Convergence towards the Revealed Comparative Advantage Neutral Point for East Asia: Similarities and Differences between the Three Countries

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The aim of this study is to use two main revealed comparative advantage (RCA) indices (Balassa's and the most recent "normalized" indices) and various quantitative techniques in order to systemically and rigorously draw some conclusions as to comparative advantage (CA) of the three East Asian countries. We use both HS 2-digit and 4-digit data to see how the three countries perform in RCA from 1995 to 2008. Overall, we find that there still exists a strict hierarchy in terms of CA in the three East Asian countries, although there is also a catching up process between them with a convergence towards a more competitive structure of RCA in exports. This mainly means that Japan and Korea are already in the process of converging towards the RCA neutral point (thus sectors that had RCA in 1995 get worse and sectors that did not have RCA in 1995 get better). However, China's position is still different from that of the other two countries (overall it might still be in the process of divergence).

Keywords: Revealed comparative advantage, Balassa's and normalized indices, Galtonian, Robust, Quantile regressions, Convergence, East Asia

JEL Classification: C1, C21, F10, F14

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I. Introduction

The purpose of this paper is to systematically compare the three East Asian countries Korea, Japan, and China in terms of RCA or revealed comparative disadvantage (RCD) in order to reach some concrete conclusions as to their relative hierarchy (or "distance") of trade specialization and their mutual catching-up tendencies. A review of literature has revealed that this rigorous comparison has not taken place so far; however, there are some other similar studies which will be summarized below. We will endeavor to answer the following question. Is East Asia converging towards a more homogeneous and perhaps similar international trade? Is the CA underlying its East Asia's trade becoming more common to all three countries? As more and more developing countries become more involved in the international arena of trade, one would expect that developed countries lose ground in terms of CA in some traditional sectors (see next paragraph), hence one would expect that for these latter countries their overall RCA converges towards the RCA neutral point[1] (no RCA and no RCD). Amongst the three East Asia nations, China is the only apparent developing one vis-à-vis the other two, but is this country converging in the same way?

This brings up another issue, namely the relationship between development stages and degree of specialization (see for example Kwark, 2005). In the previous paragraph, we hinted at a consequence of development: developed countries would be more despecialized than developing nations. This is what some other studies suggest; for example, De Benedictis *et al.* (2009) empirically established that there is a positive monotonic relationship between income per capita and degree of diversification. Hence, more diversification means that developed countries lose their CA in several sectors after some long period of time and they improve in others (consequently, as the country develops more and more, it might have fewer and fewer sectors for which it has a CA[2]). Instead

[1] Note that in order to provide evidence to this question we examine RCA indices. Other techniques could be perhaps used such as intra-industry trade as many researchers have already endeavored to carry out (*e.g.*, Hiratsuka 2006). This type of trade (either vertical or horizontal intra-industry) has been increasing in East Asia, China playing an important connection role as a huge assembly factory. However, it is out of scope of this paper to use other techniques, hence our concentration on RCA indices.

[2] CA is meant to be relative to some cut-off or neutral point: so measured CA (through RCA) must be above the neutral point to be deemed as being com-

of diversification, some researchers use the term despecialization (*e.g.*, Worz 2005; Ferto and Soos 2008), which is also more related to the use of Galtonian regression as will be explained further below. In our paper, as we explore this type of regression more extensively, we will use the term “convergence” (used by many other researchers dealing with Galtonian regression) to indicate despecialization or diversification. In sections 2 and 3 below, we will more precisely define convergence. Note that convergence in this sense does not mean necessarily that developed countries will concentrate only on a small number of sectors for which they have RCA.

Since China is the least developed country between the three East Asian nations, one could also ask the plausible question: is China catching up with South Korea and Japan? Is this country becoming more similar to the other two? Ahearne *et al.* (2003) suggested that China and other emerging Asian countries are comrades but also competitors in some specific sectors; however, we must know how this can be so in more precise ways. Sanidas (2009) has measured (using multidimensional scaling techniques) the actual distance between the three countries’ exports or economic development (within the context of about 100 examined countries). However, this author has used only the year 2004 and 14 major sectors’ ranking of one index of RCA for this measurement. In this paper, we use two RCA indices and various quantitative methods (mainly based on the well-known Galtonian regression) to provide a rigorous evaluation of the three East Asian countries mutual catching up process in terms of exports performance through time (from 1995 to 2008). This rigorous evaluation is useful for policy makers all over the world and in particular in the region for assessing possibilities of further development in exports and economic integration. Other studies which attempted to make a similar assessment regarding East Asian countries are the following. Lau and Shirasu (2003) have used both RCA and intra-industry indices to pinpoint at concrete related trade patterns and suggest further intra industry development; however, their analysis is descriptive and lacks of rigorous quantitative assessment. Yoon and Kim (2006), James (2000), Acharya (2008), and Ha (2005) provided similar descriptive studies by referring to the RCA, flying geese, specialization patterns, and convergence concepts. All these papers used RCA indices to capture comparative advantage patterns in East Asia countries.

parative advantage.

The Ricardo/Haberler model finds that international trade takes place from differences in labor productivity between countries while the Hecksher-Ohlin model explains it based on the differences in factor endowments and intensities. The New Trade Theory, which explains the occurrence of intra-industry trade taking into account the assumptions of imperfect competition and increasing returns of scale, does not directly use the term 'comparative advantage': Krugman (1979, p. 469) clearly stated that he developed "a simple, general equilibrium model of non-comparative advantage trade." The term 'comparative advantage' in this case (as per Krugman), however, is used in a traditional sense: that is, it is interpreted as what triggers inter-industry trade, contrasted to 'increasing returns of scale' that causes intra-industry trade. In contrast to this traditional notion of CA, there is also a broader meaning than simply what causes inter-industry trade: we may call it 'a broader notion of comparative advantage.' The broader notion of comparative advantage can be also found in the literature: for example, 'internal returns to scale as a source of comparative advantage' (Tybout 1993), or 'product differentiation as a source of comparative advantage' (Hummels and Levinsohn 1993). Palley (2008) has also explicitly analyzed these conceptual differences.

The passage from comprehensive trade theories to measuring CA has always been difficult. The major breakthrough of this RCA approach was made by Balassa's (1965) RCA index (BI), which is so far the most widely used index in analyzing trade performance, although it has been criticized for not achieving elaborate comparability over sectors or countries. Therefore, several other attempts to measure comparative advantage have been taken place to overcome the shortcomings of the BI. Recently, Sanidas and Shin (2010) have systematically compared the BI and five other alternative indices, and formulated a strategy to properly use these indices (see also Ballance *et al.* 1987; Seyoum 2007; Yeats 1985). Here, we take up this information and use only two of these indices to draw some more definite conclusions as to the comparative advantage between the three East Asian countries, namely, China, Japan, and South Korea. Overall, we propose to check the following hypotheses: (i) the three East Asian countries are in the process of converging into a more competitive similar structure of RCA or RCD but the hierarchy is still in force; (ii) China is still behind the other two competitors but the distance is reducing; (iii) catching-up to Japan's leading position seems to take place in terms of converging RCA or RCD structures. All these hypotheses will be checked, confirmed or refuted by applying a set of ideas and methods. In particular, we apply the Galtonian regression model in order to detect structural changes of CA pattern of each country, and other techniques such as the robust or quantile regression models, as suggested in Sanidas and Shin (2010). In general we intend to cross check all our results in as many ways as possible since the area of RCA is still controversial.

Section 2 briefly describes the two RCA indices used here and explains the Galtonian regression method. Section 3 shows results about RCA of East Asian economies by using a comprehensive set of descriptive and more econometric-oriented methods such as those mentioned in Section 2. Section 4 discusses and concludes.

II. RCA Indices and Quantitative Methodology

A. RCA Indices

Based on the conclusions by Sanidas and Shin (2010), in this study, we choose two major RCA indices, the famous BI (Balassa 1965)[3] and the normalized[4] RCA index (NI) (Yu *et al.* 2009). The BI is expressed as follows:

$$BI_{ij} = \frac{X_{ij} / X_i}{X_{wj} / X_w} \tag{1}$$

where $X_i = \Sigma_j X_{ij}$; $X_{wj} = \Sigma_i X_{ij}$; and $X_w = \Sigma_i \Sigma_j X_{ij}$.

A given country i is considered to have comparative advantage (disadvantage) in commodity j, when the commodity j's exports market size of country i in terms of its total national exports market size is greater (less) than the commodity j's world exports market size in terms of the world total exports market size; this implies that when BI_{ij} is greater (less) than unity country i has a RCA (RCD). The CA neutral (or, dichotomy) point is when BI_{ij} is equal to unity, *i.e.*, when the size-wise importance of commodity j's market in the country i is as big as that in the world export market.

The NI is expressed as follows:

[3] Balassa (1965) adopted Liesner (1958)'s ideas of using relative export performance, and proposed using the ratio of export shares.

