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Assessing the agricultural trade complementarity of the Association of Southeast Asian Nations countries

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Abstract: This paper aims to investigate the agricultural trade complementarity of the Association of Southeast Asian Nations (ASEAN) countries on the global agricultural market over the period 1997–2015 by employing the trade complementarity index (TCI), the export similarity index (ESI), and Spearman's rank correlation coefficients for competitiveness indicators. The results indicate that: (i) the ASEAN countries' agricultural export patterns are weakly complementary in matching the regional import demands; while (ii) they are relatively complementary in exporting agricultural products to the world market; (iii) the countries' agricultural competitiveness patterns are more affected by and benefited from the global integration than the regional integration; and (iv) the countries, moreover, tend to become more substitutable over time. The research results suggest that the ASEAN countries should cooperate and utilise the internal markets to enhance the competitiveness and predominantly focus on the external global markets.

Keywords: Association of Southeast Asian Nations, agriculture, competitiveness, complementary, similarity

The Association of Southeast Asian Nations (ASEAN) internal and external economic integration results in two major free trade markets including the ASEAN Economic Community (AEC) and the Regional Comprehensive Economic Partnership (RCEP). The AEC offers the opportunities in the form of a huge market of US$ 2 800 billion and over 625 million people in 2015. This region is collectively the third largest economy in Asia and the seventh largest economy in the world. The prospective RCEP countries have a population of 3.4 billion people and a gross domestic product of US$ 49 500 billion (ASEAN 2017). Petri et al. (2012) believe that the ASEAN economic integration could gain a similar result to those coming from the European single market, amounting to 5.3% of the region's income. The benefits could be doubled if the regional integration can lead to new free trade agreements with key external partners and the whole region will share in these benefits.

The ASEAN countries, however, encounter both internal challenges consisting of competitions among the member countries; import substitution policies of industrialization; small extent of intra-ASEAN trade; and wide differences in economic size, development level, and industrial competence giving rise to divergent perceptions of benefits and external obstacles including strong globalization, global market competition, rapid economic and trade growth in India and China, and the proliferation of preferential trade agreements (Chia 2013; Ravenhill 2008). Although the ASEAN countries are diverse in terms of social, economic, and political structures, they are in the similar geographical area and natural conditions (Siah et al. 2009). These may cause the countries to become competing with each other. Naya and Plummer (1997) confirm that the ASEAN economic cooperation has not developed significantly and it may be due to the dominance of politics or the effects of trade diversion in a region characterised by low levels of intra-regional trade.

The agriculture is a key contributor to the ASEAN countries' economies in three manners: (i) it is an important component of GDP in Cambodia, Myanmar, Lao, Vietnam, and Indonesia; (ii) there is significantly high rate of employment in agricultural sector in Lao, Cambodia, Vietnam, Thailand, and Indonesia; and (iii) the sector accounts for the significant share of export values in Myanmar, Indonesia, Thailand,

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Vietnam, and Malaysia. Moreover, the countries have similar comparative advantages in agricultural products such as rice, natural rubber, spices, vegetable fats and oils, wood in chips, fuelwood, fish, and crustaceans (Hoang et al. 2017). Thus, this research is motivated to identify whether the ASEAN countries are complementary on the world market.

The study aims to investigate the trade complementarity of the ASEAN countries on the world agricultural market by employing: (i) the trade complementarity index (TCI); (ii) the export similarity index (ESI); and (iii) the Spearman's rank correlation coefficients for competitiveness indices such as the revealed comparative advantage, the relative trade advantage, and the normalized revealed comparative advantage over the period 1997–2015. The result will contribute to both economic literature and practical implications. First, the paper expands the empirical studies of the complementarity and competitiveness indices in the ASEAN context. Second, the findings provide the vital complementarity and competitiveness indicators for organisational business strategies, national development and trade policies, and regional integration programs.

LITERATURE REVIEW

The international trade integration and free trade agreements bring both benefits and challenges to the member countries. The member countries will achieve more social welfare from the difference of demands, resource endowments, and production and trade patterns while they face the competition from the similarity of the factors, production, and trade. The trade complementarity rather than substitutability and competition will result in the rapid growth of trade flows between the partners. According to Drysdale (1969), complementarity is used to define the extent to which countries have dissimilar resources and patterns of production, and they are, therefore, likely to trade intensively with each other. Specifically, he describes the concept of complementarity "in a relative sense and measures the extent to which one country's export pattern matches another country's import pattern more closely than it matches the pattern of world imports". Finger and Kreinin (1979) confirm that if the exports between countries are not similar or there is no commodity overlap in export, then there is a trade creation and *vice versa*. Vaillant and Ons (2002) explain the trade complementarity as a measure of the level of similarity between the export supply of a country and the import demand of its partners. Wu and Zhou (2006) add that if there are overlaps in the two countries' comparative advantage or trade patterns and thus there must be competition between them in the areas. The empirical measures of aggregate trade performance and complementarity can identify the general direction and thrust in which a country's investment and trade should take in order to exploit international differences in product and factor supply and demand (Vollrath and Johnston 2001). There are various methods to empirically analyse the complementarity, similarity, competition, and substitutability between countries based on trade performance data.

Drysdale (1969) proposes TCI for an industry or a country in its partner country or region. The TCI measures the extent to which a country's export to its partner country is relatively large since the product composition of the exporting country matches that of importing country more closely than it matches the commodity composition of the world trade. There are two measures of the level of trade complementarity derived from the two-flow trades of these countries. The index has been modified and employed by scholars such as Vaillant and Ons (2002), Andreosso-O'Callaghan (2009). Vollrath and Johnston (2001) propose a framework of the trade complementarity index (TCIv) with the different components. The main parts of this formula are the relative export advantage and the relative import advantage. The TCIv measures the degree to which one country's relative export share structure corresponds with another's across certain commodities. In other words, the index assesses the market match between two countries where a country is selling what the other country wants to buy (Chen and Yang 2008).

