

The Export Effect of Servitization of Manufacturing

Hyunsoo Kim Associate Research Fellow, New Trade Strategy Team, International Trade Department (kimhs@kiep.go.kr)

Jungu Kang Principal Researcher, Trade Agreement Team, International Trade Department (jgkang@kiep.go.kr)

Hyeyoon Keum Senior Researcher, Trade Agreement Team, International Trade Department (hykeum@kiep.go.kr)

Jae Wook Jung Assistant Professor, Sogang University (jwjung1224@sogang.ac.kr)

I. Introduction

As the importance and share of services in the overall economy continues to rise, the phenomenon of so-called servicification of manufacturing is intensifying. The servicification of manufacturing means the increasing reliance of the manufacturing sector on services. Manufacturing firms produce services such as logistics, finance, engineering, R&D, design, marketing, and advertising inside or outside the firm and utilize them into their overall business activities at a higher proportion than before. Sales of services along with goods by manufacturing firms also become prevalent. New promising markets have emerged through the linkage of goods and services and the convergence between goods and services is expected to become a more important factor of industrial competitiveness as digital transformation accelerates.

This study examines the status and characteristics of Korea's servicification of manufactu-

ring and its impact on firm performance and exports. In particular, we focus on servitization of manufacturing, which is the phenomenon of manufacturing firms producing more services as final goods and provide them to the market with their products. For brevity, we call a manufacturing firm which provide services to markets as a final good a "servitized firm" in this article.

II. Status and Characteristics of Servitization of Manufacturing in Korea

Looking at the status of servitization in the manufacturing sectors focusing on the service sales generated by manufacturing firms, the servitization of manufacturing in Korea has gradually increased. Sales in service sectors, which stood at 4.5% of the total sales of manufacturing firms in 2012, surged to 15.9% in 2017, and then decreased to 6.9% in 2019. By

industry, the servitization rate decreased in labor-intensive industries such as food and beverage, textile and clothing, and wood and printing industry. In capital-intensive industries such as chemicals, electronics, and machinery, however, the trend toward servitization was clear between 2012 and 2019. The major service areas in which manufacturing firms produce was distribution services. Professional services, engineering services, and R&D services also emerged as major service

areas. Sales by manufacturing firms in the distribution service sector accounted for about 74% of total service sales by manufacturing firms in 2012 and about 60% in 2019. This can be interpreted as attempts of manufacturing firms to strengthen interaction with customers through expansion into distribution business, such as the introduction and expansion of e-commerce or establishment of offline stores, under a situation where product competition in the market becomes stronger.

Table 1. Sales of Manufacturing Firms in Service Sectors in Korea

(Unit: trillion won, %)

	2012	2013	2014	2015	2016	2017	2018	2019	
# of firms (A)	4,882	4,833	4,747	4,667	4,876	4,993	5,238	5,331	1.3
Total Sales (B)	1,050.3	1,055.6	1,028.3	991.4	1,076.1	1,189.8	1,222.5	1,203.4	2.0
Sales per firm (B/A)	0.22	0.22	0.22	0.21	0.22	0.24	0.23	0.23	0.7
Sales in service sectors (C)	47.3	45.4	56.6	80.3	150.7	189.2	129.6	83.0	8.4
Proportion of Sales in Services (C/B)	4.5	4.3	5.5	8.1	14.0	15.9	10.6	6.9	

Source: Survey of Business Activities.

Table 2. Proportion of Servitized Firms by Country

Country	Total # of Manufacturing Firms	# of Servitized Firms	Proportion (%)
Korea	5,164	807	15.6
Japan	25,335	4,469	17.6
United States	405,630	91,598	22.6
Germany	124,398	59,758	48.0
France	31,046	3,667	11.8

Source: ORBIS Database.

Next, using the ORBIS database, we compare the level of servitization with major countries such as the United States, Japan, Germany, France, by identifying manufacturers which provide services as a secondary business. The share of the servitized firm is the highest in Germany at 48%, followed by the US at 22.6% and Japan at 17.6%. In the case of Korea, the number of servitized firms is the smallest at 807, but the proportion is higher than that of France at 15.6%. Also, 40.4% of Servitized firms in Korea are found in the computer, electronic and optical product manufacturing industries. Most of servitized firms are concentrated in the heavy and chemical industry in all major countries, but this concentration is more prominent in Korea. In addition, we look at foreign affiliates of manufacturing firms and their major business sector. Most of the sales of service subsidiaries of Korean manufacturing firms are concentrated in the wholesale and retail industry, compared with major countries such as the United States and Germany, which generate sales not only in the wholesale and retail business but also in the ICT, financial service, and professional/science/technology service industries.

