Section 2
Interregional Trade Balances by Industry and Labor Productivity: A Comparison of Osaka, Tokyo, and Aichi

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Introduction

Chapter 6 Section 1 of the 2023 'Kansai and the Asia Pacific Economic Outlook' organized the industrial structure of the Kansai economy, identified growth industries, and examined its future industrial structure. Among Japan's three major economic regions—the Kansai region, the Tokyo metropolitan area, and the Chubu region—the relative standing of the Kansai region has declined, and the downward trend in the Kansai region's economic share of the national total shows no sign of stopping. This decline stems from disparities in growth rates among the core prefectures of each economic region: Osaka, Tokyo, and Aichi.[1] Section 1 examined the characteristics of interregional trade balances by industry for Greater Kansai. Particularly concerning is the significant reduction in Osaka prefecture's interregional surplus in "commerce," raising fears about declining competitiveness in this sector.

Section 2 examines the "earning" industries (those with substantial interregional surpluses) in Osaka, Tokyo, and Aichi by comparing their interregional trade balances by industry. It also explores the background of the growth rate disparity among these three prefectures from the perspective of labor productivity in these "earning" industries, based on data such as the Economic Census.[2]

1. "Earning" industries in Osaka Prefecture, the Tokyo Metropolitan Area, and Aichi Prefecture from an Interregional Balance Perspective

As shown in Section 1, the top 10 industries contributing to Osaka prefecture's interregional balance surplus (integrated major categories, 37 sectors)

1) From 1991 to 2021, the Greater Kansai's GRP (Gross Regional Product) share of the national total declined from 19.2% to 17.9%. During this period, Osaka prefecture's real GRP annual average growth rate (simple average) was 0.10%, while Tokyo's was 0.66% and Aichi's was 1.10%.
2) For medium- to long-term economic growth, improving productivity is a crucial factor alongside labor and capital.

are: (1) "Commerce," (2) "Business Services," (3) "Transportation and Postal Services," (4) "Production Machinery," (5) "Metal Products," (6) "General-Purpose Machinery," (7) "Iron and Steel," (8) "Electrical machinery," (9) "Petroleum and Coal Products," and (10) "Real Estate." These include both non-manufacturing and manufacturing sectors (Table 6-2-1). The "earning pillar," "Commerce," recorded an interregional balance surplus of approximately 2.3 trillion yen. However, as noted in Section 1, this surplus has significantly narrowed compared to 2011. Furthermore, while "Information and Communications" and "Finance and Insurance" rank highly in Tokyo (discussed later), they do not appear on Osaka prefecture's list of "earning" industries.

Table 6-2-1 Top 10 Industries with the Largest Interregional Surplus in Osaka Prefecture (Unit: million yen)

Osaka (2015, 37 departments)

1	Commerce	2,349,229
2	Business services	1,485,891
3	Transport and postal services	636,461
4	Production machinery	445,544
5	Metal products	326,344
6	General-purpose machinery	299,680
7	Iron and steel	211,151
8	Electrical machinery	198,192
9	Petroleum and coal products	111,218
10	Real estate	105,391

Note: Reprinted from Table 6-1-2 in Section 1 for Osaka prefecture. Grayed industrial sectors indicate manufacturing.
Source: Prepared by the authors based on "2015 Osaka prefecture Input-Output Table Statistics" from the Statistics Division, General Affairs Department, Osaka prefecture

Next, examining the top 10 industries in Tokyo's interregional surplus from the '2015 Tokyo Input-Output Tables' (integrated major categories, 38 sectors) reveals: (1) "Headquarters," (2) "Commerce," (3) "Information and Communications," (4) "Business Services," (5) "Finance and Insurance," (6) "Education and Research," (7) "Personal Services," (8) "Real Estate," (9) "Healthcare and Welfare." The composition consists solely of non-manufacturing industries (Table 6-2-2).[3] A distinctive feature of the Tokyo Input-Output Tables is that headquarters activities are specifically listed as an independent sector. The interregional surplus from headquarters activities, at approximately

3) Only these nine sectors recorded surpluses; the other 28 sectors recorded deficits. Among them, the Food and Beverage sector's deficit reached approximately 4.3 trillion yen.

Table 6-2-2 Top 10 Industries with the Largest Interregional Surplus in Tokyo Metropolitan Area (Unit: million yen)

Tokyo (2015, 38 departments)

1	Headquarters	14,947,922
2	Commerce	12,983,099
3	Information and Communications	9,317,706
4	Business Services	8,390,878
5	Finance and Insurance	4,405,420
6	Education and Research	2,054,703
7	Personal Services	822,183
8	Real Estate	586,266
9	Healthcare and Welfare	121,894
10	–	–

Note: The table shows only industries with interregional surpluses; industries with interregional deficits are not included. Colored industry sectors indicate manufacturing.
Source: Prepared by the authors based on the Tokyo Metropolitan Government Statistics Department's "Tokyo Metropolitan Input-Output Tables: 2015 Tokyo Metropolitan Input-Output Tables"

15 trillion yen, shows a significant gap compared to the approximately 2.3 trillion yen interregional surplus from "Commerce," Osaka prefecture's primary revenue generator. Furthermore, Tokyo's second-ranked sector, "Commerce," recorded an interregional surplus of approximately 13 trillion yen, far exceeding that of Osaka's "Commerce" sector.

