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Impact Analysis of Normalized Revealed Comparative Advantage on ASEAN's Non-Oil and Gas Export Pattern Using a Gravity Model Approach

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Introduction

International trade occurs when two or more countries that trade with each other enjoy advantages. The expected profit is through comparative advantage which comes in the form of increased production efficiency where each country is able to purchase products at a lower price. Conversely, a country is able to sell its products abroad at a relatively higher price (Sarwedi 2010).

Market openness through the establishment of free trade agreements, in theory, is able to provide either advantages or possible losses to the countries involved in the cooperation. The advantage is a more efficient allocation of natural resources in production specialization, which means

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F. F. Hastiadi (ed.), *Globalization, Productivity and Production Networks in ASEAN*,
https://doi.org/10.1007/978-3-030-16510-9_5

increasing comparative advantage of countries (trade creation). On the contrary, this will further lower comparative advantage with the presence of trade diversion (Widyasanti 2010).

The early establishment of the Association of Southeast Asian Nations (ASEAN) in 1967 had a major agenda to continue to develop economic cooperations, one of which was trade. ASEAN is one of the regional market export destinations that continue to evolve into an increasingly open market, especially for its member countries. ASEAN realizes that the best way to cooperate is by opening up each economy in order to create regional economic integration, followed up by, among others, the establishment of the ASEAN Free Trade Area (AFTA) in 1992.

There are at least four periods in ASEAN milestones: pre-AFTA (pre-1993), post-AFTA pre-Asian Crisis (1993–1998), post-AFTA post-Asian Crisis (1999 to present), and AFTA open trade cooperation with partners outside ASEAN (ASEAN Plus). ASEAN Plus implementation phase began in mid-2005 with the implementation of ACFTA (ASEAN-People's Republic of China Comprehensive Economic Cooperation Agreement). Furthermore, the phase continued with the establishment of the ASEAN Economic Community (AEC) in 2015 and the planned merger of several ASEAN Plus cooperations into Regional Comprehensive Economic Partnership (RCEP) (ASEAN 2011).

According to UNComtrade data (2014), the Standard International Trade Classification (SITC) trade data nomenclature version 2, as presented in Fig. 5.1, recorded a total intra-ASEAN trade in 1967 (when ASEAN only comprised five founding states) of US$1.63 billion or 16.66% of total ASEAN trade to the world which later increased to US$ 26.99 billion or 18.71% of the total ASEAN trade to the world in 1983—one year before Brunei Darussalam joined ASEAN. This means that for a period of 16 years an increase in the average intra-ASEAN trade reaches 20.18% per year with the highest increase in 1979 (45.98%) and a slight decrease (−1.84%) in 1975.

In 1993 when AFTA began to take into effect, the market share of intra-ASEAN trade was still unable to hit 25% until 2012, although the value of intra-ASEAN trade had reached US$584.67 billion. In addition, the increase in trade since the establishment of ASEAN in 1967 until the year 2012 was 14.35% per year. This indicates 12.36% increase per year since AFTA was implemented (1993–2012) or only 11.91% per year

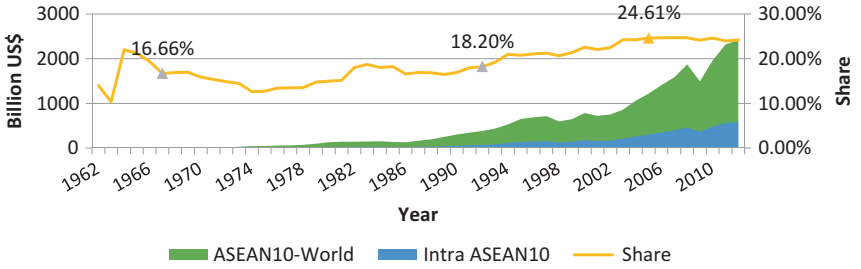

Fig. 5.1 Intra-ASEAN trade, 1962–2012. Source: Authors, from UNComtrade (2014, processed)

since the establishment of ASEAN Plus for the first time (2005–2012). Likewise, the share of intra-ASEAN exports and imports in the period of 1967–2012 jumped from 13.66% to 25.85% (for exports) and from 15.01% to 22.48% (for imports).

In addition, total intra-ASEAN non-oil trade in 1967 as shown in Fig. 5.2 was recorded at US$1.48 billion. This value is equivalent to 16.18% of the total value of non-oil trade of ASEAN to the world. Then, the value climbed to US$14.47 billion, but its share dropped to 14.58% in 1983. In general, ASEAN trade over a period of 16 years since the formation of ASEAN, posts an increase on an average of 15.37% per year. During the period, the highest increase occurred in 1973 (53.56%), while the lowest decline (−7.60%) took place in 1975.

Meanwhile, intra-ASEAN non-oil trade also has not been able to touch 25% until 2012 even though the trade value has reached US$428.75 billion in 2012. This means that the increase in non-oil trade intra-ASEAN in 1967–2012[1] was 14.09% per year. In other words, there is an increase in intra-ASEAN trade by 11.56% per year since AFTA is implemented (1993–2012) or only 9.57% per year since the formation of ASEAN Plus for the first time (2005–2012).

Similarly, the share of intra-ASEAN exports and imports in the period 1967–2012 soared from 20.78% to 23.15% (for exports) and from 12.59% to 20.51% (for imports). Nevertheless, the market share increase

[1] The intra-trade assumption here only reflects trade among ASEAN member states without including trade with members of ASEAN Plus and non-ASEAN (China, Japan, Korea, India, Australia and New Zealand).

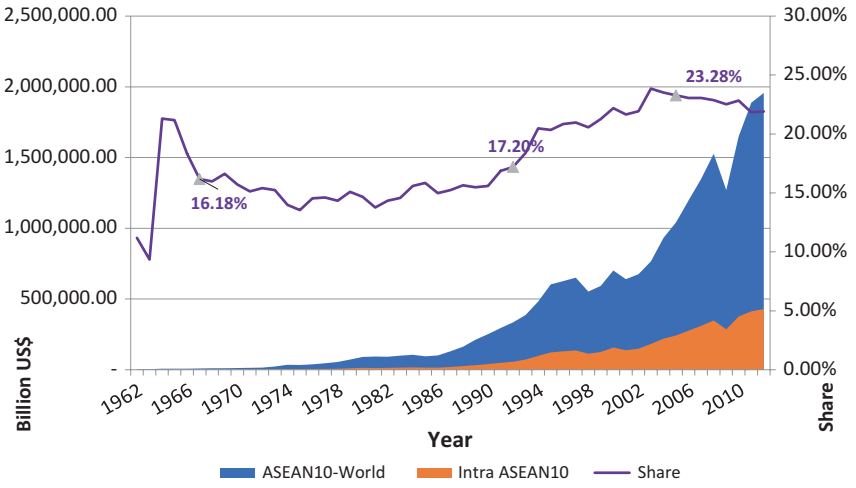

Fig. 5.2 Non-oil and gas Intra-ASEAN trade, 1962–2012. Source: Authors, from UNComtrade (2014, processed)

remained at the range of 25%. The share of intra-ASEAN trade is still relatively small compared to that of intra-European Union trade. The European Union (EU) is a form of economic integration which is considered the most advanced in the world today. The share of intra-EU trade has reached an average in the range of 66%, both for the whole commodity and for non-oil commodities, during the period 2003–2012 (UNComtrade 2014). Lowering intra-regional ASEAN trade is in line with what was mentioned by Elliott and Ikemoto (2004) who argued that the orientation of foreign trade of member countries of ASEAN (both exports and imports) generally still tended to be oriented from and to non-ASEAN nations, such as China, Japan, United States and the countries of Western Europe.

As global challenges upsurge, which result from the impact of the Asian crisis in the late 1990s and the global financial crisis in 2008, as well as from the rapidly growing China and India economies, ASEAN is spurred to further deepen its economic integration. In 2003, the idea of the AEC emerged. AEC has a goal to make ASEAN as a single market and production base, competitive economic region, a region with equitable economic development and integration with the global economy.

AEC covers liberalization and facilitation of trade in goods, trade in services and investments, including protection and promotion of investment; narrowing differences in development; and openness of trained manpower and capital flows (Chia 2013). In addition to the establishment of the AEC, ASEAN has also developed FTA cooperation with several trading partners within ASEAN Plus and plans to merge numerous ASEAN Plus[2] cooperations into RCEP (ASEAN 2011).

