The Interaction between
China, Japan, and Korea in the Export Market[†]

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This paper analyzes changes in the export potential and competitiveness of China, Japan, and Korea. The analysis of Japan's export market share reveals that in sectors where Korea's potential was strong in the early 1990s, Japan's market share diminished. This suggests the possibility that Korea was catching up with Japan, eating into Japan's market share. The same analysis of Korea's export market share in the 2000s shows, for items in which China's export potential was high, Korea's market share has declined comparatively since 2010, with the tendency growing much larger. China's export potential continues to expand in markets for Korea's key export products, making it difficult to rule out the possibility that Korea's competitiveness in key export products will be hindered, driven by the catching up of China. To respond to these challenges, it is important for Korea continuously to foster and enhance creative and core capabilities that latecomers will not easily be able to emulate.

Key Word: catch up, product space, export market competition, comparative advantage, export potential
JEL Code: F14, F47, O57

I. Introduction

Korea has pursued export-driven growth since its initial development stage, and exports are still a major growth engine of Korea. It is inevitable that small economies such as Korea seek growth by relying on foreign demand. Thus, to determine whether Korea can sustain its economic dynamism, it is necessary to grasp whether the country can maintain its competitiveness in the export market in the future.
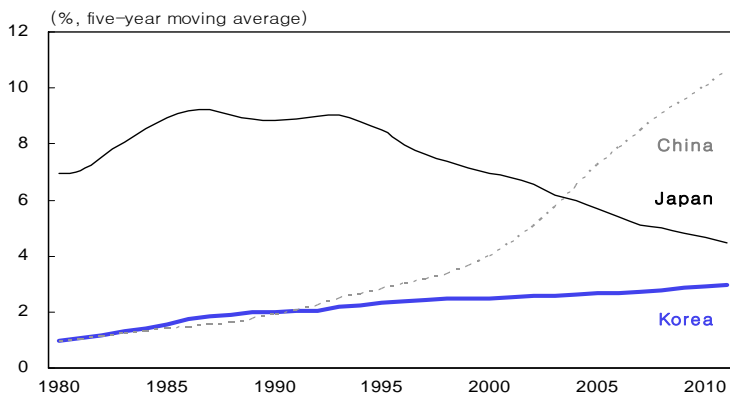
FIGURE 1. GLOBAL EXPORT MARKET SHARES OF
CHINA, JAPAN, AND KOREA

Source: UNCTAD

   This paper studies the impacts of export competitors on Japan's exports in the 1990s and on Korea's exports in the 2000s and compares them. As reported in Cho (2014), the Korean economy of today and the Japanese economy in the early 1990s are similar in many respects. For example, Korea's demographic structure follows Japan's, with a lag of approximately 20 years, and Korea's inflation rate is declining, as Japan's was in the early 1990s. Given that Japan's long recession started at that time, it is meaningful to analyze the possibility that in the near future the Korean economy will follow the way of Japan. This paper analyzes the Japanese and Korean economies, focusing on the export sector.
   Here, we examine what happened with regard to Japan's exports. In the early 1980s, Japan achieved economic growth with a rapid expansion of its export market dominance, but later experienced an economic downturn in the 1990s, with exports also sluggish. Figure 1 shows the trend of Japan's export market share. Japan's export market share was extended in the early 1980s, maintaining a high level until the beginning of the 1990s. The market share, however, began consistently to decline after reaching its peak in 1993. Japan's market share was 9.6% in 1993, following the US at 12.3% and Germany at 10.1%. However, it has since continued to fall, reaching a level of 3.6% in 2014. It is comprehensible that Japan's domestic demand declined during the recession of the 1990s to some extent. This is, however, different from the recession experiences in other countries in that the Japanese economic downturn appeared even in the export sector, which mainly depends on foreign demand in the short term. In other words, in a recession exports are expected to expand more than domestic demand and thus to somewhat mitigate the economic downturn, but a further analysis reveals that this does not apply in Japan's case. Thus, it is difficult to attribute the sluggish Japanese economy in the 1990s to insufficient demand, as the Japanese economy went through a slump in both its domestic and foreign markets at that time. Instead, it may be a signal that Japanese firms became less competitive.
   There were numerous factors that weakened the competitiveness of Japanese firms. Examples include changes in the demographic structure of the country, labor market rigidity, inefficient resource allocation, and mismanaged macroeconomic

policies. Because the analyses of these factors are covered in detail in other chapters of Cho (2014), this paper will focus mainly on the impact of export competitors.

The exchange rate of the yen may affect the competitiveness of Japanese goods. Due to the Plaza Accord in 1985 and following Japan's monetary policy, the yen/dollar exchange rate (annual average) dropped from 238.5 in 1985 to 94.0 in 1995. The appreciation of the yen deteriorated the price competitiveness of Japanese goods in the global market. As Obstfeld (2011) reported, this significant appreciation clearly also affected Japan's export market share. Although the exchange rate of the yen is an important issue, this paper does not address this issue in depth. Instead, the dynamic competition among China, Japan, and Korea is the main topic here.

In contrast to Japan, China's market share increased from 1.8% in 1990 to 12.4% in 2014. In particular, China's market share skyrocketed in 2000s. Despite the rapid rise of China, Korea's market share has grown at a comparatively steady pace. Korea's market share was close to 2% in the early 1990s; it continued to expand moderately, reaching 3% in 2010, and has maintained this level since then.

