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# COMPARATIVE ADVANTAGE IN JAPAN, KOREA, AND TAIWAN BETWEEN 1980 AND 1999: TESTING FOR CONVERGENCE AND IMPLICATIONS FOR CLOSER ECONOMIC RELATIONS

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This paper seeks to explore the basis for a free trade agreement (FTA) between Japan and the Republic of Korea by comparing export patterns of these two countries with that of a nonmember—Taiwan—that is geographically close and is also a major exporter of machinery. After calculating indices of revealed comparative advantage (RCA) for 3-digit SITC categories, we test for convergence of export patterns between each pairing of partners (Japan-Korea, Korea-Taiwan, and Japan-Taiwan). We find that even though each partner has a statistically significant correlation of RCA indices, export patterns of Korea and Taiwan are converging with that of Japan, while in the case of Taiwan and Korea there is no significant convergence between their export patterns. Finally, we identify sectors where trade diversion is likely to occur and provide an upper-bound estimate of the potential amount of trade that might be diverted from Taiwan by a Japan-Korea FTA.

## I. INTRODUCTION

THE purpose of this study is to provide empirical analyses of emerging patterns of international trade of three major East Asian economies in order to assess the implications of the possible free trade agreement between Japan and the Republic of Korea.[1] Japan and Korea began to explore the possibility of establishing closer economic relations following the summit between President Kim Dae-jung and Prime Minister Keizō Obuchi in October 1998. President Kim expressed his

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[1] This paper is one of a series of empirical studies of ICSEAD of the trade relationship of Japan, Korea, and Taiwan. See also James and Movshuk (2000) and James (2001).

wish to put past difficulties between the two countries behind in order to build a basis for a new relationship in the twenty-first century. This decision led to the establishment of the 21st Century Japan-Korea Economic Relations Study Team (IDE-JETRO 2000) and the beginning of serious discussions between intellectual, business, and official circles in the two countries of the framework for a Japan-Korea free trade agreement (FTA).

The decision to initiate negotiations between Japan and Korea follows similar moves between Korea and Chile, Korea and New Zealand, Japan and Singapore, and Japan and Mexico.[2] The reasons for the break with the past practice of "pure multilateralism" by both Japan and Korea are explored elsewhere. Here, our purpose is to establish empirically the basis for a closer economic relationship in the dimension of international trade, focusing primarily on merchandise trade. We wish to develop an understanding of the current status of "revealed comparative advantage" indices (RCAs) among industries in Korea and Japan, in order to understand whether the two countries have complementary or competitive export structures. We also attempt to examine the potential for trade diversion with third parties, particularly with reference to Taiwan.

Inclusion of Taiwan is dictated by the importance of Taiwan, first in its own right, as a major trading power on a global and regional basis and second because of the similarity of its pattern of trade with that of Korea. Taiwan is also becoming established as a major supplier of information technology (IT) hardware, including personal computers, mobile telephones, semiconductors, and fiber-optic cable. The inclusion of Taiwan helps us draw attention to the ultimate importance of the mechanisms by which an FTA implements tariff discrimination and national treatment provisions with regard to members and nonmembers.

Our study of patterns of comparative advantage in Japan, Korea, and Taiwan is most closely related to that of Lee (1986), who also analyzed indices of revealed comparative advantage (RCAs) in Japan, Korea, and Taiwan. However, Lee's study, which covers 1964–77, has become dated. In contrast, we analyze the dynamics of comparative advantage over the more recent period of 1980–99. Second, we not only report Spearman rank correlation coefficients between national RCA indices, but also test the statistical significance of these correlation coefficients. Third, our study also applied statistical tests for the presence of trend in the convergence/divergence of national export patterns. Finally, while Lee's paper dealt only with exports to OECD countries, our analysis is based on exports to destinations throughout the world. Lee reports that export specialization patterns between Korea and Taiwan are similar but between Korea and Japan and Taiwan and Japan are quite dissimilar.

[2] In point of fact, as of October 2001 as many as twenty new FTAs involving Asian and Pacific countries have been proposed, with several already in the negotiating stage.

We have obtained somewhat different results. In particular, we find that export specialization patterns of Korea-Japan and Taiwan-Japan are similar and are converging.

The plan of the paper is as follows. In Section II, we discuss our data and methodology in selecting a theoretically sound measure of RCA. Section III reports our major findings about the convergence of comparative advantages in Japan, Korea, and Taiwan. In Section IV, we discuss implications of our findings for closer economic cooperation among Japan, Korea, and Taiwan, identifying sectors with the highest potential for trade divergence from Taiwan by a Japan-Korean free trade agreement. Section V concludes.

## II. DATA AND METHODOLOGY

We have used the *World Trade Analyzer* database of Statistics Canada (2001) to calculate RCA indices for Japan, Korea, and Taiwan at the 3-digit SITC level of aggregation over two separate subperiods (1980–89 and 1990–99). Though a large number of alternative RCA indices have been proposed in the literature, many of these indices are not consistent, producing very different rankings of RCA with the same sample of data (Ballance, Forstner, and Murray 1987). Therefore, it is important to use RCA indices that have a sound theoretical background. Vollrath (1991) investigated the theoretical underpinning of ten RCA indices, and recommended the following ones:

$$RCA1_i^c = (X_i^c / X_t^c) / (X_i^w / X_t^w), \tag{1}$$

$$RCA2_i^c = (X_i^c / X_t^c) / \{(X_i^w - X_i^c) / (X_t^w - X_t^c)\}, \tag{2}$$

where $X$ denotes exports, and subscripts $i$ and $t$ refer to a specific $i$th commodity and the sum of all commodities (that is, $X_t = \sum_i X_i$). Superscripts $c$ and $w$ denote a particular country $c$ and the world.

The only difference between these indices is that *RCA2* avoids double counting, excluding $X_i^c$ and $X_t^c$ from the corresponding totals in the denominator of *RCA1*. For this reason we will report results for *RCA2*. It is important to remember that the index is still not perfect, since it can be biased by voluntary export restraints (as in the case of U.S.-Japan agreement on car exports to the United States, or the Multi-Fibre Arrangement on textiles and clothing). Similarly, RCA indices can be distorted by various export incentives, such as European agricultural export subsidies. Unfortunately, in practice it is very difficult to evaluate the extent to which trade distortions can bias RCA indices.

Our approach is to test the statistical significance of correlations between national RCAs as an alternative indicator of the extent to which export structures are similar among these three economies. The sample was subdivided into the two sub-

periods so that median values of RCAs in each period could be calculated.[3] We then differentiated product categories with high RCA values. A ranking of RCA indices (Tables I to III) for the top 10 per cent of RCA indices provides information on the structure of exports in each economy during the two periods. Our principal interest is in evaluating the extent to which export comparative advantage is similar among these three economies, and in assessing the dynamic changes in export patterns. In particular, we attempt to measure whether export structures are becoming more similar over time among the three economies.

In order to achieve the above objectives we first calculated Spearman rank correlation coefficients for 217 3-digit SITC categories between Korea-Japan, Japan-Taiwan, and Korea-Taiwan (reported in Tables IV, V, and VI, respectively). We then evaluated the tendency of export structures to converge using a Daniels test for trend, discussed by Conover (1999, pp. 323–24).

The Daniels test is a counterpart to the more conventional parametric testing for trend by OLS regression. In OLS, a time series $y_t$ is regressed on the linear trend $T$ and the intercept, and the presence of trend is verified by a significant $t$-statistic for the trend variable $T$. However, the validity of this parametric approach depends on several assumptions of the OLS regression that may not hold in practice (such as the normality assumption for the disturbance term). In addition, the parametric test may have low power if the time trend in $y_t$ is nonlinear.

On the other hand, the Daniels test replaces the original $y_t$ with corresponding ranks $R(y_t)$, and calculates Pearson's correlation coefficient between $R(y_t)$ and a time trend.[4] The use of ranks makes the test robust against outlying observations, as long as outliers do not substantially affect the ordering of observations. Besides, there is no need to assume normality in the analyzed data. Finally, the test does not assume any particular trend pattern (such as a linear trend). When $y_t$ is normally distributed, the asymptotic relative efficiency of the Daniels test is only slightly less (98 per cent) than the power of the parametric test with an OLS regression (Conover 1999, p. 323). On the other hand, if the distribution of $y_t$ is not normal, the Daniels test may become much more powerful than its parametric counterpart.