As previously discussed, amid deepening economic integration, the share of intra-ASEAN trade stays at the range of 25% although it only covers non-oil exports. The concern is that the ASEAN member countries need to know the extent of non-oil exports pattern in the ASEAN market. In this case, they need to find out commodities that have comparative advantage, especially those having the largest and most significant influence on the pattern of ASEAN's non-oil exports.

The knowledge clearly becomes necessary to avoid ASEAN member countries only being target market when ASEAN actually opens up AEC market within RCEP concept. According to Chia (2013), the spirit of establishment of AEC itself is to make ASEAN a single market and production base, a competitive economic region, and a region with equitable economic development and global economy integration. Coverage of AEC includes liberalization and facilitation of trade in goods, services and investments, together with protection and promotion of investment; narrowing development differences; and openness of trained manpower and capital flows.

With regards to trade patterns[3] (in this case is a pattern of non-oil exports), studies that employ gravity models are already quite abundant, particularly those related to trade flows (Kepaptsoglou et al. 2010).

[2] ASEAN Plus is ASEAN-*People's Republic of China Comprehensive Economic Cooperation Agreement (*ACFTA), implemented in mid-2005; ASEAN-Korea *Comprehensive Economic Cooperation Agreement* (AKFTA), implemented in mid-2007; ASEAN-Japan *Comprehensive Economic Partnership* (AJCEP), implemented in late 2008; ASEAN-India *Comprehensive Economic Cooperation Agreement* (ASEAN-India CECA) and ASEAN-Australia and New Zealand *Free Trade Agreement* (ASEAN-ANZ FTA) which was implemented in early 2010.

[3] Trade pattern is anything that is traded by a country (be it goods or services), with whom, and to which direction (export or import) the trade is conducted. Trade pattern itself is one of the main goals of trade theory, particularly in terms of which goods or services that will be exported or imported by a country (Deardorff 2010).

Nevertheless, studies applying approach of commodities trade pattern remain limited.

Studies related to ASEAN trade flows are, among others, the ones conducted by Elliott and Ikemoto (2004) and Hapsari and Mangunsong (2006). Both studies utilize export pattern approach in viewing trade flows. Both researches have taken into account a variable which is a derivative product of comparative advantage, namely complementarity and similarity indices. 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) in their study which aims to identify the effect of comparative advantage on export patterns do 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 also that RCA has several drawbacks, the authors also refer to Yu et al. (2009) who modify 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 that need to be focused on to increase 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 effect of comparative advantage, that is, NRCA, on the pattern of ASEAN's non-oil exports during the period 1989–2012.

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

This chapter consists of section "Conceptual Framework" describing the conceptual framework of comparative advantage and trade patterns through gravity model approach; section "Empirical Research Review" outlining a number of relevant empirical researches; section "Methodology" introducing the model, variables, data and estimation methods in this study; section "Results and Analysis" discussing the results of the estimates; and section "Conclusion".

Conceptual Framework

Comparative Advantage, Pattern Export and NRCA

Comparative advantage or Ricardian model is a classical economic theory which argues that a country to another are interdependent and can mutually benefit each other, and one of which is economic benefit. The two countries can conduct exchange transactions in accordance with their comparative advantage, in this case is the comparison of number of labors used to produce one unit of product (Ricardo 1817; Edward and Schoer 2002). Ricardian models show that countries with a higher comparative advantage in a product will tend to focus its production factors on producing and increasing the amount of production and subsequently exporting to countries that have lower comparative advantage for that product. In opposition, the country will tend to reduce or even not to produce products that have lower comparative advantage and subsequently will import such product from countries that have higher comparative advantage (Appleyard et al. 2006).

In further development, the difference in production endowment factor is considered having an impact on international trade (Hecksher 1919; Ohlin 1933). Based on Heckscher-Ohlin theory, Edward and Schoer (2002) suggest that exports are made by countries with abundant production endowment factor as they have lower opportunity cost compared to other countries. Therefore, differences in production endowment and opportunity cost are the core of comparative advantages, in addition to differences in technological development (Salvatore 2002; Costinot 2009).

In line with the above explanation, it can be said that comparative advantage is considered being able to show export performance pattern. This is consistent with the definition of trade pattern, that is, anything traded by a country (either goods or services), with whom trade transactions are carried out, and to which direction (export or import). Trade pattern itself is one of the main objectives of trade theory, especially in terms of goods or services that will be exported or imported by a country (Deardorff 2010).

Index of revealed comparative advantage (RCA) or Balassa revealed comparative advantage (BRCA) is one tool to measure the level of comparative advantage in empirical studies (Balassa 1965). Although useful in examining whether a country has a comparative advantage in specific products, it has some limitations (Hillman 1980; Bowen 1983, 1985, 1986; Ballance et al. 1985, 1986; Deardorff 1994; Hoen and Oosterhaven 2006). Most researches apply BRCA index only to identify the relative ranking of the comparative advantages of a country for different commodities even though generally it remains problematic in its relative order (Yeats 1985).

Some RCA alternatives have been developed to overcome the weaknesses of BRCA, among others, BRCA log (Vollrath 1991), symmetrical revealed comparative advantage (SRCA) (Laursen 1998), weighted revealed comparative advantage (WRA) (Proudman and Redding 1998), additive revealed comparative advantage (ARCA) (Hoen and Oosterhaven 2006). Although the indices develop some aspects of BRCA, but none of those indices could be the one that can be generally applied to comparison between spaces (either commodities, state or region) and time.

To answer the problem of BRCA limitations and some of the alternative RCA indices, Yu et al. (2009) have developed BRCA index into an NRCA. NRCA possesses attributes that can indicate the rank and comparable in comparative advantage across commodities, countries and time spans and it is expected to show a country's trade pattern, thereby enabling identification of the types of commodities that have good potential in a market and at a specific time. NRCA index value for each commodity from each country as a whole is zero or neutral. This is in line with the assumption that no country has a comparative advantage for all commodities.

The NRCA equation is as follows:

$$\mathrm{NRCA}_k^i = \frac{\Delta X_{ik}}{X} = \frac{X_{ik}}{X} - \frac{X_k X_i}{XX} \tag{5.1}$$

where,

NRCA_k^i is the difference in the comparative advantages of country i for product k in a specific market;
X_{ik} is commodity export k of country i to a specific market;
X_i is the total exports of country i to a specific market;
X_k is the world's commodity exports k to certain markets; and
X is the world export to a specific market.

NRCA value span ranges from neutral value (0) is $-0.25 <$NRCA < 0 and $0 <$NRCA < 0.25. This signifies that a commodity has actual export value lower than the comparative advantage in its neutral value if the NRCA value is smaller than 0. On the contrary, a commodity has actual export value greater than the comparative advantage in its neutral value if the NRCA value is smaller than 0.

The symmetrical range of values causes the total number of NRCA for all commodities of a country or trading market to become zero or neutral. Consequently, in a country or market, if one of the commodities from a country experiences increase in comparative advantage, the same commodity from other countries will experience a decline in comparative advantage.

NRCA can be used to determine the level of specialization of a country. In this condition, NRCA can be used to look for the comparative advantage among commodities in a country using the following equation:

$$\Delta\mathrm{NRCA}_{kl}^i = \frac{\Delta X_{ik}}{X} - \frac{\Delta X_{il}}{X} = \left[\left(\frac{X_{ik}}{X} - \frac{X_k X_i}{X * X}\right) - \left(\frac{X_{il}}{X} - \frac{X_l X_i}{X * X}\right)\right] \tag{5.2}$$

where,

$\Delta \text{NRCA}_{kl}^{i}$ is the difference in the comparative advantages of commodity k with commodity l in country i;
X_{ik} is a commodity export k of country i to a specific market;
X_{il} is a commodity export l of country i to a specific market;
X_i is total exports of country i;
X_k is commodity export k of country i;
X_l is commodity export l of country i; and
X is world's exports to a specific market.

