



RIETI Discussion Paper Series 25-E-103

Service-oriented Structural Transformation of Manufacturing Firms: An analysis using panel data for Japanese firms

MORIKAWA, Masayuki
RIETI



Research Institute of Economy, Trade & Industry, IAA

The Research Institute of Economy, Trade and Industry
<https://www.rieti.go.jp/en/>

Service-Oriented Structural Transformation of Manufacturing Firms: An analysis using
panel data for Japanese firms *

Masayuki MORIKAWA

Research Institute of Economy, Trade and Industry

Abstract

This study uses Japanese firm panel data to examine trends in manufacturing firms' shift toward service-oriented businesses—referred to as “Manufacturing X.” A distinguishing feature of this study is that it analyzes not only overall non-manufacturing businesses but also narrowly defined service businesses. We find that manufacturing firms' share of non-manufacturing sales has been steadily increasing. If the current trend continues, the share of non-manufacturing sales among these firms is projected to reach 16.5% by 2040. Both the proportion of firms engaged in and sales share of narrowly defined services such as machine repair, professional services, and business services are rising, indicating a gradual shift in manufacturers' service businesses. Expanding narrowly defined service sales is positively associated with sales growth and profitability.

Keywords: servitization, diversification, manufacturing X, labor productivity, ROA

JEL Classification: L60, L80

RIETI Discussion Papers Series aims at widely disseminating research results in the form of professional papers, thereby stimulating lively discussion. The views expressed in the papers are solely those of the author(s), and do not present those of the Research Institute of Economy, Trade and Industry.

* I would like to thank Kyoji Fukao, Seiichiro Inoue, Naohiro Kaji, Daiji Kawaguchi, Eiichi Tomiura and the seminar participants at RIETI for their valuable comments and suggestions. I am grateful to the Ministry of Economy, Trade and Industry for providing the micro data from the Basic Survey of Japanese Business Structure and Activities used in this study. This research is supported by the JSPS Grants-in-Aid for Scientific Research (21H00720, 23K20606).

Service-Oriented Structural Transformation of Manufacturing Firms: An analysis using panel data for Japanese firms

1. Introduction

The shift in recent years toward service-oriented manufacturers has drawn attention from researchers. This trend stems from the fact that, amid globalization, value-added from services—such as product development and design that precedes the manufacturing process and post-production marketing and after-sales service—has become more important than value-added from the manufacturing process (so-called “smile curve”). Empirical studies on value-added trade using international input-output tables have indicated that developed countries tend to generate value-added from services (e.g., Francois *et al.*, 2015).

A factoryless goods producer (FGP) is the ultimate form of service-oriented manufacturing (e.g., Bernard and Fort, 2015; Morikawa, 2016; Kamal, 2023). FGPs are firms that have outsourced production processes to the extreme, deindustrializing their own business activities. They do not manufacture products themselves but focus their operations on product design, coordination of production activities, marketing, and sales. Representative examples include Apple Inc. in the U.S. and Dyson Ltd. in the U.K. Among Japanese firms, UNIQLO Co., Ltd., Nitori Co., Ltd., and Ryohin Keikaku Co., Ltd. can be regarded as close equivalents. Morikawa (2016) documents that Japanese FGPs are large in scale and highly productive.

Meanwhile, major countries increasingly seek to maintain and expand domestic manufacturing capacity from an economic security perspective. In particular, U.S. President Trump is attempting to revive domestic manufacturing through arbitrarily high tariff policies. These actions constrain the global value chain development pursued by many firms under the premise of a free trade system. At the same time, policies aimed at repatriating factories and expanding domestic manufacturing capacity may lead to an expansion of low value-added activities.

Amidst these circumstances, the Ministry of Economy, Trade and Industry’s (METI) quantitative outlook for Japan’s economy and industrial structure through 2040 states that manufacturing will achieve higher value-added through differentiation by utilizing frontier technologies and service-oriented approaches such as DX and maintenance (Committee on New Direction of Economic and Industrial Policies, Industrial Structure Council, 2025); METI refers to this transformation as “Manufacturing X.” Furthermore, it states that services classified in the standard industry classification system under information and communications or professional services could be included in manufacturing output.

This study uses panel data from Japanese firms to provide an overview of the trend toward

service-oriented businesses in manufacturing firms. While service-oriented businesses encompass several aspects, the focus here is on the service-oriented structural transformation of sales.

Relevant past studies include Crozet and Milet (2015), who focused on French firms' servitization. They revealed that many manufacturing firms engage in service businesses and the profit margins of firms that sell services are higher than those of pure manufacturing firms. Based on Danish employer-employee linked data, Bernard *et al.* (2017) showed that firms that transitioned from manufacturing to the service industry exhibit higher productivity and growth rates. They further point out that these sector-switching firms fall into two distinct types: (1) traditional wholesale firms and (2) firms that maintain and enhance their R&D and technological capabilities. They argue that policies focusing solely on manufacturing firms risk overlooking these high-growth firms and may instead be biased toward inefficient firms.

Ito *et al.* (2020) presented a detailed analysis of the service-oriented transformation of Japanese manufacturing firms. Using data from the Basic Survey of Japanese Business Structure and Activities (BSJBSA) for fiscal years 2001 to 2015, they concluded that a service-oriented transformation, measured as a manufacturing firm's increased revenue from service businesses, had not occurred. Rather, the share of non-manufacturing activities in total output has declined. In their analysis, they treated all sales from activities other than manufacturing as non-manufacturing (service) sales. However, as discussed later, wholesale sales account for an overwhelmingly large portion of non-manufacturing sales within manufacturing firms. Since wholesale involves purchasing and reselling from other domestic and foreign firms, it can be considered a part of manufacturing operations. Wholesale sales, including purchases and sales from overseas subsidiaries and affiliates, are naturally substantial, particularly for manufacturing firms that have built global supply chains.

In addition, the activities of many traditional non-manufacturing businesses conducted by manufacturing firms—such as construction, transportation, and real estate—differ from the activities assumed in “Manufacturing X.” As suggested by Bernard *et al.* (2017), heterogeneity within non-manufacturing sectors should be accounted for in the analysis. A key feature of the present study is its disaggregation of non-manufacturing sales to analyze narrowly defined service activities. Another contribution is its extended coverage to fiscal year 2023, post-pandemic, thereby clarifying more recent realities.

This study is also related to research on firm diversification. The benefits of diversification—the “economies of scope”—are thought to depend on the strength of the synergies with the core business. In the past, research has generally suggested that conglomeration reduced firm value and “selection and concentration” of businesses was desirable (e.g., Lang and Stulz, 1994; Berger and Ofek, 1995). Reflecting on excessive diversification into unrelated fields like real estate during the bubble era, Japan experienced a subsequent strong movement back to core businesses.

