

Vacancy and Gentrification in Japan: A Multi-Scale Analysis Across the Three Metropolitan Areas, Kyoto Prefecture, and Toda City

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Vacancy and Gentrification in Japan: A Multi-Scale Analysis Across the Three Metropolitan Areas, Kyoto Prefecture, and Toda City

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ABSTRACT

Abstract

This dissertation examines how vacancy relates to gentrification in Japan through a deliberately multi-scale design that links national-metropolitan dynamics to prefectural and neighbourhood processes. Using Japan's three major metropolitan areas (Tokyo, Nagoya, Kansai) as the macro baseline, Kyoto Prefecture as a tourism-exposed arena, and Toda City (Saitama) as a contrastive micro case, the thesis asks whether widely used gentrification proxies travel across scales, how tourism pressure is transmitted into housing outcomes, and when neighbourhood conditions override otherwise gentrification factors. To ensure cross-scale comparability, all chapters employ a unified indicator set—HH, HRB, HO, TIE, WCEP, LP, VACANCY/SLTR—and a common methodological protocol combining correlation/OLS, mediation analysis, Most-Similar-Systems Design (MSSD) with k-NN screening, Moran's I/LISA for spatial diagnostics, and (M)GWR for locally varying relationships.

At the metropolitan scale, results demonstrate that the white-collar employment structure (WCEP) and land price (LP) consistently organise the spatial differentiation of vacancy across the three metropolitan areas. An INDEX quadrant classification (growth/decline × high/low price) provides a transparent reading of macro patterns, aligning vacancy contrasts with functional restructuring rather than income alone. These findings establish both the reach and the limits of metropolitan-level proxies and motivate the need to open the black box of transmission at lower scales.

At the prefectural scale in Kyoto, where tourism-led urban restructuring is salient, the analysis shows that tourism exposure does not act directly on vacancy; instead, LP functions as a mediating mechanism that translates visitor pressure and use conversion into changes in SLTR and the distribution of rentable vacancies. This tourism → LP → SLTR/vacancy path remains phase-specific yet robust across temporal windows, reconciling short-term displacement tendencies with longer-term reallocation of residential stock. Kyoto thus converts metropolitan regularities into a concrete valuation-to-housing chain that clarifies

when and how tourism pressures materialise as vacancy outcomes.

At the micro scale in Saitama/Toda, the thesis uses MSSD + k-NN to identify county-level units under comparable macro exposure (HH, HRB, HO, TIE, WCEP, LP) and isolates Toda City as a low-vacancy outlier. Neighbourhood analysis demonstrates statistically significant spatial clustering (Moran's I/LISA) and reveals that everyday access, road connection, and service layout—i.e., the built-form and micro-environment—account for local heterogeneity where metropolitan/prefectural signals alone cannot. MGWR further shows that effect sizes on vacancy vary locally rather than being captured by a single global parameter, underscoring the contingent, place-bound nature of mechanisms at street- and block-level.

Synthesising across scales, the dissertation uses a simple three-step frame—macro proxies → valuation mechanism → neighbourhood conditions—to show where common gentrification measures work in Japan and where they do not. The contributions are: (i) a cross-scale protocol with harmonised indicators, time windows, and weights that allows movement from metropolitan screening to neighbourhood diagnosis; (ii) a mediation approach that places tourism inside the valuation–housing chain instead of treating it as a stand-alone dummy variable; and (iii) a MSSD workflow that improves observation perspective and factor changes, supported by local-variation modelling with MGWR.

For future research, the priorities at each scale are confirmed as follows: at the metropolitan level, combine WCEP–LP signals with quadrant-specific reuse strategies; at the prefectural level, manage LP–use linkages in tourism jurisdictions to guide visitor pressure toward sustainable rental supply; at the neighbourhood level, adjust connectivity, land-use mix, and facility networks to reduce vacancy clusters. Although the overall approach in this study is limited by non-aligned time intervals and parameter choices, it can be directly reused as a research mechanism, with entry points tailored to each scale and to the available data-collection pathways.

In addition, we determined the content of the entire chapter structure, as shown in Figure A.

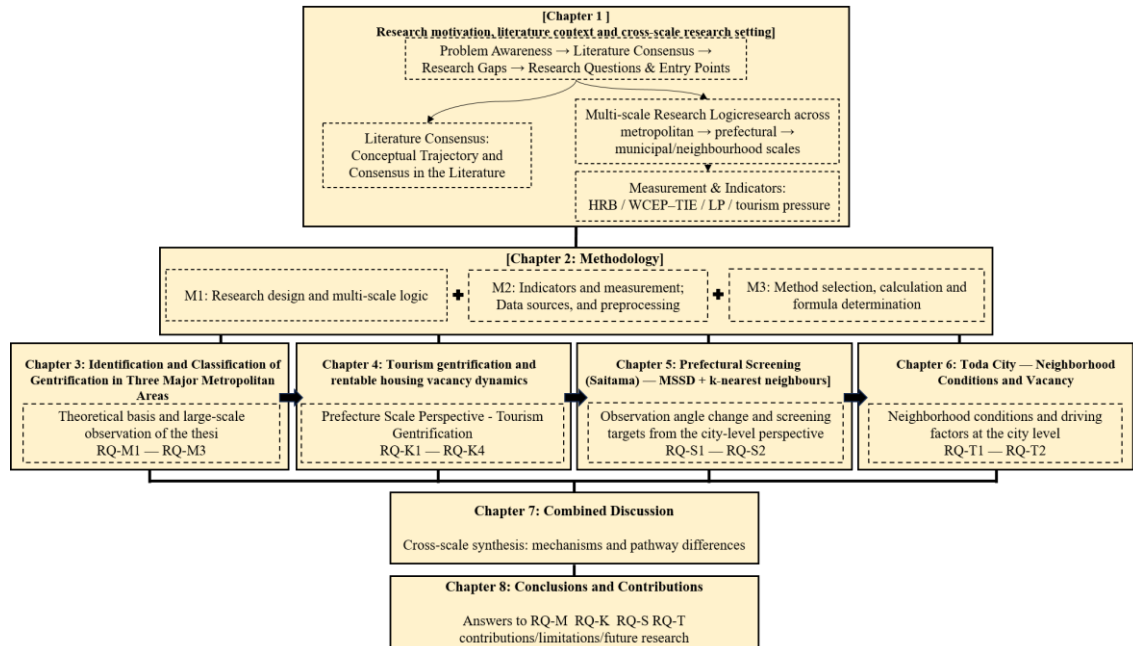


Fig A. Thematic structure of doctoral dissertation and main contents of each chapter

Publications and Contributions

Paper 1 → Chapter 3

Citation: Liu, Q., Nishi, H., Lin, J.-J., & Sho, K. (2025). Driving factors of gentrification: Evidence from the three major metropolitan areas of Japan. *Cities*, 167, 106318. <https://doi.org/10.1016/j.cities.2025.106318>

Paper 2 → Chapter 4

Citation: Liu, Q., Lin, J.-J., Baba, H., Nishi, H., Zhao, S., & Sho, K. (2026). Tourism gentrification and rentable housing vacancy dynamics: A mediation analysis of Kyoto Prefecture, Japan. *Cities*, 168, 106406. <https://doi.org/10.1016/j.cities.2025.106406>

Paper 3 → Chapter 6

Citation: Liu, Q., Sho, K., Corcoran, J., & Ando, N. (2024). Effects of neighbourhood characteristics on the distribution of vacant houses in Toda city, a satellite city of Tokyo metropolis of Japan. *Scientific Reports*, 14(1), 25794. <https://doi.org/10.1038/s41598-024-74663-3>

Abbreviations

300F/N — Public facilities within 300 m per neighbourhood.

A/N — Apartments per neighbourhood (housing-supply measure).

AIC — Akaike Information Criterion.

Aicc — Corrected Akaike Information Criterion (small-sample version).

B/N — Bus stops per neighbourhood (200 m service radius used).

C/F — Community/commercial service-facility area to residential floor-area ratio.

CTI — Tourism Industry Index: composite indicator of tourism intensity.

CTS — Standardized number of tourist sites.

F/N — Public facilities per neighbourhood.

GIS — Geographic Information System.

HH — Households: number of households (demographic indicator).

HRB — High-Rise Buildings: ratio/number of buildings over six floors (urban development intensity).

HO — Homeownership: rate of owner-occupied housing units (residential stability/mobility).

HS INDEX / IHS — Housing Supply Index: composite index of HRB–HH changes (adequacy of supply relative to demographic change).

IO INDEX / IIO — Industry and Occupation Index: composite index based on change in WCW (occupational upgrading proxy).

K-NN — k-Nearest Neighbours (screening/matching).

LISA — Local Indicators of Spatial Association.

LP — Land Price: average or log change in land price (yen/m²), indicating economic impact and spatial demand shifts.

MGWR — Multiscale Geographically Weighted Regression.

MLIT — Ministry of Land, Infrastructure, Transport and Tourism (Japan).

Moran's I — Global spatial autocorrelation statistic.

MSSD — Most-Similar-Systems Design.

NILIM — National Institute for Land and Infrastructure Management (Japan).

OLS — Ordinary Least Squares.

P/F — Park/green-space area to residential floor-area ratio.

PLATEAU — MLIT's national 3D city-model project/dataset.

QGIS — QGIS (formerly "Quantum GIS"), open-source GIS software.

RPD — Residence Promotion District.

S/F — Supermarket area to residential floor-area ratio.

SLTR — Short- and long-term rentable vacant houses.

TIE — Tertiary-Industry Employment: employment in the service sector (education, finance, healthcare, etc.).

VACANCY — Vacancy (vacant-housing outcome measure).

VIF — Variance Inflation Factor.

VH — Vacant Houses.

VH/N — Vacant houses per neighbourhood.

VH/T — Vacant houses over total dwellings (vacancy rate).

WCW — White-Collar Workers: share of managerial/professional/clerical employees (occupational structure proxy).

15–64/N; 65–99/N; 100–150/N — Share of dwellings by floor-area band per neighbourhood.

Bootstrap method — Resampling technique to estimate accuracy/stability of sample estimates (e.g., standard errors, confidence intervals).

Causal stepwise regression — Mediation testing approach following Baron & Kenny (1986).

Commercial land — Land designated for business and commercial activities.

Land prices — Monetary value per unit area (per m²) of land.

Mediation effect framework — Analytical approach to test whether an independent variable's effect on an outcome is transmitted through mediating variables (e.g., tourism → land/rent → SLTR).

Park area per person — Public green space per capita.

Rent gap — Difference between current rent and potential rent after redevelopment/improvement.

Residential land — Land designated primarily for housing purpose

Context

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Chapter 1

*Research Motivation, Literature
Context And Cross-Scale Research
Setting*

1.1 Motivation and Problem Awareness

Gentrification, is commonly used to describe urban renewal processes in which capital reinvestment, shifts in social composition, and the reconfiguration of lifestyles reshape urban space. The discussion has moved from an early focus on “residential displacement/population replacement” toward explanations that emphasize the coupling of industrial and employment structures, public and private reinvestment, and institutional environments (Glass, 1964; Atkinson, 2000; Freeman & Braconi, 2004; Davidson & Lees, 2005; Shaw, 2008). From this perspective, infrastructure construction and redevelopment are not merely physical improvements but a reordering of spatial order jointly driven by national and local reinvestment and market-based reallocation, intertwined with occupational upgrading, the reconfiguration of spatial attractiveness, and the turnover of consumption–cultural scenes (Torrens & Nara, 2007; Lin & Chung, 2017; Doucet, 2021; Yoon & Currid-Halkett, 2015).

Meanwhile, in the Japanese context, the long-term processes of post-industrial transition and demographic reconfiguration have produced a multi-scalar spatial reordering centered on adjustments in the industrial–occupational structure and jointly propelled by state–local redevelopment and infrastructure investment. The results include stagewise shifts in price- and rental-side tensions, a recombination of housing and household structures, and the differentiation and agglomeration of regional accessibility, together shaping patterns of spatial redistribution across administrative levels (Harris, 2012; Lin & Chung, 2017; Doucet, 2021). Within this framework, government-led, institution–infrastructure–market resonance—“structural gentrification”—emerges as a key lens for understanding urban processes in Japan (Davidson, 2007; Visser & Kotze, 2008).

As one subtype of gentrification, “tourism-oriented gentrification” highlights how tourism resources and consumption formats amplify price and rental tensions, and—through commercial turnover, the expansion of short-term uses, and the reprogramming of public space—reconfigure local everyday life and housing utilization (Gotham, 2005; Cocola-Gant, 2018; Russo & Scarnato, 2018; Sequera & Nofre, 2018; Yrigoy, 2019; Paulsen, 2023; Gil, 2024; Smigiel, 2024).

In Japan's cultural and tourism corridors, the concentration and seasonality of tourist flows often coincide with shop replacement, shifts in rent gradients, and the functional reallocation of street blocks, manifesting over different time windows as observable adjustments to spatial structure (Yamamura & Tsubota, 2020; Kubo & Mashita, 2020; MLIT, 2022).

Building on field observations conducted since graduate and doctoral stages, this study notes several representative spatial phenomena under the above background: in tourism-endowed cities such as Uji and in areas surrounding major attractions in Nara, vacant dwellings persist (Figure 1.1; Figure 1.2). Particularly in Kyoto, shopping streets adjacent to major sights display shopfront and storefront vacancies (Figure 1.3). Meanwhile, in non-tourism-led suburban nodes, fine-grained observation areas in local cities such as Toda—adjacent to the Tokyo Metropolis—also exhibit notable distributions of residential vacancy. From this vantage point, aside from gentrification-related drivers, it is worth distinguishing between tourism and non-tourism corridors and conducting cross-scale comparisons to assess whether the causes and expressions of vacancy are more strongly conditioned by employment and commuting structures, accessibility, and the built environment (Figure 1.4) (MIC, 2018; MLIT, 2022; Wakabayashi & Koizumi, 2018).

These reflections, together with the current state of the literature, converge on a shared problem awareness: the diverse urban situations in Japan (tourism cores, cultural attraction belts, and suburban living–commuting nodes) should be placed within a single structure-driven comparative framework. Along the chain from metropolitan structure to tourism-driven dynamics, county-level selection, and fine-scale neighborhood mechanisms, the study establishes multiple necessary vantage points and appropriate analytical entry points. In line with a three-tier perspective from metropolitan area to prefecture to city, the local vacancy phenomenon is examined accordingly.



Fig 1.1 Suspected vacant houses near the Asuka-dera tourist attraction.
(Nara City) (Photo by the author)



Figure 1.2 Suspected vacant houses near the tourist attraction in Uji Shrine.
(Uji City) (Photo by the author)



Fig 1.3 Suspected vacant houses and shops near Fushimi Inari Taisha Shrine. (Kyoto city) (Photo by the author)



Fig 1.4 Suspected vacant houses. (Toda city) (Photo by the author)

1.2 Conceptual Trajectory and Consensus in the Literature

This section synthesizes the core literature on the “gentrification–urban restructuring” nexus, tracing the conceptual shift from origins to structural explanations. It distills two mechanism axes repeatedly validated in international research: (i) spatial reordering driven by infrastructure and state-led redevelopment; and (ii) consumption-oriented and symbolic reconfiguration arising from industrial restructuring, cultural/creative economies, and tourism. It concludes with points of consensus on the Japanese context and the current state of vacant housing.

1.2.1 From Residential Replacement to a Structural Process

Although gentrification was first proposed as an observable form of neighborhood succession—centering on the displacement effects and affordability deterioration associated with middle-class in-migration to working-class areas—the expansion of research scope and methods has led scholars to treat it as a process of urban restructuring shaped by the interweaving of state policy, capital circulation, and cultural preferences. It is thus no longer equated with a simple out-migration/in-migration sequence or piecemeal refurbishment of the built environment.

Gentrification has been discussed worldwide since the 1960s, initially emerging as a descriptive term for middle-class influx into working-class neighbourhoods (Glass, 1964). Subsequent research conceptualised it as a global process of urban restructuring, emphasising its profound social, economic, and cultural implications (Ergun, 2004; Shaw, 2008; Torrens & Nara, 2007). While early scholarship highlighted class-based displacement and socio-economic upgrading (Atkinson, 2000; Freeman & Braconi, 2004), more recent work has extended the discussion towards capital flows, redevelopment, and the financialisation of housing markets (Davidson & Lees, 2005; R  rat et al., 2010; Visser & Kotze, 2008). This broadening of focus has introduced the notion of “new-build gentrification,” driven by large-scale development, rising land values,

and often state involvement (Davidson, 2007; He, 2010; López-Morales et al., 2023; Shmaryahu-Yeshurun & Ben-Porat, 2021). Evidence from diverse contexts—including North America, Europe, and the Global South—illustrates that gentrification is best understood as a structurally embedded process, one that takes varied forms depending on regional economic structures and institutional settings (Chava et al., 2018; Robertson et al., 2022; Valente et al., 2023).

In subsequent conceptual developments, emphasis shifted to its close ties with capital fluctuations, changes in land-governance arrangements, and new-build development, thereby consolidating a structural-institutional explanatory framework.

By the 1980s, gentrification research expanded beyond descriptive accounts to incorporate structural explanations. Hackworth and Smith (2001) conceptualised gentrification as occurring in successive “waves,” each tied to the dynamics of capital flows, land-use restructuring, and state intervention. Davidson and Lees (2005) introduced the idea of “new-build gentrification,” emphasising that large-scale residential development projects, rather than small-scale reinvestment, were increasingly defining the transformation of contemporary cities. This was further reinforced by Davidson (2007), whose work identified how redevelopment schemes produced new forms of exclusion.

Empirical evidence from diverse global contexts affirmed this structuralist turn. In Latin America, He (2010) and López-Morales et al. (2023) highlighted the role of global real-estate investment and urban renewal policies in reshaping local housing markets. In Israel, Shmaryahu-Yeshurun and Ben-Porat (2021) demonstrated how state-driven redevelopment amplified displacement, while in South Africa, Visser and Kotze (2008) showed that post-apartheid reinvestment reproduced racialised inequalities. These cases illustrate that gentrification is not simply a by-product of middle-class preferences but a process embedded in wider political-economic transformations.

1.2.2 Mechanism I: Infrastructure and State-Led Redevelopment

A substantial body of cross-regional research shows that infrastructure investment and redevelopment are not merely local urban improvements; rather, within frameworks of state/local governance and capital collaboration, they steer the reallocation of population, functions, and land values, thereby generating new centralities and spatial differentiation. This mechanism is particularly prominent in East Asian cities characterized by large-scale projects—especially in Japan—and finds reciprocal corroboration in institutional experiences from North America and Europe.

Infrastructure investment has also been identified as a critical driver of contemporary gentrification, shaping land values, neighbourhood composition, and displacement patterns (Doucet, 2021; Lin & Chung, 2017). In East Asian cities such as Tokyo and Taipei, infrastructure-led redevelopment has facilitated capital inflows, intensified land prices, and marginalised existing populations (Lin et al., 2022; Wang et al., 2022). These findings resonate with Canadian cases where institutional investment has produced uneven redevelopment outcomes (Doucet, 2021), collectively affirming the structural role of state-led and infrastructure-driven transformations.

More recent work highlights infrastructure investment as a central structural driver. Doucet (2021), examining Canadian transit-oriented development, demonstrated how infrastructure upgrades intensified land value increases and displaced lower-income groups. Similarly, Lin and Chung (2017) analysed regeneration in Taiwan, showing that new infrastructure created spatially uneven outcomes. In East Asia, infrastructure-led redevelopment has become particularly visible. Lin et al. (2022) identified the role of large-scale state projects in Tokyo, while Wang et al. (2022) documented how infrastructure investment in Taipei facilitated capital inflows but produced exclusionary housing dynamics. Together, these studies underline that infrastructure operates as both an economic stimulus and a mechanism of sociospatial reordering.

Under this mechanism, a coupled sequence of transport–land price–function–population has structured medium- to long-term urban reconfiguration in many cities: gains in transport accessibility and node-focused redevelopment

elevate land-price expectations; functional mixes and consumption scenes are subsequently reorganized; and population and occupational structures are re-stratified in space. Taken together, this evidence points to a policy–infrastructure–market synthesis as the structural driver of these transformations.

1.2.3 Mechanism II: Industrial Restructuring, Cultural/Creative Economies, and Tourism

Running in parallel to infrastructure-led change is a pathway rooted in industrial and cultural reconfiguration: the growth of service- and knowledge-intensive sectors, inflows of tourism capital, and the expansion of cultural/creative economies collectively redraw the geographies of consumption and the commercial ecology. Through symbolic valuation and scenographic remaking, they alter neighborhood attractiveness and use patterns, thereby prompting coordinated adjustments in residential, commercial, and spatial orders.

Industrial restructuring further influences urban change, with tourism, cultural, and creative industries frequently linked to gentrification. Tourism-driven capital inflows and wealth disparities have contributed to the displacement of low-income populations in Spain, the US, the Netherlands, and China (González-Pérez et al., 2020; Robertson et al., 2022; Valente et al., 2023; Zhang et al., 2022). Parallel processes associated with cultural economies have reshaped neighbourhoods in New York (Yoon & Currid-Halkett, 2015), London (Harris, 2012), Tokyo (Kidokoro et al., 2022), Taipei (Sho et al., 2023), and Shanghai (Arkaraprasertkul, 2019). These observations underscore that gentrification cannot be reduced to a singular mechanism but must be examined through the interplay of industrial change, symbolic economies, and land use policies.

This pathway suggests that the “symbolic valorization” generated by industry, culture, and tourism and the “financial valorization” in real-estate/land markets often reinforce one another—the former shapes place meanings and

consumption itineraries, while the latter locks in price expectations and investment logics; together they act upon community structure and urban form.

1.2.4 Characteristics of the Japanese Context and the State of Research

While international scholarship has become increasingly fine-grained, urban restructuring in Japan exhibits institutional and demographic features distinct from Europe and North America: developmentalist planning, population ageing, and institutional real-estate practices jointly shape outcomes. Much of the literature still concentrates on cases such as Tokyo and Osaka, leaving national-scale evidence relatively fragmented and concepts and empirical indicators without a unified standard. At the same time, recent empirical work suggests that large-scale redevelopment and in-situ adjustments in population/occupational structure in Japan are expressed primarily through institutional and infrastructure channels, rather than through straightforward class replacement. It is therefore necessary, in the chapters that follow, to investigate these processes across multiple observational scales, distinguishing tourism and non-tourism corridors and aligning the analysis with Japan's specific institutional settings.

Despite the robustness of global research, the Japanese context remains comparatively underexplored. Unlike Western cities where class displacement dominates, Japanese urban transformation is often shaped by developmentalist planning, demographic ageing, and institutional real estate practices (Kidokoro et al., 2023; Kırmızı, 2019; Sho et al., 2024). Prior studies have tended to focus on individual cases such as Tokyo or Osaka (Fujitsuka, 1992; Waley, 2016), leaving the national-level picture fragmented. Moreover, Japan lacks a standardised definition of gentrification, and empirical indicators are inconsistently applied (Fujitsuka, 2004; Wang et al., 2020). This absence hinders cross-national comparison and weakens theoretical engagement with broader gentrification debates.

The exploration of gentrification in Japan, particularly through quantitative approaches, remains limited and fragmented. In the context of Osaka and

Nagoya, existing studies have primarily addressed gentrification through qualitative lenses. For instance, Nagao and Edgington (2023) investigated factory relocation in Osaka that triggered job losses and community transformation. In Horie's Tachibana Street, the emergence of industrial gentrification has been noted (Kırmızı, 2019). Likewise, inner-city revival linked to the proliferation of condominiums since the 1990s has been associated with potential gentrification in central wards (Sho, 2022). In Nagoya, studies by Wang et al. (2020, 2021) have analysed gentrification driven by railway development, although these studies have focused mainly on land prices and residential mobility.

Compared to North American and European cities, gentrification in Japan follows a markedly different trajectory. Its key drivers include demographic ageing, structural employment shifts and state-led urban redevelopment, in Tokyo and other core cities, particularly large-scale high-rise housing projects in waterfront districts—rather than grassroots reinvestment or community-led rehabilitation (Lützel, 2008; Machimura, 2021; Mori, 2017).

Although class remains central to global debates on gentrification, its explanatory utility in Japan appears limited. This indicates that widening income inequality is not strongly correlated with visible spatial restructuring, especially in the Tokyo Metropolitan Area (Fujita & Hill, 2012; Tatsuto, 2016). Instead, shifts in occupational structure offer a more sensitive lens. Wakabayashi and Koizumi (2018) emphasised that white-collar employment shares are more indicative of urban change than income levels. Similarly, Koizumi and Wakabayashi (2019) argued that the expansion of professional and clerical sectors—rather than elite affluence—is a key factor in spatial transformation in Japanese cities. This aligns with Fielding (2004), who argued that occupational upgrading in post-industrial Japan can signal class restructuring without evident social polarisation. Taken together, these findings underscore the centrality of white-collar concentration as a structural marker of urban change in the Japanese context.

