



Characteristics of Employment in the Manufacturing Industry and a Review of Job Creating Subsectors

| Summary |

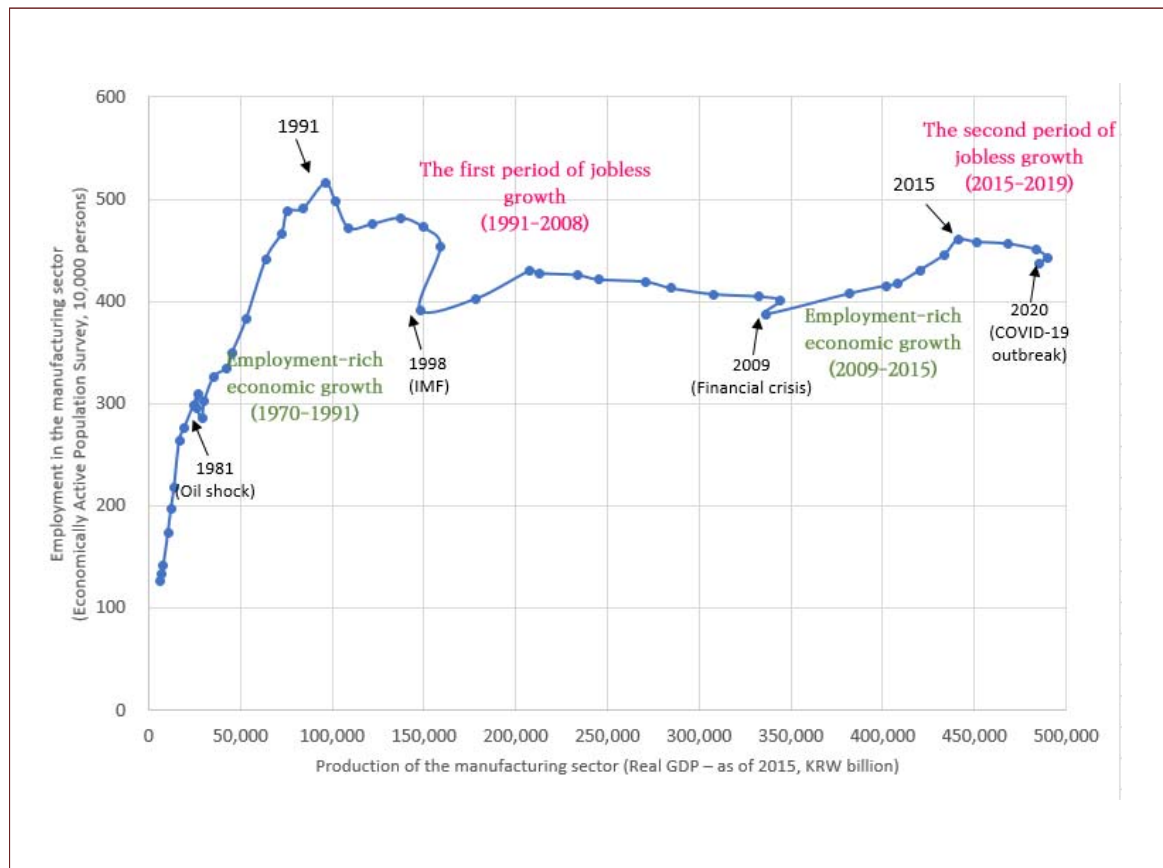
- While overall production of the manufacturing industry has contracted due to the COVID-19 pandemic, total employment levels have not undergone a major adjustment.
 - Unlike the service industry, which saw an immediate reduction in employment, the manufacturing industry has more-or-less maintained the scale of its employment. This property of manufacturing employment has served as a buffer against short-term production shocks and has helped limit the negative spillover effects on the labor market.
 - Generally, employment in the manufacturing industry is not sensitive to short-term economic downturns. However, when the production outlook deteriorates for the longer term, major reductions in employment follow. Once large-scale restructuring occurs, industrial employment seldom rebounds thereafter.
- The manufacturing industry offers jobs for the middle class, allowing a decent salary in exchange for working long hours.
 - Of particular note, labor income for workers in their 20s and 30s is higher compared to what is offered in other industries.
- To boost job creation in the manufacturing industry, this study proposes independently classifying relevant manufacturing subsectors as 'job creators,' independent of and distinguished from existing sectoral categorization as 'new industries' or 'leading export industries.' Job policies in the private sector should thus target these job creators, identified as such for their high potential to produce net employment growth.
 - To wit, there exist some segments of the manufacturing sector that record consistent gains in employment even as overall employment growth in the industry appears stagnant.
 - Among export-oriented industries in particular, those that manufacture chemicals, pharmaceuticals, and medicinal chemical products are expected to see a net increase in the number of quality jobs.
 - Industrial sub-segments where strategies for job creation in manufacturing can be implemented include the electrical equipment, special-purpose machinery, precision instruments, fabricated metal products, rubber and plastics, and food and beverage sectors. These are non-core industries that mainly supply the domestic market.
 - Sectors that produce materials, parts and equipment as well as the bio-health and food and beverage sectors can be categorized as job-creating manufacturing industries.
 - In the meantime, in order to prevent the kind of massive job losses that occurred in the steel industry in 2013 and the shipbuilding industry in 2017 it is critical to improve industrial competitiveness with a long-term perspective and proactively manage industrial restructuring risk.

1. Introduction

■ Jobless Growth in the Manufacturing Sector

- Despite recent growth in production, the manufacturing industry is seeing employment contract.
 - Value added in the sector has been soaring since 2015, but overall employment level has been falling, raising the specter of yet more jobless growth (Figure 1).
 - This phenomenon was evident between 1991 and 2008 before subsiding, but another period of jobless growth is seems to have begun in 2015.
- Before deciding to forgo job creation in the manufacturing sector and setting net job growth in the service sector as a policy target, it is important to first assess the real advantages of manufacturing jobs.

Figure 1. Jobless Growth in the Manufacturing Sector



Source: Korean Statistical Information Service (KOSIS), X-axis: Real GDP, national account, Y-axis: the number of employed persons, Economically Active Population Survey, 1970-2020

■ Consolidating Policy Strategies for Industrial Promotion and Job Creation

- In an effort to nurture new industries that are key to innovative growth, various human resource development projects are being implemented.
 - Many government authorities have prioritized human resource development in their 2021-2022 budgets. In particular, the “Big Three” industries of future mobility, bio-healthcare, and non-memory semiconductors have been selected as targets for development. The Ministry of Economy and Finance, the Ministry of Trade, Industry and Energy, the Ministry of Education, the Ministry of Land, Infrastructure and Transport, the Ministry of Science and ICT, and the Ministry of SMEs and Startups, have all allocated money for human resource development in their 2021-2022 budgets.
 - The scope of human resource development projects is not confined to incubating research talent in order to develop advanced technologies. The main objectives of these projects are to produce a professional production workforce that meets corporate requirements and which will be able to generate positive industrial outcomes.
 - Nurturing human talent is key to boosting the growth and competitiveness of new industries. In the course of cultivating talent for industrial growth and competitiveness, quality jobs should also be created to realize inclusive growth for workers.
- When production growth and job creation are decoupled, we must consider whether policies targeting production growth and job creation in the same industry are the best way to achieve policy objectives.
 - As industrial growth does not necessarily result in an increase in added value, exports, or the number of jobs created, it is therefore worthwhile to identify the manufacturing sub-segments where job creation can actually be expected.