However, recently, some studies have indicated that conglomerate firms' allocation of resources is consistent with optimal behavior (Maksimovic and Phillips, 2002), suggesting that conglomeration can positively impact firm value and productivity (e.g., Tate and Yang, 2015; Bet, 2024).¹

In Japan, Fukui and Ushijima (2007) analyzed manufacturing firms and found that the average relationship between diversification and business performance is negative; however, this negative impact is mitigated when diversification is limited to fields closely related to a firm's core business. Ushijima (2016) demonstrated the presence of a diversification discount for firm value in Japanese firms. This study advances these studies by analyzing the relationship between diversification and business performance, focusing specifically on the expansion of services by manufacturing firms.

The rest of this paper is organized as follows. Section 2 explains the study's data and method of analysis. Section 3 provides an overview of the trend toward service-oriented businesses in manufacturing firms, while Section 4 analyzes the characteristics of firms undergoing service-oriented transformation. Section 5 examines the relationship between service-oriented transformation and productivity and profitability. Finally, Section 6 summarizes the conclusions and discusses their implications.

2. Data and methodology

This study uses panel data from the BSJBSA conducted by the METI covering fiscal years 2010 to 2023.² The BSJBSA is a fundamental statistical survey based on the Statistics Act. It covers approximately 30,000 firms in mining, manufacturing, wholesale, retail, and several service sectors, all of which have 50 or more regular employees and capital of 30 million yen or more. Since the survey assigns a permanent identification code to each firm, constructing a panel data set is easy. The survey covers a wide range of items, including basic financial information such as capital, number of employees, sales, operating expenses, total cash wages, and fixed asset values. A distinguished feature of the BSJBSA is the availability of sales broken down by detailed business activity. This provides a significant advantage over other business statistics for capturing

¹ Maksimovic and Phillips (2007, 2013) provide surveys of the literature on diversification.

² The BSJBSA is a long-running annual statistical survey that began in fiscal year 1991. However, it has undergone several major changes in survey items and industry classification. Given the relatively substantial changes to the industry classification, primarily in the service sector, between fiscal years 2008 and 2009, and the major revision to the industry classification between 2009 and 2010 in the "Monthly Labour Survey" (Ministry of Health, Labour and Welfare) used for productivity measurement, panel data from fiscal year 2010 onwards are used in this study.

changes in the industrial structure within firms.

This study calculates firms' output composition using sales data using the 3-digit business activity classification from the BSJBSA and analyzes the relationships between servitization and various firm characteristics such as firm size, firm age, labor productivity, and return on assets (ROA). While total factor productivity (TFP) is the preferred productivity measure, it is most appropriately measured as a comparison between firms within the same narrowly defined industry. Accurately measuring the TFP of firms engaged in multiple businesses using data available from the BSJBSA is difficult, hence labor productivity is used instead. Labor productivity is calculated as value-added divided by labor input. Labor input is the number of full-time regular workers plus the number of non-regular workers converted to full-time equivalents, multiplied by the industry-level working hours taken from the Monthly Labour Survey (Ministry of Health, Labour and Welfare). To adjust value-added for real terms, the industry-specific value-added deflator from the National Accounts (Cabinet Office) is used.

The BSJBSA categorizes sales into five major segments: (1) sales of own-mined minerals, manufactured goods, electricity, gas, heat supply, and water; (2) processing fee income; (3) wholesale, retail, accommodation, and food service sales; (4) service business income; and (5) other business income. It then surveys the sales for each business activity by three-digit classification.³ In this study, we first define manufacturing business sales as the sum of (1) sales revenue related to manufacturing operations and (2) processing fee income. In the following analysis, the portion of total sales not attributable to manufacturing operations is defined as non-manufacturing (broadly defined service) business sales, and service business income is used as narrowly defined service business sales. The proportion of service business sales within manufacturing firms' total sales is then calculated as: (1) a simple average of manufacturing firms and (2) an aggregated value (weighted average) of manufacturing firms. We observe the time-series trends using these measures.

The BSJBSA determines a firm's primary business based on the business category with the highest sales revenue. More precisely, it classifies sales revenue into 13 major categories: mining, quarrying, and gravel extraction, manufacturing, electricity and gas supply, information and communications, wholesale trade, retail trade, credit card and installment finance, rental services, research and professional/technical services, food service activities, personal and recreational services, private tutoring, service activities (excluding other services), service activities (other services), and other industries—and then determines the industry subcategory based on the sales item (business revenue) with the largest sales amount within the major category's subcategory (3-

³ In the BSJBSA, when a firm sells its own manufactured goods directly to consumers, it is classified as (3) "Wholesale, retail, accommodation, and food service sales."

digit industry classification).

Therefore, many firms classified as manufacturing in the BSJBSA often engage in non-manufacturing activities, while some firms not classified as manufacturing may still conduct manufacturing activities. This study mainly analyzes firms that have sales from manufacturing activities as “broadly defined manufacturing firms,” even if they are not classified as manufacturing firms in the BSJBSA.⁴ Firms classified as manufacturing in the BSJBSA will be referred to as “narrowly defined manufacturing firms.” Additionally, firms with zero sales from non-manufacturing operations that engage solely in manufacturing activities will be referred to as “pure manufacturing firms.”

Among broadly defined manufacturing firms, narrowly defined manufacturing firms account for a majority at 89%, showing little change over time. Conversely, broadly defined manufacturing firms not classified as manufacturing persist at over 10% throughout the sample period. While some broadly defined manufacturing firms cease manufacturing activities and become non-manufacturing firms, a certain number of non-manufacturing firms conversely start new manufacturing activities and become broadly defined manufacturing firms. For example, 4.0% of firms engaged in manufacturing in fiscal year 2010 were no longer performing manufacturing activities by fiscal year 2023. Conversely, 5.2% of firms not engaged in manufacturing in fiscal year 2010 transitioned into broadly defined manufacturing firms by fiscal year 2023.

Based on this data composition, we document trends of service businesses in broadly defined manufacturing firms. We examine the breakdown of non-manufacturing businesses in detail. Furthermore, we analyze the characteristics of manufacturing firms undergoing service-oriented transformation. Specifically, we regress the relationship between each firm’s share of non-manufacturing or service businesses and firm characteristics (firm size, firm age, ratio of full-time regular employees, capital intensity, global activities, patent holdings, etc.), as well as business performance—labor productivity, profitability (ROA), and growth.