Next, examining the top 10 industries in Aichi prefecture with the largest interregional surplus from the '2015 Aichi Prefecture Input-Output Table' (integrated major categories, 43 sectors) reveals: (1) "Automobiles", (2) "Industrial Machinery", (3) "Commerce", (4) "Production Machinery", (5) "Other Transportation Equipment", (6) "Aircraft", (7) "Plastic Materials", (8) "Ceramics", (9) "Electricity, Gas, and Heat Supply," and (10) "Iron and Steel." With the exception of "Commerce" in third place, the list consists solely of manufacturing industries, with the "Automobile" sector's surplus being particularly outstanding (Table 6-2-3). Specifically, Aichi prefecture's "Automobile" sector recorded an interregional balance surplus of approximately 7.7 trillion yen, significantly outpacing the second-ranked "Industrial Machinery" sector's surplus of approximately 0.6 trillion yen.

Table 6-2-3 Top 10 Industries with the Largest Interregional Surplus in Aichi Prefecture (Unit: million yen)

Aichi (2015, 43 departments)

1	Automobile	7,714,352
2	Industrial machinery	643,012
3	Commerce	602,694
4	Production machinery	469,757
5	Other transportation machinery	306,322
6	Aircraft	293,633
7	Plastic products	224,026
8	Ceramics	163,571
9	Electricity, Gas, and Heat Supply	159,199
10	Iron and Steel	144,658

Note: Grayed industrial sectors indicate manufacturing.
Source: Prepared by the authors based on the "2015 Aichi prefecture Input-Output Table" from the Statistics Division, Prefectural Life Department, Aichi prefecture Bureau of Culture and Community Affairs

2. "Earning" Industries and Labor Productivity

(1) Nationwide

Next, to examine the background of the growth rate disparity among the three metropolitan areas, we compare labor productivity in "earning" industries industries. Here, we use net value added per employee from the 2021 Economic Census as the labor productivity indicator. Using this indicator enables comparisons of labor productivity by metropolitan area and industry, as described later. Specifically, we examine the following "earning" industries across the three prefectures: "Manufacturing," "Information and Communications," "Transportation and Postal Services," "Wholesale and Retail Trade" (corresponding to the "Commerce" category in the integrated major classification of the Input-Output Table), "Finance and Insurance," "Real Estate and Rental Services" (where rental services are included in the "Business Services" category in the integrated major classification of the Input-Output Tables), and "Accommodation and Food Service Activities".

Comparing labor productivity across these industries reveals significant disparities within the non-manufacturing sector (Figure 6-2-1). Specifically, the labor productivity of Tokyo's "earning" industries—such as "Information and Communications," "Finance and Insurance," and "Real Estate and Rental Services"—exceeds that of Aichi prefecture's "earning"

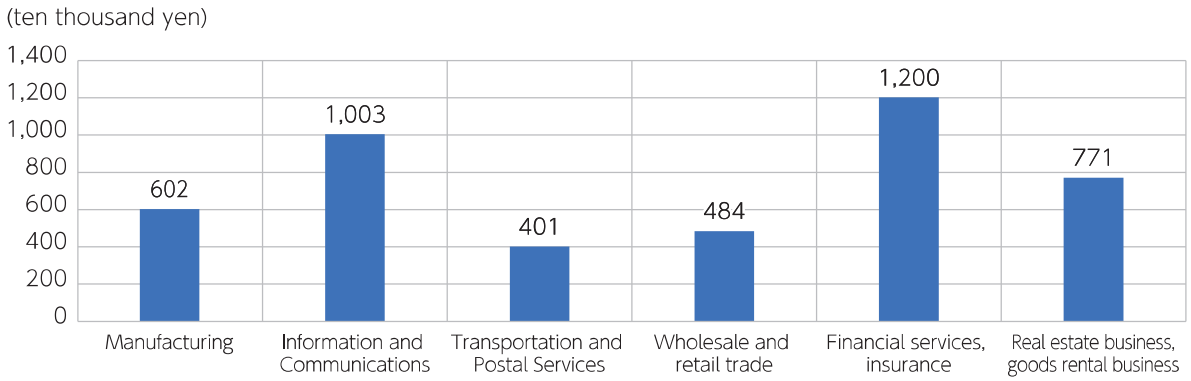

Figure 6-2-1 Per capita net value added (Nationwide)

Source: Prepared by the authors from the Ministry of Internal Affairs and Communications and Ministry of Economy, Trade and Industry's "2021 Economic Census for Business Activity"

industry, "Manufacturing".[4] Conversely, the labor productivity of Osaka prefecture's top "earning" industries—namely "Wholesale and Retail Trade" (classified as "Commerce" in the input-output table) and "Transportation and Postal Services"—falls below that of its "Manufacturing" sector.[5] In other words, while the labor productivity of Tokyo and Aichi's "earning" industries is relatively high, that of Osaka's "earning" industries is relatively low, suggesting this disparity underlies the growth rate gap.

(2) Regional Comparison

Furthermore, regional disparities in labor productivity may exist even within the same industrial sector. That is, even for an industry with low average labor productivity, if the labor productivity of that industry in a given region is relatively higher than in other regions, its contribution to growth changes.

Looking at specific examples, in "Manufacturing," labor productivity is high in Tokyo and Aichi prefecture, but relatively low in Osaka prefecture, where it is about the same as the national average (Figure 6-2-2).

