COMPARATIVE ADVANTAGE: THEORY, EMPIRICAL MEASURES AND CASE STUDIES

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Abstract: *This paper consists of three main parts i.e. theory, analytical tool and case studies of comparative advantage. Firstly, we review the theory and various empirical measures of comparative advantage. We would argue that for the catching-up economies, like ASEAN countries, the meaning of "leading exported products" could be examined from the two points of view i.e. international competitiveness and country's trade balance. Secondly, we combine two indexes of comparative advantage, i.e. Revealed Symmetric Comparative Advantage (RSCA) index by Dalum et al. (1998) and Laursen (1998), and Trade Balance Index (TBI) by Lafay (1992), which represent well the two points of view, to propose an analytical tool, namely "products mapping". Thirdly, this analytical tool is applied to analyze exported products (defined as 3-digit SITC Revision 2) of the ASEAN countries. This paper concludes that in the cases of ASEAN countries, the higher the comparative advantage for a specific product, the higher the possibility of the country as a net-exporter becomes. This finding strongly supports the theory of comparative advantage.*

Keywords: *Revealed Comparative Advantage, Trade Balance, Products Mapping.*

JEL Codes: *E00, E01, E13*

1. INTRODUCTION

In the theories of international trade, comparative advantage is an important concept for explaining pattern of trade. David Ricardo (1817) firstly introduces the concept of comparative advantage with very strict assumptions. It is then well recognized as the Ricardian model. In the modern theories of international trade,

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such strict assumptions are replaced with the more realistic ones. Heckscher (1919) and Ohlin (1933) examine the effect of different factor endowments on international trade. Their model, which is well known as the Heckscher-Ohlin (H-O) model, concludes that a country will export commodity uses the abundant factor of production, while it will import commodity uses the scarce factor of production. Some other new models also relaxing the several assumptions have emerged such as the imitation lag hypothesis (Posner, 1961), the Linder model (Linder, 1961), the flying geese model (Akamatsu, 1961, 1962), the gravity model (Tinbergen, 1962), the product cycle theory (Vernon, 1966), the Krugman model (Krugman, 1979), and the reciprocal dumping model (Brander, 1981; Brander and Krugman, 1983).

The appearances of such new models have not reduced the popularity of comparative advantage concept, which recently becomes dynamic one. Some economists argue that a country's comparative advantage is dynamic, instead of static. So far, the dynamic theory of comparative advantage has put greater attention on the changes in supply (production) side. This is related to how specific determinants affect the output (economic) growth and, in turn, comparative advantage. Redding (2004) finds that comparative advantage is endogenously determined by the past technological changes and innovation. The dynamics of comparative advantage might be also caused by the role of input trade (Jones, 2000), the friction in international trade and investment flows due to geography, institutions, transport, and information cost (Venables, 2001), the transmission of knowledge across borders (Grossman and Helpman, 1991), the technological differences across border (Trefler, 1995), and the monopolistic competition in differentiated products with increasing return to scale (Krugman, 1979). Indeed, many applied economists, e.g. Liesner (1958), Kanamori (1964), Balassa (1965), Donges and Riedel (1977), Bowen (1983), Vollrath (1991), Dalum *et al.* (1998) and Laursen (1998), among others, have tried to make various empirical measures to "reveal" countries' comparative advantage.

This paper aims to review the concept and empirical measures of comparative advantage and to derive an analytical tool, namely "products mapping", which is suitable for analyzing comparative advantage of the catching-up economies, like the ASEAN (Association of Southeast Asian Nations) countries. The remainder of this paper consists of five parts. Part 2 describes briefly literature review on the theory of comparative advantage, starting from the Ricardian model to the dynamic comparative advantage. Part 3 presents various

empirical measures of comparative advantage. In Part 4, we propose an analytical tool, namely "products mapping". We would argue that, for the catching-up economies, the meaning of "leading exported products" could be examined from two points of view i.e. international competitiveness and country's trade balance. We combine two indexes, i.e. Revealed Symmetric Comparative Advantage (RSCA) by Dalum *et al*. (1998) and Laursen (1998); and Trade Balance Index (TBI) by Lafay (1992), which represent well the two points of view, to create an analytical tool, namely "products mapping". The analytical tool is then applied to analyze exports of the (ASEAN) countries, as the case studies. The empirical results are described in Part 5. Finally, several conclusions are presented in Part 6.

2. LITERATURE REVIEW: FROM STATIC TO DYNAMIC COMPARATIVE ADVANTAGE

2.1 The Ricardian model

The principle of comparative advantage postulates that a nation will export the goods or services in which it has its greatest comparative advantage and import those in which it has the least comparative advantage (Ricardo, 1817). The term "comparative" means relative not necessarily absolute. The Ricardian model is based on several strict assumptions: (1) fixed endowment of (identical) resources, (2) factors of production are completely mobile between alternative uses within a country, (3) factors of production are completely immobile externally, (3) a labor theory of value[1] is employed in the model, (4) the level of technology is fixed for both countries, (5) unit costs of production are constant, (6) there is full employment, (7) perfect competition, (8) no government-imposed obstacles to economic activity, (9) internal and external transportation costs are zero, (10) for simple analysis: a 2-country, 2-commodity "world" (Appleyard and Field, 2001).

Suppose there are two countries A and B, which produce two commodities X and Y. For country A, let us denote α_X and α_Y are the unit labor requirements in X and Y, respectively; Q_X and Q_Y are quantities of X and Y, respectively; and LA is total labor supply. Meanwhile, for country B, let us denote β_X and β_Y are the unit labor requirements in X and Y, respectively; and LB is total labor supply. The production possibility frontiers (PPF)[2] for both countries A and B are represented by $\alpha_X Qx+\alpha_Y Q_Y=LA$ and $\beta_X Qx+\beta_Y Q_Y=LB$, respectively. These two PPFs are

represented in Figure 1. Hence, the slopes of PPFs for countries A and B are $(-\alpha_X/\alpha_Y)$ and $(-\beta_X/\beta_Y)$, respectively.

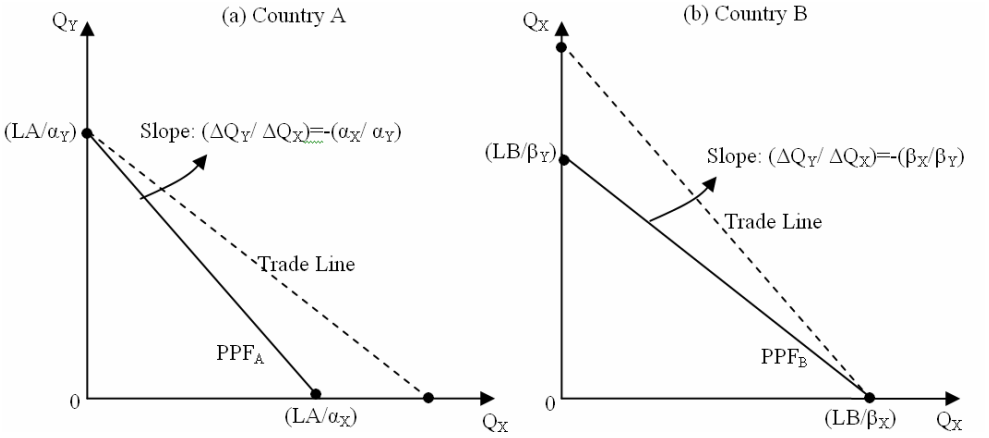


Figure 1 *The Ricardian Model*

The slope (α_X/α_Y) is steeper than (β_X/β_Y). This indicates that X is relatively more expensive (in term of Y[3]) in country A than that in country B, while Y is relatively cheaper (in term of X) in country A than that in country B. Country A will have a full specialization in Y, and country will have a full specialization in X. Each country can reach higher level of consumption by trading along the trade line (represented by the broken line). The possible terms of trade (TOT) lie in the range: $(\beta_X/\beta_Y) \leq TOT \leq (\alpha_X/\alpha_Y)$.

