantages for partner countries, which in turn reduces the gap in economic status, for example GDP, growth rates (Yao et al., 2019). The calculation of economic distance in this research was developed from the economic distance formula by Le (2017) to be as follows:

$$EcD_{ij} = Dis_{ij} X \frac{GDP\,percapof\,EUCountries_{ij}}{GDP\,percapof\,ASEAN-5countries_{ij}} \quad (6)$$

EcD_{ij} is the economic distance from origin country i to destination country in year j; Dis_{ij} is the actual distance from the capital of ASEAN 5 countries to Brussels-Belgium as an EU administrative city. Differences from the model of Le (2017) above is that the Le's model uses the GDP, while this model uses the GDP per capita.

By combining equations (3), (5) and (6), the general equation for exports from the origin country to the destination country is as follows:

$$EX_{ij} = F\,(ICE_{ij}, EcD_{ij}) \quad (7)$$

Several previous studies have examined the importance of a low-carbon economy and distance to economic growth, but not

many have linked it to exports to European Union countries. This research aims to analyse whether countries in ASEAN have implemented a low-carbon economy, and whether the intensity of carbon emissions and economic distance have an effect on the exports of ASEAN-5 countries to the European Union. The low carbon economy in this study is measured by the intensity of GHG emissions in three scopes, where the carbon emissions of each scope are part of the total carbon emissions of each scope.

3. METHODOLOGY

This research aims to examine low carbon emissions in ASEAN-5 countries, and examine whether the intensity of carbon emissions (ICE) and economic distance (ECD) in these countries affect their exports to EU countries. The sample is ASEAN 5 countries (Indonesia, Malaysia, Philippines, Singapore, Thailand) which exported to the EU from 2012 to 2022. Analysis uses descriptive analysis, and a panel data regression equation model with the Gravity model. The use of the panel data regression equation model follows a certain procedure, which begins with selecting the model to be used, using the Chow-test, Hausman-test and Lagrange Multiplier test, in order to choose the best model, whether it is the common effect model (CEM), fixed effect model (FEM), or random effect model (REM), then detects whether there is multicollinearity and heteroscedasticity in the model, as well as normality test.

If all the requirements have been met, then carry out hypothesis testing in equation (8), which has been changed to a multiple linear regression equation. For analytical purposes, the intensity of carbon emissions in this study is separated into three scopes, so that equation (8) becomes:

$$EX_{ij} = \propto + \beta_1 ICE1_{ij} + \beta_2 ICE2_{ij} + \beta_3 ICE3_{ij} + \beta_4 EcD_{ij} + \varepsilon_{ij} \quad (8)$$

Due to differences in units and variable quantities, all variable data is in natural logarithmic form, so the equation becomes:

$$Ln\, EX_{ij} = \propto_i + \beta_1 ln\, ICE1_{ij} + \beta_2 ln\, ICE2_{ij} + \beta_3 lnICE3_{ij} + \beta_4 lnEcD_{ij} + \varepsilon_{ij} \quad (9)$$

EX_{ij} is exports from ASEAN i countries to the EU in year j; $ICE1_{ij}$ represents intensity of carbon emissions originating from any manufacturing and industrial processes in a origin country i in year j, measured with carbon emissions scope 1 (https://edgar.jrc.ec.europa.eu/report_2023) divided by manufacturing value added; $ICE2_{ij}$ represents the intensity of carbon emissions originating from electricity consumption, measured with carbon emissions scope 2 (https://ourworldindata.org/grapher/carbon-intensity-electricity) divided by constant GDP/capita; and $ICE3_{ij}$ represents the intensity of carbon emissions originating from waste (solid waste disposal and waste water treatment), measured with carbon emissions scope 3 (https://edgar.jrc.ec.europa.eu/report_2023) divided by manufacturing value added. EcD_{ij} is the economic distance calculated based on equation (6), using actual distance data from the capital cities of ASEAN countries to Brussels-Belgium, as well as GDP per Capita data from destination and origin countries (http://www.cepii.fr/CEPII/en/bdd_modele/bdd_modele_item.asp?id=8). The scope-1 and scope-3 carbon emission unit data is $mtCO_2eq$/year, while the scope-2 carbon emission unit is grCO2eq/KwH.

4. RESULTS AND DISCUSSION

4.1. Low Carbon Economy: Have ASEAN Countries Done it?

A low-carbon economy is characterized by low energy consumption, low pollution and low emissions (Xie et al., 2023), and plays an important role in realizing the smooth transformation of economic structure and sustainable development of economy and society (Liu and Ma, 2023).

