

# Characteristics of Korea's Industrial Structure through the Structural Change Index

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## 1. Preface

The industrial structure is constantly evolving due to supply-side factors such as technological advancement, the labor force, capital accumulation, and international competition as well as demand-side factors such as changes in consumer needs due to increased income levels, and industrial policy factors that complement these two factors.

In general, in a more energetic and dynamic economy, it can be expected that the industrial structure will change rapidly as the entry and exit as well as growth and extinction of enterprises that constitute each industry become more frequent. If domestic resources are reallocated from a relatively low-productivity sector to a high-productivity sector through smooth industrial restructuring, the overall productivity of the economy will increase and the growth rate will also rise. On the other hand, if resource-

es cannot efficiently move from a low-productivity sector to a high-productivity sector due to the rigidity of the factor market or political and social resistance, the efficiency of the economy as a whole is likely to decrease and growth is also likely to stagnate.

There has been much debate about the relationship between changes in the industrial structure and economic growth. Research appears to show a close correlation between the two.<sup>1</sup> However, the paths that define the relationship between the two are very diverse, and the direction of causality is not clear.

As the absolute scale of the Korean economy has rapidly expanded over the past few decades, its industrial structure has also changed at a very rapid pace. However, as growth has stagnated and corporate restructuring delayed in recent years, the pace of change in the industrial structure is slowing down noticeably.

Hereinafter, we will first look at how Korea's

1 Aiginger, K. (2001), "Speed of Change and Growth of Manufacturing". In M. Peneder, K. Aiginger, G. Hutschenreiter and M. Martnerbauer, *Structural Change and Economic Growth*, WIFO, study commissioned by the Ministry of Economics and Labour: Vienna.  
Peneder, M. (2003), "Industrial Structure and Aggregate Growth", *Structural Change and Economic Dynamics*, 14 (2003), pp. 427-448.

industrial structure has changed since 1970, and then examine how the speed and direction of structural change differ from major advanced countries and the implications that such findings carry.

## 2. Changes in Value Added Share by Industrial Sector

First, let us look at how the share of each sector of Korean industry has changed during the period from 1970 to 2020. The share of manufacturing in terms of value added (nominal basis) rose from 19 percent in 1970 to 30.5 percent in 1988, but has since declined slightly and has (until recently) remained flat. The share of manufacturing temporarily reached a record high of 30.9 percent in 2011, but has since fallen to 27.2 percent as of 2020 following a modest decline and rebound.

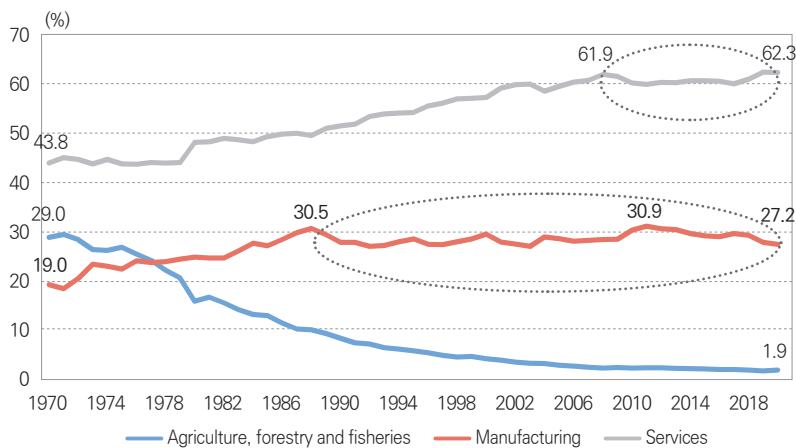
The share of the service sector rose almost

continuously from 43.8 percent in 1970 to 61.9 percent in 2008 before stagnating; it has since slightly increased to nearly 62.3 percent in 2019 and 2020. On the other hand, the share of agriculture, forestry and fisheries decreased from 19 percent in 1970 to 1.9 percent in 2020, falling consistently over the entire period.

The fact that the value added share of manufacturing and services in Korean industry has not changed significantly can be confirmed by comparison with the G7 countries. See Figures 2 and 3.