3. Trends in service businesses of manufacturing firms

Figure 1-A plots the proportion of broadly defined manufacturing firms with non-manufacturing sales or “servitized firms.” This proportion was 35.3% in fiscal year 2010 and 43.7% in fiscal year 2023, showing a clear upward trend over time. Conversely, this means that

⁴ This definition is similar to that of Bernard *et al.* (2017). Ito *et al.* (2020) treat firms with manufacturing business divisions or establishments as manufacturing firms.

“pure manufacturing firms” engaged solely in manufacturing activities decreased from 64.7% to 56.3%. This figure also shows the proportion of firms classified as manufacturers (narrowly defined manufacturing firms) that engage in non-manufacturing activities, revealing a nearly identical upward trend over time. Breaking down non-manufacturing activities, firms with sales in wholesale, retail, accommodation, and food services increased from 22.8% in fiscal year 2010 to 27.5% in fiscal year 2023. Firms with sales in service businesses rose from 9.7% to 13.5% and those with sales in other businesses grew from 15.7% to 20.4% over the same period. All segments showed increasing trends.

However, changes in firm size or industry transitions may have caused some firms to fall outside the scope of the BSJBSA, while others were newly included. This change in sample composition could influence the observed trend. Therefore, we focus our analysis on firms present in both fiscal years 2010 (the dataset’s starting point) and 2023 (the ending point) (hereinafter referred to as “panel firms”) (see **Figure 1-B**). Manufacturing firms engaged in non-manufacturing activities accounted for 36.6% in fiscal year 2010 and 44.2% in fiscal year 2023, confirming that the proportion of pure manufacturing firms decreased (from 63.4% to 55.8%). Of the pure manufacturing firms in fiscal year 2010 (6,894 firms), 22.3% were engaged in non-manufacturing activities by fiscal year 2023. Conversely, of the pure manufacturing firms in fiscal year 2023 (6,109 firms), 12.3% were firms that had engaged in non-manufacturing activities in fiscal year 2010. The result indicates that a certain number of firms have started new non-manufacturing businesses or withdrawn from existing ones.

Breaking down non-manufacturing businesses among the panel firms reveals across the board increases; firms with sales in wholesale, retail, accommodation, and food services rose from 23.8% in fiscal 2010 to 28.6% in fiscal 2023; those with service business sales increased from 9.9% to 13.3%; and those with sales in other businesses grew from 16.4% to 20.4%. Changes in the sample composition did not significantly affect the aggregate trends.

Figure 2-A shows the ratio of non-manufacturing business sales in broadly defined manufacturing firms. An upward trend is observed in both the simple average and aggregated value (weighted average). Conversely, the share of manufacturing sales in the total sales of broadly defined manufacturing firms (weighted average) declined by 2.5 percentage points during this period, from 88.9% to 86.4% (the simple average decreased from 88.0% to 85.1%). In absolute terms, non-manufacturing sales contributed 24.4% of the total sales growth for broadly defined manufacturing firms between fiscal years 2010 and 2023. However, the share of non-manufacturing sales varies significantly across firms, with standard deviations of 25.1% and 27.8% in fiscal years 2010 and 2023, respectively.

Even when calculating the weighted average using only panel firms that are present in both fiscal years 2010 and 2023 (see **Figure 2-B**), the proportion of manufacturing sales declined.

However, the decline was smaller than that in **Figure 2-A**, at 1.5 percentage points from 89.8% in fiscal year 2010 to 88.3% in fiscal year 2023 (the simple average decreased from 87.8% to 86.2%). While the conclusion remains essentially unchanged, this indicates that changes in the sample composition exerted a certain influence. Between fiscal years 2010 and 2023, non-manufacturing sales contributed 17.4% to the total sales growth of broadly defined manufacturing firms.

Figure 3-A shows the composition (weighted average basis) of non-manufacturing sales by broad business category. The “other businesses” category combines the sales figure for “other businesses” from the BSJBSA with the figure for “sales of mineral products, manufactured goods, electricity, gas, heat supply, and water” minus the sales figure for manufacturing activities. While wholesale, retail, accommodation, and food services (primarily wholesale) remain large in volume (7.8% in fiscal year 2010, 8.3% in fiscal year 2023), narrowly-defined services increased from 1.1% in fiscal year 2010 to 1.8% in fiscal year 2023 (+0.7 percentage points), and other businesses rose from 2.0% to 3.4% (+1.4 percentage points).⁵ These results indicate that the sales composition of manufacturing firms shifted toward services during this period. **Figure 3-B** focuses on panel firms existing in both fiscal years 2010 and 2023, confirming that the share of service sales has increased.⁶

Table 1-A shows the breakdown of non-manufacturing sales in broadly defined manufacturing firms for fiscal years 2010 and 2023, further subdivided into: (1) the percentage of firms implementing each activity (number of firms implementing each activity / number of broadly defined manufacturing firms) and (2) the percentage of sales of each activity (weighted average).⁷ While it is possible to subdivide down to the three-digit classification level, this table uses the business classifications shown to avoid excess complexity. Manufacturing firms engage in a wide range of non-manufacturing activities. The largest share is the wholesale trade (22.5% in fiscal year 2023), followed by real estate (10.3%), retail (6.3%), construction (5.8%), professional services (4.3%), business services (4.0%), and machine repair (3.5%). Somewhat unexpectedly, 2.4% of manufacturing firms engage in accommodation and food services, a non-negligible

⁵ While Figure 3-A depicts the weighted average, the simple average shows a qualitatively similar pattern. For non-manufacturing businesses overall, the share increased from 12.0% in fiscal year 2010 to 14.9% in fiscal year 2023. Within this category, wholesale, retail, accommodation, and food services rose from 7.3% to 8.3%, services businesses increased from 2.0% to 2.6%, and other businesses climbed from 2.6% to 3.9%.

⁶ Looking at the simple (unweighted) average for panel firms, non-manufacturing sales as a whole rose from 12.2% in fiscal year 2010 to 13.8% in fiscal year 2023. Wholesale, retail, accommodation, and food services increased from 19.6% to 20.6%. Service businesses rose from 2.0% to 2.2%. Other businesses climbed from 2.6% to 3.1%.

⁷ In a small number of firms, the total sales of their individual business segments fall below the firm’s total sales. In this case, firms with a discrepancy exceeding 1% were excluded from the sample for calculation.

proportion. Conversely, only 1.9% are involved in information and communications. Firms engaged in businesses unrelated to manufacturing, such as finance and insurance, healthcare and welfare, and education and learning support, are few but do exist.

Compared to the composition in fiscal year 2010, the proportion of manufacturing firms engaged in these activities has increased across nearly all non-manufacturing businesses. Within service businesses, manufacturing firms providing professional and business services—closer to the image of “Manufacturing X”—have shown a particularly significant increase. Even when focusing solely on panel firms included in the BSJBSA for both fiscal years 2010 and 2023, the proportion of firms engaged in these service activities has risen (see **Table 1-B**).