1.2.5 Current Status of Vacant Houses in Japan

To enable mechanism identification and context-sensitive comparison across subsequent multi-scale vantage points, this subsection summarizes, at the national level, the official classification and the overall severity of Japan's vacant-

housing situation.

Japan's definition of vacant housing broadly aligns with other countries: a dwelling or building that is not inhabited or in regular use. In practice, identification typically combines administrative water-usage records with on-site observation of buildings and yards. From the perspective of housing typologies, vacant housing is one of the standard categories within the broader group of non-occupied dwellings.

According to the Ministry of Internal Affairs and Communications (MIC), the number of vacant houses rose from about 7.56 million in 2008 to 8.48 million in 2018, with the national vacancy rate reaching 13.6% (MIC, 2018; 2019). Following the Ministry of Land, Infrastructure, Transport and Tourism (MLIT) classification, vacant housing is grouped into four types (see Figure 1.5): (i) vacant rental housing—dwellings standing empty while intended for rent; (ii) vacant housing for sale—units standing empty while offered for sale, whether new or used; (iii) vacant secondary housing—so-called villas or second homes, used intermittently (e.g., for recreation or occasional overnight stays) rather than as permanent residences; and (iv) other vacant housing—dwellings not occupied that do not fall under the first three types, including units whose residents are absent for extended periods. The “other” category often contains older or substantially deteriorated stock (MLIT, 2022). Among these categories, vacant rental housing accounted for 50.9% of all vacant units in 2018, making it the largest share of national vacancies (MIC, 2019; MLIT, 2022).

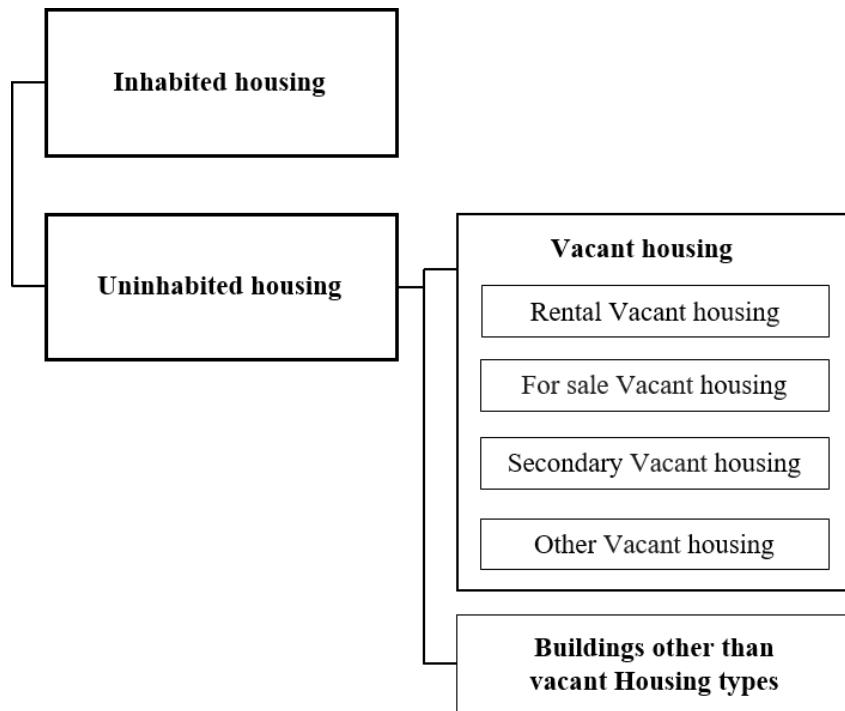


Fig 1.5 Vacant housing by the Japanese government

Responding to rising all type of vacant houses ratios, the Japanese government enacted the 2014 Act on Special Measures for Promotion of Countermeasures against vacant houses to encourage the use of underutilized housing. However, in areas with strong tourism demands such as Kyoto, vacancy can still be managed for potential conversion to short-term rental or seasonal use. From 2008 to 2018, Kyoto Prefecture's vacancy rate slightly declined from 13.1% to 12.8%, contrasting with the national increase. Similar patterns occurred in Fukuoka (13.7% to 12.7%) and Chiba (13.1% to 12.6%). Notably, all three prefectures experienced a growth in tourism during this period.

On this basis, the above facts provide the necessary background for subsequent, context-specific discussion: on the one hand, the nationwide rise in vacancy rates and the composition of vacancy categories indicate mounting stress within the housing system; on the other, slight declines in certain regions under tourism growth point to the possibility of managed vacancy and room for use conversion over time.

1.2.6 Synthesis of Consensus and Research Questions

Bringing together the foregoing literature and official statistics, this 1.2 section distills a baseline consensus and the core questions to be addressed.

Consensus. Gentrification should be understood as a structural process co-shaped by the state, the market, and institutional arrangements. Across institutional settings, infrastructure and redevelopment repeatedly reorganize land values, population composition, and functional space. In parallel, industrial restructuring, cultural/creative economies, and tourism provide consumption-oriented and symbolic pathways that also reconfigure urban space.

Research questions. At the national and metropolitan scales in Japan, existing work remains fragmented, lacking unified conceptual definitions and comparable indicators. Relative to income or class, employment and occupational structure appear to be more sensitive macro signals in the Japanese context, yet how these shifts interact across urban scales to reorganize housing and spatial distribution requires systematic testing. With nationwide trends and local differences coexisting, the category composition of vacant housing and the phenomenon of managed vacancy suggest possibilities of use conversion and temporal adjustment—issues that subsequent chapters will scrutinize with localized literature and data.

1.3 Three Major Metropolitan Areas (Tokyo, Nagoya, Kansai): Macro Scale and Theoretical Supports

1.3.1 Research Setting and Period (2005–2020)

Building on the conceptual trajectory and key mechanism cues outlined in Section 1.2, this section shifts to the metropolitan observational scale and designates Japan's three principal metropolitan areas as the window for national

comparison and as a reference frame for later chapters (2005–2020). The aim is to capture the urban restructuring jointly shaped by post-crisis redevelopment, demographic change, and policy realignment in Japan, and to establish a macro benchmark against which the subsequent tourism-conditioned, county-level, and neighborhood-scale analyses can be read.

Against this background, the present study investigates the driving factors of gentrification in Japan's three major metropolitan areas—Tokyo, Nagoya, and Kansai—between 2005 and 2020. These regions concentrate economic, cultural, and political activity, and they have been subject to accelerated urban redevelopment, demographic transition, and post-recession policy realignment. By focusing on these metropolitan areas, the study situates Japan's urban change within both domestic and international frameworks, providing a robust foundation for comparative analysis.

1.3.2 Overseas Drivers and Evidentiary Bases of Gentrification

To support comparability at the metropolitan scale, a survey of international literature on quantitative pathways and evidence of urban restructuring in major metropolitan regions indicates that existing studies make core contributions around “indicator integration—cross-city comparison—interpretive divergence.

The driving factors of gentrification have been widely discussed. Drawing from a broad spectrum of global experiences in Salt Lake City (Torrens & Nara, 2007), Auckland (Liu et al., 2019), New York (Zapatka & Beck, 2021), Boston (Preis et al., 2021), Toronto (Hawkins et al., 2022), Amsterdam and Rotterdam (Hochstenbach & van Gent, 2015), London (Reades et al., 2019), Seoul, Busan and Gwangju (Kim et al., 2022) and Sydney (Thackway et al., 2023), the relevance of quantitative methods in deciphering the urban dynamics of gentrification has been highlighted. These studies underscore the indispensable role of statistical analysis in integrating socioeconomic indicators to provide a deeper understanding of gentrification.

Despite extensive research from various perspectives, including changes in the industry (Kidokoro et al., 2022), population structure (López-Gay et al., 2021) and income levels (Meltzer & Ghorbani, 2017) in gentrified neighbourhoods, the

definitive driving factor of gentrification remains unclear. The persistence of unanswered questions highlights the complexity of gentrification; thus, further integrated studies are needed to disentangle the intricate factors influencing gentrification. Hochstenbach and van Gent (2015) indicated that social mobility is important in explaining gentrification in low-status neighbourhoods, while others (Shmaryahu-Yeshurun & Ben-Porat, 2021; Zapatka & Beck, 2021) emphasised that consumption led to production in neighbourhood gentrification. Although some studies (for Toronto, Montreal and Vancouver, see Walks et al., 2021) have been conducted across metropolitan areas, most focus on specific gentrified neighbourhoods in a single city (Arkaraprasertkul, 2019; Zapatka & Beck, 2021) or area (Sharifi et al., 2021; Zhang et al., 2022). But, Walks et al. (2021) demonstrated that changes in the class structure of households were crucial for inner-city gentrification.

1.3.3 Drivers and Distinctiveness in the Japanese Context

In contrast to the international evidence reviewed above, Japan's metropolitan regions exhibit distinctive institutional, demographic, and developmental trajectories. First, the literature is concentrated on the capital region and a few core-city cases, with quantitative studies relatively dispersed. Second, the combined effects of industrial and occupational restructuring, state-led redevelopment, and population ageing tend to weaken the explanatory power of like class displacement account, highlighting key points where local evidence and contextual differences diverge.

The exploration of gentrification in Japan, particularly through quantitative approaches, remains limited and fragmented. In the context of Osaka and Nagoya, existing studies have primarily addressed gentrification through qualitative lenses. For instance, Nagao and Edgington (2023) investigated factory relocation in Osaka that triggered job losses and community transformation. In Horie's Tachibana Street, the emergence of industrial gentrification has been noted (Kırmızı, 2019). Likewise, inner-city revival linked to the proliferation of condominiums since the 1990s has been associated with potential gentrification in central wards (Sho, 2022). In Nagoya, studies by Wang et al. (2020, 2021) have

analysed gentrification driven by railway development, although these studies have focused mainly on land prices and residential mobility.

Compared to North American and European cities, gentrification in Japan follows a markedly different trajectory. Its key drivers include demographic ageing, structural employment shifts and state-led urban redevelopment, in Tokyo and other core cities, particularly large-scale high-rise housing projects in waterfront districts—rather than grassroots reinvestment or community-led rehabilitation (Lützeler, 2008; Machimura, 2021; Mori, 2017).

Although class remains central to global debates on gentrification, its explanatory utility in Japan appears limited. This indicates that widening income inequality is not strongly correlated with visible spatial restructuring, especially in the Tokyo Metropolitan Area (Fujita & Hill, 2012; Tatsuto, 2016). Instead, shifts in occupational structure offer a more sensitive lens. Wakabayashi and Koizumi (2018) emphasised that white-collar employment shares are more indicative of urban change than income levels. Similarly, Koizumi and Wakabayashi (2019) argued that the expansion of professional and clerical sectors—rather than elite affluence—is a key factor in spatial transformation in Japanese cities. This aligns with Fielding (2004), who argued that occupational upgrading in post-industrial Japan can signal class restructuring without evident social polarisation. Taken together, these findings underscore the centrality of white-collar concentration as a structural marker of urban change in the Japanese context.

1.3.4 Research Questions at the Metropolitan Scale

At the metropolitan scale, this study employs a unified time period and spatial framework to identify common drivers and regional heterogeneity, thereby providing a benchmark and a selection basis for subsequent meso-scale and neighborhood-level analyses.

Informed by Japan's unique urban restructuring processes—marked by occupational shifts and spatial disparities—this study refrains from redefining gentrification. Instead, it advances a multi-dimensional approach grounded in

social, spatial, and employment-based indicators, operationalised through spatial classification to clarify patterns across metropolitan Japan. Building on this literature, the study addresses the following research questions:

RQ-M1. What are the key indicators associated with gentrification-like processes in Japanese metropolitan areas?

RQ-M2. How can a coordinate axis classification method be used to identify spatial differences in gentrification-related transformation across multiple urban scales in Japan?

RQ-M3. What are the observed spatial patterns of gentrification-related indicators in Tokyo, Nagoya and Kansai metropolitan areas, and how do they differ between urban cores and surrounding areas?

1.4 Kyoto: Tourism-Oriented Urban Restructuring and Housing Impacts at the Prefectural Scale

1.4.1 Tourism-Oriented Gentrification

The basic concept and general mechanisms of “tourism gentrification” have been broadly established in existing scholarship. However, for a tourism-led form of urban restructuring, the literature focusing on its specific effects on residential and rental systems—and on how these dynamics manifest in Kyoto—requires renewed confirmation.

Tourism gentrification, an influential concept in urban and tourism studies, refers to the process through which tourism-driven investment and development restructure local urban environments and housing systems, leading to the spatial, economic, and symbolic displacement of existing residents (Gotham, 2018). As a distinct subprocess within broad urban restructuring, tourism gentrification has emerged as a powerful force reshaping contemporary cities, particularly those rich in cultural and historical heritage (Gotham, 2005; Cocola-Gant, 2018; Russo

& Scarnato, 2018).

Although tourism gentrification shares several features with classical gentrification, including rising property values and residential displacement (Butler & Robson, 2001; Hackworth & Smith, 2001), it is uniquely shaped by seasonal tourist flows, digital short-term rental platforms, and the global commodification of local culture (Martínez, 2019; Coccola-Gant, 2018). Concerning tourism, urban authenticity is a marketable asset, attracting tourism-oriented redevelopment within historically residential neighborhoods (Ergun, 2004; Hayes & Zaban, 2020).

Tourism gentrification has wide-ranging implications for urban spaces, contributing to urban revitalization and economic activation (Donaldson, 2009; Sequera & Nofre, 2018) and accelerating the transformation of residential environments. Public spaces are privatized, small businesses are displaced, and local communities face mounting pressures from commercial encroachment (Coccola-Gant, 2018; Russo & Scarnato, 2018). These transformations often displace vulnerable groups, whereas noise, crowding, and the erosion of place identity and negatively affect the well-being of remaining residents (Anguelovski et al., 2020; Cole et al., 2021).

Furthermore, tourism gentrification disrupts traditional rental systems in the housing market, increases the demand for investment-oriented property acquisitions, and drives up rental costs, especially in tourist-adjacent districts (Zuk et al., 2018; Gil, 2024). These pressures often reallocate housing, in which long-term rentals are either removed from the market or converted to short-term rental, widening affordability gaps and contributing to market volatility (Mixa & Loftsdóttir, 2023; González-Pérez, 2020; Yrigoy, 2019).

Although research on prices, land use, and community displacement is relatively extensive, work directly addressing rentable vacant housing within tourism contexts remains limited. In tourism gentrification-affected cities, vacancy may signal underuse, speculative holding, transitional housing status, and indirect displacement owing to affordability pressures (Dias et al., 2015; Biagi et al., 2012). Recent studies have begun to trace such transitions via rental conversion and informal occupancy, particularly in deregulated housing settings

(Cocola-Gant & Gago, 2021).

Against this background, the present study focuses on Kyoto—a UNESCO World Heritage City in which traditional urban morphology intersects with recent, rapid tourism expansion (Kim & Nam, 2019; Yamamura & Tsubota, 2020). In light of Japan’s sustained concern with vacancy (Kubo & Mashita, 2020), we ask whether tourism-related forces exert persistent pressure on the stock of rentable vacant housing, regardless of whether units are ultimately oriented toward short- or long-term market rental.

1.4.2 International Evidence and Comparative Perspectives on Tourism Gentrification

Existing research largely follows the chain of “prices → rents → use conversion,” with most studies concentrating on price dynamics and commercial/functional turnover; by contrast, the “rentable vacancy” that corresponds to tourism gentrification remains underexamined, despite its status as a key indicator of stress in the housing system. In particular, Kyoto—given its heritage assets and recent tourism expansion—provides a necessary empirical context for identifying the tension within the “tourism–rental system” nexus.

Rooted in rent gaps and land prices, tourism gentrification transforms neighborhoods by increasing property values and prioritizing tourist consumption. In New York, Smith (2002) emphasizes investment capital targets undervalued housing stock in inner-city areas—using speculative investment to fuel large-scale housing-market transitions. In East Asia, González Martínez (2016) and Kim and Holifield (2024) highlight how national tourism policies intersect with housing systems to promote tourism gentrification. In Málaga, Santos-Izquierdo et al. (2023) describe commercial revitalization through tourist rebranding. These regional cases underscore the need for comparative frameworks to understand tourism gentrification as a multiscale and context-sensitive process (Bobic, 2022).

The impacts of tourism gentrification on local communities extend beyond displacement and include changes in land-use patterns, commercialization of cultural spaces, and the weakening of community cohesion. In Istanbul, Özdemir and Selçuk (2017) observed that tourism gentrification transformed public and private spheres, further escalating the exclusion of vulnerable groups. Such studies highlight how the physical and social effects of tourism gentrification vary across different governance models, market conditions, and tourist economies, requiring a refined theoretical modeling.

Mainstream tourism gentrification research has primarily focused on the effects of short - term rental, such as vacation house rental platforms including Airbnb, along with rent gaps and direct displacement (Paulsen, 2023; Smigiel, 2024; Sakuma & Kato, 2024). However, less attention has been given to the structural transformation of the rental housing-market as a whole—particularly regarding vacancy and the potential conversion of underutilized rental house. This issue is especially significant within Japan’s current social context of rising vacant houses. In the following section, we focus on how tourism gentrification affects sltrs in Japan, with a particular emphasis on the specific dynamics in Kyoto Prefecture.

1.4.3 Rentable Vacant Housing under Tourism Gentrification

At the national scale, the classification and magnitude of vacancy summarized in section 1.2 are divided into four categories. With the Kyoto case in view—and after highlighting the points and contrasts most closely related to it—this subsection focuses specifically on rentable vacant housing among those four categories, so as to capture the direct impact of tourism gentrification on local vacancy.

Housing vacancy is a predominant concern in Japan, especially in urban contexts. According to the Ministry of Internal Affairs and Communications (MIC) (MIC, 2018; 2019), the number of vacant houses increased from

approximately 7.56 million in 2008 to 8.48 million in 2018, with national vacancy rates reaching 13.6%. Vacant houses are officially categorized into four groups, based on the classification by the Ministry of Land, Infrastructure, Transport, and Tourism (MLIT) (MLIT, 2022). These are houses—vacant houses originally intended for rental use, houses for sale, second homes, and other housing—which are typically older or substantially deteriorated. Among these, vacant rental housing accounted for 50.9% of all vacant houses in 2018, making it the largest category of national housing vacancies.

Responding to rising all type of vacant houses ratios, the Japanese government enacted the 2014 Act on Special Measures for Promotion of Countermeasures against vacant houses to encourage the use of underutilized housing. However, in areas with strong tourism demands such as Kyoto, vacancy can still be managed for potential conversion to short-term rental or seasonal use. From 2008 to 2018, Kyoto Prefecture's vacancy rate slightly declined from 13.1% to 12.8%, contrasting with the national increase. Similar patterns occurred in Fukuoka (13.7% to 12.7%) and Chiba (13.1% to 12.6%). Notably, all three prefectures experienced a growth in tourism during this period. Therefore, vacant houses can be managed actively in tourism-intensive areas rather than indicating a structural surplus.

1.4.4 Tourism, Rentable Vacancy, and Housing Cost

The scale and destination of “rentable vacancy” are pivotal for affordability and volatility in tourism cities' rental markets. Accordingly, this subsection first clarifies—based on international and local studies—the literature positioning of the transmission chain linking tourism pressure to land price/rent dynamics and the reallocation of rentable stock, and then identifies the research gap in Japan from this angle.

Tourism investment often redirects SLTR away from stable tenancy and into tourism-serving configurations. In Lisbon, Lopes et al. (2019) documented how vacant houses were reactivated as short-term rental, reducing affordable housing supply. Jover and Díaz-Parra (2020) observed a parallel decline in long-term

rental availability in Seville. Gocer (2021), Wang (2011), and Grodach (2014) confirmed that under tourism gentrification, vacancy is often functional rather than idle and associated with landlord strategies and speculative intentions. Katsinas (2021) found that landlords increasingly opt for short-term rental to maximize revenue, a shift contributing to broad rent gaps and reinforcing displacement pressures.

The SLTR, the total supply of rentable housing is closely intertwined with the structure of local housing costs. Nordvik and Gulbrandsen (2009) identified rental availability as a key determinant of affordability. As land prices and rent costs increase in tourism gentrification contexts, SLTR dynamics shift, expanding or contracting based on profitability and regulation. Larraz and García-Gómez (2020) and Janoschka and Sequera (2016) have demonstrated that such dynamics are directly related to rising investor expectations and policy environments.

Moreover, multiple regional studies have demonstrated how financialization amplifies the impact of tourism gentrification on SLTR. Katsinas (2021) linked short-term rental expansion to investor-driven reinvestment strategies in Greece. Kowalczyk (2023) revealed how global capital inflows fuel speculation and unit conversion in Central and Eastern Europe. Robertson et al. (2020) demonstrated that short-term rental platforms facilitate tenancy disruption in New Orleans. Similar effects have been observed in Iceland (Mixa & Loftsdóttir, 2023), where financial markets mediate tourism–housing links. Kondo and Miyamae (2022) have illustrated how rental market changes facilitate displacement in Japan. Finally, Gravari-Barbas and Guinand (2020) and Liang and Bao (2015) have highlighted how increases in land price distort traditional housing functions under tourism gentrification.

These studies collectively underscore the complex interplay between tourism, financialization, and housing markets. However, they primarily often overlooking the transitional status of housing units that remain vacant yet are functionally embedded in tourism economies. Therefore, this study accounts for whether housing is vacant and how and why that vacancy operates within evolving tourism contexts.

Entry points based on the current literature, Japan’s specific context, and the

transmission chain tourism pressure → rentable vacancy → housing costs.

Grounded in the existing state of research and Japan's distinctive policy-institutional setting, and focusing on the identification of transmission and temporal heterogeneity along the chain. We pose the following questions as entry points:

RQ-K1. At the ward (district) scale, does tourism pressure exert a systematic influence on changes in rentable vacancy?

RQ-K2. Do land prices and rents mediate the relationship between tourism pressure and changes in rentable vacancy, and if so, what are the direction and magnitude of this mediation?

RQ-K3. Across adjacent and overlapping time windows, do the direction and magnitude of these effects differ, and what mechanisms account for such temporal heterogeneity?

1.5 Screening and perspective shift from the prefectural to the municipal scale

Following the metropolitan-scale baseline and the Kyoto tourism context, the observational scale turns to a finer grain for the literature review. To avoid homogenizing the inquiry, the vantage point is deliberately positioned at a non-tourism, off-core transitional scale so as to test the applicability limits of gentrification-oriented explanations and to lay the groundwork for a subsequent, potentially more decisive neighborhood-level investigation.

Saitama Prefecture—specifically the Saitama-Toda corridor—as the transitional scale between the metropolitan baseline and the neighbourhood analysis in Chapter 6. The vantage point deliberately shifts to a smaller observational grain and to a non-tourism, off-metropolitan-core context. The chapter has two aims. First, it tests whether metropolitan/tourism-oriented

gentrification proxies continue to account for vacant housing at this intermediate scale; where they do not, the analysis pivots to neighbourhood conditions that are more directly connected to residents' everyday living environments. This pivot is consistent with Japan-specific trajectories in which occupational restructuring and state-led redevelopment, rather than classic income/class polarisation, have shaped urban change (Lützeler, 2008; Wakabayashi & Koizumi, 2018). Second, it screens for candidate areas that satisfy the small-scale perspective while avoiding confounding influences from tourism and inner-core dynamics—contrasting with tourism-linked neighbourhood change documented elsewhere (Gotham, 2005; Cocola-Gant, 2016).

Substantively, Saitama functions as a selection filter. The screen provides a transparent, data-driven rationale for choosing Toda City—an outlier with a distinctively low vacancy profile under broadly similar conditions—thereby justifying a neighbourhood-based explanation centred on accessibility, road adjacency, and built-environment attributes rather than tourism-led or purely metropolitan mechanisms.

Based on the foregoing theoretical framework and explanatory shift, this section proposes the following research questions.

RQ-S1. Under broadly comparable exposure conditions, using Saitama Prefecture as the screening field, which smaller city-level unit is most suitable as the micro observation site?

RQ-S2. At the city-scale lens within Saitama, do gentrification proxies still account for inter-municipal differences in vacancy? If not, should neighborhood conditions be incorporated into the small-scale inquiry?

1.6 Toda City: Neighborhood Conditions and Vacancy—Literature Grounding and Problem Setting

Because the county-level screening has shifted the research focus explicitly

away from macro/tourism proxies toward cities that do not possess these attributes, doubts about the influence of gentrification at smaller scales call for closer attention to the literature on neighborhood conditions closely tied to local attributes, especially perspectives that are closer to residents' everyday life and environment. In addition, given Saitama Prefecture's own metropolitan positioning, it is first necessary to delineate the research background of vacancy in satellite cities and to consolidate and clean the relevant literature.