2.2 Neoclassical comparative advantage

In the neoclassical theory of international trade, the constant cost assumption applied in the Ricardian model is replaced with a more realistic assumption, increasing marginal cost. This assumption is represented by the concavity[4] of PPF. Suppose two countries A and B have production possibility frontiers (PPF) and community indifference curves[5] (CICs) shown by Panels (a) and (b) in Figure 2. Let us denote P_X and P_Y are prices of X and Y. The autarky equilibriums of production and consumption are at point E_A with the relative prices $(P_X/P_Y)_A$ in the case of country A and at E_B with the relative prices $(P_X/P_Y)_B$ in the case of country B. In Figure 2, $(P_X/P_Y)_A$ is higher than $(P_X/P_Y)_B$, country A will specialize in Y, while country B will specialize in X[6]. Both countries A and B can gain from trade with applying possible terms of trade (TOT_{Int}): $(P_X/P_Y)_B \leq TOT_{Int} \leq (P_X/P_Y)_A$. With this TOT_{Int}, both countries A and B could reach higher CICs. It is clearly shown

that the autarky equilibriums are determined by PPF and CIC. The volume of trade is shown by the shaded triangles.

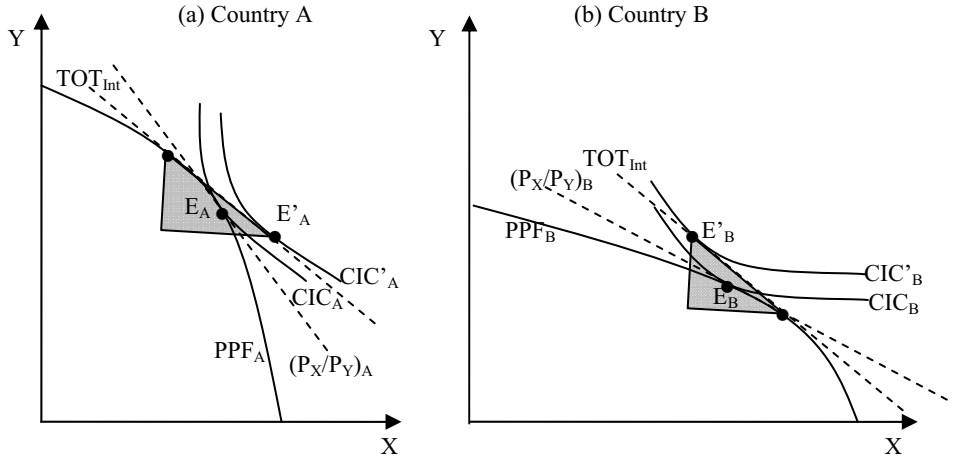


Figure 2 *Neoclassical Gains from Trade*

2.3 Dynamic comparative advantage

A country's comparative advantage might change due to the changes in supply and demand sides in both domestic and international markets. The supply side is related to PPF; while, the demand side is related to community preferences. On this matter, Echevarria (2008) finds that in the long run, comparative advantage is driven by total factor productivity (TFP) differential. This explains the fact that less developed countries are likely to export primary commodities even though they are not less capital-intensive. In addition, non-homothetic preferences imply fewer countries export only or mostly primary commodities as the global economy develops.

To describe dynamic comparative advantage, let us suppose a small country (price taker in international market) uses its available inputs labor (L) and capital (K) to produce competing outputs X (*labor-intensive* good) and Y (*capital-intensive* good). Let us assume the country is relatively a labor-abundant country. In addition, the country has a production possibility frontier (PPF) and a community indifference curve (CIC), as depicted by PPF_0 and CIC_0 in Figure 3, respectively. The international term of trade is $(P_X/P_Y)_{Int}$. The initial equilibriums in both production and consumption are at points A and B, respectively. The volume

of international trade is depicted by the triangle ABC i.e. exports of X (quantity: CA) for the imports of Y (quantity: CB).

With economic growth, the PPF shifts outward, allowing the country to choose different production combinations of X and Y. The various new possible equilibriums in production are located within the regions fixed by the mini-axes drawn through the original production equilibrium at point A. If the new equilibrium in production lies on the straight line 0P, the economic growth is *product-neutral*, since productions of the export good and the import competing good have increased in the same rate. If the new equilibrium lies in region I_P, it is *protrade-biased* (reflecting the relatively greater availability of the export good); in region II_p, it is *ultra-protrade-biased*; in region III_P, it is *antitrade-biased* (reflecting the relatively greater availability of the import-competing good); and in the region IV_P, it is *ultra-antitrade-biased* (Appleyard and Field, 2001).

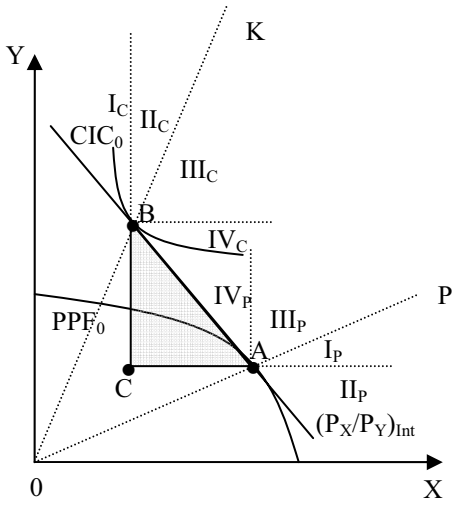


Figure 3 *Equilibriums in Production and Consumption*

In addition, the economic growth will also affect the consumption equilibrium. The consumption effect of growth on trade can be isolated by the mini-axes whose origin is at initial consumption equilibrium B. If the new equilibrium point is on the straight line 0K, consumption of both goods X and Y will increase proportionally and the consumption trade effect will be *neutral*. If the new consumption equilibrium point falls in region I_C, it is *a pro-trade consumption* effect; in region II_C, it is an *ultra-protrade consumption* effect; in region III_C, it is an *anti-trade consumption* effect; and in region IV_C, it is *ultra-antitrade*

consumption effect (Appleyard and Field, 2001). The changes in either PPF or CIC are basically sources of the dynamics in countries' comparative advantage.

3. VARIOUS EMPIRICAL MEASURES OF COMPARATIVE ADVANTAGE

3.1 Catching-up economies: dynamic comparative advantage

Many domestic and international factors determine a country's comparative advantage. Balance *et al.* (1987) argue that economic conditions in the various trading countries will determine the international pattern of comparative advantage and the pattern of international trade, production and consumption (TPC) among countries. In empirical studies, researchers apply data on TPC, such as exports, imports, production and consumption, to "reveal" countries' comparative advantage. However, the application of such data brings several problems about the data aggregation, the magnitude of TPC data, the concordance TPC data and the government trade interventions.