[4] We chose the NI as it was found to have many desirable properties (see Sanidas and Shin, 2010 and also see Table 1A below).

$$\Delta X_{ij} = X_{ij} - X_{ij}^{*} = X_{ij} - \frac{X_i X_{wj}}{X_w} \quad \text{and hence} \quad NI_{ij} = \frac{\Delta X_{ij}}{X_w} = \frac{X_{ij}}{X_w} - \frac{X_{wj} X_i}{X_w X_w} \qquad \text{(2a)}$$

The NI brings in a hypothetical situation: a given country i is considered to have comparative advantage (disadvantage) in commodity j, if its exports, X_{ij}, exceeds what would have been in the hypothetical situation where there is no comparative advantage, X_{ij}^{*}, which is derived from $(X_{ij}^{*}/X_i)/(X_{wj}/X_w)=1$. Thus, country i is considered to have no comparative advantage when $X_{ij}-X_{ij}^{*}=0$, *i.e.*, $NI_{ij}=0$. The total world exports, X_w, is used for normalization. Appendix Table 1 contains the BI and NI of China, Japan, and South Korea for 1995 and 2008, and the variation between the two years.

As thoroughly analyzed by Sanidas and Shin (2010), none of RCA indices is 'the perfect one.' All indices have various imperfections (see also Vollrath, 1991). However, among these various attempts for RCA index, the NI seems to be so far the most successful in terms of avoiding the BI's comparability issues and obtaining favorable features that an RCA index should have, as shown in Table 1A below. For this reason, both BI and NI will be used in this study to examine RCA in East Asian economies. However, note that BI and NI are related with the following relationship (2b). We can see that there is an imperfect inverse relation between NI and BI when considering two points in time (the term $X_w/X_{wj}X_i$ in BI is reversed in NI). Thus it can be easily shown with a real example (see Table 1B below) that when the exports variables in (2b) change over time it is possible that NI becomes larger whereas BI becomes smaller.[5] Thus:

$$BI_{ij} = NI_{ij}\frac{X_w^2}{X_{wj}X_i} + 1, \quad \text{and} \quad NI_{ij} = (BI_{ij} - 1)\frac{X_i X_{wj}}{X_w^2} \qquad \text{(2b)}$$

In order to show more precisely the relation between BI and NI, the following example in Table 1B will be useful for the reader's understanding and subsequent analysis. We also included the symmetric index based on BI, which is a transformation of the BI according to the formula: $SI=(BI-1)/(BI+1)$ (Dalum *et al.* 1998). In this example (with

[5] As the BI can be easily transformed into a symmetric index (Dalum *et al.* 1998), this imperfect inverse relationship can still be maintained (see further below for an example).

TABLE 1A
PROPERTIES OF BI AND NI

	Comparative advantage neutral point	Sum over sectors	Sum over countries	Independence from aggregation level	Independence from reference group of countries	Symmetry	Normality
BI	1	not constant	not constant	×	×	×	×
NI	0	0	0	√	√	√	×

Note: These properties are discussed in various papers and summarized in Sanidas and Shin (2010).

TABLE 1B
EXAMPLE OF THE RELATIONSHIP BETWEEN BI AND NI
(FOR SECTOR NO 61 HS-2)

Variables	95	08	Variables	95	08
			BI	4.1090	3.8354
X_{ij}	6,937,409	60,856,596	$BI-1$	3.1090	2.8354
$X_{ij}^{*}=X_iX_{ij}/X_w$	1,688,343	15,866,894	$X_i X_{wj}/X_w^2$	0.000376	0.000986
$X_{ij}-X_{ij}^{*}$	5,249,066	44,989,702	NI	0.001170	0.002795
NI	0.001170	0.002795	NI*10000	11.70	27.95
X_w	4,486,867,456	16,098,513,202			
X_{wj}	148,779,552	1,428,686,300	$1/(X_i^{*}X_{wj}/X_w^2)$	2657.6	1014.6
X_i	50,916,740	178,789,006			
BI	4.1090	3.8354	SI	0.6085	0.5864

Note: The variables are explained in the paragraphs above.

real data) we can see how the factor $X_w/X_{wj}X_i$ affects the values of NI and BI.

B. Descriptive Analysis

Correlations (especially the Spearman method to measure rankings); Tables of RCA and RCD; Tables of rankings; variations between two different years; descriptive statistics such as means, variances, and skewness; and Cook's D for outliers, will be used in the next section. These methods can only complement but not substitute more rigorous econometric methods as explained in the next sub-section.

C. Galtonian Regression Method

Several studies use RCA indices in econometric analysis (*e.g.*, Laursen 1998; Wörz 2005; Sharma and Dietrich 2007; Frantzen 2008), in order to examine structural changes in trade specialization patterns within a country by using the Galtonian regression method.[6] The corresponding regression model is:

$$RCA_{ij}^{t_2} = \alpha_i + \beta_i \ RCA_{ij}^{t_1} + \varepsilon_{ij} \tag{3}$$

where t_1 and t_2 indicates the earlier point of time and the later point of time, respectively; α_i and β_i, standard regression coefficients; and ε_{ij}, an error term. It is assumed that the regression is linear, and that ε_{ij} follows the normal distribution and are independent of $RCA_{ij}^{t_1}$. It is noteworthy that this method compares two cross-sections at two different points of time: there is no element of continuous time involved (Dalum *et al.* 1998). However, we can vary t_2 and t_1 so that we get a continuous set of values for β_i (this will be carried out as well in the next section).

The underlying idea of Galtonian regression is to see how similar or dissimilar the distributions of RCA at two different points of time are to each other, hence the stability, or convergence/divergence of the trade specialization patterns. To interpret the corresponding results, Hart (1995) used the ratio of variances in two points of time to measure the convergence of the labor productivity, as shown in (4), where β and R^2 are the regression coefficient and the coefficient of determination between t_1 and t_2, respectively. One advantage of examining (3) is that the overall changes can be decomposed into regression effect, $(1-\beta)$, and mobility effect, $(1-R)$.

$$\frac{\sigma_{t2}^2}{\sigma_{t1}^2} = \frac{\beta^2}{R^2} \tag{4}$$

If $\beta > 1$, there should be divergence of trade specialization since R does not exceed unity, that is, the pattern of trade specialization is

[6] See Sanidas and Shin (2010), Cantwell (1989), Sharma and Dietrich (2007), and Galton (1889), for more information on the origin and related papers on the Galtonian regression.

considered to be strengthened because industries with initial comparative advantage become more advantaged, while those with initial comparative disadvantages become more disadvantaged (this case is called β-specialization as per Dalum *et al.,* 1998). If $\beta = R$, it can be seen that there is no convergence or divergence, thus the trade specialization pattern remains more or less stable. However, if $\beta < 1$, it does not necessarily imply convergence. The convergence happens when $\beta < R < 1$, where the pattern of trade specialization can be considered to be weakened, that is, sectors with initial comparative disadvantage improve their positions, while those with initial comparative advantage slip back. This is also called σ-de-specialization (Dalum *et al.* 1998). In addition, there is another possible case whereby $\beta < 0$: the sign of the index has changed and hence the ranking of sectors is reversed. However, this case is expected to rarely happen in real world (Dalum *et al.* 1998). Consequently, testing the null hypothesis $\beta = 1$ can show convergence/divergence of the pattern of trade specialization. If β is significantly less than 1, then we also need to examine R to determine σ-type convergence or divergence. If $0 < \beta < 1$ and no reference is made to the value of R, then we have β-de-specialization (Dalum *et al.* 1998). In this paper we call 'convergence' the case of σ-de-specialization and divergence the case of σ-specialization. Note that β-specialization and σ-specialization are equivalent in their meaning: both of them mean divergence but from a different point of view. However, as Bliss (2000) remarked, β-de-specialization is neither a necessary nor sufficient condition for σ-de-specialization.

From the estimation viewpoint, since this Galtonian regression is usually a simple OLS regression, normally distributed error terms are assumed; this is not always the case with respect to our RCA indices which consistently exhibit non-normality and influential outliers; this would lead to invalid t-statistics. To circumvent some of these problems[7] just mentioned, we also use robust and quantile regressions which might yield more effective results with respect to non-normality and influential outliers, as suggested by Sanidas and Shin (2010). In addition, the value of R is very often biased because of the presence of outliers, especially in the case of OLS. Hence the estimation procedure

[7] The Galtonian regression has been used in many areas of research. The main problem detected is the normality issue, which might also cause other problems such as heteroscedasticity. As most researchers have dealt with the normality problem, so do we in our study.

becomes important; we will check the validity of our conclusions in several ways. Furthermore, we consider and interpret the intercepts α_i of regressions since changes in intercepts are affected by factors which do not necessarily affect slopes. Hart (1995) also pointed out this issue.