Considering the composition of non-manufacturing sales (weighted average), wholesale sales account for a very large share (7.5% in fiscal 2023). This reflects manufacturing firms’ active engagement in purchasing and reselling goods from other domestic and overseas firms, not just selling their own manufactured products. The next highest proportions are construction (1.4%), information and communications (0.9%), professional services (0.7%), machinery repair (0.5%), retail (0.5%), business services (0.3%), and transportation (0.3%). Compared with the share in fiscal year 2010, the proportion of total sales accounted for by professional services, machinery repair, and business services has increased, indicating that the narrowly defined service-oriented transformation has been gradually progressing.

4. Characteristics of firms undergoing service-oriented transformation

This section uses pooled data for 14 years from fiscal years 2010 to 2023 to observe the characteristics of service-oriented broadly defined manufacturing firms through regression analysis. This includes: (1) a probit estimation to determine whether firms engage in non-manufacturing activities and (2) an OLS estimation with the share of sales from non-manufacturing businesses as the dependent variable. Additionally, a similar analysis is conducted focusing specifically on narrowly defined service businesses within non-manufacturing activities.

The explanatory variables include firm size (logarithm of the number of full-time regular employees), firm age (years since establishment), proportion of full-time regular workers (number of full-time regular employees / total number of full-time regular employee equivalents), capital intensity (tangible fixed assets / number of full-time regular employee equivalents), intangible asset intensity (intangible fixed assets / number of full-time regular employee equivalents), foreign-affiliated firm dummy, exporting firm dummy, firm with overseas subsidiaries dummy,

firm possessing patents dummy, and year dummies.⁸ Summary statistics for the main variables are presented in **Table 2**.

The probit estimation results in column (1) of **Table 3** show that larger, older, and foreign-affiliated firms tend to engage in non-manufacturing activities. Firms with higher capital–labor ratios also tend to engage in non-manufacturing activities, but the intensity of intangible assets is insignificant. Somewhat unexpectedly, the coefficient of the full-time regular worker ratio is negative and significant, indicating that firms engaged in non-manufacturing activities rely more heavily on non-regular workers. The coefficient of the foreign-affiliated firm dummy is positive and significant. However, the coefficients of the dummies for firms engaged in exports and those with overseas subsidiaries are negative and significant. This suggests no systematic relationship where manufacturing firms engaged in global activities are more likely to engage in non-manufacturing activities domestically; rather, the opposite is true. The results also show that firms holding patents tend to engage in non-manufacturing activities.

The results of the OLS estimation with the non-manufacturing sales ratio as the dependent variable show a generally similar pattern (column (2)): the coefficients of large and older firms are positive and significant, while the coefficients of the full-time regular worker ratio, export firm dummy, and overseas subsidiary-holding firm dummy are negative and significant. However, the coefficients of the foreign-affiliated and patent-holding firm dummies become negative.

Focusing specifically on narrowly defined service businesses—of particular interest in this study—the estimates (columns (3) and (4)) show that, unlike non-manufacturing businesses overall, both the probit and OLS estimations with the service sales ratio as the dependent variable yield a significantly negative coefficient of firm age. This indicates that younger manufacturing firms tend to engage in service businesses. Furthermore, the coefficient of the full-time regular worker ratio is positive and significant, indicating that firms with a higher proportion of regular workers are more likely to engage in service activities. The coefficient of the patent ownership dummy is also positive and significant, suggesting that technological capability may be related to service business activities. These results differ considerably from those observed for non-manufacturing businesses as a whole.

5. Service-oriented transformation and firm performance

⁸ Until fiscal year 2021 (2022 survey), the BSJBSA surveyed the number of full-time regular employees and number of non-regular employees (part-time, temporary workers, etc.) separately. For the latter category, it also inquired about the full-time equivalent number of employees based on working hours. However, starting with fiscal year 2022 (2023 survey), the classification changed to “indefinite-term employees” and “fixed-term employees.” Therefore, strictly speaking, discontinuity exists between the data from fiscal year 2021 and earlier and that from fiscal year 2022 and later.

In this section, we used a sample of broadly defined manufacturing firms to conduct fixed-effects estimation with labor productivity, ROA levels, changes in sales, labor productivity, and ROA as dependent variables and the ratios of non-manufacturing sales and narrowly-defined service sales as explanatory variables. The rate of change refers to changes up to five years ahead, aiming to observe the relationship with medium-term firm growth. Since business composition is an endogenous variable determined by the firms themselves, this analysis does not intend to identify the causal relationship between service orientation and management performance. All estimates include firm size (log of number of employees) and year dummies as control variables. Furthermore, the estimation equation explaining labor productivity additionally controls for the capital–labor ratio or its change.

The estimation results are shown in the upper panel of **Table 4**. When labor productivity is used as the dependent variable, the coefficient of the non-manufacturing sales ratio is negative and significant at the 1% level, whereas in the estimation using ROA as the dependent variable, the coefficient is positive and significant (columns (1) and (2), respectively). When sales growth is the dependent variable, the coefficient of the non-manufacturing sales ratio is insignificant (column (3)). However, when labor productivity growth is the dependent variable, the coefficient of the non-manufacturing sales ratio is significantly negative (column (4)). Finally, when ROA growth is the dependent variable, the coefficient of the non-manufacturing sales ratio is significantly positive (column (5)).

Focusing specifically on the ratio of narrowly defined service sales (lower panel of **Table 4**), while no significant relationship with labor productivity is found, a significantly positive relationship is observed with ROA level, sales growth, and ROA growth. This suggests that the shift toward services among manufacturing firms may contribute to firm growth and improved profitability.

While not entirely clear when viewed across non-manufacturing businesses as a whole, diversification cannot be said to have had a negative effect, a natural outcome if firms are rationally determining their business domains. On the other hand, diversification into narrowly defined service businesses is often positively associated with manufacturing firm performance. As noted in the introduction, this result is consistent with other recent research findings.

6. Conclusion

This study utilized panel data from the BSJBSA to examine trends in the service-oriented transformation of manufacturing firms—referred to as “Manufacturing X”—and analyzed the

characteristics of firms undergoing this transformation and its relationship with their performance. The main findings are as follows.

First, while the proportion of non-manufacturing sales in the total sales of broadly defined manufacturing firms is not particularly high, both the percentage of firms engaging in non-manufacturing activities and share of non-manufacturing sales in their total sales have been trending upward.