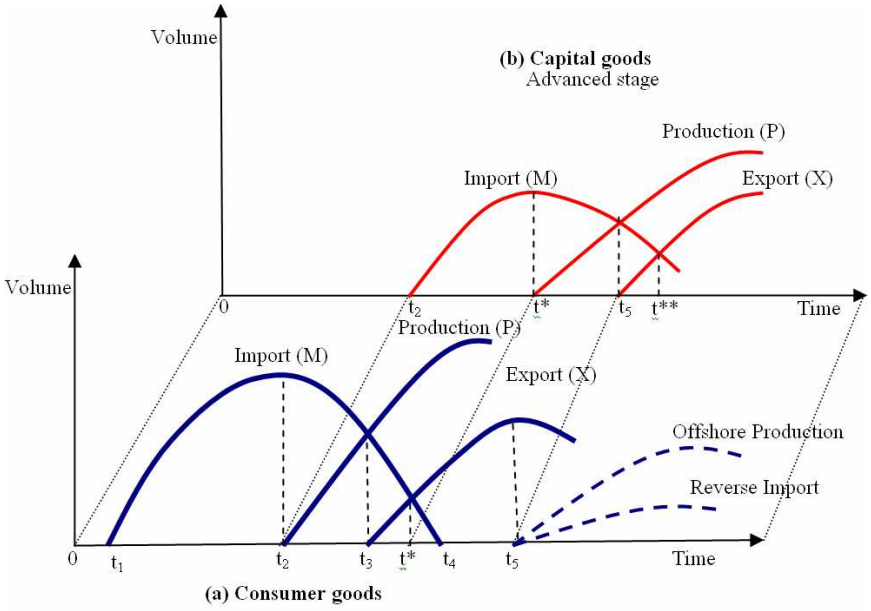


Figure 4 *Flying Geese Paradigm: Import-Production-Export-Reverse Import*
Source: Kojima (2000).

One of the very famous theories related to TPC is the Flying Geese (FG) paradigm by Akamatsu (1961, 1962). Figure 4 represents the FG paradigm, which consists of the four following catching-up stages (Kojima, 2000):

(1) *First stage*: manufactured consumer goods are imported from advanced countries (started from t_1 in Panel a).
(2) *Second stage*: the domestic production (import-substitution strategy) exists (started from time t_2 in Panel a). At the same time, the country must also import capital goods (started from t_2 in Panel b).
(3) *Third stage*: the domestic production are also for exports (started from t_3 in Panel a). At time t*, trade in consumer goods is in the equilibrium or trade balance (Export=Import) and domestic production equals domestic demand (since domestic demand = domestic production – export + import). This stage implies a successful implementation of the catching-up process of the industry concerned along the sequential path import-production-export (M-P-E), which is the basic pattern of the FG model.
(4) *Fourth stage*: the advanced status in consumer goods industry is further elevated. It is shown by the decrease of export in consumer goods (from t_4 in Panel a), meanwhile capital goods export start (from t_5 in Panel b). The industry is reallocated to the less-developed countries (Offshore production depicted by broken line in panel a), based on their comparative advantage[7].

3.2 Quantitative measures to "reveal" countries' comparative advantage

Nowadays, there are many empirical measures of comparative advantage. We will briefly discuss the available empirical measures that are framed in the catching-up process as previously shown in Figure 4. Let us denote M_{ij} , X_{ij} and P_{ij} as values of imports, exports and production of the country i for the commodity j, respectively. Balance *et al.*, (1987) summarizes the available empirical measures (including ones by Balassa, 1965; Donges and Riedel, 1977; UNIDO, 1982; Bowen, 1983) as follows:

(1) The ratio of exports (X_{ij}) to production (P_{ij}): X_{ij}/P_{ij}. This index varies from 0 to 1 and basically shows the portion of domestic production that is exported. A country might simultaneously produce and export commodities. In Figure 4, this situation is represented by the time beyond t_2. This index is suitable for analyzing the comparative advantage of commodities domestically produced. Non-exportable commodities will have index 0 (in the time t_2t_3), while exportable commodities will have index greater than zero (beyond the time t_3).
(2) The ratio of imports (M_{ij}) to consumption (C_{ij}): M_{ij}/C_{ij}. This index represents the portion of imports in consumption. In Figure 4, for the period

t_1t_2 domestic consumption is mainly fulfilled from imports. For the period t_2t_4, consumption is supplied by both domestic production and imports. For the period beyond t_4t_5, consumption is supplied only by domestic production. When the reverse import occurs beyond time t_5, the situation in the period t_1t_2 might again occur.

(3) The ratio of net trade ($T_{ij}=X_{ij}-M_{ij}$) to production: T_{ij}/P_{ij}. In Figure 4, in the time t_3t_4 the country exports and imports simultaneously. Before the time t* the index will be negative, while in the period beyond t* the index will be positive.

(4) The ratio of production to consumption: P_{ij}/C_{ij}. This index basically shows the portion of domestic production in the total consumption. In Figure 4, in the time t_1t_2, the index will be zero, in the time t_2t_3 it will be between 0 and ½, and in time beyond t_3 it will be greater than ½.

(5) The ratio of actual net trade to "expected"[8] production ($E[P_{ij}]$): $T_{ij}/E[P_{ij}]$.

(6) The ratio of the deviation of actual from expected production (DP) to expected production: $DP/EP=(P_{ij}- E[P_{ij}])/ E[P_{ij}]$.

(7) The ratio of deviation of actual from expected consumption (DC) to expected production: $DC/EP=(C_{ij}- E[C_{ij}])/E[P_{ij}]$.

(8) The ratio of the net trade from the total trade $T_{ij}/XM_{ik}=(X_{ij}-M_{ij})/(X_{ik}+M_{ik})$.

(9) The ratio of actual exports to expected exports[9], $BAL_{ik}=X_{ik}/E(X_{ik})$

(10) The Donges and Riedel index, $D\text{-}R_{ij}=((T_{ij}/XM_{ij}/T_{im}/XM_{im})-1)*(\text{sign } T_{ij})$, where m indicates the summation across all manufactured products.

The applicability of the measures depends upon the available data required. Balance *et al.* (1987) note that the measures (1)-(7) are difficult to apply since the data of trade and production is generally collected by employing the different classifications. For example, trade data is classified using the Standard International Trade Classification (SITC) while industrial production data is classified using the International Standard Industrial Classification (ISIC) (in the case of Indonesia, *Kode Lapangan Usaha Indonesia*, KLUI). Therefore, concordance is difficult. The concordance might be made but in aggregated product definition[10]. In contrast, the measures (8)-(10), especially (8) and (9), are commonly applied in the empirical studies, since consistent data on imports and exports are available, even for rather detailed product definition[11].

4. "PRODUCTS MAPPING" FOR ANALYZING COMPARATIVE ADVANTAGE OF THE CATCHING-UP ECONOMIES

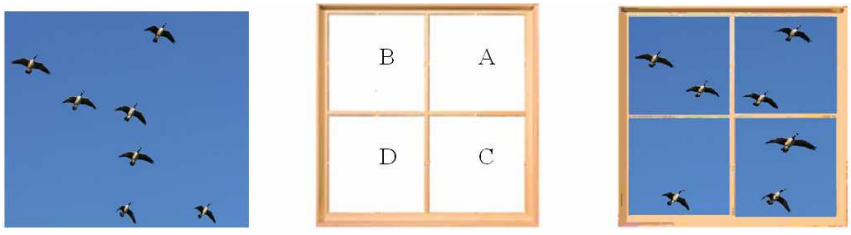
4.1 Leading exports: two points of view

We would argue that the meaning of "leading exported products" could be examined from two different points of view, i.e. domestic trade-balance and international competitiveness. *First,* from the domestic point of view, leading exported products are meant as exported products that can give bigger amount of foreign exchange for domestic economy. From the standard macroeconomic identity Y=C+I+G+(X-M), where Y, C, I, G, X and M are output, consumption, investment, government expenditure, exports and imports, respectively, it is clearly shown that trade-balance (X-M) is one of sources of output growth (Y). From this point of view, the higher the share of a specific product in the total domestic exports, the more significant the contribution of the exported product to the domestic economy becomes. Such product can be considered as foreign exchange creators for domestic economy.