■ Manufacturing Industries with the Potential for Job Creation

- In this paper, we:
 - (1) Analyze short- and long-term changes in manufacturing employment
 - (2) Examine the nature of manufacturing jobs from a worker’s point of view.
 - (3) Propose a set of manufacturing subsectors where net employment growth can

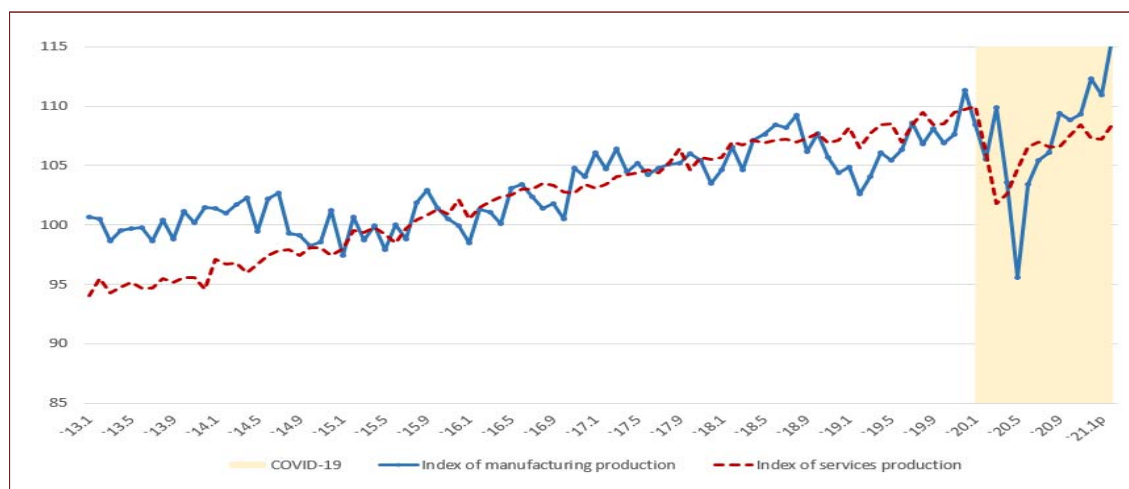
be anticipated. We term these segments “job creating subsectors.”

- Job-creating manufacturing industries are explored as an independent concept distinguishable from new industries, export-oriented industries, and high-tech industries.
 - There are industries not categorized under existing classifications such as new industries or export-oriented manufacturing industries, but are considered to have good potential to create jobs.
 - As different industries exhibit different patterns in export, added value, and employment growth, a two-track strategy that pursues production increases and employment growth as independent objectives is most appropriate.

2. Employment in the Manufacturing Sector Remained Intact amid the COVID-19 Pandemic

- Manufacturing production fell sharply following the COVID-19 viral outbreak in February 2020 (see Figure 2).
 - The manufacturing production index (which includes mining production) fell 13 percentage points, from 109.9 in March 2020 to 95.6 in May 2020.
 - Services production suffered a smaller decline of 7.5 percentage points, recording 110 in January 2020 and 101.8 in March 2020.

Figure 2. Changes in Manufacturing and Services Production caused by COVID-19

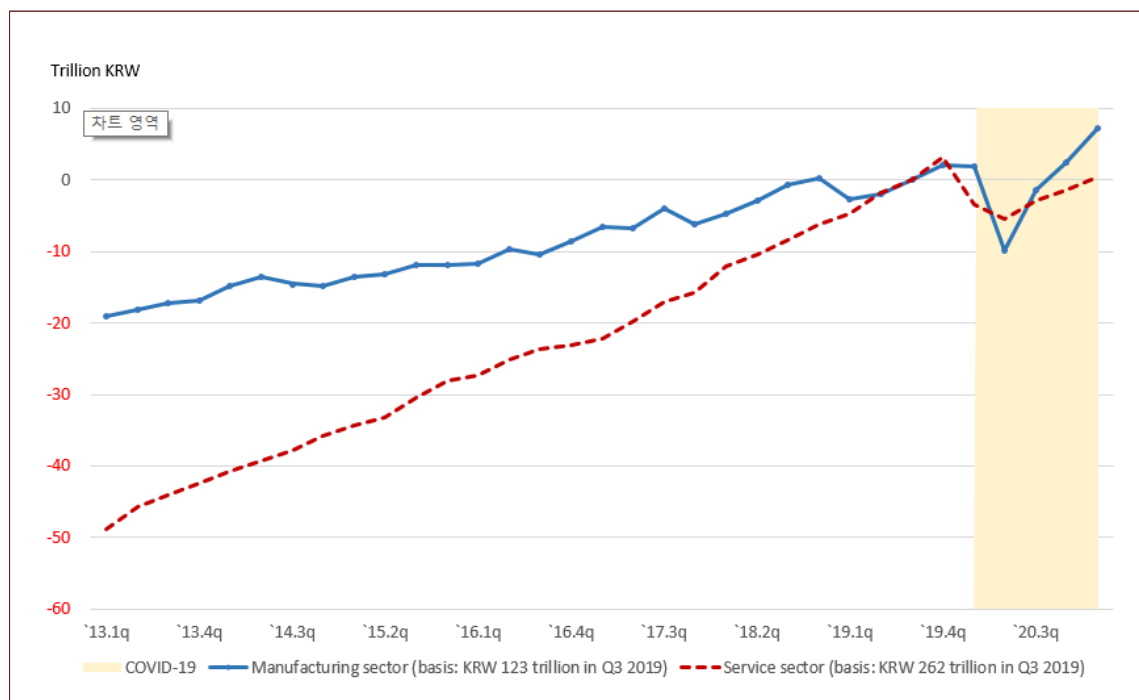


Source: Statistics Korea, Korean Statistical Information Service, Index of All Industry Production (IAIP), Jan. 2013–Feb. 2021 (Values in 2015 = 100)

■ Production Loss in the Manufacturing Sector

- A large loss of production has been identified in the manufacturing sector as evidenced by real GDP. The real GDP of the manufacturing sector decreased from KRW 125 trillion in the fourth quarter (Q4) of 2019 to KRW 113 trillion in the second quarter (Q2) in 2020, registering a decline of KRW 12 trillion (9.6 percentage points). Service production meanwhile declined by KRW 9 trillion (3.4 percentage points), from KRW 265 trillion in Q4 of 2019 to KRW 256 trillion in Q2 of 2020.