In practice, we calculated exact $p$-values for the Spearman rank correlation coefficient in the Daniels test by the algorithm of Best and Roberts (1975), adapted for TSP software package (version 4.5).

[3] We used median values, since they are more robust indicators of general tendencies compared with mean values (especially when outlying observations are present).

[4] In other words, the Daniels test is the Spearman rank correlation between $y_t$ and $T$.

## III. RESULTS

### A. *The Structure of Comparative Advantage: Japan, Korea, and Taiwan*

The median RCA values for the top 10 per cent of 3-digit product categories in each of the two subperiods (Tables I, II, and III, respectively) provide some information on the changing structure of comparative advantage in Japan, Korea, and Taiwan. In the first subperiod, SITC 776 (which includes semiconductors) is among the top-ranked RCA values only in the case of Japan. Similarly, SITC 764 (telecommunications) is also ranked among the top ten export categories only in Japan. Household electronic products (SITC 762 and 761), photographic equipment (SITC 881), optical instruments (SITC 871), and various types of machinery and transport equipment figure prominently in Japan's leading export categories ranked by RCA values in 1980–89. In Korea, although machinery and transport equipment are important, seven of the top ten items are labor-intensive manufactures (including textiles, apparel, and footwear). Similarly, in Taiwan in the first subperiod labor-intensive manufactured products are predominant in comparative advantage. The only resource-based items in the top rankings are fish (SITC 034) in Taiwan and Korea and wood products (SITC 635) and leather manufactures (SITC 612) in Taiwan.

In the second subperiod, Japan has an RCA structure heavily weighted toward information and communication technology products, transport equipment, and various types of machinery. Components for office machinery (SITC 759) and telecommunications equipment (SITC 764) RCAs rank among the top categories in Japan in this period. Computers (SITC 752) and office machines (SITC 751) fell just below the cutoff for the top 10 per cent of RCA-ranked products in Japan, with RCA indices of 1.53 and 1.64, respectively. On the other hand, consumer electronics products become much less important compared with the first subperiod in Japan.

In Korea, semiconductors (SITC 776) become important in the second subperiod. However, a large number of labor-intensive items remain important in the latter period, along with some metal products, consumer electronic items, and ships. Korea lags in specialization in computer hardware, although in the second subperiod this sector finally attains an RCA of 1.25. In contrast, telecommunications equipment's RCA reaches a high value of 1.86 in the second subperiod.

In Taiwan in the second subperiod IT products, such as computers (SITC 752) and office machines (SITC 751), achieve high ranks (along with motorcycles). Semiconductors' (SITC 776) RCA is 2.14 in the second subperiod. Yet, despite the growing importance of IT products, a large number of items that are labor-intensive or that use standard technology nevertheless remain important. Thus, an important distinction between Korea and Taiwan on one hand and Japan on the other can be

TABLE I

RANKED RCA INDICES FOR JAPANESE EXPORTS TO THE WORLD (TOP 10 PER CENT)

| SITC Code and Product Category | 1980–89 | SITC Code and Product Category | 1990–99 |
|---|---|---|---|
| 881 Photographic apparatus and equipment | 4.96 | 759 Parts of and accessories for office machines | 4.26 |
| 762 Radio broadcast receivers | 4.80 | 881 Photographic apparatus and equipment | 3.91 |
| 761 Television receivers | 4.28 | 793 Ships, boats | 3.34 |
| 764 Telecommunications equipment and parts | 4.26 | 871 Optical instruments and apparatus | 2.86 |
| 782 Motor vehicles for transport | 3.84 | 782 Motor vehicles for transport | 2.56 |
| 785 Motorcycles, motor scooters, etc. | 3.53 | 781 Passenger motor cars | 2.50 |
| 898 Musical instruments | 3.45 | 712 Steam engines | 2.48 |
| 781 Passenger motor cars | 3.25 | 736 Machine tools for working metal | 2.44 |
| 793 Ships, boats | 3.07 | 783 Road motor vehicles | 2.39 |
| 871 Optical instruments and apparatus | 3.00 | 776 Thermionic, cold & photo-cathode valves | 2.33 |
| 678 Tubes, pipes of iron or steel | 2.98 | 713 Internal combustion engines | 2.28 |
| 884 Optical goods | 2.97 | 884 Optical goods | 2.27 |
| 783 Road motor vehicles | 2.85 | 743 Pumps & compressors | 2.23 |
| 759 Parts of and accessories for office machines | 2.83 | 778 Electrical machinery and apparatus | 2.16 |
| 674 Plates and sheets of iron or steel | 2.77 | 724 Textile & leather machinery | 2.11 |
| 885 Watches and clocks | 2.77 | 785 Motorcycles, motor scooters, etc. | 2.09 |
| 711 Vapor generating boilers | 2.61 | 882 Photographic & cinematographic supplies | 2.07 |
| 666 Pottery | 2.59 | 895 Office and stationery supplies | 2.04 |
| 653 Woven fabrics | 2.44 | 764 Telecommunications equipment | 2.03 |
| 776 Thermionic, cold & photo-cathode valves | 2.39 | 711 Vapor generating boilers | 2.00 |
| 696 Cutlery | 2.33 | 674 Plates and sheets of iron or steel | 1.82 |
| 625 Rubber tires | 2.20 | 772 Electrical appliances (switches, relays, etc.) | 1.81 |

Note: RCA indices were calculated by equation (2), using export values from *World Trade Analyzer* database of Statistics Canada (2001) on CD-ROM.

TABLE II

RANKED RCA INDICES FOR TOTAL KOREAN EXPORTS (TOP 10 PER CENT)

| SITC Code and Product Category | 1980–89 | SITC Code and Product Category | 1990–99 |
|---|---|---|---|
| 848 Articles of apparel and clothing accessories | 11.91 | 883 Cinematograph film | 8.59 |
| 844 Textile under garments | 8.98 | 653 Woven fabrics | 7.19 |
| 831 Travel goods, handbags, etc. | 8.41 | 793 Ships, boats | 6.96 |
| 653 Woven fabrics | 7.14 | 655 Knitted or crocheted fabrics | 4.53 |
| 851 Footwear | 7.04 | 266 Synthetic fibers for spinning | 4.14 |
| 786 Trailers | 6.84 | 786 Trailers | 3.98 |
| 761 Television receivers | 6.81 | 776 Thermionic, cold & photo-cathode valves | 3.83 |
| 843 Outer garments | 6.33 | 761 Television receivers | 3.73 |
| 793 Ships, boats | 6.02 | 611 Leather | 3.70 |
| 846 Knitted under garments | 5.71 | 847 Clothing accessories | 3.48 |
| 693 Wire products | 5.39 | 657 Special textile fabrics | 3.39 |
| 696 Cutlery | 5.35 | 656 Embroidery, ribbons, etc. | 3.28 |
| 762 Radio broadcast receivers | 5.34 | 696 Cutlery | 2.86 |
| 847 Clothing accessories | 5.21 | 674 Plates and sheets of iron or steel | 2.70 |
| 845 Knitted outer garments | 5.15 | 625 Rubber tires | 2.61 |
| 656 Embroidery, ribbons, etc. | 4.82 | 693 Wire products | 2.51 |
| 842 Men's outer garments | 4.76 | 677 Iron and steel wire | 2.48 |
| 034 Fish | 4.53 | 783 Road motor vehicles | 2.46 |
| 894 Baby carriages, toys | 3.97 | 697 Household equipment of base metal | 2.41 |
| 697 Household equipment of base metal | 3.79 | 511 Hydrocarbons | 2.38 |
| 691 Iron and steel structures | 3.54 | 848 Clothing accessories | 2.30 |
| 625 Rubber tires | 3.39 | 612 Manufactures of leather | 2.12 |

Source: See Table I.