Second, from international competition point of view, leading exported products are products that have high comparative advantage in the international market. A specific exported product becomes leading export if its share in the total world export is dominant. It might be possible that a specific product is not significant as foreign exchange creator but it can compete internationally.

4.2 Two indicators of comparative advantage: "Products Mapping"

In this sub-section, we present our analytical tool, namely "products mapping", which consider the both points of view previously mentioned. As also clearly mentioned in the flying geese concept, we would argue that there are two crucial variables for analyzing the catching-up economies' comparative advantage, i.e. domestic trade-balance and international competitiveness.



(a) Geese Flying (b) Window: Analytical Tool (b) Flying Geese framed in the Analytical tool

Figure 5 *Geese Flying and "Product Mapping"*
Source: http://www.pbase.com/cogard/flying_ducks_geese__shorebirds for the geese flying

Therefore, the analytical tool should be constructed by combining the two variables. As for illustration, imagine we are sitting in a room. Outside, there are geese flying (panel (a) in Figure 5), corresponding with the exported products in out analysis. The room has a window (panel b of Figure 5), corresponding with the analytical tool. Through the window, we see geese flying (panel c).

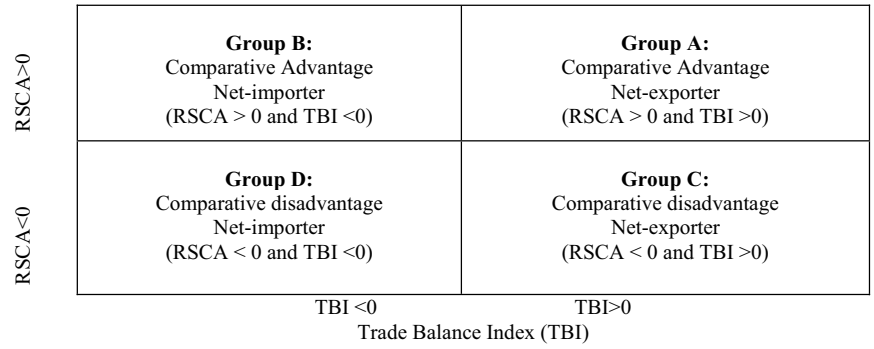


Figure 6 *Products Mapping*

Two indicators are required to represent the both two point of views, domestic trade-balance and international competitiveness as previously mentioned. We choose Revealed Symmetric Comparative Advantage (RSCA) by Dalum *et al.* (1998) and Laursen (1998) as the indicator of comparative advantage and Trade Balance Index (TBI) by Lafay (1992) as the indicator of export-import activities. The RSCA index is a simple decreasing monotonic transformation of Revealed Comparative Advantage (RCA) or Balassa index (Balassa, 1965). RCA index is formulated as follows:

$$RCA_{ij} = \left(x_{ij} / x_{in}\right) / \left(x_{rj} / x_{rn}\right) \quad (1)$$

where RCA_{ij} represents revealed comparative advantage of country i for group of products (SITC) j; and x_{ij} denotes total exports of country i in group of products (SITC) j. Subscript r refers to all countries without country i, and subscript n refers to all groups of products (SITC) except group of product j. The values of the index vary from 0 to infinity ($0 \leq RCA_{ij} \leq \infty$). RCA_{ij} greater than one means that country i has comparative advantage in group of products j. In contrast, RCA_{ij} less than one implies that country i has comparative disadvantage in group of products j.

Since RCA_{ij} turns out to produce values that cannot be compared on both sides of one, Dalum *et al.* (1998) and Laursen (1998) have made Revealed Symmetric Comparative Advantage (RSCA) index, which is formulated as follows:

$$RSCA_{ij} = \left(RCA_{ij} - 1\right)/\left(RCA_{ij} + 1\right) \quad (2)$$

The values of $RSCA_{ij}$ index can vary from minus one to one (or $-1 \leq RSCA_{ij} \leq 1$). $RSCA_{ij}$ greater than zero implies that country i has comparative advantage in group of products j. In contrast, $RSCA_{ij}$ less than zero implies that country i has comparative disadvantage in group of products j.

Trade Balance Index (TBI) (Lafay, 1992) is employed to analyze whether a country has specialization in export (as net-exporter) or in import (as net-importer) for a specific group of products (SITC)[12]. TBI is simply formulated as follows:

$$TBI_{ij} = \left(x_{ij} - m_{ij}\right)/\left(x_{ij} + m_{ij}\right) \quad (3)$$

where TBI_{ij} denotes trade balance index of country i for group of products (SITC) j; x_{ij} and m_{ij} represent exports and imports of group of products j by country i, respectively. Values of the index range from -1 to +1. Extremely, the TBI equals -1 if a country only imports, in contrast, the TBI equals +1 if a country only exports. Indeed, the index is not defined when a country neither exports nor imports. In this case, we put zero since the group of products shows either potentially to be exported or imported. Any value within -1 and +1 implies that the country exports and imports a commodity simultaneously. A country is referred to as "net-importer" in a specific group of product where the value of TBI is negative, and as "net-exporter" where the value of TBI is positive.

By using the RSCA and TBI indexes, the "products mapping" is constructed[13]. Products (SITC) can be categorized into four groups A, B, C and D as depicted in Figure 5. Group A consists of products, which have both comparative advantage and export-specialization; Group B consists of products, which have comparative advantage but no export-specialization; Group C consists of products, which have export-specialization but no comparative advantage; and Group D consists of products, which have neither comparative advantage nor export-specialization.