Figure 3. Changes in the Real GDP of Manufacturing and Services Production caused by COVID-19



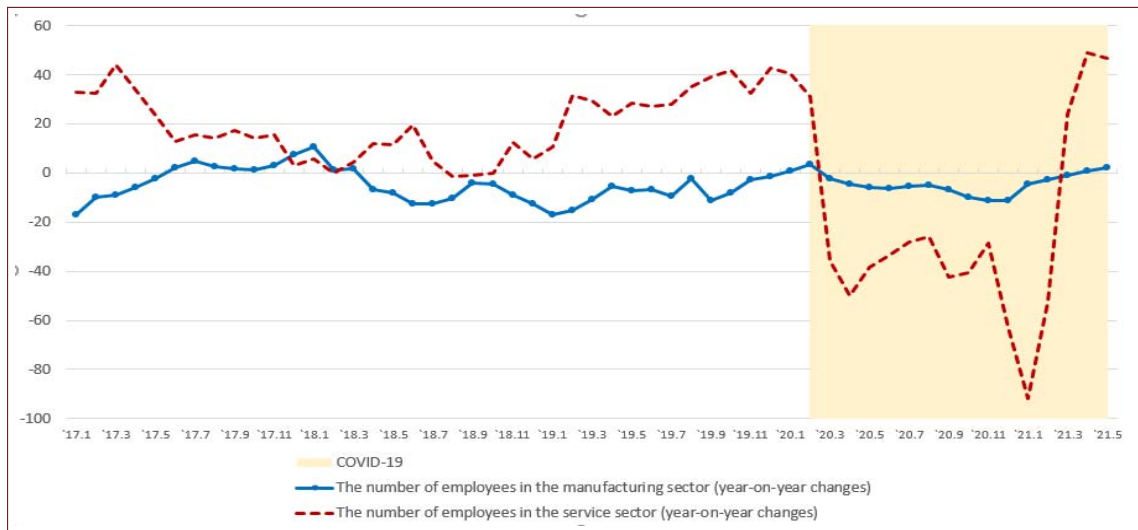
Source: Statistics Korea, Korean Statistical Information Service, National account, Real quarterly GDP, 1Q 2013-1Q 2021 (3Q 2019 = 0)

■ Employment Losses Not Evident in the Manufacturing Sector

- The production decline resulting from the COVID-19 pandemic was greater in the manufacturing sector than in the services sector. However, employment losses were more severe in the service industries.
 - In terms of the number of employed persons from the Economically Active Population Survey as shown in Figure 4, employment in the manufacturing sector during the pandemic has remained intact, whereas employment in the services sector plunged during the same period.

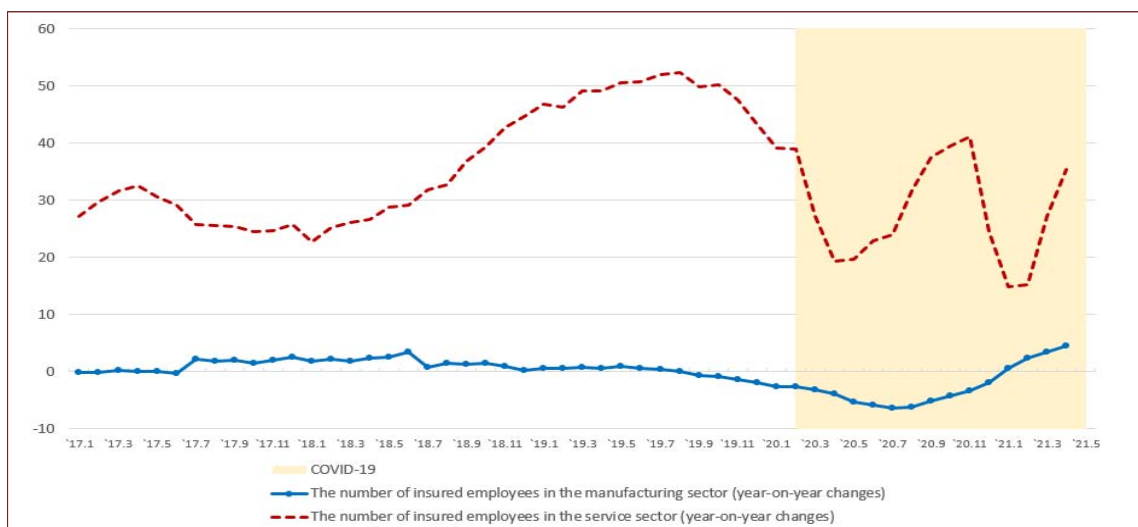
- And according the number of the employees insured under the national health insurance scheme (Figure 5), the number of employees in the manufacturing sector decreased by approximately 50,000 (1.5 percentage points) from December 2019 to August 2020 and then recovered, while the number of employees in the service industries fell by 250,000 persons (2.6 percentage points) from April 2020 to January 2021.

Figure 4. Changes in the Number of Employed Persons in the Manufacturing and Service Industries caused by the COVID-19 Pandemic



Source: Statistics Korea, Korean Statistical Information Service, The number of employed persons, Year-on-year changes, Jan. 2013–May 2021

Figure 5. Changes in the Number of Employees Covered by the National Health Insurance in the Manufacturing and Service Industries caused by the COVID-19 Pandemic



Source: Korea Employment Information Service (KEIS), Employment Information System, The number of insured employees, Year-on-year changes, Jan. 2013–May 2021

3. Characteristics of Short- and Long-term Changes in Manufacturing Jobs

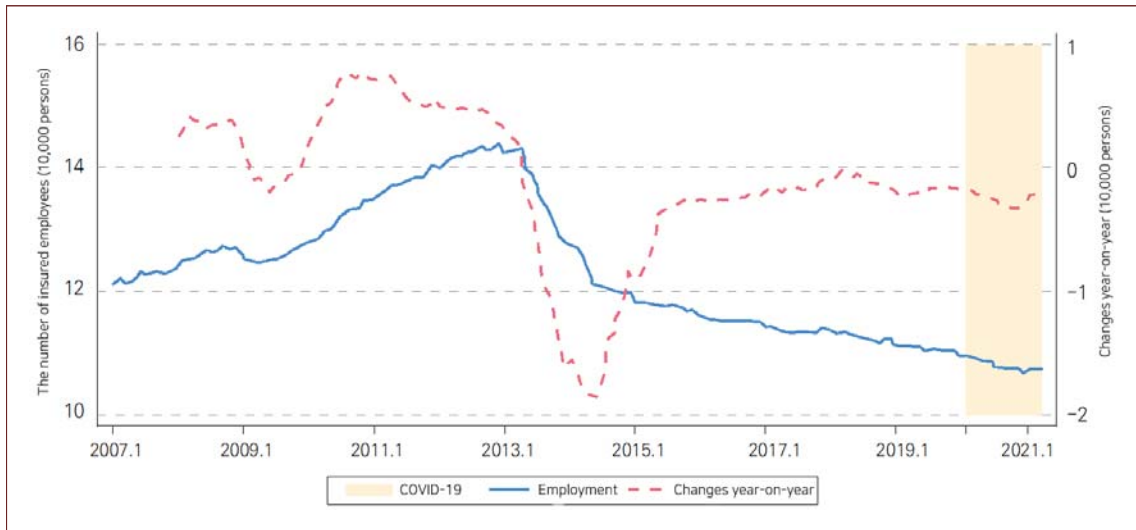
- Employment in the manufacturing sector is sensitive to short-term industrial decline, but employment in the sector is resilient and does not react to small-scale industrial fluctuations. However, when such fluctuations accumulate and trigger industrial restructuring, large-scale, segment-wide employment losses ensue.
- Manufacturing industries tend to hoard labor and COVID-19-induced production shocks did not impact employment levels. As such, the manufacturing sector is able to function as a buffer against the negative effects of temporary economic downturns.
 - Manufacturing industries have long production processes, manage inventories and cash flows on an extended time-scale, and employ a high proportion of skilled workers. For companies in the manufacturing sector, the benefits gained from frequent employment adjustments when the economy contracts are smaller than the costs incurred from production delays once the economy recovers. If manufacturing companies scale back employment during temporary economic downturns, they are unable to quickly ramp up production once the economy recovers due to an absence of skilled workers. Hence, the sector tends to maintain employment levels during short-term economic slowdowns.
 - This may also be attributable to the effects of some policies, such as those that make it more difficult to fire workers and subsidies granted to firms that retain their workers. In manufacturing subsectors where the majority of businesses are small and medium sized enterprises (SMEs), where the average employee has 6.4 years of service. This is less than workers in the electricity and gas (11.9 years), public administration (10.8 years), finance and insurance (9.3 years), and education sectors (8.8) years, where firing workers is more difficult.
 - In industries where COVID-19 dealt a severe blow to employment levels, the average number of years of service is low: four years for employees in arts and recreation related services, two years in the hospitality sector, and 3.8 years for wholesale and retail trade employees. Employees in a handful of service sectors average fewer years of service than manufacturing employees, including professional, scientific, and technical activities (4.6 years), information and communication (6 years average) and construction (2.7 years average).