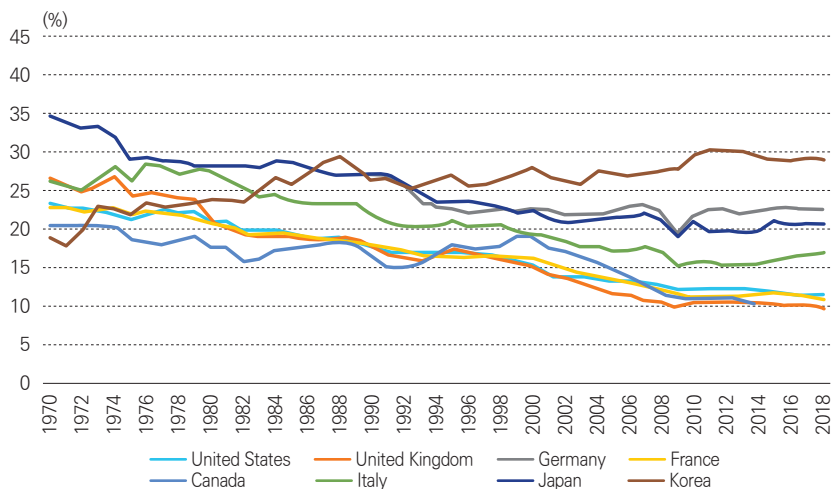
The value added share of Korean manufacturing (29.1 percent in 2018) is significantly higher than that of G7 countries including Germany (22.7 percent) and Japan (20.8 percent), both of which are manufacturing powerhouses. But the share of the service sector in the Korean economy (60.9 percent in 2018) remains at a significantly lower level than in G7 countries, in which services accounts for close to 70 to 80 percent

Figure 1. Trends in Shares of Value Added by Sector in Korean Industry



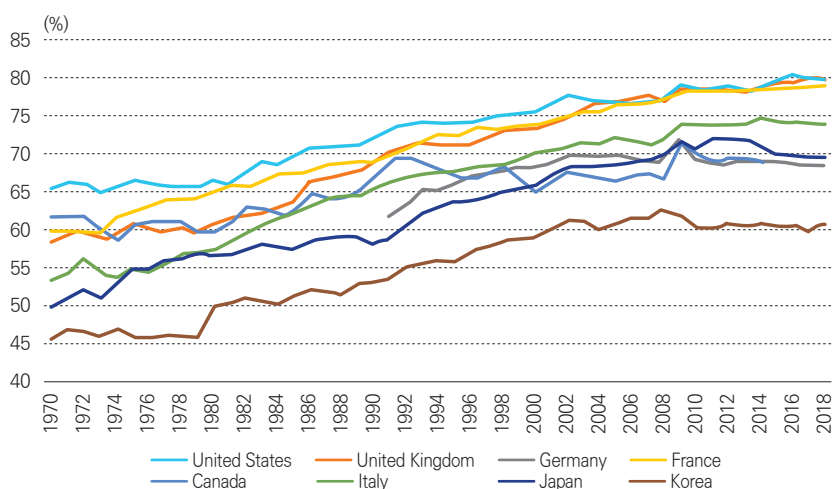
Source: Bank of Korea, *Economic Statistics System (ECOS)*.

**Figure 2. Trends in Shares of Value Added in G7 Countries and Korea: Manufacturing**



Source: OECD, *STAN Database (2020 ed.)*.

**Figure 3. Trends in Shares of Value Added in G7 Countries and Korea: Services**



Source: OECD, *STAN Database (2020 ed.)*.

of value added.

Unlike the share of manufacturing in Korea, which has maintained a stable level since the 1990s, the share of manufacturing in the G7 countries, with the exception of Germany and Japan, which has been moving sideways since the 2000s, exhibited a downward trend until

just before the global financial crisis. The share of manufacturing in the United Kingdom in particular fell from 26.8 percent in 1970 to 9.9 percent in 2018, the steepest decline among developed countries, and the share of manufacturing in the United States was nearly halved, from 23.5 percent to 11.7 percent during the

same period.

However, in the process of overcoming the financial crisis, countries have come to recognize the importance of the manufacturing industry and have implemented manufacturing promotion policies competitively. As a result, the share of manufacturing in the G7 countries has been generally stable in the 2010s.

On the other hand, while the service sector's share of value added in Korea has remained stagnant since the 2000s, services have come to account for an ever-growing share of value-added in G7 countries over the relevant period, excepting only for Canada since the 1990s and manufacturing stalwarts Germany and Japan since 2010s.

### 3. Trends in Structural Change Index of Korean Industry

Next, in order to determine the degree of structural change in industry in more detail, the

magnitude of structural change will be indexed and examined.