If Korea follows Japan and Korean firms become less competitive in the export market, the impact on Korea would be severer, as Korea relies more on exports for economic growth than Japan did. The ratio of exports to GDP of Japan in the early 1990s was only approximately 10%, while that of Korea today is greater than 50%. These figures themselves may mislead, as Korea is more involved in global value chains than Japan was and hence a percentage of Korea's exports consists of imported inputs, which do not contribute to Korea's GDP directly. (See Koopman, Wang, and Wei 2014; Timmer, Erumban, Los, Stehrer, and de Vries 2014; Johnson 2014 for double counting in gross exports.) After controlling for imported inputs in the export production figures, Korea still relies on exports much more than Japan did in the 1990s. Figure 2 shows the ratios of value-added exports to GDP. Japan's export ratios in the 1990s were slightly less than 10%, while Korea's export ratio in 2011 exceeded 30%.
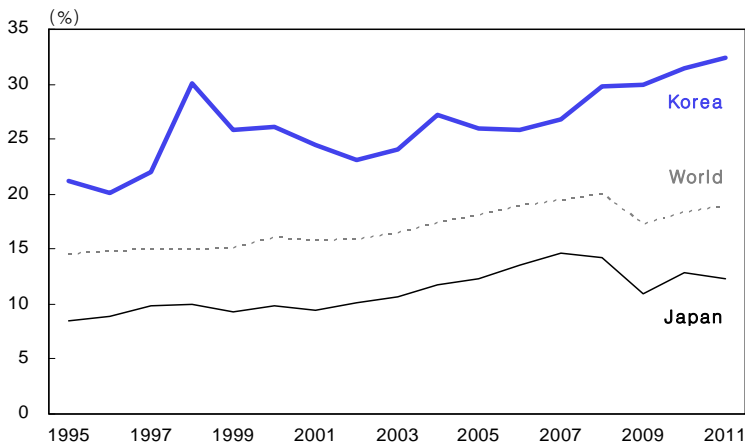

FIGURE 2. RATIOS OF VALUE-ADDED EXPORTS TO GDP

Source: Author's calculations using WIOD data.

As Korea's export figures have remained stagnant since the second half of 2014, concerns are growing in Korea that China may catch up in the export industry, much like Korea benchmarked Japan to do the same. A clear resolution to this issue is very difficult to find. This paper intends to uncover clues regarding this question so as to urge policymakers to prepare for this potential threat to the Korean economy.

The main analysis method of this paper is based on the concept of the product space in Hidalgo *et al.* (2007). The product space is a useful tool with which to measure the export potential of an individual product. I measure the export potential of export competitors and attempt to determine how it affects a certain county's export market share.

There is, obviously, a considerable body of literature on the export competitiveness of China, Japan, and Korea. In this paper, I focus on the interaction among China, Japan, and Korea considering the catch-up efforts of the countries.

Choi, Tcha, and Kim (2005) and Shin and Lee (2003) studied Korea's export competitiveness with a focus on competition with China and Japan by analyzing export market shares, export basket similarities, and comparative advantages by industry. In contrast, this paper analyzes dynamic catch-up patterns based on the export potential and compares the Korean economy of today to the Japanese economy of the past.

Lee (2008) and Jung (2014) also analyzed the impact of China on Korea's exports, similar to this paper. These papers, however, analyzed China as an export market of Korean products, whereas this paper does considers countries as competitors in the global export market.

Hidalgo *et al.* (2007) introduced the concept of the product space, upon which this paper is based. The product space is a useful tool for measuring a certain country's capability to produce and export a certain product. They reported that it is more probable to have a comparative advantage in terms of a certain product, as products similar to the product have a comparative advantage. Hausmann, Hwang, and Rodrik (2007) used the product space concept and empirically showed that what countries produce matters in terms of economic growth. Poncet and de Waldemar (2015) conducted a micro-data analysis of Chinese firms and reported that firms tend to export more products that are closely related to products having a comparative advantage. The key concept used in the main analyses of those papers is essentially a match to that used in this paper. I apply the concept of the product space to the dynamic competition among China, Japan, and Korea.

Youn (2013) and Choi (2014) also analyzed Korea's export products using the concept of the product space. Youn (2013) compared the degrees of export complexity among the United State, Japan, Korea, and China, while Choi (2014) studied the relationship between participation in global value chains and export complexity. I expect the present paper to add to the contributions to those papers in how it analyzes the interaction between the three countries in terms of export competitiveness in a dynamic setting.

There are papers about catching up in the export market that focus on particular industries, such as those of Lee and Lim (2001) and Mu and Lee (2005). The empirical analysis of export markets overall in this paper may complement those studies.

This paper is organized as follows. Section II presents the main framework of the empirical analysis. Section III examines Japan's dominance in the global export market in the 1990s, with emphasis on Korea's impact on Japan. Section IV, in the same vein, studies China's influence on Korea's dominance in the export market since 2000, and Section V concludes the paper.

II. The Main Framework of the Empirical Analysis

This paper uses the concept of the product space as developed by Hidalgo *et al.* (2007). In this section, I introduce this concept briefly and explain how it is applied in this study.

First, it is necessary to measure the comparative advantage of a certain item of a certain country. Following Balassa (1965), I define the revealed comparative advantage (RCA) of a country's item as the ratio of the share of the item in the country's exports to that in the world's exports. That is, the RCA of item i of country k is

$$RCA_i^k = \frac{x_i^k / \sum_j x_j^k}{x_i^{world} / \sum_j x_j^{world}},$$

where x_i^k is the export of item i from country k. If a country's RCA for an item is high, it indicates that the country exports the item relatively more than other countries, reflecting the country's comparative advantage. RCA can be rewritten as

$$RCA_i^k = \frac{x_i^k / x_i^{world}}{\sum_j x_j^k / \sum_j x_j^{world}}.$$

That is, a country's RCA for an item is the ratio of the country's dominance in the item's market to that in the total export market. Given that the revealed comparative advantage of an item reflects the dominance of the item, RCA also represents the country's export competitiveness for the item.