■ Long-term Economic Crisis and Segmental Decline

- In the event of a long-term economic crisis — industrial restructuring, for example — manufacturing employment undergoes segmental decline. Since 2013 (when industrial subsector data on employment trends was first made available via Korea's national employment insurance scheme) there have been two instances of major employment declines in the manufacturing sector. One occurred in the steel industry and the other in the shipbuilding industry.
- Steel Industry Employment Shock of 2013
 - Excess supply and lackluster demand in the global market made industrial restructuring inevitable in the iron and steel industries. Many companies launched asset disposal and labor reduction initiatives in 2012 to staunch the bleeding and survive. Major steelmakers implemented measures to overcome the crisis. POSCO (Korea's largest steelmaker and a major global player in the industry) shut down its Pohang Steel Plant No. 1 in 2012 and its stainless steel plant No. 1 in 2014.
 - POSCO also closed its FINEX (No.1) Pohang Steelworks in 2014. Hyundai Steel suspended the operation of its hot rolled steel sheet production line and permanently closed its electric arc furnace at the Pohang site in 2014. Dongkuk Steel closed its No. 1 plate mill at Pohang Works in 2012 and KG Dongbu Steel halted the operation of its electric arc furnace at the Dangjin Works in 2014.¹⁾
 - Major restructuring of the steel industry in 2013 (KSIC 24, manufacture of basic metals) led to a massive reduction of sectoral employment: around 20,000 persons, a 14 percent drop. Employment levels have continued to fall ever since.
- The Employment Shock in the Shipbuilding Industry in 2017
 - Combined orders at Korean shipbuilding companies plummeted by 80 percentage points year-on-year in 2016. This prompted a major corporate restructuring of eight major shipbuilders.
 - The sector (KSIC 311, building of ships and boats) shed 70,000 workers (38 percent of total employment) in the two years following 2016. Since then, employment levels have continued to dip or remain flat despite a rebound in ship orders.

1) Park, Gyeongseo, et. al. (2016) *Ways to Develop the Korean Steel Industry in the Period of Excess Global Supply*, p. 30

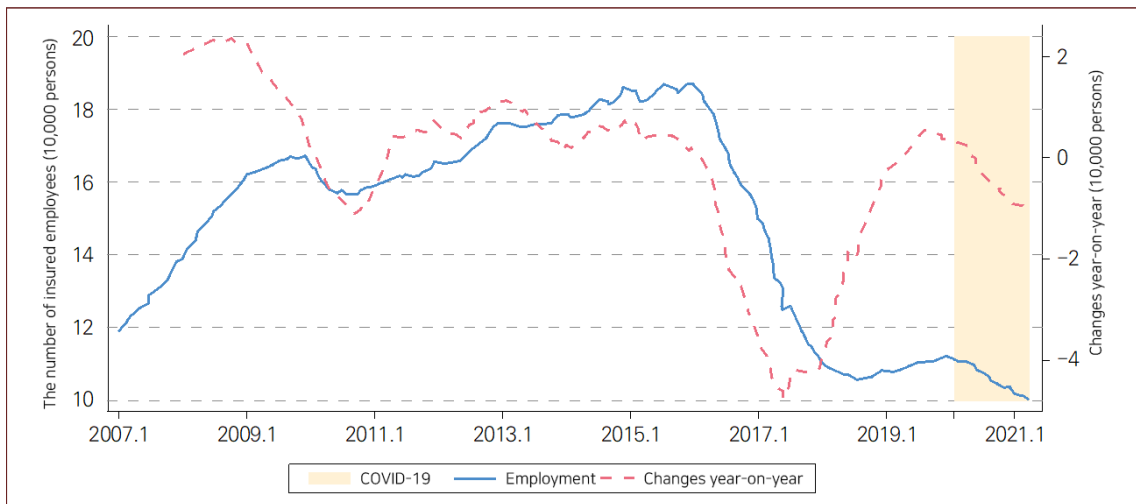
Figure 6. Employment in the Iron and Steel Industries



Source: Korea Employment Information Service (KEIS), Employment Information System (EIS), Jan. 2007 – Apr. 2021

Note: Employment is represented by the number of employees covered by the national health insurance. Changes in employment year-on-year are calculated by the number of insured employees of the current month minus the number of insured employees of the same month in the previous year. The note for the below graphs concerning the employment trend is the same and are thus not repeated below.

Figure 7. Employment in the Shipbuilding Industry



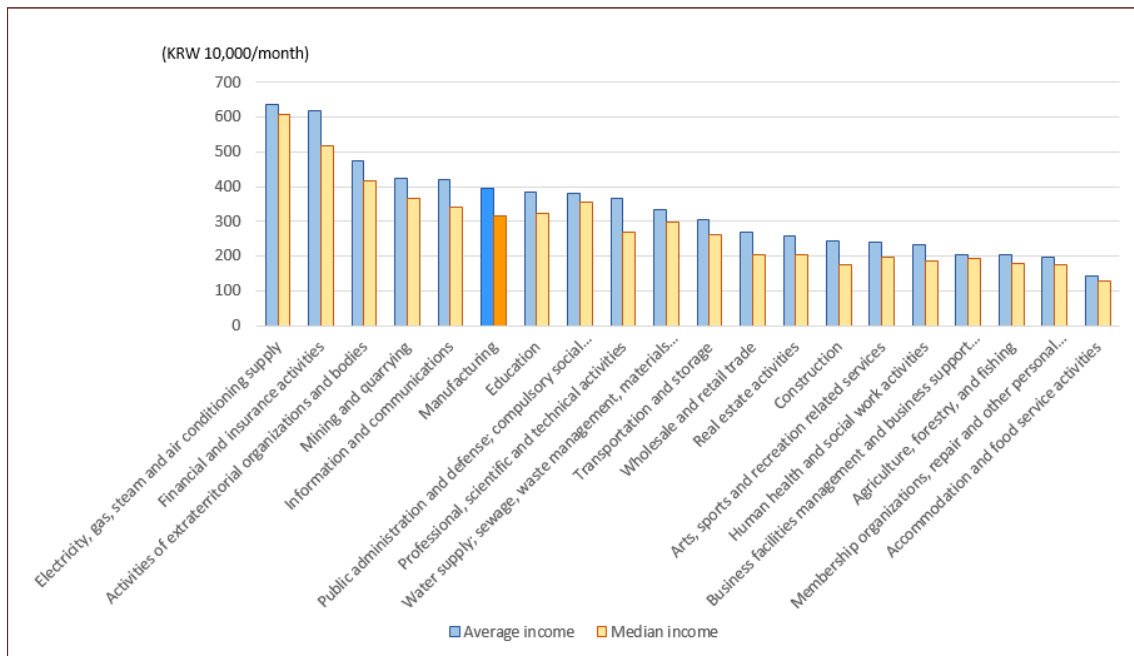
4. Manufacturing Jobs for the Middle Class

- The manufacturing offers a path to joining the middle class, offering decent wages (which can approach upper-middle-class levels) but requiring long working hours.
 - Service sector salaries are more polarized. Professionals earning high salaries in the electricity and gas supply, financial service activities, and information and communication sectors contrast with workers making far less money in business

facilities management, personal services, and hospitality. But the manufacturing sector is home to large numbers of blue collar jobs that offer a middle-class incomes.