Second, within non-manufacturing businesses, wholesale sales account for a very large proportion—over half of non-manufacturing sales. Wholesale includes the purchase and resale of products manufactured by domestic and overseas subsidiaries and affiliates. Within non-manufacturing activities, wholesale sales are closely linked to manufacturing activity and differ in nature from the service-oriented transformation referred to as “Manufacturing X.” While past studies often viewed servitization across all non-manufacturing activities, understanding “Manufacturing X” requires focusing on specific segments within non-manufacturing, such as machinery repair, professional services, business services, and information and communications. When breaking down non-manufacturing activities, while information and communications show less pronounced trends, the number of firms engaged in machinery repair, professional services, and business services, along with the proportion of sales from these activities, are all increasing. This indicates that a service-oriented transformation is gradually progressing.

Third, while the relationship between the service-oriented transformation of manufacturing firms and their business performance is not entirely clear, diversification into service businesses cannot be said to have had a negative impact. An expansion in the sales share of narrowly defined service businesses was positively correlated with growth in sales and profit margins, suggesting that the service orientation of manufacturing firms may contribute to firm growth and improved profitability.

In summary, the service-oriented transformation of manufacturing firms is progressing steadily. Furthermore, the type of service-oriented transformation referred to as “Manufacturing X” may be contributing to improved business performance. Simply extrapolating the figures analyzed in this study for fiscal years 2010 to 2023 to fiscal year 2040, the share of non-manufacturing sales of broadly defined manufacturing firms would reach 16.5% by 2040, while the share of narrowly defined service sales would reach 2.7%.

However, this study’s analysis focuses on individual firms and does not cover firm groups. Considering firm groups as a whole, many manufacturing firms likely operate service businesses through subsidiaries or affiliated firms. This point should be noted as a limitation of this study.

References

- Berger, Philip G. and Eli Ofek (1995). "Diversification's Effect on Firm Value." *Journal of Financial Economics*, Vol. 37, No. 1, pp. 39–65.
- Bernard, Andrew B. and Teresa C. Fort (2015). "Factoryless Goods Producing Firms." *American Economic Review*, Vol. 105, No. 5, pp. 518–523.
- Bernard, Andrew B., Valerie Smeets, and Fredric Warzynski (2017). "Rethinking Deindustrialization." *Economic Policy*, No. 89, January, pp. 5–38.
- Bet, German (2024). "The Productivity Effects of Corporate Diversification." *Journal of Industrial Economics*, Vol. 72, No. 2, pp. 685–728.
- Committee on New Direction of Economic and Industrial Policies, Industrial Structure Council (2025). The Fourth Interim Report. (in Japanese)
- Crozet, Matthieu and Emmanuel Milet (2017). "Should Everybody Be in Services? The Effect of Servitization on Manufacturing Firm Performance." *Journal of Economics and Management Strategy*, Vol. 26, No. 4, pp. 820–841.
- Francois, Joseph, Miriam Manchin, and Patrick Tomberger (2015). "Services Linkages and the Value Added Content of Trade." *The World Economy*, Vol. 38, No. 11, pp. 1631–1649.
- Fukui, Yoshitaka and Tatsuo Ushijima (2007). "Corporate Diversification, Performance, and Restructuring in the Largest Japanese Manufacturers." *Journal of the Japanese and International Economies*, Vol. 21, No. 3, pp. 303–323.
- Ito, Keiko, Tomohiko Inui, Heiwai Tang, and Taiji Furusawa (2020). "Servicification of Japanese Manufacturing Firms." RIETI Policy Discussion Paper, 20-P-27. (in Japanese)
- Kamal, Fariha (2023). "A Portrait of US Factoryless Goods Producers." in Nadim Ahmad, Brent R. Moulton, J. David Richardson, and Peter van de Ven Eds. *Challenges of Globalization in the Measurement of National Accounts*, University of Chicago Press.
- Lang, Jarry H. P. and Rene M. Stulz (1994). "Tobin's q, Corporate Diversification, and Firm Performance." *Journal of Political Economy*, Vol. 102, No. 6, pp. 1248–1280.
- Maksimovic, Vojislav and Gordon M. Phillips (2002). "Do Conglomerate Firms Allocate Resources Inefficiently?" *Journal of Finance*, Vol. 57, No. 2, pp. 721–767.
- Maksimovic, Vojislav and Gordon Phillips (2007). "Conglomerate Firms and Internal Capital Markets." in B. Espen Eckbo ed. *Handbook of Empirical Corporate Finance, Vol. 1*, Elsevier B. V., Ch. 8, pp. 423–479.
- Maksimovic, Vojislav and Gordon M. Phillips (2013). "Conglomerate Firms, Internal Capital Markets, and the Theory of the Firm." *Annual Review of Economics*, Vol. 5, pp. 225–244.
- Morikawa, Masayuki (2016). "Factoryless Goods Producers in Japan." *Japan and the World Economy*, Vol. 40, December, pp. 9–15.

- Tate, Geoffrey and Liu Yang (2015). "The Bright Side of Corporate Diversification: Evidence from Internal Labor Markets." *Review of Financial Studies*, Vol. 28, No. 8, pp. 2203–2249.
- Ushijima, Tatsuo (2016). "Diversification, Organization, and Value of the Firm." *Financial Management*, Vol. 45, No. 2, pp. 467–499.

Table 1. Number of manufacturing firms engage in non-manufacturing activities and share of non-manufacturing sales

A. Whole sample

		2010FY		2023FY		2010-23FY	
Business category		Number of firms	Sales	Number of firms	Sales	Number of firms	Sales
Wholesale, retail, accommodations, and food service	Wholesale	18.27%	6.89%	22.52%	7.48%	4.24%	0.59%
	Retail	4.55%	0.34%	6.26%	0.47%	1.71%	0.13%
	Accommodations & food service	1.70%	0.06%	2.43%	0.12%	0.73%	0.06%
Services	Lease and rental	0.92%	0.08%	1.30%	0.08%	0.38%	0.00%
	Professional services	2.31%	0.34%	4.26%	0.69%	1.95%	0.35%
	Personal & recreational services	1.10%	0.06%	1.38%	0.09%	0.28%	0.03%
	Waste disposal	0.80%	0.07%	1.14%	0.09%	0.34%	0.02%
	Car maintenance	0.33%	0.04%	0.48%	0.04%	0.15%	0.00%
	Machine repair	2.91%	0.34%	3.52%	0.50%	0.60%	0.16%
	Business services	2.68%	0.15%	3.95%	0.27%	1.28%	0.11%
	Information & communications	1.77%	0.94%	1.90%	0.87%	0.12%	-0.08%
Other businesses	Finance & insurance	0.51%	0.00%	0.60%	0.00%	0.10%	0.00%
	Healthcare & welfare	0.14%	0.00%	0.40%	0.01%	0.26%	0.01%
	Education	0.29%	0.01%	0.34%	0.01%	0.04%	0.00%
	Agriculture	0.42%	0.03%	0.77%	0.03%	0.35%	0.00%
	Construction	4.56%	0.72%	5.82%	1.39%	1.26%	0.67%
	Transportation	1.82%	0.13%	2.60%	0.26%	0.78%	0.12%
	Real estate	7.91%	0.12%	10.29%	0.17%	2.38%	0.05%
	Combined services	0.10%	0.00%	0.16%	0.01%	0.06%	0.01%
	Other businesses	1.78%	0.03%	1.42%	0.01%	-0.36%	-0.01%
Mining, electricity, and gas		0.54%	0.22%	3.59%	0.75%	3.05%	0.53%
Number of broadly defined manufacturing firms		14,386		16,093			