When comparing comparative advantage of commodity with partner countries within a particular market, be it country, regional or global, the NRCA equation becomes

$$\Delta \text{NRCA}_{k}^{i-j} = \frac{\Delta X_{ik}}{X} - \frac{\Delta X_{jk}}{X} = \left[\left(\frac{X_{ik}}{X} - \frac{X_k X_i}{X * X} \right) - \left(\frac{X_{jk}}{X} - \frac{X_k X_j}{X * X} \right) \right] \quad (5.3)$$

where,

$\Delta \text{NRCA}_{k}^{i-j}$ is the difference in the comparative advantages of commodity in country i with commodity j for product k in a specific market;
X_{ik} is a commodity export k of country i to a specific market;
X_{jk} is a commodity export k of country j to a specific market;
X_i is total exports of country i to a specific market;
X_j is total exports of country j to a specific market;
X_k is a world's commodity export k to a specific market; and
X is world's exports to a specific market.

In the interim, the equation of comparative advantage comparison of commodity in time range changes becomes:

$$\begin{aligned} \Delta \text{NRCA}_{k,t+1}^{i} &= \frac{\Delta X_{ik,t+1}}{X_{t+1}} - \frac{\Delta X_{ik,t}}{X_t} \\ &= \left[\left(\frac{X_{ik,t+1}}{X_{t+1}} - \frac{X_{k,t+1} X_{i,t+1}}{X_{t+1} * X_{t+1}} \right) - \left(\frac{X_{ik,t}}{X_t} - \frac{X_{k,t} X_{i,t}}{X_t * X_t} \right) \right] \end{aligned} \quad (5.4)$$

where,

$\Delta NRCA^{i}_{k,t+1}$ is the difference in the comparative advantages of commodity in country i for commodity k between a time range of $t + 1$ and t;
$X_{ik,\,t+1}$ is a commodity export k of country i at time $t + 1$;
$X_{ik,\,t}$ is a commodity export k of country i at time t;
$X_{i,\,t+1}$ is total exports of country i at time $t + 1$;
$X_{i,\,t}$ is total exports of country i at time t;
$X_{k,\,t+1}$ is world's commodity export k at time $t + 1$;
$X_{k,\,t}$ is world's commodity export k at time t;
X_{t+1} is world's exports at time $t + 1$; and
X_t is world's exports at time t.

According to Yu et al. (2009), NRCA is considered consistent in measuring the comparative advantage that is symmetrical, additive for the range of countries and commodities, and comparable across countries, commodities and time. Therefore, NRCA can be used in time-series analysis as well as in comparative analysis of comparative advantage among countries with panel data analysis.

Gravity Model in International Trade

The use of the gravity model approach in international trade flows is developed separately by Tinbergen (1962) and later Pöyhönen (1963). Linnemann (1966) adds the variable and moves further by establishing a theoretical justification in the form of Walrasian general equilibrium system.

Although initially there was no theoretical support for gravity model, since the late 1970s, there were numerous developments that had filled this gap. Anderson (1979) conducted the first formal attempt to derive the equation of gravity based on Cobb-Douglas expenditure system, assuming identical homothetic preferences between regions and products were differentiated by region of origin. Bergstrand (1985, 1989) also explored the theoretical support of bilateral trade in some papers, where the gravitational equation was associated with the model of monopolistic

competition and product differentiation (not intercountry-based). Helpman (1987) used the framework of product differentiation with increasing returns to scale (IRS) to justify the gravity model.

Deardorff (1995) derived the gravitational equation from two extreme cases based on Heckscher-Ohlin (H-O) model. The first case is in the form of free trade with homogeneous products where both producers and consumers do not differ in choosing one of the many trading partners. The second case is where the country produces different goods and each has different Cobb-Douglas or constant elasticity of substitution (CES) preference. Deardorff drew the conclusion that the gravity model was consistent with the existing trading model. Eaton and Kortum (1997) as cited by Rahman (2003) derived the gravity equation in a Ricardian framework. Evenett and Keller (1998) argued that the gravitational equations could be derived from the H-O model with both perfect and imperfect product specialization conditions.

In the past ten years, development of gravity model indicates that out of 75 studies using this model, most are related to the impact of FTA trade policy, particularly regional FTA, the rest is related to the flow of trade in general (Kepaptsoglou et al. 2010). Similarly, in the new determinant in international trade, there are several variables that have good potential to explain the gravity model of trade, namely the level of development, trade policy, affinity of language and colony, geography, relative population density, common currency, and membership in a regional trade agreement (Yamarik and Ghosh 2006).

Empirical Research Review

Empirical studies using gravity model in terms of economic integration (FTA) against flows and trade patterns have been commonly conducted until the last decade. The use of gravity model is empirical model other than the computational general equilibrium (CGE) model. With regards to the use of gravity model in examining the pattern of trade in ASEAN, Elliott and Ikemoto (2004) as well as Hapsari and Mangunsong (2006) both apply the augmented gravity model to investigate the determinants of trade flows among AFTA member states. Both studies identify the

influence of AFTA formation on intra-regional and extra-regional trades by comparing the trade patterns among countries involved in AFTA scheme and non-AFTA countries.

Gravity model on both studies utilize some basic variables by adding some other control variables. These basic variables have some connections with trade, consistent with the results of empirical studies with other gravity model. In their studies this time, Elliott and Ikemoto (2004) as well as Hapsari and Mangunsong (2006) add two variables, namely Complementarity Index (COM) and Similarity Index (SIM). COM and SIM are added into the model because though differences in economic level are able to describe the differences in endowment factor, the variable is explicitly unable to explain product differentiation and demand inequality (Deardorff 1984 in Elliott and Ikemoto 2004).

Ng and Yeats (2003) suggest that COM can separate the effect of the commodity composition from other factors that encourage trade flows. Besides, it represents the alignment between export and import structures in a bilateral trade with the assumption that traded commodity reflects innate ability factor. It is also said that complementarity is one of the products of comparative advantage if assuming that the pattern of export and import describes resource endowment and demonstrates the existence of economic resources and which production structure that complements (Drysdale 1967). At the interim, SIM, according to Ng and Yeats (2003) provides information on whether the export structure of trading between two countries has a common key export product or not. One of the shortcomings of COM and SIM is its more aggregate nature. In this regard, both indices cannot capture the comparative advantage which later can portray the difference in endowment factor from different commodities, both within a country or in its comparison with other countries.

In their study, Elliott and Ikemoto (2004) have a specific purpose, in addition to those described above, to determine whether an increase occurs in trade between AFTA members (intra-trade) or in trade with partners outside AFTA. Thus, the effect of increased trade will be utilized as much by members of AFTA. Furthermore, it will become part of trade policy-making and negotiations.

Specification of estimates made in this study is by making a comparison between the time before AFTA and the time afterwards. The division of the period for comparison purposes comprises time periods of 1982–1987, 1983–1987, 1988–1992, 1993–1997 and 1998–1999 as well as a summary of two periods, 1983–1997 and 1993–1999. Moreover, the estimations are conducted three times, namely (1) using a single intra-regional bias dummy Regional Trade Agreement (RTA) to determine the pattern of bilateral trade with comparable RTA other than ASEAN; (2) using two intra- and extra-regional bias to identify trade creation and trade diversion; and (3) is similar to stage (1), but is only intended for ASEAN.

In the meantime, Hapsari and Mangunsong (2006) employ data of 1988–2003 and in the model (which is almost similar to that of Elliott and Ikemoto) they utilize price as an additional control variable. Next, estimation is conducted in three stages using ordinary least square (pooled data), namely (1) estimating standard gravity model equation (economic size and distance variables) which is added with tariff and geographical dummy variables; (2) estimating the same model as step (1) and adding tariff, dummy RTA (ASEAN), trade creation, and trade diversion variables; and (3) estimating the same model as step (2) by adding a variable index of complementarity and similarity.

The results obtained from these two studies are slightly different, yet they give complementary explanation. In general, AFTA affects increase in trade among ASEAN member countries and it also causes slight reduction of welfare for non-ASEAN countries, due to the diversion of trade to ASEAN countries (Hapsari and Mangunsong 2006).

According to Elliott and Ikemoto (2004), based on the range of AFTA implementation period in the first five-year period, there is no significant improvement in trade flows in ASEAN, due to the limitations of institutional progress of each ASEAN government. Moreover, this is attributable to the effects of enlargement of share of non-ASEAN exporters, such as China and Latin American countries. The Asian crisis in the late 1990s actually spurred the increase in trade among ASEAN member countries and after the crisis passed, trade situation returned to become more outward looking.

