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The Effect of COVID-19 on Cities and the Outlook for the Future

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The Effect of COVID-19 on Cities and the Outlook for the Future

Introduction

The Japanese government moved the status of new coronavirus infection (COVID-19) from "new influenza and other infectious diseases (so-called category 2 equivalent)" to "category 5 infectious diseases" on 8 May 2023. More than three years have passed since the first case of infection was confirmed in Japan on 15 January 2020 and the World Health Organization (WHO) declared a pandemic situation in March 2020[1]. During the period, the COVID-19 epidemic had a significant impact on economic activities and people's lifestyles, such as the cumulative total of 33,802,739 positive cases and 74,669 deaths (figures published by the Ministry of Health, Labor and Welfare, as of 8 May 2023).

During the first phase of the COVID-19 outbreak, the government declared the first state of emergency for seven prefectures on 7 April 2020 (the scope was expanded to the whole country on 16 April 2020), and took measures to reduce human contact as much as possible, including restricting outdoor activities and requesting restaurants and other establishments to close. Real gross domestic product (GDP) growth fell sharply to -8.1% (-28.6% on an annualized basis) in the period from April to June 2020 (it turned positive in the period from July to September and from October to December, but was -4.7% in calendar year 2020).

After this, second and third emergency declarations were issued by 2021, depending on the status of COVID-19 infection, but the negative impact on economic activities has been controlled by specifying the target prefectures, requesting restaurants and other establishments to reduce their opening hours, and by targeting measures to reduce human contact (see Fig.1 on page 32).

Thus, measures to reduce human contact are effective in preventing COVID-19 infection, and the impact on cities where people accumulate and economic activities take place is unavoidable. Figure 1 shows the half-year change rate in land prices from the 1 July 2017 Prefectural Land Price Survey[2] to

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[1] Infection Disease law classifies infectious diseases in five categories, from 1 to 5, taking into consideration infection power and severity, and prescribes the measures that government can take to prevent infection spread. This includes a shifting from a system in which the government requests much, to one in which it participates in the public variously, to one involving a voluntary approach—that is, correspondence respecting a personal choice (from Ministry of Health, Labor and Welfare HP).

[2] Based on Country Use Plan Law Enforcement Order Article 9, prefectural governors determine the standard price on July 1 every year and announce it in September of the year.

the 1 January 2022 Public notice of land prices[3]. This figure was prepared using common sites (1,496 sites) from the Prefectural Land Price Survey and the Land Price Public Notice. The spread of COVID-19 infection led the price of land to a sharp decline at the time of the 1 July 2020 prefectural land price survey, which was followed by a gradual recovery. The half-year change rate in the price of residential and commercial areas reversed at this time. Before COVID-19, commercial land prices were rising faster than residential land prices, but after COVID-19, residential land prices have recovered faster than commercial land prices. This change suggests that residential life and economic activities considerably changed around COVID-19. For example, the change strikingly reflects people's behavior patterns of avoiding human contact and spending more time at home, also known as stay-at-home demand.

Thus, this paper proceeds with an analysis of how the impact of COVID-19 on cities has changed land prices and population movements, how far they have recovered up to present, and how they will do in the future, using the half-year rate of change in land prices in common sites (1,496 sites) of the Prefectural Land Price Survey and the Land Price Survey[4].

The structure of this paper is based on previous studies on the impact of the COVID-19 epidemic on cities, in Chapter 1, and focuses on the issues to be clarified in this paper. Based on these identified issues, Chapter 2 sets out three hypotheses and conducts empirical analysis from July 2017 to January 2022, when three emergency declarations were issued, to verify the hypotheses. In Chapter 3, the results of the verification of the hypotheticals are examined to see whether they apply to the Tokyo metropolitan area, the Osaka metropolitan area and the four regional cities. In addition, as population movement seems to be a factor in the rate of change in land prices in residential areas, the status of population movement is examined from the perspective of urban centers and suburbs. Chapter 4 describes trends in the impact of the COVID-19 epidemic on cities after 2022 and the outlook for the future.

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[3] An evaluator commissioned by the Ministry of Land, Infrastructure, Transport and Tourism evaluates it and the Ministry announces it in March of the year.

[4] I extracted common points between time series data of the Prefecture Land Price Survey and of the Land Price Public Notice. The Land Information Center Foundation is the source of the data points and taught me the method to extract common points.

1. Genealogy of Previous Studies and the Position of This Study

1.1 Genealogy of Previous Studies

In the U.S., around the COVID-19 epidemic, there was an exodus of population from the central business districts (CBD), where commercial business activities take place, to mainly suburban areas. This is eminently reflected in housing price fluctuations. Ramani and Bloom (2022) showed that from February 2020 to February 2022, the closer an area is to the CBD, the more densely populated it is, and the more negative the impact on house prices, rents and population. Dividing metropolitan areas into three groups according to population size – large, medium and small – shows that while house prices are rising in the larger group of metropolitan areas, the increase in house prices near the CBD is smaller than in the other areas. The paper states that they found a 'doughnut effect' for such house prices and population movements.

Chun et al (2022) of The Brookings Institution graphed the differences in house price fluctuations between urban and suburban areas from pre–COVID-19 to the Omicron strain epidemic period (January and February 2022). In East Coast metropolitan areas (e.g., the New York metropolitan area), suburban area house prices rose while city center areas fell; whereas, in West Coast metropolitan areas (e.g., the San Francisco metropolitan area), both areas rose but the rise was greater in suburban areas. In Rust Belt metropolitan areas (e.g., the Baltimore metropolitan area), city center area house prices have risen above those in suburban areas since the early stages of the pandemic.

Analysis by Liu and Su (2021) also shows that the demand for housing becomes smaller in densely populated areas. They explain that this is due to a decrease in demand relative to population density by prevalence of teleworking and the decreasing value of access to commercial premises. The analysis also showed a statistically significant decrease in housing demand in larger cities, albeit to a small degree.

Wheaton (1973) constructed Alonso's (1964) model as a general equilibrium model and reached theoretical conclusions about the relationship between land rent and distance from the CBD. The Wheaton model concludes that as income and transportation costs (commuting costs) decline in closed cities with no population migration to other cities, urban boundaries expand and land rents in the center decline and those in the suburbs rise (land rents are sloped with respect to distance). In the open city case, land rents would increase at all points. In my opinion, this conclusion applies to what is actually happening in the U.S. after COVID-19 – i.e., housing prices in suburban areas are rising, as the cost of transportation has dropped significantly due to the widespread use of telework.

Wang (2021) examined the impact of COVID-19 on housing prices in five U.S. cities and found that only in one of them, Honolulu, did housing prices decline significantly from the onset of COVID-19. They point out that this price vulnerability in Honolulu is related to its dependence on the service industry. In the other four cities (Houston, Santa Clara, Irvine, and Des Moines), house prices have mostly increased since COVID-19 occurred, due to strong housing market fundamentals, affluent amenities, and less reliance on the service industry.

Francke and Korevaar (2021) found that in 17th century Amsterdam and 19th century Paris, regarding the relationship between infectious diseases and real estate prices, housing prices fell significantly and rents declined slightly, but these price shocks were only temporary and quickly returned to their original trajectory.

Lin and Tang (2021) used data on housing transactions in 34 major Chinese cities from May 2019 to June 2020 to analyze whether property prices respond to infection risk and, if so, whether this response varies with urban characteristics, local income, and population density. The results showed that although housing prices in infected areas declined by about 1.3% compared to prices in non-infected areas, these price shocks were only transitory, persisting in the first three or forth months of an outbreak. The study also shows, for instance, that the higher the population density of the infected community, the greater the decline in housing prices.

Kutsuzawa, Akai, and Takemoto (2022) conducted the first empirical analysis of how differences in the number of infected and dead persons per population in COVID-19 affected land prices through changes in preferences for residential and commercial land, based on panel data from official land price announcements in Japan. The results of the analysis revealed that (1) the degree of decline in land prices after the epidemic was greater where the number of COVID-19 cases and deaths per population was higher, and (2) the degree of decline in land prices due to infection was greater where land use was more sophisticated with higher floor-area ratio.

Sakuma (2022) notes that the number of excess transfers into 23 wards of Tokyo from the periphery of Kanagawa, Chiba, Tokyo and Saitama prefectures has been negative in all months except February 2020 through February 2023, after +0.3 thousand in March 2019.

There are three main findings from the previous studies. One, the impact of COVID-19 on housing prices soon after its occurrence is negative, but that impact is transitory – Lin and Tang (2021), Francke and Korevaar (2021). Two, the negative impact on real estate prices is greater in commercial areas than in residential areas and is greater for those with higher floor-area ratios – Kutsuzawa, Akai, and Takemoto (2022). Three, the higher the population density, the greater the decline in housing prices, indicating that in some areas the population is moving from city centers to the suburbs – Ramani and Bloom (2022), Liu and Su (2021), Frei (2022), Lin and Tang (2021), Sakuma (2022).

1.2 Positioning of This Research

Prior studies have shown that the impact of COVID-19 on housing prices in China during the first year following the event was negative, but that the impact was transitory. However, it is not clear whether the impact of COVID-19 on real estate prices in Japan has changed – that is, whether it was transitory

Next, the impact on real estate prices has been shown to be greater in commercial areas than in residential areas, and even more so in those with higher floor-area ratios. But further detailed analysis is possible, such as whether the impact differs among districts as differentiated by type of building use ("use districts") in the City Planning Act, or whether the impact differs by metropolitan area or rural area. Use districts regulation restricts the use of buildings and so forth in each of 12 different zoning districts. This rule is suitable for looking at urban impacts because this is the most basic system of land use regulation in urban planning (see Appendix Tables 1 and 2).

Finally, the negative relationship between population density and real estate prices observed in the U.S. after the COVID-19 outbreak could hold true in Japan. Considering that in Japan, like in the U.S., measures were taken to reduce human contact and behavioral patterns changed as people avoided crowding, it is assumed that similar phenomena are occurring in Japan. If so, the issue to be explored is whether this is happening only in commercial areas or also in residential areas. In commercial areas, land prices are expected to fall due to a sharp decrease in demand for restaurants; whereas, in residential areas, land prices are expected to fall due to the outflow of population from areas with high population density to areas with low population density[5]. The actual conditions of population movement in Japan are not apparent.

This study clarifies the above three issue

2. Empirical Analysis

In Chapter 2, we will develop the hypotheticals, the model and data, and the results of the analysis through estimation in order to clarify the three issues from the previous chapter.

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[5] Ueno (2023) shows that land price has declined for a long time in local regions due to the population outflow.

2.1 Hypothesis

Hypotheses are formulated for each of the three issues that were identified by organizing the previous studies.

1. The relationship between the higher number of deaths in COVID-19 and the greater degree of decline in land prices is transitory, although there is a temporary negative effect.
2. The impact of COVID-19 on real estate prices depends on the use districts in which the land is located.
3. In the post-COVID-19 period, the more densely populated a city is, the greater the decline in real estate prices. This phenomenon has occurred not only in commercial areas but also in residential areas

The reason we choose the number of deceased persons rather than infected persons is that Kutsuzawa et al. (2022) shows that the number of deaths influences land price much more than the number of infected persons. Afterward we examine changes in the influence of the number of deaths.

2.2 Model & Data

The estimation formula is as follows[6].

$$\%\triangle PRICE_{it} = \alpha + \beta_1 \%\triangle PRICE_{it-1} + \beta_2 COVID_{it} + \beta_3 Emergencydummy_t + \beta_4 RATE_t + \beta_5 Zonedummy_i + \beta_6 lndensity_i + \lambda_t + \varepsilon_{it}$$

i : Common points of Land Price Public Notice and Prefectural Land Price Surveys

t : Time as of July 1, 2017 to January 1, 2022

$\%\triangle PRICE_{it}$: Half-year change rate of land prices (%)

COVIDit: Deaths per 100,000 in the prefecture at point i from period t-1 to period t

$Emergencydummy_t$: Dummy of half-year including the emergency declaration

$Rate_t$: Difference of t period between a long-term interest rate and a short-term interest rate

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6 Kutsuzawa et al. (2022) analyses explained variables as natural logarithm of listed land price for one year after COVID-19 with the method of instrumental variables, because for this period the area of higher land price has higher population density and has more deceased or infected persons by COVID-19 and so the simultaneous decision and endogeny-related bias is very large. On the other hand, our study analyses explained variables as the half-year change rate of land price and thus do not use the method of instrumental variables, considering the simultaneous decision and endogeny-related bias is small. It is because, based on Figures 3-1 to 3-6, more densely populated areas do not decline at the larger change rate in July 2020. We include four semi-periods after COVID-19 when the correlation between death tolls and the half-year change rate is low.

$Zonedummy_i$: Dummy of use districts at point i

$Indensity_i$: Natural logarithm of population density of municipalities at point i

λ_t: Dummy of time

ε_{it}: Measurement error

$Floor_i$: Floor area ratio (%) instead of $Zonedummy_i$.

For the first-half period rate of change in land prices (%), which is the explained variable, we used common sites (1,496 sites) from the Public Notice of Land Prices and Prefectural Land Price Surveys to create panel data for 10 semi-annual periods from July 1, 2017 to January 1, 2022.

The explanatory variables are the first-half period rate of change before one half, the number of deaths from COVID-19, dummy of half-year including the emergency declaration, the difference of t period between a long-term interest rate and a short-term interest rate, the number of people per inhabitable land area, zoning dummies, and floor area ratio. The first-half period rate of change before one half is subject to adaptive expectation[7]. The number of deaths (persons/100,000) in COVID-19 was calculated per 100,000 persons every six months from the cumulative number of deaths, by prefecture, published by the Ministry of Health, Labor and Welfare. Dummy variables of half-year including the emergency declaration is created by grouping the half year including the first emergency declaration as 1, the half year including the second and third emergency declarations as 2 and the other half year as 0. The difference of t period between a long-term interest rate and a short-term interest rate is calculated with the Japanese 10-year government bond rate and unsecured call money rate (mid-month). We think this difference reflects the effect of Quantitative and Qualitive Money Easing (QQE) since April,2013[8]. The number of daytime population per inhabitable land area (persons/ha) is obtained by dividing the number of daytime population in the municipality by the inhabitable land area. For the use districts dummies, nine dummy variables were created by grouping six residential uses and two commercial uses out of 12 types of use districts as 1–8, and the other use districts as 9 (other). Considering the similarity of the city, the semi-residential and rural residential zones are included in the other zoning districts (see Appendix Table 1). The floor area ratio was used as a coefficient for the floor area ratio (%) at each location.

The descriptive statistics for the above explained and dependent variables are summarized in Table 1.

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[7] The Bank of Japan shows price expectation in Japan is still very adaptive in “All-inclusive inspection” (September,2016).

[8] The BOJ has pursued QQE to achieve the inflation goal of 2 percent since April 2013. During the observation period of this paper, the BOJ has conducted yield curve control with the short-term interest rate at negative 0.1 percent and the long-term interest rate at around 0 percent and has clarified long-term interest rate in the range of negative 0.25 percent to positive 0.25 percent since March 2021.