According to Finger and Kreinin (1979), some propositions in international economics can be explained by the use of an index measuring the similarity of the exports of any two countries to the third markets. If exports are dissimilar, namely little or no commodity overlap, then there is little scope for trade diversion. Observing changes over time in the export similarity between two countries can assess the degree to which their economic structure is becoming more similar or more divergent. Moreover, the dynamics of the similarity index may explain the changes in the capital flow, labor flow, and economic structure (Benedictis and Tajoli 2007). Finger and Kreinin (1979) then propose the index

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of export similarity to identify the similarity of the trade patterns of countries in a common market in which both countries compete. The measure involves to working out the sector share of total exports for each country and, after that, for each pair of countries, and to sum the minimum of the two countries' shares for a given sector across all sectors. The index has been employed by authors such as Linnemann and Beers (1988), Shuai and Wang (2011), and Nguyen et al. (2017).

The trade complementarity between two countries can be measured by the bilateral trade flows, and their trade flows to the world market using the trade intensity index proposed by Kojima (1964) or Brown (1949). The index is presented in two forms, namely the export intensity index and import intensity index. These indices reflect the ratio of the share of a country's trade with its partner relative to the share of world trade destined for the partner (Wu and Zhou 2006).

The extent of the association between trade competitiveness indices of countries is an excellent measure of substitutability or complementarity between two countries. The degree and nature of the association between trade competitiveness indices can be identified by using the Spearman's rank correlation coefficient. In other words, by testing the ranks of agricultural sectors in two countries, the correlation would explain the nature of the products – substitutable or complementary - which are sold by the two countries (Jayawickrama and Thangavelu 2010).

MATERIALS AND METHODS

Trade complementarity index

Drysdale (1969) proposes the trade complementarity index (TCI). The main idea of the index is to measure the extent to which one country's export pattern matches another country's import pattern more closely than it matches the pattern of world imports. The greater this similarity, the more likely trade between them is. The TCI can be presented as follows:

$$\mathrm{TCI}_{ab} = \sum_j^n \left(\frac{X_a^j}{X_a} \times \frac{M_w - M_a}{M_w^j - M_a^j} \times \frac{M_b^j}{M_b} \right) \quad (1)$$

where X_a^j is the country *a*'s export of commodity *j*; X_a is country *a*'s total export; M_w is the world import; M_a is country *a*'s total import; M_w^j is the world import of commodity *j*; M_a^j is the country *a*'s import of commodity *j*; M_b^j is the country *b*'s import of commodity *j*. M_b is country *b*'s total import. The value of TCI greater (less) than the unity indicates the existence of strong (weak) complementarity between the export specialisation of country a and the import specialisation of country *b*. The TCI value of unity means that the export and import specialisations are similar to the world economy specialisation and, therefore, the existence of comparative advantage cannot explain the bilateral trade.

Export similarity index

Finger and Kreinin (1979) suggest the export similarity index (ESI) to measure the degree of similarity of exports between two countries on the world market. The ESI also explains the trade complementarity between two countries by comparing the export patterns of the countries on the world market. The model can be defined as follows:

$$\mathrm{ESI}\left(ab, w\right) = 100 \times \left\{ \sum_j^n \min \left(\frac{X_a^j}{X_a}, \frac{X_b^j}{X_b} \right) \right\} \quad (2)$$

where ESI (*ab*, *w*) is the similarity degree of export patterns of country *a* and country *b* to the world market; X_a^j / X_a is the share of commodity *j* in country *a*'s total export to the world market; and X_b^j / X_b is the share of commodity *j* in country *b*'s total export to the world market. The ESI value ranges from 0 to 100. If the exports of both countries to the world market are entirely the same, this index is 100; if they are totally different, it is zero. The greater (smaller) values of the ESI mean, the higher (lower) degree of the export similarity or the lower (higher) degree of the export complementarity. The increase of the ESI indicates that country *a* and country *b* are getting more substitutable or competing and *vice versa*.

Spearman's rank correlation coefficients of the competitiveness indicators

According to Jayawickrama and Thangavelu (2010), the level of association between trade competitiveness indices of two countries is a good tool to measure the complementarity between the countries. The Spearman's rank correlation coefficient is useful to identify the degree and nature of the associa-

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tion between trade competitiveness indicators. The Spearman's rank correlation coefficient can be computed by using the formula as follows:

$$\rho_s = 1 - \left\{ \frac{6\sum_j^n d_j^2}{n\left(n^2-1\right)} \right\} \quad (3)$$

where j = 1,2, ... , n is agricultural sector, d_j is the difference between the ranks of the competitiveness in sector j in two countries. The ρ_s value ranges from negative one to positive one. A positive (negative) ρ_s indicates that the two countries are substitutable (complementary) on the world market. The closer ρ_s to the unity, the stronger is the export substitutability between the two countries and *vice versa*. If the two countries have the same competitiveness ranking across sectors, the difference between rankings become zero and Spearman's rank correlation coefficient equal one, and the countries have perfectly substitutable agricultural competitiveness structures. The increase of ρ_s indicates that the weaker country catches up quickly with the stronger country due to the change in the competitiveness (Jayawickrama and Thangavelu 2010).

In this paper, the competitiveness indicators for Spearman's rank correlation coefficients include the revealed comparative advantage (RCA), the relative trade advantage (RTA), and the normalised revealed comparative advantage (NRCA) which are calculated in Hoang (2017).