The research related to the use of comparative advantage, in this case the RCA index, as a determinant of exports or export performance pattern was conducted by Yue and Hua (2002). This study aims to determine whether comparative advantage, which is identified through the RCA index, affects the development of China's exports. Estimations are made by two-stage least square (2SLS) regression to find out the export determinant from both the demand and supply sides as well as panel data regression to examine the relationship of comparative advantage with export performance.

The assumption used in this study is China as a price taker. The comparative advantage index used is RCA for chemical products (RCA5), raw materials RCA, and finished goods manufacturing industry (RCA 68), and machinery and transportation equipment RCA (RCA7). The data used cover the period 1980–2000 for export data, in accordance with SITC 1-digit level, that is SITC 0–8 and SITC level 3. The results and conclusions of the study signify that RCA index is able to explain the pattern of China's export growth evolving in accordance to their comparative advantage.

Hypothesis

As presented in the previous section, this study aims to find out the determinant of non-oil exports of ASEAN countries, especially to identify the effect of comparative advantage on the pattern of non-oil exports of the ASEAN member states.

The hypothesis to be tested in this study is that the greater the difference between the comparative advantage of one of the member countries of ASEAN with its trading partner country in the ASEAN market (ΔNRCA), the bigger the non-oil exports. Comparative advantage will have a significant positive relationship with non-oil exports. As for this study, the comparative advantage used is based on commodity groups. It is then expected that the size of influence of comparative advantage of each commodity on non-oil exports from ASEAN member countries is obtained.

Methodology

This study refers to and modifies the model used by Elliott and Ikemoto (2004) and Hapsari and Mangunsong (2006) which modifies augmented gravity model from basic model variations of Tinbergen (1962) and Pöyhönen (1963). Additionally, this research model also refers to Yue and Hua (2002) and Yu et al. (2009). Therefore, the modification in this study to the models used in the two previous studies mentioned above is replacing the complementarity index variable with 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

$$\log\left(X_{ijt}\right) = \alpha_0 + \alpha_1 \log\left(\mathrm{PGDP}_{it}\right) + \alpha_2 \log\left(PGDP_{jt}\right) + \alpha_3 \log\left(POP_{it}\right) + \alpha_4 \log\left(POP_{jt}\right) + \alpha_5 \log TC_{ijt} + \alpha_6 \mathrm{AFTA}_{jt} + \alpha_7 \mathrm{ASEANPLUS}_{jt} + \alpha_8 \mathrm{CRISIS}_{t} + \sum \alpha_{9k} \Delta \mathrm{NRCA}_{kt}^{i-j} + \mu_{ijt} + \varepsilon_{ijt} \quad (5.5)$$

where each variable can be described as follows:

1. 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. Numerous independent variables are used as determinant of those exports. Use of exports as dependent variable is initial variable from gravity models (Tinbergen 1962 and Pöyhönen 1963).
2. 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. Besides, GDP per capita is a proxy of capital endowment ratio (Bergstrand 1985; Sohn 2005). The GDP per capita is also considered a proxy to determine the influence endowment factor on fragmentation (Kimura et al. 2007) as well as the proxy of infrastructure endowment and the skills of the workforce in the trading country (Türkcan 2011). GDP per capita is also an approach to economic development level that has positive impact on international trade (Frankel and Rose 2000; Elliott and Ikemoto 2004).

3. POP_i and POP_{jt} are population of the exporter country *i*, and population of the trading partner's 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. It also shows the effect of absorption where, despite rising population and increasing production, the produced goods are more absorbed in the domestic market than for export (Razzaghi et al. 2012). On the other hand, population can depict the economic direction of a country. If the direction is outward-oriented, the import demand will increase with the increase in population. Conversely, if the orientation direction is inward-oriented, the demand for imports declines along with the increase of population (Tayyebi 2005).
4. TC[4] 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 (Tinbergen 1962; Pöyhönen 1963). Index *Trade Cost* is the trading cost which is calculated using inverse gravity framework based on a research by Novy (2009). TC is an estimate of the cost of trading based on the cost of bilateral trade and gross national output.
5. 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.

[4] 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.

6. $\Delta NRCA_{kt}^{i-j}$ is a variable used to reflect the different comparative advantages of a country commodity *i* with its trading partner (*j*) in the ASEAN market. $\Delta NRCA_{kt}^{i-j}$ is calculated based on Eq. (5.3). Given the relatively small ΔNRCA value, ΔNRCA is multiplied by 100. In line with the findings by Yue and Hua (2002) that comparative advantage is considered capable of showing patterns of exports, it is expected that the higher the $\Delta NRCA_{kt}^{i-j}$, the greater the impact on the amount of exports from *i* to *j*.

Sources of data used in the study are in accordance with the variables in the empirical model described in Table 5.1.

The trade data used in the calculation of NRCA is based on the data of three-digit SITC version 3 (SITC3) which are then grouped according to UNCTAD (2013a, b). This is a grouping of commodities based on the origin of the raw material and the level of technology and skills of the workforce of an industry. The use of SITC data at three-digit level is because at this level the characters of commodities by technology similarity and production factors can be seen (Greenaway and Milner 1986; Menon 1996). The commodity grouping in this research can be seen in Table 5.2.

As for the purpose of analysis, the researchers create three alternative combinations of commodities grouping by commodity group codes, namely:

- Combination I: **1A, 2, 3, 4** and **5**
- Combination II: **2, 3, 41A** and **5**; and
- Combination III: **2, 3A, 3B, 3C1, 3C2, 3C3, 3D1, 3D2, 3D3, 41A** and **5**.

Combination I and II are similar to one another. Combination II integrates Coal and Derivatives (Code 1A) with Mining Goods (Code 4) into Mining Goods including Coal and Derivatives (Code 41A). Combination III are similar to combination II but the commodities in combination III are disaggregated into numerous groups of industry or manufacturing commodities based on the different skill levels of the workforce and technology.

Table 5.1 Variables, descriptions and sources of data

Variables	Descriptions	Relationship	Sources
$\text{Log}(X_{ijt})$	Log of bilateral trade between countries *i* and country *j* in year *t*, in million US$ according to SITC classification version 3		UNComtrade 2014, accessed through WITS
$\text{Log}(\text{PGDP}_{it})$	Log of constant GDP per capita in 2005 of country *i* in year *t*, GDP is in US$	+	WDI, World Bank 2014
$\text{Log}(\text{PGDP}_{jt})$	Log of constant GDP per capita in 2005 of country *j* in year *t*, GDP is in US$	+	WDI, World Bank 2014
$\text{Log}(\text{POP}_{it})$	Log of POP of country *i* in year *t*	–	WDI, World Bank 2014
$\text{Log}(\text{POP}_{jt})$	Log of POP of country *j* in year *t*	+	WDI, World Bank 2014
$Log(\text{TC}_{ijt})$	Trade cost index of country *i* and country *j* in year *t*	–	ESCAP, World Bank 2014
AFTA_{ijt}	Cooperation dummy of AFTA in year *t*	+/–	
ASEANPLUS_{ijt}	Cooperation dummy ASEAN PLUS in year *t*	+/–	
CRISIS_{ijt}	Economic crisis dummy	+/–	
$\Delta\text{NRCA}_{kt}^{i-j}$	Comparison between comparative advantage of country *i* and country *j* for commodity *k* in year *t*	+	Own calculations based on UN Comtrade data

Descriptive analysis of the calculation results of NRCA will be addressed using combination III coupled with other energy commodities (1B, 1C and 1D). The descriptive analysis not only focuses on non-oil commodities alone, but will be more thorough. NRCA calculation is based on Eq. (5.1). In addition, to identify changes in comparative advantage over time, the following periods are used: 1989 (the period prior to AFTA), 1996 (the period after AFTA and before the 1998 crisis), 2004 (after the Asian crisis, before the establishment of the ASEAN Plus, and before the global financial crisis) and 2012 (after the establishment of the ASEAN Plus and post-global financial crisis).