III. Empirical Analysis

A. Data Description

HS (Harmonized System) 2-digit level exports data, the basic variables for calculating the corresponding RCA indices, are retrieved from three PC-TAS (Personal Computer Trade Analysis System) CD-ROMs published by International Trade Centre (ITC) and its website.[8] HS 2-digit data consist of 98 sectors (from HS 01 to HS 99 with HS 77 being empty as "reserved for possible future use."). Appendix Table 2 contains a brief description of HS 2-digit codes. HS 4-digit level exports data are retrieved from UN Comtrade.[9] The calculations of the two RCA indices, namely, the BI and NI introduced in Section 2, for China, Japan, and South Korea are carried out by the authors according to (1) and (2), except that we scaled up the NI by 10,000 as recommended by Yu *et al.* (2009). In addition, with respect to all sectors of the three countries, Hillman's condition (Hillman 1980) is examined: no violation was found, which implies that the numeric values of BI (and probably NI[10]) can adequately function in cross-country analyses. With regard to the regression analysis, the statistical package STATA 10.0 is used.

B. Descriptive Analysis of RCA

An examination of the main exports of each one of the three countries shows that their RCA is well related to the main exports of these nations (for example vehicles, electrical and non-electrical machinery for Japan as well as for Korea, apparel and electrical machinery for China, and so on). In total, Table 2 shows the number of sectors with comparative advantage/disadvantage for each country. The number of industries that have comparative advantage has remained approximately the same between 1995 and 2008. This agrees with Dalum *et al.*

[8] www.intracen.org
[9] comtrade.ur.org
[10] The Hillman condition might not be applicable to the NI in the same way as it is to the BI.

TABLE 2
NUMBER OF SECTORS WITH RCA AND RCD IN THE 3 COUNTRIES

		China		Japan		South Korea	
		1995-1997	2006-2008	1995-1997	2006-2008	1995-1997	2006-2008
NI (HS-2)	Number of sectors with RCA	47	45	14	18	28	21
	Number of sectors with RCD	51	52	84	79	70	76
NI (HS-4)	Number of sectors with RCA	481	510	296	301	253	217
	Number of sectors with RCD	775	746	960	955	1003	1039

Notes: (i) We first took the average of 3 years' RCA index and then counted RCA and RCD; (ii) BI and NI yield the same results except for minor differences due to the availability of data; hence only NI is shown in this table.

(1998, p. 430) who stated that "trade patterns do not change 'overnight' and do not change fundamentally even over three decades." One interesting finding here is that both RCA indices tell us that China has the most sectors with comparative advantage among the three countries, and Japan has the least, which implies that Japan, the most economically developed country out of the three, has been despecialized the most, out of the three, in terms of exports performance, followed by South Korea and then China. The 2-digit data and the 4-digit data yield similar results.

In order to check between all pairs of countries any tendencies towards convergence in ranking structures we calculated pair-wise Spearman rank correlation coefficients between the three countries for BI in 1995 and 2008, as shown in Table 3. We can witness that the correlation for all pairs increased, but more so between China and Japan than for South Korea and Japan or between South Korea and China (the smallest increase between the two years). Considering the existing hierarchy between Japan, South Korea, and China in terms of economic development and exports specialization, we can infer that there is a catching-up for all three pairs of countries. These three countries are in the process of converging towards a similar export structure, although not

TABLE 3
SPEARMAN RANK CORRELATION COEFFICIENTS (HS-2)

Correlation between	BI	
	1995	2007
China - Japan	0.2791	0.4858
Japan - South Korea	0.6433	0.7856
South Korea - China	0.5311	0.5727

Note: The ranks are calculated in relation to all other countries in the world, hence since we had no data for 2008 we have used 2007 for comparison.

in a consistent or similar way.

C. Econometric Analysis of RCA

The Galtonian method is the linear simple regression with respect to the two cross-sections of two different time periods. Rewriting the corresponding model (3), we have:

$$RCA_{ij}^{t_2} = \alpha_i + \beta_i \; RCA_{ij}^{t_1} + \varepsilon_{ij}$$

where the normality is assumed on the error terms. Thus, we first investigate whether or not the normality assumption is met.[11] We use the average over 1995-1997 for t_1, and the average over 2006-2008 for t_2 for HS 2-digit sectors, and 1995 for t_1 and 2008 for t_2 for HS 4-digit sectors.[12] We used scatter plots and histograms of the BI and NI to roughly check the linear relationship between the two points of time, and also the presence of outliers.[13] The distribution of the BI seems to be far from being symmetric: it is very right-skewed. For the NI, it looks possibly symmetric and bell-shaped without the outliers; however, it is very concentrated around the threshold point, which leads to a high kurtosis.[14] To check normality more formally, we first estimated OLS

[11] It is generally accepted that if the sample size is 30 or more, normality would be met. Yet, we still examine the normality issue in this study following previous researches (*e.g.*, Dalum *et al.* 1998; Laursen 1998) which took this issue into account.

[12] We took the average into account here to control the effect from short-term fluctuations.

[13] Detected with Cook's D technique.

[14] Kurtosis, skewness, and other descriptive statistics were calculated but are not shown here.

Galtonian regressions. Then we examined the corresponding residuals by some normality tests such as Shapiro-Wilk W test, Shapiro-Francia test, and Skewness-Kurtosis test (relevant results are not shown here). The null hypothesis of normality was not accepted at 5% significant level in all cases.

The existence of non-normality and outliers lead us to try using different methods instead of the OLS regression model. The first one is the robust regression. Regression outliers pose a serious threat to standard least squares analysis, and the robust regression tries to devise estimators that are not so strongly affected by outliers (Rousseeuw 1987). However, although robust regression deals with outliers and non-normality, the calculation of R^2 (which is needed for our detection of convergence or divergence as per Section 2) in this case is not possible in a clear cut way. The second method is the quantile regression, which estimates the median or other quantiles. De Benedictis and Tamberi (2004) argue the usefulness of using the median instead of the mean in the case of BI.

Accordingly, the robust regression and the quantile regression are applied on our dataset: each one of the two RCA indices averaged over 2006-2008 is regressed on that over 1995-1997 for China, Japan, and South Korea. The relevant results are shown in Table 4, which also contain OLS estimates for comparison. There are some noticeable differences between the three econometric methods used. For example, for South Korea, and for NI, whereas the OLS yields $\beta=0.85$ (HS-2), the robust regression yields $\beta=0.54$. This difference is important in this case because when combined with the value of R, we predict a stable situation in the OLS case but a convergence in the robust regression case. This is a good example as to how the robust regression by eliminating the influence of outliers provides a very different estimate of β (and of the intercept α in this regard). Regarding the quantile regression, its results often agree with the OLS results.[15] Note that the apparent contradiction between the estimates for BI and NI (particularly evident for Japan and China) is probably partly due to the imperfectly inverse relationship between BI and NI (as explained earlier, see Equation 2b in sub-section 2.*A*). However, this contradiction might also be due to the asymmetry of BI.[16] Thus the coefficient β for China is 0.40

[15] It is out of scope of this paper to systematically examine differences between the three regression methods.

[16] This has been suggested by an anonymous referee.

TABLE 4
RESULTS OF REGRESSIONS FOR CHINA, JAPAN, AND SOUTH KOREA (HS-2 AND HS-4)

			BI				NI			
			$\hat{\beta}$	R	$\hat{\alpha}$	$\hat{\beta}/R$	$\hat{\beta}$	R	$\hat{\alpha}$	$\hat{\beta}/R$
China	OLS	HS2	0.40***	0.9	0.479***	0.444	0.96***	0.33	0.003	2.909
			(conv.) σ-de-spe. and β-de-spe.				(div.) σ-spe. and β-de-spe.			
		HS4	0.35***	0.666	0.682***	0.526	1.793***	0.446	-1.51	4.020
			(conv.) σ-de-spe. and β-de-spe.				(div.) σ-spe. and β-spe.			
	Robust	HS2	0.40***	0.901	0.38***	0.444	1.04***	0.948	-0.46**	1.097
			(conv.) σ-de-spe. and β-de-spe.				(div.) σ-spe. and β-spe.			
		HS4	0.419***	0.837	0.385***	0.501	1.095***	(0.981)	-0.026**	1.116
			(conv.) σ-de-spe. and β-de-spe.				(div.) σ-spe. and β-spe.			
	Quantile	HS2	0.40***	0.71	0.31**	0.563	1.35***	0.49	-0.47***	2.755
			(conv.) σ-de-spe. and β-de-spe.				(div.) σ-spe. and β-spe.			
		HS4	0.428***	0.525	0.334**	0.815	1.195***	0.429	-0.013***	2.786
			(conv.) σ-de-spe. and β-de-spe.				(div.) σ-spe. and β-spe.			
Japan	OLS	HS2	1.02***	0.92	0.06	1.109	0.57***	0.87	0	0.655
			(div.) σ-spe. and β-spe.				(conv.) σ-de-spe. and β-de-spe.			
		HS4	0.928***	0.715	0.137	1.298	0.723***	0.787	0	0.919
			(div.) σ-spe. and β-de-spe.				(conv.) σ-de-spe. and β-de-spe.			
	Robust	HS2	0.98***	0.987	0.026**	0.993	0.43***	0.983	0.016	0.437
			(stable)				(conv.) σ-de-spe. and β-de-spe.			
		HS4	0.889***	0.979	0.016**	0.908	0.433***	0.997	-0.0008	0.434
			(conv.) σ-de-spe. and β-de-spe.				(conv.) σ-de-spe. and β-de-spe.			
	Quantile	HS2	0.99***	0.83	0.016	1.193	0.41***	0.75	-0.015	0.547
			(div.) σ-spe. and β-de-spe.				(conv.) σ-de-spe. and β-de-spe.			
		HS4	0.935***	0.687	0.0019	1.361	0.436***	0.604	0.0007	0.722
			(div.) σ-spe. and β-de-spe.				(conv.) σ-de-spe. and β-de-spe.			