The RCA was proposed by Balassa (1965). The idea of the RCA index is to compare the performance of a country in a commodity with the performance of a reference group of countries using export flows by using the observed export patterns. The RCA index can be defined as follows:

$$\mathrm{RCA}_a^j = \left\{ \frac{X_a^j}{X_a} \right\} \div \left\{ \frac{X_w^j}{X_w} \right\} \quad (4)$$

where X_a^j represents the country a's export of product j; X_a is country a's total export; X_w^j is the world export of commodity j; X_w is the world export. The RCA values range between zero and +∞, and the comparative-advantage-neutral point is one.

Vollrath (1991) develops the RTA index to measure the competitive advantage. The index is calculated as the difference between the relative export advantage (RXA) and the relative import advantage (RMA). The Vollrath's indices are formulated as follows:

Relative export advantage (RXA):

$$\mathrm{RXA}_a^j = \left\{ \frac{X_a^j}{X_a} \right\} \div \left\{ \frac{X_w^j}{X_w} \right\} \quad (5)$$

Relative import advantage (RMA):

$$\mathrm{RMA}_a^j = \left\{ \frac{M_a^j}{M_a} \right\} \div \left\{ \frac{M_w^j}{M_w} \right\} \quad (6)$$

Relative trade advantage (RTA):

$$\mathrm{RTA}_a^j = \mathrm{RXA}_a^j - \mathrm{RMA}_a^j \quad (7)$$

where the description of X is similar to those in the RCA index and M is explained similarly to X. The RTA values are between –∞ and +∞ and the comparative-advantage-neutral point is zero. The RTA values are positive in the case of competitive advantages and negative in opposite situations.

Yu et al. (2009) propose the NRCA index to measure the degree of deviation of a specific country's actual export from its neutral level in terms of its relative scale with respect to the world export market and thus establishes its comparability across commodity and country. The country a's export of commodity j at the neutral point, $\hat{X}_a^j$ is derived from the comparative-advantage-neutral point of the RCA index. The NRCA index can be presented shortly as follows:

$$\mathrm{NRCA}_a^j = \frac{\Delta X_a^j}{X_w} = \frac{X_a^j - \hat{X}_a^j}{X_w} = \frac{X_a^j}{X_w} - \frac{X_a X_w^j}{X_w X_w} \quad (8)$$

where the NRCA values range from –0.25 to 0.25 with the neutral point of zero when the actual export is identical to the expected export of the country. The NRCA > 0 presents the country a's actual export of commodity j is higher than the expectation. The NRCA < 0 indicates that the country a's actual export of commodity j is lower than the expectation.

Data

According the definition of the EU and the WTO, the agricultural products cover the codes of "0 + 1 + + 21 + 22 + 231 + 24 + 261 to 265 + 268 + 29 + 4" in Standard International Trade Classification (SITC) Revision 3 (SITC Rev. 3). This study selects a sample of 61 agricultural commodity groups of 8 ASEAN countries at 3-digits in SITC Rev. 3 and at 2-digits in Harmonized System (HS) over the period 1997–2015. All data is extracted from the official and open sources

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such as the United Nations Comtrade (UN Comtrade 2017) and the International Trade Center (ITC 2017).

RESULTS AND DISCUSSION

The agricultural trade complementarity of the ASEAN countries

The Table 1 shows that all TCI values are smaller than one and relatively close to zero. These results, generally, imply that the ASEAN countries are weakly complementary or strongly competing in the agricultural trade. In other words, the agricultural export patterns of the ASEAN countries weakly match the agricultural import patterns of the partner countries in the ASEAN region in comparison with the agricultural commodity composition of the word trade. The *M*.TCI values indicate the mean import complementarity of one country to other ASEAN countries. The result shows that the agricultural import patterns of Brunei and Malaysia are the most strongly complementary to the agricultural export patterns of other ASEAN countries while those of Thailand and Singapore are the most weakly complementary to the export patterns of the ASEAN countries. The *X*.TCI values explain the mean export complementarity of one country to other ASEAN countries. The result states that the agricultural export patterns of Vietnam and Thailand are the most strongly complementary to the agricultural import patterns of other ASEAN countries. Vietnam's agricultural supply is the most strongly complementary to the demand of Brunei, Indonesia, and Philippines with the TCI values of 0.75, 0.55, and 0.54, respectively whilst the supplies of Brunei and Singapore are not complementary to those of the ASEAN countries.

The trend analysis of the mean TCI values shows that the agricultural complementarity degree of the ASEAN countries slightly decreases over the period 1997–2015. This indicates that the ASEAN countries become less complementary or more competing with each other along with their regional and global integration processes (Figure 1).

The agricultural export similarity of the ASEAN countries

The ESI explains the trade complementarity between the countries with the focus on comparing their export patterns on the world market. The results, in general, show the significantly low degree of similarities in the agricultural export patterns of the ASEAN countries with the mean ESI value of 2.8. This means that the ASEAN countries are strongly complementary in exporting the agricultural products to the global market. The ESI results contrast with those of the TCI analysis. The possible explanation for these different results between the TCI and the ESI is that the TCI measures the match of a country's export supply for its partner's import demand while the ESI pays attention to comparing the export patterns among these countries. Indonesia, Thailand, and Vietnam have the highest degree of agricultural export similarities to other ASEAN countries with the ESI values of 4.73, 4.28, and 4.26, respectively. Brunei, Singapore, and Cambodia obtain the lowest degree of agricultural export similarities to other ASEAN countries. The country pairs of Thailand – Vietnam and Indonesia

Table 1. Agricultural trade complementarity by the trade complementarity index (TCI)