TABLE III

RANKED RCA INDICES FOR TOTAL TAIWANESE EXPORTS (TOP 10 PER CENT)

| SITC Code and Product Category | 1980–89 | SITC Code and Product Category | 1990–99 |
|---|---|---|---|
| 831 Travel goods, handbags, etc. | 14.79 | 785 Motorcycles, motor scooters | 9.52 |
| 785 Motorcycles, motor scooters | 11.58 | 655 Knitted or crocheted fabrics | 7.41 |
| 894 Baby carriages, toys | 11.13 | 694 Nails, screws, etc. | 5.88 |
| 851 Footwear | 9.62 | 657 Special textile fabrics | 4.56 |
| 635 Wood manufactures | 8.78 | 656 Embroidery, ribbons, etc. | 4.33 |
| 899 Other miscellaneous manufactured articles | 7.59 | 653 Woven fabrics | 3.77 |
| 845 Knitted outer garments | 7.51 | 266 Synthetic fibers for spinning | 3.53 |
| 666 Pottery | 6.46 | 751 Office machines | 3.53 |
| 655 Knitted or crocheted fabrics | 6.40 | 752 Automatic data processing machines | 3.30 |
| 842 Men's outer garments | 6.02 | 894 Baby carriages, toys | 3.28 |
| 893 Sanitary or toilet articles, etc. | 5.11 | 612 Manufactures of leather | 2.88 |
| 697 Household equipment of base metal | 5.10 | 695 Hand tools | 2.78 |
| 612 Manufactures of leather | 5.09 | 651 Textile yarn | 2.77 |
| 056 Vegetables, roots, tubers | 4.53 | 771 Electric power machinery | 2.76 |
| 846 Knitted under garments | 4.40 | 899 Other miscellaneous manufactured articles | 2.53 |
| 694 Nails, screws, etc. | 3.99 | 291 Crude animal materials | 2.49 |
| 764 Telecommunications equipment | 3.89 | 034 Fish | 2.49 |
| 821 Furniture | 3.67 | 812 Sanitary, plumbing fixture | 2.45 |
| 034 Fish | 3.53 | 884 Optical goods | 2.44 |
| 657 Special textile fabrics | 3.51 | 697 Household equipment of base metal | 2.42 |
| 847 Clothing accessories of textile fabrics | 3.50 | 895 Office and stationery supplies | 2.41 |
| 848 Articles of apparel and clothing accessories | 3.46 | 611 Leather | 2.41 |

Source: See Table I.

drawn based on the lingering importance of labor-intensive manufactures in the export structure of the two former economies.[5]

B. *Statistical Tests of Export Similarity and Convergence*

We have calculated Spearman rank correlation coeffficients for each pair of economies (Tables IV, V, and VI) over the entire sample period (1980–99). Essentially, we find that all these correlations are statistically significant, with all *p*-values less than the 5 per cent threshold of statistical significance (in fact, most *p*-values were less than 1 per cent, indicating a high level of statistical significance).

We also found that inclusion of nonmanufacturing trade (i.e., SITC categories 0–4) is important in obtaining this result. If we exclude primary sectors and focus just on manufactures, there are a few insignificant correlation coefficients, particularly for Japan and Korea as a pair. Since we are concerned with a free trade agreement that corresponds to the requirements of GATT Article XXIV (covering substantially all trade), we decided the most comprehensive coverage of merchandise trade was justified.[6]

Our results indicate that pair-wise, the correlation between Korea and Japan has tended to be slightly higher than that between Japan and Taiwan (as shown by the diagonal figures given in bold type in Tables IV and V). Moreover, the correlations appear to be rising over the entire sample period for both pairs, as is indicated by the positive (0.868) and statistically significant result (*p*-value is essentially zero) for the test for presence of trend (see note in Table IV). Interestingly, pair-wise Korea and Taiwan have even greater correlation coefficients than the other two pairs (see Table VI, diagonal figures given in bold type), however, there is no statistically significant trend over time (*p*-value is insignificant at 0.627).

What can we conclude from the observed convergence of export specialization between Korea and Japan and Taiwan and Japan? First, it is important to recognize that in spite of the trend, the export specialization of Korea and Taiwan still reflects a more labor-intensive and less technologically advanced factor endowment than that of Japan. Thus, Korea, for example, in 1999 had an export specialization that was more highly correlated (and was statistically significant) with Japan in the early 1980s ($\rho = 0.661$ ) than in 1999 ($\rho = 0.542$). As shown in notes to Table IV, the time trend test statistic is also shown to be greater in the first row of Table IV than in the diagonal (0.949 and 0.868, correspondingly). A similar result obtains for Taiwan as well (Table V). In contrast, though the time trend statistic is positive (0.116) for Korea and Taiwan as one moves along the diagonal (see Table VI), its *p*-value

[5] In part, the existence of large export quotas under the Multi-Fibre Arrangement for textile and apparel items may help explain this pattern. See Baldwin, Chen, and Nelson (1995).

[6] Trade in services was not covered because reliable data on international service transactions that are comparable across countries are not readily available.

TABLE

SPEARMAN RANK CORRELATIONS BETWEEN JAPANESE

| | KR80 | KR81 | KR82 | KR83 | KR84 | KR85 | KR86 | KR87 | KR88 |
|---|---|---|---|---|---|---|---|---|---|
| JP80 | **0.427** | *0.476* | *0.480* | *0.485* | *0.541* | *0.542* | *0.559* | *0.577* | *0.597* |
| JP81 | 0.410 | **0.459** | 0.465 | 0.472 | 0.526 | 0.530 | 0.548 | 0.562 | 0.589 |
| JP82 | 0.411 | 0.466 | **0.473** | 0.481 | 0.532 | 0.538 | 0.553 | 0.572 | 0.597 |
| JP83 | 0.399 | 0.446 | 0.454 | **0.464** | 0.512 | 0.521 | 0.537 | 0.557 | 0.581 |
| JP84 | 0.389 | 0.431 | 0.442 | 0.453 | **0.492** | 0.507 | 0.526 | 0.542 | 0.571 |
| JP85 | 0.381 | 0.420 | 0.429 | 0.442 | 0.476 | **0.496** | 0.515 | 0.527 | 0.562 |
| JP86 | 0.352 | 0.389 | 0.404 | 0.417 | 0.449 | 0.468 | **0.489** | 0.499 | 0.530 |
| JP87 | 0.324 | 0.360 | 0.373 | 0.387 | 0.417 | 0.437 | 0.455 | **0.469** | 0.504 |
| JP88 | 0.300 | 0.341 | 0.354 | 0.372 | 0.402 | 0.414 | 0.427 | 0.442 | **0.480** |
| JP89 | 0.291 | 0.334 | 0.350 | 0.369 | 0.399 | 0.410 | 0.419 | 0.436 | 0.469 |
| JP90 | 0.269 | 0.314 | 0.330 | 0.346 | 0.379 | 0.394 | 0.402 | 0.416 | 0.449 |
| JP91 | 0.268 | 0.312 | 0.331 | 0.347 | 0.379 | 0.395 | 0.401 | 0.416 | 0.445 |
| JP92 | 0.270 | 0.309 | 0.331 | 0.347 | 0.377 | 0.393 | 0.402 | 0.415 | 0.443 |
| JP93 | 0.262 | 0.304 | 0.331 | 0.347 | 0.377 | 0.392 | 0.400 | 0.412 | 0.440 |
| JP94 | 0.253 | 0.291 | 0.320 | 0.337 | 0.363 | 0.380 | 0.385 | 0.395 | 0.422 |
| JP95 | 0.236 | 0.274 | 0.302 | 0.320 | 0.347 | 0.363 | 0.368 | 0.377 | 0.405 |
| JP96 | 0.229 | 0.265 | 0.293 | 0.308 | 0.330 | 0.349 | 0.354 | 0.360 | 0.388 |
| JP97 | 0.228 | 0.262 | 0.290 | 0.307 | 0.332 | 0.347 | 0.353 | 0.360 | 0.385 |
| JP98 | 0.218 | 0.248 | 0.278 | 0.292 | 0.326 | 0.336 | 0.340 | 0.346 | 0.373 |
| JP99 | 0.197 | 0.231 | 0.258 | 0.272 | 0.307 | 0.314 | 0.320 | 0.328 | 0.355 |

Source: See Table I.

Note: Test for time trend in the cross-country correlations in the mean diagonal: 0.868 ($p$-value < 0.001);

greatly exceeds 0.05, indicating that there is no significant convergence in trade patterns of Korea and Taiwan.

