

# The Impact Analysis of Normalized Revealed Comparative Advantage on ASEAN's Non-Oil and Gas Export Pattern

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*Abstract—The development of global economic challenges has forced ASEAN countries to further deepen its economic integration within the ASEAN Economic Cooperation (AEC) and to incorporate several ASEAN Plus agreements into Regional Comprehensive Economic Partnership (RCEP). Under this circumstance, the ASEAN members need to distinguish that the difference in comparative advantage of each export commodity affects the pattern of ASEAN's non-oil exports. This study attempts to identify the impacts of comparative advantage, represented by Normalized Revealed Comparative Advantage (NRCA) index, on the non-oil export pattern of the ASEAN countries using the augmented gravity model as its research method. The results indicate that comparative advantage positively influences the ASEAN's non-oil exports; and that the comparative advantages have the biggest influence in agricultural commodities.*

**Keywords:** Comparative Advantage, Export Pattern, NRCA, ASEAN, Gravity Model

## I. INTRODUCTION

Studies related to ASEAN trade flows are, among others, the ones conducted by [1] and [2]. Both studies utilized export pattern approach in viewing trade flows. Both researches took the derivative products of comparative advantage: complementarity and similarity indices, as variables. Both of these variables are considered able to capture a comparative advantage in terms of differences in endowment factor and to explain product differentiation and inequality in product demand. Yet, the comparative advantage is in aggregate, whilst the difference in either each commodity or each group of commodities cannot be shown by these two variables.

Yue and Hua (2002) [3] in their study which aimed to identify the effects of comparative advantage on export patterns did not use the gravity model, but the model of export supply instead. Such research is able to explain that the comparative advantages affect export performance with index variable of Revealed Comparative Advantage (RCA) as an approach. Considering that RCA has several drawbacks, the study refers to [4] who modified RCA index equation into Normalized Revealed Comparative Advantages (NRCA) index which can cover the shortcomings of RCA index.

Therefore, to answer the two questions related to the pattern of non-oil export of ASEAN member countries in the ASEAN

market, this study will use gravity model by adding index NRCA as one of the variables. It is then expected that NRCA has impact on the pattern of ASEAN non-oil exports. Moreover, this can be one of the considerations for ASEAN member countries in determining trade policy, particularly in terms of which commodities need to be focused on to increase the non-oil exports.

In general, this study aims to identify the determinants of ASEAN's non-oil exports in the ASEAN market. Furthermore, this study seeks to determine the effects of comparative advantage, that is, NRCA, on the pattern of ASEAN's non-oil exports during the period of 1989-2012.

Utilizing panel data analysis, this research finding suggests that comparative advantage positively affects the non-oil exports; and comparative advantage of natural resources-based commodities has the greatest impact.

## II. METHODOLOGY

This study refers to and modifies the model used by [1] and [2] which modified the augmented gravity model from basic model variations of [5] and [6]. Additionally, this research model also refers to [3] and [4]. Therefore, the modification in this study to the models used in the two previous studies is replacing the complementarity index variable with Normalized Revealed Comparative Advantages (NRCA) variable index, which can present the export pattern based on of comparative advantage comparison from commodity groups. The equation model in this study is

$$\begin{aligned} \log(X_{ijt}) = & \alpha_0 + \alpha_1 \log(PGDP_{it}) + \alpha_2 \log(PGDP_{jt}) \\ & + \alpha_3 \log(POP_{it}) + \alpha_4 \log(POP_{jt}) \\ & + \alpha_5 \log(TC_{ijt}) + \alpha_6 AFTA_{jt} \\ & + \alpha_7 ASEANPLUS_{jt} \\ & + \alpha_8 CRISIS_t + \sum_{9k} \alpha_{9k} \Delta NRCA_{kt}^{i-j} \\ & + \mu_{ijt} + \varepsilon_{ijt} \end{aligned}$$

where each variable can be described as follows:

- (a)  $X_{ijt}$  is a non-oil exports from country  $i$  to country  $j$  at time  $t$ . Exports are dependent variable as an approach to trade

among ASEAN member countries as well as between an ASEAN member country and a non-ASEAN country.