At this point, I explain the concept of the product space developed by Hidalgo *et al.* (2007). With the product space, we seek to measure the capability a certain country has to produce a certain item. To do this, we investigate whether the country has a comparative advantage in items that require similar capabilities to produce the original item. If this country has the capability to produce the item effectively, it will have a comparative advantage in the near future even if it does not have this initially. That is, with the product space, we can measure the potential that a certain country will have competitiveness with regards to a certain item. For an intuitive explanation of the product space, one can refer to Hidalgo and Hausmann (2008). Several previous studies, including Hidalgo *et al.* (2007) and Hausmann, Hwang, and Rodrik (2007) found that the product space is useful for

predicting specialization patterns and economic growth in the near future.

To construct the product space, we need to define the concept of the distance or proximity between two goods. In the product space, because we measure the export potential, proximity must refer to more than simple superficial similarity. If two items are similar in terms of the production potential, then when a country has a comparative advantage in one item, the country should also tend to have a comparative advantage in the other item. Using this concept, Hidalgo *et al.* (2007) defined proximity as the conditional probability that a country has a comparative advantage in one item given that the country has a comparative advantage in another item. That is, the proximity of items i and j is expressed as

$$\phi_{ij} = \min\{\Pr(RCAx_i \mid RCAx_j), \ \Pr(RCAx_j \mid RCAx_i)\},$$

where $RCAx_i$ represents the event that a country has a comparative advantage in item i. In practice, we calculate the conditional probability using its property of

$$\Pr(RCAx_i \mid RCAx_j) = \frac{\Pr(RCAx_i \cap RCAx_j)}{\Pr(RCAx_j)}.$$

The probabilities on the right-hand side are measured by the maximum likelihood estimation with the data of all countries available in a corresponding year. The proximity is common to all countries in a year, but it may evolve over time.

Following Hidalgo *et al.* (2007), I define the export potential index (or density) of a certain item from a certain country as the weighted average of the transformed comparative advantage indices, setting the levels of similarity as the weights,

(1)
$$w_i^k = \frac{\sum_j \phi_{ij} f(RCA_j^k)}{\sum_j \phi_{ij}},$$

where $f(\cdot)$ is a non-decreasing function. In this definition, the export potential index of an item is higher as items similar to the item tend to have higher comparative advantage indices. This is consistent with the definition of proximity, which increases in the probability that a country has comparative advantages in both items.

In Hidalgo *et al.* (2007), the numerator on the right-hand side of eq. (1) is set to the sum of proximity indices of items with a comparative advantage. That is, the export potential (density) in the paper is defined as

$$\tilde{w}_i^k = \frac{\sum_{\{j : RCA_j^k > 1\}} \phi_{ij}}{\sum_j \phi_{ij}}.$$

In other words, Hidalgo *et al.* (2007) set $f(RCA_j^k) = 1(RCA_j^k > 1)$, where $1(\cdot)$ is an indicator function. Note that RCA may take any non-negative number. In this paper, I use a different function, $f(\cdot)$, to gain more information from RCA. For example, we expect that the degrees of the competitiveness of items with RCA values of 0.99 and 1.01 are not very different. Moreover, an item with an RCA value of 0.99 is far more competitive than an item with an RCA value of 0.01. If there are a large number of items and their RCA values are spread widely, this restriction of the indicator function may not affect the export potential index much. In this paper, I do not rely on this assumption. In contrast with Hidalgo *et al.* (2007), where a discrete function was used, I define the export potential index using a smoothly increasing function.

Because RCA is the ratio of an item's share in a country's export basket to that in the world's export basket, it takes a value between zero and one for an item with a comparative disadvantage, whereas it is assigned a value greater than one for an item with a comparative advantage. Thus, the RCA value of an item with a comparative disadvantage is restricted to a far smaller range compared to an item with a comparative advantage. Thus, if the untransformed RCA is used, the export potential is then sensitive to items with comparative advantages. I introduce a transformation of RCA to adjust this property. To do this, the transformation function should be increasing more rapidly in the domain $(0,1)$ than in the domain $(1,\infty)$. In addition, a function is expected to reflect RCA better if it is a smooth function and its range is bounded. In sum, we need a function that is continuous, concave, and bounded. We consider the following function.

$$f(RCA_j^k) = 1 - \exp(-RCA_j^k).$$

This function is a continuously increasing concave function, and its range is between zero and one. There are, of course, numerous other functions that have identical properties. Nevertheless, in this paper, I adopt this function, which has the required characteristics.
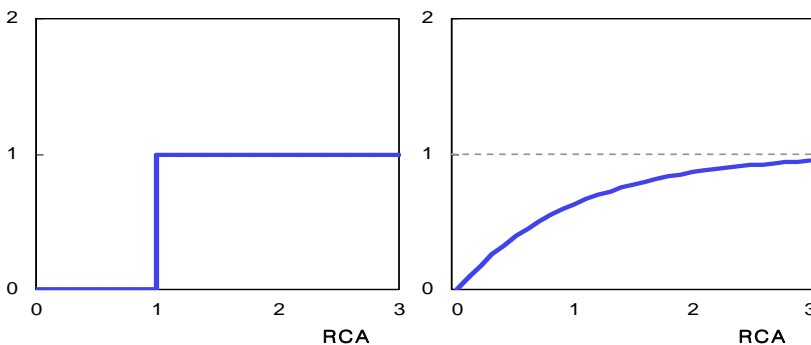