In sum, though we found a significant convergence among the contemporaneous RCA indices of Japan, Korea, and Taiwan, there is even closer similarity between Japanese trade pattern in the early 1980s and more recent trade patterns in Korea and Taiwan. In other words, the trade specialization of Korea and Taiwan has been following in the footsteps of Japan's trade pattern to such a degree that at present the RCA rankings of these three economies have already become very close to each other. On the other hand, in contrast to the convergence of trade patterns between Japan and Korea and Japan and Taiwan, we did not identify any significant convergence between Korean and Taiwanese patterns of trade.

The presence of a positive trend between the two pairs with Japan does imply that, over time, the three are becoming more competitive and less complementary with one another. This means that they will increasingly compete in third country markets with one another. Nevertheless, it is important to recognize that trade patterns between Korea and Japan and Taiwan and Japan are somewhat different from global patterns (James 2001). For example, while machinery (SITC 7) makes up over half of Korea's global exports in 1999, it comprises only around 30 per cent of its exports to Japan. Looking at this from the perspective of Japan, however, gives

IV

AND KOREAN RCA INDICES (1980–99)

| KR89 | KR90 | KR91 | KR92 | KR93 | KR94 | KR95 | KR96 | KR97 | KR98 | KR99 |
|---|---|---|---|---|---|---|---|---|---|---|
| *0.589* | *0.608* | *0.618* | *0.632* | *0.646* | *0.664* | *0.663* | *0.660* | *0.649* | *0.651* | *0.661* |
| 0.581 | 0.601 | 0.610 | 0.623 | 0.638 | 0.656 | 0.657 | 0.653 | 0.640 | 0.639 | 0.650 |
| 0.587 | 0.603 | 0.613 | 0.627 | 0.642 | 0.658 | 0.664 | 0.663 | 0.653 | 0.650 | 0.661 |
| 0.569 | 0.585 | 0.593 | 0.605 | 0.623 | 0.640 | 0.646 | 0.648 | 0.636 | 0.635 | 0.648 |
| 0.558 | 0.580 | 0.587 | 0.600 | 0.614 | 0.634 | 0.644 | 0.645 | 0.627 | 0.627 | 0.636 |
| 0.552 | 0.574 | 0.583 | 0.597 | 0.613 | 0.634 | 0.646 | 0.643 | 0.627 | 0.631 | 0.640 |
| 0.524 | 0.549 | 0.562 | 0.578 | 0.593 | 0.615 | 0.625 | 0.622 | 0.609 | 0.618 | 0.629 |
| 0.496 | 0.524 | 0.539 | 0.556 | 0.570 | 0.590 | 0.610 | 0.615 | 0.605 | 0.612 | 0.621 |
| 0.476 | 0.506 | 0.523 | 0.541 | 0.554 | 0.577 | 0.594 | 0.600 | 0.592 | 0.589 | 0.602 |
| **0.468** | 0.497 | 0.517 | 0.534 | 0.554 | 0.577 | 0.590 | 0.594 | 0.590 | 0.592 | 0.609 |
| 0.450 | **0.480** | 0.500 | 0.518 | 0.539 | 0.561 | 0.577 | 0.580 | 0.575 | 0.581 | 0.599 |
| 0.447 | 0.476 | **0.497** | 0.516 | 0.540 | 0.563 | 0.576 | 0.575 | 0.572 | 0.580 | 0.600 |
| 0.444 | 0.476 | 0.496 | **0.518** | 0.539 | 0.564 | 0.577 | 0.577 | 0.575 | 0.582 | 0.598 |
| 0.441 | 0.472 | 0.494 | 0.512 | **0.535** | 0.558 | 0.572 | 0.575 | 0.573 | 0.580 | 0.597 |
| 0.428 | 0.458 | 0.479 | 0.498 | 0.516 | **0.545** | 0.557 | 0.557 | 0.557 | 0.570 | 0.585 |
| 0.410 | 0.444 | 0.465 | 0.487 | 0.506 | 0.534 | **0.551** | 0.555 | 0.553 | 0.567 | 0.579 |
| 0.396 | 0.430 | 0.452 | 0.477 | 0.499 | 0.527 | 0.542 | **0.544** | 0.546 | 0.559 | 0.571 |
| 0.392 | 0.424 | 0.447 | 0.471 | 0.497 | 0.524 | 0.537 | 0.539 | **0.541** | 0.556 | 0.564 |
| 0.382 | 0.414 | 0.435 | 0.463 | 0.488 | 0.511 | 0.530 | 0.525 | 0.530 | **0.550** | 0.553 |
| 0.364 | 0.397 | 0.419 | 0.446 | 0.469 | 0.497 | 0.513 | 0.514 | 0.526 | 0.542 | **0.542** |

test for time trend in the cross-country correlations in the first row: 0.949 ($p$-value < 0.001).

one a different impression. Imports of SITC 7 comprise only about 27 per cent of Japan's global imports, yet account for over 36 per cent of imports from Korea. Similarly, machinery accounts for almost 57 per cent of Japan's imports from Taiwan, or more than double than the overall share of machinery in imports from the world.

Exports of labor-intensive manufactures (defined as textiles, apparel, footwear, and miscellaneous manufactures in SITC 65, 84, 851, and 89, respectively) account for a slightly larger share of exports to Japan than to the world. Yet from Japan's perspective, Korea is a more important supplier of labor-intensive goods (about 15 per cent of imports from Korea in 1999) compared with imports from the world (about 12 per cent). In the cases of both Taiwan and Korea, however, there is a sharp drop in the share of labor-intensive goods in exports to Japan particularly since 1994. Hence, the actual pattern of bilateral trade between Japan and Korea seems to be converging with the overall comparative advantage structure of the two countries.

Other factors that may influence trade patterns include exchange rate movements and the use of nontariff barriers. With regard to the first influence, we have made use of ten-year time intervals in order to look at long-term patterns of comparative

TABLE

SPEARMAN RANK CORRELATIONS BETWEEN JAPANESE

| | TW80 | TW81 | TW82 | TW83 | TW84 | TW85 | TW86 | TW87 | TW88 |
|---|---|---|---|---|---|---|---|---|---|
| JP80 | **0.374** | *0.378* | *0.385* | *0.410* | *0.406* | *0.414* | *0.455* | *0.480* | *0.455* |
| JP81 | 0.366 | **0.379** | 0.384 | 0.411 | 0.405 | 0.421 | 0.456 | 0.480 | 0.455 |
| JP82 | 0.360 | 0.373 | **0.380** | 0.404 | 0.401 | 0.421 | 0.453 | 0.477 | 0.452 |
| JP83 | 0.349 | 0.364 | 0.370 | **0.396** | 0.396 | 0.413 | 0.448 | 0.472 | 0.452 |
| JP84 | 0.333 | 0.350 | 0.352 | 0.378 | **0.377** | 0.402 | 0.429 | 0.454 | 0.436 |
| JP85 | 0.332 | 0.353 | 0.354 | 0.379 | 0.380 | **0.401** | 0.436 | 0.460 | 0.438 |
| JP86 | 0.300 | 0.327 | 0.330 | 0.356 | 0.359 | 0.382 | **0.415** | 0.440 | 0.418 |
| JP87 | 0.277 | 0.306 | 0.309 | 0.331 | 0.336 | 0.360 | 0.387 | **0.412** | 0.393 |
| JP88 | 0.271 | 0.295 | 0.297 | 0.321 | 0.329 | 0.347 | 0.374 | 0.401 | **0.378** |
| JP89 | 0.270 | 0.297 | 0.300 | 0.323 | 0.333 | 0.342 | 0.379 | 0.408 | 0.382 |
| JP90 | 0.248 | 0.277 | 0.281 | 0.303 | 0.309 | 0.320 | 0.357 | 0.384 | 0.363 |
| JP91 | 0.242 | 0.274 | 0.279 | 0.303 | 0.307 | 0.317 | 0.356 | 0.382 | 0.362 |
| JP92 | 0.231 | 0.267 | 0.274 | 0.295 | 0.297 | 0.307 | 0.345 | 0.371 | 0.353 |
| JP93 | 0.232 | 0.265 | 0.272 | 0.292 | 0.294 | 0.304 | 0.337 | 0.362 | 0.347 |
| JP94 | 0.225 | 0.256 | 0.263 | 0.283 | 0.278 | 0.286 | 0.312 | 0.344 | 0.330 |
| JP95 | 0.222 | 0.254 | 0.259 | 0.277 | 0.272 | 0.284 | 0.308 | 0.338 | 0.322 |
| JP96 | 0.201 | 0.237 | 0.244 | 0.264 | 0.259 | 0.271 | 0.295 | 0.324 | 0.309 |
| JP97 | 0.194 | 0.228 | 0.236 | 0.256 | 0.248 | 0.256 | 0.286 | 0.316 | 0.302 |
| JP98 | 0.182 | 0.214 | 0.227 | 0.245 | 0.232 | 0.239 | 0.269 | 0.300 | 0.285 |
| JP99 | 0.172 | 0.200 | 0.213 | 0.230 | 0.216 | 0.226 | 0.252 | 0.283 | 0.268 |

Source: See Table I.