2.3 Approach of Observation Period

The observation period of estimations I–IV is from July 1, 2017 to the first half-year period (July 1, 2020), the second half-year period (January 1, 2021), the third half-year period (July 7, 2021) and the fourth half-year period (January 1, 2022), separately in all uses, residential and commercial. The purpose of these estimations is the test of hypothesis 1.

Next, estimation V is the observation period from the first half-year period (July 1, 2020) including the phase of COVID-19 outbreak to the fourth half-year period (January 1, 2022), separately in all uses, residential and commercial. The comparison between estimations Ⅳ and Ⅴ is for the test of hypothesis 2. Estimation V in residential and commercial is for the test of hypothesis 3.

Then, we calculate estimation VI separately in residential and commercial, including floor area rate and population density and excluding the use districts dummy as explained valuables to confirm the coefficients marks of the floor area rate. The simultaneous use of the floor area rate and use districts dummy brings the problem multicollinearity.

2.4 Result of Empirical Analysis

Table 2 summarizes the estimation results. In all estimations I–VI, the results of the F-test and the Hausman test support the fixed effects model.

2.4.1 Verification of Hypothesis 1

To verify hypothesis 1, looking at the estimations I–IV results, the correlation between the number of deaths due to COVID-19 infections and land prices was highest in estimation I (until July 1, 2020), with an impact on first-half period rate of change in land prices of residential -0.428% and commercial -1.490% per 1 death per 100,000 population. This includes the period when the first state of emergency was declared and measures were taken to avoid human contact as much as possible. As of estimation II (January 1, 2020), the rate is residential -0.053% and commercial -0.651%. The result is still low, especially in commercial land. The correlation between the number of deaths and residential land prices is not significant since estimation III (June 1, 2021). Although the second and third emergency declarations were issued, the fact that the first round of vaccination (first and second doses) began on February 17, 2021 may have caused a change in people's behavior. In contrast, the correlation between the number of deaths and commercial land prices is a significantly negative 0.113% till estimation IV (January 1, 2022).

In summary, the correlation between the number of deaths due to COVID-19 infections and residential land prices is not significant; whereas, the correlation degree becomes smaller but is significant for the longer period in terms of commercial land prices.

The first-half period rates of change in land prices are residential -0.874% and commercial -4.172% in the half-year including the first emergency declaration. The result shows the rate of commercial is very high. The influence degree become smaller: residential -0.113% and commercial -0.448%. The difference of regulation strength and the fact that the first round of vaccination began on February 17, 2021 may have caused this change.

The coefficient of the difference between long-term and short-term residential interest rate is unexpectedly significantly positive. The coefficient of the "-commercial" estimate is only significantly negative in estimate IV; the other estimates are significantly positive or not significant. During the observation period, the 10-year Japanese bond rate has been under 0.1% and so the effect of QQE is not reflected in land price.

2.4.2 Verification of Hypothesis 2

To verify hypothesis 2, we compare the coefficients of use districts dummy from the estimations IV and V results. Estimation IV includes the entire period and estimation V is limited to the post–COVID-19 period, and the difference between the two is whether the pre–COVID-19 condition is included. The coefficient indicates what percent higher or lower the rate of change is based on Type 1 exclusive districts for low-rise residential buildings.

As for the "-residential" estimate results, the coefficient of V -residential is larger than that of IV -residential only in Type 1 exclusive districts for medium and high-rise residential use (IV is not significant, V is a significant 0.459). The coefficients of IV -residential and V -residential are not significant in Type 2 exclusive districts for medium and high-rise residential use. The coefficient of V -residential is smaller than that of IV -residential in neighborhood commercial districts. In other words, after COVID-19, compared with Type 1 exclusive districts for low-rise residential buildings, the Type 1 exclusive districts for medium and high-rise residential use is positive 0.459%, the Type 2 exclusive districts for medium and high-rise residential use is unchanged (not significant) and the neighborhood commercial districts is negative 1.78%. The other districts are not calculated.

In Type 1 exclusive districts for medium and high-rise residential buildings, construction of medium and high-rise residential buildings is permitted, and stores and restaurants are limited to small-scale ones. On the other hand, in Type 2 exclusive districts for medium and high-rise residential buildings, there are no size requirements for stores and restaurants, and in neighborhood commercial districts, almost all buildings are allowed (see Appendix Table 2). This is because the range of allowed uses may influence to residential land prices.

There is no estimation result of the coefficients for commercial uses, because there are few spots of commercial land among Type 1 exclusive districts for low-rise residential buildings (see Appendix Table 1-4).

Looking at the estimation result for all uses, the coefficients for Type 1 residential districts (7.151 for IV-all and 5.900 for V-all), neighborhood commercial districts (7.121 for IV-all and 5.776 for V-all) and commercial districts (7.105 for IV-all and 4.609 for V-all) are smaller in V than in IV. After COVID-19, the coefficients are -1.251% for the Type 1 residential zone, -1.345% for neighborhood commercial zones and -2.496% for commercial zones, compared to Type 1 exclusive districts for low-rise residential buildings. The drop of these coefficients chiefly indicates the drop of the commercial land prices in these districts based on residential land prices of Type 1 exclusive districts for low-rise residential buildings. Of all the use districts, the drop in the coefficient for commercial districts is the largest. Cabarets, restaurants, and nightclubs are allowed in commercial use districts, but not in neighborhood commercial districts (see Appendix Table 2). The drop of the coefficients for commercial districts is due to the factor that the districts have many shops that are mainly open at night with eating and drinking. The drop of Type 1 residential districts is the smallest of the three districts types due to the factor that fewer commercial buildings are allowed compared with neighborhood commercial districts and commercial districts.

Floor-area rate has the significantly positive correlation with the half-year change rate of residential land prices but has no correlation with the half-year change rate of commercial land prices. This correlation with residential land prices is consistent with the factor that the coefficients of dummy valuables for Type 1 exclusive districts for medium and high-rise residential use are significantly positive, as explained by the above.

In this way, after COVID-19, the more that non-residential building uses are allowed, the larger the decline in land prices is inclined to be based on Type 1 low-rise residential areas. One factor contributing to this is that the COVID-19 epidemic increased the demand for housing, as people needed to spend more time at home.

Another factor was the request for restaurants to close, especially those offering alcoholic beverages and karaoke facilities, and shorten their hours of operation. These measures, in conjunction with encouraging people to refrain from using these facilities, until the declaration of the third state of emergency were to reduce human contact. Additionally, the accelerated spread of e-commerce has greatly reduced the instances of people shopping in stores and eating and drinking in restaurants.

2.4.3 Verification of Hypothesis 3

To test hypothesis 3, we look at the estimates results for V. The coefficient of population density is significantly negative in V-residential but is not estimated in V-commercial. This means that after the occurrence of COVID-19, the rate of change in residential land prices is lower in municipalities with higher population density. The after–COVID-19 trend becoming stronger is evidenced by the more-negative coefficients of V than of IV, including the period before COVID-19. Although the coefficient of this estimate, - 0.308, is smaller than the coefficient estimated by Ramani and Bloom (2022), -2.561, the sign is the same: negative. The fact that the half-year change rate of land prices is more negative in residential areas in more densely populated municipalities indicates that residents may be moving to areas with lower population density to avoid areas with higher population density, where the infection rate tends to be higher with more human contact[9].

2.5 Chapter Summary

In this chapter, analysis of panel data for 10 semi-annual periods (from July 1, 2017 to January 1, 2022) of the half-year change rate of land prices (%) at common sites (1,496 sites) in the Official Land Price Survey and Prefectural Land Price Survey reveals the following three points.

· The correlation between the number of deaths due to COVID-19 infections and land prices is not significant early in residential land prices but is significant for the longer periods in commercial lands. The influence of the first state of emergency declaration is more negative than that of the second and third, especially in commercial land prices.

· After the occurrence of COVID-19, the rate of decline tends to be larger for uses where non-residential buildings are permitted, based on Category 1 low-rise exclusive residential districts.

· The results of residential land prices show that the half-year change rate of land prices declines for sites in municipalities with higher daytime population densities.

[9] Nakagawa et al. (2020) shows that the correlation between the number of infections due to COVID-19 infections and population density is significant, but the correlation between the number of deaths and population density is not significant.

3. Verification through Comparisons among Regions

3.1 Comparisons of Land Price among Regions

3.1.1 Business District

The result of the preceding chapter shows that the correlation between the number of deaths due to COVID-19 infections and land prices is significant for the longer periods in commercial lands than in residential lands and the correlation between population density and commercial land prices is not significant. To investigate this point, I make comparisons between regions in commercial areas. Figure 2-1 is a graphical representation to compare the nation as a whole, the wards of Tokyo, and the three central wards of Tokyo, focusing on commercial areas with floor-area ratios of 700% or higher. This figure shows that at July 1, 2020, the year-on-year rate of change was low for the wards of Tokyo (16 sites), the nation as a whole (36 sites) and the three central wards of Tokyo (7 sites), in that order. This order has no correlation between population density and the drop of land prices due to COVID-19. Figure 2-2 compares Japan, Osaka City, Nagoya City, and Yokohama City, focusing on commercial areas with floor-area ratios of 700% or higher. Compared to the nation as a whole, Nagoya and Yokohama City fell sharply in July 2020 but recovered quickly thereafter. Osaka City's recovery has been slower even after a larger drop in July 2020 than that of the nation as a whole.

To investigate why the recovery of commercial areas differs by region, I looked at whether differences in telework implementation rates have an impact. Sakuma et all (2022) notes that office attendance rates in Japan's six major cities in the COVID-19 seasons have generally followed the same trend, although the level varies from city to city. Looking at office attendance rate levels by city, of the five phases, Tokyo has the lowest attendance rate and Osaka has the next lowest attendance rate through the first phase (April and May 2022), the second phase (June 2020 to September 2021), and the third phase (October 2021 to January 2022)[10]. Thus, it is possible that the lower attendance rates in Tokyo and Osaka compared to other major cities have affected commercial land prices.

In Osaka City the change rate of the land prices was high before COVID-19 but the recovery was slow after COVID-19, because commercial spots in Osaka City contain many “shops and offices” and so

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[10] Sakuma et all (2022) shows that in the first phase Tokyo is 36.1%, Osaka is 40.0%, Nagoya is 40.4%, Fukuoka is 41.7%, Sapporo is 50.5% and Sendai is 50.2%. In the second phase Tokyo is 49.5%–64.9%, Osaka is 50.8%–72.2%, Fukuoka is 51.4%–72.9%, Nagoya is 52.6%–75.1%, Sapporo is 51.2–76.3% and Sendai is 50.8–79.0%. In the third phase Tokyo is 79.8%, Osaka is 86.1%, Fukuoka is 87.2%, Sapporo is 50.5%, Nagoya is 92.1% and Sendai is 92.4%.

the change of the number of tourists to Japan[11], especially Chinese tourists, may have influenced land prices.

However, in Figure 2-1, the trend that year-on-year rates of change become lower in order of the nation as a whole, the words of Tokyo and the three central wards of Tokyo, is more pronounced after July 1, 2018, before COVID-19. It can be interpreted that land prices were too high in the central Tokyo area and the rate of increase slowed down, while the rate of increase was higher in the surrounding areas. This trend suggests that in the Tokyo area the year-on-year rate of change is smaller in municipalities with higher population densities and that the difference is due to the fact that land prices are too high in municipalities with higher population densities.

3.1.2 Residential Districts

Next, we look at residential lands. The estimate results of the proceeding chapter show the change rate of residential land is more negative in higher population density municipalities. Figure 3-1 to Figure 3-6 show six blocks for the half-year change rate of land prices in residential areas in Tokyo, Osaka, Hokkaido, Miyagi, Hiroshima, and Fukuoka prefectures. In order to visually grasp whether there is a difference in the rate of change in land prices between urban and suburban areas, as is the case in large metropolitan areas in the U.S., we made it possible to compare the half-year change rate of land prices in the densely populated urban center area and its surrounding municipalities. A comparison of the six areas shows that the relationship between urban center areas and suburbs clearly changed before and after COVID-19 in the Tokyo area (Figure 3-1), Hokkaido (Figure 3-3), and Hiroshima Prefecture (Figure 3-5).

Comparing before and after July 1, 2020 in Figure 3-1, before January 2020, the rate of increase in the Tokyo wards was considerably higher than in Tokyo (excluding Tokyo wards) and the surrounding area of Tokyo. However, after July 1, 2020, the half-year change rate of the surrounding area of Tokyo recovered slightly above that of Tokyo wards and Tokyo until January 2021. As a result, although the half-year change rate of Tokyo wards is higher than that in Tokyo and the surrounding areas after July 1, 2021, there is little difference in the rate of increase between the Tokyo metropolitan area and Tokyo (and surrounding area). This means that the rate of change in land prices in Tokyo and surrounding area, where population density is lower, increased relative to the Tokyo wards. This is consistent with the estimated results with a negative population density coefficient. Table 3 shows that in the Tokyo area, many cities with higher residential land appreciation rates have lower population densities than

[11] The Osaka sightseeing department of a public interest incorporated foundation estimated the record high number of foreign tourists to Osaka (2019) to be about 12.3 million persons, about 45% of which were Chinese.

prefectural capitals in Saitama, Chiba, and Kanagawa prefectures.

In Figure 3-3, before July 1, 2020, the half-year change rate of Sapporo is much higher than that of Hokkaido (excluding Sapporo). Nevertheless, at some points after July 1, 2020, the half-year change rate of Hokkaido (excluding Sapporo) is higher than that of Sapporo. Therefore, it can be seen that there is not much difference between the two. Hiroshima Prefecture, shown in Figure 3-5, shows a similar relationship.

In the Osaka area (Figure 3-2), the relationship between (1) Osaka City, (2) Osaka Prefecture (excluding Osaka City), and (3) the surrounding areas of Osaka Prefecture remains virtually unchanged. Miyagi Prefecture in Figure 3-4 and Fukuoka Prefecture in Figure 3-6 also show no change from the relationship before January 2020, as the half-year change rate relative to the government ordinance–designated cities increases significantly more than the rest of the country after that, although it declines in July 2020.

3.2 Comparison of Population Movements among Regions

The immediately preceding section, 3.1, showed clear changes in the relationship between urban centers and suburban areas in the Tokyo metropolitan area, Hokkaido, and Hiroshima Prefecture before and after COVID-19. In the other areas, the relationship between urban centers and suburbs did not change much before or after COVID-19. In this regard, we examined whether changes due to population shifts are having an impact. Figures 4-1 to 4-4 show the number of transfers from the suburbs to the central region within areas or prefectures; whereas, Figures 5-1 to 5-6 show the number of transfers from the suburbs to the central region, including out-of-area and out-of-prefecture population movements. Negative numbers of in-migrants indicate the out-migrants. Next, I explain the information captured in Figures 4-1 to 4-4 and 5-1 to 5-6 and explain the respective changes.