There are several ways to index structural change, but in this study, the magnitude of structural change in Korean industry is calculated using the Structural Change Index (SCI), which is a slightly modified version of the Michael-Stoikov Index.<sup>2,3</sup>

SCI ( $\sigma$ ) does not necessarily reflect innovation in the usual sense, as it fluctuates even with the decline of a specific industry or the exit of a company within an industry. Rather, since this index reflects all changes in the industrial structure, including contraction, it is reasonable to view it as an indicator of the vitality or dynamism of the economy as a whole.

Figure 4 shows SCI trends in Korean industry calculated using the value-added share (nominal basis) of twenty-eight sectors (including thirteen manufacturing and eleven service sectors) for the period from 1970 to 2020.<sup>4</sup>

SCI figures are generally higher in the 1970s

2 In this study, the Structural Change Index is defined as follows.

$$\text{Structural Change Index } (\sigma) = 0.5 \times \frac{\sum_{i=1}^n |w_i^{t2} - w_i^{t1}|}{T} \quad (\text{Equation 1})$$

Here,  $w_i^t$  is the proportion of industry  $i$  to the total value added in the year  $t$ ,  $T$  is the period from  $t1$  to  $t2$  (number of years), and  $n$  is the number of industries. Therefore, the second part on the right side of the above formula shows the average size of the structural change in one year by dividing the absolute amount of change of the industrial structure between  $t1$  and  $t2$  into period  $T$  (number of years). However, since all changes here in the share are calculated twice, it is finally standardized by multiplying by 0.5 so that the maximum value of the change becomes 1.

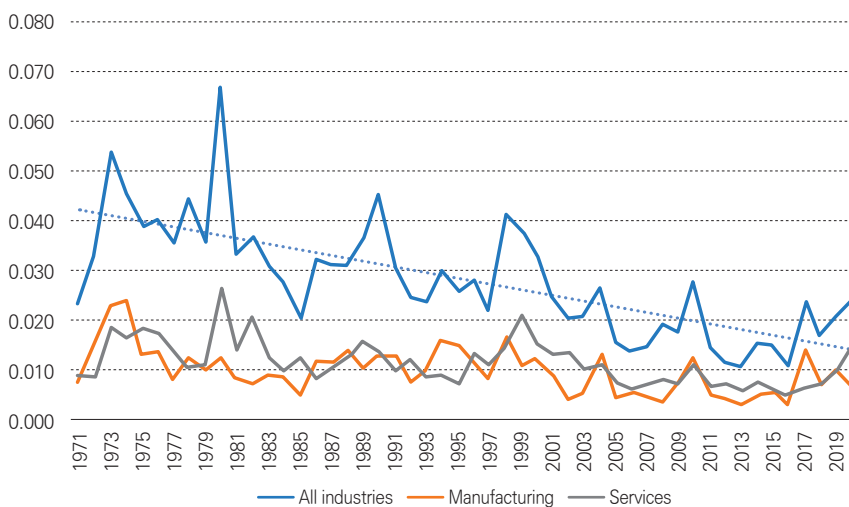
3 In this study, the term *structural change index* was used for convenience. As a similar concept, Young (1992) and Wölfl (2005) used the terms *rate of structural transformation* and *speed of structural change*, respectively. Also Lee (1993) analyzed the restructuring trend in Korean industry for the period from 1974 to 1988 using a similar indicator named the Industrial Adjustment Index.

Young, A. (1992), "A Tale of Two Cities: Factor Accumulation and Technical Change in Hong Kong and Singapore", O.J. Blanchard and S. Fischer (eds.), *NBER Macroeconomics Annual 1992*, MIT Press, Cambridge, Massachusetts.

Wölfl, A. (2005), *The Service Economy in OECD Countries*, STI Working Paper 2005/3, OECD, Paris.

Kyungtae Lee (1993), *Characteristics of Korea's Industrial Structure through International Comparison* (in Korean), Research Report No.290, Korea Institute for Industrial Economics & Trade.

**Figure 4. Trends in Structural Change Index of Korean Industry**



Source: Bank of Korea, *Economic Statistics System (ECOS)*.

and 1980s than in the subsequent periods, because active restructuring was carried out centering on the manufacturing industry during the rapid initial industrialization process. The volatility of the index greatly increased during internal and external crises or industrial restructuring process such as the two oil shocks of the 1970s, the financial crisis of the late 1990s, the bursting of the dotcom bubble and the global financial crisis of the 2000s. In addition, the fluctuation range of the structural change index gradually decreases over time, which is thought to be due to the fact that as the economy matures, its ability to absorb the effects of external

shocks improves and the speed at which it recovers from shocks picks up.