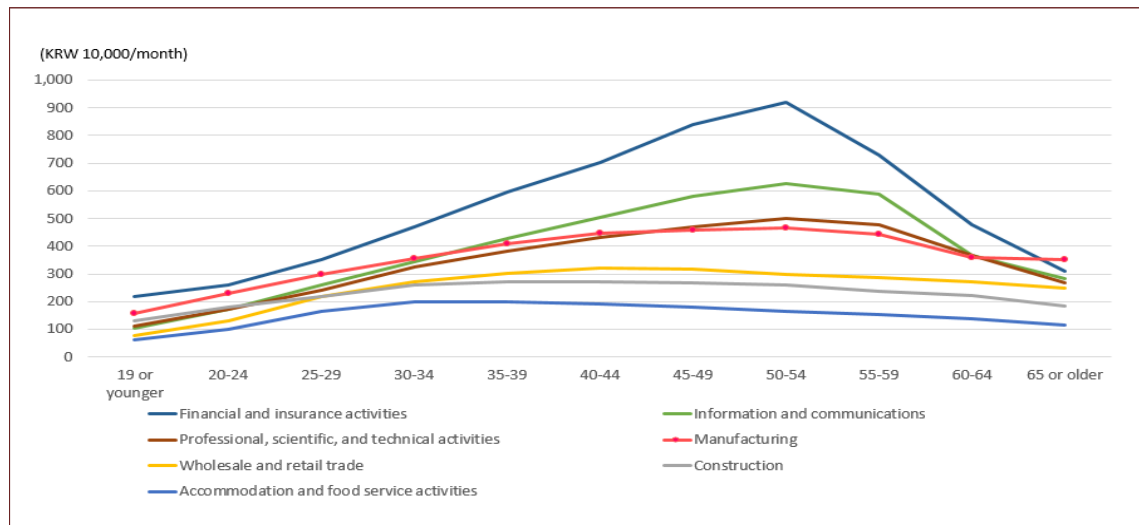
- The average monthly wage in the manufacturing sector is around KRW 3,960,000, with a median value of KRW 3,150,000. The sector ranks has the sixth-highest average monthly wage and is ranked eighth in terms of median values of 20 large industrial categories (Figure 8).
- Manufacturing industries also offer relatively high incomes for young adults. Jobs in the manufacturing sector offer the second-highest income for workers in their 20s and 30s, second only to following the financial services sector. (Figure 9)
- Whereas income (or hourly wages) for workers in other industries is dependent on an employee’s academic credentials, career experience and expertise, workers in the manufacturing sector can instead earn middle class levels of income by working relatively long hours. (Figure 10)

Figure 8. Monthly Average and Median Incomes by Industrial Category



Source: Statistics Korea, Korean Statistical Information Service, Administrative Employment Statistics, 2019

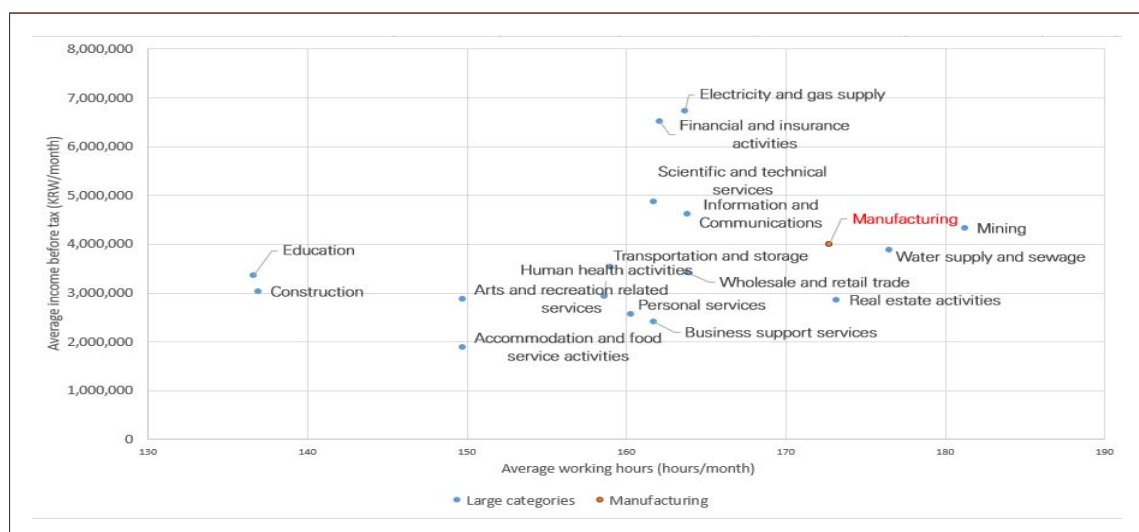
Figure 9. Average Income by Industrial Category and Worker Age



Source: Statistics Korea, Korean Statistical Information Service, Administrative Employment Statistics, 2019

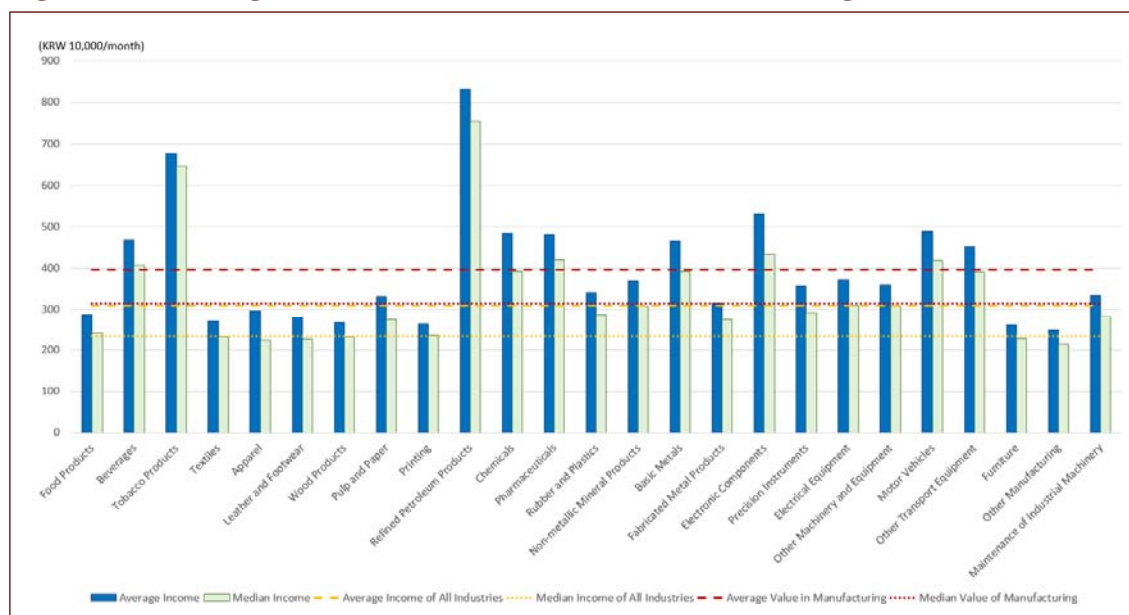
- There are only eight manufacturing sub-sectors in which average income was lower than economy-wide average income: food products, textiles, apparel, leather and footwear, wood products, printing, furniture, and other manufacturing. For the remaining 17 sub-sectors, employees earn more than the average. (Figure 11)
- This is to say that manufacturing industries offer good-paying jobs for less-credentialed and less-experienced workers, clearing a path to the middle class for people willing to work long hours in exchange for a decent wage.