FIGURE 3. THE TRANSFORMATIONS OF RCA IN
THE DEFINITION OF THE EXPORT POTENTIAL INDEX

Note: The figure on the left shows the transformation of RCA in Hidalgo *et al.* (2007), and the figure on the right shows this for the transformation in this paper

Figure 3 compares the two transformations in Hidalgo *et al.* (2007) and this paper. The figure on the left shows the transformation used in Hidalgo *et al.* (2007), which has a discontinuity when RCA = 1. In contrast, the figure on the right shows the transformation used in this paper, which is continuous and strictly increasing. Although there is not a notable difference in the export potential indices between the two measures, the measure in this paper predicts future comparative advantages marginally better than that in Hidalgo *et al.* (2007).

At this point, I explain how the product space is applied to the dynamic catch-up relationship in this paper. If country A chases country B, then one may expect that country B's market share will gradually drop relatively further in items where country A's export potential is high. That is, the current export potential of country A will be negatively correlated with changes in country B's export market share in the future. I will test this hypothesis to analyze the evolution of Japan's and Korea's export market shares.

A. *Data Description*

In the empirical analysis, export data by country and item for each year are used. In this paper, items are classified according to the four-digit SITC (Standard International Trade Classification). Although HS (Harmonized System) is more commonly used than SITC, the latter reflects the processing stage better than the former. Hidalgo *et al.* (2007) also classified items according to the four-digit SITC. The data source is the UN Comtrade Database (retrieved on November 26, 2014). Data for Korea and Japan by item are available starting in 1988, while those of China are available starting in 1992. Thus, I used the data from 1992, as they cover the beginning of the period when Japan's exports declined. Note that to construct the product space, data from a sufficient number of countries are needed. When I collected the data for this paper, not enough countries reported detailed export data for 2013. If the data of 2013 are used, the product space for 2012 may be far different from that of 2013 because they would be constructed with very different sets of countries. Thus, the data from 1992 to 2012 are used. This paper studies not short-term cycles of exports but export trends; to clean certain idiosyncratic factors year by year, three-year average values are most commonly used in this paper. This implies that the empirical analysis in this paper ranges from 1993 (1992-1994 average) to 2011 (2010-2012 average).

B. *Export Potential and Comparative Advantage*

To show the usefulness of the export potential (density) and to explore the evolution of the revealed comparative advantage, Hidalgo *et al.* (2007) divided products into three categories. *Transition products* are those for which $RCA_{i,1990} < 0.5$ and $RCA_{i,1995} > 1$, and *undeveloped products* are those for which $RCA_{i,1990} < 0.5$ and $RCA_{i,1995} < 0.5$. The third category was *others*. Hidalgo *et al.* (2007) found that transition products tended to have a higher density than undeveloped products. In words, among products that a country did not export

actively ($RCA_{i,1990} < 0.5$), those with a higher density are more likely to be exported in five years with a comparative advantage ($RCA_{i,1995} > 1$).

Table 1 shows the relationship between the export potential and the revealed comparative advantage of each country. The correlation coefficients of the export potential in 2000 and the future revealed comparative advantage indices are all positive. First, the export potential and revealed comparative advantage for the same year (t=2000) are not perfectly correlated. The correlation coefficients are 0.6, indicating that they measure a different property of the economy. Second, the correlation tends to decrease as the time gap between the export potential and the revealed comparative advantage becomes wider. This occurs because the export potential itself evolves, making it difficult to predict the export composition of the very distant future with only the export potential of today.

Nevertheless, the export potential still contains information about future export market shares. Table 2 displays the simple regression results, showing that for items where Korea's export potential index was higher by one standard deviation in 2000 than the average, the market shares in 2006 are approximately 3.5($= e^{1.24}$) times higher than the average. While the market shares in 2011 are only 2.9 times higher than average, these values are nonetheless statistically significant.

Note that the correlation coefficients of Japan do not decrease much over time. This may be due to the relative stability of Japan's export structure. This pattern stands in contrast with those of China and Korea, whose export structures have been evolving relatively quickly.

TABLE 1—RELATIONSHIP BETWEEN THE EXPORT POTENTIAL AND
REVEALED COMPARATIVE ADVANTAGE

Correlation coefficients of the export potential in 2000 and the revealed comparative advantage for each year

Correlation coefficients	China	Korea	Japan
Revealed comparative advantage in 2000	0.62***	0.66***	0.66***
Revealed comparative advantage in 2006	0.50***	0.54***	0.66***
Revealed comparative advantage in 2011	0.37***	0.45***	0.60***

Note: *** Significant at the 1 percent level.
      ** Significant at the 5 percent level.
       * Significant at the 10 percent level.

TABLE 2—RELATIONSHIP BETWEEN KOREA'S EXPORT POTENTIAL AND
EXPORT MARKET SHARES

Regression model: $\ln marketshare_{it} = \beta_{0,t} + \beta_{1,t} exportpotential_{i,2000} + \epsilon_{it}$

Year of dependent variables	Regression coefficients $\beta_{1,t}$	t-statistics
t=2000	1.49***	(27.9)
t=2006	1.24***	(20.7)
t= 2011	1.05***	(16.3)

Note: *** Significant at the 1 percent level.
      ** Significant at the 5 percent level.
       * Significant at the 10 percent level.