In "Transportation and Postal Services," Osaka prefecture's labor productivity is higher than the national average, and than Tokyo, and Aichi prefecture. Notably, Tokyo's productivity is significantly below the national average (Figure 6-2-3).

In "Wholesale and Retail Trade," Tokyo's labor productivity is high, and Osaka prefecture also exceeds the national average (Figure 6-2-4).

4) Looking at the value added per employee in Tokyo, "Information and Communications" is 11.24 million yen, "Finance and Insurance" is 17.95 million yen, and "Real Estate and Rental Services" is 12.72 million yen. In contrast, Aichi prefecture's "Manufacturing" is 6.57 million yen.

5) Looking at value added per employee in Osaka prefecture, "Wholesale and Retail Trade" is 5.9 million yen, and "Transportation and Postal Services" is 5.25 million yen.

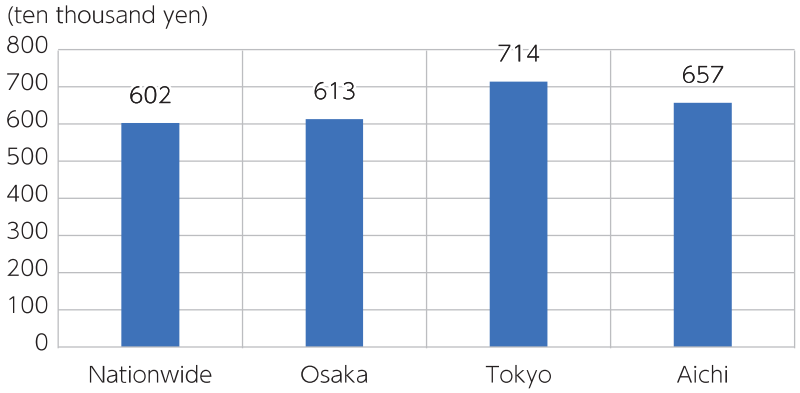

Figure 6-2-2 Per capita net value added (Manufacturing)

Source: Prepared by the authors from the Ministry of Internal Affairs and Communications and Ministry of Economy, Trade and Industry's "2021 Economic Census for Business Activity"

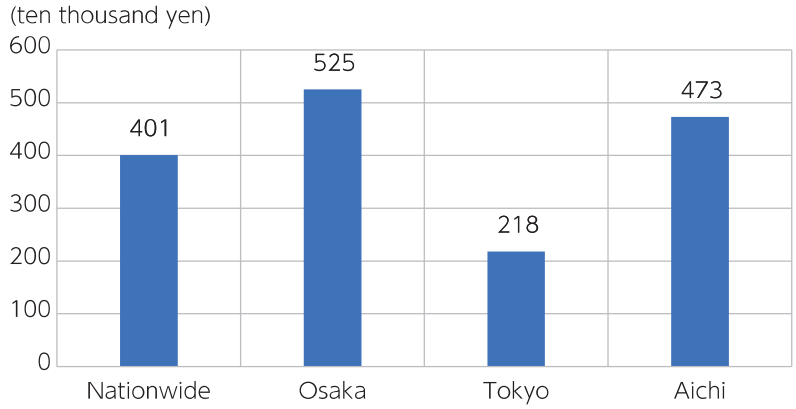

Figure 6-2-3 Per capita net value added (Transportation industry, Postal)

Source: Prepared by the authors from the Ministry of Internal Affairs and Communications and Ministry of Economy, Trade and Industry's "2021 Economic Census for Business Activity"

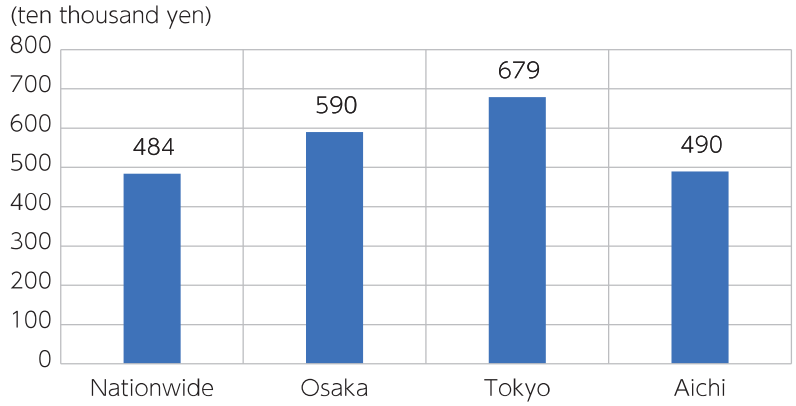

Figure 6-2-4 Per capita net value added (Wholesale and retail trade)

Source: Prepared by the authors from the Ministry of Internal Affairs and Communications and Ministry of Economy, Trade and Industry's "2021 Economic Census for Business Activity"