Figure 2 shows the development of GHG carbon emissions and their intensity in ASEAN-5 countries in 2012-2022 which are grouped into three scopes. Scope-1 carbon emissions (resulting from manufacturing and industrial processes) tend to increase slightly in ASEAN countries, especially Indonesia, which increased quite high starting in 2015. The overall intensity of scope-1 carbon emissions fluctuates in each country, with the lowest intensity is Singapore and the highest is Malaysia. However, starting in 2020, the intensity of all countries decreased, although previously there were several countries whose intensity had decreased. This means that countries in ASEAN have made efficient use of energy resources.

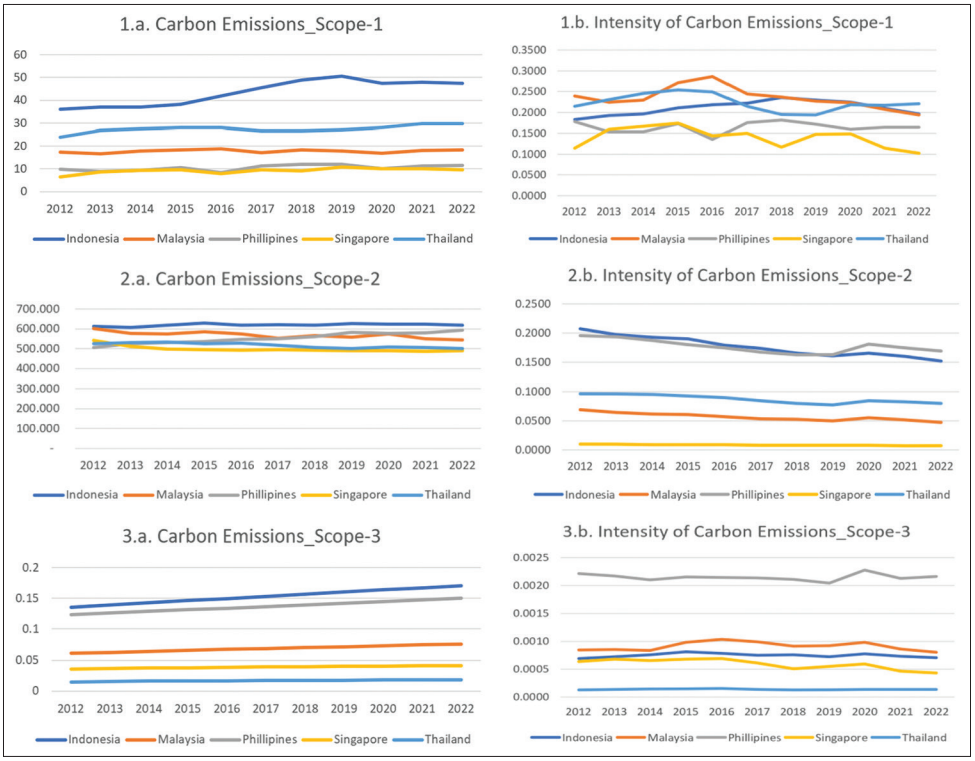
Scope-2 carbon emissions (results from electricity consumption) tend to stagnate from year to year, but the intensity of carbon emissions tends to decrease in all countries. This means that ASEAN countries have made efficient efforts in electricity technology. The lowest scope 2 carbon emissions are Singapore and the highest are Indonesia, while the lowest carbon emission intensity is Singapore and the highest are the Philippines and Indonesia. Even though it tends to decrease, the carbon emission intensity of the Philippines and Indonesia is still higher than the other three countries.

Scope-3 carbon emissions (carbon emissions from waste) show a steady and low trend for Thailand, Singapore and Malaysia, while carbon emissions for Indonesia and the Philippines are increasing. The intensity of carbon emissions in Thailand is the lowest and constant, the other three countries show a slight decreasing trend, while the Philippines is the highest and slightly increasing.

A reduction in carbon intensity means there is a commitment from these countries to implement a low-carbon economy. The decreasing intensity of carbon emissions can be interpreted as meaning that countries in the ASEAN region have attempted to implement efficient use of energy in their economic activities, and can also mean that they have attempted to implement future energy strategies in their economic activities. This is because the lower the intensity of CO_2 emissions, the less CO_2 emissions are emitted per unit of GDP. Singapore is the most efficient country in utilizing energy resources, while the Philippines is the opposite.