III. Servitization of Manufacturing and Firm Performance

Based on the stylized fact that servitization of

manufacturing in Korea has gradually increased, we empirically analyze the effect of servitization of manufacturing on the firm performances by using the Survey of Business Activities. Specifically, we identify the servitized firms from the database in the Survey of Business Activities and examine the correlation between service sales by manufacturing firms and main indicators for firm performance such as profit rate, sales, employment, production of goods, and value added under the following equation.

$$Y_{i,t} = \alpha_0 I_{service\ intensity,t-1} + X_{i,t-1} + \delta_{j,t} + \varepsilon_{i,t} \quad (1)$$

Y denotes various firm performance indicators of firm i in time t . I is an indicator function which has 0 if the service intensity index is positive in time $t-1$. Since the firm's performance is closely related to the size of the firm, the control variable X includes the number of employees. In addition, as a control variable that can affect the firm's performance, the firm's share of sales in the same industry and the same type and the Herfindahl-Hirschmann index, which represents the level of the market concentration in the industry, are included in X . δ refers to the firm-year fixed effect and the service intensity and covariates precede the firm's performance index, considering the possibility of reverse causality that changes in performance indicators may affect the service intensity.

Table 3. Effect of Servitization on Firms' Performance

Dependent var. Independent var.	Profit rate	Employment	Total sales	Value-added per capita
Servitization (t-1)	0.052** (0.025)	0.004 (0.003)	0.000 (0.003)	0.013*** (0.006)
Employment (t-1)	-0.074*** (0.024)	0.749*** (0.013)	0.062*** (0.005)	-0.014** (0.007)
Market share	0.110*** (0.020)	0.023*** (0.002)	0.000 (0.003)	0.067*** (0.007)
H-H Index	-0.060 (0.050)	-0.006 (0.006)	0.005 (0.010)	-0.043*** (0.017)
Lagged dependent var. (t-1)	0.007* (0.004)	-	0.858*** (0.026)	0.386*** (0.013)
Lagged dependent var. (t-2)	0.004 (0.003)	0.141*** (0.015)	-0.003 (0.017)	0.165*** (0.010)
Lagged dependent var. (t-3)	0.011 (0.008)	0.073*** (0.010)	0.095*** (0.020)	0.169*** (0.010)
Industry-year FE	O	O	O	O
Observations	21,497	21,513	21,513	21,513
Groups	4,965	4,966	4,966	4,966

Source: Author's calculation

The analysis shows that servitized firms show higher performance than firms which do not provide services. The servitization of manufacturing improved firm's profit rates by about 5%p and brought an additional 13,000 won of value-added per capita. In other words, this suggests that the servitization of manufacturing progressed in the direction of improving firm's productivity and profitability. This can be interpreted that, in the recent trend toward servitization of manufacturing in Korea, the effect of increasing the productivity and profitability through servitization was stronger than the effect of intensifying market competition and lowering the profit rate due to servitization.

IV. Servitization of Manufacturing and Exports

As seen above, a significant number of manufacturing firms generate service sales. According to the previous studies, many of these firms supply the services they produce to foreign markets and the services the manufacturing firms produce and provide to foreign markets account for a significant proportion of total service exports. Thus, we further analyze whether manufacturing firms which provide services to foreign markets show higher performance even in foreign markets through the following equation.

$$\ln(EX_{ipct}) = \beta_0 + \beta_1 S_{ict} + \beta_2 X_{i(pc)t} + \delta_{pct} + \varepsilon_{ipct}. \quad (2)$$

Equation (2) compares the difference between export of products provided with services and exports of products without services within the same product-country-year. EX denotes firm i 's total exports of product p to country c in year t . The main variable of interest, S , is a dummy variable which is equal to 1 when firm i exports both goods and services to

country c in year t . The vector X includes covariates of firm-year, firm-country-year, and firm-product-country-year. It contains sales per capita of firm i in year t , the number of products that firm i exports to country c in year t , the presence of firm i 's parent firm and foreign affiliates in country c in year t . In addition, the equation controls product-country-year fixed effect with δ .