	Brunei	Cambodia	Indonesia	Malaysia	Philippines	Singapore	Thailand	Vietnam	***X*.TCI**
Brunei	–	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cambodia	0.17	–	0.05	0.14	0.07	0.03	0.01	0.06	**0.08**
Indonesia	0.20	0.15	–	0.50	0.12	0.13	0.08	0.28	0.21
Malaysia	0.17	0.11	0.06	–	0.12	0.08	0.06	0.20	**0.12**
Philippines	0.14	0.09	0.06	0.09	–	0.04	0.04	0.09	0.08
Singapore	0.06	0.06	0.02	0.03	0.02	–	0.02	0.02	**0.03**
Thailand	0.52	0.14	0.33	0.35	0.34	0.11	–	0.16	0.28
Vietnam	0.75	0.17	0.55	0.34	0.54	0.15	0.16	–	**0.38**
***M*.TCI**	**0.29**	**0.10**	**0.15**	**0.21**	**0.17**	**0.08**	**0.05**	**0.12**	–

M.TCI values indicate the mean import complementarity of one country to other ASEAN countries; *X*.TCI values explain the mean export complementarity of one country to other ASEAN countries

Source: own calculations based on UN Comtrade data (2017)

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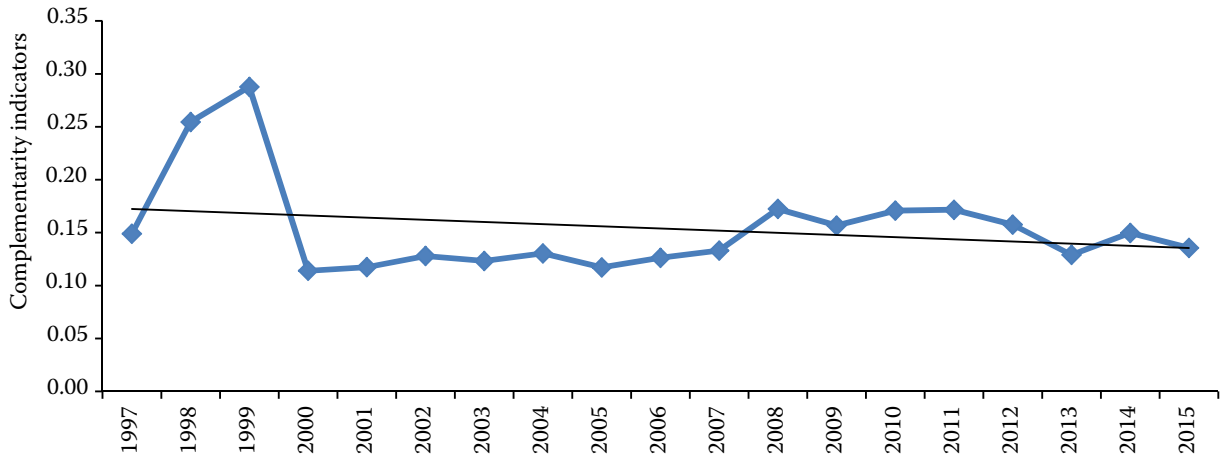

Figure 1. Trend of ASEAN countries' agricultural complementarity indicators

Source: own calculations based on UN Comtrade data (2017)

– Malaysia the most similar in agricultural export patterns (Table 2).

The trend analysis for the mean ESI values over the period 1997-2015 indicates the increasing similarity in the agricultural export patterns of the ASEAN countries. This means that the ASEAN countries have become more similar or competing with each other along with their regional and global integration processes (Figure 2).

The agricultural trade complementarity by Spearman's rank correlation coefficients

This study classifies ρ_s values into 4 groups to identify the degree of the agricultural trade complementarity: (i) strong complementarity (–1, –0.5); (ii) weak complementarity (–0.5, 0); (iii) weak substitutability (0, 0.5); and (iv) strong substitutability (0.5, 1).

Spearman's rank correlation coefficients of the RCA indicators

The positive ρ_s values of the RCA indicators in Table 3 show that the ASEAN countries are competing on the world market and they have the weak substitutability in agricultural competitiveness structures with the mean ρ_s value of 0.43. Indonesia has the strongest agricultural substitutability for other ASEAN countries with the ρ_s value of 0.51 while Brunei obtains the weakest agricultural substitutability for other ASEAN countries. Indonesia-Philippines, Indonesia-Singapore, and Indonesia-Malaysia are the pairs of countries with the strongest agricultural substitutability whilst Cambodia-Thailand, Singapore-Thailand, and Malaysia-Vietnam are the pairs of countries with the strongest agricultural complementarity.

Table 2. ASEAN countries' agricultural export similarity by the export similarity index (ESI)

	Brunei	Cambodia	Indonesia	Malaysia	Philippines	Singapore	Thailand	Vietnam
Brunei	–	–	–	–	–	–	–	–
Cambodia	0.05	–	–	–	–	–	–	–
Indonesia	0.10	2.55	–	–	–	–	–	–
Malaysia	0.10	1.91	9.25	–	–	–	–	–
Philippines	0.10	0.85	4.86	3.67	–	–	–	–
Singapore	0.08	0.59	1.73	1.81	1.32	–	–	–
Thailand	0.10	3.22	7.33	3.51	3.96	1.53	–	–
Vietnam	0.10	2.91	7.29	3.20	4.40	1.59	10.33	–
Mean ESI	**0.09**	**1.72**	**4.73**	**3.35**	**2.74**	**1.24**	**4.28**	**4.26**

Source: own calculations based on UN Comtrade data (2017)

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Table 3. Spearman's rank correlation coefficients of the revealed comparative advantage (RCA) indicators

	Brunei	Cambodia	Indonesia	Malaysia	Philippines	Singapore	Thailand	Vietnam
Brunei	–	–	–	–	–	–	–	–
Cambodia	0.52	–	–	–	–	–	–	–
Indonesia	0.30	0.40	–	–	–	–	–	–
Malaysia	0.35	0.35	0.62	–	–	–	–	–
Philippines	0.40	0.40	0.66	0.46	–	–	–	–
Singapore	0.35	0.34	0.64	0.59	0.53	–	–	–
Thailand	0.40	0.20	0.44	0.32	0.57	0.27	–	–
Vietnam	0.29	0.49	0.48	0.28	0.43	0.34	0.51	–
Mean	**0.37**	**0.39**	**0.51**	**0.42**	**0.49**	**0.44**	**0.39**	**0.40**