1.6.1 Necessity of a Neighborhood Lens within a Satellite-City

Context

Beyond the metropolitan and county trajectories set out in Sections 1.2–1.5, the theoretical points related to the neighborhood scale and the locally grounded evidence merit closer attention.

The growing prevalence of vacant houses, driven by societal challenges such as declining birth rates, aging populations, and surplus housing stock, has become a critical issue for urban development in Japan and other countries (Gu & Asami, 2016; Suzuki & Hino, 2018). These vacant properties generate negative externalities, affecting not only the surrounding environment but also the character of residential neighbourhoods and local land values (Benediktsson, 2014; Sadayuki et al., 2020). In light of contemporary social shifts, the need to redistribute populations and resources between central and satellite cities has gained increasing attention (Westerink et al., 2013; Lee et al., 2015; Mouratidis, 2019). He and Zhang (2023), examining residential mobility in Beijing, China, found that because homes in satellite cities are often larger than those in central areas, residents of satellite cities are more likely to stay in their homes rather than relocate to urban centres. Similar trends have been observed globally, including in France (Segú, 2020), the United States (Myers et al., 2023), and South Korea (Park et al., 2021). Compared to the complex urban dynamics of central cities, the vacant house phenomena is more widespread and easily identifiable in satellite cities (Hino et al., 2022; Nishiyama, 2020). However, most recent research on vacant houses has primarily focused on central cities within global metropolitan areas, such as metropolitan counties in the United States (Zhu et al., 2024); Shenzhen (Liang, 2021), Guiyang (Shi et al., 2022), Chengdu (Zhang et al., 2023),

and Shenyang (Williams et al., 2019) in China, as well as Tokyo (e.g., Sadayuki et al., 2020) and Utsunomiya City (Nishiyama, 2020) in Japan. While some studies (e.g., Baba & Asami, 2017; Baba & Hino, 2019) have addressed the issue of vacant houses in satellite cities, there remains a significant gap in the empirical analysis of vacant house distribution in relation to neighbourhood characteristics.

Based on the foregoing global–Japan evidence, dimensions such as neighborhood living convenience, accessibility, and built form provide greater explanatory power for vacancy in satellite cities; accordingly, the discussion proceeds with everyday living scenarios and supply structure as the organizing threads.

Key factors affecting residential satisfaction include the availability of green spaces, accessibility to public transportation, and proximity to urban public spaces. Overall living convenience is also a critical consideration (Tao et al., 2022; Shen et al., 2021; Chiang et al., 2015; Zhu & Wang, 2023; Kikuchi et al., 2022), and these preferences can vary significantly across age groups (Zhuang & Ye, 2023). Scholars (e.g., Szabó et al., 2014; Ouyang, 2017) have highlighted that residents are less likely to choose less convenient areas for their homes, suggesting that living convenience may play a key role in the occurrence of vacant houses in satellite cities.

1.6.2 Housing supply, policy context, and vacancy

Vacant housing arises from a mismatch between housing supply and demand (Molloy, 2016; Madanipour, 2018), highlighting the important role played by housing supply in the emergence of vacant homes. In Japan's satellite cities, housing supply issues such as residents relocating due to inadequate living space or the inability to find tenants have already been noted, which indicates the considerable impact of housing supply on the occurrence of vacant homes. In satellite cities in Japan, housing supply issues such as residents moving owing to insufficient living space or an inability to find tenants have been observed (Toda City, 2018; 2023). Studies from East Asian countries further indicate that unit floor area is a key factor contributing to the rise in vacant houses, particularly in China

(Yang et al., 2023), Japan (Baba & Hino, 2019), and Taiwan (Chiang et al., 2015). However, the specific floor area most associated with vacancy rates has yet to be clearly identified.

Policy also plays a significant role in the prevalence of vacant houses. For instance, Cho et al. (2020) found that the implementation of urban renewal plans had a considerable impact on residential property values, which may lead to a reduction in vacant homes in surrounding areas. In Mexico, Monkkonen (2019) revealed that federal housing finance policies were linked to higher vacancy rates, a trend observed in both central and satellite cities. Similar policy interventions have been explored in South Korea (Park et al., 2021) and Taiwan (Hsiao, 2022), suggesting that policy support may be a crucial factor influencing vacancy rates in satellite cities.

The above literature collectively points to two primary variable strands of neighborhood conditions—living convenience and housing supply structure—supplemented by environmental variables such as road exposure/road adjacency.

1.6.3 Literature review: methods and cross-national scope

Within the broad global discussions on vacant housing, there are various aspects of interest, including the methods used for identifying vacant properties. In China, Zou and Wang (2020) proposed an algorithm to distinguish between vacant and occupied residential properties using remote sensing image processing and analysis techniques. Similarly, Williams et al. (2019) developed a method based on social media data to identify the distribution of vacant houses in China. These discussions also encompass interpretations of the status of vacant properties, such as those using spatial autocorrelation indicators. For example, Morckel (2014) identified statistically significant clustering of housing vacancies and predictors of abandonment in the U.S. Further, Molloy (2016) provided valuable insights into vacant houses in the U.S. real estate market. In this study, we focused on the occurrence and distribution of vacant housing across different countries to bolster the theoretical framework of our research. Previous comprehensive nationwide analyses have addressed the distribution of vacant houses and strategies for reducing vacancy rates in various countries, including South Korea (e.g., Joo et al., 2022; Jeon & Kim, 2023), Taiwan (e.g., Hsiao, 2022),

Syria (e.g., Wind & Ibrahim, 2020), and France (e.g., Segú, 2020). Our extensive literature review indicates that discussions about the distribution of vacant housing are not uncommon worldwide. The following section focuses on exploring the literature on vacant housing within the Japanese context.

1.6.4 Japan-specific literature and data conventions

According to the Ministry of Land, Infrastructure, Transport and Tourism (MLIT, 2015), the Japanese government defines vacant housing as buildings or related structures that are not used for residential purposes. According to data published by the Statistics Bureau, Ministry of Internal Affairs and Communications (2019), the number of vacant houses in Japan increased from 57.59 million in 2008 to 62.42 million in 2018, with the vacancy rate rising to 13.6%. The Special Measures Act on the Promotion of Vacant House Countermeasures was enacted in 2014 to curb this increasing trend.

Cutting-edge research on the identification of vacant housing in Japan has been advancing towards more predictable and convenient methods. For example, Tomita et al. (2022) employed machine learning techniques for analysis, and Konomi et al. (2019) used Wi-Fi network usage data. This shift towards innovative approaches is a response to the mainstream method for investigating vacant houses in Japan, which primarily relies on information on registered vacant houses and water meter usage data (e.g., Akiyama et al., 2018; Sayuda et al., 2022). This limits the understanding of the relationship between the distribution of vacant houses and neighbourhood characteristics (Ouchi, 2018).

In Japan, the research on vacant houses is concentrated in large cities. The excessive dependence on and concentration of population and wealth in Tokyo city centre have been mitigated by surrounding satellite cities in Chiba, Saitama, and Kanagawa Prefectures (Kidokoro et al., 2023; Gu et al., 2023). Nevertheless, the number and scale of vacant houses are highest in large cities in Japan (Statistics Bureau, 2019), meaning that most studies have focused on cities such as Tokyo (e.g., Gu & Asami, 2016; Sadayuki et al., 2020). This scenario indicates both the significance of vacant housing in Japan and a research gap.

Consequently, previous studies have conducted preliminary assessments of vacant houses in Japan using big data and public data and have identified indicators related to neighbourhood characteristics.

Given the above constraints in Japanese conventions and the concentration of research, observation at the city scale should select a non-tourism—suburban—low-vacancy representative site that is suitable for carrying out a neighborhood-mechanism examination.

1.6.5 Neighborhood characteristics and vacancy

The correlation between neighbourhood characteristics and vacant houses has been rarely studied, although several scholars (e.g., Hackman, 2019; Chen, 2023) have discussed the importance of neighbourhood characteristics for quality of life. Yamada et al. (2016) revealed that residents prioritise the convenience of shopping, public transportation, commuting, scenic street views, and environmental hygiene as essential neighbourhood characteristics. Moreover, using ordinary least squares and logistic regression models, Deng and Ma (2015) demonstrated a correlation between vacant houses and local amenities such as supermarkets, retail stores, bus stations, and parks. Basic infrastructure, public facilities, and parks have also been found to be associated with residents' housing awareness and occupancy rates (Gao & Asami, 2007; Liu et al., 2015; Shi et al., 2023).

As shown in Table 1.1, among the various factors influencing the occurrence of vacant houses, studies have emphasised the importance of building size, road conditions, and facilities within the urban structure, demonstrating their positive or negative relationships with the distribution of vacant houses (Oda et al., 2018; Baba & Asami, 2017; Baba & Hino, 2019; Joo et al., 2022; Williams et al., 2019; Gu et al., 2019; Kim et al., 2016). Based on a systematic literature review, this study identified the factors that are potentially associated with the occurrence of vacant houses, including living convenience and housing supply.

Based on the above literature review, pose the following questions:

RQ-T1. Among neighbourhood features, which variables are most strongly and consistently associated with vacancy rates, and in which directions?

RQ-T2. Do vacant houses in Toda exhibit significant global and local spatial autocorrelation, indicating spatial patterning at the neighbourhood scale?

Table 1.1. Neighbourhood characteristics and vacant house distribution relationship

Author	Study Area	Method	Verified variables
Oda et al. (2018)	Hadano, Japan	Structural equation model	+Distance to educational facilities
Baba and Asami (2017)	Three major metropolitan areas in Japan	Logistic regression model	+Floor area +Adjacent to a road +Grocery stores -Daycare facilities
Baba and Hino (2019)	Kawaguchi, Japan	Multinomial logistic regression	+Adjacent to a road -Floor area
Joo et al. (2022)	South Korea	Logistic regression model	-Contact area (adjacency)
Williams et al. (2019)	China	Cluster analysis	+Distance to school
Gu et al. (2019)	Dayton, U.S.	Regression analysis	-Retail lots (facilities) +Floor area
Kim et al. (2016)	Nagasaki, Japan	Logistic regression	+Distance from educational facilities

*+&-indicate a positive and negative correlation with the distribution of vacant houses, respectively.

1.7 Chapter Summary and Transition

This chapter integrates international debates on gentrification with Japan's distinctive urban development trajectories and organizes the inquiry across three interlinked scales—metropolitan area, prefectural, and city—thereby constructing the dissertation's conceptual framework. First, at the metropolitan scale, it situates Japan's three major regions within a structural explanatory framework that emphasizes state-led redevelopment, adjustments in occupational structure, and market valuation signals, while also identifying the importance of income/class substitute indicators in the Japanese context. Second, at the prefectural scale, a tourism-oriented region is selected; after establishing the necessity of a mediation logic under such a background, the chapter re-examines how tourism pressure reshapes valuation and rental dynamics and may reallocate the stock of rentable units—offering a feasible angle for studying vacancy formation under tourism conditions. Third, in the move from the prefectural to the city scale, Saitama Prefecture is positioned as a non-tourism, heterogeneous screening sample: the first task is to test the selective coverage of gentrification proxies; where they underperform, the analysis should pivot toward neighborhood conditions that are closer to community life and residents' everyday environments. Fourth, at the city scale, neighborhood conditions should focus more closely on the relationships among living convenience, accessibility/road exposure, and built form/size-band composition and the spatial distribution of vacancy in a satellite-city environment. Chapter 1 retraces the full pathway from everyday observations that sparked the research awareness, through a review of the literature and identification of existing gaps, to the final articulation of targeted research questions. It records the study's initial reasoning and synthesis process. Please refer to Figure 1.6 for this workflow.

In sum, the chapter clarifies a core consensus indicated by current international evidence: urban change is better understood as a structural process rather than being explained by a single factor or short-term fluctuations. Within this framework, the subsequent empirical chapters specify their primary research positioning and points of entry, and decompose testable questions by scale: (i) whether, in Japan, the most sensitive macro signals indeed arise more from occupational upgrading and state-organized redevelopment than from the

income/class polarization emphasized by traditional gentrification theory; (ii) whether the tourism pathway, as a branch of gentrification, constitutes a distinct and identifiable transmission mechanism through land-price–rent dynamics and the reallocation of rentable stock; and (iii) whether, in non-tourism municipal and satellite-city contexts at the metropolitan periphery, explanations of vacancy should return to configurations at the level of everyday life and the built environment—such as accessibility, road exposure, service–facility layouts, and the structure of housing supply.

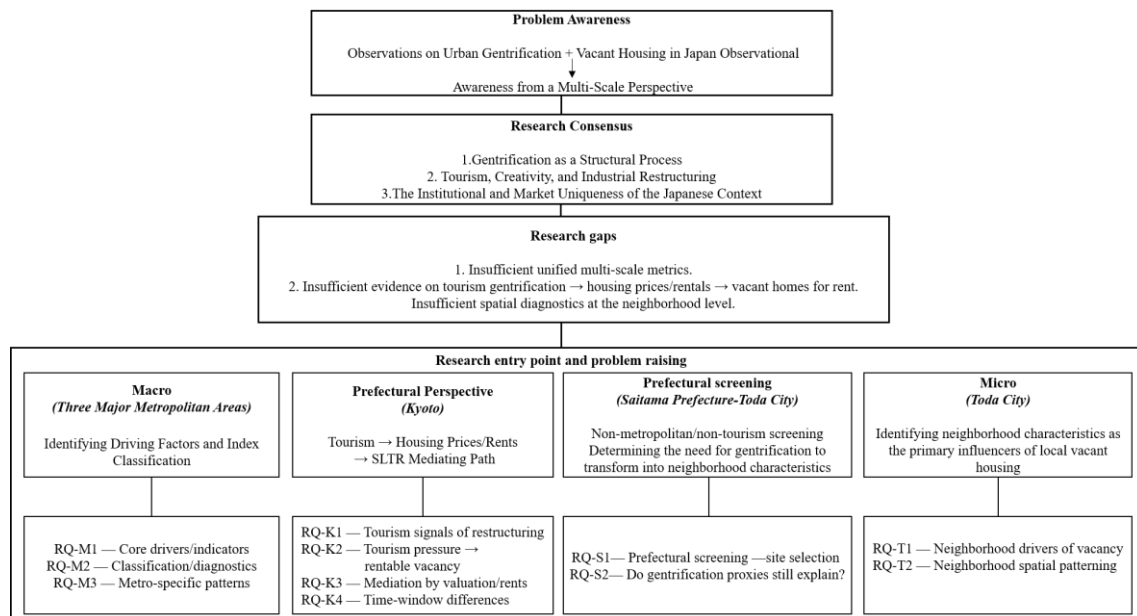


Fig 1.6 Chapter 1 Main process, from research motivation to establishing research goals

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Chapter 2

Methodology

Chapter 2 — Position within the Dissertation

Chapter 2 explains how the study is organized and measured, so that results reported at different scales can be compared fairly. It takes the five themes set out in Chapter 1—occupational upgrading, housing supply and tenure, land-price dynamics, tourism pressure, and neighborhood conditions—and states how each theme is turned into indicators, which observation windows are used, which public data are drawn on, how the data are prepared, and how tables and figures are reported in a uniform way. Writing these choices once, in one place, keeps the later chapters aligned even when they focus on different areas and scales.

This chapter also clarifies where each scale fits in the overall study and what kind of patterns it is designed to reveal. At the metropolitan scale, the shared indicators are used to describe broad differences and establish a national baseline. In tourism regions, the same set is arranged to examine whether tourism pressure is linked to changes in land prices, rents, and the supply of dwellings that are available to rent. At the prefectural scale, the chapter sets out a transparent way to compare municipalities that look similar on the main indicators but differ in vacancy outcomes, so that a suitable city can be chosen for closer study. At the neighborhood scale, the chapter explains how clustering is checked and how the strength and direction of relationships are allowed to vary across places when a single city-wide average would hide meaningful differences.

In short, Chapter 2 fixes the measurement and reporting rules used everywhere else: indicator meanings, time windows, data sources and preparation, and the analysis steps attached to each scale. The later empirical chapters follow these same rules while changing only what must change—study area, period, and the mapping of local variables to the shared indicators.

2.1 Research design and multi-scale logic

The design links the concepts consolidated in Chapter 2—occupational upgrading, housing supply and tenure, land-price dynamics, tourism pressure,

and neighbourhood conditions—to a single, cross-scale measurement scheme. Indicators, observation windows, and data preparation steps are fixed once (as defined in Chapter 2) and then applied consistently at each scale. Estimation is organised so that broad patterns are profiled first and finer spatial mechanisms are examined only where warranted by the structure of the data.

At the metropolitan scale, the shared indicators are used to characterise system-wide variation and to estimate baseline associations among employment structure, housing supply/tenure, valuation signals, and vacancy. This stage establishes the reference against which narrower contexts are read.

In tourism contexts, the same indicators are arranged to test a transmission sequence from tourism pressure to valuation (land prices and rents) and onward to changes in the stock available for rental. The purpose is to evaluate whether the tourism pathway adds explanatory power beyond the metropolitan signals.

At the prefectural scale, comparison focuses on units that are similar on the shared indicators but differ in vacancy outcomes. A most-similar-systems design combined with k-nearest neighbours isolates such contrasts, allowing subsequent analysis to concentrate on places where macro proxies travel unevenly.

At the neighbourhood scale, analysis begins by assessing spatial association in vacancy (global and local measures). Where the pattern is spatially uneven, city-wide models are complemented with location-varying specifications to recover heterogeneity in the links between vacancy and everyday environmental conditions (access to services, road exposure) and built-form attributes (including size-band composition).

The sequence thus proceeds from broad characterisation to targeted comparison and, where indicated by spatial structure, to localised estimation—without altering the indicators or measurement choices established in Chapter 2.

2.2 Indicators and measurement strategy

To keep results comparable across scales, all indicators are used consistently after they are defined here. At the metropolitan and prefectural scales, the core set comprises HH, HRB, HO, TIE, WCEP, LP, and vacant housing. In tourism-focused analyses, the rental-vacancy outcome is SLTR. At the neighborhood scale, the emphasis is on road adjacency, accessibility, service density, and built-form attributes. Each indicator is expressed as a level, share, or rate of change within a declared time window; log-ratio forms are used where they improve stability.

Time windows are aligned to the closest matching releases of national statistics. Conventions for computing change rates are kept the same across indicators. Z-score standardization is applied whenever cross-variable distances or clustering are calculated. Each indicator family carries a source tag: national statistics for population, tenure, employment, and vacancy; open geospatial repositories for LP; national 3D/built-environment datasets for HRB and neighborhood attributes; and official tourism portals/administrative statistics for TIE/SLTR.

2.3 Data sources, governance, and preprocessing

All indicators come from official national statistics and open governmental geodata, with prefectural or municipal repositories added only where necessary. Measures of population, housing, tenure, employment, and vacancy are taken from the Statistics Bureau's Housing and Land Survey and related releases (Ministry of Internal Affairs and Communications, 2018; 2019). Built-environment features—building heights and footprints, public facilities, and road centre-lines—are drawn from national 3D spatial datasets. LP attributes are sourced from open geospatial repositories. Tourism-related measures used to construct TIE and the rental-vacancy outcome SLTR rely on official portals and administrative statistics. Exact variable mappings (e.g., which facility layers or subperiods) are reported in the relevant empirical chapters; the measurement rules themselves follow the definitions fixed here.

Preprocessing follows one shared set of steps. Boundary alignment anchors all analyses to a single reference vintage; units created after the base year are excluded to keep like-for-like comparisons. Missing data are handled by listwise deletion at the estimation stage; targeted imputations are avoided to keep the transformation path simple and transparent. An outlier screen flags extreme change ratios traceable to boundary changes or coding errors; flagged cases are excluded from estimation, and their counts are reported. All spatial layers use a common projection and shared cartographic specifications; temporal alignment matches each statistical release to the nearest feasible observation window.

2.4 Research method selection and calculation for each scale

2.4.1 Correlations & OLS (metropolitan/prefectural scale)

We first profile co-movements among indicators with Pearson correlations, then estimate linear models with robust inference. Let (x) and (y) be standardised series of any two indicators (e.g., WCEP, LP, HRB, HO, HH, TIE, vacant housing, SLTR). The sample correlation is

$$\text{Eq. 2.1: } r_{xy} = \frac{\sum_{i=1}^n (x_i - \bar{x})(y_i - \bar{y})}{\sqrt{\sum_{i=1}^n (x_i - \bar{x})^2} \sqrt{\sum_{i=1}^n (y_i - \bar{y})^2}}$$

Two-tailed p-values are reported with a common significance convention. For regressions, the generic specification is

$$\text{Eq. 2.2: } y = X\beta + \varepsilon$$

Estimated by OLS with heteroskedasticity-robust standard errors and the standard reporting set (R , R^2 , adj- R^2 , F -test, n). Multicollinearity is screened by the variance inflation factor,

$$\text{Eq.2.3: } \text{VIF}_K = \frac{1}{1-R_K^2}$$

With thresholds and remedial steps fixed globally (drop or combine highly collinear covariates). Model diagnostics include residual normality checks, leverage/influence scans, and evaluation of functional form; outlier handling follows section 3.3. Results are interpreted in terms of direction and magnitude (no causal claims). (Method touchstones: Weeks, 2002.)

This shell underpins metropolitan/prefectural analyses in later chapters; those chapters report only differential settings (outcomes/covariates chosen from the common bundle) and their results, citing Eqs. (2.1)–(2.3).

2.4.2 Mediation framework (tourism → land price/rent → SLTR)

Where a transmission mechanism is theorised, we implement a standard linear mediation with bootstrap inference. Let (X) denote tourism pressure, (M) the market mediator (e.g., land prices or rents), and (Y) the rental-vacancy outcome (SLTR). The steps are:

Total effect (path c)

$$\text{Eq. 2.4: } Y = \gamma_0 + cX + C\theta +$$

Mediator equation (path a)

$$\text{Eq. 2.5: } M = A_0 + \alpha'X + C\pi + u$$

Outcome with mediator (paths b and c')

$$\text{Eq. 2.6: } Y = \Delta_0 + c'X + bM + C\kappa + V$$

Indirect effect and inference

$$\text{Eq. 2.7: } \textit{Indirect} = a \times b,$$

CIboot: percentile or bias – corrected over B resamples.

Temporal ordering follows data publication cycles; identification relies on

model specification, directionality by design, and robustness checks (temporal splits, collinearity diagnostics). (Method touchstones: Baron & Kenny, 1986; Pearman & Steyer, 2023; van den Bogerd et al., 2021.)

Later mediation analyses reuse Eqs. (2.4)–(2.7) and the same bootstrap CI protocol; only variable mappings and windows differ and are reported locally.

2.4.3 Comparative screening: MSSD and k-nearest neighbours

When shared proxies do not explain outcome variation adequately, we apply a most-similar-systems design (MSSD) with k-NN matching to screen units that diverge under similar structural exposure. Standardise the six structural indicators

HH, HRB, HO, TIE, WCEP, LP

By z-scores and compute Euclidean distances.

Standardisation

$$\text{Eq. 2.8: } z_{jk} = \frac{x_{jk} - \mu_k}{\sigma_k}$$

Distance and neighbour set

$$\text{Eq. 2.9: } d(j, m) = \sqrt{\sum_{k=1}^6 (z_{jk} - z_{mk})^2} \quad ; \quad \mathcal{N}_k(j) = k \text{ indices with smallest}$$

Deviation statistic (screening outcome)

$$\text{Eq. 2.10: } \Delta \text{Outcome}(j) = Y_j - \frac{1}{k} \sum_{m \in \mathcal{N}_k(j)} Y_m$$

The main setting is ($k = 5$) with sensitivity at ($k = 3, 4$). This module does not claim causality; it provides a transparent, model-agnostic way to identify outliers for closer study. (Method touchstones: Seawright & Gerring, 2008; Labovitz, 1971; Hastie, Friedman & Tibshirani, 2001.)

Later screening reuses Eqs. (2.8)–(2.10) verbatim; only the chosen outcome (Y) (e.g., vacant housing) and reporting of (k) sensitivity are chapter-specific.

2.4.4 Spatial diagnostics & locally varying models (neighbourhood scale)

Where residual spatial dependence is plausible, we diagnose clustering and consider locally varying coefficients. Global spatial autocorrelation (Moran's I)

$$\text{Eq. 2.11: } I = \frac{n}{S_0} \cdot \frac{\sum_i \sum_j w_{ij} z_i z_j}{\sum_i z_i^2} \quad ; \quad S_0 = \sum_i \sum_j w_{ij}$$

With z_i A standardised variable and w_{ij} Spatial weights. Significance is assessed by permutation. (Moran, 1950.) Local clustering (LISA)

$$\text{Eq. 2.12: } I_i = \frac{z_i}{m_2} \sum_j w_{ij} z_j \quad ; \quad m_2 = \frac{1}{n} \sum_i z_i^2$$

Yielding cluster/outlier maps with multiple-testing control via permutation pseudo-p values. (Anselin, 1995.)