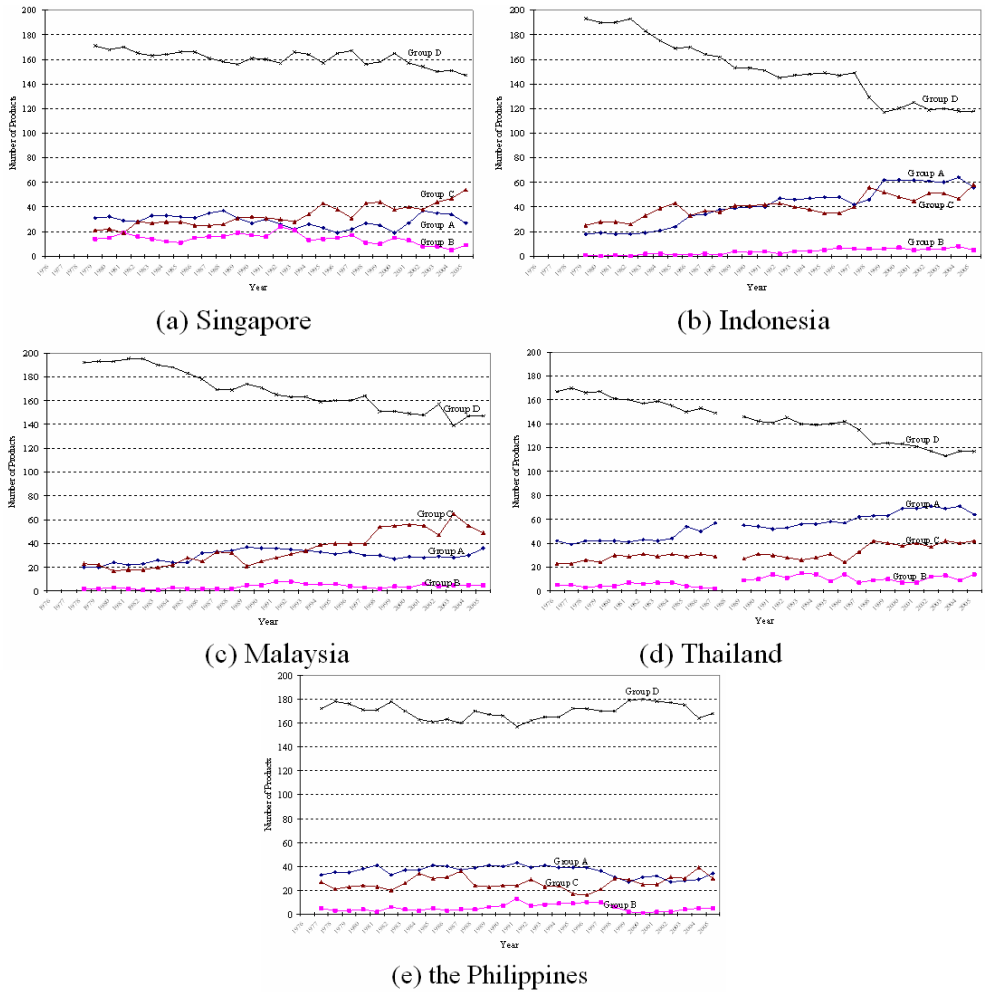


Figure 7 *Trends in the Number of Products in Each Group A, B, C and D*
Source: UN-COMTRADE, *author's calculation.*

5. THE EMPIRICAL RESULTS

5.1 Data

We use data on exports and imports published by the United Nations (UN) namely the United Nations Commodity Trade Statistics Database (UN-COMTRADE). Internationally traded products are classified according to some international standards of classification such as the Standard International Trade Classification (SITC), the Harmonized Commodity Description and Coding

System (HS) and the Broad Economic Categories (BEC). This research uses the 3-digit SITC Revision 2 and focuses on 237 groups of products. There are still two groups (SITC) that are not covered in this paper i.e. hoop and strip of iron or steel, hot-rolled or cold-rolled (SITC 675) and postal packages not classified according to kind (SITC 911)[14].

5.2 Products mapping: the ASEAN countries' exports

Table 6 shows the average number of products (defined as the 3-digit SITC) in the Groups A, B, C and D of the "products mapping" for the ASEAN countries for 1976-2005. Around 66.8 percent of the number of ASEAN's exported products is in the Group E (products have no comparative advantage, and country is as a net importer). And there are about 16 percent, 14 percent and 3 percent of the number of products in the Groups A, D and C, respectively. Group B is a rather strange group, because it consists of products, which have comparative advantage but the country as a net-importer. Compared with the other countries, Singapore had the highest portion of products lying in this group i.e. 14 products (6%). This is understandable since Singapore is as an *entrepot* centers for the other countries, especially the ASEAN countries. Singapore has very high competitive advantages in service sector, such as shipping, banking, etc.; such that she can do re-export activities efficiently. As a result, those re-exported products still have comparative advantage in the international market. The dominance of Groups D and A (together around 82.8 percent of the number of products) indicates a strong relationship between comparative advantage and the position of a country in the international market, as a net-importer or a net-exporter.

Table 6 *The Average Number of Products in each Group A, B, C and D for 1976-2005*

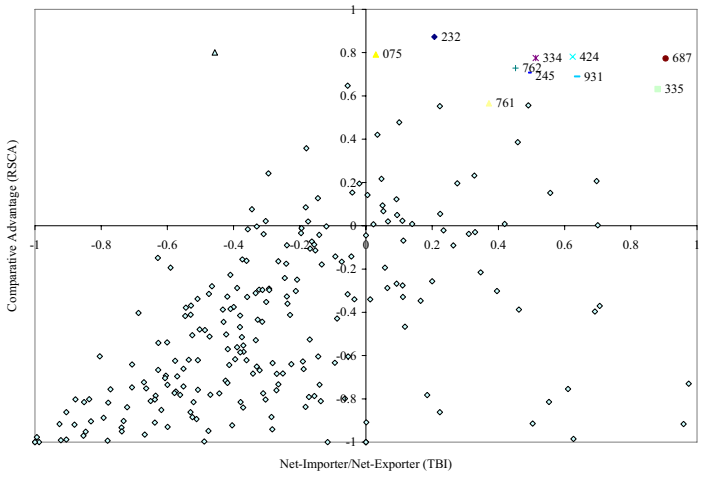
Group C			**Group A**		
Singapore	14	(6.0%)	Singapore	29	(12.2%)
Indonesia	4	(1.5%)	Indonesia	41	(17.4%)
Malaysia	4	(1.6%)	Malaysia	30	(12.6%)
Thailand	8	(3.5%)	Thailand	54	(22.8%)
the Philippines	5	(2.3%)	the Philippines	36	(15.2%)
All	7	(3.0%)	All	38	(16.0%)

Group E			Group D		
Singapore	161	(67.9%)	Singapore	33	(14.0%)
Indonesia	152	(64.0%)	Indonesia	40	(17.0%)
Malaysia	167	(70.7%)	Malaysia	36	(15.1%)
Thailand	143	(60.5%)	Thailand	31	(13.2%)
the Philippines	169	(71.4%)	the Philippines	26	(11.1%)
All	158	(66.8%)	All	33	(14.0%)

Source: UN-COMTRADE, *author's calculation*

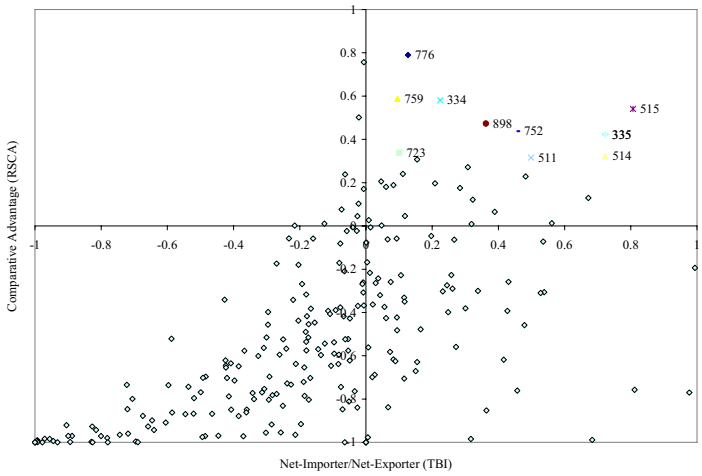
Figure 6 shows trends in the number of products in each group. Indonesia, Malaysia and Thailand have relatively similar trends in the number of products in each group i.e. decreasing the number of products in Group D and increasing the number of products in Groups A and C. The Philippines shows relatively steady trends in the number of products in each group. Singapore has negative trends in the numbers of products in Group B and D, but she has positive trends in the numbers of products in group A and C since the mid-1990s. However, the number of products in group A decreased for the last four years.