3.2.1 Tokyo Area

Figure 4-1 shows that the number of excess transfers from the surrounding area of Tokyo (Saitama, Chiba, Tokyo and Kanagawa prefectures) to the Tokyo metropolitan wards has turned from positive to negative since 2020 in Chiba, Tokyo (except Tokyo wards) and Kanagawa prefectures. Saitama Prefecture has been negative since 2018, but the negative range is evident in 2020. It is clear that the population is moving from the wards of Tokyo to the suburbs and from areas with high population density to areas with low population density. Figure 5-1 shows that the number of people moving out of the Tokyo wards is increasing only in 2021, and the number of people in 2021 is also smaller than the number of people moving out of the Tokyo wards in 2021 shown in Figure 4-1. This is due to the fact that there are still excess transfers from outside Tokyo and the surrounding area to the Tokyo wards even after COVID-19.

Furthermore, Figure 5-1 shows no change in the number of excess transfers from 2019 to 2022 in the surrounding areas of Tokyo. This was caused by a decrease in the inflow of population from outside the Tokyo metropolitan area into the surrounding areas of Tokyo, while the number of people moving out of the Tokyo metropolitan area (excluding Tokyo) from the wards of Tokyo increased.

The above population shifts are related to the pre- and post–COVID-19 changes in land price volatility in the surrounding area of Tokyo, Tokyo (except Tokyo wards) and Tokyo wards shown in Figure 3-1. The fact that the rate of change in the Tokyo wards became smaller after COVID-19 and was comparable to the rate of change in the surrounding area of Tokyo and Tokyo (except Tokyo wards) can be attributed in part to the outflow of population from the Tokyo wards. On the other hand, as shown in Figure 3-1, land prices in the Tokyo wards are recovering because of the recovery in population inflows from outside the Tokyo areas to the Tokyo wards.

3.2.2 Hokkaido/Sapporo City

Let us look at Sapporo and Hokkaido. Figure 4-4 shows that the number of excess transfers from Hokkaido to Sapporo City has slightly decreased since 2019. Moreover, Figure 5-3 shows that the number of excess transfers out of Hokkaido (excluding Sapporo City) has slightly decreased. This can be related to the change in the rate of change in land prices in Sapporo and Hokkaido (excluding Sapporo City) shown in Figure 3-3.

3.2.3 Hiroshima Prefecture/Hiroshima City

As for Hiroshima Prefecture, Figure 4-4 shows that the number of excess transfers into Hiroshima City from Hiroshima Prefecture (excluding Hiroshima City) decreased only in 2021. Figure 5-5 shows that the number of excess transfers out of Hiroshima City has been increasing since 2021, while the number of excess transfers in from Hiroshima Prefecture (excluding Hiroshima City) has been decreasing since 2020. In other words, the number of out-migration from Hiroshima City to outside Hiroshima Prefecture is increasing. This may be one of the reasons why the rate of change between Hiroshima City and Hiroshima Prefecture (excluding Hiroshima City) has remained positive, close to zero, as shown in Figure 3-5. The younger generations chiefly moved out to Tokyo and other urban centers, resulting in the number of people moving out to higher populated density municipalities tending to be increasing[12].

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[12] The inflows subtracted from outflows number is positive 581 for 2020 through 2022, and most of the increase is in people aged between 10 and 39.

3.2.4 Other Regions

Next, we examine whether the population movement can explain why the rate of increase recovered quickly after a temporary decline, as in the case of Sendai City and Fukuoka City. Figure 4-4 shows that both cities remain unchanged around COVID-19, but Figures 5-4 and 5-6 show that population inflows from outside the prefecture continue, and Sendai and Fukuoka remain in excess of out-migration. It can be explained this is related to the rate of change in land prices in Figures 3-4 and 3-6.

We examine how this is the case in the Osaka area. Figure 4-2 shows that the number of excess transfers from Osaka Prefecture to Osaka City has declined significantly since 2020, while the other three prefectures have slightly declined since 2021. Figure 5-2 shows a decrease in the number of excess incoming transfers in Osaka City, and a slight decrease in the number of excess transfers out of Osaka Prefecture (excluding Osaka City) and the surrounding area of Osaka, but no change in the fact that Osaka City has excess incoming transfers and Osaka Prefecture (excluding Osaka City) and the surrounding area of Osaka have excess outgoing transfers. Figure 3-2 shows that the differences in the rates of change in the three land prices do not appear to change much, comparing after COVID-19 with before COVID-19.

3.3. Verification of the "Reverse Population Flow" Phenomenon in the Tokyo Area

Population movement from areas with high population density to areas with low population density was clearly seen in the Tokyo area. Although smaller in scale than the "doughnut effect" in the U.S. in that there has not been a massive population exodus[13] or a continuing decline in residential land values as in the large East Coast cities of the U.S., it will be necessary to analyze why the population backflow is occurring.

Figure 6 shows the excess migration (including by foreign residents) from the Tokyo and surrounding areas to the Tokyo metropolitan wards by age group. Regarding the total number of residents, the number of excess out-migrants from the Tokyo wards to the Tokyo and surrounding areas after 2020 is large. By age group, it can be seen that the number of excess transfers into the Tokyo wards decreased significantly from 2020 to 2021 for those aged 20–29, and the negative number of excess transfers increased from 2020 for those aged 30–39, 40–49, and 50–59. This means that the generation in their 20s, who are beginning to become independent from their parents, are less inclined to live in the Tokyo wards, while the generation in their 30s to 50s is more inclined to move out and live in the

[13] Frei (2022) says New York's greatest population loss, about 305,000, was from 2020.7 to 2021.7. Afterward New York City and State devised the City and Housing Vision, "Making New York Work for Everyone".

suburbs. Looking at the 0–9 age group, there has been an excess of out-migration since 2018, which has gradually grown larger. This means that the child-rearing generation has been showing more preference to move out and reside in the suburbs since 2018, which may be due to rising housing prices in the Tokyo wards and a decrease in the supply of new condominiums. The rapid increase in suburban migration from 2020 is likely due to lifestyle changes in the direction of reduced human contact and teleworking, the latter of which has reduced the burden of commuting time.

In 2022, the number of the 20–29 year old cohort moving into the Tokyo metropolitan area returned to the 2019 level, which is attributable to the recovery in economic activity and the fact that rents for rental housing have not been rising as much. On the other hand, in the 30–39, 40–49, and 50–59 age groups, the number of out-migrants has been larger since 2020 than in 2019, and the trend of out-migration is likely to continue after 2023.

3.4 Chapter Summary

In this chapter, we see that the correlation between COVID-19 infection deaths and land prices is significant for longer periods in commercial lands than in residential lands and that the rate of change in residential land prices is lower in densely populated municipalities, and we check to see if these results apply to all regions.

・In the Tokyo and Osaka areas, the half-year change rate in land prices was lower in areas with higher population density when compared to commercial areas with floor-area ratios of 700% or more. However, in Nagoya and Yokohama, land prices recovered more quickly, possibly due to the size of the commercial area and the rate of telecommuting.

・In terms of residential areas, the most significant changes in the relationship between the central area and the suburbs before and after COVID-19 were in the Tokyo and surrounding areas, Hokkaido, and Hiroshima Prefecture. In contrast, the Osaka area, Miyagi Prefecture, and Fukuoka Prefecture did not have significant changes. This may have been caused by changes in population movement, such as the shift from negative to positive numbers of excess transfers to Tokyo wards in the Tokyo and surrounding areas after COVID-19 and, in the case of Hiroshima City, by the increasing number of people moving out to Tokyo. Furthermore, when looking at the migration in and out of the Tokyo wards by age group, it was found that some age groups continued to change after the COVID-19 outbreak, even in 2022, the third year of the COVID-19 outbreak.

4. Trends and Outlook for 2022 and Beyond

We have seen that the tendency for the rate of change in land prices to be smaller at sites in densely populated municipalities occurs in commercial areas with high daytime population densities among those with floor-area ratios of 700% or higher, and in residential areas in areas where population movements have changed significantly. In these areas, land prices have not returned to their pre–COVID-19 levels. We examined the trends and prospects for 2022 and beyond.

4.1 Land Price

In 2022, priority measures to prevent the spread of the disease were implemented until March 21, but later the "Policy Approach Toward Coronavirus" (decided by the Headquarters for Countermeasures to Combat New Coronavirus Infections on September 8, 2022) was issued. This policy was designed to balance infection prevention with socioeconomic activities by focusing on protecting the elderly and others at risk of serious illness without imposing new behavioral restrictions.

According to the 2023 official announcement on land prices, the national average of land prices for all uses, residential land, and commercial land all rose for the second consecutive year, and the rate of increase expanded. In addition, the rate of increase in commercial land exceeded the rate of increase in residential land. The Land Price LOOK Report for the fourth quarter of 2022 shows that land prices in highly utilized areas in major cities have been recovering under COVID-19, in addition to firm demand for condominiums and demand for retail stores. For the first time in three years since the fourth quarter of 2022, land prices rose or remained flat in all districts, with no districts experiencing a decline. However, as seen in Figure 2-1, the rate of change in land prices at sites with floor-area ratios of 700% or more in commercial areas, which were most negatively affected, shows that on January 1, 2023, the rate of change was +2.4% nationwide (36 sites), +1.54% in the Tokyo wards (16 sites), and +0.91% in the three central wards of Tokyo (7 sites). This indicates that the rate of increase has not reached the pre–COVID-19 level and is recovering gradually.

4.2 Other Economic Indicators

We pick out some of the data on economic activity that seems to have been strongly affected by COVID-19 to provide some perspective on future trends.

First, Figure 7-1 shows a graph of the number of inbound foreign visitors to Japan, which had dropped to -99.3% (indexed at 100 in 2019) as of January 2022 (of which the number of tourists had dropped to -100%). However, the number of inbound foreign tourists increased sharply from October 2022, following the Japanese government's implementation of measures such as acceptance of individual travel and resumption of visa waiver measures from October 11, 2022.

Next, Figure 7-2 shows the trend of rail and track passenger volume compared to the same month in 2019 according to the Monthly Railway Transportation Statistics, showing a large drop in April and May 2020, followed by a slight recovery in June 2020 and a year-on-year increase from around October 2021. In 2022, all months are above the same month in 2021, but have not reached 100% compared to the same month in 2019. This indicates that there is room for further growth in rail and track passenger volume in 2023 and beyond.

According to the "Food Service Industry Market Trends Survey" (see Figure 7-3) published by the Japan Food Service Association, year-on-year pub/izakaya sales, which fell the most after COVID-19, were 50.5% in 2020 and 57.8% in 2021, but recovered to 180.9% in 2022. Although they recovered, in 2022 they were still at 49.2% of the 2019 level. Fast food, on the other hand, is growing steadily, falling slightly in 2020 but still at 107.9% in 2022, which is 108.6% of the 2019 level.

4.3 The Effect of Telework

Figure 7-4 shows that the telework implementation rate was highest at 31.5% in May 2020 during the first emergency declaration, fell to 20.2% in July of the same year, returned to 22.7% in October 2021, and has been on a gradual decline since. However, companies with 1,000 or more employees still have a high rate of telework implementation (34% in January 2023). This result suggests that urban areas with more large companies (Tokyo and Osaka areas) have a higher concentration of offices and other facilities with floor-area ratios of 700% or higher, which may be one reason for the slow recovery in commercial land prices in densely populated areas. The trend of out-migration from the Tokyo metropolitan area to the Tokyo metropolitan area may also be influenced by the implementation of telework.

Regarding the future of telework implementation rates, according to Morikawa (2022), in both the 2020 and 2021 surveys of companies, slightly more than 50% of companies intend to return to the conventional way of working in principle, while slightly more than 30% intend to reduce the number of teleworkers. On the other hand, Morikawa (2023) found that the number of workers who wanted to telecommute at a high frequency after the end of the COVID-19 has increased from 37.1% in 2020 to 60.1％ in 2021 and more to 76.5% in 2022. Thus, the study indicates that there is a significant gap between the attitudes of companies and workers regarding future telecommuting rates.

The workers moving out of the Tokyo wards to the Tokyo and surrounding areas are those in their 30s to 50s who are relocating, and if telecommuting through teleworking is having an impact on these groups, the desire to telecommute by workers will be strong. In the U.S., it is reported that the average office occupancy rate is still at 50% in 2023 due to the strong desire of workers to telecommute and the strong conflicts with company management. How the teleworking implementation rate will evolve in the future, given the gap between labor and management[14], should be closely watched from the perspective of its impact on land prices.

4.4 Chapter Summary

In summary, from 2023 onward, the number of inbound foreign visitors is expected to recover significantly, and economic activity, which has not yet returned to 2019 levels, will become increasingly active as COVID-19 is moved from category 2 to category 5. However, the lifestyle changes associated with the three-year voluntary curfew, especially the accelerated pace and convenience of life, such as e-commerce, are not expected to be reversed.

In Japan, the demand for housing in the suburbs is not rising as markedly as in the U.S., although there are regional differences in land prices. Therefore, it is expected that there will be a certain number of people in Tokyo and surrounding areas who purchase houses far from their workplaces and engage in telework. Therefore, while the trend of gradual recovery in commercial facilities and offices will continue as in the past, it is unlikely that they will return to normal anytime soon.

[14] See, for example, Wall Street Journal, “The Return to the Office Has Stalled”, 5.15, 2023.

Summary

In this paper, the analysis of panel data on the half-year change rate in land prices revealed the following: (1) the correlation between the number of deaths due to COVID-19 infections and land prices is not significant early in residential land prices but is significant for the longer periods in commercial lands, and the influence of the first state of emergency declaration is more negative than that of the second and third, especially in commercial land prices; (2) after the spread of COVID-19 infection, land prices declined more in areas where commercial facilities such as stores and restaurants were permitted than in areas where houses were exclusively located in Category 1 low-rise exclusive residential districts; (3) the rate of change in residential land prices was lower for sites located in municipalities with high daytime population densities.

Next, taking up changes in land prices and population movements in several areas, we have seen that land prices have risen relatively more in residential areas in the Tokyo area with lower population densities, and this is due to a shift in population movement from excess transfers in to excess transfers out from Tokyo wards to suburban areas. By age group, after COVID-19, the number of excess transfers decreased for those in their 20s who were becoming independent from their parents; whereas, they increased for those in their 30s to 50s who were moving out of the Tokyo wards and into the suburbs. No other areas showed major changes in population movement from central to peripheral areas after COVID-19, shifting from excess in-migration to excess out-migration, but the number of out-migrants from suburban areas with low population density decreased in all areas except the Tokyo area.

Furthermore, looking at land prices for commercial land with a floor-area ratio of 700% or higher, which is expected to be most affected by COVID-19, through the official announcement of land prices on January 1, 2023, the situation has not returned to its pre–COVID-19 state and is recovering gradually in line with the Tokyo and Osaka urban center areas. The number of foreign visitors to Japan is expected to rise significantly in the future, and restaurants and other establishments open at night, which were most affected, have been recovering since 2022, and further recovery is expected. However, the parts of the business that have accelerated and made life more convenient, such as e-commerce, will not go back to their previous state, and the business type must change accordingly. In addition, in the Tokyo area, land prices in municipalities with low population densities are rising relative to other areas, and given that demand in the suburbs is increasing due to lifestyle changes and telework, it is expected that a certain number of people will not return to the center of Tokyo. It remains to be observed how the rate of telework implementation will change and to what extent the demand for housing in the suburbs will persist.