Locally varying regression (MGWR/GWR)

$$\text{Eq. 2.13: } y_i = \beta_0(u_i, v_i) + \sum_k \beta_k(u_i, v_i) x_{ik} + \varepsilon_i$$

Where coefficients vary over space with kernel-weighted estimation; bandwidths are selected by an information criterion. We report local coefficients, significance surfaces (with appropriate multiple-comparison caution), and compare fit against global OLS. (Applied references within the project: Yin et al., 2022; Lu et al., 2023.)

Later neighbourhood analyses invoke Eqs. (2.11)–(2.13) directly, adopting the common spatial weights, projection, bandwidth selection rule, and reporting template defined in this chapter; only variable lists and unit definitions are local.

2.5 Validity, robustness, and limitations

Each mechanism from Chapter 2 is matched to a specific indicator family:

WCEP for occupational upgrading; HRB/HO/HH for housing development and tenure; LP for market valuation; TIE and SLTR for tourism-linked rental supply; and neighborhood attributes (road adjacency, accessibility, service density, built form) for local conditions. Measurements follow the same rules at every scale. When a combined view is needed, variables are standardized in the same way (z-scores), so differences in results reflect real contrasts rather than shifting metrics.

Correlations and OLS follow Eqs. (2.1)–(2.3) with robust errors, screening for multicollinearity (VIF), residual checks, and an explicit outlier policy. The mediation setting (Eqs. (2.4)–(2.7)) respects time order and reports bootstrap confidence intervals, with collinearity checks and period splits to avoid spurious indirect paths (Baron & Kenny, 1986; Pearman & Steyer, 2023; van den Bogerd et al., 2021). The MSSD + knn comparison (Eqs. (2.8)–(2.10)) is descriptive rather than causal: it holds shared structural exposure constant and highlights units with different vacancy outcomes for follow-up analysis (Seawright & Gerring, 2008; Labovitz, 1971). Spatial association is examined with Moran’s I and LISA (Eqs. (2.11)–(2.12)). Only when clustering remains in the residuals do we estimate locally varying models (Eq. (2.13)); spatial coefficients are read as evidence of heterogeneity, not as strong causal claims.

And, because indicators, time windows, and preparation rules are the same across scales, results show clearly where macro and tourism proxies and where they do not. Findings are bounded by the sampling frame—units, periods, and sources—documented in Section 2.3 and are not extended beyond those contexts.

For robustness.

Indicator sensitivity: alternative normalizations; level vs. Change-rate forms; log-ratio variants.

Screening sensitivity: vary k in knn (main $k = 5$; sensitivity $k = 3, 4$) and, where informative, compare Euclidean with alternative distance metrics (details in appendices).

Spatial sensitivity: vary neighborhood definitions, accessibility thresholds, and spatial weights/bandwidths; control multiple testing for local statistics via permutation.

Time-window checks: align to adjacent statistical releases where feasible.

Any departure from the global rules is reported explicitly as a differential setting in the relevant empirical chapter—never as a silent change. Full matrices, screening lists, diagnostics, bandwidth/weight details, and sensitivity outputs are directed to the appendices, keeping the main text focused while preserving transparency.

2.6 Chapter summary

Chapter 3 sets a single, consistent way to measure and analyse the study across scales. It fixes the indicator families, the observation windows and spatial units, the data-preparation steps (alignment of boundaries and years, standardisation, treatment of missing values and outliers), and a uniform reporting style for tables, figures, and references.

Analytically, this chapter specifies four components, each with its corresponding equations:

Correlations and OLS (Eqs. (2.1)–(2.3));

Mediation linking tourism pressure, valuation (land prices/rents), and rental stock outcomes (Eqs. (2.4)–(2.7));

Most-similar-systems screening with k-nearest neighbours to compare structurally comparable units with different vacancy outcomes (Eqs. (2.8)–(2.10));

Spatial association diagnostics (Moran's I and LISA) and, where indicated, locally varying regression (Eqs. (2.11)–(2.13)).

Subsequent empirical chapters draw on these definitions and equations without redefining them; they report only study-specific settings (e.g., area, period, variable mapping) and their findings, while all measurement choices and analytical details remain as stated here.

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Chapter 3

Three Major Metropolitan Areas and gentrification

Chapter 3 — Position within the Dissertation

This chapter constitutes the first empirical analysis of the dissertation and provides the metropolitan-level foundation for the subsequent case studies. While the overall thesis investigates the interaction between gentrification and vacant housing across multiple urban contexts, the metropolitan scale offers a necessary theoretical and empirical baseline. By examining Japan's three major metropolitan areas—Tokyo, Nagoya, and Kansai—between 2005 and 2020, the chapter establishes the structural drivers of gentrification and develops a framework that will support the interpretation of later findings.

In this design, the three metropolitan areas function as the national reference point: they highlight the distinctive features of Japanese gentrification and test the applicability of international explanatory models. The findings here clarify how occupational change, land values, and housing supply interact at the macro scale, and they provide the analytical context for understanding divergent mechanisms in the following chapters. Kyoto Prefecture, analysed in Chapter 4, represents a tourism-driven case where gentrification reshapes rental housing markets, while Saitama Prefecture and Toda City, addressed in Chapters 5 and 6, illustrate neighbourhood-level dynamics where vacant housing and local conditions play a central role. Taken together, these multi-scalar investigations contribute to a comprehensive understanding of the gentrification–vacant housing nexus in Japan.

3.1 Introduction — Three Major Metropolitan Areas (2005–2020)

Gentrification has been discussed worldwide since the 1960s, initially emerging as a descriptive term for middle-class influx into working-class neighbourhoods (Glass, 1964). Subsequent research conceptualised it as a global process of urban restructuring, emphasising its profound social, economic, and cultural implications (Ergun, 2004; Shaw, 2008; Torrens & Nara, 2007). While early scholarship highlighted class-based displacement and socio-economic

upgrading (Atkinson, 2000; Freeman & Braconi, 2004), more recent work has extended the discussion towards capital flows, redevelopment, and the financialisation of housing markets (Davidson & Lees, 2005; R  rat et al., 2010; Visser & Kotze, 2008). This broadening of focus has introduced the notion of “new-build gentrification,” driven by large-scale development, rising land values, and often state involvement (Davidson, 2007; He, 2010; L  pez-Morales et al., 2023; Shmaryahu-Yeshurun & Ben-Porat, 2021). Evidence from diverse contexts—including North America, Europe, and the Global South—illustrates that gentrification is best understood as a structurally embedded process, one that takes varied forms depending on regional economic structures and institutional settings (Chava et al., 2018; Robertson et al., 2022; Valente et al., 2023).

Infrastructure investment has also been identified as a critical driver of contemporary gentrification, shaping land values, neighbourhood composition, and displacement patterns (Doucet, 2021; Lin & Chung, 2017). In East Asian cities such as Tokyo and Taipei, infrastructure-led redevelopment has facilitated capital inflows, intensified land prices, and marginalised existing populations (Lin et al., 2022; Wang et al., 2022). Industrial restructuring further influences urban change, with tourism, cultural, and creative industries frequently linked to neighbourhood transformation (Gonz  lez-P  rez et al., 2020; Harris, 2012; Yoon & Currid-Halkett, 2015; Kidokoro et al., 2022; Sho et al., 2023; Arkaraprasertkul, 2019; Zhang et al., 2022).

Within Japan, pathways diverge from many Western cases. Demographic ageing, state-led redevelopment, and occupational restructuring—rather than income polarisation alone—feature prominently, often through large-scale high-rise projects and waterfront redevelopment (L  tzeler, 2008; Machimura, 2021; Mori, 2017). Prior studies emphasise that occupational structure can be more diagnostic of spatial change than income, particularly in the Tokyo Metropolitan Area (Fujita & Hill, 2012; Tatsuto, 2016; Wakabayashi & Koizumi, 2018; Koizumi & Wakabayashi, 2019; Fielding, 2004).

Against this background, this chapter examines Japan’s three major metropolitan areas—Tokyo, Nagoya, and Kansai—between 2005 and 2020 as a national macro baseline. It evaluates how occupational change, land prices, and housing development/tenure interact at the metropolitan scale, establishing structural patterns that subsequent chapters interpret under tourism mediation (Kyoto) and neighbourhood mechanisms (Saitama/Toda). Methods, indicators, and reporting follow the unified protocol specified in Chapter 3.

3.2 Literature Review and Analytical Positioning

Global research has moved from early descriptive accounts of middle-class in-migration and displacement to structurally oriented explanations linking gentrification to capital flows, state intervention, and redevelopment logics (Glass, 1964; Atkinson, 2000; Freeman & Braconi, 2004; Hackworth & Smith, 2001; Davidson & Lees, 2005; Davidson, 2007; Rérat et al., 2010; Visser & Kotze, 2008; Lees, Shin, & Lopez-Morales, 2016). Infrastructure investment has been repeatedly identified as a catalyst for neighbourhood restructuring and land-value escalation, including transit-induced dynamics observed in Taipei and Tokyo as well as Canadian and European cases (Lin & Chung, 2017; Lin, Yai, & Chen, 2022; Wang et al., 2022; Doucet, 2021). Alongside production-side drivers, consumption- and culture-led change—creative industries, symbolic economies, and tourism-adjacent redevelopment—has shaped inner-city transformation across multiple regions (Harris, 2012; Yoon & Currid-Halkett, 2015; Kidokoro, Fukuda, & Sho, 2022; Sho, Chen, & Oshima, 2023; Arkaraprasertkul, 2019; González-Pérez, Vives-Miró, & Rullan, 2020; Robertson, Oliver, & Nost, 2022; Valente, Bornioli, Vermeulen, & Russo, 2023; Zhang, Lu, Huang, & Zhang, 2022). The takeaway for this chapter is that metropolitan restructuring reflects intertwined production and consumption mechanisms rather than a single pathway.

Quantitative advances have refined how metropolitan gentrification is detected and compared across cities. Studies have operationalised change through composite indices, machine-learning classifications, and longitudinal designs, demonstrating the value of integrated socioeconomic indicators for tracking urban restructuring (Torrens & Nara, 2007; Liu, Deng, Song, Wu, & Gong, 2019; Reades, De Souza, & Hubbard, 2019; Preis, Janakiraman, Bob, & Steil, 2021; Hawkins, Ahmed, Roorda, & Habib, 2022; Thackway, Ng, Lee, & Pettit, 2023). Yet findings diverge on sequencing and primacy of drivers: some emphasise demand-led neighbourhood change where “consumption leads production,” while others stress class mobility or structural real-estate cycles (Hochstenbach & van Gent, 2015; Zapatka & Beck, 2021; Shmaryahu-Yeshurun & Ben-Porat, 2021; Walks, Hawes, & Simone, 2021). Evidence also differs on the role

of condominium development—ranging from arguments that it restructures metropolitan housing fields to claims that condos do not necessarily induce gentrification (Rosen & Walks, 2013; Boustan, Margo, Miller, Reeves, & Steil, 2023). These divergences justify a comparative metropolitan baseline that evaluates multiple indicator families in parallel rather than privileging a single mechanism.

In Japan, the literature highlights distinctive pathways. Rather than income polarisation alone, demographic ageing, state-led redevelopment, and occupational restructuring figure prominently, including high-rise and waterfront projects that recompose central-area demographics (Lützel, 2008; Mori, 2017; Machimura, 2021). Importantly, several studies argue that occupational structure is a more sensitive signal of spatial change than income—particularly in the Tokyo Metropolitan Area—suggesting that growth in professional/clerical employment better captures urban restructuring than distributional income shifts (Fujita & Hill, 2012; Tatsuto, 2016; Wakabayashi & Koizumi, 2018; Koizumi & Wakabayashi, 2019; Fielding, 2004). This Japan-specific emphasis motivates the inclusion of WCEP among the metropolitan indicators used in this chapter.

Bringing these strands together, the metropolitan literature supports an integrated indicator approach that couples: (i) occupational upgrading signals (e.g., WCEP); (ii) housing development/tenure markers that speak to supply and repositioning (HH, HRB, HO); and (iii) market valuation signals that register price pressure and capitalised expectations (LP). Prior work also cautions that single-city neighbourhood studies may miss region-wide dynamics and that cross-metropolitan comparisons can reveal selective reach of proxies (Hochstenbach & van Gent, 2015; Hawkins et al., 2022; Walks et al., 2021; Reades et al., 2019). Accordingly, this chapter treats Japan's three major metropolitan areas as a national baseline to assess how these indicator families covary and whether global proxies travel under Japanese institutional and demographic conditions.

Finally, because infrastructure and redevelopment have repeatedly mediated metropolitan restructuring in East Asia and beyond (Lin & Chung, 2017; Lin et al., 2022; Wang et al., 2022; Doucet, 2021), the analysis interprets LP

alongside development/tenure indicators to separate demand-pull from supply-repositioning patterns. The chapter proceeds under the dissertation's unified protocol for indicators, estimation, and reporting; all operational definitions and model shells are given once in Chapter 3 and are invoked here without repetition.

Informed by Japan's unique urban restructuring processes—marked by occupational shifts and spatial disparities—this study refrains from redefining gentrification. Instead, it advances a multi-dimensional approach grounded in social, spatial, and employment-based indicators, operationalised through spatial classification to clarify patterns across metropolitan Japan. Building on this literature, the study addresses the following research questions:

RQ1. What are the key indicators associated with gentrification-like processes in Japanese metropolitan areas?

RQ2. How can a coordinate axis classification method be used to identify spatial differences in gentrification-related transformation across multiple urban scales in Japan?

RQ3. What are the observed spatial patterns of gentrification-related indicators in Tokyo, Nagoya and Kansai metropolitan areas, and how do they differ between urban cores and surrounding areas?

3.3 Research framework

3.3.1 Research areas

To determine the driving factor of nationwide gentrification, we studied three metropolitan areas: Tokyo Metropolitan Area, Nagoya Metropolitan Area and Kansai Metropolitan Area. As noted in a previous study (Dantsuji et al., 2023), these are the three largest metropolitan areas in Japan (Figure 3.1). They represent Japan's core in terms of economy, culture and politics. Towns and villages were excluded due to their lower population density and less urbanised nature. Additionally, gentrification is more prominent in large cities, which are more

susceptible to economic, cultural and social changes (Kırmızı, 2023).

Additionally, unlike some conventional definitions of Japan's three major metropolitan areas, this study defines each metropolitan area by centring on Tokyo, Nagoya and Osaka—cities with high population concentration where gentrification is likely to be more pronounced—and includes their surrounding areas to construct the metropolitan zones for analysis. Our research delved into the typical manifestations of gentrification and captured its significant changes by dividing each metropolitan area into an urban centre and a suburb.

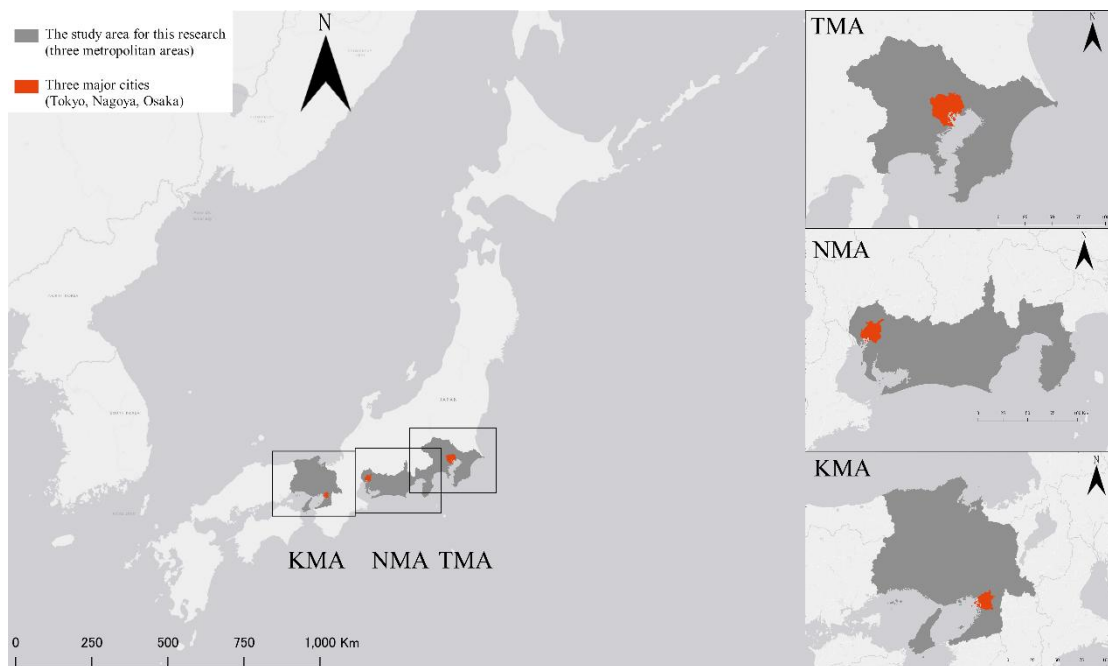


Figure 3.1 The three metropolitan areas, including three major cities

3.3.2 Selection of gentrification driving factors in Japan

Gentrification research has been undertaken using census data to identify socioeconomic indicators, such as changes in demographics, income, occupation, high-rise buildings and housing prices (Ilic et al., 2019; Kidokoro et al., 2022; Torrens & Nara, 2007; Zapatka & Beck, 2021). This study selected each indicator comprehensively based on literature review and the current state of data availability in Japan, forming the foundation of the research framework. The data selection trend was classified into (i) increase in high-rise buildings, (ii) increase in white-collar workers and tertiary industry and (iii) increase in land prices.

3.3.3 Increase in high-rise buildings (HRB)

Gentrification has been connected with the increasing number of HRB. North American studies have linked gentrification to downtown revitalisation. Traditionally, suburbs housed the middle class; however, since the 1980s, gentrification has transformed downtown areas (Baum-Snow & Hartley, 2020; Rosen & Walks, 2013). Condominium development, attractive for high-income households due to tax benefits, contributes to gentrification (Boustan et al., 2023).

The housing market's financialisation, linked to HRB, contributes to gentrification as high-income residents displace the impoverished (August & Walks, 2018). This is often associated with high-rise condominiums. Studies from Korea (Ha, 2004; Kim et al., 2022) examined Seoul's profit-driven development plan that replaced informal housing with high-rises, displacing locals and devastating low-income communities. Studies from India (Chava et al., 2018), China (Zhan, 2021) and the US (Boustan et al., 2023) provide similar evidence.

3.3.4 Increase in white-collar workers (WCEP) and tertiary industry employment (TIE)

As gentrification is characterised by an influx of high-income individuals and the displacement of original inhabitants (Youngbloom et al., 2023), it is always accompanied by the expansion of white-collar employment, which causes significant gentrification in neighbourhoods (Scott, 2019). The influx of TIE and WCW as residents is a basic process of gentrification (Shaw, 2008).

Studies from the UK (Cameron, 1992), the US (Meltzer & Ghorbani, 2017), Canada (Ley, 1986), Australia (Rofe, 2000) and China (Zhang et al., 2022) support this argument. Hence, WCW and TIE are catalysts for gentrification, accelerating industrial and socioeconomic transformation.

3.3.5 Increase in land prices (LP)

LP is an important indicator of gentrification. Gentrification often involves changes in land or housing ownership (Chava et al., 2018; Meltzer & Ghorbani, 2017); as high-income people flood in, low-income natives are forced to leave (Fong et al., 2019; Youngbloom et al., 2023). Changes in land ownership may be undertaken through government-led urban redevelopment (Ha, 2004; Lim et al., 2013; Zhan, 2021), changes in the local social structure and job market (Gentili & Hoekstra, 2021; Meltzer & Ghorbani, 2017; Schusler et al., 2023) and rent increase (August & Walks, 2018; Park et al., 2023; Valente et al., 2023). The impact of gentrification on the local community is reflected in changes in LP. Guerrieri et al. (2013) described LP increases as the endogenous factor leading to community gentrification and displacement of low-income people.

Thus, land or housing prices are widely used to measure gentrification, with global evidence from Toronto and Vancouver (Ley et al., 2002) and Minneapolis (Lee & Newman, 2021). Furthermore, land or housing prices have been applied for the verification of gentrification through various factors, including urban parks or green spaces (Wu & Rowe, 2022), vacant properties (Lee & Newman, 2021), cultural infrastructure and activities (Džupka & Gróf, 2021) and local dynamics, including household income, educational attainment and building permits (Hawkins et al., 2022).

Previous studies have proven the importance of LP for the evaluation of gentrification (Dawkins & Moeckel, 2016; Grube-Cavers & Patterson, 2015; Rosenthal & Helsley, 1994; Shin, 2009). López-Morales et al. (2023) indicated that the significance of LP overshadows other factors in demand-driven and other forms of middle-class gentrification. Moreover, the impact of LP fluctuations on other variables has been indicated in several studies (Brown-Saracino, 2017; Ding et al., 2016; Kreager et al., 2011).

3.3.6 Research design and analysis method

The research methodology consists of two parts: a comparative analysis

using regression models and the innovative coordinate axis method. For the regression model analysis, we developed five models, focusing on three major metropolitan areas and the three central cities: a nationwide model encompassing the three major metropolitan areas, Tokyo, Nagoya and Kansai Metropolitan Area models, and a central-city model.

Based on the literature review, where gentrification-related factors, such as an increase in HRB, WCW, TIE and LP have been prominently evidenced worldwide, we used these factors as dependent variables in the regression model. This clarifies the intricate, interrelated dynamics of the gentrification factors within Japan's metropolitan areas. By assessing the fit of the regression models for each representative gentrification factor, we draw comparisons and conclusions about their respective roles and influence across different areas.

The data analysis primarily utilised correlation analyses of various factors and multiple regression analysis. The objective was to discern the explanatory power and significance of independent variables across each metropolitan area and the three major cities to understand the patterns of gentrification in these areas. As shown in Figure 3.2, the change rate of the proportion of HRB (above six floors), increase in WCW, TIE ratio and household ownership ratio from 2005 to 2020 were considered as dependent variables. Household (HH) and homeownership (HO), as supplementary factors, can reveal gentrification based on local displacement and population shifts. They provide a more comprehensive understanding through the regression model and offer deeper insights into how gentrification dynamics influence the stability and movement of the local population.

Using individual wards and cities as the basic administrative units, we classified gentrification in the three metropolitan areas based on the key factors identified in existing literature, including the white-collar rate (high-income population), key indicators of displacement, high-rise rates and population. To address concerns regarding the spatial scale sensitivity of gentrification analysis, this study adopts a two-tiered design. In addition to the macro-scale examination of the three major metropolitan areas, six small-scale wards were selected based on projected population change by 2050 (National Institute of Population and Social Security, 2024), including three areas of expected growth and three of

anticipated decline. The smallest ward in the growth group, Yaesu 2-chome in Tokyo, had a population of only 27 in 2020, while the largest, Tsukuda 2-chome, had 10,374. Among areas projected to face population decline, the population ranges from 19 in Izu-san, Atami City (Region Code 222050470), to 5,423 in Kamoi 2-chome, Yokosuka City. This approach enables a robust validation of the INDEX quadrant method by testing its applicability across varied spatial resolutions, from highly localized neighbourhoods to broader metropolitan zones.

By utilising coordinate axis classification and Geographic Information System (GIS) methods, we gain a deeper understanding of the specificity and geographical distribution of gentrification in each area. Figure 2 illustrates the research process.