Note: Test for time trend in the cross-country correlations in the mean diagonal: 0.767 ($p$-value < 0.001);

advantage. Naturally, a substantial real appreciation of the yen against the NT dollar and the Korean won would tend to enhance the competitiveness of the latter economies' products in the Japanese market, but would not be expected to alter the composition of comparative advantage in a predictable manner. One reason for this is that manufacturing industries in both economies depend upon imports of Japanese machinery and intermediate components. The second factor of nontariff barriers is likely to have influenced particular trade patterns between Korea and Japan and Taiwan and Japan. Starting in 1978, Korea put in place the Import Sources Diversification Program that created substantial nontariff barriers to imports from Japan (Yamazawa 2001; James 2001; Bridges 1993). The program tried to reduce the Korean deficit with Japan and shift Korean imports towards the United States in order to reduce Korea's trade surplus with the United States. Interestingly, when the program was initiated, a survey by the Korean Traders Association revealed that a large number of Korean firms considered Japanese goods superior to American ones in terms of quality, service, knowledge of the Korean market, and other nonprice factors of their purchasing decisions (Nam 1987). Besides, the survey showed that the average price of Japanese goods was 22 per cent lower than comparable American goods, including machinery goods, electronics, chemical goods, and textiles. Thus, to achieve the program's goals, the Korean government

V

AND TAIWANESE RCA INDICES (1980–99)

| TW89 | TW90 | TW91 | TW92 | TW93 | TW94 | TW95 | TW96 | TW97 | TW98 | TW99 |
|---|---|---|---|---|---|---|---|---|---|---|
| *0.446* | *0.455* | *0.474* | *0.496* | *0.546* | *0.566* | *0.591* | *0.610* | *0.613* | *0.598* | *0.622* |
| 0.448 | 0.456 | 0.476 | 0.498 | 0.549 | 0.567 | 0.591 | 0.612 | 0.615 | 0.600 | 0.624 |
| 0.444 | 0.450 | 0.469 | 0.493 | 0.542 | 0.558 | 0.582 | 0.604 | 0.610 | 0.596 | 0.616 |
| 0.443 | 0.450 | 0.469 | 0.491 | 0.542 | 0.557 | 0.580 | 0.604 | 0.608 | 0.596 | 0.614 |
| 0.427 | 0.434 | 0.453 | 0.481 | 0.533 | 0.545 | 0.567 | 0.598 | 0.600 | 0.586 | 0.603 |
| 0.431 | 0.439 | 0.457 | 0.487 | 0.540 | 0.550 | 0.571 | 0.601 | 0.603 | 0.593 | 0.610 |
| 0.413 | 0.423 | 0.441 | 0.468 | 0.528 | 0.540 | 0.562 | 0.593 | 0.596 | 0.586 | 0.605 |
| 0.385 | 0.400 | 0.417 | 0.446 | 0.502 | 0.518 | 0.544 | 0.581 | 0.582 | 0.572 | 0.591 |
| 0.376 | 0.390 | 0.408 | 0.440 | 0.499 | 0.514 | 0.539 | 0.578 | 0.580 | 0.571 | 0.594 |
| **0.378** | 0.393 | 0.410 | 0.445 | 0.504 | 0.521 | 0.544 | 0.580 | 0.587 | 0.581 | 0.604 |
| 0.356 | **0.371** | 0.391 | 0.426 | 0.487 | 0.506 | 0.530 | 0.569 | 0.576 | 0.569 | 0.593 |
| 0.357 | 0.372 | **0.391** | 0.426 | 0.487 | 0.506 | 0.531 | 0.569 | 0.576 | 0.570 | 0.595 |
| 0.344 | 0.359 | 0.379 | **0.412** | 0.475 | 0.495 | 0.523 | 0.562 | 0.566 | 0.558 | 0.586 |
| 0.337 | 0.351 | 0.372 | 0.406 | **0.468** | 0.489 | 0.517 | 0.557 | 0.565 | 0.556 | 0.582 |
| 0.319 | 0.333 | 0.354 | 0.389 | 0.455 | **0.475** | 0.505 | 0.542 | 0.548 | 0.539 | 0.567 |
| 0.310 | 0.327 | 0.348 | 0.384 | 0.450 | 0.471 | **0.501** | 0.541 | 0.548 | 0.539 | 0.568 |
| 0.298 | 0.315 | 0.337 | 0.373 | 0.444 | 0.465 | 0.494 | **0.534** | 0.543 | 0.536 | 0.564 |
| 0.290 | 0.307 | 0.330 | 0.366 | 0.436 | 0.458 | 0.486 | 0.524 | **0.533** | 0.526 | 0.558 |
| 0.274 | 0.292 | 0.315 | 0.347 | 0.413 | 0.439 | 0.471 | 0.506 | 0.510 | **0.503** | 0.538 |
| 0.259 | 0.279 | 0.301 | 0.333 | 0.401 | 0.428 | 0.461 | 0.496 | 0.500 | 0.491 | **0.529** |

test for time trend in the cross-country correlations in the first row: 0.967 ($p$-value < 0.001).

implemented severe administrative curbs on Japanese imports to Korea, contrary to GATT/WTO nondiscriminatory principles. However, in the late 1990s the nontariff restrictions against Japanese imports were gradually abolished, largely due to two factors: a new policy goal to attain OECD membership, and because the program's elimination was a precondition to obtain the IMF bailout package after the Asian financial crises. In the summer of 1999, all discriminatory trade restrictions against Japan were eventually lifted (Yamazawa 2001). Taiwan also placed a quantitative restriction of imports of transportation equipment from Japan (particularly autos) that may have biased trade patterns up until the recent accession of Taiwan to the WTO. It is also possible that informal private sector barriers to imports have influenced trade patterns among the three economies, but this influence is difficult to quantify. It is unlikely that nontariff barriers that discriminate against Japanese products will have influenced the overall pattern of comparative advantage of either Taiwan or Korea and, in any case, a Korea-Japan FTA would presumably resolve any lingering effects of the previous ban on imports of Japanese consumer goods into the Korean market.

The rising share of machinery in trade among the three (including in trade between Taiwan and Korea) indicates that there may be scope for expansion of intra-