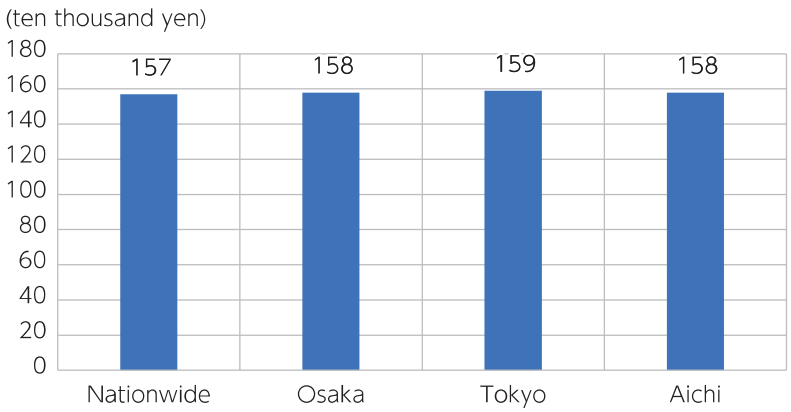

Figure 6-2-5 Per capita net value added (Accommodation and food service industries)

Source: Prepared by the authors from the Ministry of Internal Affairs and Communications and Ministry of Economy, Trade and Industry's "2021 Economic Census for Business Activity"

On the other hand, in the "Accommodation and Food Service Industry," there is almost no difference in labor productivity between the national level, Osaka prefecture, the Tokyo metropolitan area, and Aichi prefecture (Figure 6-2-5).

3. Labor Productivity and Agglomeration Benefits

As seen thus far, Tokyo has higher labor productivity than other regions in most industries, though the degree varies by sector. Labor productivity may be higher in industries benefiting from agglomeration and lower in those suffering from agglomeration disadvantages. Therefore, we attempt to verify labor productivity and agglomeration benefits by industry using prefecture-level data from the "2021 Economic Census for Business Activity". For the labor productivity indicator, we use value added per employee, as in previous analyses. Next, as an indicator of agglomeration benefits, we use the ratio of the number of business establishments across all industries to the total habitable land area (establishment density). The reason for focusing on the number of establishments across all industries rather than individual industries is to confirm the impact of the urbanization of the economy (the effect of diverse industries clustering within the same region).

First, plotting a scatter diagram of labor productivity versus establishment density for all industries reveals a positive correlation: higher establishment density correlates with higher labor productivity (Figure 6-2-6). Note that both labor productivity and business density have been transformed into natural

logarithms.[6)] A trend line is plotted on the scatter plot, showing that Tokyo deviates significantly upward from the trend line.

Looking at the scatter plot for "Manufacturing," a positive correlation between labor productivity and business density is observed, similar to the case for all industries. However, the relationship is not as strong as for all industries, and Tokyo is largely on the trend line (Figure 6-2-7).

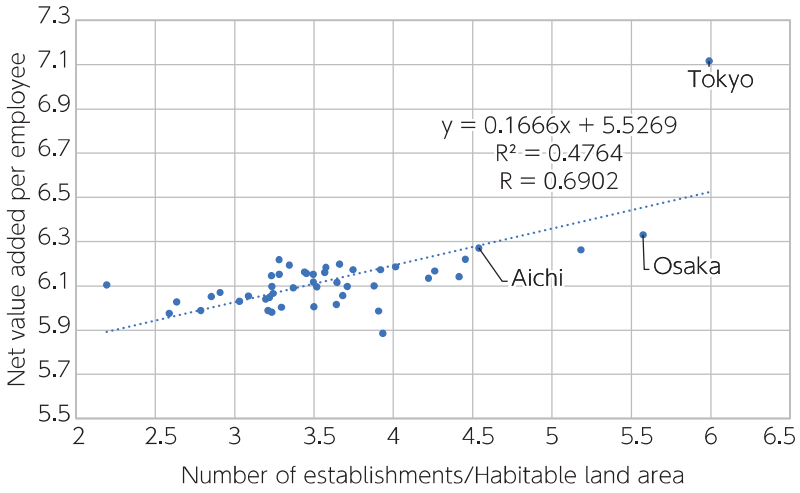

Figure 6-2-6 Relationship Between Labor Productivity and Business Establishment Density (All Industries, 2021)

Source: Prepared by the authors from the Ministry of Internal Affairs and Communications and Ministry of Economy, Trade and Industry's "2021 Economic Census for Business Activity" and the Geospatial Information Authority of Japan's "Area Survey by Prefecture, City, Ward, Town, and Village"

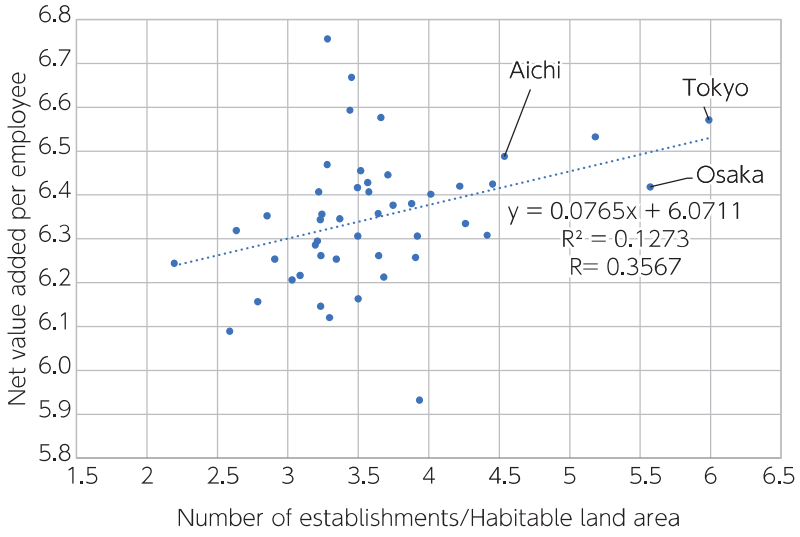

Figure 6-2-7 Relationship Between Labor Productivity and Business Establishment Density (Manufacturing, 2021)

Source: Prepared by the authors from the Ministry of Internal Affairs and Communications and Ministry of Economy, Trade and Industry's "2021 Economic Census for Business Activity" and the Geospatial Information Authority of Japan's "Area Survey by Prefecture, City, Ward, Town, and Village"

6) The same applies to the scatter plot of labor productivity and establishment density below.