III. Japan's Experience in the 1990s

This section analyzes Japan's dominance in the global export market in the 1990s based on neighbor countries catching up with Japan. As shown in Figure 1, Japan's dominance in the global export market started to decline in 1993. First, this paper looks at the composition of Japan's export basket and how it changed in the 1990s.

In the 1990s, Japan's exports were concentrated in the sector of machinery and transport equipment (SITC #7). Japan's export dominance in that sector was rapidly dwindling, however, in the 1990s. Japan's market share in the sector was 18.0% in 1992-1994; shrinking to 12.3% by the end of the 1990s. In contrast, the market shares in this sector of Korea and China increased from 2.6% and 1.1% to 3.4% and 2.6%, respectively, during the same period. This suggests the possibility that the latecomers ate into Japan's share of its key export markets.

Next, I examine the systematic relationship between Japan's market share and its competitors' export potential. If Korea or China caught up with Japan, it is expected that Japan's market shares would decline relatively more in the sectors where Korea's or China's export potential levels were high. The regression model is expressed as

$$\ln(RCA_{i,1999}^{JPN}) - \ln(RCA_{i,1993}^{JPN}) = \beta_0 + \beta_1 w_{i,1993}^{KOR} + \beta_2 w_{i,1993}^{CHN} + \beta_3 w_{i,1993}^{JPN} + \epsilon_i.$$
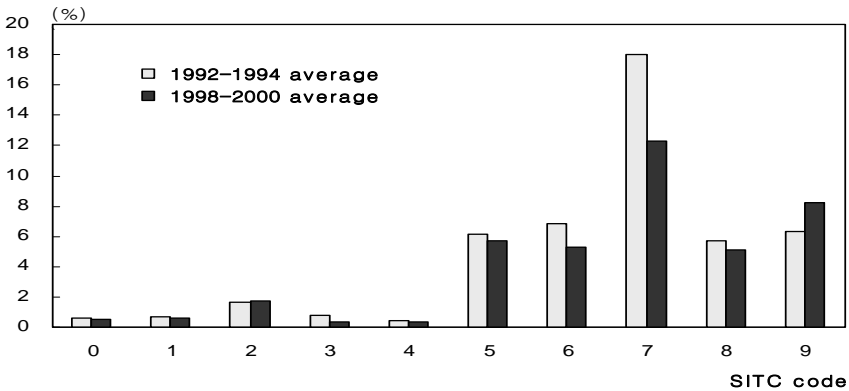

FIGURE 4. JAPAN'S EXPORT MARKET SHARE BY ITEM

Note: One-digit SITC descriptions are as follows.
  0: Food and live animals,
  1: Beverages and tobacco,
  2: Crude materials, inedible, except fuels,
  3: Mineral fuels, lubricants and related materials,
  4: Animal and vegetable oils, fats and waxes,
  5: Chemicals and related products, n.e.s.,
  6: Manufactured goods classified chiefly by material,
  7: Machinery and transport equipment,
  8: Miscellaneous manufactured articles,
  9: Commodities and transactions not classified elsewhere in the SITC.

Source: UN Comtrade Database

The dependent variable is the rates of change of Japan's comparative advantage index in the 1990s. The main independent variables are Korea's and China's export potential levels for the starting year of the measured period. Because Japan's own export potential may also affect the change in Japan's market share, I control for Japan's potential in the starting year of the measured period.

Note that the dependent variable is the log difference (growth rate) of the comparative advantage indices. Given that RCA is the ratio of a country's dominance in an item's market to that in the total export market, the dependent variable also indicates the growth rate of the item's export market share. We can see this from the following equations:

$$\ln(RCA_{i,1999}^{JPN}) - \ln(RCA_{i,1993}^{JPN}) = \ln\left(\frac{x_{i,1999}^{JPN} / x_{i,1999}^{WORLD}}{\sum_j x_{j,1999}^{JPN} / \sum_j x_{j,1999}^{WORLD}}\right) - \ln\left(\frac{x_{i,1993}^{JPN} / x_{i,1993}^{WORLD}}{\sum_j x_{j,1993}^{JPN} / \sum_j x_{j,1993}^{WORLD}}\right)$$

$$= \ln\left(\frac{x_{i,1999}^{JPN}}{x_{i,1999}^{WORLD}}\right) - \ln\left(\frac{x_{i,1993}^{JPN}}{x_{i,1993}^{WORLD}}\right) + \text{terms independent of } i.$$

I normalize the export potential such that the export potential of a certain country in a certain year has a mean of zero and variance of one. Note that such an affine transformation does not affect the t-statistics of the coefficient estimates. The interpretation of the regression coefficient is then straightforward. For an item of which Korea's export potential is higher by one standard deviation than the average export potential of Korea, the expected rates of change of Japan's export market share from 1993 to 1999 is higher by β_1 than the average rates of change of Japan's export market shares.

The empirical analysis shows that for items in which Korea showed high export potential levels, Japan's market share decreased. This finding indicates that a fall in Japan's market share of a certain item was contingent on the pace at which Korea caught up. In Table 3, a significantly negative regression coefficient for Korea's export potential indicates that Japan's market share has dropped comparatively

TABLE 3—IMPACT OF KOREA AND CHINA ON
JAPAN'S EXPORT MARKET SHARE IN THE 1990s

Dependent variable: rates of change of Japan's export market shares between 1993 and 1999

Independent variables	Regression coefficients	t-statistics
Korea's potential in 1993	-0.14**	(-2.32)
China's potential in 1993	0.00	(0.01)
Japan's potential in 1993	-0.01	(-0.33)
constant	-0.03	(-1.27)
Number of observations	1,031	
R-squared	0.03	

Note: *** Significant at the 1 percent level.
** Significant at the 5 percent level.
* Significant at the 10 percent level.