(Table 4 Continued)

TABLE 4
CONTINUED

			BI				NI			
			$\hat{\beta}$	R	$\hat{\alpha}$	$\hat{\beta}/R$	$\hat{\beta}$	R	$\hat{\alpha}$	$\hat{\beta}/R$
South Korea	OLS	HS2	0.47***	0.75	0.016**	0.627	0.85***	0.84	0	1.012
			(conv.) σ-de-spe. and β-de-spe.				(stable)			
		HS4	0.312***	0.424	0.346**	0.736	0.609***	0.508	-9.98	1.199
			(div.) σ-spe. and β-de-spe.				(div.) σ-spe. and β-de-spe.			
	Robust	HS2	0.32***	0.779	0.154***	0.411	0.54***	0.977	-0.19***	0.553
			(conv.) σ-de-spe. and β-de-spe.				(conv.) σ-de-spe. and β-de-spe.			
		HS4	0.316***	0.956	0.084***	0.331	0.565***	0.993	(-0.01***)	0.569
			(conv.) σ-de-spe. and β-de-spe.				(conv.) σ-de-spe. and β-de-spe.			
	Quantile	HS2	0.36***	0.309	0.09**	1.165	0.88***	0.314	0.004	2.803
			(div.) σ-spe. and β-de-spe.				(div.) σ-spe. and β-de-spe.			
		HS4	0.355***	0.354	0.057**	1.003	0.439***	0.371	-0.0098***	1.183
			(stable)				(div.) σ-spe. and β-de-spe.			

Notes: * (significant at 10% level); ** (significant at 5% level); *** (significant at 1% level); the comparison is between 1995-97 and 2006-08; the R for the robust regression is provided by STATA's own method. The tests for β and R confirm the conclusions regarding convergence or divergence.

for BI but close or larger than one for NI, and so on. We will discuss or infer further below as to which RCA index is more likely to yield the right answer. In Table 4 we also included t-tests on whether the regression coefficient is significantly different from unity; also whether this coefficient is equal to R (following the Galtonian regression steps as mentioned in 2.C). In Table 4, the ratio β/R is also included in order to detect σ-de-specialization or σ-specialization.[17]

Thus, in Table 4 we also see whether or not the pattern of trade

[17] The comparison ($\beta<R$) is not always valid: first because outliers seriously affect R, and second because the R is not clearly defined for the robust method. Thus, two measures of R in robust regression (the one used by STATA) and the one proposed by UCLA University yield different values for it, but without significantly affecting our conclusions. The direct calculation of the ratio of the two variances as per (4) has confirmed the findings.

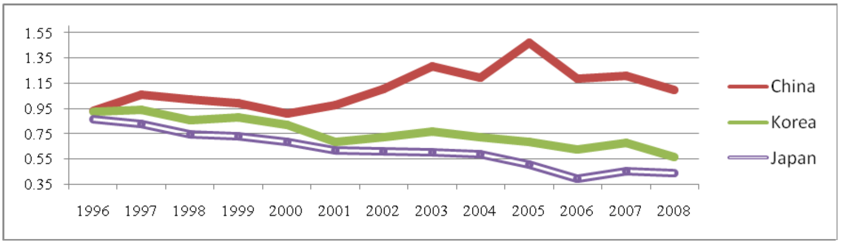
specialization has strengthened (as per analysis in sub-section 2.*C*). Overall, it seems that our two indices and our three regression methods are not apparently consistent in yielding same or similar results. We ought to provide answers to the following questions. Does each country experience divergence or convergence? Is the NI or the BI telling us the truth? Is the OLS, or the robust version or the quantile version telling us the true story? Consequently, although for BI our regression estimates indicate convergence in some cases, they indicate divergence for NI in the same cases. In particular, this contrast is very evident for the case of China: the NI indicates divergence both in terms of β-specialization and σ-specialization, whereas the BI indicates the contrary: convergence both in terms of β-de-specialization and σ-de-specialization. This is the consequence mainly of the estimated β coefficient in the relevant regressions, which in turn is due to the imperfectly inverse relationship between NI and BI and the asymmetry of BI, as indicated in the previous paragraph.[18] We will pick up this contrast again further below. For Japan and South Korea, there is much less contradiction, especially if we consider the 'robust regression' method which eliminates outliers. For these countries, there is strong evidence that they are already in the process of convergence, both in terms of β-de-specialization and σ-de-specialization: sectors with RCA become worse and sectors with RCD become better. The σ-de-specialization, in particular, shows a decrease in dispersion or variance from 1995-97 to 2006-08. Also note that all β coefficients are significantly greater than zero thus indicating cumulativeness or 'stickiness' (Dalum *et al.* 1998).

So far we have examined the situation of a static comparison between 2006-08 and 1995-97. Here, in a more dynamic way, we will summarize some of our findings by conducting regressions for all years from 1996 to 2008 in relation to 1995.[19] This will also allow us to clarify some of the uncertainties in the previous sub-section. First, in Figure 1 we show the changes in the coefficient β of the Galtonian regression (robust method) for the NI only[20] (HS-4) and for our three East Asian coun-

[18] We also applied other RCA indices to these Galtonian regressions. The symmetric index (already defined in 2.*A*) and the additive (which is equal to $X_{ij}/X_i - X_{wj}/X_w$) index (both based on Balassa's original idea) tend to be similar to the NI in its estimates: a β around the value of R or greater than R, which confirms our preference for NI.

[19] We also used a different basis to confirm this, *e.g.*, 1996 or 1997.

[20] We also used the BI to construct the same graphs as for NI. There is again some symmetry between NI and BI results; for example the β for Japan is slowly



Source: calculated by the authors.

Figure 1

Trends of Coefficient β (Slope) of Galtonian Regression (NI)

tries.[21] The results are revealing. They show that both Korea and Japan (and all other countries we examined but not shown on the graph) exhibit a continuous downward trend. However, China exhibits a mixed trend (first rising and becoming much greater than one and then only recently declining). The coefficient β being less than one for Korea and Japan (it has the tendency to approach 0.35 to 0.5 by 2008), suggests that these two countries (hence not China) might be convergent in terms of trade specialization: sectors that were initially at the position of RCD keep improving through time, and those that were at the position of RCA keep worsening through time, thus approaching the neutral point of no RCA on average. In addition, we can be more certain that the β-de-specialization takes place for Korea and Japan but not for China, although very recently, β started approaching unity.

To confirm these results, we then checked all 1256 HS-4 sectors in all three countries (see Table 5). Thus, for South Korea, 869 out of 1242 sectors showed a clear sign of convergence.[22] Divergence is overall the situation in China as NI suggests,[23] but probably within a few years

declining, but those of Korea and China declining much faster. The intercept for China is positive but rising fast, contrary to those Korea and Japan which rise much slower.

[21] We also checked these dynamic Galtonian regressions for some other countries (Thailand, Germany, Philippines, Indonesia, Belgium, Malaysia, and France) but not shown in the graph: their behavior is similar to that of Korea and Japan.

[22] Since the number of sectors 869 that exhibit convergence exceeds the number of sectors that exhibit divergence (373), it is almost certain to have an overall convergence (according to the definition presented in Section 2) if we assume that outliers do not influence the results in the opposite direction.

[23] Once more the results between BI and NI are 'contradictory' as already

TABLE 5

NUMBER OF INDUSTRIES CONVERGING OR DIVERGING (HS-2 AND HS-4)

	China		Japan		South Korea	
	BI	NI	BI	NI	BI	NI
RCA/ better (D)	10 (122)	20 (214)	8 (139)	3 (55)	4 (53)	4 (51)
(D) total	38 (387)	55 (708)	25 (568)	4 (145)	34 (501)	16 (373)
RCD/ worse (D)	28 (265)	35 (494)	17 (429)	1 (90)	30 (448)	12 (322)
RCA/ worse (C)	37 (354)	27 (262)	6 (155)	11 (239)	24 (204)	24 (207)
(C) total	59 (842)	43 (534)	64 (652)	94 (1097)	60 (712)	79 (869)
RCD/ better (C)	22 (488)	16 (272)	58 (497)	83 (858)	36 (508)	55 (662)

Notes: (i) 'RCA/better' indicates sectors that has RCA in 1995 and became worse in 2008, and so on. (ii) RCA/better and RCD/worse together imply divergence, and RCA/worse and RCD/better convergence; (iii) any small discrepancies in the totals are due to variations being zero or unavailable data; (iv) numbers in brackets are the HS-4 data.