In this paper we use land price of each district-block-lot, density of each municipality, and the number of deaths in each prefecture as the data. Development of a new method for collecting such data in more-congruent dataset sizes could raise the precision of the estimation in the future.

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Table 1-1　Descriptive Statistics（All samples）

	Number of Observations	Average	Standard Deviation	Min	Max
Price（yen/㎡）	14,960	0.683	1.972	-18.8	30.8
Deaths (1/100,000 persons)	14,960	1.504	3.451	0	22.64
Daytime population per inhabitable area (persons/ha)	14,960	64	92.21	2.503	731.6
Dummy of use districts	14,960	4.601	2.603	1	9
Floor area ratio (%)	14,960	249.4	164.2	15	1300

Note: This table and the immediately following tables through Table 3 made by the author.

Table 1-2　Descriptive Statistics　（Residential areas）

	Number of Observations	Average	Standard Deviation	Min	Max
price（yen/㎡）	10,190	0.459	1.344	-10.9	12.2
Deaths (1/100,000 persons）	10,190	1.501	3.476	0	22.64
Daytime population per inhabitable area (persons/ha)	10,190	49.16	57.01	2.503	596.0
Dummy of use districts	10,190	3.249	1.892	1	9
Floor area ratio (%)	10,190	167.4	61.49	15	600

Table 1-3　Descriptive Statistics　（Commercial areas）

	Number of Observations	Average	Standard Deviation	Min	Max
price（yen/㎡）	4 ,560	1.178	2.873	-18.8	30.8
Deaths (1/100,000 persons）	4 ,560	1.518	3.391	0	22.64
Daytime population per inhabitable area (persons/ha)	4 ,560	97.70	1.371	3.458	731.6
Dummy of use districts	4 ,560	7.614	0.840	1	9
Floor area ratio (%)	4 ,560	433.9	174.39	100	1300

Table 1-4　The number of spots for each use district

	All Samples	Residential Areas	Commercial Areas
Category 1 low-rise exclusive residential districts	３，４３２	３，３８２	１０
Category 2 low-rise exclusive residential districts	９０	８０	０
Category 1 medium-to-high-rise exclusive residential districts	２，２８７	２，２２７	２０
Category 2 medium-to-high-rise exclusive residential districts	９３０	８８０	４０
Category 1 residential districts	２，９８０	２，８６０	９０
Category 2 residential districts	６２０	５６０	５０
Neighborhood commercial districts	１，１81	２１	１，１６０
Commercial districts	３，２００	６０	３，０９０
The other districts	２４０	１２０	１００

Table 1-5　Descriptive Statistics　（floor area ratio for each use district）

	Number of Observations	Average	Standard Deviation	Min	Max
Category 1 low-rise exclusive residential districts	3,432	96.57	27.24	15	200
Category 2 low-rise exclusive residential districts	90	136.66	34.83	80	200
Category 1 medium-to-high-rise exclusive residential districts	2,287	190.06	26.98	100	300
Category 2 medium-to-high-rise exclusive residential districts	930	196.23	18.32	150	300
Category 1 residential districts	2,980	204.42	24.34	20	300
Category 2 residential districts	620	219.35	64.40	200	600
Neighborhood commercial districts	1,181	264.43	57.53	200	400
Commercial districts	3,200	514.37	145.08	300	1300

Table 2　Result of Estimation

(Residential areas)

	I (~7.1, 2020)	II (~1.1, 2021)	III (~7.1, 2021)	IV (~1.1, 2022)
△$PRICE_{it-1}$	-0.210*** (0.055)	-0.057 (0.039)	0.005 (0.051)	0.058 (0.051)
$COVID_{it}$	-0.428*** (0.068)	-0.053* (0.029)	0.004 (0.005)	-0.005 (0.005)
$Rate_t$	5.012*** (1.237)	6.069*** (1.187)	4.026*** (0.003)	3.983* (0.079)
$Emergencydummy_t$ (First)	-0.444*** (0.078)	-0.737*** (0.041)	-0.862*** (0.065)	-0.874*** (0.092)
$Emergencydummy_t$ (Second, Third)	—	—	-0.222*** (0.612)	-0.113* (0.062)
$Zonedummy_i$				
Category 1 low-rise exclusive residential districts	—	—	—	—
Category 2 low-rise exclusive residential districts	—	—	—	—
Category 1 medium-to-high-rise exclusive residential districts	—	—	—	-0.053 (0.115)
Category 1 medium-to-high-rise exclusive residential districts	—	—	—	-1.078 (0.140)
Category 1 residential districts	—	—	—	—
Category 2 residential districts	—	—	—	—
Neighborhood commercial districts	—	—	—	7.731*** (0.265)
Commercial districts	—	—	—	—
$lndensity_i$	—	—	—	-0.071** (0.032)
Dummy of time	Yes	Yes	Yes	Yes
Number of observations	6,114	7,133	8,152	9,171
Number of groups	1,019	1,019	1,019	1,021
R-sq	0.282	0.2225	0.193	0.184
F test	3.78 Prob > F = 0.000	4.10 Prob > F = 0.000	4.23 Prob > F = 0.000	4.31 Prob > F = 0.000
Hausman test	3913.68 Prob >chi2 = 0.000	4829.84 Prob > chi2 = 0.000	5028.08 Prob > chi2 =0.000	5343.93 Prob > chi2 =0.000

Note 1： ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively. The same is true in the following table.

Note 2： The figures in parentheses ( ) represent standard deviations that are robust against dispersion heterogeneity.

(Commercial areas)

	I (~7.1, 2020)	II (~1.1, 2021)	III (~7.1, 2021)	IV (~1.1,2022)
△PRICEit-1	-0.260***	0.071	0.172***	0.219***
	(0.071)	(0.051)	(0.050)	(0.035)
$COVID_{it}$	-1.490***	-0.651***	-0.133***	-0.113***
	(0.210)	(0.102)	(0.026)	(0.021)
$Rate_t$	13.23***	3.671	7.366*	-33.00***
	(3.032)	(3.609)	(3.893)	(6.346)
$Emergencydummy_t$	-1.179***	-2.481***	-2.900***	-4.172***
(First)	(0.266)	(0.188)	(0.239)	(0.307)
$Emergencydummy_t$		—	-0.169	-0.448**
(Second, Third)			(0.231)	(0.207)
$Zonedummy_i$				
Category 1 low-rise exclusive residential districts	—	—	—	—
Category 2 low-rise exclusive residential districts	—	—	—	—
Category 1 medium-to-high-rise exclusive residential districts	—	—	—	—
Category 2 medium-to-high-rise exclusive residential districts	—	—	—	—
Category 1 residential districts	—	—	—	—
Category 2 residential districts	—	—	—	—
Neighborhood commercial districts	—	—	—	—
Commercial districts	—	—	—	—
$lndensity_i$	—	—	—	—
Dummy of time	Yes	Yes	Yes	Yes
Number of observations	2,736	3,192	3,648	4,104
Number of groups	456	456	456	458
R-sq	0.351	0.325	0.327	0.331
F test	2.76	2.22	1.85	1.94
	Prob > F = 0.000	Prob > F = 0.000	Prob > F = 0.000	Prob > F = 0.000
Hausman test	1104.46	874.73	697.63	744.75
	Prob >chi2 = 0.000	Prob > chi2 = 0.000	Prob > chi2 =0.000	Prob > chi2 =0.000

	IV (All samples, ～1.1, 2022)	V All samples, 7.1, 2020～)	V (Residential land, 7.1, 2020～)	V (Commercial land, 7.1, 2020～)
△PRICEit-1	0.219*** (0.035)	-0.342*** (0.024)	-0.383*** (0.062)	-0.326*** (0.024)
$COVID_{it}$	-0.037*** (0.007)	-0.006* (0.003)	-0.002*** (0.003)	-0.012 (0.009)
$Rate_t$	-6.635*** (2.429)	10.83*** (0.494)	10.20*** (0.743)	13.06*** (1.060)
$Emergencydummy_t$ (First)	-1.900*** (0.115)	-0.429*** (0.036)	-0.386*** (0.055)	-0.479*** (0.074)
$Emergencydummy_t$ (Second, Third)	-0.181** (0.078)	-0.099*** (0.036)	-0.090*** (0.030)	-0.114* (0.068)
$Zonedummy_i$				
Category 1 low-rise exclusive residential districts	—	—	—	—
Category 2 low-rise exclusive residential districts	—	—	—	—
Category 1 medium-to-high-rise exclusive residential districts	-0.045*** (0.115)	0.516*** (0.115)	0.459*** (0.137)	—
Category 2 medium-to-high-rise exclusive residential districts	-0.080 (0.111)	-0.179 (0.131)	-0.186 (0.134)	—
Category 1 residential districts	7.151*** (0.212)	5.900*** (0.198)	—	—
Category 1 residential districts	—	—	—	—
Neighborhood commercial districts	7.121*** (0.200)	5.776*** (0.148)	5.951*** (0.204)	—
Commercial districts	7.105*** (0.263)	4.609*** (0.505)	—	—
$lndensity_i$	-0.067 (0.063)	-0.351*** (0.063)	-0.308*** (0.057)	—
$Floor_i$	—	—	—	—
Dummy of time	Yes	Yes	Yes	Yes
Number of Observations	13,464	5.984	4,076	1,824
Number of Groups	1,496	1,496	1,021	458
R-sq	0.219	0.425	0.378	0.468
F test	2.03 Prob > F = 0.000	6.73 Prob > F = 0.000	5.29 Prob > F = 0.000	5.57 Prob > F = 0.000
Hausman test	3369.57 Prob >chi2 = 0.000	3212.92 Prob > chi2 = 0.000	20262.26 Prob > chi2 = 0.000	818.03 Prob > chi2 = 0.000

Note: V（All samples, 2020.7.1～) and V(Commercial land, 2020.7.1～) use the option of Hausman Test “sigmamore”.

	VI（Residential land, Floor area rate, 7.1, 2020～）	VI(Commercial land, Floor area rate, 7.1, 2020～)
△PRICE$_{it-1}$	-0.379*** (0.062)	-0.326** (0.024)
COVID$_{it}$	-0.004*** (0.007)	-0.012 (0.009)
Rate $_t$	10.24*** (0.746)	13.06*** (1.060)
Emergencydummy $_t$ (First)	-0.394*** (0.056)	-0.479*** (0.074)
Emergencydummy $_t$ (Second, Third)	-0.087** (0.030)	-0.114 (0.068)
Zonedummy$_i$		
Category 1 low-rise exclusive residential districts	—	—
Category 2 low-rise exclusive residential districts	—	—
Category 1 medium-to-high-rise exclusive residential districts	—	—
Category 1 residential districts	—	—
Category 2 residential districts	—	—
Neighborhood commercial districts	—	—
Commercial districts	—	—
lndensity $_i$	-0.315*** (0.059)	—
Floor $_i$	0.004*** (0.001)	—
Dummy of time	Yes	Yes
Number of observations	4,076	1,824
Number of groups	1,021	458
R-sq	0.367	0.468
F test	5.18 Prob > F = 0.000	5.57 Prob > F = 0.000
Hausman test	17405.17 Prob > chi2 = 0.000	837.52 Prob > chi2 = 0.000

Note: VI (Residential land, Floor area rate） uses the option of Hausman Test “sigmamore”.

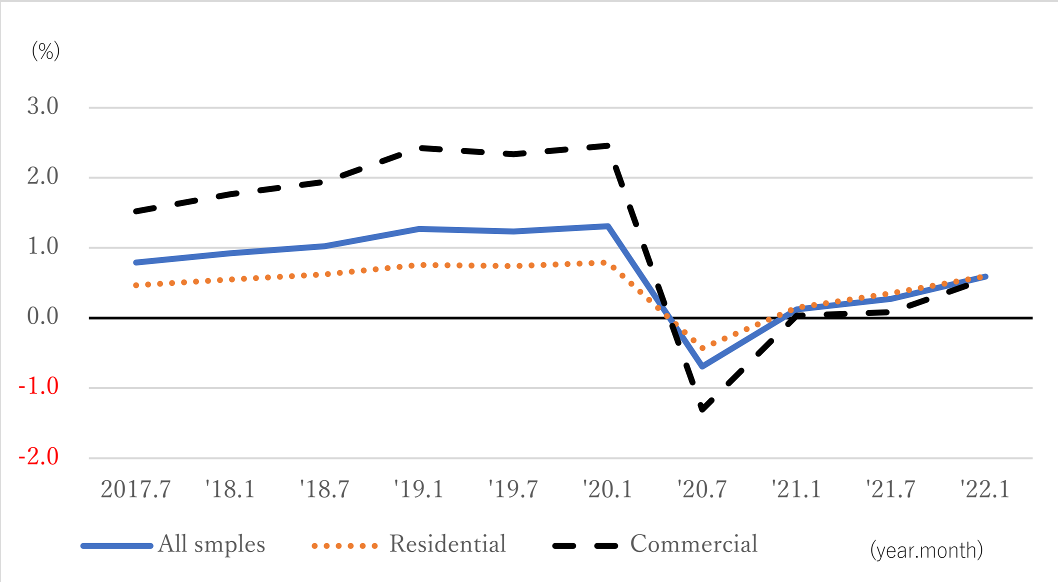
Table 3　Municipalities with high rate of land price appreciation in residential areas

List of cities where the year-on-year rate of change in residential land prices in the official land price survey for 2023 (2023) was 4% or more and positive for two consecutive years

Prefecture and Municipality		2022 Fluctuation (%)	2023 Fluctuation (%)	2023 Spots
Surrounding area of Tokyo				
Saitama	Kawaguchi	1.1	4.9	90
	Warabi	1.2	4.9	6
	Toda	1.7	5.8	50
Chiba	Ichikawa	2.3	6.8	63
	Funabashi	1.3	4.1	85
	Kashiwa	0.4	4.0	78
	Urayasu	3.3	9.7	20
Kanagawa	Chigasaki	1.0	4.1	32
Chubu Area				
Aichi	Kariya	3.1	6.3	27
	Anjo	3.2	6.2	22
	Tokai	2.6	7.8	29
	Obu	2.6	4.9	16
	Chita	2.4	4.8	14
	Takahama	1.7	4.0	12
	Toyoake	0.9	4.1	11
Kinki Area N/A				
Local Area				
Hokkaido	Sapporo	9.3	15.0	307
Miyagi	Sendai	4.4	5.9	216
Fukuoka	Fukuoka	6.1	8.0	194
Okinawa	Ginowan	2.9	4.8	10

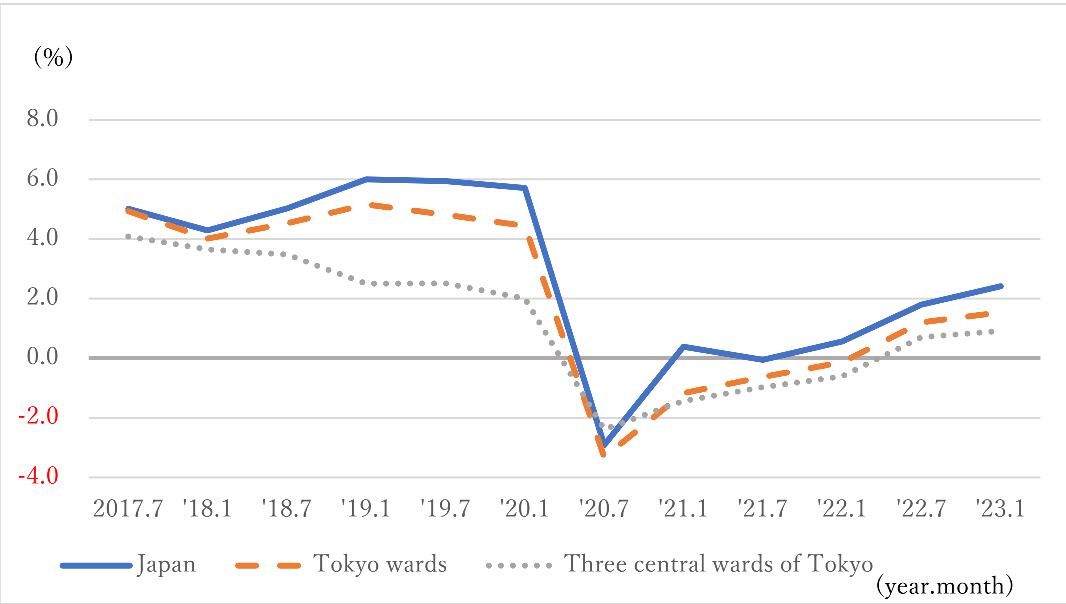
Note: The average rate of increase in the Tokyo wards was 1.5% in 2010 and 3.4% in 2023, although the rate exceeded 4% in some wards in 2023.