Source: own calculations based on UN Comtrade data (2017)

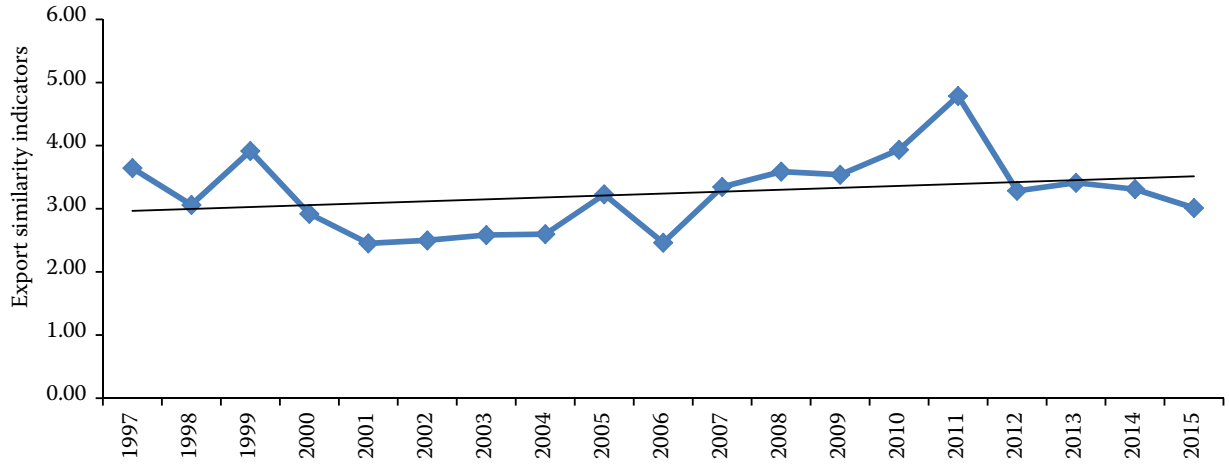

Figure 2. Trend of ASEAN countries' agricultural export similarity indicators

Source: own calculations based on UN Comtrade data (2017)

The increasing trend of the ρ_s values indicates that the agricultural competitiveness structures by the RCA of the ASEAN countries are becoming more and more substitutable or competing with each other. In other words, the weaker countries catch up quickly with the stronger countries due to the change in the agricultural competitiveness (Figure 3).

Spearman's rank correlation coefficients of the RTA indicators

The ρ_s values of the RTA indicators show the stronger agricultural complementarity of the ASEAN countries by the RTA against the RCA with the mean coefficient value of 0.15 and some negative ρ_s values. Brunei is the strongest complementary while Indonesia is the strongest substitute for other ASEAN countries in the agricultural competitiveness structures. Singapore-Thailand and Brunei-Vietnam are significantly complementary (Table 4). Moreover, the decreasing trend of the ρ_s values of the RTA indicators means that the degree of the agricultural complementarity of the ASEAN countries is becoming stronger (Figure 3). In other words, the ASEAN countries are less competing with each other on the world agricultural market. The result is contrary to those of the RCA indicators.

Spearman's rank correlation coefficients of the NRCA indicators

The result of the NRCA indicators is similar to the RCA indicators. The positive ρ_s values of the NRCA indicators show that the ASEAN countries are competing on the world market and they have the relative substitutability in agricultural competitiveness structures with the mean ρ_s value of 0.37. Indonesia also has the strongest substitutability for other ASEAN countries while Cambodia obtains

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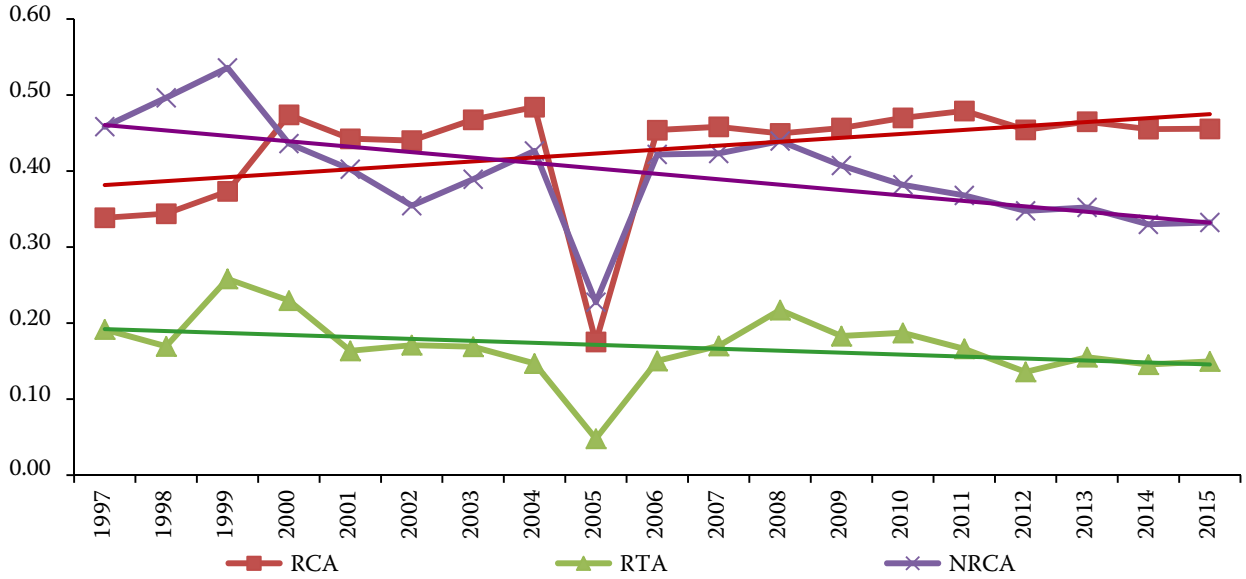