Figure 10. Working Hours and Monthly Wages by Industrial Category



Source: Statistics Korea, Korean Statistical Information Service, Labor Force Survey at Establishments (All businesses with one or more employees), 2020.

Figure 11. Average and Median Incomes in Manufacturing

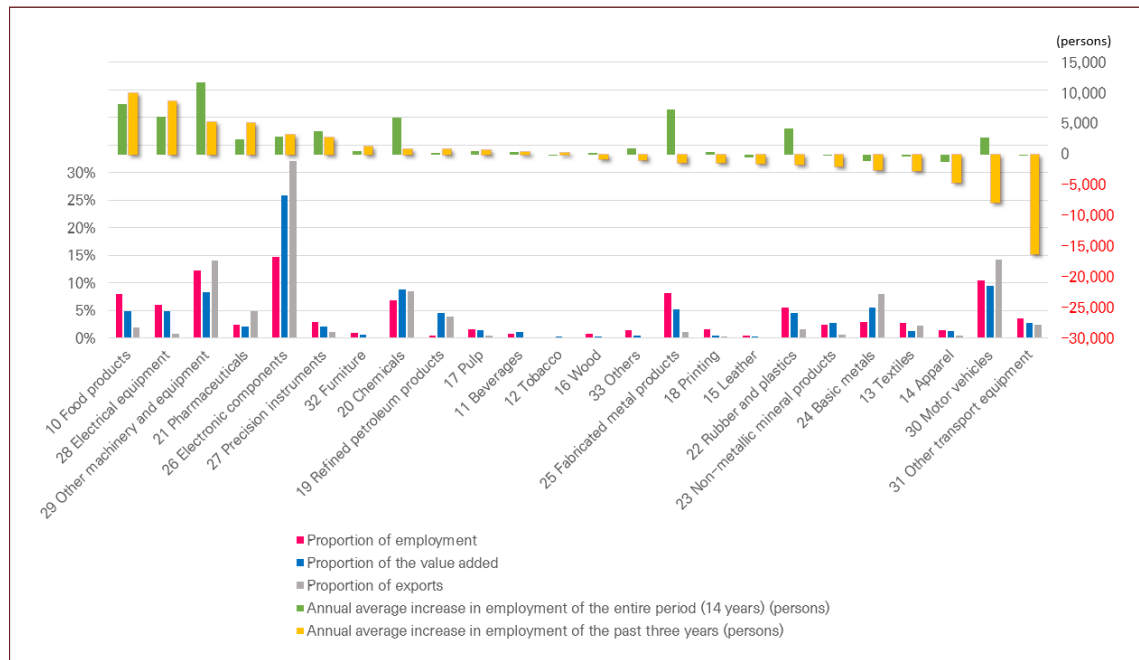


Source: Statistics Korea, Korean Statistical Information Service, Administrative Employment Statistics, 2019

5. A New Perspective for Job Creation in the Manufacturing Sector: Job-Creating Manufacturing Subsectors

- **In examining job-creating manufacturing industries, it must be noted that the terms exports, added value, employment proportion, and net job creation are all distinct concepts.**
- The lower graph in Figure 12 represents different industries' proportions of total exports, added value, and employment, based on recent data. The upper graph visualizes annual average increases of employment in the short- and long-term.
 - Industries with a relatively high proportion of exports did not exhibit particularly strong employment growth over the past three years. These sectors include: electronic components (ranked 5th), motor vehicles (ranked second-to-last), and other machinery and equipment (ranked fifth to last).
 - However, the food processing and electrical equipment sectors, in which exports account for less than two percent of goods produced, registered the largest growth in employment over the past three years. The manufacturing of food products ranked first and the manufacturing of electronic components ranked second in terms of employment growth.

Figure 12. Comparison of Employment Growth, Value Added, and Proportion of Exports in Mid-level Manufacturing



Source: Author's analysis of mid-level manufacturing based on export data (Export statistics, Korea International Trade Association, Nov. 2020), total value added (Mining and Manufacturing Survey, 2018), and employment (Employment Information System, Korea Employment Information Service, Nov. 2020).

- As has often been observed in the past, industries with large workforces tended to create more net employment. However, net job growth over the last three years shows no correlation between the scale of current employment, value added, or exports.
 - As is shown in the first row of Table 1, there is a clear, positive correlation between industrial segments with a relatively high proportion of exports and added value and industries with a large workforce.
 - However, as is indicated by the near-zero correlation coefficient in the second row, industries with large proportions of exports and added value as well as a large-scale employment are not necessarily industries that new jobs in the short term.
 - The correlation coefficient stands at a mere 0.0831 between the proportion of exports and short-term net job creation. This is even lower than the correlation coefficient with long-term net job creation. This can be understood to mean that export-oriented industries do not create as many jobs now as they did in the past.

Table 1. Correlation between Exports, Added Value, and Employment Numbers, and Short- and Long-term Net Job Creation

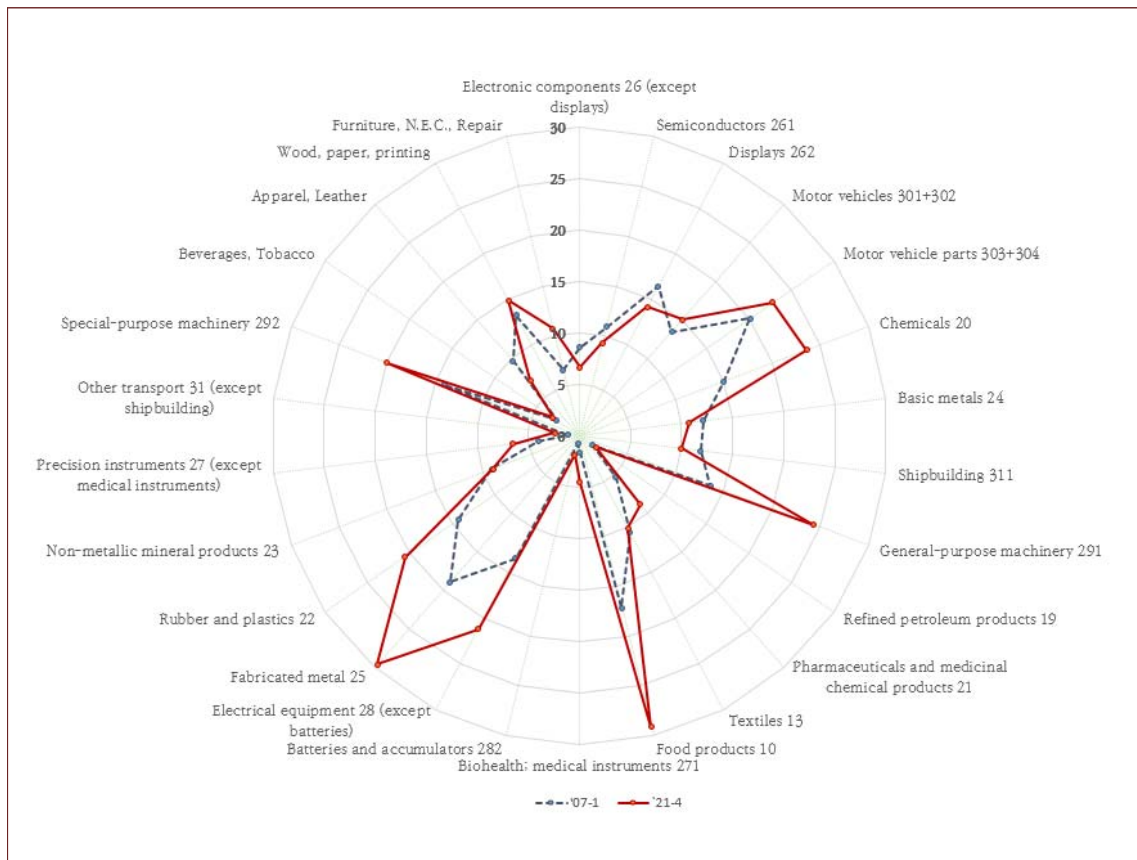
	Exports (as of Nov. 2020)	Added Value (as of 2018)	Employment (as of Nov. 2020)
Employment	0.7980***	0.8458***	-
Short-term Net Job Creation (past three years)	0.0831	0.1554	0.2018
Long-term Net Job Creation (past 14 years)	0.2780	0.3719	0.7246***