Figure 1　Half-year change rate in land prices（Average of all uses, residential and commercial, through January2022）



Note: The average of all uses is 1,496, of residential is 1,019, and of commercial is 456. The remaining 21 are for other uses. Other uses include land under construction and vacant land. Semi-residential areas are included in other uses.

Figure 2-1　Half-year change rate in commercial land prices with a floor-area ratio of 700% or more (through January 2023; comparison among the nation as a whole, the wards of Tokyo, and the three central wards of Tokyo)



Note: The breakdown of points in Japan is as follows: Sapporo 1, Chiba 2, 16 Tokyo wards (Chiyoda 3, Chuo 3, Minato 1, Shinjuku 3, Taito 2, Koto 1, Shibuya 2, Toshima 1), Musashino 1, Machida 1, Yokohama 4, Kawasaki 1, Nagoya 2, Kyoto 1, Osaka 6, Hiroshima 1. The three wards in central Tokyo are Chiyoda, Chuo, and Minato wards.

Figure 2-2 Half-year change rate in commercial land prices with a floor-area ratio of 700% or more (through January 2023; comparison among the nation as a whole, Osaka, Nagoya, and Yokohama)

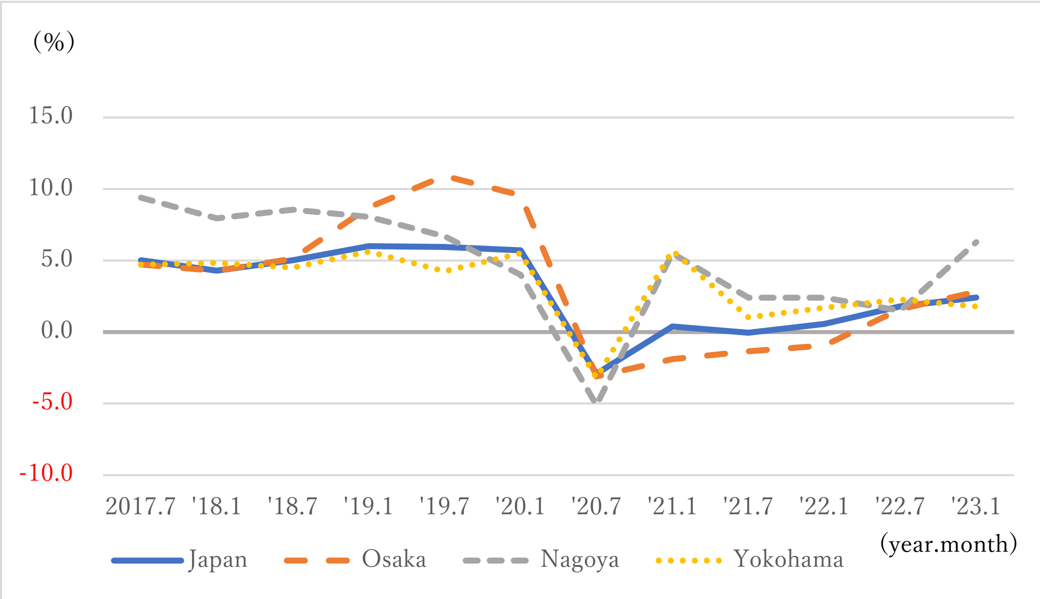
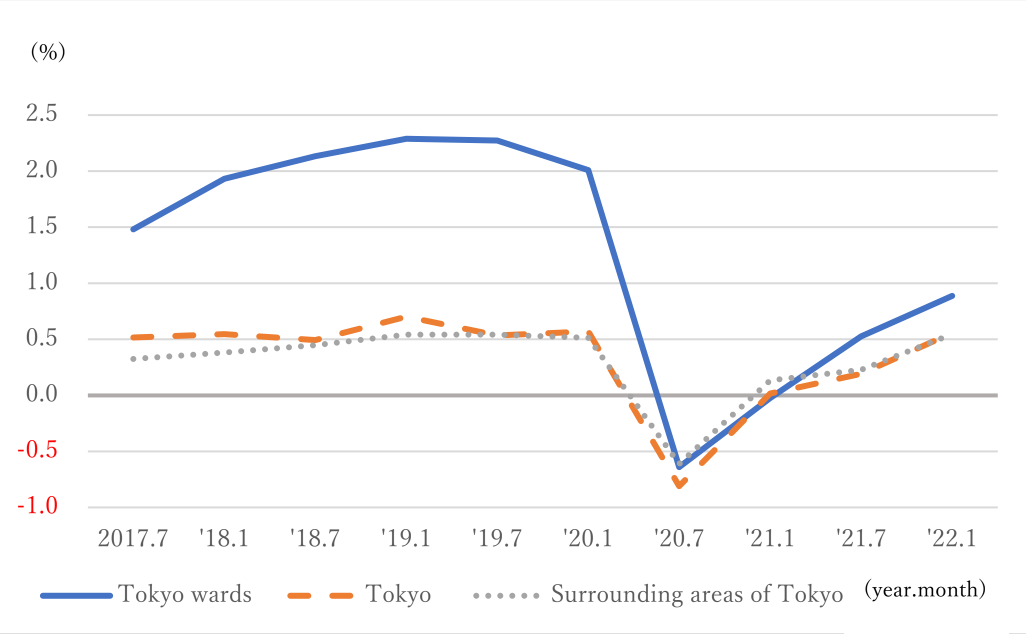
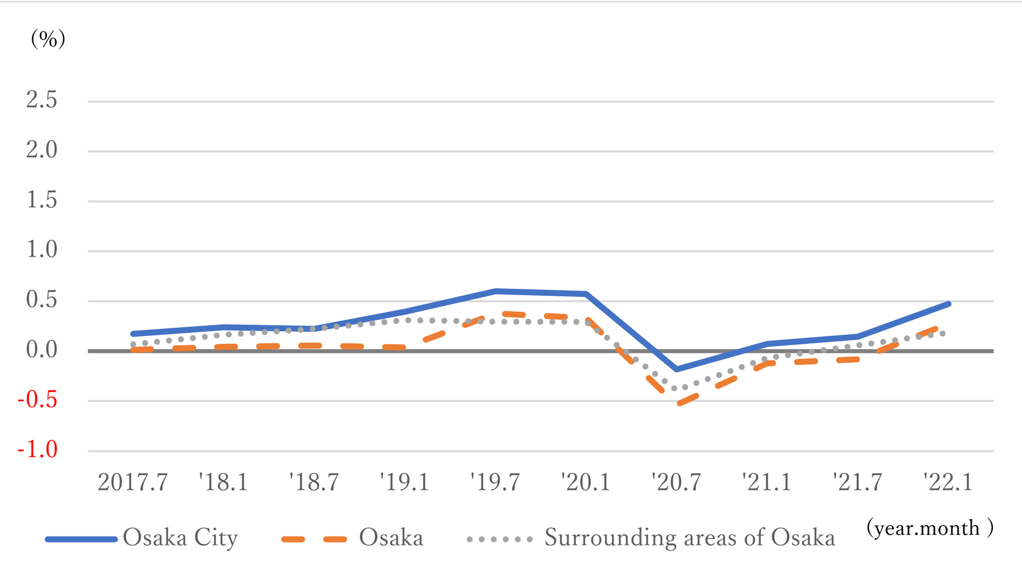


Figure 3-1　Half-year change rate of land prices in residential areas (Tokyo area)



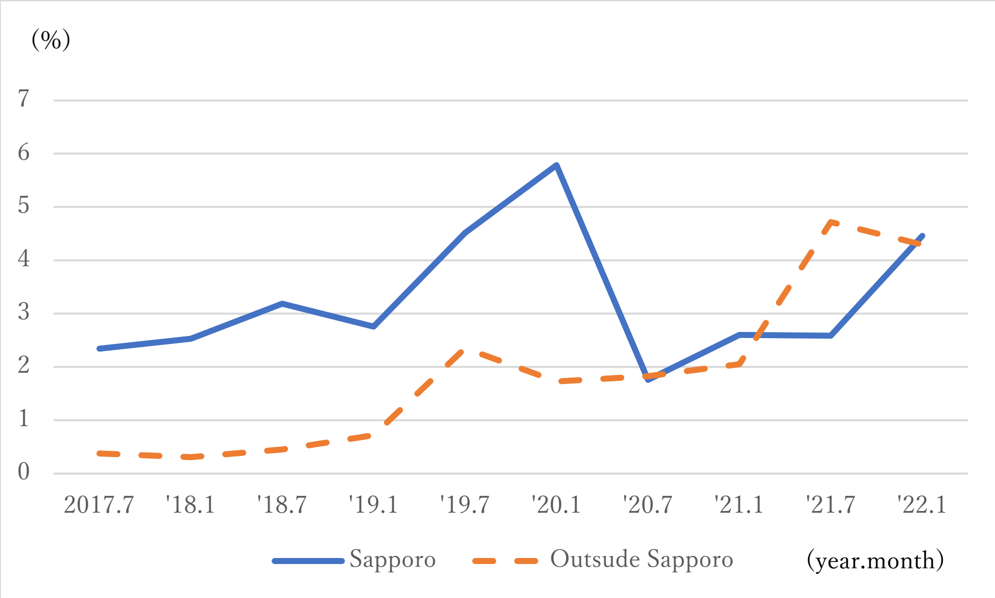
Note: The Tokyo metropolitan area includes Saitama, Chiba, and Kanagawa prefectures; the Tokyo metropolitan areas are cities, towns, and villages excluding the Tokyo wards.

Figure 3-2　Half-year change rate of land prices in residential areas (Osaka Area)



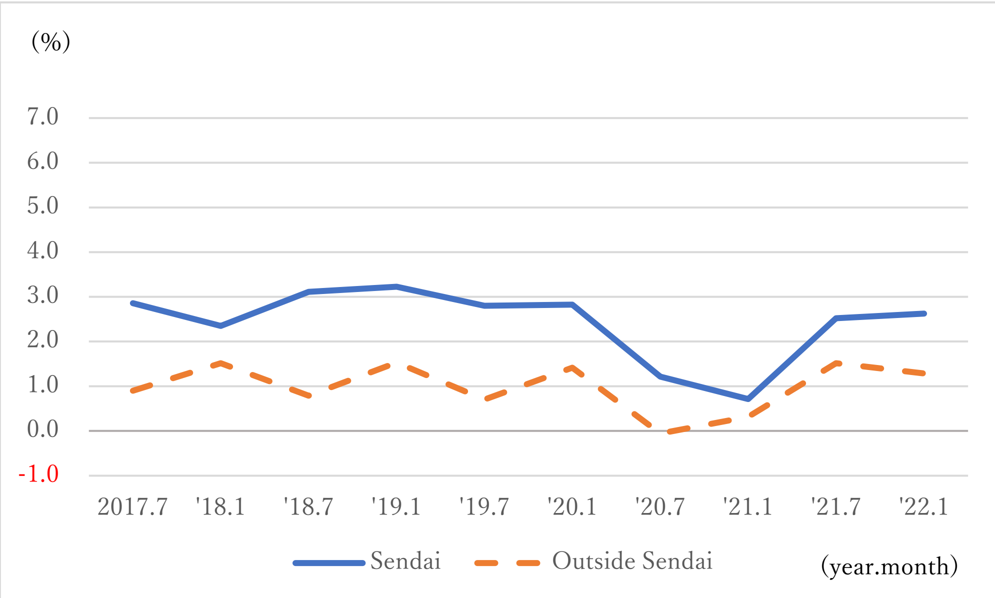
Note: Surrounding areas of Osaka include Kyoto, Hyogo, Shiga, and Nara; the Osaka metropolitan areas are cities, towns, and villages excluding Osaka City.

Figure 3-3　Half-year change rate of land prices in residential areas (Hokkaido)



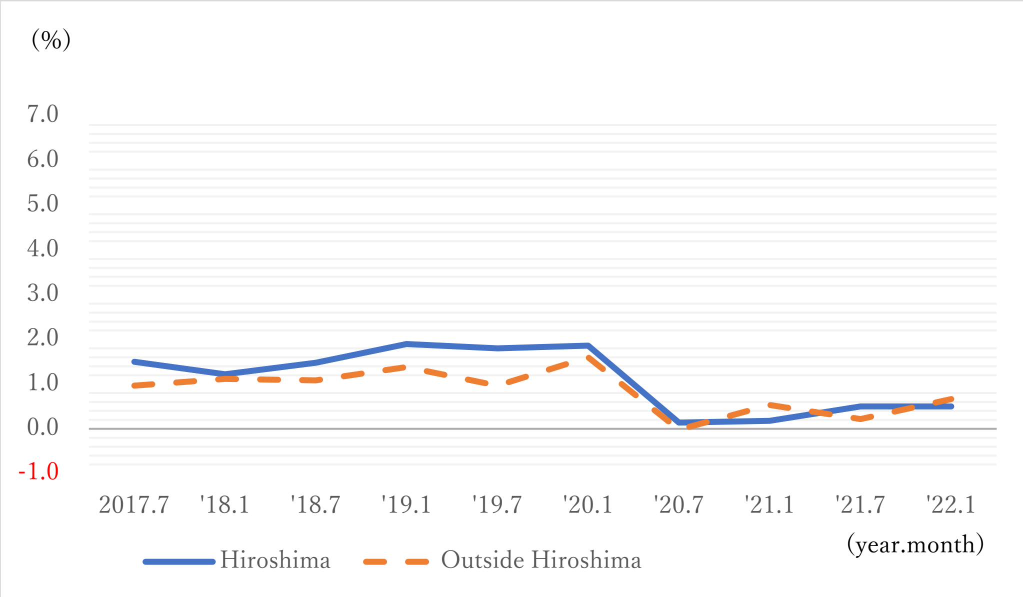
Note: "Outside Sapporo" refers to municipalities other than Sapporo in Hokkaido.