TABLE 4—IMPACT OF KOREA AND CHINA ON JAPAN'S EXPORT MARKET SHARE IN
THE 1990S WITH DIFFERENT TIME GAPS

Dependent variables:
(1) rates of change of Japan's export market shares between 1993 and 1999 (baseline)
(2) rates of change of Japan's export market shares between 1993 and 1998
(3) rates of change of Japan's export market shares between 1993 and 1997
(4) rates of change of Japan's export market shares between 1993 and 1996

Independent variables	Measured periods			
	(1) t=1993 to 1999	(2) t=1993 to 1998	(3) t=1993 to 1997	(4) t=1993 to 1996
Korea's potential in 1993	-0.14**	-0.12*	-0.11*	-0.04
	(-2.32)	(-1.96)	(-1.96)	(-1.02)
China's potential in 1993	0.00	0.00	0.03	-0.02
	(0.01)	(-0.01)	(0.40)	(-0.45)
Japan's potential in 1993	-0.01	-0.01	0.01	-0.01
	(-0.33)	(-0.18)	(0.27)	(-0.20)
Constant	-0.03	-0.05*	-0.05**	-0.02
	(-1.27)	(-1.85)	(-2.08)	(-1.20)
Number of observations	1,031	1,031	1,031	1,031
R-squared	0.03	0.02	0.01	0.01

Note: t-statistics are in parentheses.
        *** Significant at the 1 percent level.
         ** Significant at the 5 percent level.
          * Significant at the 10 percent level.

further in sectors where Korea's potential is high. In items where Korea's export potential index was higher by one standard deviation in 1993, the rates of change of Japan's market share dropped by nearly 14 percentage points more, meaning that Korea's impact on the changes in Japan's market share was significant. In contrast, when Korea's potential was controlled for, China's impact on Japan's export shares was statistically insignificant. This result does not necessarily imply that China's overall impact on Japan's export was negligible. Note that the analysis controls for countries' average export market shares across items. If a country's market shares for all items increased at the same rate, the analysis cannot capture this data. The regression results simply indicate that China did not have a significant impact on Japan's exports, particularly for items whose market shares dropped in the 1990s at a rate greater than the average. Because China's global export share increased from 2.4% to 3.4%, it is still possible that China caused the decline in Japan's overall export market share.

Of course, Korea's export potential alone may not explain most of the change in Japan's export market share for each item. The regression shows only the trend in the change pattern for Japan's export market composition in the 1990s. Because the regression includes only a few independent variables, it is also possible that omitted-variable bias exists. Note that the dependent variables are the relative changes in the market shares. Thus, it is less likely that the regression result depends on Japan's macroeconomic environment. However, it is still possible that countries other than Korea and China systematically affected Japan's export market shares. As presented previously, the US and Germany were the major exporters in the early 1990s. They may affect the export market competence levels of both Japan and Korea. To examine this, I also include the export potential of the US

and/or Germany as independent variables. The regression coefficients for these variables were statistically insignificant while regression coefficients of Korea's export potential were nearly identical to the baseline results.

In the empirical analysis in this section, I establish a six-year gap to cover the period from 1993 and 1999. I set the starting year as 1993, as Japan's export dominance started to decline in 1993 and China's data are available starting only in 1993. I set the ending year to 1999 to cover the 1990s. I found that a shorter time gap leads to a smaller regression coefficient for Korea's export potential, meaning that it takes time for latecomers to catch up. Table 4 shows the results with different time gaps. For the cases with the five-year and the four-year gaps, the coefficients of Korea's export potential are marginally insignificant at 5 percent with the p-values of 0.0507 and 0.0503, respectively, while with a three-year gap, the coefficient is insignificant at 10 percent.

IV. Korea's Export Competitiveness and China's Catch-up Actions

In this section, I examine Korea's export competitiveness of today through the lens of Japan's experience of the 1990s.

First, similar portfolios of export products were noted for Japan in the past and Korea recently. Figure 5 shows the export basket for Japan and Korea for these two respective eras. Both countries have particularly high market shares in the machinery and transport equipment sector (SITC #7). They have also relatively high shares in the chemicals and related products sector (#5) and in manufactured goods classified chiefly by materials (#6). Note that the market share of Japan in the machinery and transport equipment sector dropped rapidly in the 1990s. On the one hand, concerns arise that Korea's market shares may decline in key export markets, such as electrical and electronic products, ships, and iron and steel, due to latecomers which eventually catch up with Korea, similar to Japan in the 1990s. On the other hand, the similarity of the export portfolios may result from Korea's benchmarking Japan for a long time.

If Korea caught up with Japan in these sectors, latecomers may then also easily be able to catch up with Korea in the same sectors. Of course, it is difficult to determine whether Korea will follow Japan or not by merely comparing their export portfolios. To uncover a clue about Korea's export competitiveness in the future, I undertake the same empirical analysis used in the previous section.