Figure 3. Trend of Spearman's rank correlation coefficients of competitiveness indices

NRCA – normalised revealed comparative advantage; RCA – revealed comparative advantage; RTA – relative trade advantage

Source: own calculations based on UN Comtrade data (2017)

Table 4. Spearman's rank correlation coefficients of the relative trade advantage (RTA) indicators

	Brunei	Cambodia	Indonesia	Malaysia	Philippines	Singapore	Thailand	Vietnam
Brunei	–	–	–	–	–	–	–	–
Cambodia	0.35	–	–	–	–	–	–	–
Indonesia	–0.05	0.17	–	–	–	–	–	–
Malaysia	–0.01	0.08	0.52	–	–	–	–	–
Philippines	0.13	0.17	0.50	0.39	–	–	–	–
Singapore	0.41	0.09	0.21	0.16	0.05	–	–	–
Thailand	–0.24	–0.02	0.25	0.08	0.33	–0.30	–	–
Vietnam	–0.21	0.22	0.37	–0.01	0.29	–0.10	0.43	–
Mean	**0.06**	**0.15**	**0.28**	**0.17**	**0.27**	**0.08**	**0.08**	**0.14**

Source: own calculations based on UN Comtrade data (2017)

the weakest substitutability (Table 5). The decreasing trend of the ρ_s values of the NRCA indicators means that the level of the agricultural complementarity of the ASEAN countries is becoming stronger (Figure 3). In other words, the ASEAN countries are less and less competing with each other on the world agricultural market over time.

The research results, in general, demonstrate that the ASEAN countries are weakly complementary in matching the regional agricultural import demands while they are relatively complementary in exporting agricultural products to the global market. These countries' agricultural trade flows and competitiveness patterns are more affected by and benefited from the global integration than the regional integration. It is remarkable that the ASEAN countries tend to become more and more competing or substitutable on both regional and global markets. The potential explanation for these issues is the economic linkages, dependences or trade relations between the ASEAN and the external markets, especially the giant and close markets. China (including Hong Kong), the United States of America (the U.S.), Japan, India, and Australia are the top agricultural trade partners of the ASEAN countries with the shares of the ASEAN agricultural export of 15, 10.5, 7.3, 6, and 2.3%, respectively in 2016. These markets, in total, account for over 41% of agricultural export value, equal to US$ 49 809 million, and 38% of agricultural import value, equal to US$ 38 714 million, in the ASEAN countries in 2016 (Figures 4–5). China, India, and Australia

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Table 5. Spearman's rank correlation coefficients of the normalised revealed comparative advantage (NRCA) indicators

	Brunei	Cambodia	Indonesia	Malaysia	Philippines	Singapore	Thailand	Vietnam
Brunei	–	–	–	–	–	–	–	–
Cambodia	0.09	–	–	–	–	–	–	–
Indonesia	0.34	0.19	–	–	–	–	–	–
Malaysia	0.36	0.13	0.74	–	–	–	–	–
Philippines	0.28	0.17	0.59	0.44		–	–	–
Singapore	0.27	0.09	0.58	0.59	0.36	–	–	–
Thailand	0.39	0.17	0.48	0.47	0.54	0.34	–	–
Vietnam	0.30	0.28	0.57	0.33	0.47	0.31	0.53	–
Mean	**0.29**	**0.16**	**0.50**	**0.44**	**0.41**	**0.36**	**0.42**	**0.40**

Source: own calculations based on UN Comtrade data (2017)

are the most increasing import markets of the ASEAN's agricultural export with the annual growth rate of 14, 18, and 13%, respectively, over the period 2001–2016.

It is suggested that the ASEAN countries have to expand and predominantly focus on the external global markets based on the international trade and economic agreements and partnerships of the association or the individual member countries to avoid the fierce competition in the regional markets and to enhance the economic and trade development. This strategy may cause the higher competition pressure on the world agricultural commodity markets.

The trade structure and its dynamics commonly reflect the deep structure of a country's economy and production in nature as the resources and competitive advantages cannot change quickly despite sudden shocks, new technology, and institutional systems. Though the ASEAN countries, in general, have advantages to produce agricultural products from the appropriate natural environment, fertile soil, and abundant water, they face the problems of increasing input costs, unstable and growing market prices due to the land degradation, the climate change, the negative environmental impact, and changing politics and economic conditions (Hoang et al. 2017). Moreover, the food price crisis in 2007–2008 results in the significantly negative impact on the ASEAN countries' food security and thus they have to change the agricultural production system and food policy to ensure the national food security such as the Philippines with the promoting self-sufficiency, subsidies to farmers, and consumer price controls or subsidies; Malaysia