Figure 3-4　Half-year change rate of land prices in residential areas (Miyagi)



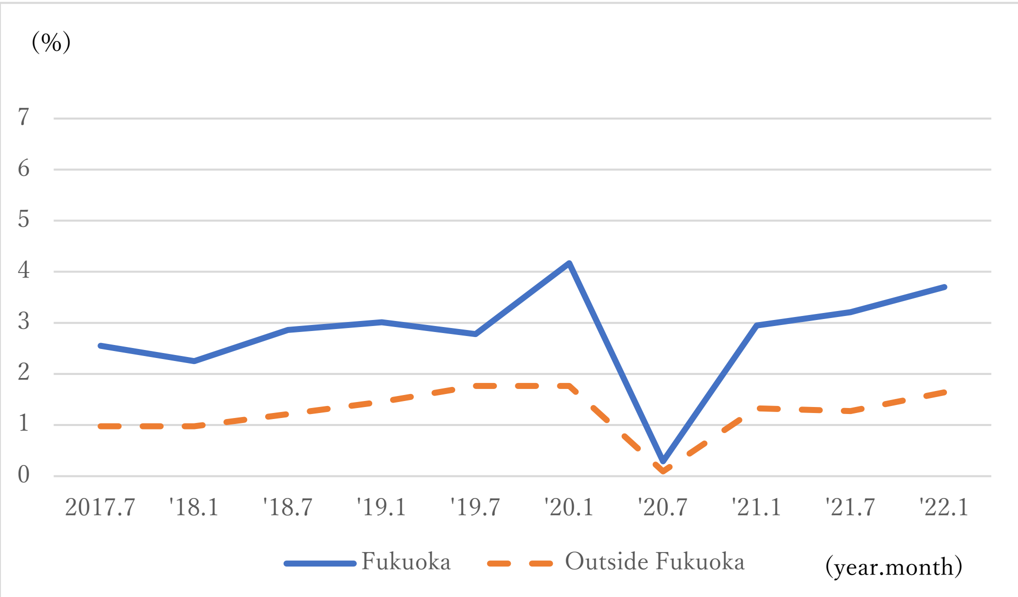
Note: "Outside Sendai" refers to municipalities in Miyagi Prefecture other than Sendai City.

Figure 3-5　Half-year change rate of land prices in residential areas (Hiroshima)



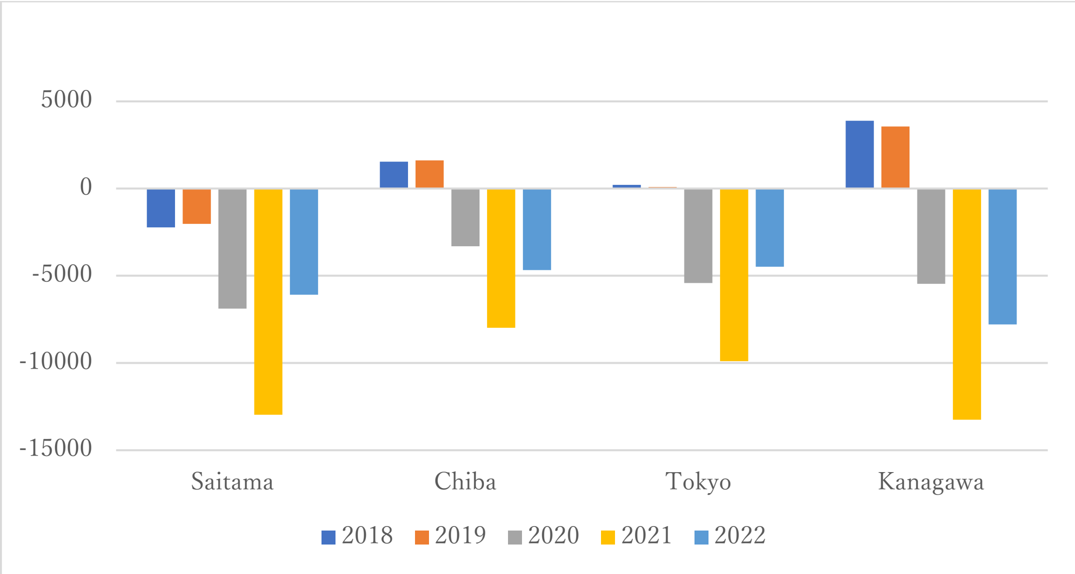
Note: "Outside Hiroshima" refers to municipalities in Hiroshima Prefecture other than Hiroshima City.

Figure 3-6　Half-year change rate of land prices in residential areas (Fukuoka)



Note: "Outside Fukuoka" refers to municipalities in Fukuoka Prefecture other than Fukuoka City.

Figure 4-1 Trends in the number of people moving into Tokyo wards from Tokyo (except Tokyo wards) and the surrounding area (2018–2022)



Note: Figures 4-1 to 4-4 were prepared by the author from "Table 11 Number of persons moving in by place of residence before and after migration (Japanese migrants)" in "Annual report on internal migration in Japan" derived from the basic resident registration (Ministry of Internal Affairs and Communications).

Figure 4-2 Trends in the number of people moving into Osaka City from Osaka (except Osaka City) and the surrounding area (2018–2022)

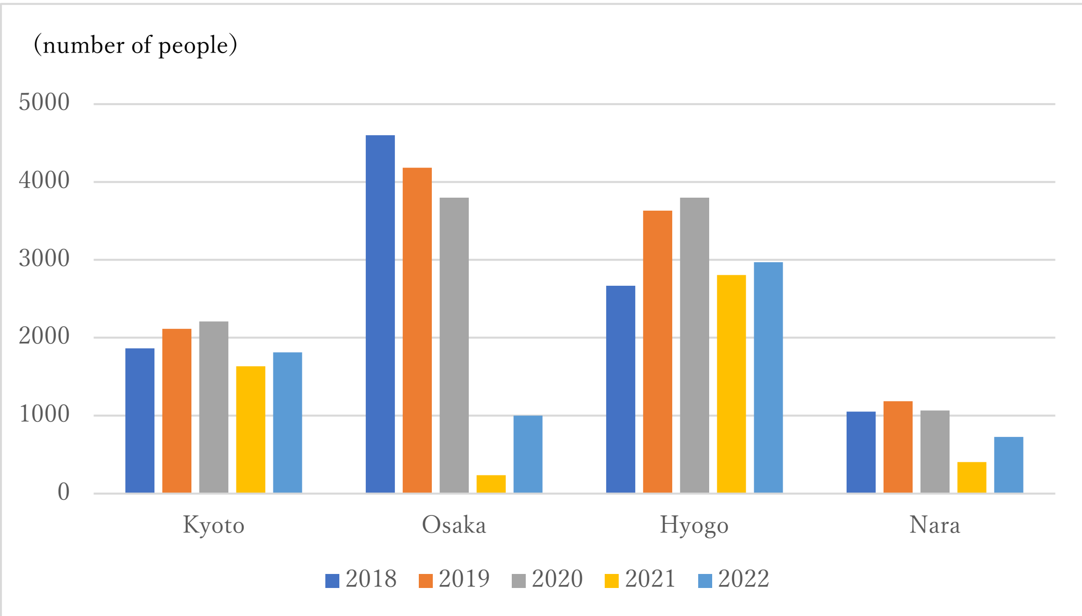


Figure 4-3　Trends in the number of people moving into Nagoya City from Nagoya (except Nagoya City) and the surrounding area (2018–2022)

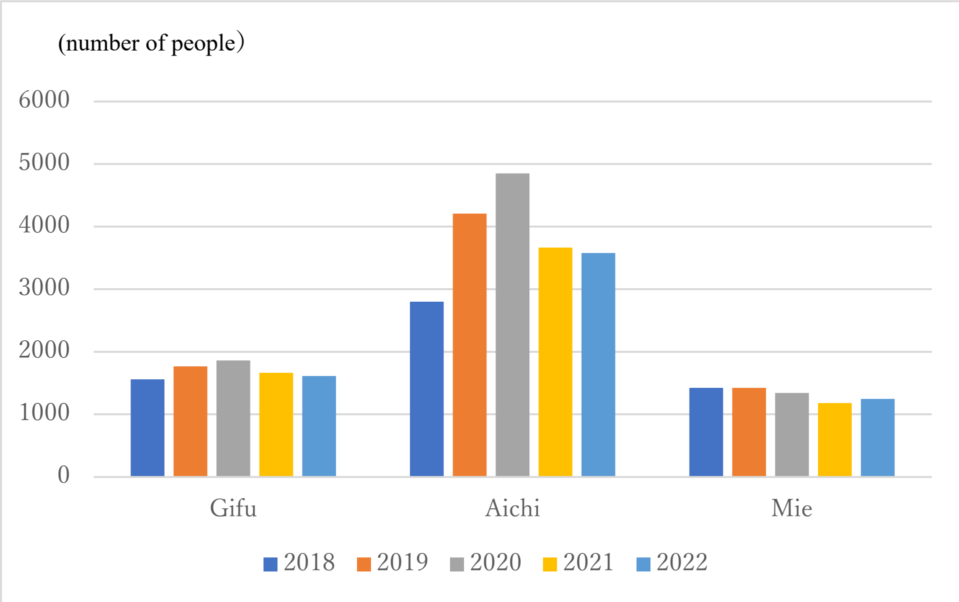
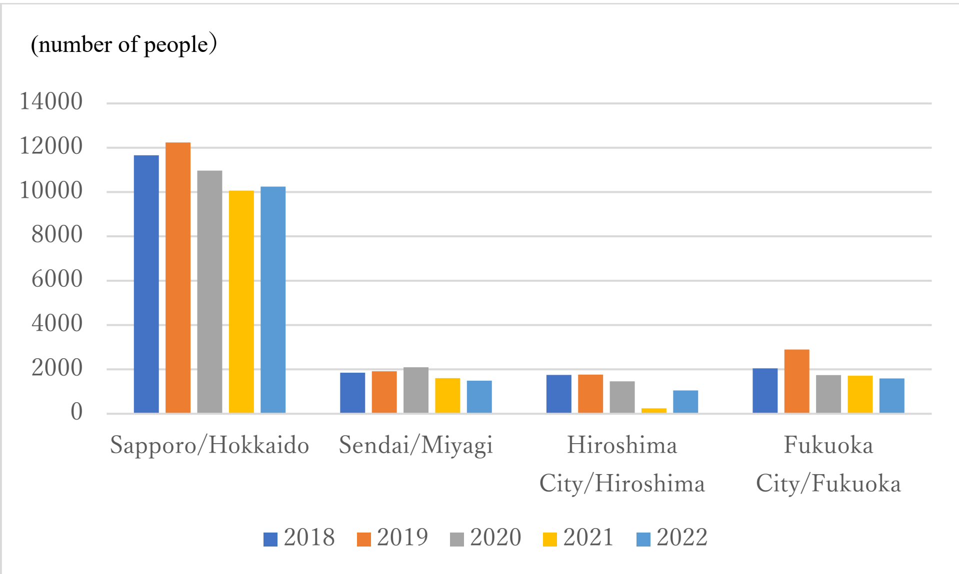
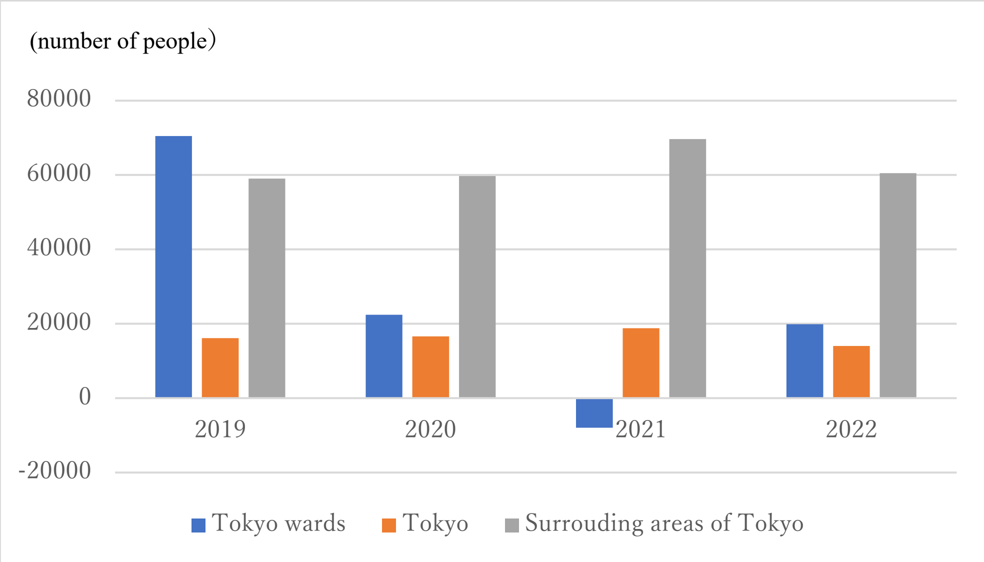


Figure 4-4　Number of people moving into the four local cities from each prefecture (2018–2022)



Note: Sapporo/Hokkaido indicates the number of excess transfers from Hokkaido to Sapporo. Other pairings are the same.

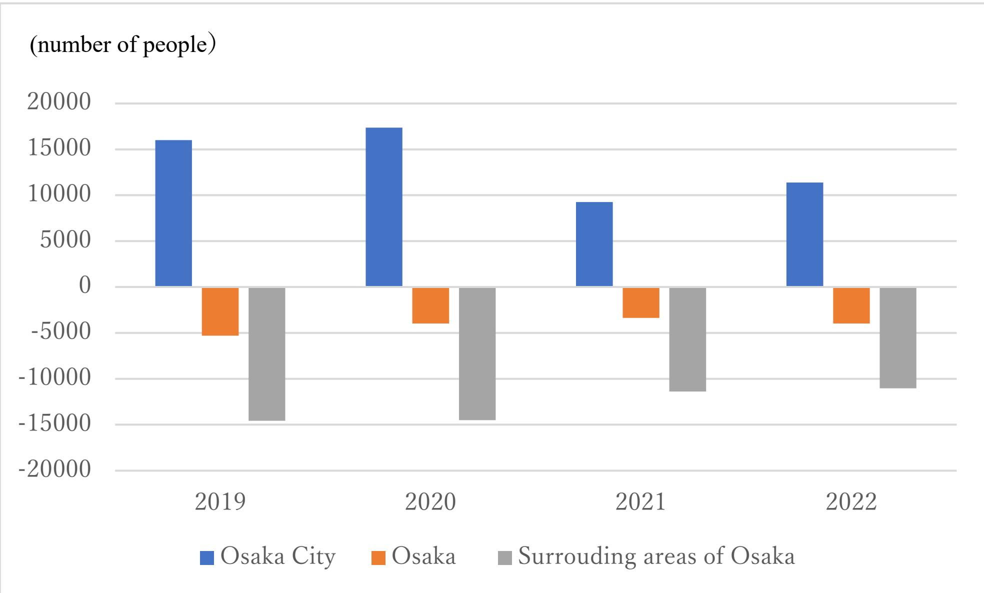
Figure 5-1　The number of in-migrants and out-migrants in Tokyo wards, Tokyo, and surrounding area of Tokyo (excluding Tokyo). In Figures 5-1 to 5-6, the data includes population movement outside the surrounding area of the urban center (e.g., Tokyo in Figure 5-1)



Note 1: Figures 5-1 to 5-6 were prepared by the author from "Table 11 Number of persons moving in by place of residence before and after migration (Japanese migrants)" in "Annual report on internal migration in Japan" derived from the basic resident registration (Ministry of Internal Affairs and Communications).