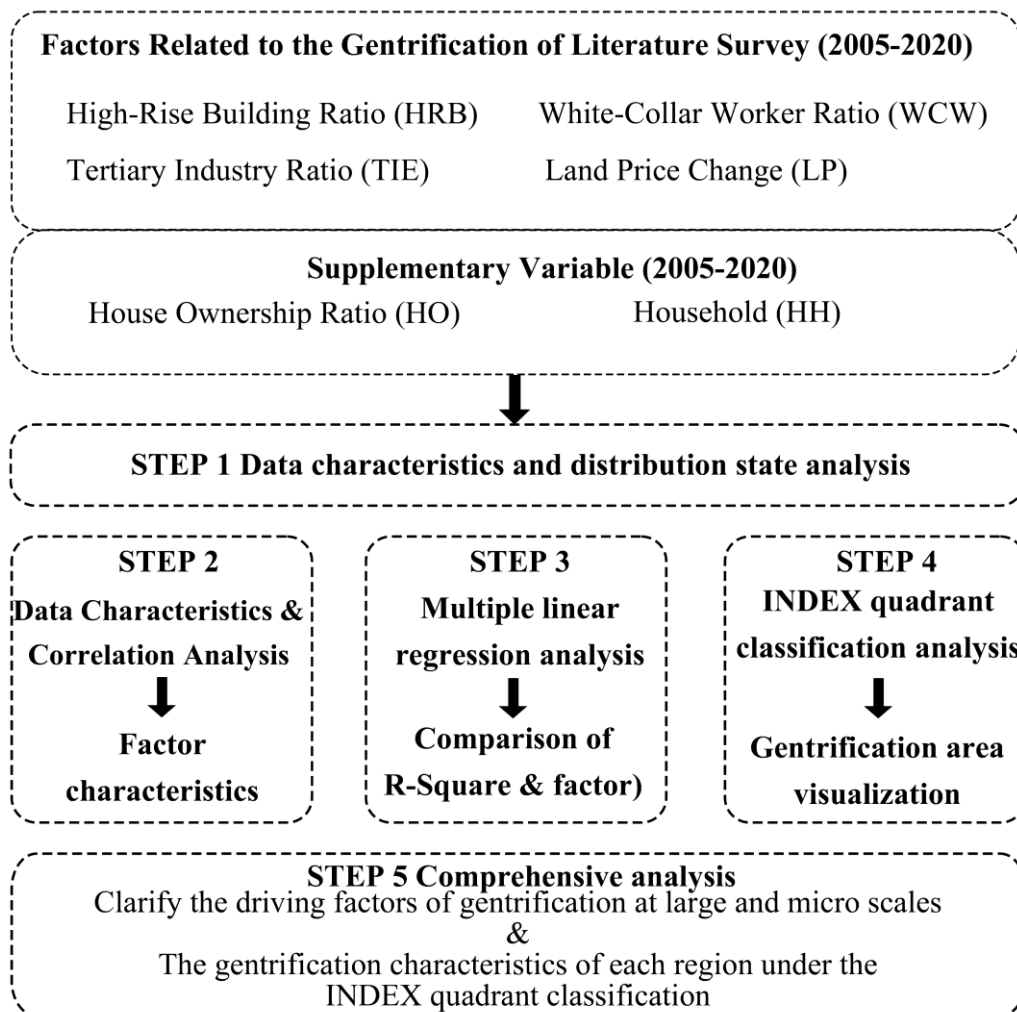


Figure 3.2. Chapter 3 Research framework

3.3.7 Data collection and definition of gentrification indicators

The data used in this study were obtained from the e-Stat Statistical GIS of Japan, a publicly accessible database provided by the Japanese government. The basic administrative wards are cities and wards. We specifically selected data from the Population Census, using statistical dataset code 00200521 for the years 2005 and 2020, which includes small-area wards. The dataset comprises five key types of variables: total population and number of households by gender, number of general households by housing ownership, number of households by housing type, number of employed persons by industry (major category) and employment status and number of employed persons by occupation (major category).

The population scale of these wards ranges from 168 thousand (Aogashima Village) to 364.7 thousand (Yokohama City) across Japan. For our analysis, we focused on wards and cities within metropolitan areas, where population sizes range from 1.5 thousand (Katsuura City) to 364.7 thousand. Data for the six selected small-area wards were also sourced from the same database. Given the discrepancies in the 2000 survey findings and the current administrative regions, this study focused on data from 2005 to 2020. We extracted data on household numbers, HRB, homeownership rates (HO), TIE employment, WCW and lps from the aforementioned database. To understand the dynamics of HRB and WCW, we examined the population trends. The change rate in the number of households (HH) was considered from 2005 to 2020. Acknowledging the importance of white-collar job proportions as an indicator of gentrification, we selected the change rates in the proportion of TIE and WCW from 2005 to 2020.

We explored the impact of housing development and supply on gentrification by analysing indicators, such as HRB and number of homeowner houses (HO), utilising open LP data. The change rate in the proportion of HRB and HO was considered from 2005 to 2020. For the LP data, we employed data from the land numerical information published by the Japanese government, which has spatially attributed GIS data in the Geographic Markup Language format [<https://nlftp.mlit.go.jp/ksj/>].

As the data for all six factors were based on changes observed from 2005 to

2020, this study employed a formula for calculating the relative change rates for all the factors (Eqs. (4.1) to (4.6)).

$$\text{Eq3.1 : HH} = \frac{\text{Number of households (2020)}}{\text{Number of households (2005)}}$$

$$\text{Eq3.2 :HRB} = \frac{\text{Number of high-rise buildings / Number of homeowner households (2020)}}{\text{Number of high-rise buildings / Number of homeowner households (2005)}}$$

$$\text{Eq3.3 :HO} = \frac{\text{Number of homeowner households / Number of households (2020)}}{\text{Number of homeowner households / Number of households (2005)}}$$

$$\text{Eq3.4 :WCW} = \frac{\text{Number of managers,professionals and technical employment / Total employment (2020)}}{\text{Number of managers,professionals and technical employment / Total employment (2005)}}$$

$$\text{Eq3.5 :TIE} = \frac{\text{Number of employees in the tertiary sector / Total employment (2020)}}{\text{Number of employees in the tertiary sector / Total employment (2005)}}$$

$$\text{Eq3.6 :LP} = \frac{\text{Log (average official land price in each ward) (2020)}}{\text{Log (average official land price in each ward) (2005)}}$$

The calculation of the independent and dependent variables involved rates of change for HH, HRB, TIE, HO, WCW and LP. Outliers were identified in some regional data points. To ensure clear analysis results in subsequent data analysis, data from all cities or wards within the three metropolitan areas were reviewed, and outliers were excluded.

The data were organised based on the following logic— we focused on long-term changing trends and spatial differences rather than an accurate mapping of the current administrative divisions. Therefore, when discrepancies in administrative boundaries between 2005 and 2020 were observed, the 2005 boundaries were used as the standard. Cities or wards that were newly established by 2020 were excluded from the analysis.

Further, changes in factor proportions, indicating potential atypical or outlier data, were excluded from the sample. Wards with a change rate below 0.5, indicating a significant decline, or above 2, suggesting atypical growth, were also excluded. The areas adjusted, based on administrative region organisation and outlier exclusion, are detailed in Appendices A and B. For the six small-area samples, administrative units were excluded only if data were missing, regardless of whether they experienced significant population growth or decline.

The descriptive statistics of 338 cities and wards within Japan's three metropolitan areas from 2005 to 2020 present regional variations (Table 1).

Table 3.1. Descriptive statistics for each factor

Factors	Data type	Minimum	Maximum	Mean	Std. Deviation
HH (2005)	People	8360	429680	71649.3	61595.8
				8	4
HH (2020)	People	7292	492065	81606.9	73046.2
				4	0
HH (2005–2020)	Change ratio	0.58	1.952	1.128	0.18
HRB (2005)	House	29	108521	12513.8	14677.3
				6	4
HRB (2020)	House	29	179023	18950.0	23708.6
				8	4
HRB (2005– 2020)	Change ratio	0.55	1.969	1.173	0.20
HO (2005)	People	5032	198824	38158.7	31482.6
				7	6
HO (2020)	People	5557	228263	46327.3	37455.6
				9	8
HO (2005–2020)	Change ratio	0.65	1.387	0.994	0.08
TIE (2005)	People	6998	340889	61733.7	54087.2
				8	8
TIE (2005)	People	5641	335702	57795.7	50235.3
				5	4
TIE (2005–2020)	Change ratio	0.60	1.702	0.983	0.110
WCW (2005)	People	1462	233859	19097.7	24434.0
				7	4
WCW (2020)	People	1273	246149	22010.7	27702.5
				5	6
WCW (2005– 2020)	Change ratio	1.05	1.611	1.233	0.11

LP (2005)	Yen/m ²	18600	1602416.67	92233.7	9223.37
				2	
LP (2020)	Yen/m ²	12200	2646666.67	92233.7	9223.37
				2	
Ln (2005 LP)	Change ratio	9.83	14.29	11.90	0.70
Ln (2020 LP)	Change ratio	9.41	14.79	11.90	0.88
Ln (2020 LP)- Ln (2005 LP)	Change ratio	-0.68	0.94	0.002	0.244

Note: Ln is an abbreviation for a logarithmic function based on the constant *e*.

3.4 Statistical Analysis of Gentrification-related Variables

3.4.1 Correlation Analysis of Gentrification-related Variables

Initially, this study conducted a correlation analysis with HH, HRB, HO, TIE, and WCW as independent variables and LP as the dependent variable. The outcomes are presented in Table 3.2 and Figure 3.3.

The analysis of all areas within the three metropolitan areas and the correlation analysis of various factors within these zones and the three largest cities reveal that changes in WCW exhibit the most significant correlation with other gentrification indicators.

Regarding the interrelationship among different factors, there was a low to moderate positive correlation between the number of HRB and HH. This suggests that developments in HRB are in sync with population growth or housing demand, a characteristic observed in neighbourhoods experiencing gentrification.

The positive correlation between changes in WCW and LP, particularly

within the Tokyo and Kansai metropolitan areas, suggests that areas witnessing an increase in higher-income professions concurrently experience increases in land values. This aligns with gentrification where economic enhancement leads to an uptick in property values.

The correlation between TIE and other factors, such as LP and changes in WCW, though varying, was generally positive. This is closely linked to the economic indicators associated with middle-class expansion and gentrification.

Table 3.2. Correlation coefficients with LP

Independent variables	Nationwide	Tokyo metropolitan area	Nagoya metropolitan area	Kansai Metropolitan area	Three central cities
N	338	163	64	111	63
HH	0.201**	0.267**	-0.447**	0.636**	0.283*
HRB	0.077	0.278**	-0.089	-0.172	0.368**
HO	-0.272**	-0.254**	-0.302*	-0.491**	-0.499**
TIE	0.054	-0.112	-0.214	0.438**	-0.365**
WCW	0.493**	0.597**	0.511**	0.466**	0.380**

Note: *Correlation is significant at the 5% level (bilateral). **Correlation is significant at the 1% level (bilateral).

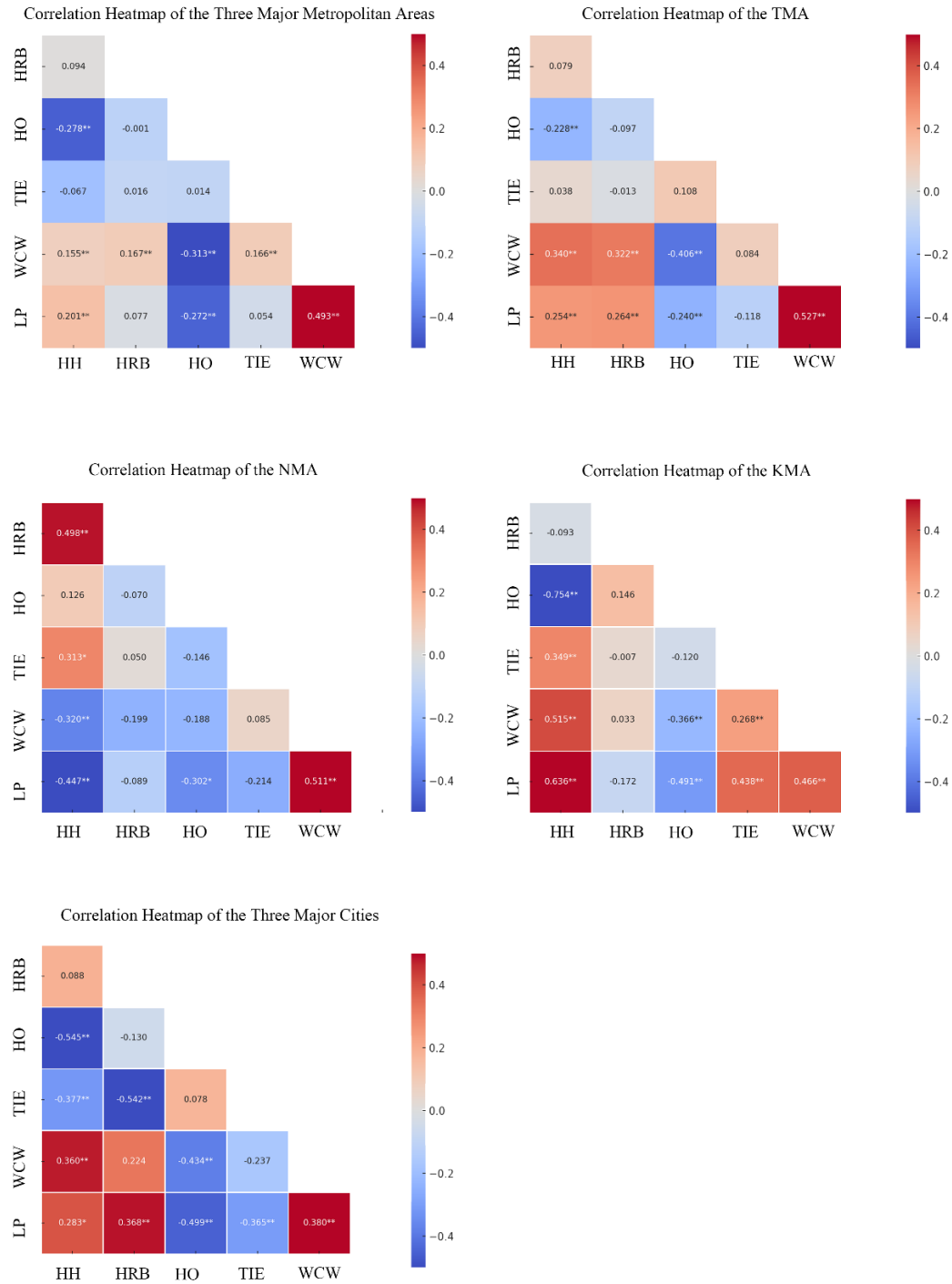


Figure 3.3. Correlation analysis results

3.4.2 Multiple Regression Analysis

Focusing on key factors closely related to gentrification, we established

regression equations for each ward, using LP, HRB, TIE and WCW as dependent variables. The regression models are presented in Equations (4.7)–(4.10).

$$\text{Eq 3.7: } LP = \beta_0 + \beta_1(HH) + \beta_2(HRB) + \beta_3(HO) + \beta_4(WCW) + \beta_5(TIE) + \varepsilon$$

$$\text{Eq 3.8: } HRB = \beta_0 + \beta_1(HH) + \beta_2(LP) + \beta_3(HO) + \beta_4(WCW) + \beta_5(TIE) + \varepsilon$$

$$\text{Eq 3.9: } TIE = \beta_0 + \beta_1(HH) + \beta_2(LP) + \beta_3(HO) + \beta_4(WCE) + \beta_5(LP) + \varepsilon$$

$$\text{Eq 3.10: } WCW = \beta_0 + \beta_1(HH) + \beta_2(LP) + \beta_3(HO) + \beta_4(TIE) + \beta_5(LP) + \varepsilon$$

Through the multivariate regression analysis of the four models, we estimated 20 regression models for Nationwide, Tokyo Metropolitan Area, Nagoya Metropolitan Area, Kansai Metropolitan Area and the three central cities. To evaluate the quality of the models, we focused on the R-squared values to determine the independent variables that best fit the overall model. Moreover, we examined the regression coefficients (Beta) of the other factors in these multivariate linear regression models to assess the contribution of each variable. The results (Table 3) highlight the best-fitting regression models. The complete set of regression models for all five area is provided in Appendices C–G.

Table 3.3. Multiple regression analysis in each area

Sample	Dependent Variable of Highest R-Square Model	Other Factors: Beta Values (sig)
Nationwide (N = 338)	WCW (R-Square = 0.316)	HH: 0.013 (0.786) HRB: 0.131 (0.005) HO: -0.197 (<0.001) TIE: 0.145 (0.002) LP: 0.419 (<0.001)
Tokyo Metropolitan Area (N = 163)	WCW (R-Square = 0.443)	HH: 0.157 (0.013) HRB: -0.276 (<0.001) HO: 0.182 (0.004) TIE: 0.157 (0.010) LP: 0.391 (<0.001) HH: -0.294 (0.027)

Nagoya Metropolitan Area (N = 64)	LP (R-Square = 0.438)	HRB: 0.137 (0.244)
		HO: -0.205 (0.054)
		TIE: -0.195 (0.079)
		WCW: 0.422 (<0.001)
		HH: 0.375 (0.003)
Kansai Metropolitan Area (N = 111)	LP (R-Square = 0.498)	HRB: -0.096 (0.381)
		HO: -0.127 (0.074)
		TIE: 0.249 (0.002)
		WCW: 0.176 (0.033)
		HH: -0.453 (<0.001)
Three Central Cities (N = 63)	TIE (R-Square = 0.483)	HRB: -0.453 (<0.001)
		HO: -0.363 (0.007)
		WCW: -0.041 (0.712)
		LP: -0.235 (0.053)

Note: Beta (sig) is the Standardized Coefficients Beta and p values with significant factors.

After selecting the best-fitting models, we use LP as an outcome indicator reflecting value appreciation and conduct a comprehensive analysis across all areas.

The results show that WCW was the best-fitting dependent variable in the Nationwide and Tokyo Metropolitan Area samples, indicating that occupational upgrading serves as a strong indicator of gentrification in these areas. In contrast, the best fit in Nagoya and Kansai was observed with LP as the dependent variable, while TIE was most explanatory in the Three Central Cities.

In the nationwide model, WCW was positively associated with HRB, TIE, and LP, suggesting that increased white-collar concentration correlates with new housing development, higher income levels, and land value gains. HO showed a significant negative association, indicating that areas with rising WCW tend to experience declining homeownership.

In Tokyo, WCW was positively related to HH, HO, TIE, and LP, while negatively associated with HRB. This inverse HRB-WCW relationship may reflect redevelopment dynamics that reduce the volume of small-scale housing even as higher-income groups concentrate.

In Nagoya, LP was positively associated with WCW but negatively correlated with HH, suggesting that land value growth occurs in areas with occupational upgrading but without corresponding household expansion.

In Kansai, HH, TIE, and WCW all showed positive associations with LP, indicating a multi-faceted pattern of gentrification driven by population, income, and occupation.

In the Three Central Cities, TIE was most strongly explained by declines in HH, HRB, and HO, revealing a distinct pattern: income concentration here coincides with demographic and residential contraction. This diverges from trends in other areas and underscores the unique restructuring processes underway in these urban cores.

3.5 Classification Based on Gentrification INDEX in Japanese Metropolitan Areas

3.5.1 INDEX Calculation and Descriptive Statistics

Gentrification can be illustrated as the inflow of WCW due to the increasing TIE and the growth of HRB, accompanied by increasing HO (Kidokoro et al., 2022; Kidokoro et al., 2023). This study employed an index relationship and GIS analysis to examine the gentrification processes and trends from three perspectives: overall, within each metropolitan area and within individual metropolitan areas.

For the index relationship analysis, the study selected the HH change rate as the dependent variable to describe gentrification based on two indices. Based on the conclusions from the above statistical data analysis, WCW showed the strongest correlation nationwide and within each metropolitan area. We created the Industry and Occupation INDEX(IO)(I_{IO}) to reflect a key factor representative of high-income populations in past gentrification studies, namely, the WCW change rate.

The formula is expressed as: $I_{IO} = WCW \times 100$ (3.11)

Regarding the relationship between I_{IO} Values and gentrification, when I_{IO} Is less than 100, it signifies that the local area's WCW has decreased from 2005–2020. When I_{IO} Is greater than 100, it indicates an increase in the local area's WCW.

The Housing Supply INDEX(HS) (I_{HS}) was designed to measure the relationship between local building development (HRB) and the demographic changes in gentrified areas (HH).

The formula is expressed as: $I_{HS} = HRB/HH \times 100$ (3.12)

For I_{HS} , values closer to 100 suggest that the level of urban development in the local area meets the changes in HH and does not indicate significant gentrification. When I_{HS} Is less than 100, it indicates that the rate of change in HH surpasses the speed of HRB development, suggesting a lack of gentrification impact. When I_{HS} Is greater than 100, it implies that the pace of HRB and urban development exceeds the growth or replacement of HH.

The relationship between the I_{IO} And I_{HS} Values showed gentrification in the three metropolitan areas. The mean and minimum values of I_{IO} Exceeding 100 indicate that, since 2005, the high-income population or WCW in various wards have increased. The average value of I_{IO} (106.238) suggests an overall tendency of housing supply development and population changes slightly leaning towards development outpacing HH growth (Appendices H).

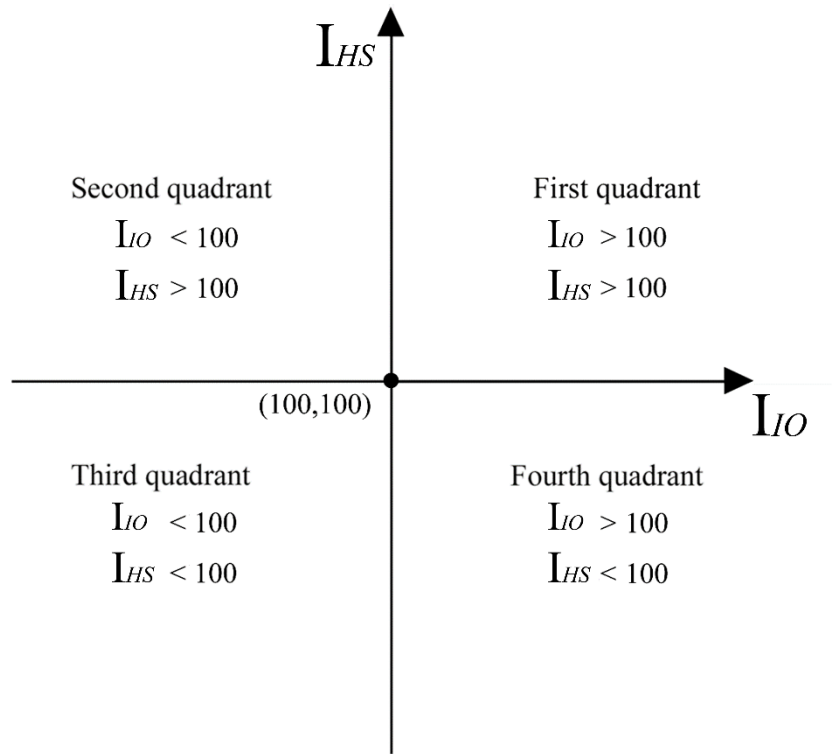


Figure 3.4. Classification of gentrification by I_{IO} And I_{HS}

3.5.2 Gentrification Classification of INDEX Quadrant

Based on the calculation of the multifactorial indexes IIO and IHS, this study introduces a coordinate axis classification method to assess gentrification-related dynamics in Japan's three major metropolitan areas. By taking (100, 100) as the origin, the IIO–IHS coordinate plane is divided into four quadrants, as shown in Figure 4.

Quadrant I ($IIO > 100$, $IHS > 100$) indicates wards where increases in white-collar employment coincide with a proportional or greater increase in housing supply. This reflects a balanced state of urban development and occupational upgrading without substantial housing pressure.

Quadrant IV ($IIO > 100$, $IHS < 100$) includes areas undergoing white-collar population growth without corresponding housing expansion, suggesting that demand outpaces supply and pointing towards possible displacement pressures.

Quadrant II ($IIO < 100$, $IHS > 100$) represents areas where housing supply increases while the white-collar population declines.

Quadrant III ($IIO < 100$, $IHS < 100$) reflects wards with both declining white-collar employment and housing supply per household, indicating overall urban contraction or stagnation.

To test the applicability and interpretive validity of this index-based classification method across spatial scales, this study also explores whether metropolitan-level trends align with the micro-level realities of socio-spatial restructuring in contemporary Japan.

3.5.3 Classification of Gentrification in Metropolitan Areas and Micro-scale Wards: An INDEX Quadrant-based Analysis

Building upon the INDEX-based framework, this section presents a multiscale analysis of gentrification by first examining the overall trends in the three major metropolitan areas and their core cities, and an analysis of the intra-urban variations across selected small-scale wards. The results are visualised in Figs. 3.5 to 3.7.