Notes: Broadly defined manufacturing firms are firms with non-zero manufacturing sales, a broader definition than the definition for those classified as manufacturers in the BSJBSA. The figures in the table show the composition at the aggregation level (weighted average, not simple average). Non-manufacturing businesses showing significant growth during this period are indicated in red.

B. Panel firms

		2010FY		2023FY		2010-23FY	
Business category		Number of firms	Sales	Number of firms	Sales	Number of firms	Sales
Wholesale, retail, accommodations, and food service	Wholesale	19.10%	6.38%	23.78%	6.56%	4.68%	0.18%
	Retail	4.55%	0.36%	5.70%	0.45%	1.15%	0.08%
	Accommodations & food service	1.59%	0.05%	1.90%	0.08%	0.32%	0.03%
Services	Lease and rental	1.03%	0.08%	1.32%	0.08%	0.29%	-0.01%
	Professional services	2.36%	0.30%	4.23%	0.67%	1.87%	0.37%
	Personal & recreational services	1.14%	0.06%	1.18%	0.03%	0.04%	-0.03%
	Waste disposal	0.84%	0.08%	1.04%	0.08%	0.20%	0.00%
	Car maintenance	0.39%	0.05%	0.47%	0.05%	0.07%	0.00%
	Machine repair	2.99%	0.34%	3.83%	0.46%	0.84%	0.12%
	Business services	2.49%	0.16%	3.47%	0.23%	0.98%	0.07%
	Information & communications	1.66%	1.09%	1.92%	1.00%	0.26%	-0.09%
Other businesses	Finance & insurance	0.51%	0.00%	0.49%	0.00%	-0.01%	0.00%
	Healthcare & welfare	0.14%	0.00%	0.25%	0.00%	0.11%	0.00%
	Education	0.26%	0.01%	0.29%	0.01%	0.03%	0.00%
	Agriculture	0.42%	0.02%	0.76%	0.02%	0.34%	0.00%
	Construction	4.92%	0.72%	5.56%	0.93%	0.65%	0.21%
	Transportation	1.82%	0.13%	2.29%	0.12%	0.47%	-0.01%
	Real estate	8.27%	0.13%	10.60%	0.14%	2.33%	0.01%
	Combined services	0.09%	0.00%	0.14%	0.00%	0.05%	0.00%
	Other businesses	1.96%	0.03%	1.31%	0.01%	-0.65%	-0.02%
Mining, electricity, and gas		0.61%	0.25%	3.74%	0.80%	3.13%	0.55%
Number of broadly defined manufacturing firms		10,658		10,728			

Notes: Broadly defined manufacturing firms are firms with non-zero manufacturing sales, a broader definition than the definition of those classified as manufacturers in the BSJBSA. The figures in the table show the composition at the aggregation level (weighted average, not simple average). Data are aggregated focusing solely on “panel firms” included in both fiscal years 2010 and 2023. Non-manufacturing businesses showing significant growth during this period are indicated in red.

Table 2. Summary statistics of major variables

Variable	Obs	Mean	Std. dev.	Min	Max
Firm size (ln employees)	207,903	5.182	0.985	3.912	11.37
Firm age	207,903	57.243	20.845	0	228
Full-time regular employee ratio	207,900	0.879	0.163	0	1
Tangible capital intensity	207,262	11.140	22.242	0	5198
Intangible capital intensity	207,900	0.331	5.108	0	1272.2
Foreign-affiliated firm dummy	207,903	0.094	0.292	0	1
Exporting firm dummy	207,903	0.353	0.478	0	1
Firm with overseas subsidiaries dummy	207,903	0.264	0.441	0	1
Firm with patents dummy	207,903	0.331	0.470	0	1
Labor productivity	191,049	1.352	0.562	-5.682	8.422
ROA	207,784	0.042	0.083	-12.544	1.579
Sales growth	112,164	0.038	0.324	-7.137	5.065
Labor productivity growth	98,300	0.017	0.426	-7.349	6.340
ROA growth	112,066	-0.001	0.092	-12.635	9.017

Note: Growth rate of sales, labor productivity, and ROA are up to five years ahead.

Table 3. Characteristics of firms engaged in service activities

	(1) Non-manufacturing activities	(2) Share of non-manufacturing sales	(3) Service activities	(4) Share of service sales
	dF/dx	Coef.	dF/dx	Coef.
ln employees	0.0103 *** (0.0013)	0.0081 *** (0.0007)	0.0253 *** (0.0008)	0.0084 *** (0.0003)
Firm age	0.0022 *** (0.0001)	0.0005 *** (0.0000)	-0.0009 *** (0.0000)	-0.0004 *** (0.0000)
Full-time regular employee ratio	-0.1324 *** (0.0072)	-0.0583 *** (0.0040)	0.0351 *** (0.0044)	0.0090 *** (0.0017)
Tangible capital intensity	0.0012 *** (0.0002)	0.0000 * (0.0000)	0.0001 *** (0.0000)	-0.0001 ** (0.0000)
Intangible capital intensity	0.0001 (0.0002)	0.0001 (0.0001)	0.0001 (0.0001)	0.0000 (0.0000)
Foreign-affiliated firm	0.0134 *** (0.0043)	-0.0074 *** (0.0021)	-0.0069 *** (0.0025)	-0.0038 *** (0.0008)
Exporting firm	-0.0122 *** (0.0027)	-0.0235 *** (0.0014)	0.0008 (0.0017)	-0.0082 *** (0.0005)
Firm with overseas subsidiaries	-0.0141 *** (0.0030)	-0.0155 *** (0.0015)	0.0020 (0.0019)	-0.0061 *** (0.0006)
Firms with patents	0.0322 *** (0.0027)	-0.0121 *** (0.0014)	0.0198 *** (0.0017)	0.0052 *** (0.0006)
Year dummies	yes	yes	yes	yes
Nobs.	207,262	207,262	207,262	207,262
Ppseudo R ² , Adj.-R ²	0.0131	0.0082	0.0165	0.0136

Notes: Probit (columns (1) and (3)) and OLS (columns (2) and (4)) estimation results with robust standard errors reported in parentheses. Probit estimations report marginal effects and pseudo R².