(based on Figure 1, this would be the case within approximately 7-8 years, that is, for β to be significantly less than one) this country will also experience convergence like all other countries. The suggested present divergence is mainly due to the following two reasons: first the expected tendency for China to increase her exports (due to her existing RCAs) considerably more than the increase in world exports in several sectors (as the example in Table 1B shows). This can be contrasted to Japan's exports which have been rather growing slowly in the last 15 years, thus contrasting the Chinese exports (in Table 4 we can see that the coefficients β are greater for NI than BI for China but they are smaller for NI than for BI for Japan). Second, China's fast catching-up in economic development infers that particular sectors (especially on

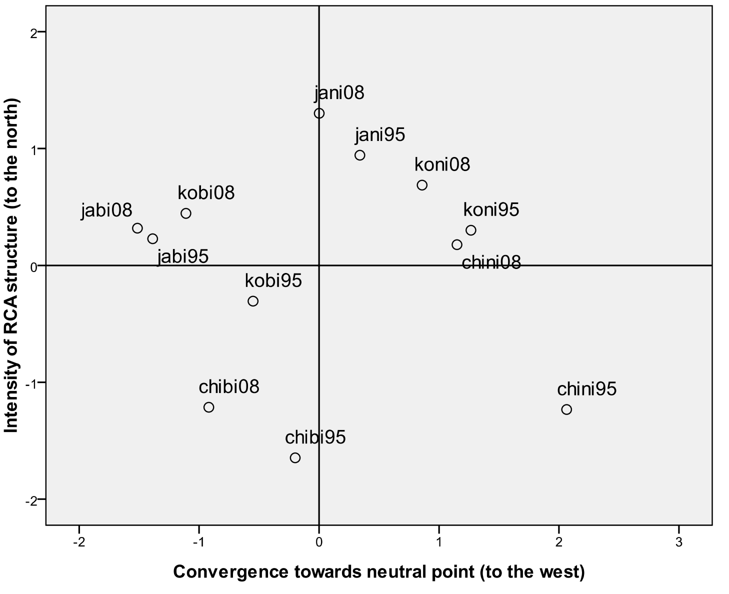
explained in the previous paragraphs. However, as we have already indicated, we are inclined, in the present paper, to adopt NI as NI seems to yield overall more consistent and expected results (NI has many desirable properties as Table 1A above showed and the analysis so far here). As we have already mentioned, NI is also "supported" by other RCA indices, such as the additive and the symmetric ones.

the HS-4 basis) for which China had RCD (mainly the less technologically advanced ones) become worse now in relation to 1995 (a tendency to expect given the technological catch-up of China). All this agrees with the definition of NI: whereas the BI only takes into account the world export ratio, the NI considers the resilience and the capability of the nation to export.

The overall tendency for convergence (for Korea and Japan and soon for China) is also observed in many other countries. By calculating the four categories as in Table 5, we confirmed that the following countries have shown similar signs of convergence: France, USA, UK, Australia, Spain, Brazil, Thailand, Malaysia, Sweden, Netherlands, Canada, Mexico, Indonesia, Italy, Poland and Greece (we only examined 23 major nations of various development stages in this respect). However, only four countries showed signs of divergence according to similar calculations: besides China, also India, the Czech Republic, and to a lesser extent the Philippines (which all are fast growing countries like China). Finally, another way to measure the similarity between countries in terms of the coefficient β is to calculate correlations between the β of all pairs of countries (for the period 1995 to 2008). Thus, as expected, China's β is negatively correlated with that of all other nations, whereas Japan's β is highly correlated (0.952) with South Korea's, Malaysia's, Thailand's, and Indonesia's.

In this discussion we will further confirm these conclusions by applying another quantitative technique, namely multidimensional scaling (MDS) as per Sanidas (2009), in order to measure more precisely the position of exports performance of the three East Asian countries (the technique is only applied to these three nations for 1995 and 2008 for the two indices, hence distances are not calculated in relation to the remaining countries of the world). We carried out this analysis by considering two situations (and we obtained similar results); first, if all 98 HS-2 sectors are included (not shown here), and second, if only the 37 most technologically advanced sectors[24] are included (Figure 2). In this Figure 2 we can clearly see that the results for the two indices are similar as expected (they are situated in a parallel way on the map due to their imperfectly inverse relationship). Thus, South Korea's RCA structure in 2008 has approached that of Japan considerably, and China's RCA structure in 2008 is now almost the same as South Korea's one

[24] These sectors have the codes 28 to 40, and 72 to 99, but excluding 94, 97, and 98 (see Appendix Table 2).



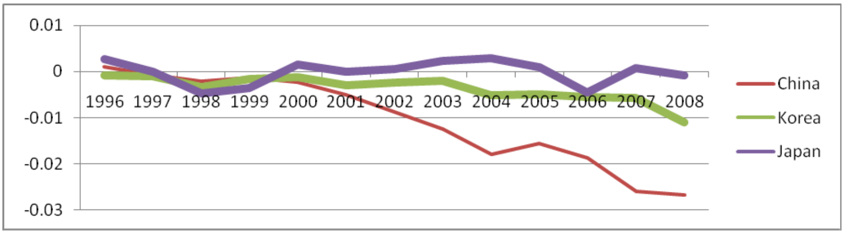
Notes: (i) We provide the meaning of the two axes on the map as they are not provided by the technique of multidimensional scaling (ALSCAL algorithm as in SPSS); (ii) the diagnostics of the method are satisfactory (not reported here); (iii) the distance is measured as per Euclidian formula, and the standardization used is as per one standard deviation (iv) legend: "chibi95" stands for China's BI in 1995, "koni08" stands for South Korea's NI in 2008, and so on; (v) the "intensity of RCA structure" on the y-axis indicates the overall relative distance between the 16 vectors on the map (chibi95, etc), this intensity being higher in the north of the map where we have strong RCAs in most of these 37 sectors; we found that "convergence towards the neutral point" on the *x*-axis might be a good interpretation of this axis (the multidimensional technique widely used in applied research in social sciences allows the researcher to provide his or her own interpretation of the 2 axes).

FIGURE 2

DISTANCES FOR THE 37 TECHNOLOGICALLY ADVANCED SECTORS

in 1995; overall China has approached the other two countries but it still remains behind them, although the gap has been reduced considerably. Also note the movement from east to the west of the map indicating the convergence process.

We will now turn to the examination of the intercept of Galtonian



Source: calculated by the authors.

FIGURE 3

TRENDS OF INTERCEPT α OF GALTONIAN REGRESSION (NI)

regressions usually ignored (Hart 1995, discusses this point too) in research; however, we recommend that they should also be examined as they contain their own relevant information. Figure 3 shows the trends in the intercept of the Galtonian regressions. As expected, the intercept becomes increasingly negative for China and to a lesser extent for Korea, as we regress the cross section data further apart in time. This is less the case for more advanced countries like Japan, France and Germany (not shown here). This is because as we compare years further apart, China has improved considerably in terms of the initial level of RCA (or RCD), and consequently increased exports considerably. As we use NI (hence the neutral point being equal to zero), the intercept shows the situation whereby we get an estimate of the initial conditions of exports: China started from a very low point in relation to most other countries as it has been isolated for a long time. Hence the examination of intercept α is directly more indicative of the catching up process than showing convergence or divergence. Another way to measure the similarity between countries in terms of the coefficient α (intercept) is to calculate correlations between the α of all pairs of countries (for the period 1995 to 2008). Thus, as expected, China's α is positively correlated with that of South Korea (0.86) and Thailand's but negatively with that of Japan's, whereas Japan's α is uncorrelated with all other countries' intercept.

Related to the analysis of intercept, and following suggestions made in Sanidas and Shin (2010), we also examined the fitted value of comparative-advantage-neutral point in order to take into account both slope and intercept of the regression lines (results not shown here for BI, but shown for NI in Table 4 above). We found that the BI and NI do not disagree to each other too much (as expected). China and South

Korea show negative variations (the predicted value of RCA is lower than the neutral point used as a value in the regressor RCA of the base year), thus implying that if on average all industries are situated on the break-even point (1 for BI or 0 for NI), then we can predict a worsening of RCA, thus on average all sectors will be situated at the RCD area. On the contrary, the results for Japan indicate an equal or close to positive variation, thus implying that Japan has the ability to remain strong if on average, all industries are situated on the break-even point at the base year. It also implies that the Japanese economy has more self-sufficiency and resilience than the other two nations have (although Korea is more resilient than China).

IV. Conclusion

We used the well-known Galtonian model, three regression methods (OLS, robust, and quantile), two RCA indices (BI and NI, and at times others), and several descriptive techniques to examine East Asian countries' (China, Japan, and South Korea) export performance from 1995 to 2008. The combination of several quantitative ways used in this paper leads us to draw some conclusions with more confidence, despite the imperfection of RCA indices (however, that is all we have at preset in the literature). Based on Galtonian analysis that has precise ways to determine convergence towards or divergence away from the neutral point we established that only China is still in the divergence stage (industries with initial RCA become stronger while those with RCD become weaker) although on a descending trend. This divergence can be expressed through both σ-specialization and β-specialization. This allows us to predict that very probably in about five to ten years time China will also go into the convergence stage in a significant way (hence de-specialization).