Note 2: Surrounding areas of Tokyo indicates Saitama, Chiba, Tokyo and Kanagawa.

Figure 5-2　The number of in-migrants and out-migrants in Osaka City, Osaka Prefecture (excluding Osaka City), surrounding area of Osaka (excluding Osaka Prefecture)



Note: Surrounding areas of Osaka area includes Kyoto, Osaka, Hyogo and Nara prefectures.

Figure 5-3 The number of in-migrants and out-migrants in Sapporo City and Hokkaido Prefecture (excluding Sapporo City)

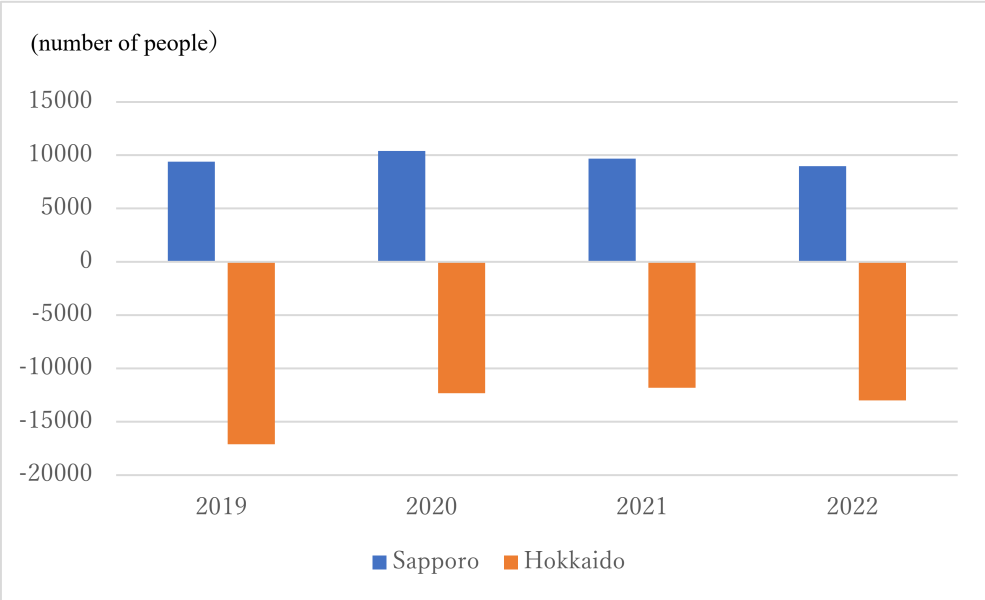


Figure 5-4 The number of in-migrants and out-migrants in Sendai City and Miyagi Prefecture (excluding Sendai City)

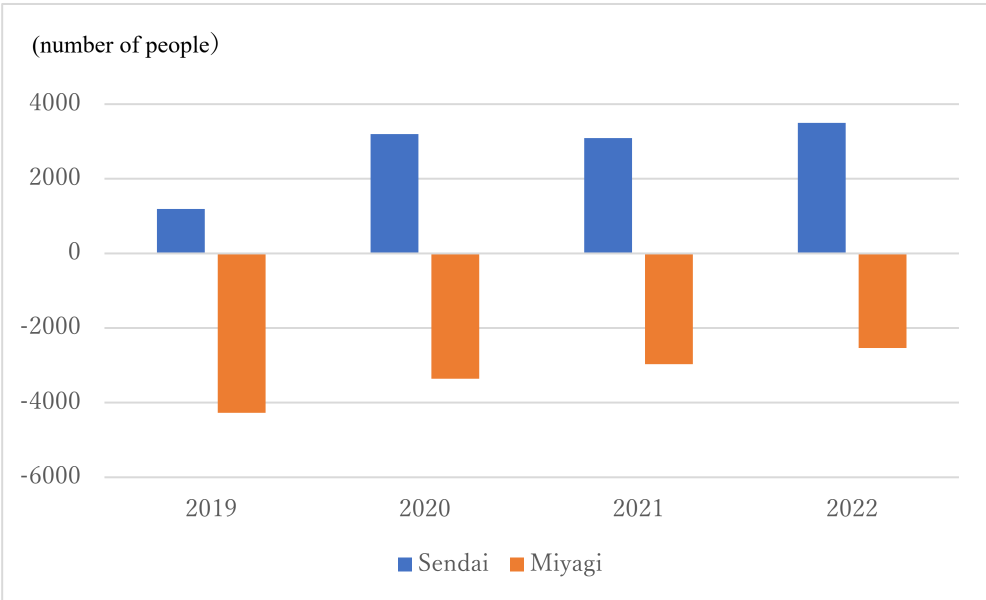


Figure 5-5　The number of in-migrants and out-migrants in Hiroshima City and Hiroshima Prefecture (excluding Hiroshima City)

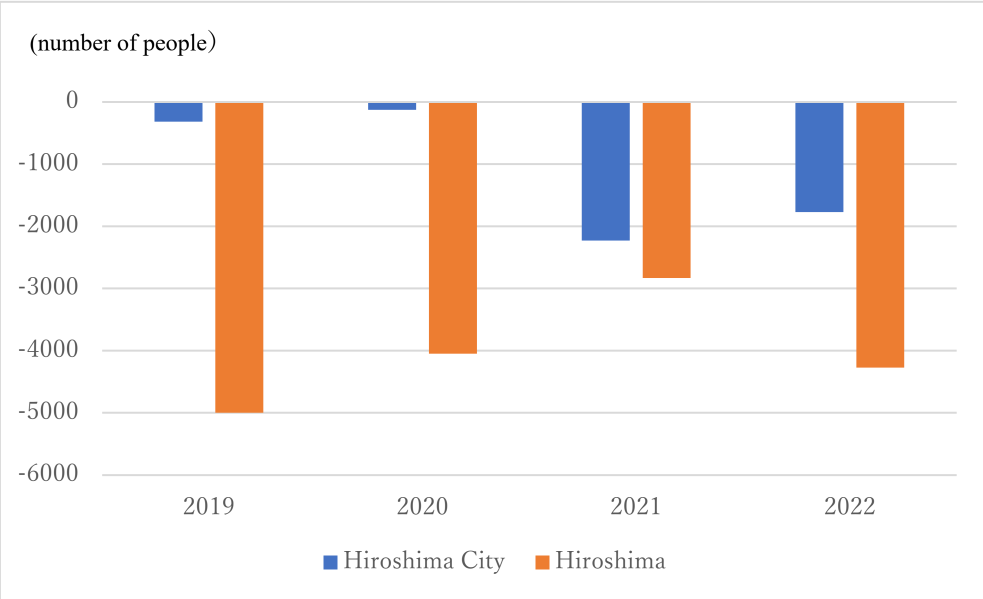


Figure 5-6　The number of in-migrants and out-migrants in Fukuoka City and Fukuoka Prefecture (excluding Fukuoka City)

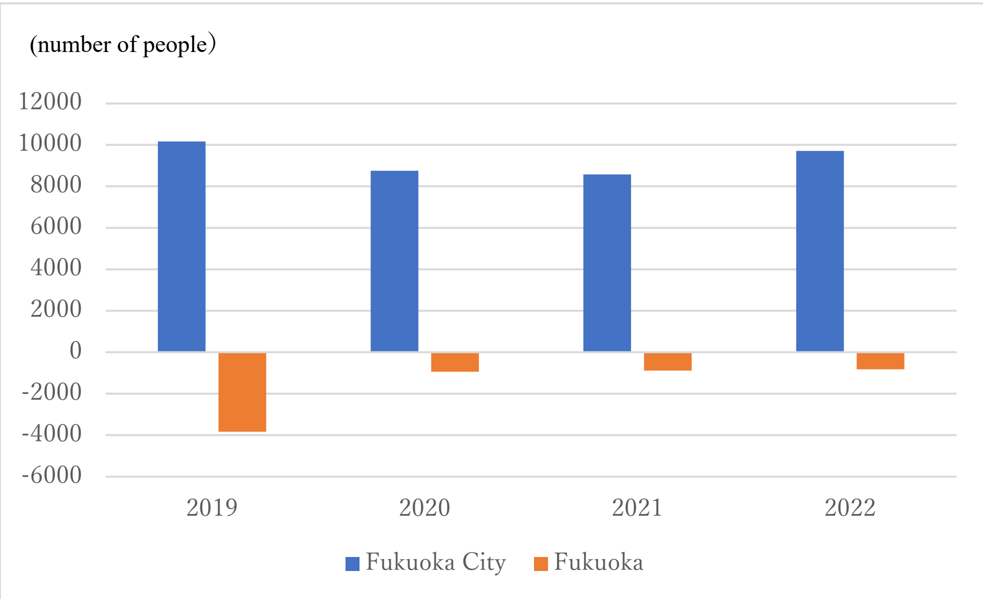
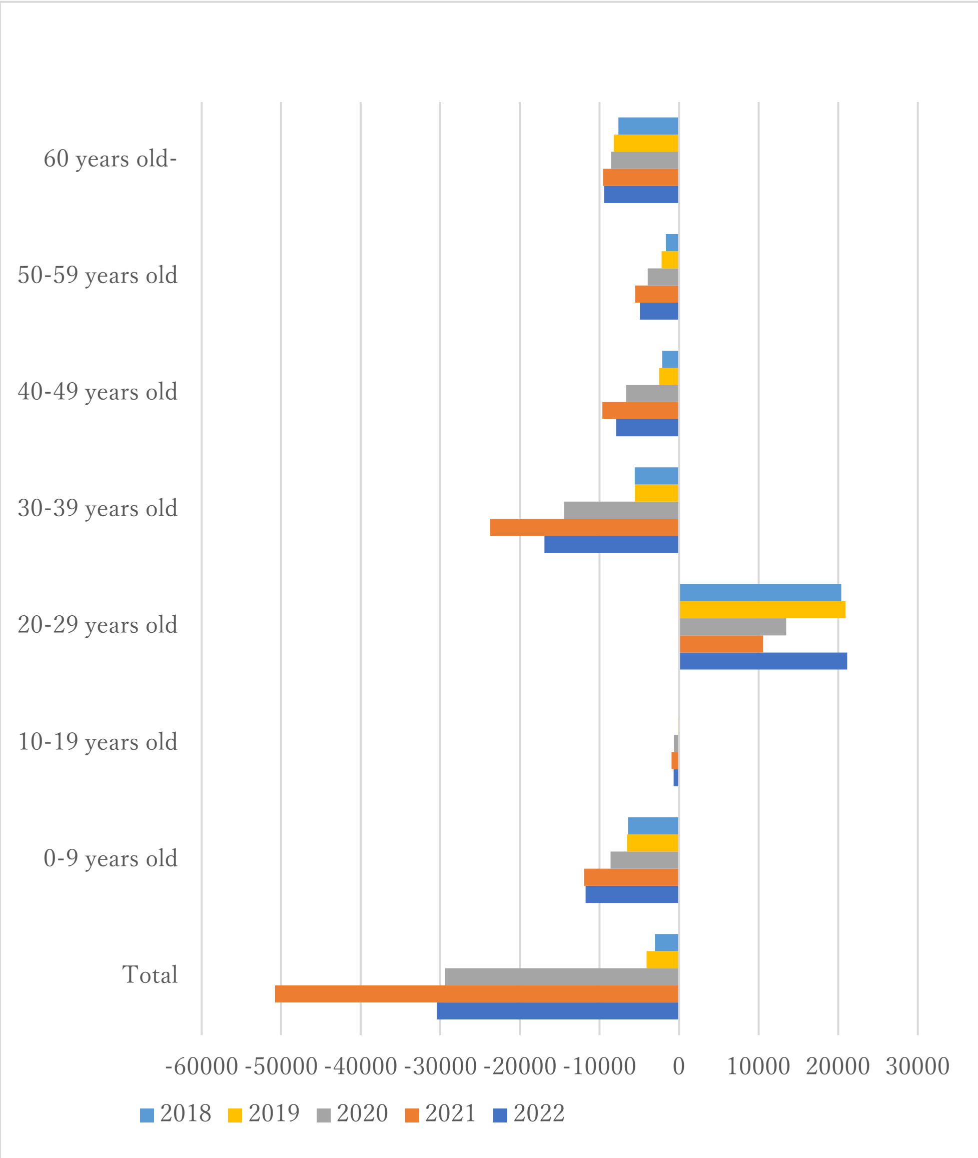
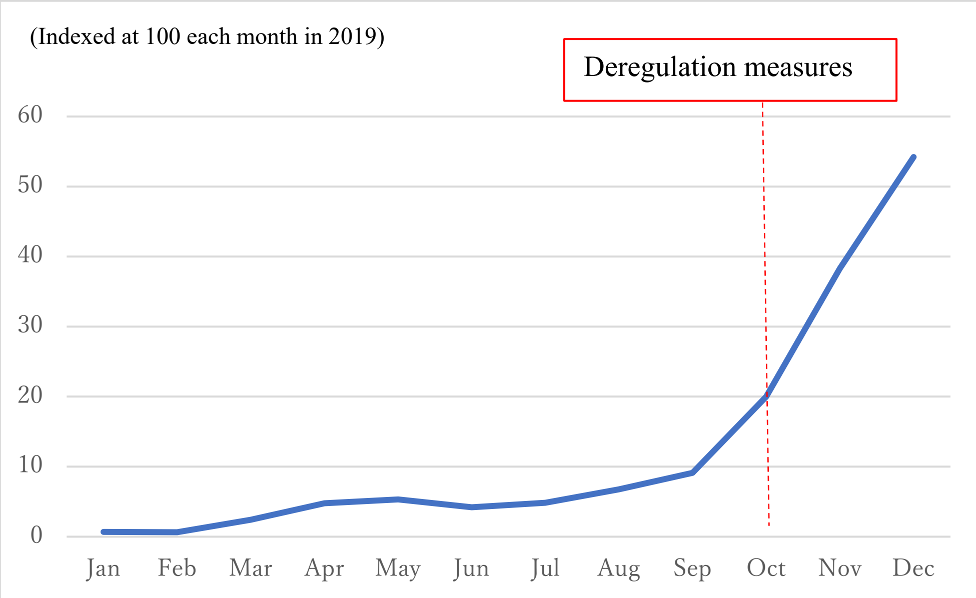