Figure 5 shows the SCI (annual average) for each period calculated by dividing the entire period by about 10 years.<sup>5</sup>

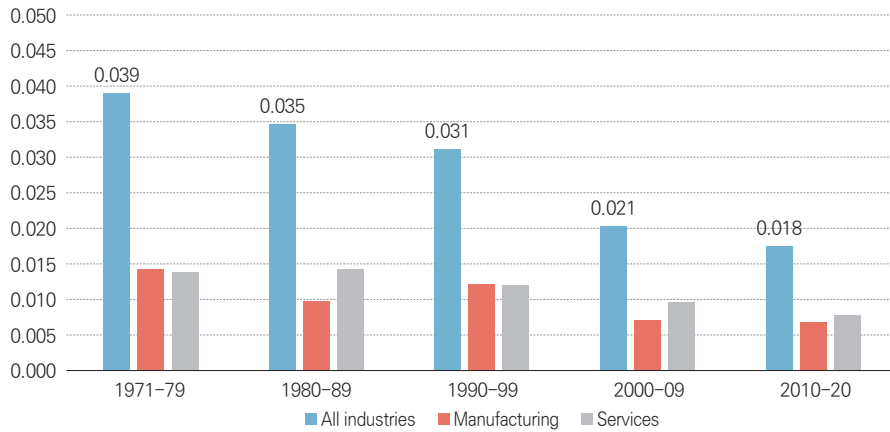
Comparing SCI by period, it can be seen that the speed of structural change in Korean industry has been steadily slowing; by the 2010s, it was less than half of what it was in the 1970s. Manufacturing SCI entered a downward trend after the 2000s and services SCI did so after the 1990s. The index value of the former was similar to or slightly smaller than that of the latter.

The decrease in the average value of the

4 Since the value of the Structural Change Index varies depending on the level of industry classification, in this study the same level of industry classification (twenty-eight sectors) was used in calculating the structural change index not only for Korean industry but also for industries in major advanced countries, which will be introduced later.

5 Since SCI for each period calculated by (Equation 1) largely depends on the shares of the comparative year and the base year, a problem emerges: it cannot properly reflect the structural changes in other years included in the period. Therefore, we defined SCI by period as a simple average of the annual structural change indices.

**Figure 5. Structural Change Index of Korean Industry by Period**



Source: Bank of Korea, *Economic Statistics System (ECOS)*.  
 Note: Simple average of annual structural change indices.

structural change index is thought to be related to the fact that Korea's economic growth rate has been declining gradually as a period of rapid growth centered on the manufacturing industry came to an end and Korea entered a period of stability following the 1990s.

In particular, it seems that a combination of factors including a decline in corporate vitality due to market regulations (such as high entry barriers), the delayed exit of marginal firms, a low birth rate and accelerated aging of the population weighed significantly on productivity growth and has retarded the pace of structural change. The coefficient of correlation between the GDP growth rate and SCI calculated for the period from 1971 to 2020 was 0.77, indicating that there is a relatively high positive correlation between the two.<sup>6</sup>

#### 4. International Comparison of the Structural Change Index

Comparing SCI between G7 and Korean industries, the average level of structural change in all industries since the 1990s is highest in Korea, followed by Canada, the United Kingdom, Japan and Germany. See Figure 6.

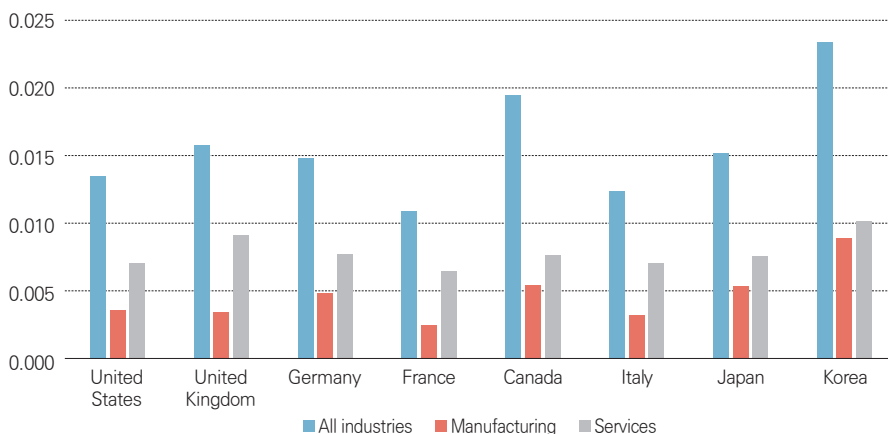
The SCI of the manufacturing sector is also highest in Korea, followed by Canada, and lowest in France. Service sector SCI is relatively high in Korea and the United Kingdom, while the rest of the countries show similar levels.