For "Transportation and Postal Services," no correlation is observed between the two variables, and Tokyo deviates significantly downward (Figure 6-2-8). In Tokyo, the disadvantages of agglomeration (disadvantages of congestion) may be suppressing labor productivity in "Transportation and Postal Services."

In "Wholesale and Retail Trade," a clear positive correlation exists, with Tokyo and Osaka deviating above the trend line (Figure 6-2-9).

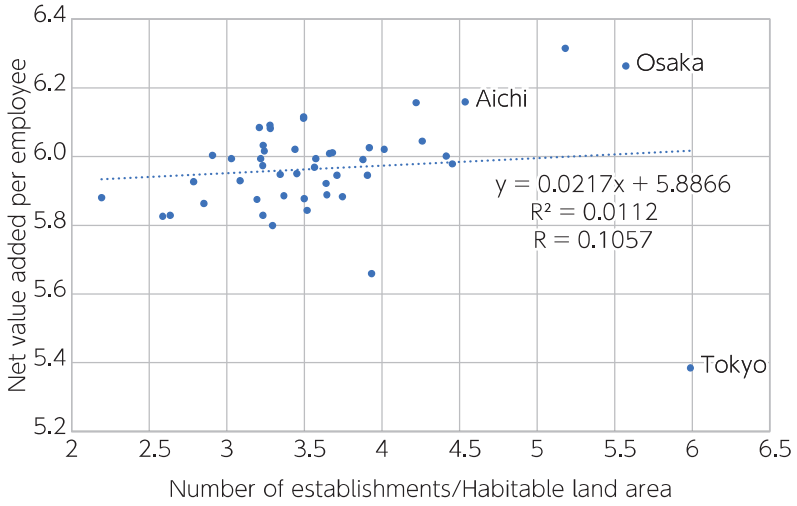

Figure 6-2-8 Relationship Between Labor Productivity and Business Establishment Density (Transportation industry, Postal, 2021)

Source: Prepared by the authors from the Ministry of Internal Affairs and Communications and Ministry of Economy, Trade and Industry's "2021 Economic Census for Business Activity" and the Geospatial Information Authority of Japan's "Area Survey by Prefecture, City, Ward, Town, and Village"

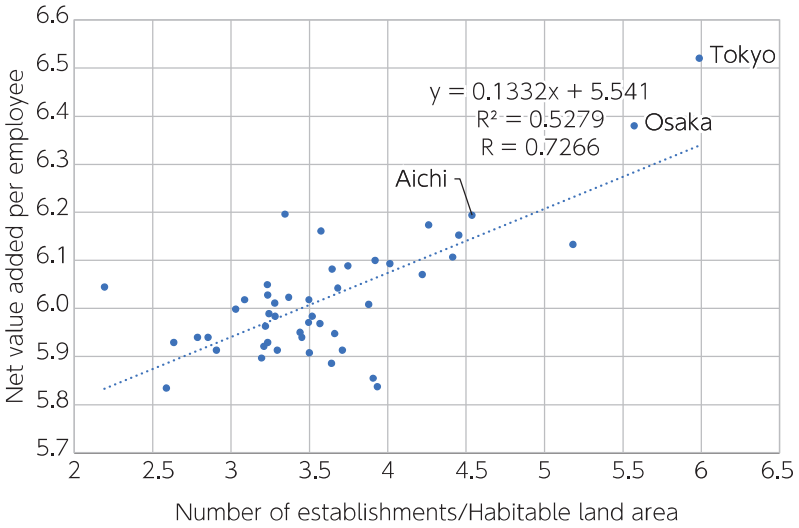

Figure 6-2-9 Relationship Between Labor Productivity and Business Establishment Density (Wholesale and retail, 2021)

Source: Prepared by the authors from the Ministry of Internal Affairs and Communications and Ministry of Economy, Trade and Industry's "2021 Economic Census for Business Activity" and the Geospatial Information Authority of Japan's "Area Survey by Prefecture, City, Ward, Town, and Village"

The "Wholesale and Retail Trade" sector stands out as an industry where the benefits of agglomeration have a particularly strong impact on labor productivity. The "Manufacturing" sector also shows agglomeration benefits affecting labor productivity, though to a lesser extent than the aforementioned industries. Conversely, no correlation between labor productivity and agglomeration benefits is observed in "Transportation and Postal Services" or "Accommodation and Food Service Activities" (Figure 6-2-10).