At this stage, I analyze the impact of China's and Japan's export potential levels at a certain point in time on Korea's export market share after that point in time. The empirical method used here is identical to that in the analysis of Japan's export competitiveness. The regression model is expressed as

$$\ln(RCA_{i,t+6}^{KOR}) - \ln(RCA_{i,t}^{KOR}) = \beta_{0,t} + \beta_{1,t} w_{i,t}^{CHN} + \beta_{2,t} w_{i,t}^{JPN} + \beta_{3,t} w_{i,t}^{KOR} + \epsilon_{i,t}.$$

The dependent variable is the rate of change of each export-market share (or revealed comparative advantage index) of Korea. The main independent variables are the export potential indices of China and Japan at the beginning of the year of
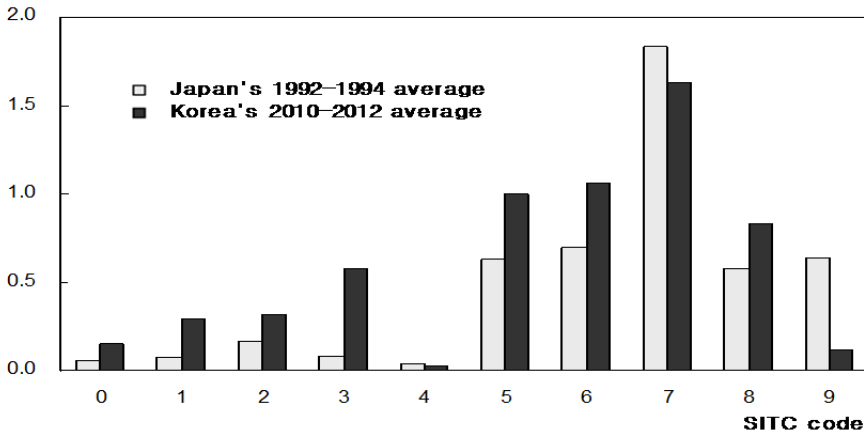
FIGURE 5. REVEALED COMPARATIVE ADVANTAGE OF JAPAN AND KOREA BY ITEM

Note: One-digit SITC descriptions are as follows.
   0: Food and live animals,
   1: Beverages and tobacco,
   2: Crude materials, inedible, except fuels,
   3: Mineral fuels, lubricants and related materials,
   4: Animal and vegetable oils, fats and waxes,
   5: Chemicals and related products, n.e.s.,
   6: Manufactured goods classified chiefly by material,
   7: Machinery and transport equipment,
   8: Miscellaneous manufactured articles,
   9: Commodities and transactions not classified elsewhere in the SITC.

Source: UN Comtrade Database

the measured period. As before, I control for Korea's export potential index and set the time gap to six years.

Table 5 shows the empirical results year by year. Until the early 2000s, the regression coefficient of China's potential remained insignificant, meaning that there were no noticeable inclinations at that time between the rates of change in Korea's market shares and China's export potential. However, as the coefficient decreased gradually to show a statistically significant negative correlation in the mid-2000s, Korea's market shares started to decrease comparatively in the sectors where China's export potential levels were high. For items where China's export potential index was higher by one standard deviation in 2005, the rate of change of Korea's market share dropped by nearly 21 percentage points more in 2011. Note that China's negative regression coefficient of its export potential is gradually rising. This implies that the impact of its catching up with Korea on Korea's market share is growing.

The coefficients of Korea's export potential, which is a control variable, are all negative and statistically significant. Recall that Korea's export potential was positively correlated with Korea's current and future market shares and that the correlation with current market shares is higher than that with future market shares. These findings imply that Korea's export potential is negatively correlated with the future rates of change of its market shares. I set the future rate of change of the market shares as the dependent variable instead of the future market shares because market shares are persistent. If future market shares were set as a dependent

TABLE 5—IMPACT OF CHINA AND JAPAN ON
KOREA'S EXPORT MARKET SHARE IN THE 2000S

Dependent variable: rates of change of Korea's export market shares between t and t+6

Independent variables	Measured periods					
	t=2000 to 2006	t=2001 to 2007	t=2002 to 2008	t=2003 to 2009	t=2004 to 2010	t=2005 to 2011
China's potential in t	**0.13***	**0.01**	**-0.01**	**-0.11**	**-0.16****	**-0.21*****
	(1.66)	(0.19)	(-0.10)	(-1.34)	(-2.21)	(-3.09)
Japan's potential in t	**0.46*****	**0.38*****	**0.38*****	**0.35*****	**0.33*****	**0.27*****
	(6.66)	(5.14)	(4.39)	(3.88)	(3.50)	(2.75)
Korea's potential in t	-0.49***	-0.45***	-0.47***	-0.42***	-0.40***	-0.33***
	(-6.40)	(-5.70)	(-5.41)	(-4.53)	(-4.01)	(-3.17)
constant	-0.18***	-0.19***	-0.22***	-0.14***	-0.09***	-0.04
	(-4.85)	(-5.31)	(-5.73)	(-3.79)	(-2.45)	(-1.04)
Number of observations	1,031	1,031	1,031	1,031	1,031	1,031
R-squared	0.12	0.13	0.11	0.12	0.12	0.11

Note: t-statistics are in parentheses.
        *** Significant at the 1 percent level.
        ** Significant at the 5 percent level.
        * Significant at the 10 percent level.

variable, the regression result may mislead us in that a low market share of an item may not be caused by the impacts of other countries but by Korea's poor performance with regard to the item in question in the past. That is, by constructing the regression model, it is likely that the coefficient of Korea's potential is negative. Hence, the interpretation of the coefficient of Korea's export potential should be cautious, and one should not give weight to it. In the regression analysis of Japan's market shares, the coefficient of Japan's potential is statistically insignificant. As shown in Section II, the correlation of Japan's export potential and future market shares does not decrease over time, which implies that Japan's export potential may not be significantly correlated with future changes in market shares. The main difference between Korea and Japan is likely that Japan's export structure is more stable than Korea's.

To address this issue, I set future market shares as a dependent variable and Korea's current market shares and export potential as control variables. The qualitative results are virtually identical to the baseline.