Scope-1 and scope-3 carbon emissions in ASEAN-5 still tend to increase, especially in Indonesia, which is higher than other

Figure 2: Carbon emissions and intensity of carbon emissions



Source: The authors

Mt CO_2 eq. /Manufacturing value added in USD billions (ICE_Scope 1) gr CO_2eq/KwH/GDP per cap in USD (ICE Scope 2) Mt CO_2 eq./Manufacturing value added in USD billions (ICE Scope 3)

ASEAN countries. Carbon emissions are high because Indonesia is the country with the 4th largest population in the world and has the largest GDP in ASEAN. However, in 2022, based on a press release from the Ministry of Energy and Mineral Resources (https://www.esdm.go.id/), Indonesia has succeeded in reducing GHG carbon emissions by 118.2 million tonnes of CO_2, where this figure exceeds the target which is planned to reduce emissions by 2023 by 116 million tons of CO_2. And this is proven by the continued decline in the intensity of carbon emissions in Indonesia. This reduction in carbon emissions is in line with Indonesia's commitment to realizing GHG reduction based on the Paris Agreement, which Indonesia and every other ASEAN country has stated in their nationally determined contribution (NDC).

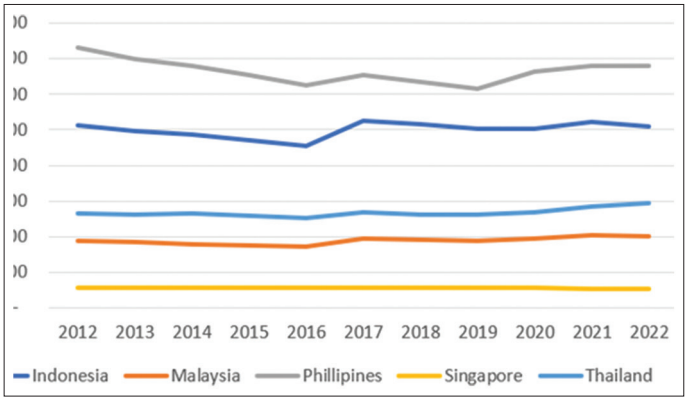
ASEAN has also established a strategy for ASEAN Carbon Neutrality, which aims to accelerate an inclusive transition towards a green economy, fostering sustainable growth and complementing national efforts as part of a regional collective effort. There are four main results expected from this strategy to ensure ASEAN's competitiveness on the global stage and readiness for transition, consisting of developed green industries (capturing the full value of regional green value chains to unlock ASEAN manufacturing and export potential), interoperability within ASEAN (enabling exchange of green electricity, products, and feedstocks to accelerate the roll out of green technologies), globally credible standards (ensuring ASEAN remains a top destination for international capital to increase liquidity in regional markets), and green capabilities (developing the necessary green talent and expertise within ASEAN to drive the climate transition).

4.2. Economic Distance: Does it Reflect Competitiveness?

Economic distance is the distance associated with differences in geographic distance and comparison of economic indicators of the destination country and the origin country. Economic distance reflects differences in the costs of production factors and differences in technological capabilities between the destination country and the origin country. The higher the economic distance, the higher the factor costs of the origin country compared to the factor costs of the destination country, and vice versa. It can also be interpreted that the smaller the economic distance, the more competitive the technological capabilities. The magnitude of the economic distance from year to year between ASEAN-5 countries is calculated using equation (6).

Figure 3 depicts the development of the economic distance of ASEAN countries in 2012-2022. There is a tendency for a slight increase in economic distance, where the lowest economic distance is Singapore, followed by Malaysia, and then Thailand, while the Philippines is the country with the highest economic distance, followed by Indonesia. This shows that Singapore is more competitive than other ASEAN countries in trade with the EU, while the Philippines and Indonesia are less competitive. The economic distance of ASEAN countries seems to be in accordance with the amount of these countries' exports to the EU, as seen in Figure 1, where Singapore is the highest exporting country, while the Philippines is the lowest. This relationship was also explained by Le (2017), who conducted research in Vietnam, that economic distance had a negative effect on trade. Longer economic distance

Figure 3: Economic distances of ASEAN-5 countries



Source: The authors

can hinder their bilateral trade, because greater economic distance means there are quite high differences in demand structures. Countries with different demand structures will import and export less horizontally differentiated products. Thus, bilateral trade volume will decrease as economic distance increases. Conversely, countries tend to increase their mutual trade (intra-industry trade) when the countries have approximately the same per capita income and corresponding demand structures.

4.3. The Effect of Low-Carbon Economies and Economic Distancing on Exports

A low-carbon economy has been implemented in ASEAN countries, characterized by decreasing carbon emission intensity. On the other hand, several ASEAN countries have competitive trade with the EU, seen from their low economic distance, especially Singapore, Malaysia and Thailand, while Indonesia and the Philippines are less competitive. However, can low carbon emissions and economic distance increase ASEAN countries' exports to the EU?

Table 1 shows the answer to the question whether a low-carbon economy and economic distance affect exports, which is preceded by testing the prerequisite panel data regression equations. This table shows that the data is normally distributed and there are no symptoms of heteroscedasticity, and the correlation between dependent variables is low. Based on the Chow-test and Hausman-test, the best model is the fixed effect model.