- (b)  $PGDP_{it}$  and  $PGDP_{jt}$  is the Gross Domestic Product (GDP) per capita of exporter (i) and importer (j). This variable is used as an indication of purchasing power of both exporter and importer.
- (c)  $POP_i$  dan  $POP_{jt}$  is population exporter country  $i$  and population of the trading partners country (importer)  $j$ , respectively. The population itself can be used as a proxy for the magnitude of demand or market. Population can also signify presence of import substitution effect where domestic production receives incentives on the expanding market.
- (d)  $TC^1$  is the index of the cost of transportation from country  $i$  to country  $j$ , where there is the assumption that the amount of bilateral trade increases with the size of their economies and decreases with increasing transportation costs due to differences in distance [5] [6].
- (e) The dummy variables in this research model are AFTA, ASEANPLUS and CRISIS. AFTA is worth 1 if the importer is a country belonging to AFTA, while 0 if the importer is a non-AFTA. ASEANPLUS is worth 1 if the importer is a country that joins in the scheme of ASEAN Plus, while 0 if the importer is a non-ASEAN Plus country. In the interim, CRISIS is intended to show the time of the economic crisis. Dummy CRISIS' value is 1 if the economy is in crisis, that is the Asian crisis in 1997-1999 and the global financial crisis in 2007-2009, and is valued 0 if there is no crisis.
- (f)  $\Delta NRCA_{kt}^{i-j}$  is a variable used to reflect the different comparative advantages of a country commodity  $i$  with its trading partner (j) in the ASEAN market.

### III. RESULTS AND DISCUSSIONS

The estimated gravity model in this study employs Fixed Effect Model (FEM) to estimate panel data. The method is chosen because it is considered being able to overcome the Multilateral Trade Resistance (MTR) with proxy. It is acceptable in theory through country-specific fixed effect MTR, which is the concept that the bilateral trade between the partner countries is not only influenced by partner countries but also by their interaction with other countries in the global region [7] [8] [9] [10].

Based on Table 1, it can be concluded that the AFTA and ASEANPLUS variables are dummy that need to be included in the model. This is reflected in the level of significance of both variables. In addition, if the dummy is not included as a variable in the model, it would reduce the significance of the other variables, especially  $\Delta NRCA$ , the main variable in this study. Similarly with CRISIS variable, although it is not a significant variable, it affects the significance of the other variables if they are omitted from the model. Related to the

significance of the variables in the model, CRISIS variable will not be discussed further.

Based on column 4, several findings can be described in more details as follows. First, GDP per capita of ASEAN as exporter and GDP per capita of its trading partners display the same results and are consistent with researches that utilized gravity model, that is GDP significantly and positively affects exports [11] [1]. The estimation results indicate that the level of ASEAN economy as exporter has a greater influence on the increase in ASEAN non-oil exports, when compared to the economic level of its trading partners (both ASEAN and non-ASEAN) as importers. This means that from the results of model estimation, the elasticity of the ASEAN's GDP per capita increase is greater than the GDP per capita of its trading partners. Based on the rule of *ceteris paribus*, every 1% increase of ASEAN's GDP will increase ASEAN's non-oil exports by nearly 2.00%. Meanwhile, the rise of GDP of ASEAN trading partner by 1% will increase ASEAN's non-oil exports by 1.21%. It means that the export pattern of ASEAN follows the concept of growth leads to export; where the internal factors of economic growth become the greater benchmark compared to its export market conditions.

The GDP per capita which is a proxy of the capital-endowment ratio, in addition to indication of purchasing power [12], shows an increased domestic capability as an incentive for domestic producers to at least improve production quality or quantity. This will create larger economic scale able to produce export goods, which in turn can boost exports. On the other hand, the economic capacity of partner countries (importers) leads to an increase in demand for goods which then increases the imports of goods from outside.

Second, the POP or population variable which is indicated by the population of exporting countries (ASEAN) demonstrates a significant effect and is contrary to the non-oil export of ASEAN. The population of importers (ASEAN and non-ASEAN) gives contrary effect that is positive on the increasing exports of ASEAN. An increase in the population of ASEAN member states by 1% causes a decline in the value of non-oil exports of ASEAN by 0.48% (*ceteris paribus*) and an increase in the population of importers by 1% causes an increase in ASEAN's non-oil exports by 0.42%.