***: p<0.01, **: p<0.05, *: p<0.10.

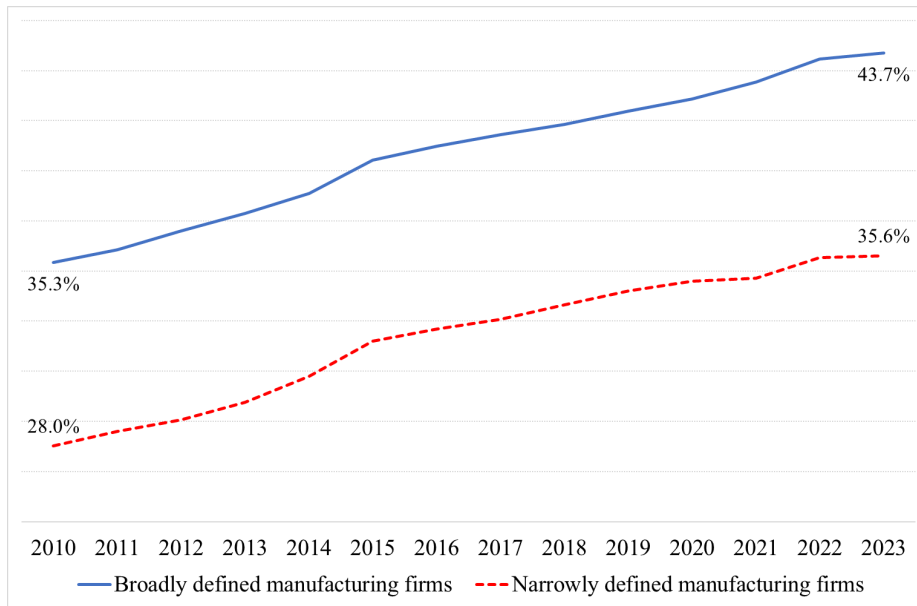
Table 4. Service-oriented transformation and firm performance

	(1) LP	(2) ROA	(3) Sales growth	(4) LP growth	(5) ROA growth
Non-manufacturing sales	-0.0300 *** (0.0112)	0.0042 *** (0.0014)	-0.0114 (0.0084)	-0.0190 ** (0.0080)	0.0050 *** (0.0013)
In employees	yes	yes	yes	yes	yes
Capital intensity	yes	no	no	yes	no
Firm FE	yes	yes	yes	yes	yes
Year FE	yes	yes	yes	yes	yes
Nobs.	191,422	207,712	112,115	98,538	112,016
R ² (within)	0.0217	0.0049	0.0453	0.0240	0.0090
Service sales	-0.0161 (0.0289)	0.0217 *** (0.0051)	0.1473 *** (0.0278)	-0.0121 (0.0238)	0.0092 ** (0.0090)
In employees	yes	yes	yes	yes	yes
Capital intensity	yes	no	no	yes	no
Firm FE	yes	yes	yes	yes	yes
Year FE	yes	yes	yes	yes	yes
Nobs.	190,895	207,784	112,164	98,204	112,066
R ² (within)	0.0216	0.0049	0.0463	0.0226	0.0090

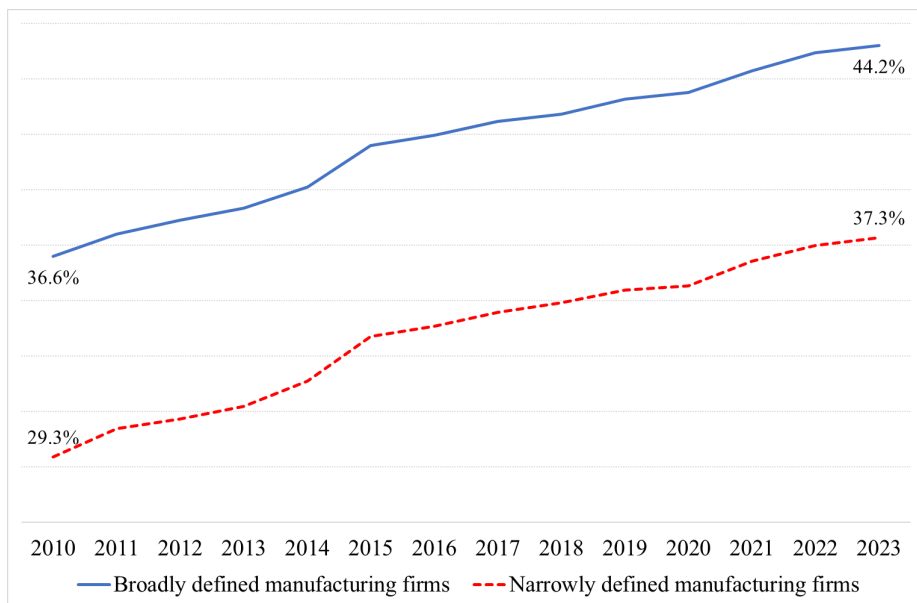
Notes: Fixed effects estimations with robust standard errors reported in parentheses. p<0.01, **: p<0.05. “LP” in columns (1) and (4) stands for labor productivity.