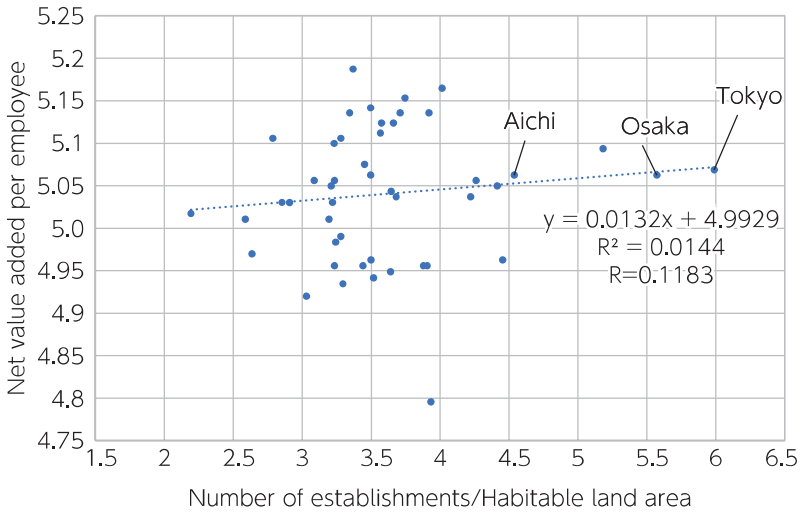

Figure 6-2-10 Relationship Between Labor Productivity and Business Establishment Density (Accommodation and Food Service, 2021)

Source: Prepared by the authors from the Ministry of Internal Affairs and Communications and Ministry of Economy, Trade and Industry's "2021 Economic Census for Business Activity" and the Geospatial Information Authority of Japan's "Area Survey by Prefecture, City, Ward, Town, and Village"

The previous section highlighted regional disparities in labor productivity. This section further discusses the relationship between labor productivity and industrial agglomeration. Specifically, it confirmed a corresponding relationship: regions with high labor productivity also exhibit significant agglomeration benefits, while regions with low labor productivity show smaller agglomeration benefits (or face greater agglomeration disadvantages). For example, in the "Transportation and Postal Services" sector, Tokyo's labor productivity is significantly below the national average. This is largely attributable to factors such as congestion, rising land prices, and high wages resulting from the concentrated location of industries, i.e., it is considered to stem from agglomeration diseconomies.

4. Labor Productivity and Capital-Labor Ratio

Theoretically, high (low) labor productivity depends on a high (low) capital-labor ratio (capital stock per worker).[7] That is, regional disparities in labor productivity across industries may stem from regional disparities in the capital-labor ratio. Below, we examine the relationship between labor productivity and the capital-labor ratio using time-series data. Specifically, we use time-series data for labor productivity and capital stock per worker from the R-JIP Database 2021 by the Research Institute of Economy, Trade and Industry (RIETI). This data comprises real net value added per worker and real net capital stock per worker for three prefectures. Note that this data is available for the period 1994–2018, with 2018 being the latest year.

First, examining the change in labor productivity reveals a significant gap between Osaka and Tokyo metropolitan area, which has been widening over the long term. Conversely, no major gap exists between Osaka prefecture and Aichi prefecture (Figure 6-2-11). Looking at the change in the capital-labor ratio, Tokyo has the highest, followed by Aichi prefecture, with Osaka prefecture having the lowest. Since the 2010s, all three prefectures have shown a declining trend, but Osaka prefecture appears to be experiencing a particularly strong decline (Figure 6-2-12).

Looking at the scatter plot showing the relationship between the capital-labor ratio and labor productivity based on time-series data for all industries in Osaka Prefecture, we can see that the capital-labor ratio and labor productivity

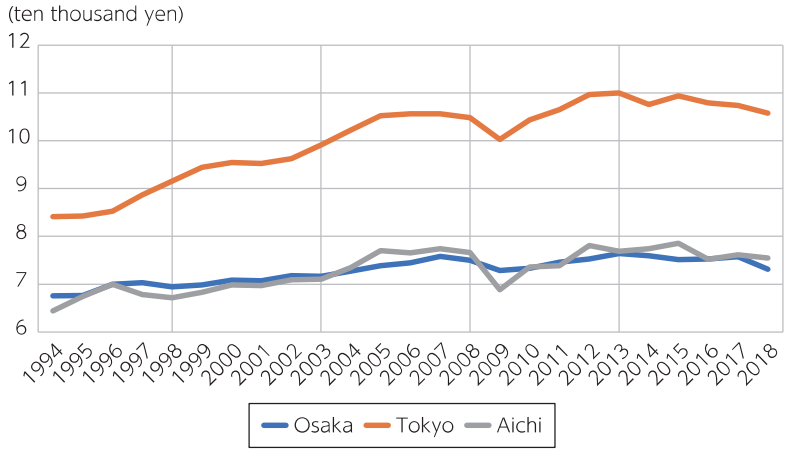

Figure 6-2-11 Change in Labor Productivity in Osaka Prefecture, Tokyo Metropolitan area, and Aichi Prefecture (All Industries, Real Value Added per Employee)

Source: Prepared by the authors based on the "R-JIP Database 2021" from the Research Institute of Economy, Trade and Industry (R-JIP)

7) Assuming a Cobb-Douglas production function model, it can be derived that labor productivity is an increasing function of the capital-labor ratio.