The influence of population on exports is in line with the studies by [13] as well as [14]. Both studies suggested that the negative effects of the population, particularly in exporting countries, on exports indicate an incentive for domestic products as a result of an increase in the number of markets in the country, which can be referred to as import substitution effect. There is also the absorption effect where domestic production that increases with the number of population is absorbed in the domestic market first before being exported abroad. Meanwhile, the increasing population of the importing country will increase the market size. Market growth in trading partners is one of the factors for the demand increase in the export market.

Third, differences in the value of non-oil exports that is the result of Free Trade Agreement (FTA) in ASEAN show significant gains. If the ASEAN trading partners are countries belonging to the AFTA scheme, then there are differences in

<sup>1</sup>The trade cost data are available from ESCAP only for the period 1992 - 2011. Therefore, this study requires data period 1989-2012 and the available data are processed with extrapolation so that the appropriate data are obtained.

the value of non-oil exports amounting to 18.23%, lower than that of the trading partners not included in the AFTA scheme. This condition matches to the findings of [1] who argued that the member countries of ASEAN are more likely to be outward looking, so that more trade (in this case export) is conducted with trading partners outside ASEAN. It is reinforced by the findings in this study, that the presence of ASEAN Plus, which was marked by the commencement of ACFTA in 2005, shows differences in non-oil exports by 8.85%; it is greater when exports are made to partners without a trade agreement.

AFTA and ASEANPLUS also indicate that ASEAN intra-regional market is considered less beneficial for ASEAN member countries themselves. The estimation of dummy AFTA and ASEAN Plus demonstrate that in order to increase intra-regional trade, seen from the side of exports, ASEAN countries need to adopt policies to better utilize the ASEAN Plus scheme which will then be merged into RCEP.

Fourth, the trade cost index (Trade Cost, TC index) as a proxy for the cost of trade, shows a negative effect on exports. An increase of 1% in costs affects the decline in the value of non-oil exports by 1.28% (*ceteris paribus*). This is consistent with the statements of [5] and [6] that exports declined as the cost of trade increased. Trade costs are not only material, but also include the quality of trade facilitation itself.

Lastly is the influence of the main variables,  $\Delta NRCA$ , against non-oil exports. Results from this study indicate that the  $\Delta NRCA$  significantly affects positively on the increase of non-oil exports to ASEAN trading partners. It can be described as follows: (i) an increase in 1 unit of agricultural commodities

$\Delta NRCA$  increases non-oil exports by 10.92% (*ceteris paribus*); (ii) an increase in 1 unit of manufacturing commodities  $\Delta NRCA$  leads to 5.84% rise in non-oil exports; (iii) an increase of 1 unit of mining commodities  $\Delta NRCA$  (including coal, mineral and gemstone) makes a 13.55% increase in non-oil exports; and (iv) an increase of 1 unit of other commodities  $\Delta NRCA$  increases the non-oil exports amounting to 8.55%. The above findings are in accordance with the Theory of Comparative Advantage or Richardian Model stating that comparative advantage will increase export. Since  $\Delta NRCA$  is the comparative advantage NRCA index of exporting countries which is subtracted with NRCA index of importing countries, the increase in  $\Delta NRCA$  index can be interpreted as an increase in the comparative advantage of the exporter or the comparative decline of importer. Thus, exporting countries will tend to focus the production factors to increase the amount of production and subsequent export to countries that have lower comparative advantage for these products [15]. Additionally, it appears that non-oil exports in ASEAN are more reliant on exporting agricultural commodities and mining. This means that natural resources products remain the top ASEAN's non-oil exports as the impact of changes in comparative advantage for mining and agricultural commodities is significant.

It will be interesting to find out further the effect of changes in comparative advantage relative differences in manufacturing commodities to non-oil exports when manufacturing commodities are disaggregated according to the skill level of the workforce and the level of technology. For this purpose, the results of the estimate are shown in column 5.