Figure 1. Percentage of firms engaged in non-manufacturing businesses

A. Whole sample



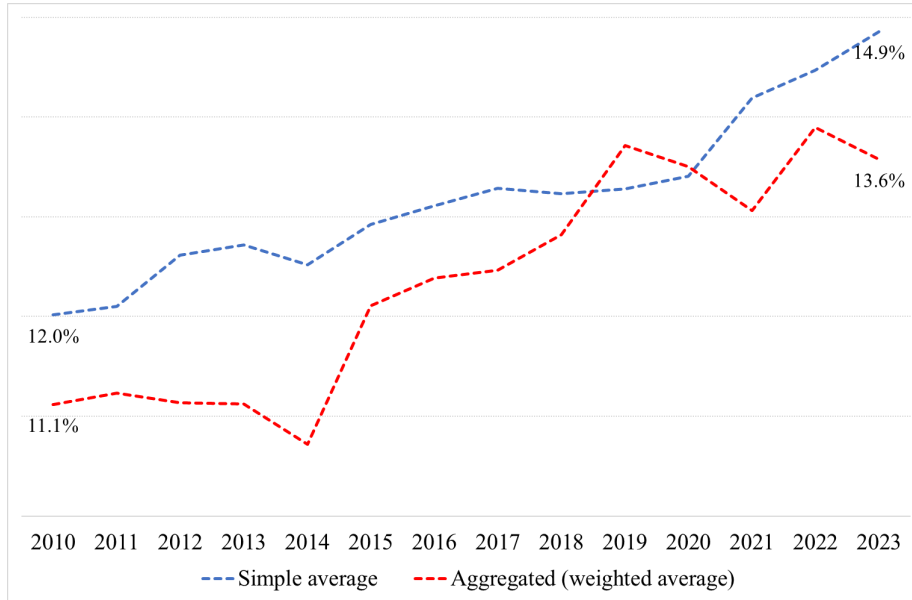
B. Panel firms



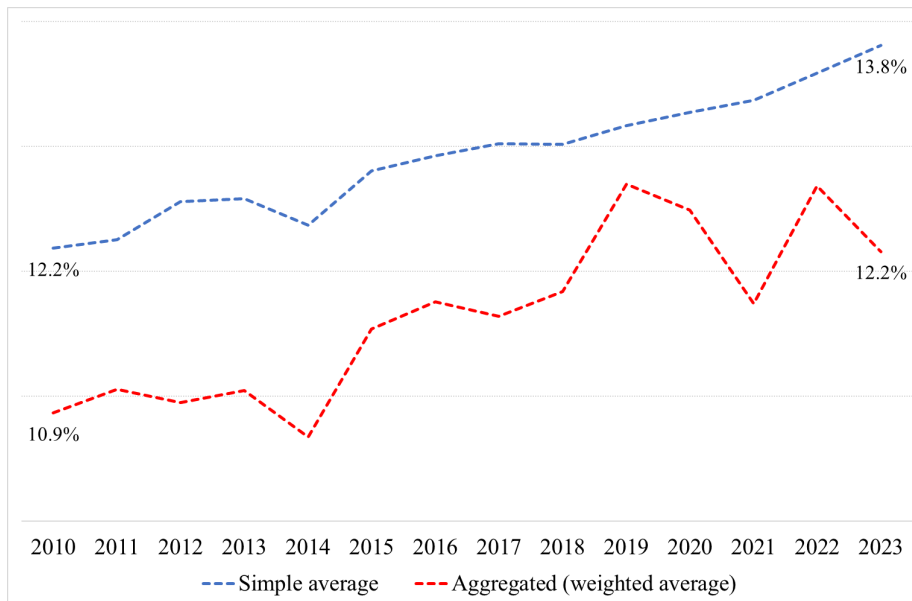
Note: The sample is limited to “panel firms” that are included in the BSJBSA for both fiscal years 2010 and 2023.

Figure 2. Percentage of non-manufacturing sales to total sales

A. Whole sample



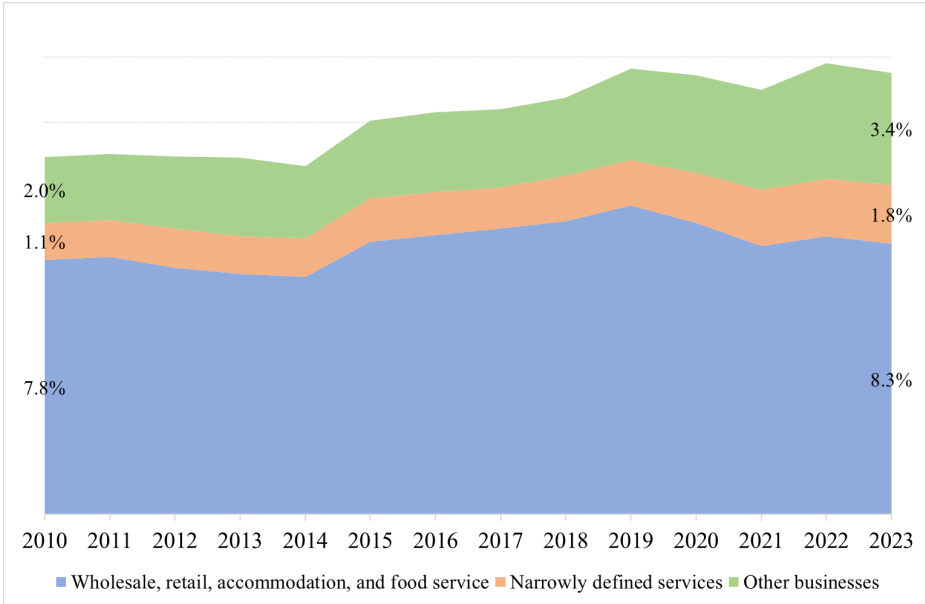
B. Panel firms



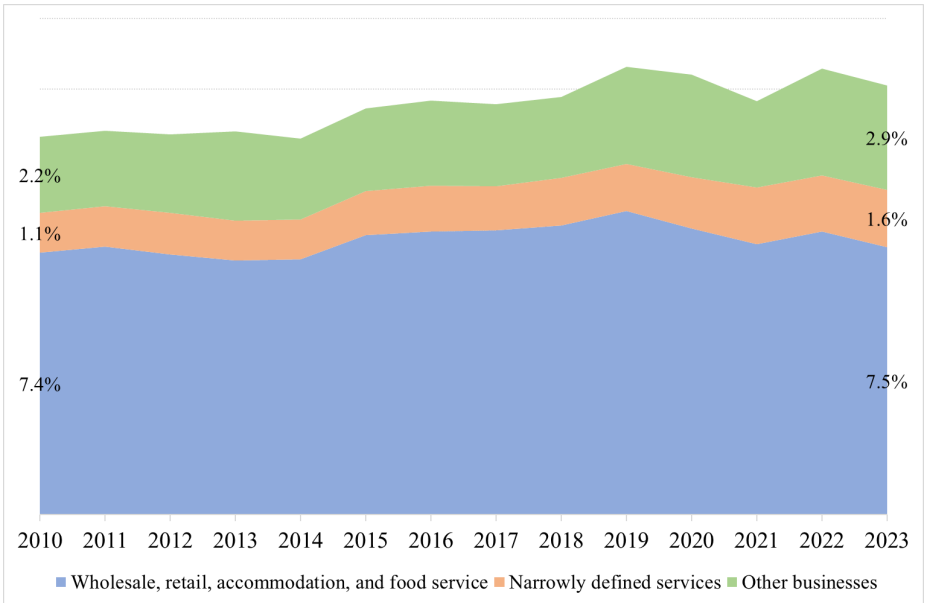
Note: The sample is limited to “panel firms” that are included in the BSJBSA for both fiscal years 2010 and 2023.

Figure 3. Composition of non-manufacturing sales by broad segment

A. Whole sample



B. Panel firms



Note: The sample is limited to “panel firms” that are included in the BSJBSA for both fiscal years 2010 and 2023.