These results are consistent with those of Amiti and Freund (2010). Their paper analyzed the evolution of China's export structure, finding that machinery and transport equipment (SITC #7) grew most strongly and that within the category telecoms (SITC #76), electrical machinery (SITC #77), and office machines (SITC #75) experienced the fastest growth. These were Korea's key export sectors in the early 2000s. While Korea has maintained its market share in electrical machinery, Korea's market shares in telecoms and office machines have been dropping, while China's market shares in these areas have been increasing to high levels. China's comparative advantage indices for these sectors in 2012 are 3.1 (SITC #75), 2.5 (SITC #76), and 1.5 (SITC #77). Thus, the results in Amiti and Freund (2010) partly support the claim of this paper.

Determining with regard to China which sectors have been catching up with Korea is important. If China has affected Korea's market shares in sectors where Korea does not have a comparative advantage, Korea may not need to worry much.
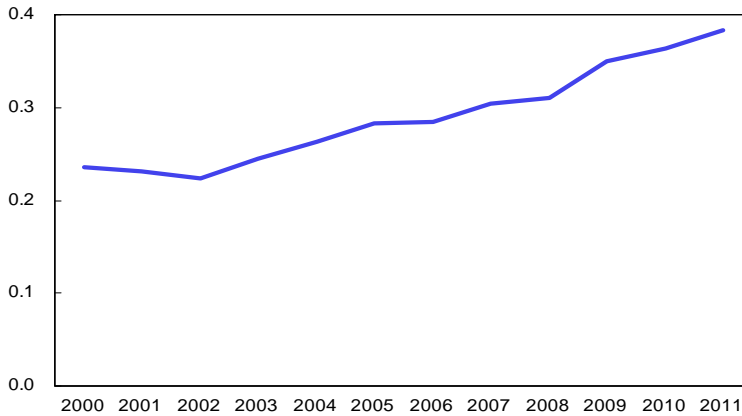
FIGURE 6. THE CORRELATION OF
KOREA'S REVEALED COMPARATIVE ADVANTAGE AND
CHINA'S EXPORT POTENTIAL INDICES

Note: For each year, we calculate the simple correlation coefficient of Korea's
RCA and China's export potential indices across products.

In contrast, if China has been chasing Korea in Korea's key export markets, this would represent a critical problem that Korea should address.

China's potential continues to grow in items where Korea has a high export market share. This implies that there may be a considerable burden on Korea to sustain its export competitiveness in key export items in the future. Figure 6 shows that the correlation coefficient between Korea's comparative advantage index and China's export potential index has gradually widened since 2003, indicating China's intensifying catch-up efforts with Korea in items where Korea's market share is large. If this trend continues, it is highly likely that, much like Japan in the 1990s, Korea could experience a decrease in its market dominance in key export items due to the increasing competition from latecomers, including China.

V. Concluding Remarks

This paper found that Korea faces a similar predicament to Japan in the early 1990s, when its long-term slump in exports began, in terms of the composition of export items and the catching up of latecomers. Korea's export product composition in recent times has been mainly composed of machinery and transport equipment, showing characteristics similar to those of Japan in the early 1990s. Moreover, Japan's falling export market shares of its key products in the 1990s, partially driven by the catch-up efforts of latecomers, have been echoed in Korea since 2010.

The empirical analysis shows that in items where China's export potential was high, Korea's market dominance has posted a relative decline since 2010, with the tendency growing much larger. China's export potential continues to expand in markets for Korea's key export products, making it difficult to rule out the possibility that Korea's competitiveness in key export products will be hindered.

To respond to these challenges, it is important for Korea continuously to foster and enhance creative and core capabilities that latecomers will not easily be able to emulate. Due to the catching up of latecomers, Japan's overall export market dominance has weakened, but its relative strength has been sustained in sectors that require sophisticated technology. Sectors where Japan's export market dominance has been maintained are those that require (relatively) highly advanced technology. Examples include specialized machinery for particular industries (SITC #72), metalworking machinery (SITC #73), road vehicles (SITC #78), photographic apparatuses, and equipment and supplies and optical goods, n.e.s.; watches and clocks (SITC #88). Rather than merely emulating this strategy and catching up, Korea now needs to take the lead in technological development and strengthen its own unique competitiveness, differentiated from that of latecomers.

Furthermore, based on the recognition that the rapidly changing environment has left Korea with no other alternative but to change its industrial structure, it should formulate an economic platform that can respond to this challenge in a flexible and efficient manner. If the Korean economy fails promptly to shift its limited production resources, such as labor and capital, from industries that have a comparative disadvantage to those that have a comparative advantage, it could lead to a decline in productivity overall and hence cause a reduction in Korea's competitiveness in export markets.

The results of this paper should be interpreted cautiously. There are, of course, numerous factors that affect the competitiveness of a country in the global export market. This paper focused only on neighbor countries catching up and did not rule out other important factors such as changes in the demographic structure, labor market rigidity, inefficient resource allocation, and mismanaged macroeconomic policies. To grasp precisely whether Korea can maintain its competitiveness in the export market in the future, more comprehensive studies are needed. In addition, this paper did not explain why a country caught up with a particular country at a specific time. The analysis with cross-country panel data may help us resolve this issue. Another issue that this paper did not address is overseas production. Indeed, it is said that Japan expanded overseas productions tremendously in the 1990s. The decline of Japan's export market share due to overseas production may not reflect the weakened competitiveness of Japanese firms. Thus, it may be a factor of the estimation bias that this paper did not consider the foreign direct investment and international fragmentation of production by multinational firms.

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