Based on the t-test, the intensity of carbon scope-2 (ICE2), scope-3 (ICE3) and economic distance (EcD) have a negative effect on ASEAN countries' exports to the EU, while the intensity of carbon scope-1 (ICE1) does not. Constanta (C) is also significant, it implies that the baseline level of the dependent variable (when the independent variable is 1) is significantly different from zero. These results show that if ICE2 falls by 10% then Exports will rise by 8.7%, if ICE3 falls by 10% then exports will rise by 4.2%, and if the economic distance (EcD) falls by 10% then Exports will rise by 6.2%.

As mentioned previously, carbon emissions intensity is the amount of carbon emitted per unit of GDP (or another output measure), so a lower intensity reflects a more efficient use of

Table 1: Test the prerequisites and t-test for the regression equation

Test				Prop.
Normality-test:				
Jaeque Bera				1.297
prob.				0.523
Heteroscedasticity-test:				0.000
Multicollinearity test:				
Corelations				<0.36
Chow-test:				
prob. c-s F				0.001
prob Chi-square				0.000
Hausman-test: pr ob. c-s random				0.000
Conclusion: The best model is FEM				
Dependent variable: Ln exports				
Variable	**Coefficient**	**Std error**	**t-statistic**	**Prob**
C	4.925	1.494	0.444	0.10**)
Ln ICE1	0.137	0.139	0.986	0.33
Ln ICE2	−0.865	0.094	−9.169	0.00***)
Ln ICE3	−0.423	0.187	−2.261	0.03***)
Ln ECD	−0.617	0.262	−2.350	0.02***)

***) sig. 5%; **) sig. 10%

Sources: The authors

FEM: Fixed effect model, ECD: Economic distance

fossil resources. The efficiency in question can mean that the percentage increase in GDP is much greater than the percentage increase in carbon emissions. Based on the regression results above, an increase in exports is related to a decrease in GHG emission intensity, especially for scope-2 carbon emissions and scope-3 carbon emissions. This condition is in accordance with the commitment of ASEAN countries in implementing the Paris Agreement which is applied in international trade, that developed countries and developing countries have the same relationship. Collective obligation to reduce greenhouse gas emissions. Trade can play an important role in driving climate action, in particular by facilitating the diffusion of climate-friendly products (Di Leva and Shi, 2017). Carbon emissions which tend to increase in ASEAN countries do not yet support climate change action, but provide economic benefits for the countries concerned because the intensity decreases. Meanwhile, scope_1 carbon emission intensity (carbon emissions from the manufacturing/production process) has no effect on ASEAN countries' exports to the EU. This is caused by fluctuations in the intensity of carbon emissions in all countries, and the intensity in all countries fell in 2020 (Figure 2). The fluctuating intensity of carbon emissions is caused by unstable manufacturing products when carbon emissions continue to increase.

Economic distance, which has a negative effect on exports, means that if ASEAN countries' trade with the EU becomes more competitive, then ASEAN countries' exports will increase. However, like trade in general, increased exports from the origin country or increased imports from the destination country are more due to an increase in demand from the destination country for several reasons. This stands to reason that because of the economic conditions following the Covid-19 pandemic and the influence of the Russia-Ukraine war, demand for goods from ASEAN to the EU has increased.

5. CONCLUSION

This research aims to determine the existence of a low-carbon economy and the economic distance of the ASEAN-5 countries (Indonesia, Malaysia, Philippines, Singapore and Thailand), and to examine its influence on exports to European Union countries. The low carbon economy is measured by the CO_2 GHG emission intensity which is broken down into three emission scopes, namely scope-1 emission intensity (CO_2 emissions from manufacturing processes and any industry), scope-2 (CO_2 emissions from electrical activities) and scope-3 (CO_2 emissions from upstream activities related to solid waste disposal and waste water treatment).

Based on the analysis that has been carried out, it is known that CO_2 GHG emissions from the three scopes continue to increase, but the intensity of scope-2 and scope-3 is decreasing, while the intensity of scope-1 emissions tends to fluctuate. The decreasing intensity of carbon emissions indicates efficient use of resources for the economy (as measured by the amount of CO_2 emitted per unit of manufactured product or GDP). The CO_2 emission intensity of scope-2 and scope-3 has a negative influence on the increase in exports of ASEAN-5 countries to the EU, while the CO_2 emission intensity of scope-1 has no influence. Meanwhile, economic distance (measured by the ratio of GDP per capita of the two countries of origin and destination, as well as geographical distance) has a negative influence on the increase in exports of ASEAN-5 countries to the EU. This means that there is competitive trade between ASEAN-5 countries and the EU. The lower the economic distance, the more competitive trade from origin countries to destination countries.

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