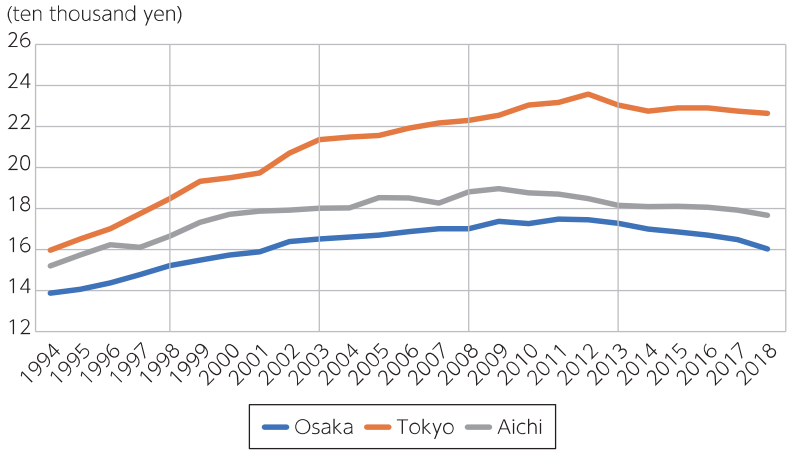

Figure 6-2-12 Change in Capital-Labor Ratio in Osaka Prefecture, Tokyo Metropolitan area, and Aichi Prefecture (All Industries, Real Value Added per Employee)

Source: Prepared by the authors based on the "R-JIP Database 2021" from the Research Institute of Economy, Trade and Industry (R-JIP)

are positively correlated (Figure 6-2-13). Furthermore, since 2013, labor productivity in Osaka prefecture has declined in response to the decrease in the capital-labor ratio. This suggests that a capital shortage is likely behind the decline in labor productivity in Osaka prefecture. This corresponds with Inada (2022) analysis that "the cause of the Kansai economy's decline lies in relative underinvestment."

Similarly, examining the scatter plot of the capital-labor ratio and labor productivity based on time-series data for all industries in Tokyo reveals a positive correlation between the two (Figure 6-2-14).

Moreover, since 2013, labor productivity has declined in response to the decrease in the capital-labor ratio, though the extent of this decline has been

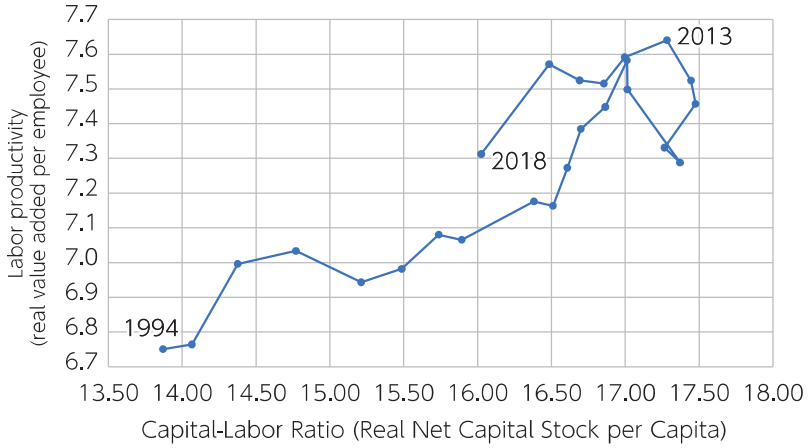

Figure 6-2-13 Capital-Labor Ratio and Labor Productivity (Osaka, All Industries)

Source: Prepared by the authors based on the "R-JIP Database 2021" from the Research Institute of Economy, Trade and Industry (R-JIP)

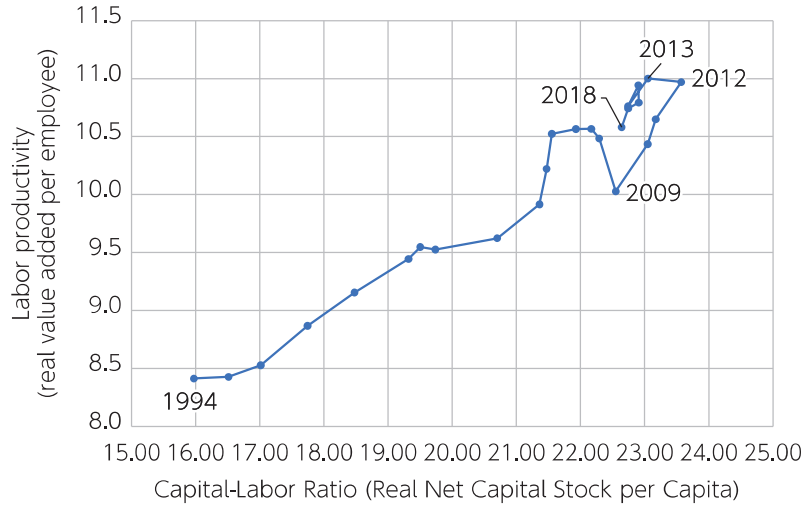

Figure 6-2-14 Capital-Labor Ratio and Labor Productivity (Tokyo, All Industries)

Source: Prepared by the authors based on the "R-JIP Database 2021" from the Research Institute of Economy, Trade and Industry (R-JIP)