Table 7. *"Products Mapping": Top-Ten Products in 1985 and 2005*

Products Mapping	Top-Ten Products
	a.1. Singapore 1985:

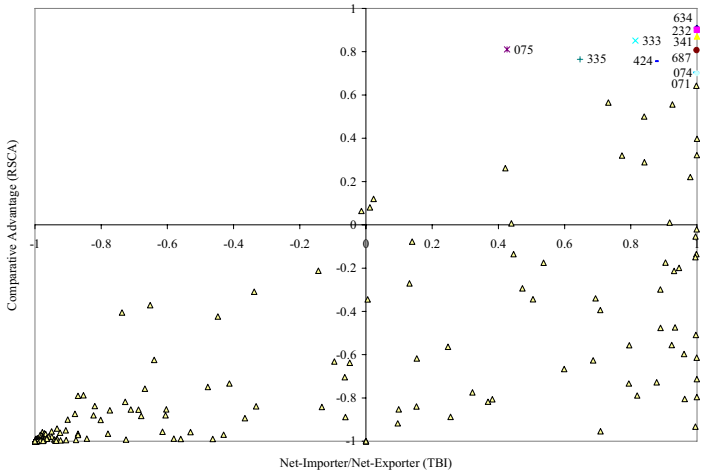
SITC	Commodity Description
232	Natural rubber latex; rubber and gums
075	Spices
424	Other fixed vegetable oils, fluid or solid, crude, refined
334	Petroleum products, refined
687	Tin
762	Radio-broadcast receivers
245	Fuel wood and wood charcoal
931	Special transactions, commodity not classified according to class
335	Residual petroleum products, nes and related materials
761	Television receivers

Products Mapping	Top-Ten Products



a.2. Singapore 2005:

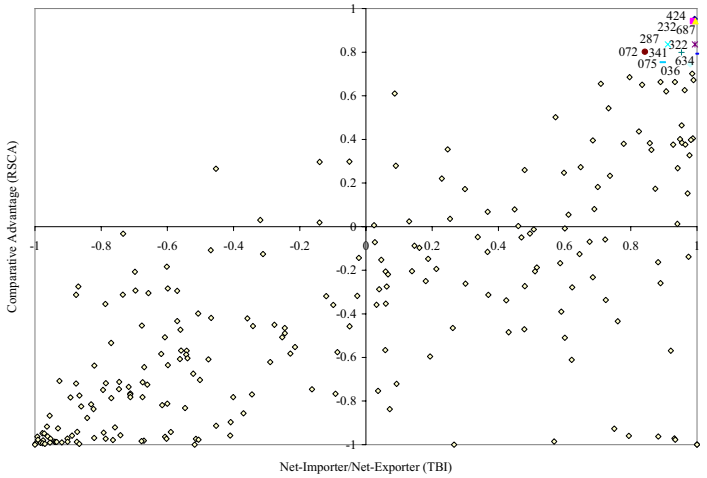
SITC	Commodity Description
776	Thermionic, microcircuits, transistors, valves, etc
687	Tin
759	Parts, nes of and accessories for machines of headings 751 or 752
334	Petroleum products, refined
515	Organo-inorganic and heterocyclic compounds
277	Natural abrasives, nes
898	Musical instruments, parts and accessories thereof
752	Automatic data processing machines and units thereof
335	Residual petroleum products, nes and related materials
723	Civil engineering, contractors' plant and equipment and parts, nes
514	Nitrogen-function compounds
511	Hydrocarbons, nes, and derivatives



b.1. Indonesia 1985:

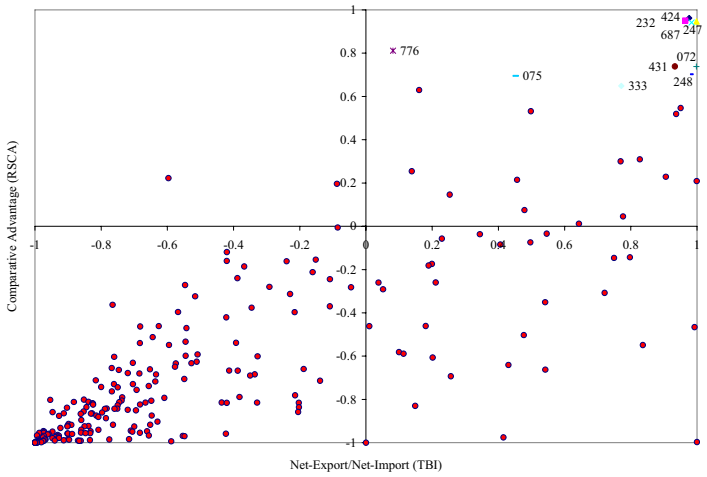
SITC	Commodity Description
634	Veneers, plywood, improved" wood and other wood worked nes"
232	Natural rubber latex; rubber and gums
341	Gas, natural and manufactured
333	Crude petroleum and oils obtained from bituminous minerals
075	Spices
687	Tin
335	Residual petroleum products, nes and related materials
424	Other fixed vegetable oils, fluid or solid, crude, refined
074	Tea and mate
071	Coffee and coffee substitutes

Products Mapping	Top-Ten Products



b.2. Indonesia 2005:

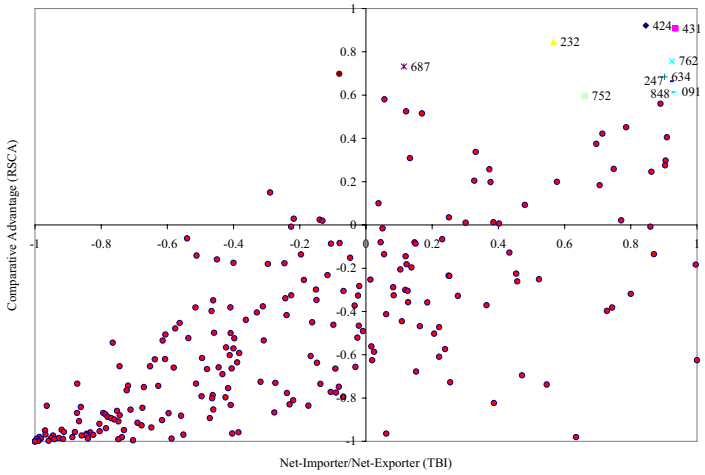
SITC	Commodity Description
424	Other fixed vegetable oils, fluid or solid, crude, refined
687	Tin
232	Natural rubber latex; rubber and gums
287	Ores and concentrates of base metals, nes
322	Coal, lignite and peat
072	Cocoa
634	Veneers, plywood, improved" wood and other wood worked nes"
341	Gas, natural and manufactured
075	Spices
036	Crustaceans and molluscs, fresh, chilled, frozen, salted, etc



c.1. Malaysia 1985:

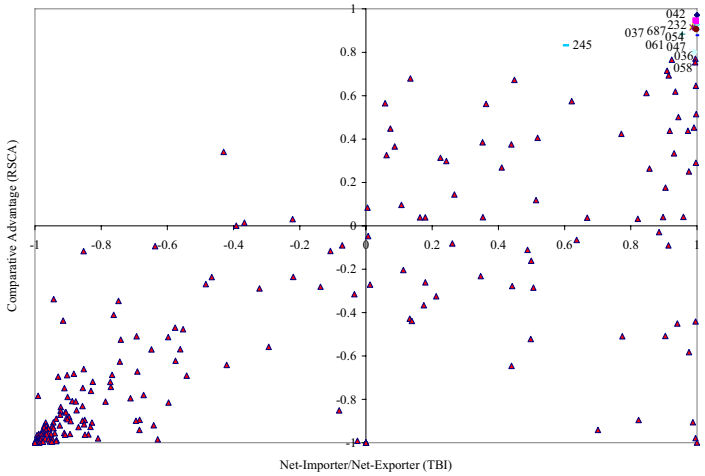
SITC	Commodity Description
424	Other fixed vegetable oils, fluid or solid, crude, refined
232	Natural rubber latex; rubber and gums
247	Other wood in the rough or roughly squared
687	Tin
776	Thermionic, microcircuits, transistors, valves, etc
431	Animal and vegetable oils and fats, processed, and waxes
072	Cocoa
248	Wood, simply worked, and railway sleepers of wood
075	Spices
333	Crude petroleum and oils obtained from bituminous minerals

Products Mapping	Top-Ten Products



c.2. Malaysia 2005:

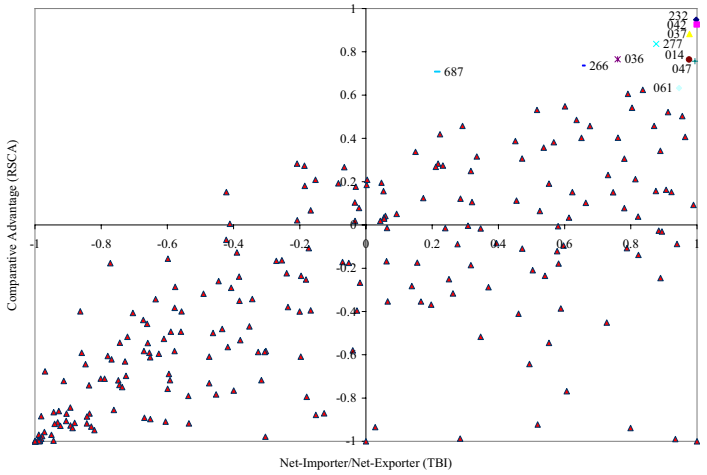
SITC	Commodity Description
424	Other fixed vegetable oils, fluid or solid, crude, refined
431	Animal and vegetable oils and fats, processed, and waxes
232	Natural rubber latex; rubber and gums
762	Radio-broadcast receivers
687	Tin
634	Veneers, plywood, improved" wood and other wood worked nes"
247	Other wood in the rough or roughly squared
091	Margarine and shortening
848	Articles of apparel, clothing accessories, non-textile, headgear
752	Automatic data processing machines and units thereof



d.1. Thailand 1985:

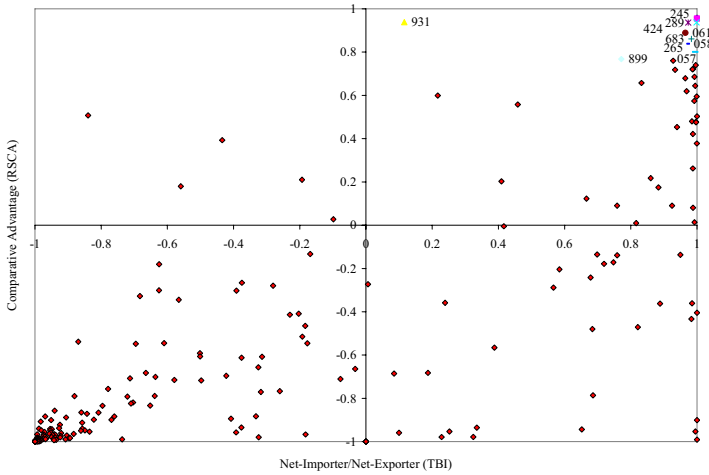
SITC	Commodity Description
042	Rice
232	Natural rubber latex; rubber and gums
037	Fish, crustaceans and molluscs, prepared or preserved, nes
687	Tin
054	Vegetables, fresh or simply preserved; roots and tubers, nes
047	Other cereal meals and flour
036	Crustaceans and molluscs, fresh, chilled, frozen, salted, etc
061	Sugar and honey
245	Fuel wood and wood charcoal
058	Fruit, preserved, and fruits preparations

Products Mapping	Top-Ten Products



d.2. Thailand 2005:

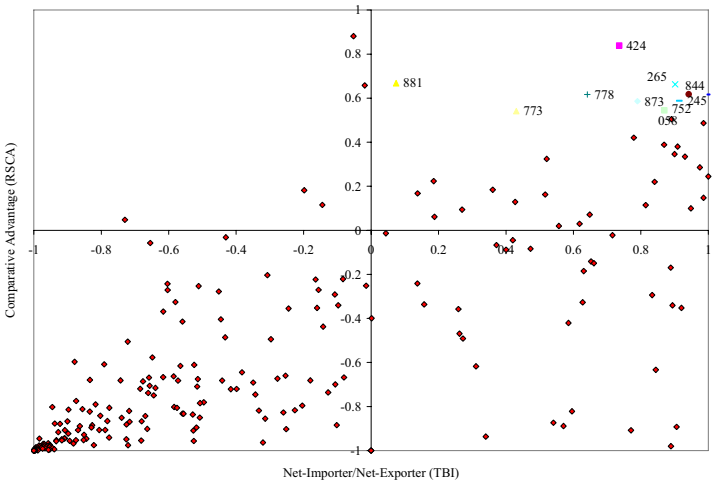
SITC	Commodity Description
232	Natural rubber latex; rubber and gums
042	Rice
037	Fish, crustaceans and molluscs, prepared or preserved, nes
277	Natural abrasives, nes
036	Crustaceans and molluscs, fresh, chilled, frozen, salted, etc
047	Other cereal meals and flour
014	Meat and edible meat offal, prepared, preserved, nes; fish extracts
266	Synthetic fibres suitable for spinning
687	Tin
061	Sugar and honey



e.1. the Philippines 1985:

SITC	Commodity Description
245	Fuel wood and wood charcoal
289	Ores and concentrates of precious metals, waste, scrap
931	Special transactions, commodity not classified according to class
265	Vegetable textile fibres, excluding cotton, jute, and waste
424	Other fixed vegetable oils, fluid or solid, crude, refined
061	Sugar and honey
683	Nickel
058	Fruit, preserved, and fruits preparations
057	Fruit and nuts, fresh, dried
899	Other miscellaneous manufactured articles, nes

Products Mapping **Top-Ten Products**



e.2. the Philippines 2005:

SITC	Commodity Description
424	Other fixed vegetable oils, fluid or solid, crude, refined
881	Photographic apparatus and equipment, nes
265	Vegetable textile fibres, excluding cotton, jute, and waste
844	Under garments of textile fabrics, not knitted or crocheted
778	Electrical machinery and apparatus, nes
245	Fuel wood and wood charcoal
752	Automatic data processing machines and units thereof
873	Meters and counters, nes
058	Fruit, preserved, and fruits preparations
773	Equipment for distribution of electricity

Source: UN-COMTRADE, *author's calculation*

Table 7 presents the products mapping for 1985 and 2005. The second column represents top-ten listed products in Group A. These products are considered as the best-ten products in term of their comparative advantage and trade balance. They are in the position of having comparative advantage in the international trade and the country in the position of having positive trade balance (or as net-exporter). All figures show positive relationship between comparative advantage and trade balance. The higher the comparative advantage of a specific product, the higher the possibility of a country as a net-exporter becomes. This result strongly supports the theory of comparative advantage (Ricardo, 1817): "a nation, like person, gains from trade by exporting the goods or services in which it has its greatest comparative advantage in productivity and importing those in which it has the least comparative advantage".