In order to see the characteristics of structural change in each country in more detail, Figure 7 compares SCI trends in the G7 countries and Korean industries from the early 1990s to the present.

The SCI of each country was greatly affected

<sup>6</sup> The years 1980, 1998, and 2020, during which negative economic growth rates were recorded, were excluded from the calculation of the correlation coefficient.

**Figure 6. Sectoral Comparison of Structural Change Index between G7 Countries and Korea**



Source: OECD, *STAN Database (2020 ed.)*.

Note: 1) Simple average of annual SCI for the period from 1990 to 2018.

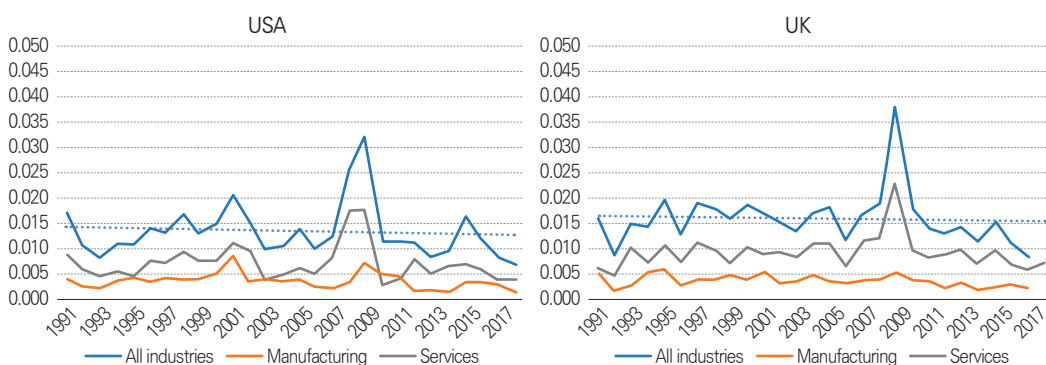
2) UK (1991 to 2017), Germany (1992 to 2017), Canada (1990 to 2014), Italy (1993 to 2018), Japan (1991 to 2017).

by the collapse of the IT bubble in the early 2000s and the global financial crisis of 2008. However, in case of Korea, the impact of the financial crisis in the late 1990s is prominent in addition to these factors. On average, the SCI of Korean industry maintained very high levels until the 1990s, but continued to decline thereafter and had fallen to a level similar to the G7 countries by the late 2010s. In both the G7 countries and Korea, service sector SCI scores were high-