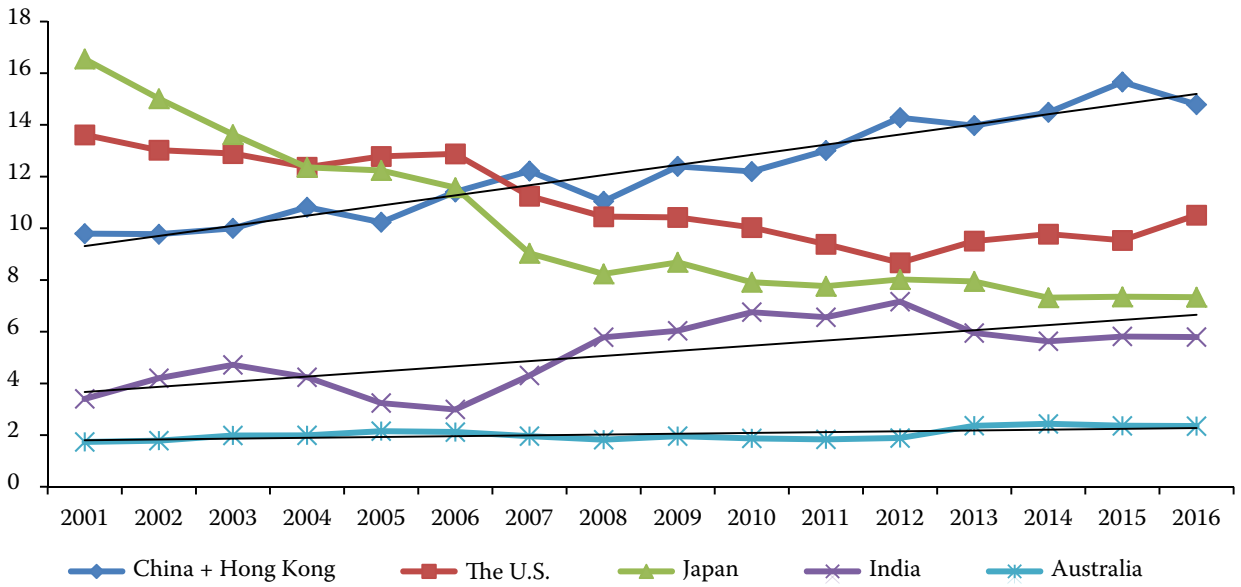

Figure 4. Shares of top markets in ASEAN's total agricultural export (%)

Source: own calculations based on ITC data (2017)

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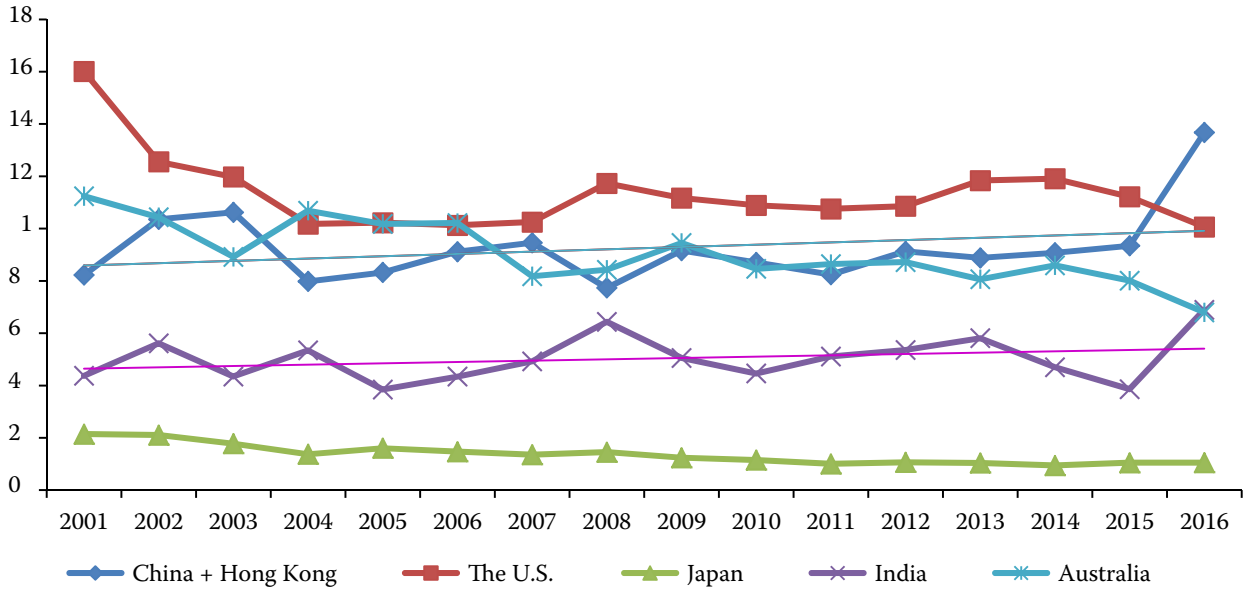

Figure 5. Shares of the top markets in ASEAN's total agricultural import (%)

Source: own calculations based on ITC data (2017)

and Myanmar with the promoting self-sufficiency; Vietnam, Cambodia, and Thailand with export restrictions; Thailand, Indonesia, Malaysia, and Cambodia with consumer price controls or subsidies (Chandra and Lontoh 2010; Wana and Andreosso-O'Callaghan 2017). The change of agricultural production systems and food policies of the ASEAN countries may remarkably affect the agricultural trade flows in the ASEAN region, the agricultural trade competitiveness patterns on the world market, and significantly explain the reasons why these countries tend to be more substitutable in the internally regional markets while they are more complementary on the international markets.

CONCLUSION

This study assesses the agricultural complementarity degree of the ASEAN countries on the world market along with the regional and global economic integration processes. The results by the TCI, generally, imply that the ASEAN countries are weakly complementary or strongly competing in the agricultural trade in the world market. In other words, the agricultural export patterns of the ASEAN countries weakly match the agricultural import patterns of the partner countries in the ASEAN region in comparison with the agricultural commodity composition of the word trade. In addition, the falling trend of the mean TCI values shows that the agricultural complementarity degree of the ASEAN countries slightly decreases over the period 1997–2015. In other words, the ASEAN countries are becoming less complementary.

The results by the ESI, however, show the low degree of similarity in the agricultural export patterns of the ASEAN countries with the mean ESI value of 2.8. This means that these countries are relatively complementary in exporting the agricultural products to the world market. The different result between the TCI and the ESI indicates that the ASEAN countries are not complementary in matching their partners' agricultural import demand while they are complementary in supplying agricultural products to the world markets. In other words, the countries will obtain more benefit from exporting agricultural products to the world markets than to the regional markets. The growing trend of the mean ESI values shows that these countries are becoming more competing on the world market.