Thus, the patterns of α and β coefficients of our Galtonian regressions through 1995 to 2008 (Figures 1 and 3) confirm the results of Spearman coefficients (as in Table 3) which indicated that whereas South Korea and Japan get closer in terms of RCA structure, China is still behind these two countries in the ladder of CA in exports. This is also confirmed with our MDS analysis as shown in Figure 2. Our overall systematic analysis has indicated that the three East Asian countries are still in a process of hierarchic development amongst each other: Japan and, to a lesser extent, South Korea are still ahead of

China. However, the gap is closing gradually. We were able to arrive at these conclusions after we applied a thorough econometric combined with other simpler quantitative analyses. However, RCA indices have many flaws, especially the Balassa's index and its derivations (such as the symmetric index) as shown in the literature (see for example Sanidas and Shin, 2010). For this reason we used the newly introduced normalized RCA index (Yu *et al.* 2009) which we believe yields better results according to Sanidas and Shin (2010) and as partially demonstrated in this paper.

Based on RCA (BI index greater than 1, or NI greater than zero) that exists in 2008 (see Appendix Table 1) we can additionally conclude that as China starts converging towards the neutral point in a few years, we would expect a more intensive competition in the more advanced sectors set (like those included in Figure 2). This will allow eventually an even higher degree of intra-industry trade amongst the three East Asian countries. Hence we would expect that in about ten year time, East Asia would be a more 'mature' region than now, that is, ready for a more formal economic integration.[25] However, export patterns must be accompanied with economic development overall for this integration to take place.

On the whole, we proposed in our Introduction to check the following hypotheses: (i) the three East Asian countries are in the process of converging into a more competitive similar structure of RCA or RCD but the hierarchy is still in force; we have answered this question affirmatively; (ii) China is still behind the other two competitors, but the distance is reducing: we have also confirmed it here; (iii) catching-up to Japan's leading position seems to take place in terms of converging RCA or RCD structures: this is also confirmed. We hence, confirm that the issue whether countries converge to or diverge away from the neutral point of RCA is very important when examining export performance and similarities between nations. In our study here, we used this convergence/divergence concept together with other methods to indicate the exact structure of export performance of the three East Asian countries.

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[25] However, new products and sectors might regenerate a new process of convergence and divergence.

Appendix

Appendix Table 1
BI and NI in 1995 and 2008 and Their Variation

HS	China						Japan						South Korea					
	BI			NI			BI			NI			BI			NI		
	1995	2008	Var.	1995	2008	Var.	1995	2008	Var.	1995	2008	Var.	1995	2008	Var.	1995	2008	Var.
1	**1.51**	0.34	-1.17	**0.38**	-0.62	-1	0.01	0.03	0.02	-2.19	-0.49	1.7	0.04	0.01	-0.03	-0.6	-0.26	0.34
2	0.78	0.09	-0.69	-0.62	-4.84	-4.21	0	0.01	0.01	-8.62	-2.88	5.73	0.1	0	-0.09	-2.2	-1.48	0.73
3	**1.89**	0.82	-1.06	**2.19**	-0.69	-2.88	0.13	0.33	0.21	-6.42	-1.43	4.99	**1.24**	0.62	-0.62	**0.5**	-0.41	-0.91
4	0.16	0.1	-0.06	-1.89	-3.5	-1.61	0	0.01	0.01	-6.69	-2.11	4.58	0	0	0	-1.88	-1.07	0.81
5	**6.74**	**2.1**	-4.64	**1.33**	**0.45**	-0.88	0.07	0.09	0.01	-0.64	-0.2	0.44	0.29	0.22	-0.07	-0.14	-0.09	0.05
6	0.1	0.09	-0.01	-0.55	-0.88	-0.33	0.01	0.07	0.06	-1.8	-0.5	1.31	0.05	0.06	0.02	-0.49	-0.25	0.24
7	**2.56**	0.97	-1.59	**2.33**	-0.09	-2.42	0.01	0.02	0	-4.39	-1.46	2.93	0.2	0.08	-0.12	-1.01	-0.69	0.31
8	0.58	0.33	-0.25	-0.77	-2.63	-1.86	0.02	0.03	0.01	-5.37	-2.09	3.28	0.2	0.06	-0.14	-1.23	-1.02	0.21
9	0.98	0.45	-0.53	-0.02	-0.98	-0.96	0.01	0.03	0.02	-3.12	-0.95	2.16	0.02	0.03	0.01	-0.87	-0.48	0.39
10	0.06	0.07	0.01	-2.62	-5.28	-2.66	0	0	0	-8.3	-3.11	5.19	0	0	0	-2.34	-1.58	0.76
11	0.5	0.39	-0.11	-0.23	-0.52	-0.3	0.14	0.12	-0.02	-1.15	-0.41	0.74	0.07	0.05	-0.02	-0.35	-0.23	0.13
12	**2.08**	0.36	-1.72	**1.36**	-2.25	-3.61	0.07	0.04	-0.03	-3.46	-1.84	1.62	0.51	0.11	-0.4	-0.52	-0.87	-0.36
13	0.77	**1.03**	0.26	-0.03	**0.01**	0.04	0.16	0.16	0	-0.32	-0.12	0.2	**1.37**	0.46	-0.91	**0.04**	-0.04	-0.08
14	**5.14**	**1.14**	-3.99	**0.11**	**0.01**	-0.1	0.06	0.04	-0.02	-0.07	-0.02	0.05	0.18	0.04	-0.15	-0.02	-0.01	0.01
15	0.51	0.08	-0.44	-0.97	-4.5	-3.53	0.03	0.03	0	-5.73	-2.59	3.14	0.03	0.01	-0.02	-1.62	-1.33	0.29
16	**2.5**	**1.77**	-0.73	**1.49**	**1.63**	0.14	0.22	0.26	0.04	-2.32	-0.86	1.46	**1.06**	0.14	-0.92	**0.05**	-0.5	-0.55
17	0.44	0.24	-0.2	-0.65	-1.32	-0.67	0.04	0.05	0.02	-3.36	-0.9	2.46	0.53	0.19	-0.34	-0.46	-0.39	0.07
18	0.12	0.07	-0.05	-0.69	-1.66	-0.97	0.01	0.04	0.02	-2.29	-0.94	1.35	0.1	0.04	-0.07	-0.59	-0.48	0.11
19	0.45	0.24	-0.21	-0.56	-1.91	-1.35	0.12	0.15	0.02	-2.7	-1.18	1.52	0.55	0.26	-0.29	-0.39	-0.52	-0.12
20	**1.71**	**1.34**	-0.37	**1**	**0.92**	-0.08	0.02	0.02	0	-4.12	-1.45	2.67	0.16	0.13	-0.02	-1	-0.65	0.35
21	0.4	0.32	-0.08	-0.72	-1.63	-0.92	0.2	0.32	0.12	-2.86	-0.9	1.97	0.28	0.36	0.08	-0.72	-0.43	0.3
22	0.37	0.11	-0.26	-1.51	-4.35	-2.84	0.04	0.07	0.02	-6.79	-2.5	4.29	0.12	0.15	0.03	-1.77	-1.15	0.62
23	0.53	0.35	-0.18	-0.68	-1.88	-1.2	0.05	0.03	-0.02	-4.01	-1.52	2.49	0.05	0.06	0.01	-1.14	-0.76	0.38
24	**1.46**	0.25	-1.21	**0.7**	-1.37	-2.06	0.18	0.17	-0.01	-3.72	-0.83	2.89	0.08	0.23	0.15	-1.18	-0.39	0.79
25	**2.41**	0.87	-1.54	**1.65**	-0.34	-2	0.48	0.37	-0.12	-1.8	-0.93	0.87	0.49	0.46	-0.03	-0.5	-0.4	0.1
26	0.18	0.07	-0.11	-1.24	-7.46	-6.23	0.02	0.02	0.01	-4.43	-4.31	0.12	0.03	0.07	0.04	-1.24	-2.09	-0.85
27	0.66	0.13	-0.53	-6.11	-131	-125	0.1	0.14	0.04	-48	-70.9	-22.9	0.36	0.47	0.11	-9.62	-22.1	-12.4
28	**2.11**	**1.27**	-0.85	**2.62**	**1.75**	-0.87	0.55	0.89	0.34	-3.15	-0.4	2.74	0.32	0.83	0.51	-1.34	-0.3	1.03
29	0.85	0.91	0.06	-1.27	-1.79	-0.52	**1.06**	**1.16**	0.1	**1.52**	**1.74**	0.22	0.88	**1.82**	0.93	-0.82	**4.52**	5.34
30	0.33	0.08	-0.25	-2.82	-19.7	-16.9	0.16	0.16	0	-10.6	-9.93	0.63	0.06	0.06	0	-3.32	-5.62	-2.3
31	0.29	0.69	0.4	-0.73	-1.21	-0.48	0.09	0.07	-0.02	-2.8	-2.01	0.8	0.65	0.42	-0.23	-0.3	-0.63	-0.32
32	0.74	0.63	-0.11	-0.57	-1.38	-0.81	0.68	**1.23**	0.55	-2.08	**0.47**	2.55	0.51	0.66	0.15	-0.9	-0.35	0.56
33	0.34	0.26	-0.08	-1.14	-3.5	-2.36	0.23	0.32	0.09	-3.96	-1.75	2.22	0.07	0.14	0.07	-1.35	-1.12	0.23
34	0.46	0.44	-0.02	-0.57	-1.41	-0.84	0.46	0.72	0.26	-1.69	-0.39	1.31	0.29	0.33	0.04	-0.63	-0.47	0.16
35	0.24	0.84	0.6	-0.42	-0.2	0.23	0.53	0.79	0.26	-0.78	-0.14	0.64	0.35	0.56	0.21	-0.31	-0.15	0.16
36	**4.77**	**2**	-2.77	**0.34**	**0.18**	-0.16	0.11	0.17	0.06	-0.24	-0.08	0.16	0.68	0.23	-0.45	-0.02	-0.04	-0.02
37	0.14	0.56	0.42	-1.09	-0.46	0.63	**2.46**	**5**	2.53	**5.55**	**2.3**	-3.25	0.3	0.54	0.23	-0.74	-0.14	0.61
38	0.42	0.63	0.21	-1.91	-3.11	-1.2	0.78	**1.58**	0.8	-2.18	**2.65**	4.83	0.27	0.49	0.22	-2.02	-1.2	0.82
39	0.73	0.7	-0.03	-2.92	-7.83	-4.91	0.68	**1.03**	0.36	-10.4	**0.46**	10.91	**1.27**	**1.7**	0.43	**2.43**	**5.12**	2.69
40	0.44	0.85	0.41	-2.1	-1.3	0.8	**1.22**	**1.57**	0.35	**2.46**	**2.63**	0.17	**1.18**	**1.48**	0.29	**0.58**	**1.12**	0.54
41	0.66	0.16	-0.5	-0.45	-1.33	-0.88	0.16	0.19	0.03	-3.35	-0.7	2.64	**3.08**	**1.07**	-2.01	**2.33**	**0.03**	-2.3
42	**9.49**	**3.82**	-5.67	**9.78**	**7.72**	-2.05	0.04	0.02	-0.01	-3.31	-1.46	1.85	**2.36**	0.12	-2.24	**1.32**	-0.67	-1.98
43	**2.98**	**1.43**	-1.55	**0.51**	**0.17**	-0.34	0.01	0	-0.01	-0.76	-0.21	0.54	0.52	0.07	-0.45	-0.1	-0.1	0
44	0.72	0.9	0.18	-1.23	-0.64	0.59	0.02	0.02	0	-12.8	-3.45	9.31	0.08	0.02	-0.06	-3.38	-1.75	1.63
45	0.1	0.11	0.01	-0.07	-0.09	-0.02	0.01	0.02	0.01	-0.24	-0.05	0.18	0.01	0.05	0.04	-0.07	-0.03	0.04
46	**21.91**	**8.48**	-13.4	**1.57**	**1.16**	-0.41	0.02	0.01	-0.01	-0.22	-0.08	0.14	0.4	0.03	-0.38	-0.04	-0.04	0
47	0.03	0.03	-0.01	-1.92	-2.18	-0.26	0.03	0.43	0.4	-5.76	-0.7	5.06	0.02	0.08	0.06	-1.64	-0.57	1.06
48	0.29	0.5	0.2	-5	-4.86	0.14	0.26	0.37	0.11	-15.5	-3.33	12.14	0.46	0.51	0.05	-3.19	-1.31	1.87
49	0.2	0.6	0.4	-1.37	-1.06	0.31	0.21	0.39	0.18	-4.03	-0.88	3.15	0.18	0.29	0.12	-1.19	-0.52	0.67