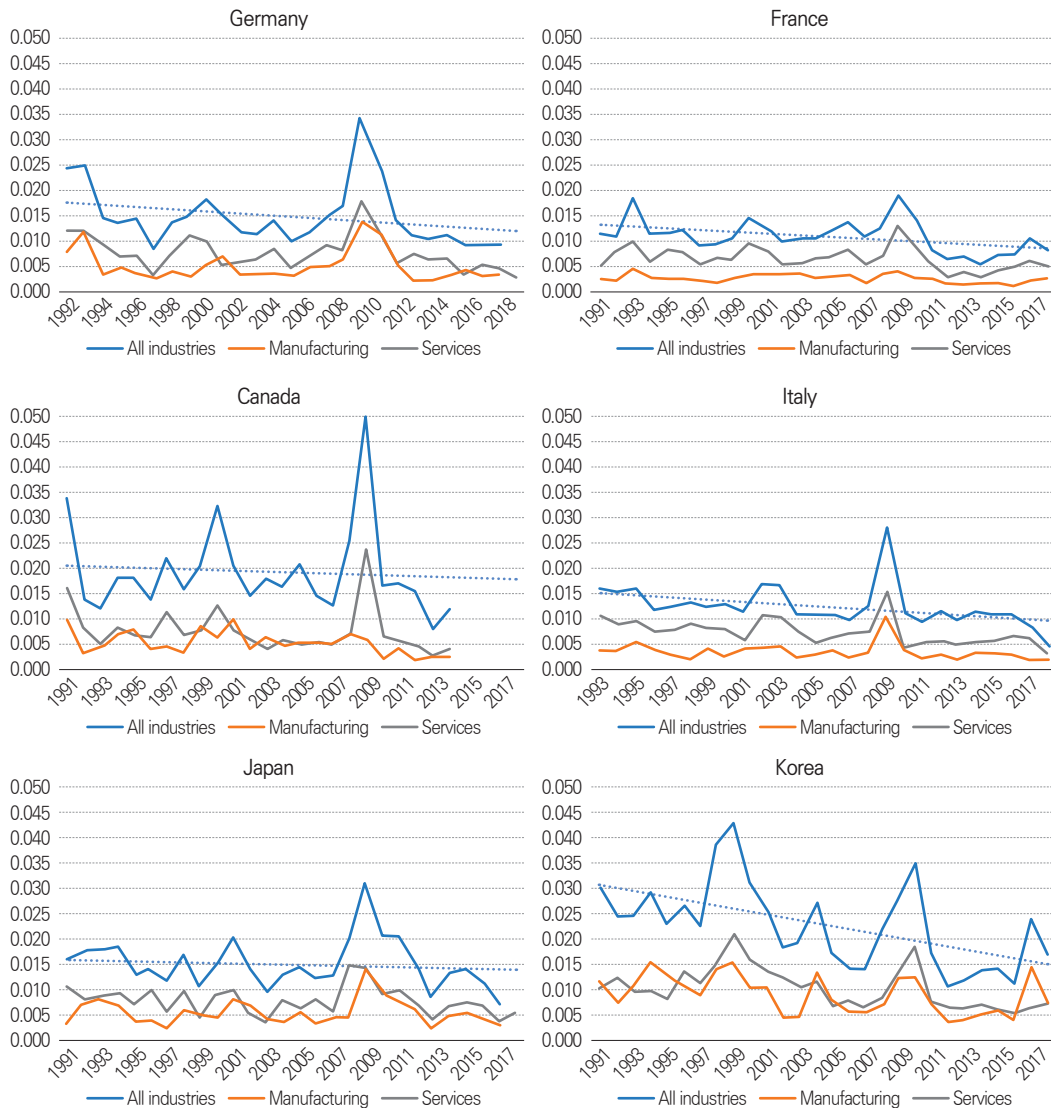
er than SCI scores of the manufacturing sector and the range of fluctuation is generally large.

SCI in Germany, France, Italy, and Korea fluctuated from time to time depending on internal and external factors, showing a tendency to decrease gradually. The decline in SCI appears to be the steepest in Korea. On the other hand, SCI scores for of the United States, the United Kingdom, Canada, and Japan remained at stable levels despite rapid fluctuations in some periods.

**Figure 7. Sectoral Trends in Structural Change Index of G7 Countries and Korea**



(Continue)



Source: OECD, *STAN Database (2020 ed.)*.

## 5. Types of Structural Change in Korean Manufacturing Industry

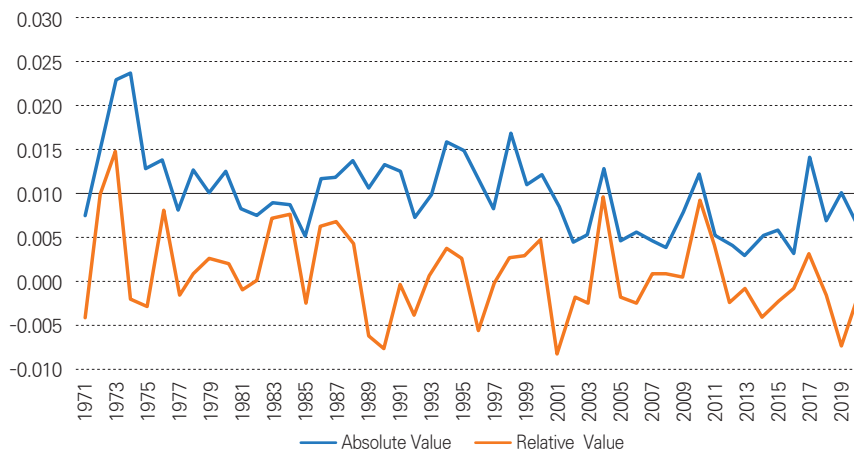
Since the Structural Change Index discussed above is an absolute value of the change in value added by industry, it is helpful in measuring the magnitude of structural change, but has limitations in identifying the direction of struc-

tural change.

For example, even in the case of negative restructuring, in which the shares of most industries decrease due to an overall slowdown of production activity in the manufacturing sector, SCI expressed as an absolute value will appear large. Therefore, in order to see the magnitude and direction of structural change



**Figure 8. Trends in the Structural Change Index of the Korean Manufacturing Industry: Absolute vs. Relative**



Source: OECD, *STAN Database (2020 ed.)*.

together, SCI expressed not only as an absolute value but also as a relative value<sup>7</sup> needs to be compared simultaneously.