In the meantime, the gravity model estimation is carried out in five scenarios, namely: (1) the estimates specification **[1]** of basic gravity

Table 5.2 Grouping of SITC3 commodities at Level 3 digit based on production factors and level of technology

Commodity group code	Description
1. Energy commodity	
1A	Coal and coal-based products (except gas)
1B	Petroleum and petroleum-based products (except gas) including lubricants and asphalt (tar)
1C	Gas, including liquefied natural gas, gas from oil and coal
1D	Electric power
2. Agricultural commodities	
2	Agriculture, animal husbandry, plantation and other agricultural products
3. Industrial/Manufacturing products commodities	
3A	Labor-intensive and resource-intensive manufacture products
3B	Low-skill and technology-intensive manufacture products
3C1	Electronics including medium-skill and technology-intensive manufacture Products
3C2	Parts of electronic and electrical products that include medium-skill and technology-intensive manufacture products
3C3	Non-electronic and non-electrical products that include medium-skill and technology-intensive manufacture products
3D1	Electronics that include high-skill and technology-intensive manufacture products
3D2	Parts of electronic and electrical products that include high-skill and technology-intensive manufacture products
3D3	Non-electronic and non-electrical products that include high-skill and technology-intensive manufacture products
4. Mining commodities	
4	Minerals (other than coal), metals, and other minerals
5. Other commodities	
5	Other commodities *(unspecified)*

Source: Authors, from UNCTAD (2013a, b)

model; (2) model specification **[2]** of basic gravity model estimation is added with dummy AFTA, ASEANPLUS and CRISIS; (3) model specification **[3]** shows the gravity model **[2]** which is added with $\Delta \mathbf{NRCA}_k^{i-j}$ variables for commodities that are based on combination I; (4) specifica-

tion [4] is the gravity model with specification similar to specification [3], but using ΔNRCA variables of commodities based on combination I; and (5) model specification [5] is gravity model specification that is similar to specification [4], but with ΔNRCA that is based on combination III.

Results and Analysis

Comparative Advantage of ASEAN Trade Commodities in ASEAN Market Based on NRCA

General overview of the average change of NRCA ASEAN as a single state entity in the ASEAN market during the period 1989–2012 is illustrated in Fig. 5.3. The average NRCA value is the average of the NRCA commodities that have NRCA value above zero. Figure 5.3 illustrates that the trend of comparative advantage average change of ASEAN tends to

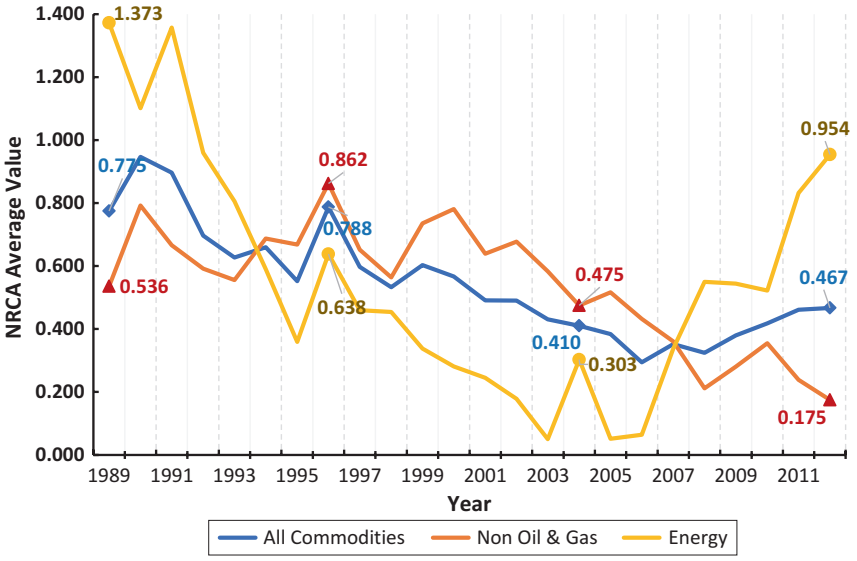

Fig. 5.3 The average change of ASEAN's NRCA in ASEAN market, 1989–2012. Source: Author's own calculation

fall by 3.73% during 1989–2012. NRCA average value of all commodities, namely energy commodities other than coal (consisting of oil and gas and electricity) and non-oil commodities was 0.775 in 1989 and then climbed to 0.788 in 1996. However, the NRCA average increase contracted to 0.410 in 2004 then slightly jumped to 0.467 in 2012. Of these changes, it appears that in the period before the Asian economic crisis in 1997, the comparative advantage of ASEAN in ASEAN market was twice as much as that of post-crisis.

For the meantime, the trend of ASEAN's average non-oil commodity comparative advantage indicates a sharper decline (−4.69%) when compared to that of the entire commodities (−3.73%) during 1989–2012. The decline in ASEAN's non-oil commodity comparative advantage is the result from changes in the pattern that occurred before the global financial crisis. The changes are mainly in the increase in comparative advantage of energy commodities which indicated an annual increase of 20.03% over the period 2007–2012. The rise of energy commodities' advantage is able to slightly drive increase in comparative advantage of all commodities, but also compensates in a form of pressure to the decline in non-oil commodities' advantage. This also indicates that intra-ASEAN trade in over the last decade is more focused on energy commodities, especially oil and gas.

To find out how much NRCA value and ranking of each commodity traded by ASEAN countries as a single entity in the regional market in a given year, refer to Table 5.3. This table describes that, in general, in the ASEAN market, petroleum commodities and their processed products (1B) have the highest comparative advantage compared to that of other energy commodities (gas (1C) and electric power (1D)) and of non-oil commodities. The calculations indicate that petroleum and its products always rank first or second. When explored further, it is found that ASEAN member that has the highest comparative advantage for petroleum and its products in the ASEAN market is Singapore. The comparative advantages of Singapore petroleum also become a major contributor to the high NRCA value for ASEAN petroleum. This finding becomes evidence that a country which possesses natural resources does not always have the advantage in the natural resources products, while a non-producing country can actually become a central and control the

commodity trade. Additionally, logistics readiness and adequate trade services are the driving factors that boost the comparative advantage. Singapore in this case took fifth position in global Logistics Performance Index (LPI 2014) and ranked first in ease of doing business (Doing Business 2014).

ASEAN commodities including non-oil show diverse changes in their comparative advantage. Commodities that belong to the low-skill and technology-intensive manufacture products (3B), non-electronic and electrical products which belong to medium-skill and technology-intensive manufacture products (3C3), non-electronic and electrical products which are classified as high-skill and technology-intensive manufacture products (3D3), minerals (including coal), metals, other minerals (41A), as well as other commodities (unspecified) (5) are one of five groups of commodities that experience discomparative advantage, where NRCA value during the period 1989–2012 is relatively always below zero.

On the side of the competitor, 3C3 commodities from Japan have the highest comparative advantage and are always ranked first in the ASEAN market during the period 1989–2012, although the level of excellence in 2012 dropped to half compared to that of 1989. The fall of Japan's 3C3 commodity advantage is attributable to, among others, the increasing advantage of European Union's 3C3. Meanwhile, China has begun to emerge as a new competitor of 3C3 commodities with comparative advantage in the ASEAN market since 2011. The emergence of China as an exporter which has a relatively high comparative advantage for electronic products with medium-level technology is one of the factors that cause the increasingly fragmented electronics industry in the country. This is evident from the increasing number of such products as laptops and mobile phones which are manufactured and marketed from China to ASEAN. Meanwhile, the European Union and the United States remain 3D3 commodity exporters with the highest comparative advantage over the period 1989–2012.

The ASEAN commodities which are labor-intensive and resource-intensive manufacture products (3A) showed superiority in the ASEAN market in the late 1980s to the early 1990s, but the trend continued to decline so that in the period 1995–1996 it turned into discomparative advantage products and remained that way until 2012. The condition

Table 5.3 NRCA results and ranking of entire ASEAN commodities in ASEAN market

Commodity group code	1989			1996			2004			2012		
	NRCA	PAKDSN[a]	PAKAN[b]	NRCA	PAKDSN	PAKAN	NRCA	PAKDSN	PAKAN	NRCA	PAKDSN	PAKAN
1B	2.696	1	2	1.172	2	5	0.803	2	8	2.424	1	2
1C	0.049	6	38	0.105	6	33	0.098	6	32	0.437	3	19
1D	0.000	8	47	0.000	7	49	0.008	8	47	0.001	8	43
2	1.891	2	4	0.401	4	13	0.152	5	28	0.026	7	40
3A	0.613	3	11	−0.123	10	106	−0.491	11	128	−0.784	12	133
3B	−1.000	12	134	−0.754	12	134	−0.717	13	134	−1.083	14	136
3C1	−0.032	10	84	−0.021	8	79	0.025	7	44	0.031	6	38
3C2	−0.029	9	83	0.202	5	20	0.289	3	18	0.101	5	30
3C3	−2.853	14	140	−2.200	14	140	−0.892	14	137	−0.880	13	135
3D1	0.045	7	39	0.946	3	6	0.264	4	20	0.207	4	24
3D2	0.078	4	31	1.900	1	2	1.644	1	3	0.509	2	17
3D3	−1.342	13	138	−1.164	13	137	−0.556	12	132	−0.475	11	131
41A	0.052	5	37	−0.389	11	125	−0.340	10	122	−0.159	9	101
5	−0.167	11	109	−0.074	9	101	−0.287	9	120	−0.356	10	119
Average NRCA values of commodities with NRCA >0	**0.775**			**0.788**			**0.410**			**0.467**		