(Appendix Table 1 Continued)

HS	China						Japan						South Korea					
	BI			NI			BI			NI			BI			NI		
	1995	2008	Var.	1995	2008	Var.	1995	2008	Var.	1995	2008	Var.	1995	2008	Var.	1995	2008	Var.
50	**12.76**	**4.67**	-8.08	**2.41**	**0.7**	-1.71	0.31	0.66	0.35	-0.42	-0.04	0.39	**3.92**	0.96	-2.96	**0.5**	0	-0.51
51	**1.65**	**1.7**	0.05	**0.68**	**0.54**	-0.15	0.25	0.49	0.24	-2.32	-0.21	2.11	0.41	0.27	-0.14	-0.52	-0.15	0.37
52	**3.99**	**2.28**	-1.71	**6.43**	**3.72**	-2.7	0.3	0.34	0.04	-4.49	-1.06	3.43	0.88	0.49	-0.39	-0.21	-0.41	-0.2
53	**5.4**	**2.07**	-3.32	**0.8**	**0.19**	-0.61	0.1	0.17	0.07	-0.48	-0.08	0.4	0.74	0.24	-0.5	-0.04	-0.04	0
54	0.73	**2.4**	1.67	-0.53	**3.17**	3.7	**1.07**	**1.14**	0.07	**0.41**	**0.18**	-0.23	**8.36**	**2.36**	-6	**12.09**	**0.86**	-11.2
55	**3.23**	**2.46**	-0.76	**4.08**	**2.54**	-1.54	0.79	**1.06**	0.26	-1.12	**0.05**	1.17	**3.27**	**1.78**	-1.49	**3.5**	**0.38**	-3.13
56	0.71	**1.13**	0.41	-0.18	**0.13**	0.32	0.9	**1.03**	0.14	-0.2	**0.02**	0.22	**1.83**	0.98	-0.86	**0.45**	-0.01	-0.46
57	**2.04**	**1.3**	-0.75	**0.63**	**0.23**	-0.4	0.02	0.07	0.05	-1.75	-0.39	1.36	0.11	0.17	0.07	-0.45	-0.18	0.27
58	**2.95**	**4.33**	1.37	**0.8**	**2.56**	1.76	0.64	0.4	-0.24	-0.44	-0.25	0.19	**3.7**	**1.1**	-2.6	**0.93**	**0.02**	-0.91
59	**1.01**	**2.1**	1.1	**0.01**	**1.26**	1.25	0.56	0.89	0.33	-0.86	-0.07	0.79	**4.06**	**2.03**	-2.03	**1.7**	**0.33**	-1.37
60	**3.4**	**3.01**	-0.4	**1.43**	**2.64**	1.21	0.57	0.6	0.03	-0.75	-0.29	0.47	**5.48**	**3**	-2.48	**2.24**	**0.73**	-1.51
61	**4.11**	**3.82**	-0.29	**11.7**	**27.78**	16.08	0.02	0.02	0	-10.9	-5.27	5.65	**1.63**	0.22	-1.41	**1.99**	-2.13	-4.13
62	**5.52**	**3.29**	-2.23	**26.18**	**22.66**	-3.52	0.04	0.03	-0.01	-16.5	-5.28	11.26	0.98	0.08	-0.9	-0.1	-2.54	-2.44
63	**6.1**	**4.27**	-1.83	**4.77**	**7.95**	3.17	0.09	0.1	0.01	-2.52	-1.19	1.33	**1.21**	0.34	-0.87	**0.16**	-0.45	-0.61
64	**5.58**	**3.64**	-1.94	**12.19**	**13.36**	1.18	0.03	0.02	-0.01	-7.7	-2.72	4.99	**1.5**	0.09	-1.41	**1.12**	-1.27	-2.39
65	**6.32**	**4.49**	-1.84	**0.69**	**1.13**	0.45	0.45	0.55	0.1	-0.21	-0.08	0.13	**2.95**	0.92	-2.03	**0.21**	-0.01	-0.22
66	**16.91**	**7.51**	-9.4	**1.03**	**0.87**	-0.15	0.05	0.01	-0.04	-0.18	-0.07	0.11	0.08	0.05	-0.03	-0.05	-0.04	0.01
67	**16.41**	**6.41**	-10	**1.34**	**1.15**	-0.19	0.01	0.02	0.01	-0.26	-0.11	0.14	**2.37**	0.61	-1.75	**0.1**	-0.02	-0.12
68	**1.43**	**1.44**	0.01	**0.48**	**1.04**	0.56	0.59	0.95	0.35	-1.35	-0.07	1.28	0.6	0.49	-0.11	-0.37	-0.33	0.04
69	**1.94**	**2.26**	0.33	**1.34**	**2.78**	1.45	0.8	0.73	-0.07	-0.87	-0.33	0.54	0.15	0.12	-0.02	-1.03	-0.54	0.49
70	0.83	**1.55**	0.71	-0.31	**1.96**	2.27	0.94	**1.49**	0.55	-0.33	**0.95**	1.29	0.29	0.66	0.37	-1.12	-0.34	0.78
71	0.67	0.27	-0.4	-1.95	-14.3	-12.3	0.15	0.57	0.43	-14.9	-4.57	10.28	1.29	0.3	-0.99	**1.42**	-3.78	-5.2
72	**1.2**	**1.17**	-0.03	**1.76**	**4.87**	3.11	**1.24**	**1.57**	0.33	**6.16**	**8.84**	2.68	**1.43**	**1.5**	0.07	**3.15**	**3.92**	0.78
73	**1.11**	**1.8**	0.69	**0.62**	**13.32**	12.71	0.88	0.93	0.06	-2.08	-0.61	1.47	**1.57**	**1.13**	-0.43	**2.67**	**0.62**	-2.05
74	0.46	0.43	-0.03	-1.44	-4.67	-3.24	0.69	**1.14**	0.45	-2.46	**0.61**	3.07	0.54	**1.11**	0.57	-1.02	**0.25**	1.27
75	0.16	0.11	-0.05	-0.36	-1.49	-1.13	0.35	0.48	0.13	-0.82	-0.47	0.35	0.19	0.32	0.13	-0.29	-0.31	-0.02
76	0.41	0.98	0.57	-2.25	-0.17	2.08	0.28	0.36	0.07	-8.12	-3.17	4.95	0.54	0.58	0.03	-1.47	-1.06	0.41
78	**2.94**	0.48	-2.46	**0.22**	-0.19	-0.4	0.07	0.3	0.23	-0.31	-0.14	0.17	0.38	0.96	0.57	-0.06	0	0.05
79	**1.62**	0.34	-1.28	**0.18**	-0.46	-0.64	0.15	0.44	0.28	-0.74	-0.21	0.53	0.53	**2.68**	2.14	-0.12	**0.32**	0.44
80	**4.76**	0.39	-4.37	**0.43**	-0.23	-0.65	0.11	0.33	0.23	-0.3	-0.14	0.17	0.25	0.42	0.16	-0.07	-0.06	0.01
81	**3.75**	**2.54**	-1.2	**0.8**	**1.75**	0.95	0.88	**1.66**	0.78	-0.11	**0.41**	0.51	0.17	0.6	0.43	-0.21	-0.13	0.08
82	**1.91**	**1.59**	-0.31	**1.3**	**1.75**	0.45	**1.29**	**1.32**	0.03	**1.23**	**0.52**	-0.71	0.97	0.92	-0.05	-0.04	-0.07	-0.03
83	**1.63**	**1.81**	0.18	**0.77**	**2.42**	1.65	0.54	0.46	-0.08	-1.66	-0.88	0.79	0.52	0.72	0.2	-0.49	-0.24	0.26
84	0.39	**1.61**	1.22	-30.2	**66.25**	96.45	**1.6**	**1.58**	-0.02	**89.12**	**34.75**	-54.4	0.66	0.95	0.29	-14.2	-1.61	12.56
85	0.98	**1.89**	0.91	-0.73	**96.37**	97.1	**1.89**	**1.45**	-0.44	**113.9**	**26.68**	-87.2	**2.35**	**2.69**	0.34	**48.73**	**50.58**	1.85
86	**3.9**	**3.15**	-0.75	**2.09**	**4.37**	2.28	0.38	0.56	0.19	-1.33	-0.49	0.85	**3.46**	0.46	-3	**1.49**	-0.31	-1.8