Figure 8 shows SCI of the Korean manufacturing industry for the period from 1970 to 2020, divided into absolute and relative values.

The relative value of SCI in manufacturing generally remained positive by the end of the 1980s, with the exception of periods immediately following the two oil-shocks and in 1985, in which exports precipitously declined. This means that manufacturing sectors in which shares have increased have surpassed manufacturing sectors in which shares have decreased. Therefore, it can be said that the changes in Korea’s industrial structure followed the trend of manufacturing expansion until the 1980s.

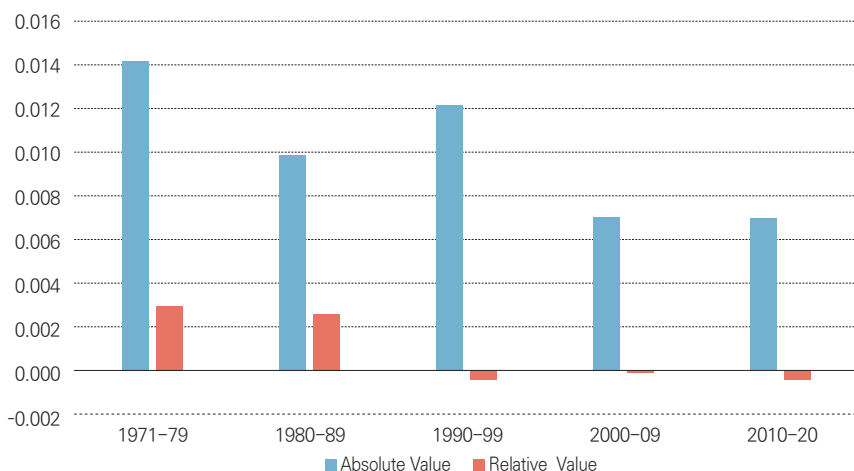
After the 1990s, the relative value of SCI tem-

porarily fluctuated due to external factors such as the collapse of the IT bubble and the global financial crisis, but on average, it hovered close to zero. See Figure 9. Taken as a whole, this period can be seen as one characterized by continual restructuring, as various sectors expanded and shrank within the manufacturing industry, even as the manufacturing industry maintained a relatively stable share of total value added.

Structural change based on absolute and relative SCI values can be categorized into four different types: manufacturing expansion, manufacturing contraction, structural adjustment and structural stagnation. With these types in mind, we can see that the direction of structural change in the Korean manufacturing sector up to the 1980s was of the manufacturing expansion type. Afterwards, structural change in man-

7 The relative value of the structural change index was calculated using the formula excluding the absolute value symbol in (Equation 1) in footnote 2.

**Figure 9. Structural Change Index of Korean Manufacturing Industry by Period: Absolute vs. Relative**



Source: OECD, *STAN Database (2020 ed.)*.

Note: The simple average of annual structural change indices.

ufacturing more closely resembled the structural adjustment type.<sup>8</sup>

## 6. Relationship between Changes in the Industrial Structure and Economic Growth

To confirm the relationship between the pace of change in the industrial structure and the economic growth rate once again, we examined the relationship between structural change in-

indices and annual real GDP growth rates of thirty OECD member countries for the period from 2000 to 2018. See Figure 10.

The result shows that SCI and the economic growth rate are not only positively correlated but also have considerable explanatory power. This confirms once again the validity of the previous argument: economies with a faster rate of change in their industrial structure tend to have higher economic growth rates.

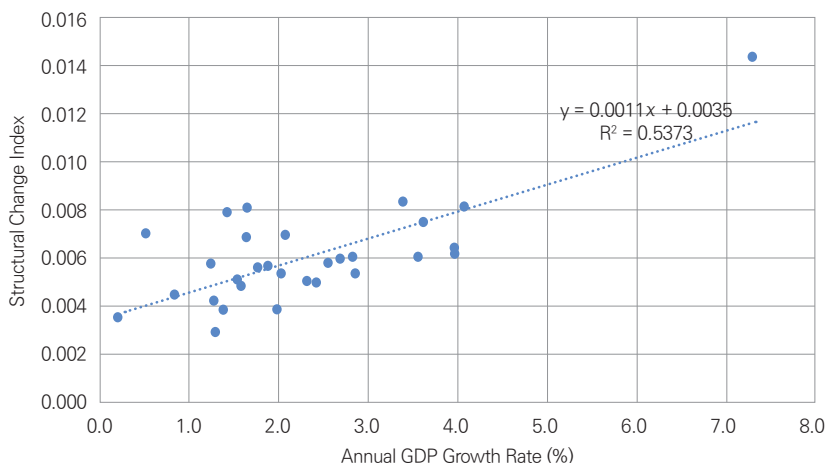
However, some main factors determining the