6. CONCLUSIONS

This paper discusses the theory, empirical measures and case studies of comparative advantage. For the developing or catching-up economies, like the ASEAN countries, the meaning of "leading exported products" can be seen from two different points of view i.e. domestic interest (exports as foreign exchange

creator) and international competition. We make an analytical tool namely the "products mapping", which is suitable for analyzing the catching-up countries' comparative advantage. The analytical tool is, then, applied to examine the ASEAN countries' exports. We conclude that there is a positive relationship between comparative advantage and trade balance. The higher the comparative advantage of a specific product, the higher the possibility of a country as a net-exporter becomes. This strongly supports the theory of comparative advantage.

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[1] Adam Smith (1776), in his work *Wealth of Nations*, states that all "value" is determined by, and measured in, hours of labor. With competitive market, the market value or price of a product is then determined by labor cost. This is the essence of the labor theory of value, which is imitated by David Ricardo (1817) as well as Karl Marx (1958). A critic of Marx (1958), which is then known as "great contradiction", is that if the exchange value of commodities is determined by the labor time they contain, how can this be reconciled with the empirically observed facts that the market prices of the commodities frequently differ from their labor values? Please see also: Cropsey (1963:713) and Ekelund and Hébert (1997:239).

[2] It is defined as all possible combinations of outputs of different goods that economy can produce with full employment of resources and maximum productivity.

[3] It is actually the concept of opportunity cost, which shows the amount of the other good (Y) has to give up for getting more of the specific good (X).

[4] The function f is concave if $f(\bar{x}) \geq \alpha f(x') + (1-\alpha) f(x'')$ where $\bar{x} = \alpha x' + (1-\alpha) x''$ and $\alpha \in [0,1]$. It is strictly concave if the strict inequality holds when $\alpha \in [0,1]$ (Hoy *et al.,*1996).

[5] Community utility function shows the aggregate individuals' utilities into social utilities. There are some examples such as purely Utilitarian type, CIC=uL+uK; non-symmetric Utilitarian type, CIC= β_1uL+ β_2uK; Maximin or Rawlsian type, CIC=Min{uL,uK}; Generalized utilitarian type; CIC= f_1(uL)+ f_2(uK), where f_1 and f_2 are concave functions; Constant elasticity type, $CIC = \left(uL^{1-\rho} + uK^{1-\rho}\right)^{\frac{1}{1-\rho}}$ for $\rho \neq 1$ and CIC=ln(uL)+ln(uK) for $\rho=1$. See Mas-Colell *et al.* (1995) for detailed explanation.

[6] This price ratio also represents individual country's comparative advantage. The assumption of perfect competition markets implies that price equals marginal cost (MC). Therefore, the expression $(px/py)_A > (px/py)_B$ can also be presented as:

$\left(MC_x / MC_y\right)_A > \left(MC_x / MC_y\right)_B$ or

$\left(\left(wL * MP_L^x + wK * MP_K^x\right) / \left(wL * MP_L^y + wK * MP_K^y\right)\right)_A > \left(\left(wL * MP_L^x + wK * MP_K^x\right) / \left(wL * MP_L^y + wK * MP_K^y\right)\right)_B$

. Where wL and wK are prices of Labor and Capital, respectively; MP_L and MP_K are marginal products for Labor and Capital, respectively. Country A has comparative advantage in product y and country B has comparative advantage in product x.

[7] It is sometimes argued that the structural transformation of industrialization in East Asia follows this 'flying geese' formation. Garment, Steel, Popular TV, Video and HDTV are frequently used to illustrate the formation. Those products have been transferred from Japan to Newly Industrialized Economies (NIEs: Hog Kong, Taiwan, Singapore and

Korea); from the NIEs to the ASEAN4 (Malaysia, Indonesia, Thailand and the Philippines); from the ASEAN4 to latecomer economies.

[8] The term "expected" means hypothetical values of trade, production and consumption that would exist as reflection of a world's hypothetical "comparative advantage neutral" (Bowen, 1983). In such a world, countries do not have comparative advantage since the relative prices would be the same. Therefore, the differences between actual and expected values can reflected as: $T_{ij} - E[T_{ij}] = (P_{ij} - E[P_{ij}]) - (C_{ij} - E[C_{ij}])$, where i denotes the country; k denotes the commodity; and $E[T_{ij}]$, $E[P_{ij}]$ and $E[C_{ij}]$ indicates the expected level of trade, production and consumption, respectively. It is assumed that there are identical preferences such that each country will produce at level depending upon its economic size, for example, Gross Domestic Product (GDP), which is denoted as Y. Therefore, the expected production and expected consumption can be expressed as: $E[P_{ij}] = E[C_{ij}] = P_{wj} * (Y_i / Y_w)$ where P_{wj} is world production (which is equal to consumption) of commodity k; Y_i and Y_w is the country's GDP and the world's GDP, respectively.

[9] Revealed Comparative Advantage (RCA) index by Balassa (1965) is also in this category.

[10] See, for example, the website of the United Nations – Statistic Division.

[11] For example, the UN-COMTRADE provides us with the detailed data on trade (export, import, re-export and re-import) by countries of reporter, by countries of partner, by years, and by the various commodity classification systems i.e. the Standard International Trade Classification (SITC) Revision 1 (1961), SITC Revision 2 (1975), SITC Revision 3 (1986), the Harmonized Commodity Description and Coding System (HS) 1992, HS 1996, HS 2002 and the Broad Economic Categories (BEC). The HS was adopted in 1983 and entered into force on 1 January 1988. The BEC is designed to serve as a means for converting external trade data compiled by using the SITC into end-use categories that are meaningful within the System National Accounts (SNA) framework. Under the SITC, products are classified according to (a) the materials used in production, (b) the processing stage, (c) market practice and uses of the products, (d) the importance of the commodities in terms of the world trade, and (e) technological changes. For the SITC, the structure of classification is: level 1 (one-digit code) for Sections, level 2 (2-digit codes) for Divisions, level 3 (3-digit codes) for Groups, level 4 (4-digit codes) for Subgroups and level 5 (5-digit codes) for Items.

[12] As far as the FG is concerned, the TBI is suitable indicator instead of inter-industry and intra-industry trade index by Grubel and Lloyd (1975:21):

Inter-industry trade: $$A_{ij} = \left[\frac{|x_{ij} - m_{ij}|}{(x_{ij} + m_{ij})} \right] * 100$$

Intra-industry trade: $$A_i = \left[\frac{(x_{ji} + m_{ij}) - |x_{ij} - m_{ij}|}{(x_{ij} + m_{ij})} \right] * 100$$

The TBI can indicates clearly whether a country as a net-exporter or net-importer.

[13] In this research, flying geese are products (SITC), therefore the analytical tool is called "products mapping". The geese might be industries or countries, therefore the analytical tool could be named "industries mapping" or "countries mapping", respectively.

[14] The two SITC have been not reported since 2001 in the world market. Technically, the Revealed Symmetric Comparative Advantage index, which is extensively employed in

this research, is not defined when there is no trade in the world market. For 1976-2000, the average share of export of the two SITC in the world export was only 0.13 percent.