(*continued*)

Table 5.3 (continued)

Commodity group code	1989			1996			2004			2012		
	NRCA	PAKDSN[a]	PAKAN[b]	NRCA	PAKDSN	PAKAN	NRCA	PAKDSN	PAKAN	NRCA	PAKDSN	PAKAN
Average NRCA values of non-oil and gas commodities with NRCA >0	**0.536**			**0.862**			**0.475**			**0.175**		
Average NRCA values of oil and gas commodities including electrical power with NRCA >0	**1.373**			**0.638**			**0.303**			**0.954**		

[a]PAKDSN: Inter-commodity Ranking in a Country
[b]PAKAN: Inter-commodity Ranking among Countries

was made possible because of the growth of the advantages of the electronic commodities that belong to medium-skill and technology-intensive manufacture products (3C1) as well as spare parts and parts of electronic and electrical goods which belong to medium-skill and technology-intensive manufacture products (3C2).

Similarly, agricultural, livestock, plantations and other agricultural commodities (2), even though they are in the advanced category (NRCA> 0) during the years 1989–2012, they indicate a decreasing pattern of comparative advantage and lean toward discomparative advantage. This is probably due to the lack of intra-ASEAN trade for this commodity. This is evidenced by the increasing NRCA value of commodities 2 from Australia, India and the United States.

For the meantime, the electronic commodities belonging to high-skill and technology-intensive manufacture products (3D1) as well as spare parts and parts of electronic and electrical goods belonging to high-skill and technology-intensive manufacture products (3D2) apparently need to become product focus of ASEAN considering that two commodity groups demonstrate a sufficiently good comparative advantage. The main competitor of commodities 3D1 in the ASEAN market is China. The potential to take over the Chinese market gap is also quite large provided that ASEAN market's exporters for 3D1 which has the relative advantage are only China and ASEAN countries. As for commodities 3D2 in the ASEAN market, the comparative advantages of ASEAN outpace other competitors such as Korea and China.

Gravity Model Estimate with Additional Dummy and ΔNRCA

In this study, the estimated gravity model 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 influenced not only by partner countries but also by their

interaction with other countries in the global region (Adam and Cobham 2007; Feenstra 2004; Mélitz 2007; Rose and van Wincoop 2001).

The FEM estimation results with numerous ΔNRCA indices are based on three combinations previously described in the methodology section in Table 5.4. There are five scenarios of estimated gravity model. Scenario [1] exhibits the estimation results from basic gravity model and signifies that all the basic variables of the gravity model has high significance and shows sign of an appropriate relationship with the existing theory. The specification estimation results of scenario [2] is to add the basic gravity model with trading partner membership in AFTA and ASEAN Plus dummy as well as CRISIS dummy.

The estimation results of model scenario [3] reveal the results of the gravity model estimation by incorporating $\Delta\,\Delta\mathbf{NRCA}_k^{i-j}$, variables, where there is ΔNRCA between the exporter's NRCA and importer's NRCA for Combination A. Scenario [4] unveils the results of gravity model estimation with similar specifications to scenario [3] using ΔNRCA variable commodity based on combination B. Next, scenario [5] is based on combination C. Therefore, the main purpose of Table 5.4 is to demonstrate the robustness test of variable group test in the model and the basis for selecting which specification model that will become the research focus.

Based on Table 5.4, it can also 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 (see scenarios [2], [3], [4] and [5] in Table 5.4). In addition, if the dummy is not included as a variable in the model, it would reduce the significance of the other variables, especially ΔNRCA, 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.

The model that becomes the focus of research is the model [4] while model [5] is a further modification to model [4] as an additional discussion that tries to look deeper at how big the influence of ΔNRCA of manufacturing commodity groups that are disaggregated according to differences in levels of labor skills and technology.

Table 5.4 FEM estimates in different scenarios

Regressand	Model specifications				
$Log(X_{ij})$	[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)	–0.05609 (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)

(*continued*)

Table 5.4 (continued)

$\Delta NRCA_{3Bt}^{i-j}$					0.080431** (0.034523)
$\Delta NRCA_{3C1t}^{i-j}$					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
*$p \leq 0.1$, **$p \leq 0.05$, ***$p \leq 0.01$

Based on scenario [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 research that utilizes gravity model; that is, GDP significantly and positively affects exports (Frankel and Rose 2000; Elliott and Ikemoto 2004). 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 also means that from the results of model estimation, the elasticity of GDP per capita increase of ASEAN is greater than GDP per capita of its trading partners. Based on the rule of ceteris paribus, every 1% increase of GDP of ASEAN will increase ASEAN 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 when 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 (Sohn 2005), shows increased domestic capability as an incentive for domestic producers to at least improve production quality or quantity. This will create larger economies of 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 that have an impact on an increase in imports of goods from outside.

Second, the POP or population variable which is indicated by the population of exporting countries (ASEAN) that 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 effect 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 Filippini and Molini (2003) as well as Razzaghi et al. (2012). Both studies suggest 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 effect of absorption where domestic production that increases with the number of population will be absorbed in the domestic market first before being exported abroad. Meanwhile, the increase in the population of the importing country will increase the market size. Market growth in trading partners will eventually become one of the factors for the increase in demand in the export market.

Third, differences in the value of non-oil exports that is the result of Free Trade Agreement (FTA) in ASEAN also show significant gains. If the ASEAN trading partners are countries belonging to the AFTA scheme, then there are differences in 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 with the findings of Elliott and Ikemoto (2004) who argue 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 also reinforced in 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%, greater when exports are made to the partner without a trade agreement.

AFTA and ASEANPLUS also indicate that ASEAN intra-regional market is considered less beneficial for ASEAN member countries themselves. Besides, the estimation of dummy AFTA and ASEAN Plus demonstrates 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. A 1% increase in costs affects the decline in the value of non-oil exports by 1.28% (ceteris paribus). This is consistent with the statements of Tinbergen (1962) and Pöyhönen (1963) that exports will decline as the cost of trade increases.

Trade costs are not only material, but also include the quality of trade facilitation itself.

Lastly is the influence of the main variables, ΔNRCA, against non-oil exports. Results from this study indicate that the impact of ΔNRCA is positive and significant on the increase in non-oil exports to ASEAN trading partners that can be described as follows: (1) increase in one unit of agricultural commodities ΔNRCA will increase non-oil exports by 10.92% (ceteris paribus); (2) increase in one unit of manufacturing commodities ΔNRCA will lead to 5.84% rise in non-oil exports; (3) increase of one unit of mining commodities ΔNRCA (including coal, mineral and gemstone) will translate into a 13.55% increase in non-oil exports; and (4) increase of one unit of other commodities ΔNRCA will lead to an increase in non-oil exports amounting to 8.55%. The above findings are in accordance with the Theory of Comparative Advantage or Ricardian model stating that comparative advantage will increase export. Since ΔNRCA is the comparative advantage NRCA index of exporting countries which is subtracted from NRCA index of importing countries, the increase in ΔNRCA 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 its factors of production to produce and increase the amount of production and subsequent export to countries that have lower comparative advantage for these products (Appleyard et al. 2006). Additionally, it appears that non-oil exports in ASEAN are more reliant on exports of agricultural commodities and mining. This means that natural resource products remain top ASEAN's non-oil exports as the impact of changes in comparative advantage for mining and agricultural commodities is significant.