Note: Short-term net job creation means the number of net new jobs added in the past three years. Long-term net job creation means the number of net new jobs added in the past 14 years. Statistically significant correlation was identified from the Pearson method (***) p-value(0.001).

■ Manufacturing Industries with Long-Term Net Job Growth

- There are only a few manufacturing industries that posted a net increase in employment levels over the previous 14 years. The level of employment in most manufacturing segments remains unchanged.
 - In Figure 13, if employment in 2021 (red) represents an increase in employment in 2007 (blue), the farther the line is drawn from the center of the circle. The inner rings of the circle mark intervals of 50,000 employed persons.
 - A long-term increase in employment was observed in a few export-oriented industries, including chemical products, general-purpose machinery, and food products. Other export-oriented segments exhibited only small changes in long-term employment.
 - Employment growth is evident in the electrical equipment (except batteries), fabricated metal, rubber and plastics, and special-purpose machinery sectors among non-export-oriented industries. Others in this segment show only minor fluctuations in employment.
- Job-creating manufacturing industries that have exhibited long-term net growth in employment levels include: the chemical products and fabricated metal products segments, materials for electronic components (excepting the secondary batteries sector) as well as the motor vehicle and construction industries. The rubber and plastics segment mostly produces parts for other industries. The general- and special-purpose machinery segments provide equipment for other industries.

Figure 13. Manufacturing Segments with Increases in Employment



Source: Korea Employment Information Service, Employment Information System, The number of insured employees (10,000 persons), Jan. 2007–Apr. 2021,

Note: Industries are laid out clock-wise in descending order of the proportion of exports (from electronic components to batteries) and in descending order of the proportion of added value (from electrical equipment to furniture/others/repair). Comparing industries in terms of long-term net employment increase, there are job-creating manufacturing industries among export-oriented manufacturing industries, but there are other industries where the export volume is insignificant.

6. Employment Trends in Job-Creating Manufacturing Subsectors

- Bio-healthcare, which is one of the so-called Big Three industries, is showing steady growth in employment levels and is expected to create quality jobs as the industry continues to grow.
- As of December 2020, the industry employed approximately 130,000 people. In addition, employment is growing quickly, adding 5,000 new workers (a four percent growth rate) every year.

- The average monthly income of workers in the pharmaceutical industry is KRW 4,810,000. With a median income of KRW 4,210,000, the pharmaceutical industry is one of the top-earning segments. It offers quality jobs with high salaries.

Figure 14. Employment in the Pharmaceutical Industry (KSIC 21)

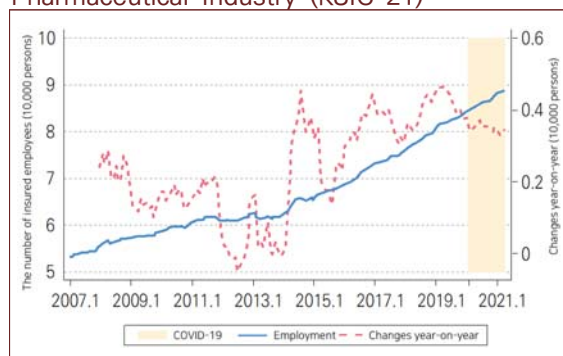
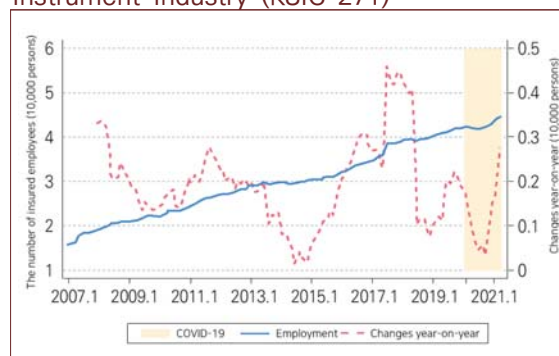


Figure 15. Employment in of the Medical Instrument Industry (KSIC 271)



■ Chemical Products, General-purpose Machinery, Food Products, and Electrical Equipment Manufacturing: Perennial Job Creators

- The financial crisis in 2009 and the outbreak of COVID-19 disease did not send the employment rate in the chemical products manufacturing industry (KSIC 20) tumbling. Rather, the industry has posted continued long term employment growth, having added 100,000 net jobs over the past 14 years.
- Employment growth in the general-purpose machinery industry (KSIC 291) has slowed since 2018. But job numbers continue to grow, despite the shocks of the financial crisis and the pandemic, with 100,000 net new jobs added over the past 14 years.
- The manufacturing of food products (KSIC 10) sector is reliant on domestic demand, but it does have a high proportion of employment and added value. Employment levels have been steadily growing, and the sector has strong potential to continue its employment expansion.
 - The periods immediately preceding and following the initial COVID-19 outbreak — from the fourth quarter of 2019 to the second quarter of 2020 — employment dipped by a small margin in the food processing sector before it eventually recovered. The sector has added over 100,000 net jobs over the last 14 years.
- The electrical equipment manufacturing industries, excluding batteries (KSIC 281,

283, 284, 285, 289), are continuously creating jobs, adding 90,000 workers to employment rolls over the past 14 years.

- Industries that manufacture electrical equipment primarily produce electrical parts such as motors, transformers, and wires rather than consumables such as electronic components. It follows that these industries are closely tied to the growth of the manufacturing, power generation, and construction industries, with great potential for creating jobs and added value.