TABLE

SPEARMAN RANK CORRELATIONS BETWEEN KOREAN

| | TW80 | TW81 | TW82 | TW83 | TW84 | TW85 | TW86 | TW87 | TW88 |
|---|---|---|---|---|---|---|---|---|---|
| KR80 | **0.649** | *0.636* | *0.638* | *0.622* | *0.635* | *0.658* | *0.648* | *0.636* | *0.678* |
| KR81 | 0.671 | **0.657** | 0.664 | 0.646 | 0.657 | 0.689 | 0.678 | 0.668 | 0.708 |
| KR82 | 0.653 | 0.649 | **0.658** | 0.640 | 0.648 | 0.677 | 0.666 | 0.651 | 0.690 |
| KR83 | 0.648 | 0.653 | 0.664 | **0.654** | 0.661 | 0.682 | 0.683 | 0.672 | 0.695 |
| KR84 | 0.655 | 0.653 | 0.668 | 0.665 | **0.668** | 0.685 | 0.696 | 0.687 | 0.683 |
| KR85 | 0.622 | 0.633 | 0.646 | 0.647 | 0.657 | **0.673** | 0.694 | 0.675 | 0.670 |
| KR86 | 0.628 | 0.635 | 0.647 | 0.651 | 0.658 | 0.685 | **0.708** | 0.688 | 0.679 |
| KR87 | 0.618 | 0.626 | 0.636 | 0.641 | 0.652 | 0.681 | 0.704 | **0.690** | 0.674 |
| KR88 | 0.637 | 0.658 | 0.673 | 0.680 | 0.686 | 0.711 | 0.736 | 0.728 | **0.710** |
| KR89 | 0.644 | 0.669 | 0.687 | 0.695 | 0.698 | 0.714 | 0.739 | 0.734 | 0.722 |
| KR90 | 0.631 | 0.648 | 0.662 | 0.671 | 0.675 | 0.703 | 0.721 | 0.716 | 0.711 |
| KR91 | 0.616 | 0.628 | 0.644 | 0.656 | 0.662 | 0.686 | 0.715 | 0.710 | 0.702 |
| KR92 | 0.587 | 0.597 | 0.611 | 0.621 | 0.627 | 0.655 | 0.681 | 0.680 | 0.676 |
| KR93 | 0.561 | 0.575 | 0.589 | 0.610 | 0.616 | 0.621 | 0.666 | 0.664 | 0.655 |
| KR94 | 0.542 | 0.551 | 0.564 | 0.585 | 0.592 | 0.604 | 0.650 | 0.653 | 0.638 |
| KR95 | 0.520 | 0.535 | 0.549 | 0.564 | 0.570 | 0.589 | 0.619 | 0.623 | 0.610 |
| KR96 | 0.507 | 0.507 | 0.522 | 0.536 | 0.548 | 0.573 | 0.595 | 0.600 | 0.590 |
| KR97 | 0.475 | 0.473 | 0.491 | 0.507 | 0.519 | 0.546 | 0.566 | 0.574 | 0.552 |
| KR98 | 0.469 | 0.477 | 0.493 | 0.511 | 0.521 | 0.541 | 0.565 | 0.569 | 0.559 |
| KR99 | 0.476 | 0.484 | 0.501 | 0.524 | 0.537 | 0.553 | 0.586 | 0.588 | 0.569 |

Source: See Table I.

Note: Test for time trend in the cross-country correlations in the mean diagonal: 0.116 ($p$-value = 0.627);

industry trade. Hence, this study on RCA structures should be augmented by studies of intra-industry trade.[7]

A possible shortcoming of the finding that Korea and Taiwan are increasingly competing against each other in similar markets may stem from our use of the 3-digit trade classification. This approach assumes that the effect of the Japan-Korea FTA would be the same for every less aggregated subsector, while it appears to be more realistic to expect that there is a substantial diversity at the disaggregated level in terms of manufacturing patterns, product quality, market segmentation, and intra-industry trade. The *World Trade Analyzer* from Statistics Canada (2001) contains trade data at 4-digit level for 1980–99, so we were able to check the robustness of our findings with a less aggregated level, using 406 trade categories. It turned out that our major results in Tables IV–VI remained essentially the same, with a highly significant contemporaneous convergence between Japan and Korea ($\rho = 0.867$, $p$-value $< 0.001$) and between Japan and Taiwan ($\rho = 0.947$, $p$-value $< 0.001$), well in excess of the corresponding statistic with 3-digit data (0.767). Finally, disaggregated trade patterns of Korea and Taiwan exhibited divergence with marginal statis-

[7] James (2001) is an initial step in that direction. The study of bilateral intra-industry trade between Korea and Japan found that intra-industry trade has risen sharply over the period 1980 (bilateral IIT=32.22) to 1997 (IIT of 47.60).

VI

AND TAIWANESE RCA INDICES (1980–99)

| TW89 | TW90 | TW91 | TW92 | TW93 | TW94 | TW95 | TW96 | TW97 | TW98 | TW99 |
|---|---|---|---|---|---|---|---|---|---|---|
| *0.674* | *0.657* | *0.642* | *0.614* | *0.596* | *0.587* | *0.596* | *0.587* | *0.594* | *0.578* | *0.566* |
| 0.703 | 0.682 | 0.665 | 0.645 | 0.622 | 0.614 | 0.626 | 0.616 | 0.627 | 0.608 | 0.607 |
| 0.687 | 0.667 | 0.651 | 0.634 | 0.612 | 0.601 | 0.612 | 0.604 | 0.620 | 0.598 | 0.594 |
| 0.697 | 0.678 | 0.664 | 0.654 | 0.635 | 0.620 | 0.626 | 0.612 | 0.627 | 0.609 | 0.606 |
| 0.682 | 0.660 | 0.653 | 0.638 | 0.619 | 0.616 | 0.629 | 0.610 | 0.624 | 0.605 | 0.611 |
| 0.666 | 0.646 | 0.637 | 0.629 | 0.620 | 0.618 | 0.626 | 0.607 | 0.625 | 0.606 | 0.607 |
| 0.678 | 0.655 | 0.646 | 0.634 | 0.628 | 0.629 | 0.633 | 0.616 | 0.636 | 0.617 | 0.617 |
| 0.681 | 0.652 | 0.639 | 0.627 | 0.621 | 0.624 | 0.631 | 0.611 | 0.634 | 0.613 | 0.615 |
| 0.716 | 0.690 | 0.678 | 0.671 | 0.665 | 0.672 | 0.677 | 0.661 | 0.682 | 0.662 | 0.658 |
| **0.728** | 0.706 | 0.696 | 0.688 | 0.686 | 0.693 | 0.701 | 0.685 | 0.704 | 0.686 | 0.680 |
| 0.715 | **0.696** | 0.688 | 0.684 | 0.686 | 0.697 | 0.704 | 0.693 | 0.711 | 0.691 | 0.691 |
| 0.707 | 0.687 | **0.683** | 0.682 | 0.686 | 0.699 | 0.710 | 0.699 | 0.718 | 0.698 | 0.702 |
| 0.680 | 0.664 | 0.658 | **0.663** | 0.670 | 0.680 | 0.696 | 0.692 | 0.711 | 0.688 | 0.692 |
| 0.659 | 0.647 | 0.646 | 0.657 | **0.662** | 0.673 | 0.689 | 0.685 | 0.709 | 0.687 | 0.687 |
| 0.647 | 0.637 | 0.632 | 0.646 | 0.663 | **0.674** | 0.684 | 0.681 | 0.704 | 0.685 | 0.687 |
| 0.615 | 0.615 | 0.609 | 0.629 | 0.636 | 0.643 | **0.665** | 0.668 | 0.685 | 0.661 | 0.659 |
| 0.592 | 0.595 | 0.594 | 0.620 | 0.630 | 0.639 | 0.663 | **0.664** | 0.682 | 0.653 | 0.652 |
| 0.564 | 0.562 | 0.562 | 0.586 | 0.605 | 0.618 | 0.647 | 0.641 | **0.664** | 0.636 | 0.641 |
| 0.559 | 0.562 | 0.564 | 0.589 | 0.610 | 0.625 | 0.654 | 0.653 | 0.672 | **0.646** | 0.648 |
| 0.575 | 0.574 | 0.579 | 0.609 | 0.633 | 0.647 | 0.674 | 0.672 | 0.692 | 0.668 | **0.674** |

test for time trend in the cross-country correlations in the first row: –0.723 ($p$-value < 0.001).

tical significance ($\rho = -0.481$, $p$-value < 0.033), while our analysis with 3-digit data resulted in an insignificant $p$-value (0.627). On the whole, our conclusion about increased competition, rather than complementarity, among Japanese, Korean, and Taiwanese trade patterns is not due to the use of aggregated trade data.[8] Likewise, JETRO (1996, fig. 1) points out that the extent of intra-industry trade still remains low in Japan, China, and the Asian newly industrialized economies (compared with the European Union), making the mitigating effect of intra-industry trade relatively small should Japan and Korea decide to form an FTA.

## IV. IMPLICATIONS

The structure of comparative advantage in Japan and Korea is similar and is converging—both these statements are supported by statistical tests that indicate a significant correlation in RCA structures and trends. Given that Taiwan's RCA

[8] We also attempted to examine the robustness of our findings at the 5-digit SITC level. Unfortunately, *World Trade Analyzer* does not contain such disaggregated data. An alternative source of trade data from OECD (2001) does contain data at the 5-digit SITC level, but does not have sufficiently long-term series data for Korea and Taiwan, with the earliest available years of 1994 and 1990, respectively.

structure is also strongly and significantly correlated with those of Korea and Japan and is also converging with that of Japan, there would appear to be a substantial potential for trade diversion should Japan and Korea form an FTA. The scope for trade diversion is limited in the large Japanese domestic market because Japan has very low tariffs and maintains few explicit quantitative barriers that would be relaxed for Korean products but not for those of Taiwan under an FTA. The simple average tariff in Japan is less than 3 per cent and the trade-weighted average tariff is also very low.[9] Hence, the margin of preference offered to imports from Korea would be quite small and would probably not be too difficult for competitive firms in Taiwan to overcome. However, trade diversion in the Korean domestic market could be substantial. The simple average tariff in Korea is about 8 per cent, with numerous industries protected by fairly high tariffs.[10] It would be difficult for firms in Taiwan to meet Japanese competition enjoying a substantial margin of preference in the Korean market.