Table 4. Effect of Service Exports by Manufacturing Firms on Their Total Export

	(1)	(2)	(3)	(4)
S_{ict}	1.3314** (0.0836)	1.1930*** (0.0863)	1.1278*** (0.1102)	0.5875*** (0.1589)
Log(sales per capita)		0.2120*** (0.0475)	0.1948*** (0.0559)	
Log(# of export products)			-0.0052 (0.0498)	1.5100*** (0.0690)
Presence of a parent firm			-0.1564 (0.2151)	0.6946*** (0.2161)
Presence of foreign affiliates			0.1559 (0.0996)	-0.0229 (0.1250)
Product-country-year FE	O	O	O	O
Firm-product-year FE	X	X	X	O
Observations	25,216	25,173	25,173	21,367
R^2	0.3995	0.4011	0.4013	0.7301

Source: Author's calculation

Table 4 shows the results of the analysis on the effect of exports both goods and services by manufacturing firms on their total exports. Looking at the results in Model 1 - 3 first, statistically significant positive coefficient estimates were obtained in all models for the explanatory variable of interest, S_{ict} . In other words, all else equal, manufacturing firms exporting goods and services export product p in country c more than firms exporting goods

only. This implies that firms exporting goods and service are not only generally larger, but also perform better in markets in which they export services as well. Model 4 contains firm-product-year fixed effect in addition to product-country-year fixed effect. It allows to control unobservable factors, such as a firm's productivity of a specific product, which affects the firm's exports and also relates to the firm's service exports. In Model 4, we obtain

the positive estimates for the coefficient of S_{ict} , although the size is reduced by about half compared to the results in Model 1 – 3. This means that firms exporting goods and service have the characteristics of achieving higher export performance regardless of the partner country. However, even after controlling for these characteristics, there still exists positive effect of providing services to foreign markets along with goods on total exports.

V. Recommendations for Korea's Servitization of Manufacturing

This study proposes several recommendations for policies which aim to promote servitization of manufacturing in Korea. First, Korean government needs to consider the customized support policy suitable for each stage and level of servitization. As servitization of manufacturing in Korea has increased since 2012, the level of service output by manufacturing firms has further diversified. Since there are differences in the strategies pursued by firms according to their respective stage and level of servitization, and the conditions for success are also different, support policies that do not take into account the various forms and levels would not be effective and may have a negative impact on the creation of the industrial ecosystem. As an example of policies customized to the stage of servitization, in the early stage, policies should focus on supporting services that enhance the value of core products. At the intermediate level, providing a solution

or building a small-scale platform can be considered. At the stage where servitization has progressed to a significant level, support policy can be provided for establishing a new business model in the form of a large platform and spinning off manufacturing functions in the form of spin-offs or spin-outs.

Second, it is necessary to promote projects where businesses that link manufacturing and service industries are developed in order to encourage servitization in the direction of improving product quality and increasing the competitiveness of manufacturing firms. The reason why exporting products and services together leads to high export performance can be mainly attributed to providing vertical differentiation of products and improving the quality of products perceived by consumers by providing products and services together. The execution of various projects to, for instance, enlist support from related experts, develop a product-service linkage system, provide support for prototyping of services, or support enterprise organization innovation for service implementation can be considered. By establishing a specialized research center that can serve as a pivotal point as a support or execution platform to support connections between manufacturing and services, R&D achievement in the area of linkage between manufacturing and services can be applied and utilized in industries.

Third, it is worth considering for policymakers to position Korea as a testbed base for the development of a manufacturing-service industry linkage business model. Korea possesses

world-class IT technology and infrastructure, and is a leading producer of core components such as semiconductors, displays, and secondary batteries, with well-established bases for other major manufacturing areas as well. Although its role as a leader in the global market is limited due to the lack of a huge domestic market, Korea has accumulated a considerable level of capabilities and know-how in the stages leading to industrialization, and its consumers

have a high tendency and interest to accept innovative products and strong demand for digital and high-tech products. Through the testbed strategy, the Korean market can be fostered as a forward base for commercialization of technologies from the linkage between manufacturing and services, and based on this, competitiveness of applied products and services can be improved. **KIEP**