Figure 16. Employment in the Chemicals and Chemical Products Industry (KSIC 20)

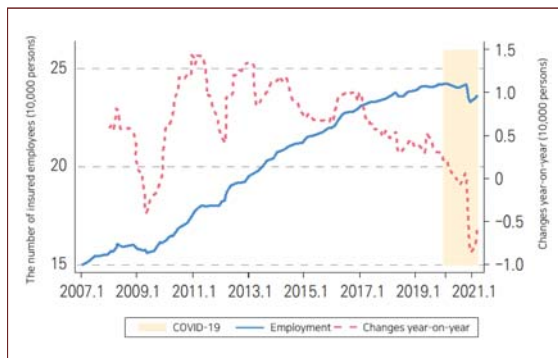


Figure 17. Employment in the General-purpose Machinery Industry (KSIC 291)

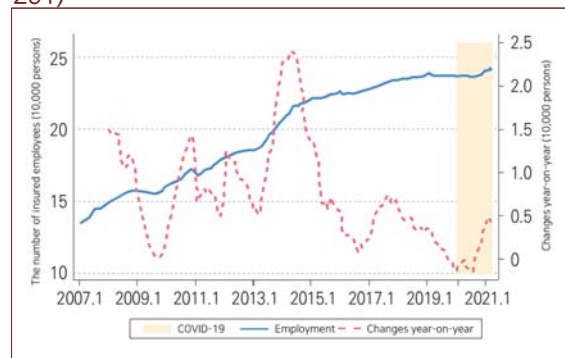


Figure 18. Employment in the Food Product Industry (KSIC 10)

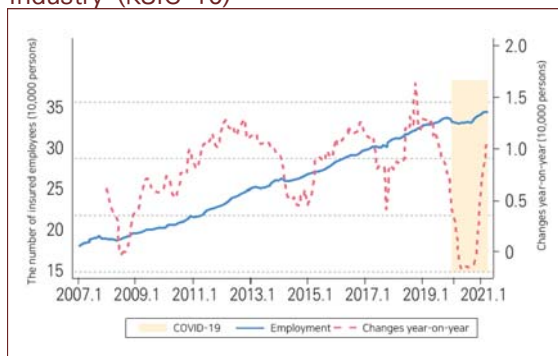
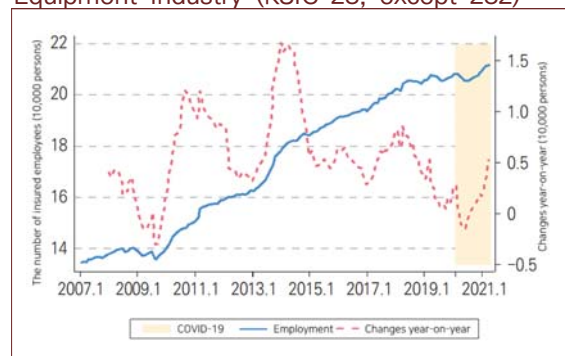


Figure 19. Employment in the Electrical Equipment Industry (KSIC 28, except 282)



■ **Recent job growth has stalled, but scale of employment remains large in certain industries**

- Recently, jobs growth has stalled. However, the fabricated metal, rubber and plastics, and special-purpose machinery industries continue to employ a large workforce. The fabricated metal products industry generates high added value with sizable net job creation, but employment levels has remained unchanged since 2014.

- The fabricated metal products (KSIC 25) sector maintained employment even as employment in the basic metals industry plunged. Employment levels suffered following the global financial crisis and the COVID-19 pandemic, but quickly recovered to pre-crisis levels in both instances.
- Most businesses in this segment are involved in casting, forging, rolling, cutting, or welding of metal materials to produce parts for electronic goods, motor vehicles, and the construction industry.
- The scale of employment is relatively large in the rubber and plastics industry (KSIC 22), but employment levels have been spiraling downward since 2017.
 - There has been some job growth amid the current post-pandemic recovery, but it is too early to tell whether this constitutes a reversal of the long-term downward trend.
 - In the manufacturing of rubber products sector, the majority of products produced are tires for automobiles. In the plastics products industry, products are not limited to household goods but also include films and sheets, interior and exterior materials for electronic products, and other parts for high value-added industries.

Figure 20. Employment in the Fabricated Metal Products Industry (KSIC 25)

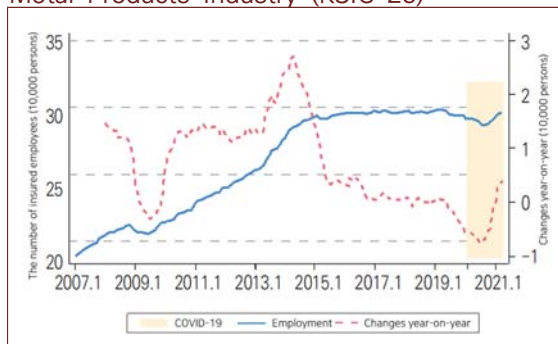
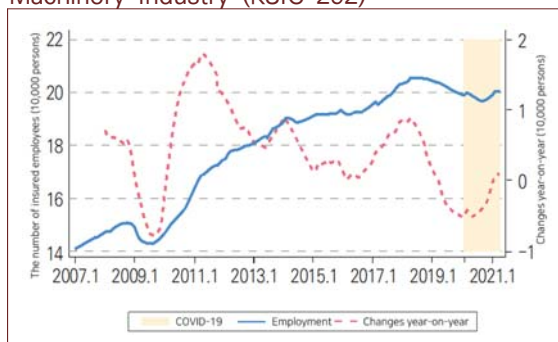


Figure 21. Employment in the Rubber and Plastics Industry (KSIC 22)



Figure 22. Employment in the Special-Purpose Machinery Industry (KSIC 292)



- The special-purpose machinery (KSIC 292) sector employs approximately 200,000 people but has shed jobs since 2018.
 - As this segment employs a large number of workers and offers relatively high wages, it is regarded as an important job-creating manufacturing industry deserving appropriate policy attention.

7. Conclusion

■ Characteristics and Strengths of Manufacturing Employment

- The manufacturing sector functions as a buffer against short-term economic shocks to production (such as the COVID-19 pandemic) and employment levels, which are not affected to the same extent as in other industries. The manufacturing sector also offers good-paying jobs to young adults that opens doors to the middle class. A decent income can be earned by working long hours.
- A new framework is required to identify and promote manufacturing industries with a potential for net job creation.
 - Industries with sizable export volumes, high added value contributions, and large-scale employment levels no longer create new jobs as they did in the past.
 - If a policy's aim is to create jobs in the manufacturing sector, it should specifically target job-creating manufacturing subsectors that are distinguishable from export-oriented manufacturing or new, emerging industries.

■ Job-Creating Manufacturing Subsectors

- Bio-healthcare is one of the Big Three industries with a high potential for quality job growth.
 - Net job creation in this segment remains limited but is showing sharp and steady growth. If nurtured as a new growth engines, the industry can create many quality jobs in the private sector.
- Among export-oriented manufacturing industries, the chemical products, general-purpose machinery, and food products sectors are expected to create quality jobs.

- In particular, the chemical products and general-purpose machinery industries create a significant number of net new jobs and also offer relatively higher incomes compared to other manufacturing industries.
- Wages in the food processing industries are relatively low, but large-scale employment expansion is plausible. Proper attention needs to be paid to this segment as it can create jobs for the elderly.
- Among non-export-oriented industries, the electrical components, fabricated metal products, rubber and plastics, and special-purpose machinery sectors can add large numbers of jobs.
 - These segments offer average manufacturing sector wages and when employment levels increase, a positive contribution to a more equitable societal wealth distribution may be achieved.
- Hence, the materials, parts, and equipment manufacturing, bio-healthcare, and food products sectors can be categorized as job-creating manufacturing industries and jobs in the materials, parts, and equipment manufacturing sector and jobs related to biotechnology offer mid-to-high wage levels. Therefore, strategies should be devised to create jobs in these segments in order to increase the number of quality jobs.

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