Spearman's correlation coefficients for the competitiveness indicators, in general, show that the ASEAN countries' agricultural competitiveness patterns are relatively substitutable on the world market. Singapore-Thailand, Brunei-Vietnam, and Brunei-Thailand are the most complementary pairs whilst Indonesia-Philippines, Indonesia-Malaysia, and Thailand-Vietnam the most substitutable pairs in the agricultural trade competitiveness patterns.

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The study, generally, suggests that the ASEAN countries should cooperate to take advantage of their economic resources and internal markets as a "common domestic" market to enhance the competitiveness and predominantly focus on the external markets based on the global trade and economic agreements and partnerships of the association and the member countries such as the RCEP, the TPP-CPTPP (Trans-Pacific Partnership), and their bilateral free trade agreements. Moreover, the ASEAN countries should specialise in producing and exporting the agricultural products with comparative advantages and import the uncompetitive products to enhance the regional trades, effectively utilise their economic resources, and create higher social welfare based on the elimination of import and export restrictions and the reduction in production subsidies.

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REFERENCES

Andreosso-O'Callaghan B. (2009): Economic structural complementarity: how viable is the Korea-EU FTA? Journal of Economic Studies, 36: 147–167.

Association of Southeast Asian Nations (ASEAN) (2017): Available at http://asean.org/asean-economic-community/ (accessed May 10, 2017).

Balassa B. (1965): Trade liberalisation and "revealed" comparative advantage. The Manchester School, 33: 99–123.

Benedictis L.D., Tajoli L. (2007): Openness, similarity in export composition, and income dynamics. The Journal of International Trade & Economic Development, 16: 93–116.

Brown A.J. (1949): Applied Economics: Aspects of World Economy in War and Peace. George Allen and Unwin, London.

Chandra A.C., Lontoh L.A. (2010): Regional Food Security and Trade Policy in Southeast Asia: The Role of ASEAN. International Institute for Sustainable Development, Manitoba.

Chia S.Y. (2013): The ASEAN economic community: Progress, challenges, and prospects. Working Paper No. 440. ADBI Working Paper – Asian Development Bank Institute.

Drysdale P. (1969): Japan, Australia, New Zealand: the prospect for western pacific economic integration. Economic Record, 45: 321–342.

Finger J.M., Kreinin M.E. (1979): A measure of export similarity and its possible uses. The Economic Journal, 89: 905–912.

Hoang V.V. (2017): Investigating the Agricultural Competitiveness in the ASEAN Countries. Research Report. University of Economics, Ho Chi Minh City.

Hoang V.V., Tran T.K., Tu V.B. (2017): Assessing the agricultural competitive advantage by the RTA index: A case study in Vietnam. AGRIS on-line Papers in Economics and Informatics, 9: 15–26.

International Trade Center (ITC) (2017): ITC Trade Map. Available at https://www.trademap.org/ (accessed May 10, 2017).

Jayawickrama A., Thangavelu M. (2010): Trade linkages between China, India and Singapore: Changing comparative advantage of industrial products. Journal of Economic Studies, 37: 248–266.

Kojima K. (1964): The pattern of international trade among advanced countries. Hitotsubashi Journal of Economics, 5: 16–36.

Linnemann H., Beers C.V. (1998): Measures of export-import similarity and the Linder hypothesis once again. Review of World Economics, 124: 445–457.

Naya S.F., Plummer M.G. (1997): Economic co-operation after 30 years of ASEAN: ASEAN Economic Bulletin, 14: 117–126.

Nguyen T.N.A., Pham T.H.H., Vallee T. (2017): Similarity in trade structure: Evidence from ASEAN + 3. The Journal of International Trade & Economic Development, 26: 1–25.

Petri P.A., Plummer M.G., Zhai F. (2012): ASEAN economic community: A general equilibrium analysis. Asian Economic Journal, 26: 93–118.

Ravenhill J. (2008): Fighting irrelevance: an economic community with ASEAN characteristics. The Pacific Review, 21: 469–488.

Shuai C.M., Wang X. (2011): Comparative advantages and complementarity of the Sino-US agricultural trade: an empirical analysis. Agricultural Economics – Czech, 57: 118–131.

Siah K.L., Choong C.K., Yusop Z. (2009): AFTA and the intra-trade patterns among ASEAN-5 economies: Trade-enhancing or trade-inhibiting? International Journal of Economics and Finance, 1: 117–126.

United Nations Comtrade (UN Comtrade) (2017): UN Comtrade Database. Available at http://comtrade.un.org/data/ (accessed May 10, 2017).

Vaillant M., Ons A. (2002): Preferential trading arrangements between the European Union and South America: the political economy of free trade zones in practice. The World Economy, 25: 1433–1468.

https://doi.org/10.17221/253/2017-AGRICECON

Vollrath T. (1991): A theoretical evaluation of alternative trade intensity measures of revealed comparative advantage. Review of World Economics, 127: 265–280.

Vollrath T.L., Johnston P.V. (2001): The Changing Structure of Agricultural Trade in North America Pre- and Post-CUSTA/NAFTA: What Does It Mean? Economic Research Service, USDA, Washington, DC.

Wana C., Andreosso-O'Callaghan B. (2017): Global financial and food price crisis: A double shock on ASEAN food security. Asian Journal of Agriculture and Development, 14: 1–15.

Wu Y., Zhou Z. (2006): Changing bilateral trade between China and India. Journal of Asian Economics, 17: 509–518.

Yu R., Cai J., Leung P.S. (2009): The normalized revealed comparative advantage index. The Annals of Regional Science, 43: 267–282.

Yang J., Chen Ch. (2008): Agricultural trade between China and ASEAN: Dynamics and Prospects. In: Chen Ch., Duncan R. (eds): Agriculture and Food Security in China. ANU Press, Acton.

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