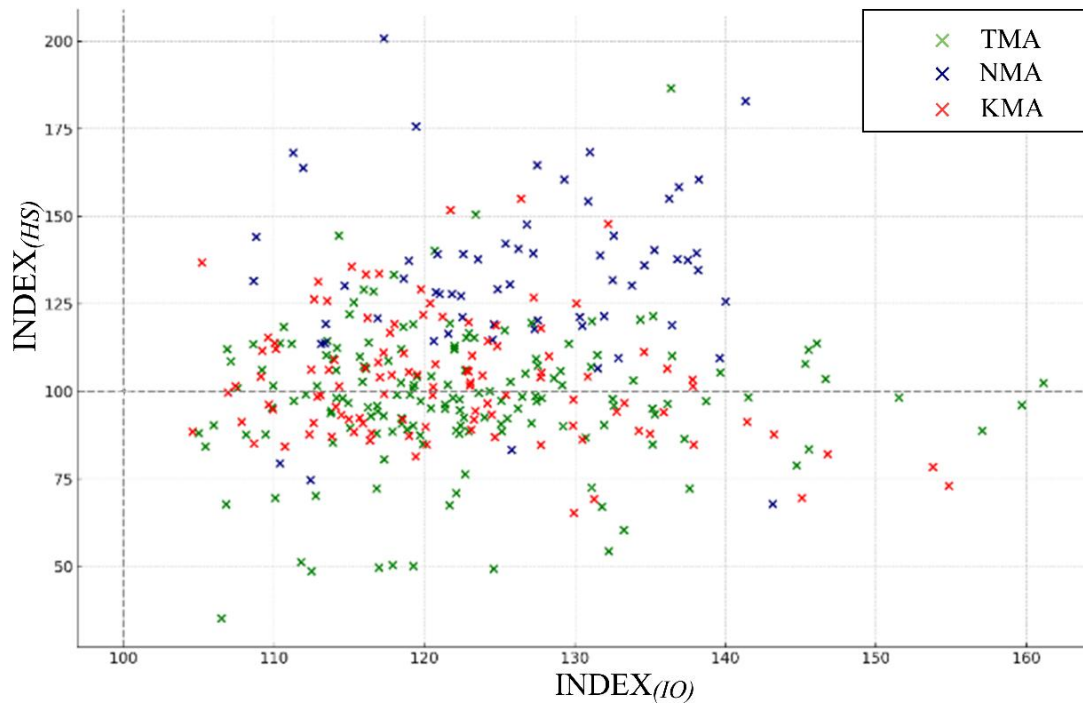


Figure 3.5. Scatter plots of classification of gentrification in the three metropolitan areas and three major cities

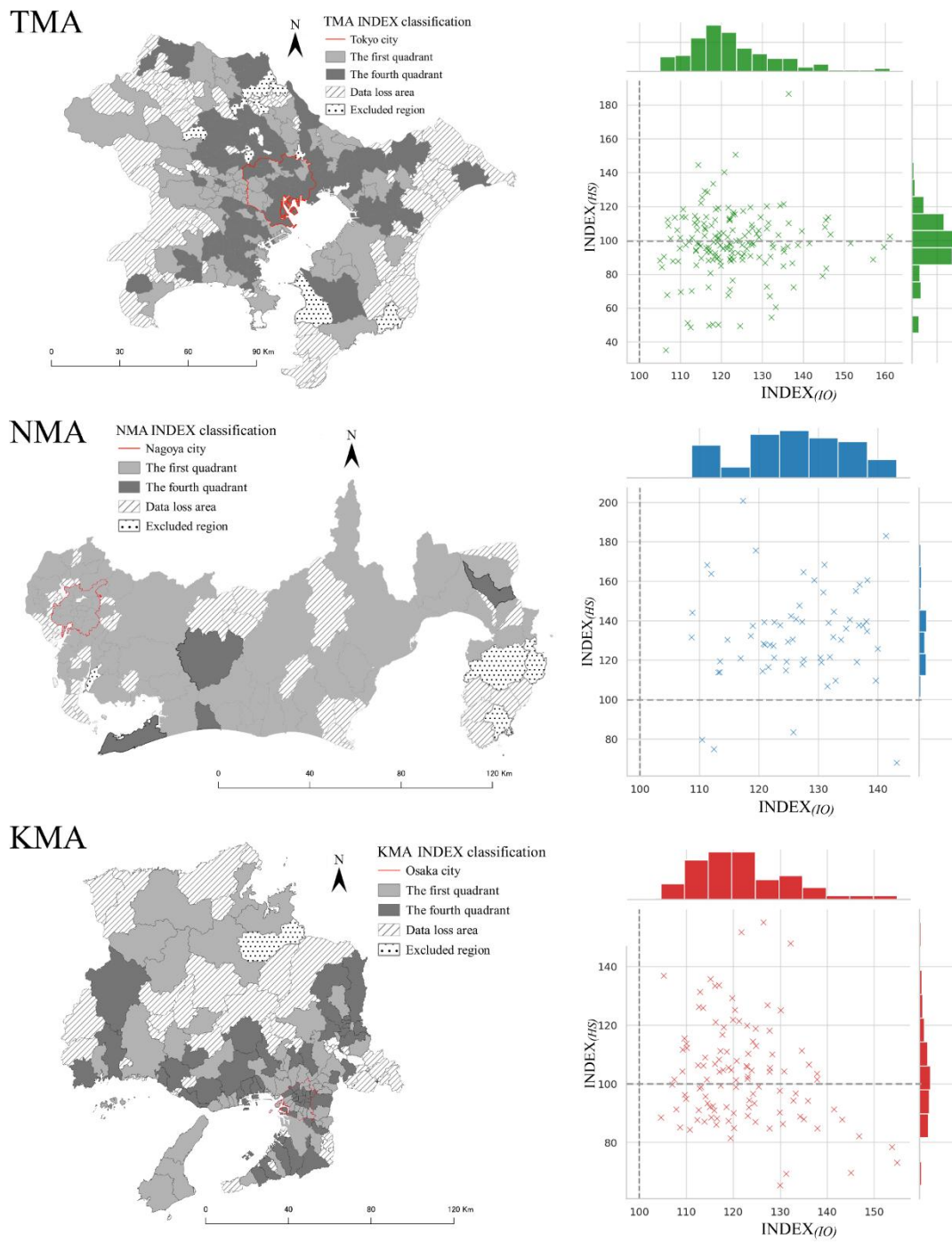


Figure 3.6. Large-scale perspective: Classification of gentrification in the three metropolitan areas and three major cities

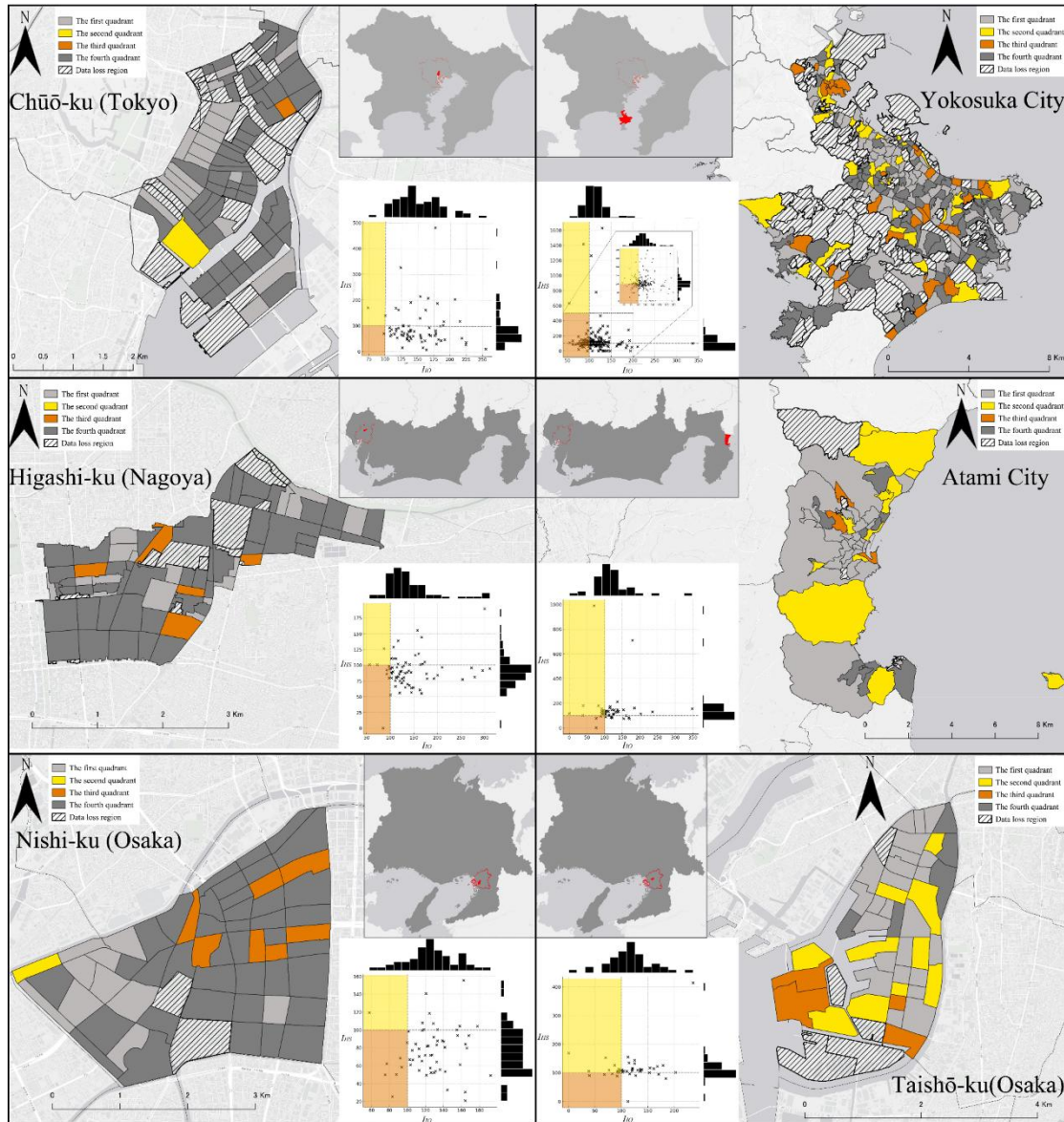


Figure 3.7. A small perspective: Six small wards in the three major metropolitan areas with population index growth and contraction

In the Tokyo Metropolitan Area, 71 of 163 cities and wards (43.6%) were located in the first quadrant, indicating both a rise in the white-collar population ($IIO > 100$) and adequate housing supply ($IHS > 100$). However, 91 areas (55.8%) fell into the fourth quadrant, where housing supply lags behind population dynamics. Notably, 15 of the 23 central Tokyo wards belonged to this category, suggesting that despite sustained economic activity and professional-class

expansion, housing development failed to keep pace. Suburban wards showed a more varied pattern, with 63 in the first quadrant and 76 in the fourth.

In the Nagoya Metropolitan Area, a markedly different spatial trend emerged. Of 64 areas, 60 (93.8%) were in the first quadrant, including all of Nagoya City. This indicates a stable alignment between occupational upgrading and housing provision, positioning Nagoya as the most balanced and demographically coherent among the three areas.

In contrast, the Kansai Metropolitan Area showed a relatively even distribution, with 59 of 111 areas (53.1%) in the first quadrant and 52 (46.9%) in the fourth. Within Osaka City, 14 of the 24 wards were in the fourth quadrant, indicating housing supply constraints. The remaining 10 wards reflected more balanced conditions. Outside Osaka City, 49 areas were in the first quadrant and 38 in the fourth. This suggests that peripheral zones—especially around Kyoto and Kobe—face less housing pressure, while central Osaka continues to experience a mismatch between white-collar growth and residential supply.

To assess the INDEX quadrant framework at a finer spatial scale, six representative wards were selected based on long-term population projections for 2050. Three of the wards—Chuo-ku (Tokyo), Nishi-ku (Osaka), and Higashi-ku (Nagoya)—are projected to experience population growth, while the others face expected decline (Appendix I).

In Chuo-ku (Tokyo), a central commercial district with projected growth, 18 wards (25.4%) were in the first quadrant, indicating occupational upgrading accompanied by sufficient housing supply. However, 51 wards (71.8%) fell into the fourth quadrant, where rising white-collar presence was not matched by adequate development, suggesting supply-side constraints and potential displacement.

In Nishi-ku (Osaka), the distribution was more balanced. Wards were spread across both the first and fourth quadrants, reflecting mixed dynamics: some areas displayed signs of gentrification, while others lagged in housing response. This indicates spatially uneven transformation under moderate upward occupational change.

In Higashi-ku (Nagoya), the pattern was skewed. Of 91 wards, 50 (69.4%) were in the fourth quadrant, and 16 (22.2%) in the first. This suggests widespread occupational upgrading without adequate housing expansion, implying growing spatial pressure.

Atami City showed internal diversity. Of 57 wards, 24 (42.1%) were in the first quadrant and 13 (22.8%) in the second. These results reflect a mix of occupational gain with either proportional or excess housing supply—typical of low-density, peripheral cities with irregular development.

In Yokosuka City, 177 of 242 wards (73.1%) were in both the first and fourth quadrants, showing a bifurcated pattern: some areas balanced white-collar growth and housing, while others experienced supply shortages, highlighting structural fragmentation.

Taisho-ku (Osaka) exhibited mixed forms. Among 42 wards, 24 (57.1%) were in the first quadrant, 5 (11.9%) in the fourth, 10 (23.8%) in the second, and 4 (9.5%) in the third. These proportions reflect highly varied intra-ward dynamics, including balanced transformation, oversupply, and urban contraction—all within a shrinking demographic context.

The INDEX quadrant method highlights intra-urban inequality by mapping employment, housing, and household change. It reveals spatial contrasts often hidden at larger scales. The coexistence of different quadrant types within a ward demonstrates how gentrification is uneven and context-specific.

3.6 Summary of Chapter 3

This chapter has addressed the nationwide drivers of gentrification across Japan's three major metropolitan areas. By employing correlation analysis, regression models, and the INDEX quadrant framework, it identified the structural role of occupational upgrading, housing supply, and land price dynamics in shaping metropolitan-level gentrification processes. The findings underscore the significance of white-collar employment and land value

appreciation as key explanatory factors, while also highlighting regional variations and intra-urban disparities.

Building on these metropolitan-scale insights, the dissertation now turns to Kyoto Prefecture. The following chapter examines how macro-level drivers—particularly land price dynamics—intersect with the phenomenon of tourism-led gentrification. This transition allows for an investigation into how broader structural forces manifest locally, shaping housing markets, vacancy patterns, and socio-spatial restructuring in a city heavily influenced by cultural industries and visitor economies.

In this way, the empirical results presented here provide both the theoretical grounding and comparative context necessary for analysing Kyoto as a case study. The next chapter therefore moves from the national and metropolitan perspective to a more place-specific inquiry, directly linking the structural drivers of gentrification with the central theme of this dissertation: the interrelationship between land values, tourism pressure, and vacant housing in the context of Japanese urban transformation.

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Chapter 3 – Appendices

Appendix A Cities excluded due to outliers

Factor	Exclusion Rule	City Name
Outlier	HH > 2	Kuki City
Exclusion	HRB > 2	Musashimurayama City, Shiki City, Okegawa City, Hasuda City, Satte City, Hidaka City, Choshi City, Tateyama City, Katsuura City, Futtsu City, Hekinan City, Ito City, Shimoda City, Izu City, Ayabe City
	HRB < 0.5	Asaka City

Appendix B Cities excluded due to missing variables

Factor	Exclusion Rule	City Name
Missing Data	New Administrative Areas After 2020	Minamiboso City, Sosa City, Katori City, Sammu City, Ichinomiya City Oamishirasato City, Kitagoya City, Yatomi City Miyoshi City, Ama City, Nagakute City, Sawara City Yachimata City, Makinohara City, Nantan City, Kizugawa City, Kato City
	No HH Data	Shiraoka City
	No HRB Data	Hatogaya City, Omaezaki City, Kikugawa City, Makinohara City, Kyotango City Sasayama City, Tamba City, Makinohara City

Appendix C Nationwide regression analysis result (N=338)

Independent variables	LP Beta (sig)	HRB Beta (sig)	TIE Beta (sig)	WCW Beta (sig)
HH	0.103 (0.037)	0.088 (0.121)	-0.080 (0.158)	0.013 (0.786)
HRB	-0.103 (0.044)		-0.009 (0.863)	0.131 (0.005)
HO	-0.007 (0.880)	0.078 (0.185)	0.052 (0.382)	-0.197 (<0.001)

TIE	-0.012 (0.799)	-0.009 (0.863)		0.145 (0.002)
WCW	0.448 (<0.001)	0.184 (0.005)	0.204 (0.002)	
LP		-0.010 (0.880)	-0.016 (0.799)	0.419 (<0.001)
R-Square	0.269	0.038	0.039	0.316

Appendix D Tokyo Metropolitan Area regression analysis result (N = 163)

Independent variables	LP Beta (sig)	HRB Beta (sig)	TIE Beta (sig)	WCW Beta (sig)
HH	0.091 (0.200)	-0.041 (0.615)	0.046 (0.583)	0.157 (0.013)
HRB	0.101 (0.150)		0.170 (0.047)	-0.276 (<0.001)
HO	0.001 (0.984)	0.045 (0.594)	-0.027 (0.747)	0.182 (0.004)
TIE	-0.160 (0.018)	-0.025 (0.747)		0.157 (0.010)
WCW	0.478 (<0.001)	0.288 (0.004)	0.262 (0.010)	.
LP		0.130 (0.150)	-0.220 (0.018)	0.391 (<0.001)
R-Square	0.320	0.120	0.069	0.443

Appendix E Nagoya Metropolitan Area regression analysis result (N = 64)

Independent variables	LP Beta (sig)	HRB Beta (sig)	TIE Beta (sig)	WCW Beta (sig)
HH	-0.294 (0.027)	0.588 (<0.001)	0.368 (0.018)	-0.116 (0.432)
HRB	0.137 (0.244)		-0.119 (0.392)	-0.108 (0.400)
HO	-0.205	-0.129	-0.230	0.005

	(0.054)	(0.279)	(0.065)	(0.968)
TIE	-0.195	-0.107		0.234
	(0.079)	(0.392)		(0.051)
WCW	0.422	-0.113	0.273	
	(<0.001)	(0.400)	(0.051)	
LP		0.170	-0.269	0.501
		(0.244)	(0.079)	(<0.001)
R-Square	0.438	0.304	0.223	0.333

Appendix F Kansai Metropolitan Area regression analysis result (N = 111)

Independent variables	LP Beta (sig)	HRB Beta (sig)	TIE Beta (sig)	WCW Beta (sig)
HH	0.375 (0.003)	0.077 (0.657)	0.351 (0.022)	0.380 (0.010)
HRB	-0.096 (0.381)		0.334 (0.011)	0.028 (0.829)
HO	-0.127 (0.074)	0.147 (0.327)	0.039 (0.656)	0.106 (0.206)
TIE	0.249 (0.002)	0.049 (0.656)		0.033 (0.725)
WCW	0.176 (0.033)	0.144 (0.206)	0.036 (0.725)	
LP		-0.237 (0.074)	0.369 (0.002)	0.242 (0.033)
R-Square	0.498	0.059	0.254	0.311

Appendix G Three-central-city regression analysis result (N = 63)

Independent variables	LP Beta (sig)	HRB Beta (sig)	TIE Beta (sig)	WCW Beta (sig)
HH	-0.139 (0.322)	-0.256 (0.073)	-0.453 (<0.001)	0.143 (0.358)
HRB	0.142 (0.270)		-0.453 (<0.001)	0.088 (0.538)
HO	-0.480 (0.001)	-0.118 (0.439)	-0.363 (0.007)	-0.263 (0.107)

TIE	-0.273 (0.053)	-0.556 (<0.001)		-0.059 (0.712)
WCW	0.125 (0.295)	0.076 (0.538)	-0.041 (0.712)	
LP		0.150 (0.270)	-0.235 (0.053)	0.154 (0.295)
R-Square	0.399	0.366	0.483	0.258

Appendix H Descriptive statistics of I_{IO} And I_{HS} Of gentrification

		N	Min.	Max.	Mean	Skewness	Kurtosis		
		Stat.	Stat.	Stat.	Stat.	Std. Error	Std. Error		
Metropolita n areas	I_{IO}	338	104.57 5	183.598	123.31 9	10.79 4	1.167	0.133	3.011
	I_{HS}	338	35.225	200.7248	106.23 8	23.55 3	0.553	0.133	1.477
Micro-scale	I_{IO}	467	0	348.214	122.20 3	1.384	0.113	6.374	0.225
	I_{HS}	467	0	1627.311	118.96 3	7.202	0.113	63.73 7	0.225

Appendix I Area-based gentrification and demographic trends: Quadrant analysis summary

Area	Scale	Region/Town	Quadrant Distribution (%)	2050 Population Trend
Tokyo Metropolitan Area	Metro	All municipalities	Q1: 43.6%, Q4: 55.8%	—
	Core City	Tokyo 23 Wards	Q1: 65.2%, Q4: 34.8%	—

	Town	Chuo Ward	Q1: 23.3%, Q2: 5%, Q3: 1.4%, Q4: 75.3%	Population index: 124.7
		Yokosuka City	Q1: 39.4%, Q2: 11.3%, Q3: 9.9%, Q4: 39.4%	Population index: 70.3
	Metro	All municipalities	Q1: 28%, Q4: 40%	—
		Nagoya City	Q1: 33%, Q3: 17%, Q4: 50%	—
Nagoya Metropolitan Area	Town	Higashi Ward	Q1: 25.3%, Q2: 2.2%, Q3: 6.6%, Q4: 66.0%	Population index: 103.2
		Atami City	Q1: 42.1%, Q2: 29.8%, Q3: 5.3%, Q4: 22.8%	Population index: 60.2
	Metro	All municipalities	Q1: 30%, Q2: 5%, Q3: 20%, Q4: 45%	—
		Osaka City	Q1: 35%, Q3: 10%, Q4: 55%	—
Kansai Metropolitan Area	Town	Nishi Ward	Q2: 12.5%, Q3: 87.5%	Population index: 110.7
		Taisho Ward	Q1: 48.0%, Q2: 18.0%, Q3: 10.0%, Q4: 24.0%	Population index: 62.8

Chapter 4

Tourism gentrification and rentable housing vacancy dynamics: A mediation analysis of Kyoto Prefecture, Japan

Chapter 4 — Position within the Dissertation

This chapter develops the dissertation's regional case by examining Kyoto Prefecture as a tourism-led pathway that complements the metropolitan foundation established earlier. While the thesis investigates the gentrification–vacant housing nexus across multiple contexts, Kyoto provides a setting where cultural industries and visitor economies intersect with land markets and rental systems. Using the study's predefined indicators and time windows, the chapter tests whether tourism-related pressures are present and evaluates how land price dynamics transmit their effects to short- and long-term rentable vacancies (SLTR), maintaining methodological continuity with prior chapters.

Situated between the nationwide analysis and the forthcoming suburban, non-tourism inquiry, this chapter clarifies how a heritage-intensive regional economy reconfigures housing availability without introducing new constructs beyond the dissertation's framework. Its results offer a directly comparable lens on urban change—aligning measures, models, and periods with earlier work—thereby preparing the ground for the subsequent Saitama–Toda analysis, where neighbourhood conditions under metropolitan influence are examined in the absence of tourism as a dominant driver.

4.1 Introduction — Kyoto Prefecture: Tourism

Pathway and Mediation

Tourism gentrification, an influential concept in urban and tourism studies, refers to the process through which tourism-driven investment and development restructure local urban environments and housing systems, leading to the spatial, economic, and symbolic displacement of existing residents (Gotham, 2018). As a distinct subprocess within broader urban restructuring, tourism gentrification has emerged as a powerful force reshaping contemporary cities, particularly those rich in cultural and historical heritage (Cocola-Gant, 2018; Gotham, 2005; Russo & Scarnato, 2018). Although it shares features with classical gentrification,

including rising property values and residential displacement (Butler & Robson, 2001; Hackworth & Smith, 2001), tourism gentrification is uniquely shaped by seasonal flows, digital short-term rental platforms, and the commodification of local culture (Cocola-Gant, 2018; Martinez, 2019; Ergun, 2004; Hayes & Zaban, 2020).

These dynamics have wide-ranging implications: public spaces become privatised, small businesses are displaced, and community cohesion is strained, with negative effects on the well-being of remaining residents (Donaldson, 2009; Sequera & Nofre, 2018; Anguelovski et al., 2020; Cole et al., 2021). At the same time, tourism reconfigures housing systems by expanding investment-oriented demand, raising rents, and reallocating supply from long-term tenancies toward short-term accommodation (Gil, 2024; Zuk et al., 2018; González-Pérez, 2020; Mixa & Loftsdóttir, 2023; Yrigoy, 2019a, 2019b).

Despite extensive work on prices, tenure conversion, and displacement, the impact on rentable vacancies remains underexplored. Vacant units may signify underuse, speculative holding, transitional housing, or indirect displacement in tourism-affected cities (Biagi et al., 2012; Dias et al., 2015). This chapter addresses the gap by focusing on Kyoto Prefecture, where heritage-driven visitation intersects with Japan's growing concerns over vacant housing (Kim & Nam, 2019; Yamamura & Tsubota, 2020; Kubo & Mashita, 2020).

Considering this theoretical and contextual foundation, this study explores how tourism gentrification affects rental housing in Kyoto by introducing short- and long-term rental vacant houses (SLTR) as a reconceptualization of rental housing availability, emphasizing its fluidity between residential and tourist uses. Using statistical data across three adjacent and overlapping periods (2008–2013, 2013–2018, and 2008–2018), a temporal mediation model is constructed to trace causal paths from tourism gentrification indicators to SLTR outcomes.

Accordingly, four hypotheses are formulated:

H1: Urban spatial indicators can identify signs of tourism gentrification in Kyoto Prefecture.

H2: Tourism gentrification substantially influences changes in SLTR

availability across districts.

H3: Land prices and rental costs mediate the effect of tourism gentrification on SLTR changes.

H4: The strength and direction of the tourism gentrification–SLTR relationship vary across different time periods.