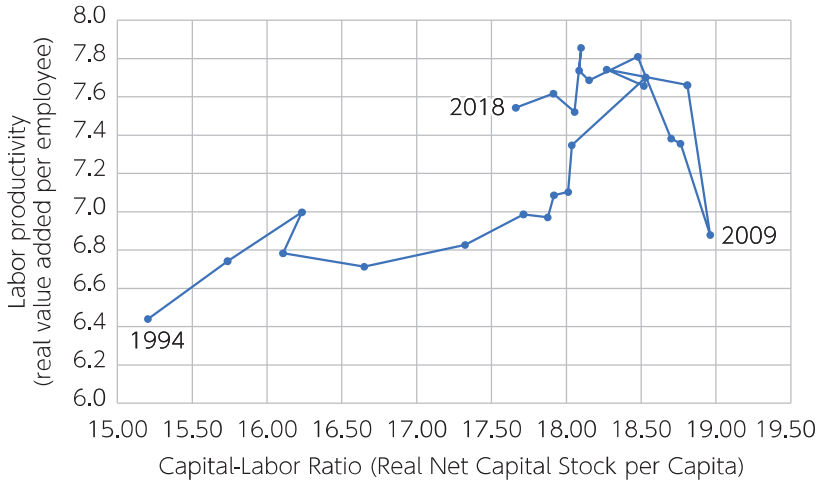

Figure 6-2-15 Capital-Labor Ratio and Labor Productivity (Aichi, All Industries)

Source: Prepared by the authors based on the "R-JIP Database 2021" from the Research Institute of Economy, Trade and Industry (R-JIP)

small. Furthermore, examining the scatter plot showing the relationship between the capital-labor ratio and labor productivity using time-series data for all industries in Aichi prefecture reveals a complex pattern, yet capital-labor ratio and labor productivity are positively correlated (Figure 6-2-15).

Furthermore, a notable feature in Aichi prefecture is the significant decline in labor productivity in 2009, following the Global finance crisis.

As described above, it is observed that in Osaka prefecture, Tokyo metropolitan area, and Aichi prefecture, labor productivity increases alongside the rise in the capital-labor ratio on an all-industry basis, indicating a positive correlation between the two.

Summary

Section 2 has examined the "earning" industries selected from the interregional trade balances by industry for Osaka prefecture, Tokyo metropolitan area, and Aichi prefecture, focusing on labor productivity. The analysis results are summarized as follows.

1) Labor productivity is a source of medium- to long-term economic growth. The labor productivity of "earning" industries in Tokyo and Aichi is relatively high, while that of Osaka's "earning" industries is relatively low. This is a factor in the growth rate disparity among these prefectures.
2) Furthermore, even within the same industry, labor productivity varies by region, significantly influenced by agglomeration benefits (or diseconomies). Tokyo generally exhibits higher labor productivity than other regions across most industries, though the degree varies by sector. Specifically, Tokyo's labor productivity is particularly high in industries benefiting from agglomeration, while it tends to be lower in industries experiencing agglomeration diseconomies. It is considered that agglomeration benefits contribute significantly to the high overall labor productivity in Tokyo.
3) In Osaka prefecture, Tokyo metropolitan area, and Aichi prefecture, a positive correlation is observed between labor productivity and the capital-labor ratio, with both increasing. Furthermore, in Osaka prefecture, a clear downward trend in both labor productivity and the capital-labor ratio has been evident since 2013. The decline in the capital-labor ratio (capital shortage) may be causing a drop in labor productivity, leading to a slowdown in growth.

From these points, it can be said that the revitalization of Osaka prefecture and the Kansai region requires: (1) fostering "earning" industries with high labor productivity, and (2) enhancing the labor productivity of existing "earning" industries. For example, for Osaka prefecture's current "earning" industries such as "commerce" and "transportation and postal services," it will be necessary to increase the capital-labor ratio and boost labor productivity through measures like promoting IT adoption.

References

Aichi Prefecture Bureau of Cultural Affairs, Department of Citizen Life, Statistics Division (2021), '2015 Aichi Prefecture Input-Output Table,' (https://www.pref.aichi.jp/soshiki/toukei/io2015.html, Last accessed: May 26, 2025), March 5, 2021

Inada, Y. (2022), 'Toward a Reversal in the Kansai Economy: Leveraging the Osaka-Kansai Expo and IR,' (https://www.apir.or.jp/research/post15681/, Last accessed: May 26, 2025), *APIR Trend Watch* No.81, June 21, 2022

Osaka Prefecture General Affairs Department Statistics Division (2021), '2015 Osaka Prefecture Input-Output Table Statistics,' (https://www.pref.osaka.lg.jp/o040090/toukei/sanren/sanren_k-io15k000xls.html, Last accessed: May 26, 2025), February 2021

Ministry of Internal Affairs and Communications / Ministry of Economy, Trade and Industry (2022), "2021 Economic Census for Business Activity", (https://www.stat.go.jp/data/e-census/2021/index.html, Last accessed: May 26, 2025), May 31, 2022

Tokyo Metropolitan Government General Affairs Bureau Statistics Department (2021), "Tokyo Metropolitan Input-Output Tables: 2015 Tokyo Metropolitan Input-Output Tables," (https://www.toukei.metro.tokyo.lg.jp/sanren/2015/sr15t1.htm, last accessed: May 26, 2025), March 2021

Research Institute of Economy, Trade and Industry (2023), "R-JIP Database 2021", (https://www.rieti.go.jp/jp/database/R-JIP2021/index.html, Last accessed: May 26, 2025), June 6, 2023