Overall, the results of the estimation **[5]** above point out that the determinants of ASEAN's non-oil exports are (a) the level of economy proxied by GDP per capita of ASEAN member countries and their trading partners with each impact is positive; (b) the size of the market with a population approach in ASEAN member countries and their trading partners, where the population of ASEAN has positive influence and the population of ASEAN trading partners has a negative impact; (c) the cost of trade from exporters (ASEAN) to importing countries (ASEAN's trading partners) which has a negative impact; (d) there is a difference in

value of non-oil exports with the presence of AFTA cooperation. ASEAN's non-oil exports value is lower when trade is performed with trading partners under AFTA cooperation; (e) non-oil exports of ASEAN become larger when trade is done with members of the ASEAN Plus compared to when it is conducted with non-ASEAN Plus trading partners; and (f) if ΔNRCA between ASEAN and its trading partners are greater, the non-oil exports from ASEAN to its trading partners will increase.

Further, the value of adjusted *R*-square specifications **[4]**, which amounts to 0.9823, indicates that the model is capable to identify 98.23% of the variation of ASEAN's non-oil exports through the free variables inside the model. The remaining 1.77% are a variable influence outside the model. This means that the goodness of fit of the model **[4]** is 98.23%. In the specification of this model, all variables have a high significance, which is significant at α = 1%. All coefficients in the model are also visible in accordance with the model, characterized by a high F-statistic with probability of 0.000000.

Becoming more interesting to find out further is how big the effect of the difference changes in comparative advantage relative of manufacturing commodities to non-oil exports turns out to be when manufacturing commodities are disaggregated according to the skill level of its workforce and the level of technology. For this purpose, the results of the estimate are shown in Table 5.4 scenario **[5]**.

The estimation results of scenario **[5]** shows that the biggest influence and significant changes in ΔNRCA, especially ΔNRCA for manufacturing commodities, to the non-oil exports is the ΔNRCA 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 one 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 one unit $\Delta NRCA_{3B}$ translates into an 8.04% increase against non-oil exports of ASEAN.

Manufacturing commodities ΔNRCA that has an influence on other non-oil exports is $\Delta NRCA_{3D1}$ which is ΔNRCA of commodities classified as electronic commodities belonging to high-skill and technology-intensive manufacture products. The estimation results find that an increase of one unit of $\Delta NRCA_{3D1}$ will have an impact on 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 one unit will impact the increase in 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.

In the meantime, ΔNRCA for manufacture commodities in group 3A (labor-intensive and resource-intensive manufacture products), 3C1 (electronic commodities which belong to medium-skill and technology-intensive manufacturing products), 3C2 (spare part commodities and parts of electronic and electrical goods classified as medium-skill and technology-intensive manufacture products) and 3D3 (commodities from non-electronic and electrical products included in high-skill and technology-intensive manufacture products) do not show a significant effect.

Based on the findings in model **[5]**, several elements need to be studied further. In this study, commodities that are used in the calculation of ΔNRCA are still in a relatively aggregated form. There is a possibility of aggregate bias from the ΔNRCA index results which will then affect the results of model estimation. It becomes necessary to disaggregate variable component which is 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 ΔNRCA 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 com-

parative 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.

In the research model, evidence of such interactions has not been found, yet an indication toward further proving of the theory of comparative advantage is made possible by the discovery of negative marks on a few commodities in the model specification **[5]** although the estimation results are not statistically significant. For instance, if in case there was a justification variable in the model that demonstrated the interaction between commodity 3A with 3C3, it could be said that when ΔNRCA of commodities categorized as labor-intensive and resource-intensive manufacture products was down by one unit, it would have an effect on increasing non-oil exports by 3.13%. The increase is the compensation of one unit increase of commodities ΔNRCA that include electronic and electrical products classified as high-skill and technology-intensive manufacture products that impact the increase in non-oil exports by 10.59%. It can therefore be said that the ASEAN countries have more specialization in electronic and electrical products commodities classified as high-skill and technology-intensive manufacture products rather than in those of labor-intensive and resource-intensive manufacture products.

Conclusion

In general, the study finds 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 reflecting the market size of exporters and importers, trading costs, the status of AFTA and ASEAN Plus cooperations, 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 proves 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 partner's NRCA in the

ASEAN market will 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 Ricardian model, in which a country will have specialization in exporting goods that have higher comparative advantage.

The study also reveals that the effects of ΔNRCA changes on ASEAN non-oil exports is ΔNRCA changes for mining commodities (including coal), agricultural commodities and other commodities. Meanwhile, ΔNRCA 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 that derive 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 that belong 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 also recommends that, first, further research is required by disaggregating ΔNRCA 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 ΔNRCA 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 becomes 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, we will show more about the pattern of export and trade of a country in a given market.

Third, ASEAN member states need to adopt policies to better utilize the ASEAN Plus scheme which will then be merged into RCEP. The consideration is the empirical results of this study that signify that it is actually exports to trading partners under ASEAN Plus that give higher exports difference, compared to those of non-ASEAN Plus countries. Meanwhile, when ASEAN's trading partners are included in AFTA cooperation, it indicates that the value of exports is lower.

References

Adam, C., & Cobham, D. (2007). Exchange Rate Regimes and Trade. *Manchester School, 75*(s1), 44–63.

Anderson, J. E. (1979). A Theoretical Foundation for the Gravity Equation. *American Economic Review, 69*(1), 106–116.

Appleyard, D. R., Field, A. J., Jr., & Cobb, S. L. (2006). *International Economics* (5th ed.). Now York: McGraw-Hill.

Association of South East Asian Nations (ASEAN). (2011). *ASEAN and FTA Partners Launch the World's Biggest Regional Free Trade Deal*. Retrieved April 25, 2014, from https://asean.org/asean-and-fta-partners-launch-the-world-s-biggest-regional-free-trade-deal/.

Balassa, B. (1965). Trade Liberalization and Revealed Comparative Advantage. *Manchester School of Economic and Social Studies, 33*, 99–123.

Ballance, R., Forstner, H., & Murray, T. (1985). On Measuring Revealed Comparative Advantage: A Note on Bowen's Indices. *Weltwirtschaftliches Archiv, 121*, 346–350.

Balance, R., Forstner, H., & dan Murray, T. (1986). More on Measuring Comparative Advantage: A Reply. *Weltwirtschaftliches Archiv, 122*, 375–378.

Bergstrand, J. H. (1985). The Gravity Equation in International Trade: Some Microeconomic Foundations and Empirical Evidence. *The Review of Economics and Statistics, 67*(3), 474–481.

Bergstrand, J. H. (1989). The Generalized Gravity Equation, Monopolistic Competition, and the Factor-Proportions Theory in International Trade. *Review of Economics and Statistics, 71*(1), 143–153.

Bowen, H. P. (1983). On the Theoretical Interpretation of Indices of Trade Intensity and Revealed Comparative Advantage. *Weltwirtschaftliches Archiv, 119*, 464–472.

Bowen, H. P. (1985). On Measuring Comparative Advantage: A Reply and Extension. *Weltwirtschaftliches Archiv, 121*, 351–354.

Bowen, H. P. (1986). On Measuring Comparative Advantage: Further Comments. *Weltwirtschaftliches Archiv, 122*, 379–381.

Chia, S. Y. (2013). *The ASEAN Economic Community: Progress, Challenges, and Prospects*. ADBI Working Paper 440. Tokyo: Asian Development Bank Institute. Retrieved from http://www.adbi.org/workingpaper/2013/10/25/5916.asean.economic.community.progress.challenges/.

Costinot, A. (2009). On the Origins of Comparative Advantage. *Journal of International Economics, 77*, 255–264.

Deardorff, A. V. (1984). Testing Trade Theories and Predicting Trade Flows. Chapter 10. In R. W. Jones & P. B. Kenen (Eds.), *Handbook of International Economics* (Vol. 1). Amsterdam: North Holland.

Deardorff, A. V. (1994). Exploring the Limits of Comparative Advantage. *Weltwirtschaftliches Archiv, 130*, 1–19.

Deardorff, A. V. (1995). *Determinants of Bilateral Trade: Does Gravity Work in a Neoclassical World?* NBER Working Paper, 5377. Cambridge, MA: National Bureau of Economic Research.

Deardorff, A. V. (2010). *Deardorffs' Glossary of International Economics*. Retrieved May 25, 2014, from http://www-personal.umich.edu/~alandear/glossary/t.html#TradePattern.

Doing Business. (2014). *WorldBank Group*. Retrieved February 25, 2014, from http://www.doingbusiness.org.

Drysdale, P. D. (1967). Japan, Australia and New Zealand: The Prospects for Western Pacific Integration. *Economic Record, 45*(111), 321–342.