This section establishes the conceptual foundation for the Kyoto case study, connecting tourism-led urban transformation to the housing vacancy issue. The following section provides a review of relevant literature to contextualize tourism gentrification, housing-market restructuring, and the evolution of rental vacancy dynamics in both global and Japanese contexts.

4.2 Literature Review

This section positions the Kyoto analysis within three strands of prior work: (i) global debates on tourism gentrification, (ii) Japan’s vacant housing system and the operational meaning of SLTR, and (iii) the links between tourism pressure, housing costs (including LP), and rentable vacancy dynamics.

4.2.1 Tourism gentrification: definition and impacts

Rooted in rent gaps and land price differentials, tourism gentrification denotes neighbourhood restructuring in which property values rise and urban space is reoriented toward tourist consumption (Smith, 2002). Comparative cases illustrate how state tourism agendas and housing systems intersect to produce tourism-led urban change in East Asia and heritage cities (González Martínez, 2016; Kim & Holifield, 2024; Santos-Izquierdo et al., 2023), underscoring the need for multiscale, context-sensitive analysis (Bobic, 2022). Beyond displacement, documented effects include shifts in land use, commercialisation of cultural spaces, and weakened community cohesion; Istanbul exemplifies how these processes reconfigure public–private realms and intensify exclusion for vulnerable groups (Özdemir & Selçuk, 2017).

Mainstream work often centres on short-term rentals (strs)—platforms such as Airbnb—linking them to rent gaps and direct/indirect displacement (Paulsen, 2023; Smigiel, 2024; Sakuma & Kato, 2024). Far less attention has been paid to how tourism gentrification restructures the rental system as a whole, particularly the status of units that remain vacant yet rentable. This gap is salient in Japan, where vacant housing is rising and tourism pressures are unevenly distributed across regions. The Kyoto case therefore focuses on SLTR as a system-level indicator that captures the fluid movement of stock between long- and short-term uses under tourism pressure. The takeaway is that tourism gentrification is multidimensional, but its implications for rentable vacancy remain underexamined in Asian contexts—precisely the gap this chapter addresses.

4.2.2 Vacant houses and SLTR in Japan

Vacancy has become a major policy concern in Japan. The number of vacant houses increased from roughly 7.56 million (2008) to 8.48 million (2018), with a national vacancy rate of 13.6% (MIC, 2018; 2019). Under the MLIT classification, vacant dwellings are grouped into rental-intended, for sale, second homes, and other (typically older/substantially deteriorated) units (MLIT, 2022). In 2018, vacant rental housing comprised 50.9% of all vacant dwellings, providing the empirical basis for this study's use of SLTR to denote units available for short- or long-term rental; here, SLTR is treated as functionally equivalent to the official vacant rental stock.

Nationally, the 2014 Act on Special Measures for Promotion of Countermeasures against Vacant Houses sought to activate underutilised stock. Yet in tourism-intensive prefectures such as Kyoto, SLTR may be retained strategically for potential conversion to short-term or seasonal use. From 2008 to 2018, Kyoto's overall vacancy rate declined from 13.1% to 12.8%, diverging from the national increase. Similar declines occurred in Fukuoka (13.7%→12.7%) and Chiba (13.1%→12.6%), each experiencing tourism growth over the period (MIC, 2019). These trends suggest that in tourism regions, vacancies can be managed rather than reflecting structural surplus. Accordingly, the Kyoto analysis reinterprets vacant rental housing as SLTR to examine how tourism exposure may reallocate rentable stock even when headline vacancy rates are stable or falling.

4.2.3 Tourism pressure, housing costs, and SLTR

International evidence indicates that tourism investment can divert rentable stock from stable tenancy toward tourism-serving configurations. In Lisbon, vacant houses were reactivated as strs, reducing affordable long-term supply (Lopes et al., 2019), while Seville experienced a parallel contraction in long-term rentals (Jover & Díaz-Parra, 2020). Studies also show that under tourism gentrification, “vacancy” is frequently functional—linked to landlord strategy, repositioning, and speculative holding (Gocer, 2021; Wang, 2011; Grodach, 2014). Landlords’ growing preference for strs to maximise revenue can widen rent gaps and intensify displacement pressures (Katsinas, 2021).

Because SLTR represents the rentable supply frontier, it is tightly coupled to local housing costs. Rental availability is a key determinant of affordability (Nordvik & Gulbrandsen, 2009); when LP and rents rise under tourism pressure, SLTR may shrink (conversion to strs) or expand (anticipatory holding), depending on profitability and regulation (Larraz & García-Gómez, 2020; Janoschka & Sequera, 2016). A parallel literature shows how financialisation amplifies these dynamics: investor-driven STR expansion (Katsinas, 2021), capital inflows and speculative conversion in CEE (Kowalczyk, 2023), platform-mediated tenancy disruption in New Orleans (Robertson et al., 2020), and finance–tourism linkages in Iceland (Mixa & Loftsdóttir, 2023). In Japan, rental-market shifts associated with strs can facilitate displacement (Kondo & Miyamae, 2022), while increases in land price may distort traditional housing functions under tourism gentrification (Gravari-Barbas & Guinand, 2020; Liang & Bao, 2015).

Collectively, these studies imply that tourism pressure → housing costs (LP/rents) → SLTR forms a plausible pathway, but prior work often overlooks the transitional status of rentable-but-vacant units embedded in tourism economies. The Kyoto chapter therefore treats vacancy not merely as idle stock but as a strategic state within a reconfigured rental system. Consistent with the dissertation’s unified protocol, the empirical test adopts a mediation design specified in Chapter 3 (§3.4.2), using temporally segmented data to examine indirect effects from tourism indicators to SLTR through LP, with bootstrap confidence intervals reported in Chapter 5.

Drawing on the above literature, this chapter adopts Kyoto Prefecture as the empirical context, operationalizes tourism gentrification indicators, and defines SLTR as the focal outcome. The next section (4.3) specifies the data sources, variable construction, and mediation-based modelling strategy for testing H1–H4 without altering the theoretical premises reviewed here.

4.3 Research Design and Analytical Framework

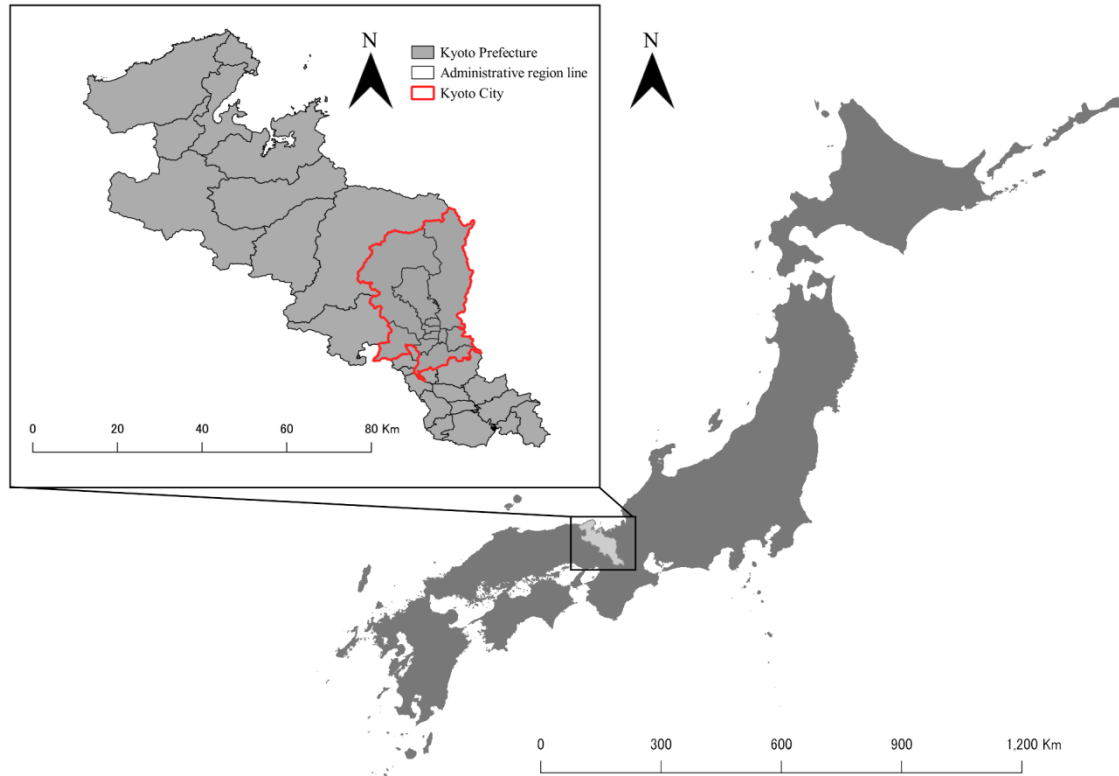
This section operationalises the Kyoto case within the dissertation’s multi-scalar design. Building directly on Chapter 3’s nationwide findings—where land price dynamics emerged as a core transmission mechanism—we specify a mediation framework to test whether tourism-led pressures influence SLTR via land values (and rents) at the prefectural scale. The following subsections reproduce the original indicators, study area, equations, and estimation steps without alteration, adapting numbering and cross-references only to fit the dissertation’s formatting.

4.3.1 Research object: Kyoto Prefecture and Japan

As shown in Figure 5.1, Kyoto, located in the central region of Japan, was selected as the research object. Since Japan established the Japan Tourism Agency in 2008, marking the implementation of its tourism nation policy (Japan Tourism Agency, 2024), the number of tourists has nearly quadrupled over a decade, increasing from 8,350,835 in 2008 to 31,191,856 in 2018, as illustrated in Figure 5.2. Within this context, Kyoto Prefecture, renowned for its UNESCO World Heritage sites. According to the 2018 Visit Rate Ranking by Prefecture, Kyoto ranks among the most visited destinations in Japan (UNESCO World Heritage Centre, 2024). The prefecture is home to 17 historical and cultural heritage sites (Kyoto Prefecture, 2024a). It also holds the highest number of national treasures and significant cultural properties—encompassing artworks and buildings—totaling 237, which accounts for 21% of Japan’s national treasures. Additionally, Kyoto has the highest number of crucial cultural buildings in Japan, with 1030

designated properties (Agency for Cultural Affairs, Japan, 2024).

Figure 4.1 Geographical location of Kyoto Prefecture and Kyoto City



Kyoto's appeal is further reflected in its high rankings for intention to visit, ranking first among Japanese travelers and second among foreign visitors (City of Kyoto, 2019). Although tourism data for Kyoto Prefecture is unavailable for 2011 and 2012 due to the impact of the Great East Japan Earthquake and changes in statistical methods (Kyoto Prefecture, 2011; Kyoto Prefecture, 2024), the prefecture remains renowned in Japan and globally for its historical heritage (Figs. 4.2 and 4.3).

Kyoto Prefecture combines high tourism growth and cultural density, make it an appropriate case for examining how tourism gentrification affects SLTR and rent levels.

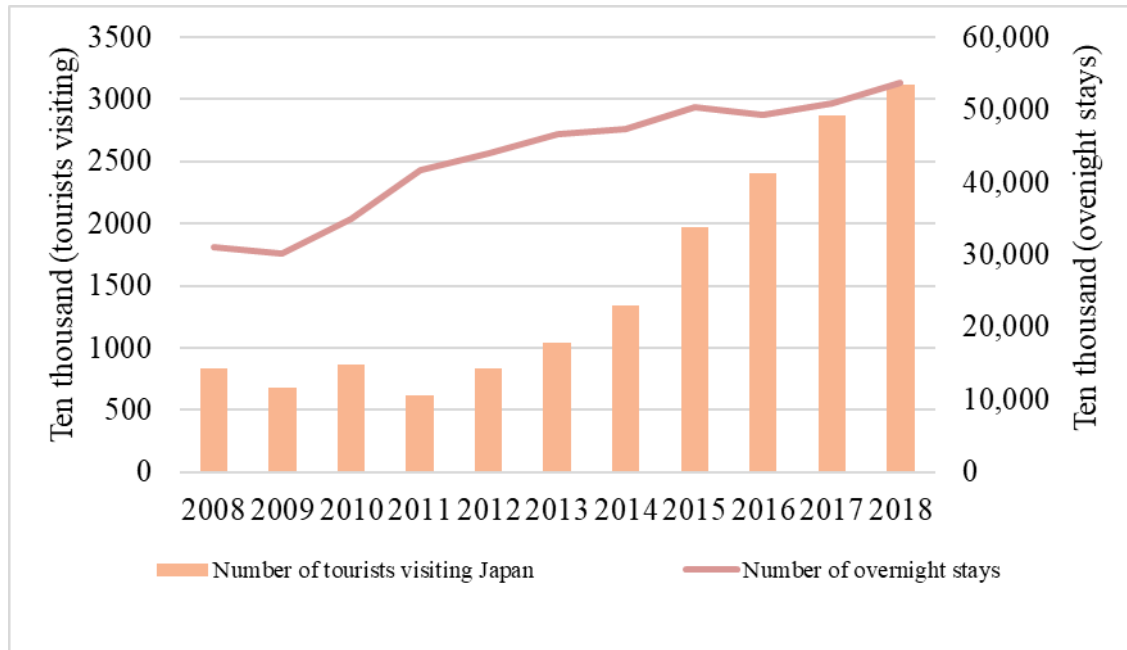


Figure 4.2 Changes in the number of foreign visitors and overnight stays in Japan from 2008 to 2018 (made by the authors based on data from e-Stat:

<https://www.e-stat.go.jp/>)

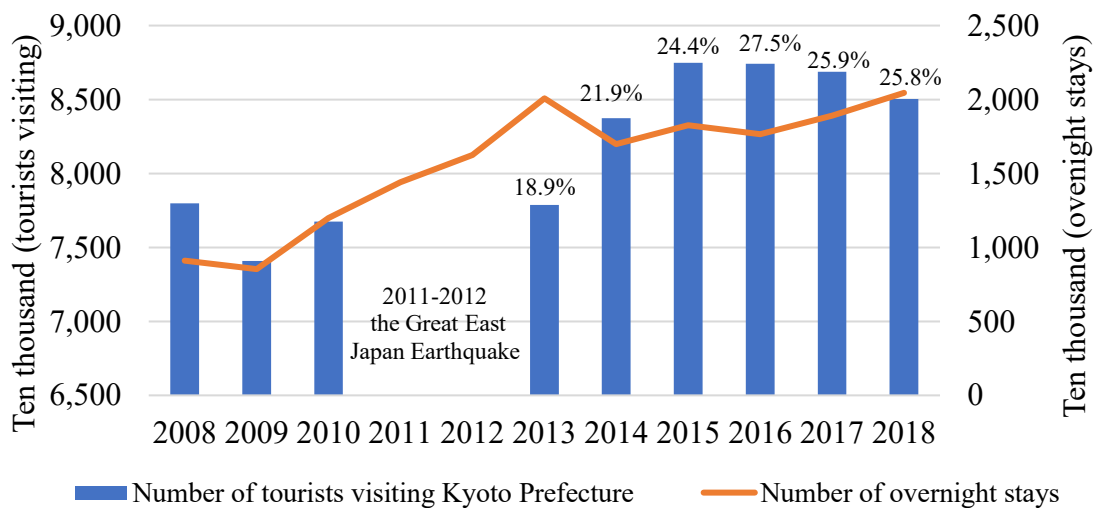


Figure 4.3 Changes in the number of foreign visitors and overnight stays in Kyoto Prefecture from 2008 to 2018

Note: The percentages indicate the proportion of foreign visitors to Japan who visited Kyoto Prefecture relative to the total number of foreign visitors to

Japan in each respective year. Due to data limitations, only data from 2013 to 2018 are available.

4.3.2 Tourism gentrification indicators and theoretical model

a) Identification method for tourism gentrification presence (H1)

To identify tourism gentrification indicators, we adopt the framework introduced by Gotham (2005), which defines tourism gentrification as the concurrent rise of tourism, entertainment activity, and property values within residential areas. Cocola-Gant (2015) further identified four forms of pressures that tourism gentrification exerts on local communities, while Cocola-Gant, Gago, and Jover (2020) expanded this framework by categorizing the spatial and economic disruptions faced by long-term residents. This theoretical foundation highlights tourism gentrification as a multidimensional process, encompassing economic change, spatial transformation, and tourism-driven intensity.

Based on this literature, we classify tourism gentrification into three dimensions—economic, physical–spatial, and tourism-related—and operationalize these through measurable indicators. The presence of tourism gentrification is thus inferred when an area simultaneously exhibits rent inflation, increased commercial land use, reduction in public space availability, and rising tourism pressure.

Table 4.1 Analytical framework for identifying signs of tourism gentrification

	Data	Literature
Economic	Residential rent price	Gotham (2005)
Physical–spatial	Residential land use	Liang & Bao (2015)
	Commercial land use	Cocola-Gant (2015)

	Number of parks	Cocola-Gant et al. (2020)
	Park area per person	
Tourism	Number of visitors	Gotham (2005)
	Amount of visitors' consumption	Katsinas (2021)

We selected local rent levels to represent economic pressure; changes in residential and commercial land use, as well as park-related metrics, for spatial transformation; and total tourist arrivals and consumption levels to capture tourism intensity. Public park data is critical, as tourism gentrification processes often reduce access to shared spaces, thereby eroding opportunities for social cohesion.

All indicators were extracted from Kyoto Prefecture's statistical repositories (City of Kyoto, 2019) and were transformed into change ratios. A district is flagged as having tourism gentrification potential if upward changes in tourism pressure and rent levels coincided with downward trends in residential land-use and public space.

b) H1 data selection and score calculation

We selected 2008 and 2018 as our benchmark years because data from subsequent years were severely affected by the COVID-19 pandemic and thus were unreliable for measuring long-term trends. Moreover, national-level housing and tourism statistics in Japan follow a 5-year publication cycle, which makes these years optimal for comparison. We collected data from the Kyoto Prefecture (2024b), MLIT (2024), and the Japan National Tourism Organization (2025). All variables were selected based on the three tourism gentrification dimensions defined in Table 1. The key dataset source was the KYOTO DATASTORE (<https://odcs.bodik.jp/260002/>). Note that the tourism-related data treats Kyoto City as a whole rather than distinguishing between its individual wards. Therefore, while testing H1, we treated each of the 29 administrative districts of Kyoto as a unit of analysis. Variables include the number of tourist spots, commercial and residential land-use shares, tourist visits and expenditures, public park metrics, average rent prices, and average land prices (Table 2). To

determine the presence of tourism gentrification in each district, we constructed a tourism gentrification Sign Score using the unweighted arithmetic mean of normalized change indicators:

$$\text{Eq 4.1: } TG \text{ Sign score} = \frac{\sum_{i=1}^n Xi}{n}$$

N: the number of indicators.

X_i : the value of the i -th indicator.

$\sum_{i=1}^n$: sum of all indicator values.

Here, we opted for equal weighting across all indicators to avoid any subjective bias, as assigning precise weights to each tourism gentrification factor would require prior knowledge, which was unavailable for this context and subject matter.

Table 4.2 Tourism gentrification sign-related data types selected

(based on Table 4.1)

Economic	Property values increased	Average rental price per square meter
Physical-spatial	Privatization of public space	Residential area land-use
		Commercial area land-use
	Loss of meeting places	Number of parks
		Park area per person
Tourism	Rapid growth of the tourism	Number of tourists
	industry	Tourism expenditure
		Number of tour places

4.3.3 Analytical model for H2–H4

- a) Stepwise mediation analysis framework for H2–H4

To analyze how tourism gentrification influences SLTR through housing-market mechanisms, we examine direct and indirect effects, focusing on land prices and rents as mediating variables. Excluding these mediators could bias the estimation of the effect of tourism gentrification on SLTR, as shown in recent urban causal modeling research (Pearman & Steyer, 2023; Kim et al., 2022; van den Bogerd et al., 2021). We adopt two complementary mediation strategies: Baron and Kenny's stepwise regression and a Bootstrap resampling method for robustness.

The stepwise regression model tests for mediation through land price and rent levels, while Bootstrap provides confidence intervals for indirect effects. Following Baron and Kenny's (1986) four-step logic, we estimate the relationships between tourism gentrification, the mediators, and SLTR. Although structural equation modeling is widely used in urban studies (e.g., Magnon et al., 2021; Xie et al., 2024), it is not applied here due to the limited sample size in Kyoto Prefecture.

The analytical procedure consists of the following steps:

Step 1: Estimate the total effect of tourism gentrification (X) on SLTR (Y), controlling for C.

$$\text{Regression Model 1: } y = \beta_0 + \beta_1 X + \beta_2 C + \varepsilon$$

Step 2: Estimate the effect of tourism gentrification on the mediating variable (M), controlling for C.

$$\text{Regression Model 2: } M = \alpha_0 + \alpha_1 X + \alpha_2 C + \varepsilon$$

Step 3: Estimate the effect of M on Y while controlling for tourism gentrification and C.

$$\text{Regression Model 3: } Y = \gamma_0 + \gamma_1 X + \gamma_2 C + \Gamma_3 M + \varepsilon$$

Model 1 estimates the total effect of tourism gentrification on SLTR (β_1); Model 2 measures the effect of tourism gentrification on mediators (α_1); and Model 3 assesses the mediators' conditional effect on SLTR (γ_2). The indirect

effect is calculated as $\alpha_1 \times \gamma_2$.

Step 4: Compare the effect of X on Y in Step 3 with that in Step 1. If, after introducing M, the direct effect of the independent variable on the dependent variable weakens or becomes insignificant, then a mediation effect exists.

Step 5: To confirm the significance of the indirect effect, we apply a nonparametric Bootstrap method using 5,000 resamples. This approach produces a bias-corrected confidence interval for the product term ($\alpha_1 \times \gamma_2$). If zero is excluded from the interval, the mediation effect is considered statistically significant.

To address H4, we replicate this entire modeling process across three adjacent and overlapping time periods: 2008–2013, 2013–2018, and 2008–2018. This temporal segmentation enables the comparison of path coefficients and mediation strength, allowing an assessment of whether the tourism gentrification–SLTR relationship remained stable, intensified, or weakened over time.

b) Selection and computation of variables for H2–H4

To analyze the direct and indirect effects of tourism gentrification on the SLTR change ratio, we used panel data from 2008, 2013, and 2018 across 29 administrative units within Kyoto Prefecture. Data were obtained from MLIT (2024), the KYOTO DATASTORE (BODIK, 2025) (<https://odcs.bodik.jp/kyoto-pref/>), and e-Stat (MIC, 2025) (<https://www.e-stat.go.jp/>). Areas with missing values were excluded to maintain consistency across three time intervals, which is essential for testing H4. Variable selection was guided by the causal mediation framework, focusing on four key components: independent variables (X), mediators (M), control variables (C), and the dependent variable (Y). Table 3 provides detailed descriptions and sources.

Table 4.3 Analysis data of tourism gentrification and empty homes in diverse urban areas of Kyoto Prefecture from 2008 – 2013 – 2018

	Type of data	References	Data source
C	Per capita residential	Lees & Phillips (2018)	KYOTO DATASTORE

	floor area (m ²)		
	Home ownership rate (percentage)		E-Stat
M	Residential rent price (YEN per m ²)	Robertson et al. (2020), Wachsmuth & Weisler (2018); Cocola-Gant (2016)	E-Stat
	Land price change (2018-2008; percentage)		Digital national land information, MLIT
X	Tourism-related facility change rate (percentage)	Sequera & Nofre (2018) Jover & Díaz-Parra (2020); Anguelovsk et al. (2020); Balzarini & Shlay (2016)	KYOTO DATASTORE
	Tourism employee number change		KYOTO DATASTORE
	rate (percentage)		KYOTO DATASTORE
Y	SLTR change ratio		E-Stat

We include the per capita residential living space and homeownership rate, as indicators of household tenure and housing density (Kim & Holifield, 2024; Katsinas, 2021; Sigler & Wachsmuth, 2016).

$$\text{Eq 4.2: Home ownership rate} = \frac{\text{Number of homeowner households / Number of households (2020)}}{\text{Number of homeowner households / Number of households (2005)}}$$

$$\text{Eq 4.3: Per capita residential floor area} = \frac{\text{Per capita living area(2018)}}{\text{Per capita living area(2008)}}$$

For X (gentrification-related variables), to develop a comprehensive exploratory model and examine its relationship with the SLTR change ratio, we considered the displacement and replacement effects induced by tourism gentrification. Accordingly, we included variables representing tourism-related industries and employment conditions. This selection is informed by studies conducted by Sequera and Nofre (2018), Jover and Díaz-Parra (2020), Anguelovski et al. (2020), and Balzarini and Shlay (2016), which highlight the economic and social transformations associated with tourism gentrification,

encompassing shifts in local industries and employment patterns.