8 Lee (1993) defined the industrial adjustment index — a concept similar to the Structural Change Index of this study — and classified industrial adjustment into four types, as follows:

- a. a case in which both the absolute and the relative values are positive and where the number of sectors whose shares have increased is larger than that of the sectors whose shares have decreased (manufacturing expansion type)
- b. a case in which the absolute value is positive and the relative value is negative and where the number of sectors whose shares have decreased is larger than that of sectors whose shares have increased (manufacturing contraction type)
- c. a case in which the absolute value is positive and the relative value is close to zero, production resources in the manufacturing move smoothly from declining sectors to growing sectors and restructuring between sectors proceeds smoothly (industrial adjustment type)
- d. a case in which both the absolute and relative values are close to zero and where the share of each sector does not change much (structural stagnation type)

See Kyungtae Lee (1993), pp. 50-53.

**Figure 10. Relationship between the Structural Change Index and the Economic Growth Rate (2000 to 2018)**



Source: OECD, *STAN Database (2020 ed.)* & *Annual National Accounts*.

Note: 1) For the thirty OECD member countries for which statistics are available.

2) Germany, Japan, Latvia, Lithuania, Luxembourg, Norway, Portugal, Switzerland, UK (2000 to 2017), Australia (2006 to 2017), Canada (2000 to 2014), Israel (2011 to 2016), New Zealand (2005 to 2018), Turkey (2009 to 2015).

bilateral relationship — especially the direction of causality between two variables — are not clear. If a change in the industrial structure is accompanied by the movement of resources to an industry with a high productivity growth rate, it has the effect of increasing the economic growth rate, whereas improvement in income levels owing to the high economic growth rate promotes changes in the industrial structure through an increase in final demand.

## 7. Policy Implications

The decline in the speed of structural change in the Korean industry can be seen as a general

phenomenon that occurs as an economy matures, but it is basically a reflection of inefficient reallocation of resources among sectors due to various structural problems inherent in the Korean economy.

Therefore, it is highly likely that this will eventually lower the vitality of industry as a whole and negatively affect the economic growth rate. The potential growth rate of the Korean economy has been steadily declining in recent years.<sup>9</sup> This may be related to the fact that the pace of structural change in Korean industry is slowing down.

In order to increase the efficiency of resource allocation and boost the vitality of industries and companies, first of all, it is urgent to fa-

<sup>9</sup> According to the Bank of Korea, the average annual potential growth rate of the Korean economy exhibits a downward trend, from between 5 and 5.2% in the early 2000s to between 2.7 and 2.8% in the late 2010s.

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cilitate the rapid restructuring of insolvent or failing companies as well as develop and implement diversified policy efforts to raise industrywide productivity. Delayed corporate restructuring (and consequently, an increase in the number of insolvent companies) has been pointed out as one of the main reasons for sluggish growth and low productivity in the Korean economy. Moreover, as the number of companies whose financial soundness has further deteriorated due to decreasing sales and profits during the COVID-19 pandemic has increased significantly, demand for restructuring is expected to greatly expand in the near future.

For the rapid restructuring of insolvent companies, it is necessary to establish a market-oriented permanent and ex-post restructuring system by supplementing the Corporate Restructuring Promotion Act, which is in temporary force until 2023, having been reintroduced several times.

In addition, the function and the role of the Corporate Revitalization Act as an industrial policy tool for preemptive and autonomous restructuring of companies that are not yet insolvent but intend to reorganize their businesses to

resolve oversupply, enter new industries, or recover vitality in areas of industrial crisis should be further expanded. In particular, it is necessary to expand the industry diagnosis system, which can quickly identify the degree of insolvency of industries and companies and diagnose their competitiveness, and use the system for the formulation of preemptive restructuring strategies of companies or the establishment of government restructuring policies.

In order to improve productivity across industry, it is necessary to overcome the limitations of material input through expanding human capital, increasing investment in intangible assets, deregulating industrial and technology convergence, the removal of barriers to entry, and the acceleration of digital transformation.

In particular, in order to improve the low productivity of the service industry, which remains at half the level of the manufacturing industry, there is a need to actively attract domestic and foreign investment through the abolition of discriminatory regulations, while enhancing overall technological competitiveness and promoting innovation through the activation of R&D investment and the enhancement of IT utilization.

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