To estimate the extent of trade diversion potential if Japan and Korea form an FTA, we have identified twenty-five SITC 3-digit categories where Taiwan and Japan have a mutual revealed comparative advantage in the second subperiod (Table VII). These are categories where because of export similarity between Taiwan and Japan, competition in third country markets is likely to take place. If Korea joins with Japan in an FTA, then tariff discrimination against nonmembers may lead to trade diversion. In particular, if Korea maintains tariffs averaging 8 per cent on imports from nonmembers but allows imports from firms in Japan to have duty free access, there is obvious potential for trade diversion in the Korean domestic market.

The 3-digit SITC categories in Table VII could not be matched with available tariff data from Korea.[11] Instead, we report on average tariffs at the 3-digit

[9] IDE-JETRO (2000) reports a simple average tariff in Japan of 2.9 per cent. It is important to recognize that technical barriers to trade could still divert trade in Japan's market from Taiwan to Korea, however. For example, should Japan and Korea in the context of the FTA extend mutual recognition to one another's product testing standards but deny such treatment to imports from Taiwan, products from Taiwan might lose market share in Japan and Korea.

[10] According to the WTO Secretariat <http://www.wto.org/english/tratop_e/tpr_e/tp138_e.htm>, this official tariff rate is biased downward, because Korean authorities calculate tariff averages with only "in-quota" tariffs, excluding "out-of-quota" tariffs. If both these tariffs are used, the WTO Secretariat estimates that the average tariff rate in Korea rises to 14.4 per cent. Though this tariff adjustment is significant for agricultural products, there is a minor modification for manufacturing sectors. Therefore, we do not expect that the incomplete coverage of official tariffs in Korea may substantially affect our results.

[11] Tariff data are available from the APEC Secretariat homepage. However, tariffs are reported for thousands of individual Harmonized System (HS) codes. Aggregating these individual HS codes into 3-digit SITC categories can be done in principle. Such an exercise requires a great deal of effort, particularly if production-weighted tariffs are desired. We have not been able to identify any studies that have done this for recent tariffs and instead rely on sources that have aggregated tariffs so that they match the Korean Standard Industrial Classification (KSIC). Noland (2000) reports on Korean tariffs using data from the United States Trade Representative's office (USTR 1998).

ISIC (International Standard Industrial Classification) for twenty-nine industries (Table VIII). We report on average tariffs, tariff range, and standard deviation and match these with trade data taken from OECD (2001). The data in Table VIII are highly aggregated compared with the SITC trade data (29 vs. 217 industries or categories). Hence, they are at best indicative of the potential for trade diversion.

In this context, it is notable that for numerous industries average tariffs equivalent to 8 per cent on an ad valorem basis are applied on all items in the industry (for example, ISIC 351: industrial chemicals, fertilizers). The amount of trade affected cannot be predetermined without data on price elasticities. However, we report average trade and the maximum amount of trade between Japan and Korea and between Taiwan and Korea.[12] It can be seen that for some sectors, in addition to the difficulty of lacking elasticity estimates, there is a wide tariff range (for machinery, ISIC 382–385, where most trade is concentrated tariffs range from 0 to 20 per cent; for iron & steel, ISIC 371, they range from 1 to 8 per cent). Thus, it would be necessary to carefully match tariffs and trade data at a more disaggregated level to be able to accurately estimate the potential trade diversion from Taiwan to Japan in the Korean market. In particular, some categories of IT products may have zero MFN (most favored nation) tariffs in Korea because of the Information Technology Agreement reached at the Singapore Ministerial Meeting of the WTO in 1996. In spite of this, the potential scope for trade diversion is large, particularly if a local content rule of origin is chosen to implement the tariff preferences in the FTA. Such a rule of origin could lead Korean and Japanese producers to substitute local components for imported components from Taiwan in order to take advantage of the 8 per cent tariff preference. Even though the components may have a zero MFN tariff, final goods that use components as inputs (VCRs, flat screen TVs, computer-controlled machinery) may have nonzero tariffs. Hence, the figures in Table VIII for imports from Taiwan in the year of maximum trade can be thought of as an upper bound for the amount of trade diversion that could take place. The mean and maximum values in Table VIII (for example, $1,794 million and $2,640 million for total manufacturing) indicate that the potential trade diversion in the case of the Korean market from an FTA can be quite large, especially in textile products, industrial chemicals, nonelectrical and electrical machinery.

[12] To calculate export trade by 3-digit ISIC sectors, we used 5-digit SITC (revision 2) trade data from OECD (2001) and a concordance between SITC and ISIC classifications, available at http://www.macalester.edu/research/economics/page/haveman/Trade.Resources. Korean import data in the OECD trade database were available for only 1994–99, and we used instead more extended time series of Japanese and Taiwanese exports to Korea for 1990–99. Our comparison of these two alternative sources with trade data for 1994 revealed that there were very few relative deviations that exceeded 10 per cent of reported Korean imports.

TABLE VII

SECTORS OF POTENTIAL TRADE DIVERSION FROM TAIWAN TO JAPAN IN THE KOREAN MARKET

| SITC | Commodity | RCA | | Exports of Taiwan to Korea | | |
|---|---|---|---|---|---|---|
| | | Japan | Taiwan | Mean | Maximum | In Year |
| 233 | Synthetic rubber | 1.43 | 1.50 | 3.36 | 4.58 | 1990 |
| 266 | Synthetic fibers | 1.50 | 3.53 | 5.46 | 20.54 | 1990 |
| 582 | Condensation & polycondensation products | 1.04 | 1.48 | 8.80 | 19.00 | 1999 |
| 628 | Articles of rubber | 1.73 | 1.38 | 2.09 | 4.54 | 1996 |
| 653 | Fabrics, woven, of man-made fibers | 1.02 | 3.77 | 24.08 | 42.23 | 1994 |
| 677 | Iron/steel wire | 1.03 | 1.17 | 0.13 | 1.10 | 1991 |
| 694 | Nails, screws, bolts | 1.37 | 5.88 | 2.96 | 7.03 | 1996 |
| 695 | Tools for use in hand or in machines | 1.36 | 2.78 | 11.48 | 18.62 | 1996 |
| 716 | Rotating electric plant and parts | 1.63 | 1.14 | 20.82 | 30.90 | 1991 |
| 724 | Textile & leather machinery and parts | 2.12 | 2.37 | 12.97 | 17.84 | 1995 |
| 728 | Machines specialized for particular industries | 1.68 | 1.25 | 19.90 | 38.79 | 1996 |
| 736 | Machine tools | 2.44 | 2.02 | 23.56 | 36.51 | 1995 |
| 749 | Nonelectric parts and accessories of machines | 1.76 | 1.03 | 10.25 | 14.80 | 1996 |
| 751 | Office machines | 1.64 | 3.53 | 77.63 | 268.86 | 1999 |
| 752 | Automatic data processing machines | 1.53 | 3.30 | 69.60 | 141.54 | 1996 |
| 764 | Telecommunications equipment | 2.03 | 1.22 | 54.84 | 94.48 | 1999 |
| 771 | Electric power machinery and parts | 1.24 | 2.76 | 14.22 | 30.30 | 1999 |
| 772 | Electrical appliances (switches, relays, fuses) | 1.81 | 1.87 | 51.94 | 107.23 | 1999 |
| 776 | Thermionic, cold & photo-cathode valves, tubes | 2.33 | 2.14 | 473.09 | 1,199.26 | 1999 |
| 778 | Electrical machinery and apparatus, n.e.s. | 2.16 | 1.46 | 30.07 | 45.54 | 1999 |
| 785 | Motorcycles, motor scooters | 2.09 | 9.52 | 11.41 | 15.09 | 1992 |
| 871 | Optical instruments and apparatus | 2.86 | 1.50 | 10.02 | 67.91 | 1999 |
| 881 | Photographic apparatus and equipment | 3.92 | 1.15 | 12.92 | 20.54 | 1991 |
| 884 | Optical goods | 2.27 | 2.44 | 1.97 | 2.35 | 1996 |
| 895 | Office and stationery supplies | 2.04 | 2.41 | 4.85 | 7.41 | 1996 |

Note: Exports are in U.S. million dollars in current prices.