Figure 6　Number of people moving into Tokyo wards from Tokyo and the surrounding area (by age group)



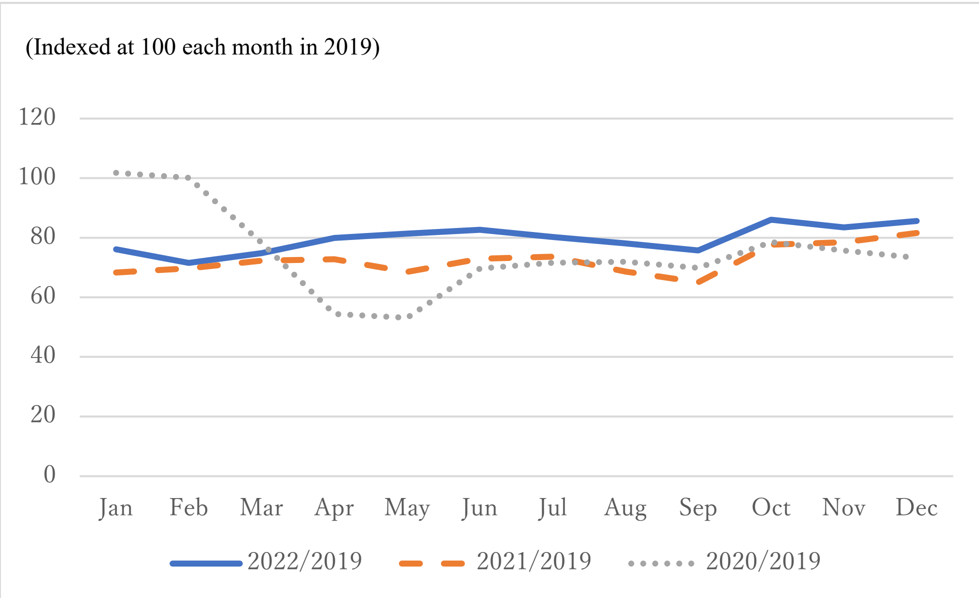
Note: Prepared by the author from Reference Table 2018 of the Population Migration Survey Report—results by age (10-year age groupings), sex, and municipality of moving in and out, including migrants (foreign nationals).

Figure 7-1　Number of foreign visitors to Japan (each month in 2022 compared to the same month in 2019)



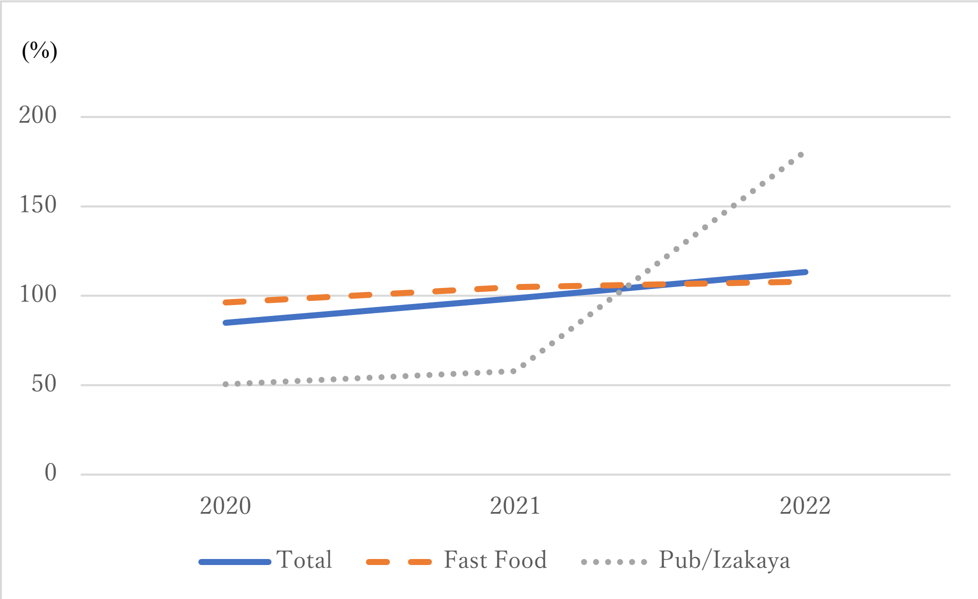
Note: Prepared by the author from materials published by the Japan National Tourism Organization (JNTO). (November 16, 2022).

Figure 7-2　Rail and track passenger volume (each month from 2020 to 2022 compared to the same month in 2019)



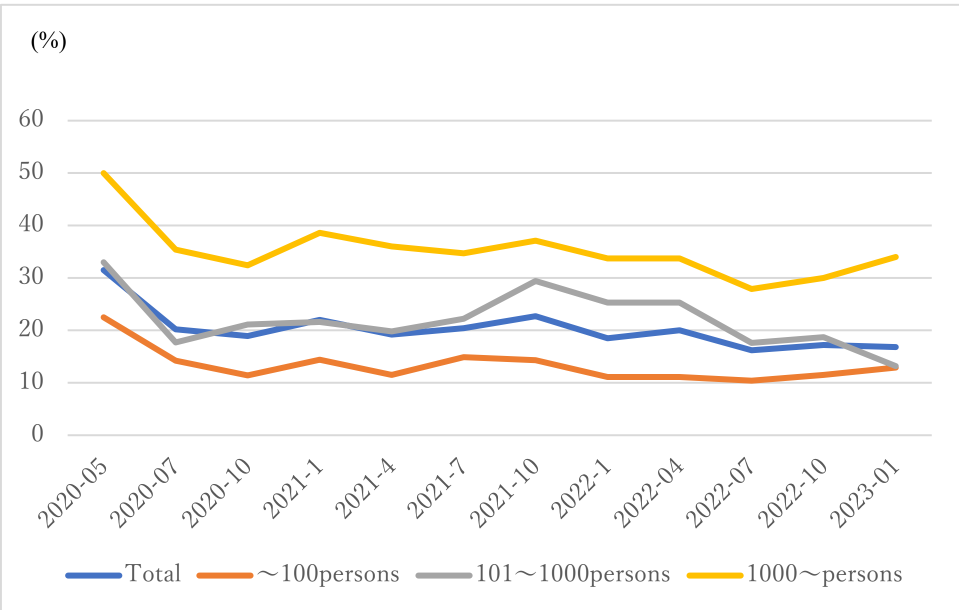
Note: Prepared by the author based on the Monthly Railway Transportation Statistics.

Figure 7-3　Foodservice market sales growth compared to previous year (from 2020 to 2022)



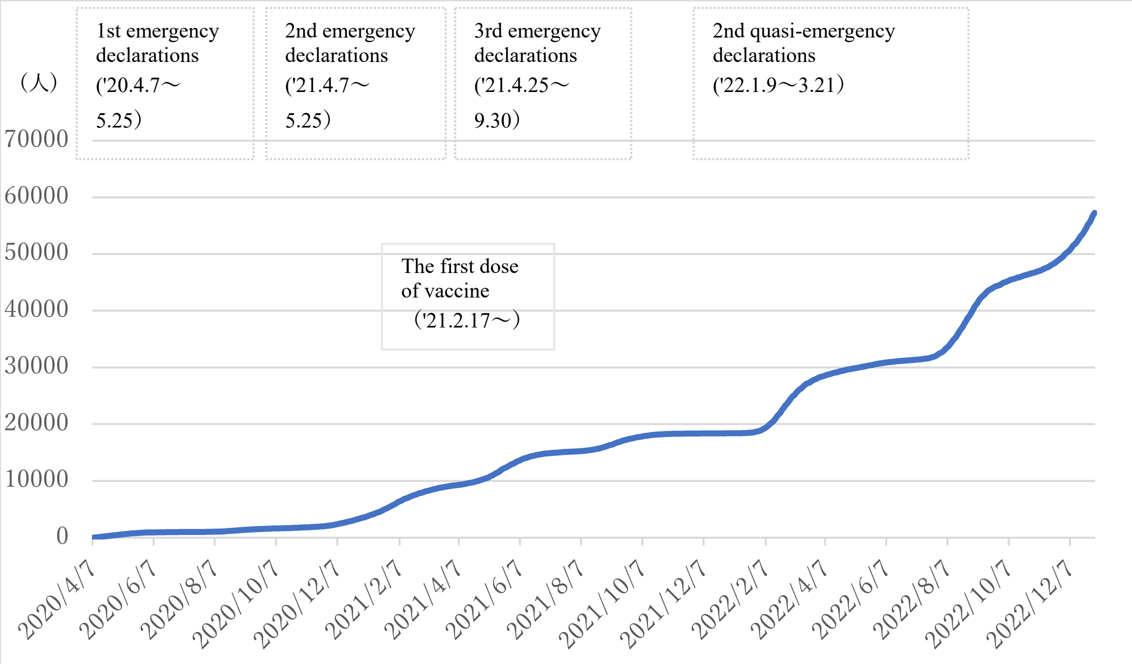
Note: The graph was prepared by the author based on year-on-year comparisons calculated from the fast food with the highest sales growth in 2022 compared to 2019 and the pub/izakaya with the lowest sales growth in 2022 compared to 2019 nationwide from the "Food Service Industry Market Trends Survey" published by the Japan Food Service Association.

Figure 7-4　Telework implementation rates (by number of employees)



Note: Japan Productivity Center "12th Survey on Workers' Attitudes" (2023).

(Attached Image 1) Cumulative number of deaths due to new coronavirus infection and timing of emergency declaration



Note: Prepared from materials released by the Government of Japan's Headquarters for Countermeasures to Combat Infectious Diseases of COVID-19 for the period from April 7, 2020 to December 31, 2022. The first round of priority measures to prevent the spread of the disease (April 5 to September 30, 2021) was not included because it overlapped with the third declaration of a state of emergency.

Information regarding Emergency Declaration Area

Areas of emergency declaration

1st: Up to 47 prefectures

2nd: Up to 11 prefectures

3rd: Up to 21 prefectures (from June 21 to July 11, only in Okinawa Prefecture)

Areas of a COVID quasi-emergency

2nd: Up to 36 prefectures

Appendix Table 1　Type of Use Area

Residential Area	Low-rise exclusive residential districts	Category 1 low-rise exclusive residential districts Category 2 low-rise exclusive residential districts
	Medium-to-high-rise exclusive residential districts	Category 1 medium-to-high-rise exclusive residential districts Category 2 medium-to-high-rise exclusive residential districts
	Residential districts	Category 1 residential districts Category 2 residential districts Quasi-residential districts, Rural residential district
Commercial Area	Neighborhood commercial districts Commercial districts	
Industrial Area	Quasi-industrial districts Industrial districts Exclusive industrial districts	

Note: The zoning system is a system that restricts the use of buildings in each of the zoning districts shown in Appendix 1, and the meaning of each zoning district and each use district is as shown below (excerpted from Article 9 of the City Planning Law).

Article 9 of the City Planning Law

(1) Category 1 low-rise exclusive residential districts are districts designated to conserve a favorable dwelling environment for low-rise housing.

(2) Category 2 low-rise exclusive residential districts are districts designated primarily to conserve a favorable dwelling environment for low-rise housing.

(3) Category 1 medium-to-high-rise exclusive residential districts are districts designated to conserve a favorable dwelling environment for medium-to-high-rise housing.

(4) Category 2 medium-to-high-rise exclusive residential districts are districts designated primarily to conserve a favorable dwelling environment for medium-to-high-rise housing.

(5) Category 1 residential districts are districts designated to conserve the dwelling environment.

(6) Category 2 residential districts are districts designated primarily to conserve the dwelling environment.

(7) Quasi-residential districts are districts designated to conserve the dwelling environment concordant with the promotion of convenience to conduct business suitable to the roadside characteristics of the region.

(8) Neighborhood commercial districts are districts designated to promote convenience to conduct commercial business and other businesses whose primary concern is the provision of daily necessities to residents of residential areas in the neighborhood.

(9) Commercial districts are districts designated primarily to promote convenience to conduct commercial business and other businesses.

(10) Quasi-industrial districts are districts designated primarily to promote convenience for industries that are not likely to degrade the environment.

Appendix Table 2: Summary of Building Restrictions (by Use Districts)

(1) category 1 low-rise exclusive residential districts, (2) category 2 low-rise exclusive residential districts, (3) category 1 medium-to-high-rise exclusive residential districts, (4) category 2 medium-to-high-rise exclusive residential districts, (5) category 1 residential districts, (6) category 2 residential districts, (7) neighborhood commercial districts, (8) commercial district, the rest omitted

Example	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Residences, apartment buildings, boarding houses								
Residences that are used for other purposes (the store, office, etc. portion of which is below a certain size)								
Kindergartens, elementary schools, middle schools, high schools								
Libraries, etc.								
Shrines, temples, churches, etc.								
Nursing homes, welfare homes for the physically disabled, etc.								
Daycare centers, public bathhouses, medical clinics								
Elderly welfare centers, child welfare facilities, etc.	1)	1)						
Officer dispatch centers, pay phones, etc.								
Universities, colleges of technology, special training schools, etc.								
Hospitals								
Certain stores, restaurants, etc. with two or fewer floors and a total floor area of 150 m^2 or less								
Certain stores, restaurants, etc., with a total floor area of 500 m^2 or less on the second floor								
Stores and restaurants other than those listed above				2)	3)	4)		
Offices, etc. other than those listed above				2)	3)			
Bowling alleys, skating rinks, swimming pools, etc.					3)			
Hotels and inns					3)			
Driving schools, barns with a total floor area exceeding 15 m^2					3)			
Mah-jongg parlors, pachinko parlors, shooting ranges, horse race ticket offices, etc.						4)		
Karaoke clubs						4)		
Automobile warehouses with two or fewer floors and a total floor area of 300 m^2 or less								
Commercial warehouses, vehicles with three or more floors or a total floor area exceeding 300 m^2 Warehouses (excluding attached garages, etc. below a certain size)								
Theaters, cinemas, theaters, with a total floor area of less than 200 m^2 of seating area								
Theaters, movie theaters, performance halls, and viewing halls with a total floor space of 200 m^2 or more in the seating area								
Buildings used for theaters, cinemas, theatrical performances, viewing halls, stores, restaurants, exhibition halls, stadiums, betting offices, ticket booths, and betting offices for winning tickets, where the floor area of the building used for such purposes exceeds 10,000 m^2.								
Cabarets, restaurants, nightclubs, dance halls, etc.								
(the rest omitted)								

Note 1: As for general notes, non-shaded cells (□) indicate uses that can be built, and shaded cells (■) indicate uses that cannot be built.

Note 2: As for specific notes 1) through 4)

1) can be built only if it is below a certain size

2) may be built only if the area used for the said purpose is two stories or less and 1,500 m^2 or less

3) may be built only if the area used for the said purpose is 3,000 m^2 or less

4) may be built only when the area used for the said purpose is 1,000 m^2 or less

Source: "City Planning Laws and Regulations Handbook, 2007 Edition" (Gyosei, 2007) PP. 3916-3917.