TABLE I. FEM ESTIMATES IN DIFFERENT SCENARIOS

Regressand $Log(X_{ij})$	Model Specifications				
	[1]	[2]	[3]	[4]	[5]
$C$	-7.3532*** (2.350912)	-9.101739*** (2.398969)	-10.81938*** (2.489238)	-6.210795*** (2.455375)	-13.39251*** (2.714252)
$Log(PGDP_{it})$	1.914438*** (0.06286)	1.891433*** (0.064094)	1.750732*** (0.082768)	1.993184*** (0.07588)	1.856974*** (0.092573)
$Log(PGDP_{jt})$	1.273707*** (0.042106)	1.224691*** (0.042942)	1.255565*** (0.048675)	1.214314*** (0.048635)	1.146371*** (0.056535)
$Log(POP_{it})$	-0.443149*** (0.113862)	-0.502671*** (0.114341)	-0.354787*** (0.114015)	-0.477653*** (0.114419)	-0.394052*** (0.128541)
$Log(POP_{jt})$	0.438797*** (0.141069)	0.641821*** (0.141866)	0.641756*** (0.146203)	0.419105*** (0.146196)	0.819746*** (0.162279)
$Log(TC_{ijt})$	-1.223267*** (0.059217)	-1.285705*** (0.060284)	-1.268065*** (0.059653)	-1.278837*** (0.060258)	-1.244777*** (0.062055)
$AFTA_{jt}$		-0.148625*** (0.03541)	-0.159802*** (0.034756)	-0.182333*** (0.03547)	-0.168761*** (0.036219)
$ASEANPLUS_{jt}$		0.072423*** (0.019036)	0.09481*** (0.020133)	0.08853*** (0.020555)	0.093463*** (0.022418)
$CRISIS_{jt}$		0,02056 (0.012783)	0,007544 (0.012523)	0,012648 (0.012815)	-0,005609 (0.013405)
$\Delta NRCA_{1At}^{i-j}$			0.892188*** (0.12822)		
$\Delta NRCA_{2t}^{i-j}$			0,054658 (0.038332)	0.109195*** (0.038584)	0.186367*** (0.045076)
$\Delta NRCA_{3t}^{i-j}$			0.066943*** (0.011501)	0.058419*** (0.011592)	
$\Delta NRCA_{3At}^{i-j}$					-0,031382 (0.02876)
$\Delta NRCA_{3Bt}^{i-j}$					0.080431** (0.034523)

Table I, cont.

$\Delta NRCA_{3C1t}^{i-j}$					0,422641 (0.464218)
$\Delta NRCA_{3C2t}^{i-j}$					0,157684 (0.106042)
$\Delta NRCA_{3C3t}^{i-j}$					0.105891*** (0.019969)
$\Delta NRCA_{3D1t}^{i-j}$					0.072898* (0.040335)
$\Delta NRCA_{3D2t}^{i-j}$					0.03534** (0.01593)
$\Delta NRCA_{3D3t}^{i-j}$					-0,00816 (0.025617)
$\Delta NRCA_{4t}^{i-j}$			0.066397** (0.033602)		
$\Delta NRCA_{41At}^{i-j}$				0.135475*** (0.031982)	0.176966*** (0.033784)
$\Delta NRCA_{5t}^{i-j}$			0.140072*** (0.034849)	0.085459*** (0.033767)	0.129712*** (0.036458)
R-squared	0,981038	0,981642	0,983054	0,982303	0,983236
Adjusted R-sq	0,980135	0,98071	0,982104	0,98133	0,98219
F-statistic	1085.423***	1052.674***	1034.854***	1009.223***	939.3961***
Num of Obs	1056	1056	1056	1056	1056

 Standard error in parentheses; \*  $p \leq 0.1$ , \*\*  $p \leq 0.05$ , \*\*\*  $p \leq 0.01$ 

The estimation results of column 5 shows that the biggest influence and significant changes in  $\Delta NRCA$ , especially  $\Delta NRCA$  for manufacturing commodities, to the non-oil exports is the  $\Delta NRCA$  change for Electronic and Electrical Products belonging to medium-skill and technology-intensive manufacture products (Commodity Code 3C3). Some examples of 3C3 are various kinds of tires, engine blocks, textile machinery, and other mid-sized industrial machinery parts. Hence, an increase of 1 unit of  $\Delta NRCA_{3C3}$  leads to an increase in non-oil exports by 10.59% (*ceteris paribus*). The second largest impact occurs at 3B commodities (commodities that are classified as low-skill and technology-intensive manufacturing products). Examples of commodities and derivative products are steel pipes, steel plates, household appliances, and so forth. Every increase of 1 unit  $\Delta NRCA_{3B}$  translates into an 8.04% increase against non-oil exports of ASEAN.