TABLE VIII

TARIFF PROTECTION IN KOREA AND POTENTIAL TRADE DIVERSION: SECTORS IN WHICH EXPORTS OF TAIWAN AND JAPAN COMPETE

| ISIC | Sector | Tariff Protection in Korea | | | Exports of Japan to Korea | | | Exports of Taiwan to Korea | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Average | Range | St. Dev. | Mean | Maximum | In Year | Mean | Maximum | In Year |
| 300 | Total manufacturing | | | | 21,683 | 30,436 | 1995 | 1,794 | 2,640 | 1996 |
| 311 | Food products | 22.4 | 3–58 | 13.7 | 48 | 68 | 1999 | 27 | 54 | 1991 |
| 312 | Food manufacturing | 9.5 | 5–40 | 7.9 | 30 | 40 | 1997 | 4 | 7 | 1991 |
| 313 | Beverages | 25.4 | 5–30 | 9.1 | 3 | 6 | 1995 | 1 | 3 | 1995 |
| 314 | Tobacco | 40.0 | 40 | 0.0 | 53 | 136 | 1995 | 0 | 0 | 1996 |
| 321 | Textiles | 8.2 | 0–30 | 2.5 | 386 | 477 | 1991 | 145 | 211 | 1995 |
| 322 | Wearing apparel | 8.0 | 8 | 0.0 | 21 | 35 | 1997 | 5 | 9 | 1996 |
| 323 | Leather products | 8.0 | 8 | 0.0 | 48 | 111 | 1990 | 35 | 72 | 1990 |
| 324 | Footwear | 8.0 | 8 | 0.0 | 7 | 13 | 1991 | 12 | 20 | 1996 |
| 331 | Wood products | 9.4 | 8–30 | 5.0 | 18 | 37 | 1996 | 8 | 19 | 1990 |
| 332 | Furniture & fixtures | 8.0 | 8 | 0.0 | 16 | 32 | 1990 | 5 | 14 | 1996 |
| 341 | Paper, paper products | 8.0 | 8 | 0.0 | 137 | 187 | 1995 | 16 | 38 | 1990 |
| 342 | Printing & publishing | 3.1 | 0–8 | 3.9 | 26 | 31 | 1995 | 2 | 4 | 1996 |
| 351 | Industrial chemicals, fertilizers | 8.0 | 8 | 0.0 | 2,803 | 3,745 | 1995 | 292 | 530 | 1995 |
| 352 | Chemical products | 8.1 | 0–21 | 2.9 | 884 | 1,128 | 1994 | 32 | 86 | 1999 |
| 353 | Petroleum refineries | 7.0 | 1–8 | 1.7 | 390 | 832 | 1995 | 15 | 27 | 1995 |
| 354 | Coal and petroleum products | 8.0 | 8 | 0.0 | 80 | 118 | 1996 | 5 | 15 | 1993 |
| 355 | Rubber products | 7.6 | 1–8 | 1.2 | 107 | 152 | 1995 | 4 | 9 | 1996 |
| 356 | Plastic products | 8.0 | 8 | 0.0 | 73 | 94 | 1997 | 25 | 41 | 1996 |
| 361 | Pottery, china, etc. | 8.0 | 8 | 0.0 | 120 | 153 | 1990 | 2 | 5 | 1991 |
| 362 | Glass products | 8.0 | 8 | 0.0 | 219 | 376 | 1995 | 16 | 28 | 1994 |
| 369 | Nonmetallic mineral products | 8.0 | 8 | 0.0 | 154 | 263 | 1996 | 6 | 8 | 1996 |
| 371 | Iron & steel | 7.3 | 1–8 | 1.5 | 1,649 | 2,347 | 1995 | 54 | 118 | 1995 |
| 372 | Nonferrous metals | 8.0 | 8 | 0.0 | 476 | 665 | 1995 | 41 | 62 | 1990 |
| 381 | Metal products | 8.0 | 8 | 0.0 | 860 | 1,361 | 1995 | 55 | 94 | 1996 |
| 382 | Nonelectrical machinery | 7.7 | 0–20 | 1.2 | 5,105 | 7,464 | 1996 | 286 | 505 | 1996 |
| 383 | Electrical machinery | 7.9 | 0–20 | 2.1 | 5,446 | 7,237 | 1999 | 589 | 1,136 | 1999 |
| 384 | Transportation equipment | 6.7 | 0–10 | 3.2 | 784 | 1,106 | 1995 | 32 | 90 | 1999 |
| 385 | Precision instruments | 8.0 | 0–15 | 0.8 | 1,587 | 2,680 | 1995 | 39 | 80 | 1999 |
| 39 | Other manufacturing | 7.9 | 0–23 | 2.4 | 183 | 240 | 1997 | 45 | 68 | 1996 |

Source: World Trade Organization (1996, tab. AIII.1).
Note: Exports are in U.S. million dollars in current prices.

## V. CONCLUSION

In this paper, we have investigated likely consequences of creating an FTA between Japan and Korea, paying particular attention to the similarity of their export patterns, as well as the extent to which third parties, particularly with reference to Taiwan, might be affected by trade diversion. To analyze the evolution of comparative advantage in Japan, Korea, and Taiwan in 1980–99, we calculated RCA indices for these economies, and detected substantial transformations in the composition of industries that had top RCA indexes.

In particular, we found that starting from the early 1990s the comparative advantages of both Korea and Taiwan were no longer concentrated in labor-intensive products, but were increasingly clustered in products with a high technology intensity, thus becoming more similar to the Japanese RCA pattern. To verify this hypothesis statistically, we ran the nonparametric Daniels test of Spearman rank correlations among RCA indices of Japan, Korea, and Taiwan.

The test identified a clear-cut convergence of comparative advantage of Japan and Korea, with the correlation coefficient rising from 0.43 to 0.54 over the period 1980–99. Similarly, the correlation coefficient between RCA indexes of Japan and Taiwan increased from 0.37 to 0.53. Besides these contemporaneous correlations, we found that there was an even more significant correlation between recent patterns of Korean and Taiwanese comparative advantage and previous patterns of Japanese comparative advantage (for example, the correlation between Japanese RCA indices in 1980 and Korean RCA indices in 1999 was as much as 0.66), indicating that there is still some room for the convergence of the trade patterns of Japan-Korea and Japan-Taiwan. In contrast, we did not identify any significant convergence of export patterns of Korea and Taiwan. The correlation coefficient for export RCA indices of Korea and Taiwan was already as high as 0.65 in 1980, and has changed little by the late 1990s.

With such a similarity among the export patterns of Japan, Korea, and Taiwan, there appears to be substantial potential for trade diversion should Japan and Korea form an FTA. To evaluate the magnitude of trade diversion for Taiwan, we focused on the Korean market rather than on Japan, since explicit trade barriers in Korea are substantially higher than in Japan. Unfortunately, we could not find Korean tariff data that matches the SITC classification used to calculate RCA indices. The best available source of Korean tariff data was classified by 3-digit ISIC sectors. However, the wide range of tariff rates within the same ISIC sector makes it difficult to estimate trade diversion with any precision. Therefore, we consider our present analysis as a preliminary study until a more comprehensive study can be launched in the future, once we have compiled a comprehensive database of Korean trade barriers.

We have neglected the possible trade creation effects of a Korea-Japan FTA in this paper. However, we would expect that the trade creation potential would be emphasized in the findings of the official study group (IDE-JETRO 2000). Moreover, we are deliberately drawing attention to the importance of the rules of origin and other details of implementation of the FTA in determining the extent to which trade diversion will take place. Key elements in the implementation of the FTA in this context (in addition to rules of origin) are mutual recognition agreements in the area of standards and product testing, dispute settlement procedures (particularly in the context of the application of national antidumping laws, competition policy, and safeguard measures), and customs valuation and procedures.

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