87	0.12	0.36	0.25	-28.2	-42.5	-14.3	**1.85**	**2.92**	1.07	**80.59**	**70.35**	-10.2	0.78	**1.23**	0.45	-6.02	**4.2**	10.22
88	0.06	0.09	0.03	-4.69	-9.95	-5.26	0.09	0.27	0.18	-13.6	-4.35	9.21	0.15	0.08	-0.07	-3.57	-2.8	0.77
89	0.76	**1.98**	1.22	-0.62	**6.01**	6.63	**3.18**	**3.67**	0.49	**16.7**	**8.95**	-7.75	**5.7**	**3.34**	-2.36	**10.17**	**3.99**	-6.18
90	0.57	**1.09**	0.52	-4.08	**2.28**	6.35	**2.05**	**1.58**	-0.47	**29.6**	**7.83**	-21.8	0.41	**2.35**	1.93	-4.67	**9.21**	13.87
91	**3.54**	0.86	-2.68	**3.35**	-0.28	-3.63	**1.27**	0.55	-0.71	**1.06**	-0.48	-1.54	0.53	0.11	-0.42	-0.52	-0.49	0.03
92	**1.67**	**2.74**	1.07	**0.16**	**0.6**	0.44	**3.17**	**2.65**	-0.51	**1.55**	**0.31**	-1.24	**4.01**	**1.13**	-2.88	**0.61**	**0.01**	-0.6
93	0.16	0.1	-0.06	-0.3	-0.42	-0.12	0.19	0.24	0.06	-0.87	-0.19	0.68	0.33	0.35	0.02	-0.2	-0.08	0.12
94	**1.67**	**2.75**	1.08	**2.62**	**16.91**	14.3	0.12	0.17	0.05	-10.3	-4.37	5.9	0.2	0.16	-0.04	-2.62	-2.24	0.38
95	**6.43**	**3.74**	-2.68	**10.19**	**14.88**	4.69	0.81	0.75	-0.06	-1.05	-0.74	0.32	**1.09**	0.18	-0.91	**0.14**	-1.24	-1.38
96	**2.97**	**3.26**	0.29	**1.68**	**3.21**	1.53	**1.64**	**1.41**	-0.23	**1.62**	**0.32**	-1.3	**2.02**	0.64	-1.38	**0.73**	-0.14	-0.87
97	0.23	0.04	-0.19	-0.32	-1.11	-0.79	0.05	0.17	0.11	-1.18	-0.53	0.65	0.17	0.2	0.04	-0.29	-0.26	0.04
98	0		0	-1.36	0	1.36	0		0	-4.06	0	4.06	0			-1.15	0	1.15
99	0.09	0.03	-0.06	-7.86	-39.3	-31.4	0.79	**1.04**	0.25	-5.46	**0.85**	6.31	0	0.25	0.25	-7.25	-8.34	-1.1
p.s.	16.83 (32)			288.34 (36)			15.08 (71)			212.50 (86)			11.86 (40)			70.65 (59)		
n.s.	-106.10 (65)			-287.98 (62)			-3.17 (26)			-212.50 (12)			-50.57(54)			-70.65 (36)		
Sum	-89.27			0			11.91			0			-38.69			0		

Notes: (i) The positive variations are tinted; the sectors that show RCA are underlined; (ii) p.s. stands for positive sum, and n.s. for negative sum.

APPENDIX TABLE 2

THE 99 HS-2 SECTORS (ABBREVIATED)

No	Description	No	Description	No	Description
1	Live animals	34	Waxes polishing or scouring	67	Feathers and down
2	Meat and edible meat	35	Glues, enzymes	68	Articles of stone, cement
3	Fish and other aquatic	36	Explosives, pyrotechnic	69	Ceramic products
4	Bird's eggs, natural honey	37	Photographic or cinematographic	70	Glass and glassware
5	Products of animal origin	38	Misc. chemical products	71	Precious stones, metals
6	Live trees and others plants	39	Plastics and articles	72	Iron and steel
7	Edible vegetables	40	Rubbers and articles	73	Articles of iron and steel
8	Edible fruit and nuts	41	Raw hides and skins, leather	74	Copper and articles
9	Coffee, tea, mate and spices	42	Articles of leather, handbags	75	Nickel and articles
10	Cereals	43	Furskins and artificial furs	76	Aluminium and articles
11	Products of milling industry	44	Wood and articles	77	Reserved for future use
12	Oil seed and oleaginous	45	Cork and articles	78	Lead and articles
13	Lac, gums, resins	46	Manufactures of straw	79	Zinc and articles
14	Vegetable plaiting materials	47	Pulp of wood	80	Tin and articles
15	Animal or vegetable fats	48	Paper and paperboard	81	Other base metals
16	Preparations of meat, fish	49	Printed books, newspapers	82	Tools, cutlery
17	Sugars	50	Silk	83	Misc. articles of metal
18	Cocoa	51	Wool, fine or animal hairs	84	Machinery - mechanical

(Appendix Table 2 Continued)

No	Description	No	Description	No	Description
19	Preparations of cereal, flour	52	Cotton	85	Electrical machinery
20	Prep. of vegetables, fruit	53	Textile fibres, paper yarn	86	Railway locomotives
21	Misc. edible preparations	54	Man-made filaments	87	Vehicles other than railway
22	Beverages, spirits	55	Man-made stable fibres	88	Aircraft, spacecraft
23	Residuals, wastes from food	56	Wadding, felt	89	Ships, boats
24	Tobacco	57	Carpets	90	Optical etc instruments, apparatus
25	Salt, sulphur etc	58	Tufted textile fabrics	91	Clocks and watches
26	Ores, slag and ash	59	Impregnated textile fabrics	92	Musical instruments
27	Mineral fuels, oils	60	Knitted textile fabrics	93	Arms, ammunition
28	Inorganic chemicals	61	Articles of apparel, clothing	94	Furniture, bedding
29	Organic chemicals	62	Articles. of apparel, not knitted	95	Toys, games
30	Pharmaceutical products	63	Other textile articles	96	Misc. manufactured articles
31	Fertilizers	64	Footwear, gaiters	97	Works of art, antiques
32	Tanning or dyeing extracts	65	Headgear and parts	98	Commodities specified at chapter
33	Essential oils, soaps	66	Umbrellas	99	Commodities n.e.s.

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