Manufacturing commodities  $\Delta NRCA$  that has an influence on other non-oil exports is  $\Delta NRCA_{3D1}$  which is  $\Delta NRCA$  of commodities classified as Electronic commodities belonging to high-skill and technology-intensive manufacture products. The estimation results show that an increase of 1 unit of  $\Delta NRCA_{3D1}$  affects on the increasing non-oil exports by 7.29%. Commodities that are grouped under 3D1 are, among others; digital computers, digital processing units, color television receivers and digital radios. Additionally, an increase of  $\Delta NRCA_{3D2}$  by 1 unit increases the non-oil exports of ASEAN by 3.53%. 3D2 commodities are spare-parts and parts of electronic and electrical goods which belong to high-skill and technology-intensive manufacturing products. Examples of commodities 3D2 are, among others, non-cellular phone telecommunications equipment, spare-parts of radio, and television tubes spare parts.

Based on the findings, several elements need to be studied further. In this study, commodities used in the calculation of  $\Delta NRCA$  are still in a relatively aggregated form. There is a possibility of aggregate bias from the  $\Delta NRCA$  index results

which then affect the results of model estimation. It becomes necessary to disaggregate variable component which are still aggregate in terms of commodity side. The possibility of aggregate bias seen in the model of this study is the large variation of significance and influence of  $\Delta NRCA$  against non-oil exports when industry/manufacture commodities (commodity 3) are disaggregated into numerous groups based on the level of workforce skills and the level of technology.

Moreover, it is interesting to further research on the interaction of changes in comparative advantage of a commodity to changes in comparative advantage of other commodities. Such assumption is necessary to find empirical evidence of trade specialization from the concept of comparative advantage of a commodity in a country.

#### IV. CONCLUSION

In general, the study found that non-oil exports of ASEAN are influenced by the level of ASEAN economies and that of their trading partners. The population of ASEAN and trading partners reflect the market size of exporters and importers, trading costs, the status of AFTA and ASEAN Plus cooperation, as well as changes in the difference between ASEAN's comparative advantage as exporter and trading partner's comparative advantage for certain commodities in the ASEAN regional market.

Specifically, the study proved that comparative advantage has an influence on the pattern of non-oil exports. It explains that the increasing changes of ASEAN's NRCA against its trading partners' NRCA in the ASEAN market would increase the non-oil exports of ASEAN to its trading partners. In other words, the increase in the comparative advantage in exporting countries or the decline in comparative advantage in importing countries increases the volume of exports from the exporter to the importer. This is in line with the Theory of Comparative Advantage or Richardian model, in which a country has



specialization in exporting goods that have higher comparative advantage.

The study also revealed that the effects of  $\Delta$ NRCA changes on ASEAN non-oil exports is  $\Delta$ NRCA changes for mining commodities (including coal), agricultural commodities, and other commodities. Meanwhile,  $\Delta$ NRCA changes for industrial products/manufacture commodities indicate the smallest effect on non-oil exports. This signifies that non-oil exports of ASEAN tend to depend on commodities derived from natural resources.

If the industrial/manufacture commodities are disaggregated, the estimation results suggest that ASEAN has a tendency to specialize in manufacture products other than electronic and electrical products belonging to medium-skill and technology-intensive manufacture products as well as products derived from the low-skill and technology-intensive industries. Furthermore, it also indicates that ASEAN has enough advantage in spare parts for high-tech electronic products. Meanwhile, ASEAN actually has a very small comparative advantage in, electric and electronic parts products for medium technology as well as high-tech electrical products and electronics.

This paper recommends that further research is required by disaggregating  $\Delta$ NRCA of commodities that are still aggregate because of possible bias aggregate. This is indicated from the presence of significant variations and major variations in the effect of the  $\Delta$ NRCA change against non-oil exports if industrial/manufacture commodities (commodity 3) are disaggregated into groups based on the level of several manufacture commodity groups, based on the work force skills and the level of technology.

Second, it is interesting to study further the interaction of changes in one comparative advantage of a commodity with changes in comparative advantage of other commodities. Assuming the existence of this interaction is important, it can be used as one empirical method to find evidence of trade specialization of the concept of comparative advantage. Viewed from the concept of trade specialization according to comparative advantage, the patterns of export and trade of a country in a given market will be shown more.

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