Eaton, J., & Kortum, S. (1997). *Technology and Bilateral Trade*. NBER Working Paper, 6253. Cambridge, MA: National Bureau of Economic Research.

Edward, L., & Schoer, V. (2002). Measures of Competitiveness: A Dynamic Approach to South Africa's Trade Performance in the 1990s. *The South African Journal of Economics, 70*(6), 1008–1046.

Elliott, R. J. R., & Ikemoto, K. (2004). AFTA and the Asian Crisis: Help or Hindrance to ASEAN Intra-Regional Trade? *Asian Economic Journal, 18*(1), 1–23.

ESCAP-World Bank. (2014). *International Trade Cost*. Retrieved April 20, 2014, from http://databank.worldbank.org/data/views/variableselection/selectvariables.aspx?source=ESCAP-World-Bank:-International-Trade-Costs.

Evenett, S. J., & Keller, W. (1998). *On the Theories Explaining the Success of the Gravity Equation*. NBER Working Paper, 6529. Cambridge, MA: National Bureau of Economic Research.

Feenstra, R. (2004). *Advanced International Trade: Theory and Evidence*. Princeton: Princeton University Press.

Filippini, C., & Molini, V. (2003). The Determinants of East Asian Trade Flows: A Gravity Equation Approach. *Journal of Asian Economics, 14*, 695–711.

Frankel, J. A., & Rose, A. K. (2000). *Estimating the Effect of Currency Unions on Trade and Output*. NBER Working Papers 7857, National Bureau of Economic Research, Inc.

Greenaway, D., & Milner, C. (1986). *The Economics of Intra-Industry Trade*. Oxford: Blackwell.

Hapsari, I. M., & Mangunsong, C. (2006, November). *Determinants of AFTA Members' Trade Flows and Potential for Trade Diversion*. Asia-Pacific Research and Training Network on Trade Working Paper Series, No. 21.

Hecksher, E. F. (1919). The Effect of Foreign Trade on the Distribution of Income. In H. S. Ellis & L. A. Metzler (Eds.), *Readings in the Theory of International Trade, American Economic Association*. Philadelphia: Blakiston.

Helpman, E. (1987). Imperfect Competition and International Trade: Evidence from Fourteen Industrial Countries. *Journal of the Japanese and International Economies, 1*(1), 62–81.

Hillman, A. L. (1980). Observation on the Relation Between Revealed Comparative Advantage and Comparative Advantage as Indicated by Pre-Trade Relatives Price. *Weltwirtschaftliches Archiv, 116*, 315–321.

Hoen, A. R., & Oosterhaven, J. (2006). On the Measurement of Comparative Advantage. *The Annals of Regional Science, 40*, 677–691.

Kepaptsoglou, K., Karlaftis, M. G., & Tsamboulas, D. (2010). The Gravity Model Specification for Modeling International Trade Flows and Free Trade Agreement Effects: A 10-Year Review of Empirical Studies. *The Open Economics Journal, 3*, 1–13.

Kimura, F., Takahashi, Y., & Hayakawa, K. (2007). Fragmentation and Parts and Components Trade: Comparison Between East Asia and Europe. *The North American Journal of Economics and Finance, 18*, 23–40.

Laursen, K. (1998). *Revealed Comparative Advantage and the Alternatives as Measures of International Specialisation*. DRUID Working Paper, 98–30.

Linnemann, H. (1966). *An Econometric Study of International Trade Flows*. Amsterdam: North-Holland.

Logistics Performance Index (LPI). (2014). *WorldBank*. Retrieved February 25, 2014, from http://www.worldbank.org.

Mélitz, J. (2007). North, South and Distance in the Gravity Model. *European Economic Review, 91*, 971–991.

Menon, J. (1996). *Adjusting Towards AFTA: The Dynamics of Trade in ASEAN*. Singapore: Institute of Southeast Asian Studies.

Ng, F., & Yeats, A. (2003, June). *Major Trade Trends in East Asia: What Are Their Implications for Regional Cooperation and Growth*. World Bank Policy Research Working Paper, 3084.

Novy, D. (2009). *Gravity Redux: Measuring International Trade Costs with Panel Data*. Working Paper. Coventry: University of Warwick, Department of Economics.

Ohlin, B. (1933). *Interregional and International Trade*. Cambridge, MA: Harvard University Press.

Pöyhönen, P. (1963). A Tentative Model for the Volume of Trade Between Countries. *Weltwirtschaftliches Archiv, 90*, 24–40.

Proudman, J., & Redding, S. (1998). *Openness and Growth*. London: The Bank of England.

Rahman, M. (2003). *A Panel Data Analysis of Bangladesh's Trade: The Gravity Model Approach*. Retrieved April 26, 2014, from https://eprints.usq.edu.au/5794/1/Rahman_ACE09_AV.pdf.

Razzaghi, S., Ali, M., Azad, M., & Sofi, Y. (2012). The Determinants of Trade Flows Between D-8 Group Members Through Gravity Model. *Journal of Basic and Applied Scientific Research, 2*(6), 5726–5731.

Ricardo, D. (1817). *On the Principles of Political Economy and Taxation*. London: John Murray.

Rose, A. K., & van Wincoop, E. (2001). National Money as a Barrier to International Trade: The Real Case for Currency Union. *The American Economic Review, 91*(2), 386–390.

Salvatore, D. (2002). *International Economics* (3rd ed.). New York: Macmillan.

Sarwedi. (2010). Analisis Determinan Perubahan Penawaran Barang Ekspor Indonesia. *Buletin Ekonomi Moneter dan Perbankan, 12*(3), 355–376.

Sohn, C. H. (2005). Does the Gravity Model Explain South Korea's Trade Flows? *Japanese Economic Review, 56*(4), 417–430.

Tayyebi, S. K. (2005). Trade Integration in ASEAN: An Application of the Panel Gravity Model. In H. Charles (Ed.), *New East Asian Regionalism, Causes, Progress and Country Perspectives* (pp. 109–127). Cheltenham: Edward Elgar.

Tinbergen, J. (1962). An Analysis of World Trade Flows. In J. Tinbergen (Ed.), *Shaping the World Economy*. New York: The Twentieth Century Fund.

Türkcan, K. (2011). Vertical Intra-Industry Trade and Product Fragmentation in the Auto-Parts Industry. *Journal of Industry, Competition and Trade, 11*(2), 149–186.

UNComtrade. (2014). Retrieved February 20, 2014, from http://www.wits.worldbank.org.

United Nations Conference on Trade and Development (UNCTAD). (2013a, June 12). *UNCTAD Product Groupings*. Retrieved February 2, 2014, from http://unctadstat.unctad.org/UnctadStatMetadata/Classifications/UnctadStat.SitcRev3Products.UnctadProductGroupingslist.Classification_En.xls.

United Nations Conference on Trade and Development (UNCTAD). (2013b, October 2). *UNCTAD Manufactured Goods by Degree of Manufacturing*. Retrieved February 20, 2014, from http://unctadstat.unctad.org/UnctadStatMetadata/Classifications/UnctadStat.SitcRev3Products.DegreeOfManufacturing.Classification_En.xls.

Vollrath, T. L. (1991). A Theoretical Evaluation of Alternative Trade Intensity Measures of Revealed Comparative Advantage. *Weltwirtschaftliches Archiv, 127*, 265–280.

Widyasanti, A. A. (2010). Do Regional Trade Areas Improve Export Competitiveness? A Case of Indonesia. *Bulletin of Monetary, Economics and Banking, 13*(1), 5–22.

World Development Indicator (WDI). (2014). *WorldBank*. Retrieved February 25, 2014, from http://lpi.worldbank.org.

Yamarik, S., & Ghosh, S. (2006). A Sensitivity Analysis of the Gravity Model. *The International Trade Journal, 19*(1), 83–126.

Yeats, A. J. (1985). On the Appropriate Interpretation of the Revealed Comparative Advantage Index: Implications of a Methodology Based on Industry Sector Analysis. *Weltwirtschaftliches Archiv, 121*, 61–73.

Yu, R., Cai, J., & Leung, P. (2009). The Normalized Revealed Comparative Advantage Index. *The Analysis of Regional Science, 43*(1), 267–282.

Yue, C., & Hua, P. (2002). Does Comparative Advantage Explains Export Patterns in China? *China Economic Review, 13*, 276–296.