Considering the sample size and the number of independent variables in the multiple regression models, we limited the number of independent variables in each model to three or four. We include changes in tourism-related facility change rate and tourism employee number change rate. Due to a high Pearson correlation ($r = 0.98$, $p < 0.001$), we construct a composite tourism intensity factor (CTI):

Eq 4.4:

$$\begin{aligned} &\text{Tourism employee number change rate} \\ &= \frac{\text{Number of tourism employees (2018)} / \text{Number of tourism employees (2008)}}{\text{Total number of employees (2018)} / \text{Total number of employees (2008)}} \end{aligned}$$

Eq 4.5:

$$\begin{aligned} &\text{Tourism – related facility change rate} \\ &= \frac{\text{Number of tourism – related facilities (2018)} / \text{Number of tourism – related facilities (2008)}}{\text{Total number of facilities (2018)} / \text{Total number of facilities (2008)}} \end{aligned}$$

Eq 4.6: CTS = Standard Score(number of tourism spots)

Eq 4.7: CTI =

$$\sqrt{\text{Tourism employee number change rate} * \text{Tourism – related facility change rate}}$$

Consistent with our mediation model structure, we identify residential rent price and land prices as key mediating variables (M) that channel the impact of tourism gentrification on SLTR changes ratio. These indicators were selected based on their established importance in literature on gentrification, particularly in studies by Robertson et al. (2020), Wachsmuth and Weisler (2018), and Cocola-Gant (2016), emphasizing the central role of housing cost dynamics in mediating displacement and housing conversion outcomes.

Accordingly, we incorporate land and rent prices as distinct mediators to isolate their individual transmission effects. In the analysis, two separate models were constructed—one for residential rent price and one for land price change—to assess the differential pathways through which tourism gentrification influences the ratio of SLTR change ratio.

Eq 4.8 : Land price change = $\ln(\text{Average official 2018 land price in each region}) - \ln(\text{Average official 2008 land price in each region})$

Eq4.9: Residential rent price = $\ln(\text{Average official 2018 rent price in each region}) - \ln(\text{Average official 2008 rent price in each region})$

The SLTR change ratio is selected as the dependent variable (Y) to quantify housing-market responses to tourism gentrification-related pressures. This variable reflects temporal shifts in the stock of SLTR available for either short- or long-term rental. The data are sourced from Kyoto Prefecture's official records of Kyoto City (City of Kyoto, 2019) on rentable vacant house and standardized against the total housing stock. This selection is theoretically grounded in prior studies that link tourism gentrification with shifts in housing use patterns. As noted by Miceli and Sirmans (2013), vacancy data can be used to infer changes in rental market behavior. Cocola-Gant (2021) further demonstrated that tourism growth frequently incentivizes landlords to convert long-term rental into short-term rental to maximize returns. In the Japanese context, Yu and Lee (2023) found a strong alignment between rising tourism pressure and changes in the allocation of vacant houses between rental and for-sale classifications.

$$\text{Eq 4.10: SLTR} = \frac{\text{Number of rentable vacant houses (2018)}}{\text{Total number of residences (2018)}} - \frac{\text{Number of rentable vacant houses (2008)}}{\text{Total number of residences (2008)}}$$

Therefore, we compiled a comprehensive dataset covering demographic and housing characteristics (C), tourism and urban transformation indicators (X), mediating housing cost pressures (M), and the ratio of SLTR changes ratio (Y), allowing the empirical testing of the multistep relationship between tourism gentrification and shifts in SLTR availability in Kyoto Prefecture.

4.3.4 Research process and novelty

H1 examines whether Kyoto Prefecture exhibits signs of tourism

gentrification based on the descriptive and comparative assessments between 2008 and 2018 using the indicators defined in our theoretical framework. H2–H4 focus on the causal mechanisms behind H1, assessing how tourism-related pressures influence the availability of SLTR through changes in land values and rental costs.

This study introduces three key innovations compared to existing tourism gentrification research. First, it reconceptualizes the stock of short- or long-term vacant rental housing as SLTR, capturing short- and long-term market flexibility. Unlike most research that isolates short- or long-term rental individually, this unified metric enables a more comprehensive view of housing transformation under tourism gentrification. Meanwhile, we apply a mediation modeling approach, estimating the direct and indirect effects of tourism gentrification on SLTR through the intermediate variables of land and rental prices. This structure captures the transmission mechanisms by which tourism impacts the vacancy system.

We conduct a three-period comparative analysis (2008–2013, 2013–2018, and 2008–2018) to test the temporal consistency and strength of these effects. This time segmentation enables the evaluation of whether the impacts of tourism gentrification intensify or stabilize over time.

STEP 1: Direct effect of tourism gentrification on SLTR:

$$\text{Eq 4.11: SLTR change ratio} = \beta_0 + \beta_1 \times \text{CTS} + \beta_2 \times \text{CTI} + \beta_3 \times \text{Home ownership rate} + \beta_4 \times \text{Per capita residential floor area} + \epsilon$$

STEP 2: Effect of tourism gentrification on mediators (land price and rent)

$$\text{Eq 4.12: Land price change} = \alpha_0 + \alpha_1 \times \text{CTS} + \alpha_2 \times \text{CTI} + \alpha_3 \times \text{Home ownership rate} + \alpha_4 \times \text{Per capita residential floor area} + \epsilon$$

$$\text{Eq 4.13: Residential rent price} = \delta_0 + \delta_1 \times \text{CTS} + \delta_2 \times \text{CTI} + \delta_3 \times \text{Home ownership rate} + \delta_4 \times \text{Per capita residential floor area} + \epsilon$$

STEP 3: Effect of mediators on SLTR (with tourism gentrification excluded)

$$\begin{aligned} \text{Eq 4.14: SLTR change ratio} = & \gamma_0 + \gamma_1 \times \text{Land price change} + \gamma_2 \times \\ & \text{Residential rent price} + \gamma_3 \times \text{Home ownership rate} + \gamma_4 \times \\ & \text{Per capita residential floor area} + \epsilon \end{aligned}$$

STEP 4: Full model incorporating all variables

$$\begin{aligned} \text{Eq 4.15: SLTR change ratio} = & \theta_0 + \theta_1 \times \text{Land price change} + \theta_2 \times \\ & \text{Residential rent price} + \theta_3 \times \text{CTS} + \theta_4 \times \text{CTI} + \theta_5 \times \\ & \text{Home ownership rate} + \theta_6 \times \text{Per capita residential floor area} + \epsilon \end{aligned}$$

Comparing the coefficients across models, we assess direct tourism gentrification effects (H2) and mediated effects via land and rental channels (H3). Repeating this structure for three periods validates H4, testing whether the strength or direction of the influence of tourism gentrification on SLTR shifts over time.

4.4 Results

This section reports the empirical findings in the same order as the analytical design: first, the descriptive verification of H1; second, the stepwise mediation tests for H2–H3 across the three time windows; and third, the Bootstrap confirmation of indirect effects. No new analyses beyond those specified in Chapter 4.3 are introduced.

4.4.1 Verification of H1: signs of tourism gentrification in Kyoto Prefecture

Based on the theoretical framework, tourism gentrification—driven by increased tourist influx and tourism industry growth—can lead to significant economic and spatial transformations in urban areas, reshaping local communities. We conducted descriptive and comparative analyses of key urban and tourism-related indicators between 2008 and 2018 to evaluate tourism gentrification in Kyoto Prefecture (H1). The dataset encompasses variables such

as the number of parks, per capita park area, land use (residential and commercial), tourist arrivals, tourism consumption, rental prices, and the number of tourist spots.

During data collection for Kyoto Prefecture's administrative districts, some areas were excluded due to missing data or a lack of evidence for tourism gentrification growth between 2008 and 2018 (Appendix B). Nonetheless, despite Uji City's H1 score being below 1, we retained it due to notable increases in tourism consumption, positive rent change rates, and the presence of 48 tourist sites.

Table 4.4 Changes in H1-related factors in diverse regions of Kyoto Prefecture from 2008 to 2018 (Kyoto City as a whole region) N = 16

Region	Park number	Park area per person	Residential land-use	Commercial land-use	Tourist arrivals	Tourist expenditure	Residential rent
Kyoto City	1.084	1.044	0.999	1.031	1.051	1.994	-0.014
Fukuchiyama City	1.162	1.183	1	1.003	0.931	0.86	0.028
Maizuru City	1.147	1.447	1.191	0.553	1.691	1.958	0.185
Ayabe City	1.048	1.238	0.864	1.871	1.451	0.937	-0.029
Uji City	1.011	1.029	0.999	1.014	0.97	1.798	0.088
Kameoka City	1.029	1.065	0.986	1.31	1.343	1.201	0.068
Jōyō City	0.935	1.394	1.098	1.022	0.919	0.931	-0.079
Mukō City	1.375	1.244	1.069	1.676	2.798	4.876	0.013

Nagaokakyo City	1.233	1.364	0.998	1.057	0.944	1.022	−0.046
Yawata City	1.011	1.062	0.976	1.288	1.12	1.42	−0.01
Kyotanabe City	1.163	0.992		1	0.73	0.617	−0.132
Kyotango City	1.2	1.59	1	1	1.175	0.844	0.053
Nantan City	1.333	1.038	1	1	1.326	1.405	−0.312
Kizugawa City	1.526	1.45	0.939	1.094	0.933	0.934	−0.045
Oyamasaki Cho	1	1.122	1	1	1.058	1.073	0.016
Kumiyama Cho	1.3	1.478	1	1	0.866	0	−0.237

First, tourism activity increased significantly. Between 2008 and 2018, Kyoto Prefecture experienced a 5% increase in tourist arrivals and a 99% surge in tourism consumption, indicating significant overall growth. Municipalities such as Maizuru and Kameoka also reported notable increases in these indicators.

Second, rental price trends varied across the prefecture. While Kyoto Prefecture encountered a slight decline in average residential rental prices, suggesting that housing supply kept pace with demand or that mitigating factors curbed rent inflation despite tourism pressure, some municipalities saw the opposite trend. For instance, in Maizuru and Uji, rental prices rose sharply, likely due to tourism-driven demand, reinforcing the notion that tourism expansion can elevate housing costs and affect local affordability.

Third, shifts in land use suggest a transition from residential to commercial purposes. Kyoto Prefecture saw a slight decrease in residential land use (change rate of 0.999), while cities like Ayabe (0.864) and Kizugawa (0.939) experienced more pronounced declines. Concurrently, commercial land use increased significantly in municipalities such as Ayabe (1.871) and Kameoka (1.310), suggesting that residential areas are being repurposed for tourism-related developments.

Finally, public facilities, measured by the number of parks, exhibited mixed results. While municipalities like Kizugawa and Mukō saw significant increases, others, such as Jōyō, experienced declines. While Kyoto Prefecture as a whole recorded a moderate increase in the number of parks, the marginal growth in per capita park area may not be sufficient to accommodate local residents and the expanding tourist population.

Overall, the analysis of data from 2008 to 2018 supports the presence of tourism gentrification in Kyoto Prefecture. While tourism growth has generated economic benefits, it has also driven urban transformations that may adversely affect local residents, aligning with the theoretical framework of tourism gentrification.

4.4.2 Descriptive Verification: 2008–2018 tourism gentrification–Short and Long-Term Rental Vacant Houses Relationship

To assess the impact of tourism gentrification on changes in Kyoto's SLTR stock, we conducted a correlation analysis for the 2008–2018 period, using the calculated 10-year change rates across 11 administrative units. Presents the correlation matrix for key variables related to H2, based on a refined sample after data exclusions (Appendix C).

The analysis reveals several notable relationships (Figure 4.4). The home ownership rate shows a significant positive correlation with the SLTR change ratio, suggesting that as more households shift to ownership, SLTR change ratio increase, potentially because of reduced demand. The standardized number of

CTS and CTI demonstrate negative correlations with land price change, potentially indicating saturation effects in heavily visited areas, where intensified tourism investment reduces the appeal for long-term residential or development investments. Meanwhile, changes in residential rent price and per capita residential floor area demonstrate no significant correlation with other core variables during this period, suggesting the limited direct influence of tourism gentrification or broader housing trends on these indicators within the aggregated timeframe.

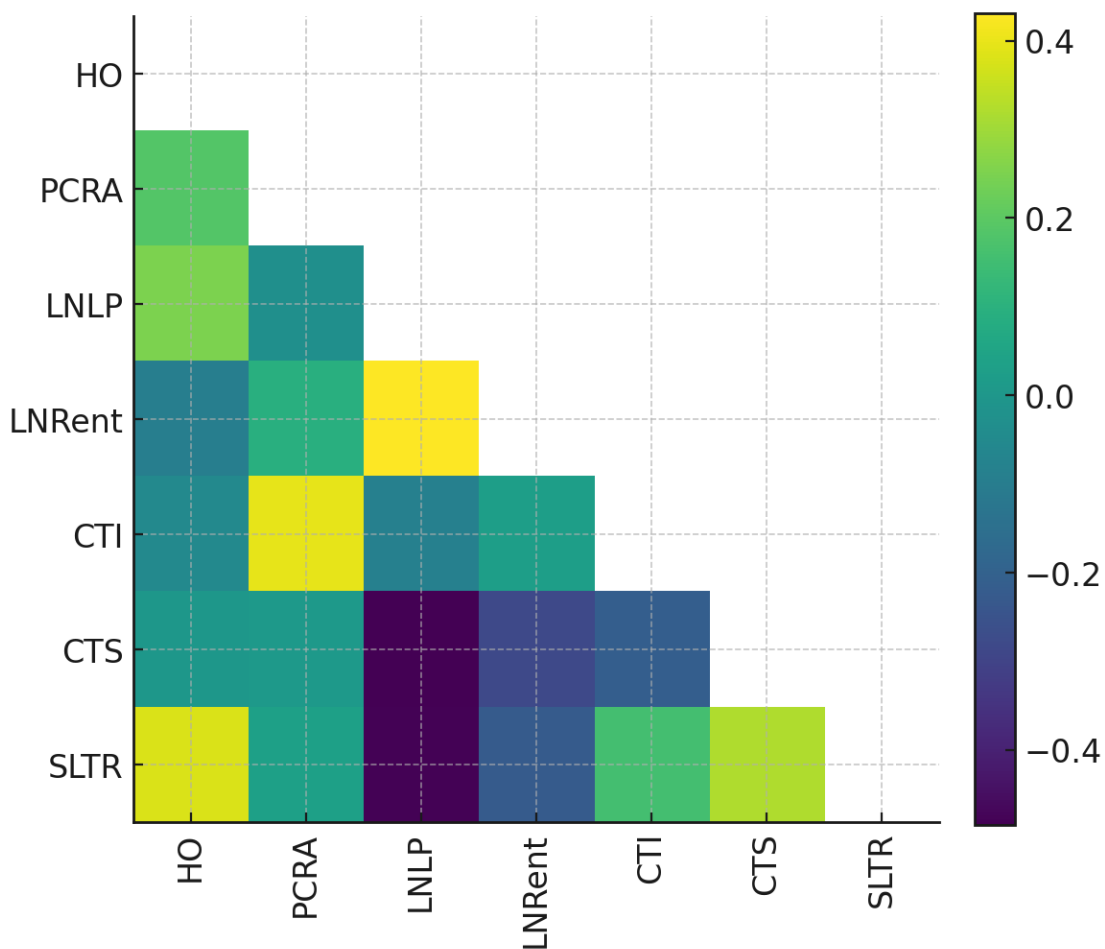


Figure 4.4 Correlation heat map between H2-related factors

Overall, tourism gentrification-related indicators (CTS, CTI) dampen land value growth, whereas shifts in home ownership emerge as the strongest predictor of rising SLTR change ratio. These findings motivate the use of causal stepwise regression (Section 5.3) to further disentangle the direct and indirect

relationships between tourism gentrification, housing costs, and vacancy changes.

4.4.3 Causal Mediation Analysis: Pathway from tourism gentrification to Short and Long-Term Rental Vacant Houses

To unpack the tourism gentrification mechanisms affecting the availability of SLTR, we conducted a stepwise causal mediation analysis, focusing on the role of land price change and residential rent price as potential mediators. The analysis was performed across three temporal segments to assess the static and sequential impacts (Table 4.5; Appendix F).

Step 1 assessed the total effect of tourism gentrification on SLTR availability. Regression results for 2008–2018 demonstrate that the concentration of CTS significantly and positively affects the SLTR change ratio ($\beta = 0.395$, $p < 0.05$), suggesting that areas experiencing higher tourism are also associated with increased SLTR turnover. However, this relationship was not observed in the individual subperiods (2008–2013, 2013–2018), indicating that the full effect of tourism gentrification on SLTR change ratio may need extended temporal horizons for manifestation. The home ownership rate consistently showed a positive association with SLTR change ratio growth, supporting the notion that owner-occupied housing expansion indirectly displaces renters, thereby increasing the stock of SLTR.

Step 2 tested whether tourism gentrification affects land price change. CTS had a significantly negative effect on land prices in the 2013–2018 ($\beta = -0.684$, $p = 0.003$) and 2008–2018 ($\beta = -0.524$, $p = 0.01$) segments, indicating that tourism-driven development, especially over extended periods, may suppress land value growth, possibly because of saturation, investor retreat, and/or weakened local desirability. However, CTI remained nonsignificant, suggesting that the spatial manifestation of tourism gentrification (via site concentration) drives land market responses rather than broader sectoral growth.

Step 3 evaluated whether land price shifts mediate the influence of tourism gentrification on SLTR. The regressions revealed that less growth in land price

was significantly associated with increased SLTR change ratio over the 2008–2018 period ($\beta = -0.685$, $p = 0.001$), reinforcing the argument that areas bypassed by land value appreciation may undergo residential turnover or speculative stagnation, further leading to persistent SLTR change ratio.

Step 4 incorporated tourism gentrification indicators and land price change into a single comprehensive model. The inclusion of land price change reduced the effect size and significance of CTS, with the direct effect becoming statistically nonsignificant ($p > 0.5$). Meanwhile, land price change retained its significance ($\beta = -0.619$, $p < 0.01$). This pattern indicates partial mediation, in which the spatial expansion of tourism gentrification impacts SLTR availability via its dampening effects on land price trajectories.

Table 4.5 Regression Results for tourism gentrification Effects on SLTR across Periods (N = 26)

Model	Factors	2008–2013	2013–2018	2008–2018
Model 1: Total effect	CTS	–0.072 ($p = 0.703$)	–0.493 ($p = 0.021$)	0.395 ($p = 0.043$)
	CTI	–0.067 ($p = 0.749$)	–0.189 ($p = 0.423$)	0.335 ($p = 0.110$)
Model 2: Tourism gentrification → Land Price	CTS	–0.321 ($p = 0.126$)	–0.684 ($p = 0.003$)	–0.524 ($p = 0.010$)
	CTI	–0.061 ($p = 0.788$)	–0.427 ($p = 0.093$)	–0.186 ($p = 0.369$)
Model 3: Tourism gentrification → residential rent price	CTS	–0.230 ($p = 0.221$)	–0.367 ($p = 0.140$)	–0.106 ($p = 0.653$)
	CTI	–0.490 ($p = 0.024$)	0.350 ($p = 0.233$)	–0.307 ($p = 0.161$)
Model 4: Mediation via land price / residential rent price	Land price change	–0.218 ($p = 0.268$)	–0.384 ($p = 0.112$)	–0.685 ($p = 0.001$)
	Residential rent price	–0.132 ($p = 0.501$)	0.023 ($p = 0.922$)	0.136 ($p = 0.447$)
Model 5: Full model	CTS	–0.118 ($p = 0.565$)	0.352 ($p = 0.178$)	0.114 ($p = 0.546$)
	CTI	–0.179 ($p = 0.461$)	0.281 ($p = 0.295$)	0.236 ($p = 0.197$)
	Land price change	–0.280 ($p = 0.194$)	–0.189 ($p = 0.448$)	–0.619 ($p = 0.007$)
	Residential rent price	–0.193 ($p = 0.412$)	–0.031 ($p = 0.883$)	0.143 ($p = 0.427$)
	R ² (Model 5)	0.342	0.434	0.557

To elucidate the mechanisms through which tourism gentrification influences SLTR change ratios in Kyoto Prefecture, we conducted a causal stepwise regression analysis within a mediation framework. The analysis is summarized as follows:

Step 1: We examined the direct impact of tourism gentrification on the SLTR change ratio. The dependent variable was the SLTR change ratio, while the independent variables were CTS and CTI, with home ownership rate and per capita residential floor area as controls. The results confirm that CTS significantly increases the SLTR change ratio, whereas CTI is insignificant. Additionally, home ownership rate is positive and significant, suggesting that escalating homeownership leads to more SLTR. Nonetheless, per capita residential floor area shows no significant effect.

Step 2: We tested whether tourism gentrification affects Land price change as a mediator. Regressing Land price on CTS and CTI, while controlling for home ownership rate and per capita residential floor area, revealed that CTS has a significant negative effect on land price, whereas CTI remains insignificant. This suggests that higher tourism activity may slow or mitigate land price growth, possibly due to overdevelopment or diminished attractiveness for permanent residents.

Step 3: We assessed the impact of land price on the SLTR change ratio. Controlling for home ownership rate and per capita residential floor area, the regression analysis demonstrates that land price has a significant negative effect on SLTR, meaning that weaker land price growth is associated with a higher percentage of unoccupied rental houses.

Step 4: In a comprehensive model incorporating tourism gentrification variables (CTS and CTI) and land price, the inclusion of land price reduced the coefficients and significance of CTS, while CTI remained nonsignificant. This indicates that land price fluctuations partially mediate the relationship between tourism gentrification and the SLTR change ratio. In other words, tourism gentrification influences SLTR indirectly by affecting land price, which, in turn, impact SLTR availability.

4.4.4 Bootstrap test results

To substantiate the above findings and formally test indirect effects, we employed a nonparametric Bootstrap method with 5,000 resamples. Table 4.6 summarizes the results of the indirect effect of CTS on SLTR change via land price change (Appendix G).

Table 4.6. Bootstrap Estimates of Indirect Effects via Land Prices

Period	Indirect Effect ($a \times b$)	95% Confidence Interval	Significant?
2008–2013	0.0834	[−0.0417, 0.4563]	No
2013–2018	0.0139	[−0.0461, 0.0736]	No
2008–2018	0.0060	[0.0008, 0.0128]	Yes

Only the 2008–2018 window yields a statistically significant indirect effect, with the 95% confidence interval excluding zero. This reinforces H3, suggesting that the influence of tourism gentrification on SLTR emerges cumulatively through sustained impacts on land markets. The shorter subperiods lack considerable mediation, possibly owing to time lags in how land price dynamics filter into housing stock changes.

Therefore, the results highlight a structurally mediated relationship. Tourism gentrification—captured through spatial tourism intensity—alters local housing markets primarily by disrupting the potential appreciation of residential land. These distortions eventually materialize as shifts in the distribution and availability of SLTR, especially over longer periods.

Taken together, the results support a temporally mediated link between tourism pressures and SLTR via land price dynamics, with effects most visible over the full 2008–2018 window. The next section discusses the implications and limitations of these findings within the Kyoto

4.5 Summary of Chapter 4

This chapter examined tourism-led gentrification in Kyoto Prefecture and its relationship with the supply of short- and long-term rentable vacant housing (SLTR). Using descriptive verification (H1), stepwise mediation (H2–H3), and Bootstrap tests across three windows (2008–2013, 2013–2018, 2008–2018), it showed that tourism pressures are associated with shifts in SLTR and that land price dynamics function as a key transmission channel. The effects were most evident over the full decade, consistent with a cumulative, time-dependent process.

Positioned against the nationwide findings, the Kyoto case translates macro-level drivers into a local tourism mechanism, clarifying how land values mediate housing-market responses in a heritage-intensive context. By keeping indicators, models, and time windows consistent with earlier chapters, this analysis provides a directly comparable lens on urban change without adding new constructs beyond the dissertation's established framework.

The next chapter turns to Saitama Prefecture—with a focus on Toda City—to test a non-tourism suburban pathway. This shift enables a neighbourhood-scale assessment of how local conditions and everyday urban infrastructures shape vacant-housing outcomes under metropolitan influences, completing the dissertation's national–regional–local trajectory

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Chapter5

Saitama Prefecture: Prefectural Screening and MSSD

Chapter 5 Position within the Dissertation

This chapter develops the dissertation’s suburban, non-tourism pathway by examining Saitama Prefecture as a transitional scale between the metropolitan foundation and the neighbourhood analysis in Toda City. While the thesis interrogates the gentrification–vacancy nexus across multiple contexts, Saitama offers a setting where commuting economies and everyday urban services—rather than visitor industries—intersect with housing outcomes. Using the study’s predefined indicators and time windows, the chapter tests the applicability of metropolitan/tourism-oriented proxies to prefectural vacancy patterns and, where limits appear, motivates a shift to neighbourhood conditions more proximate to residents’ daily environments (accessibility, road adjacency, built form), maintaining methodological continuity with prior chapters.

Situated after the Kyoto mediation study and before the micro-scale inquiry in Toda, this chapter serves two functions without introducing new constructs: (i) it establishes the selective reach of gentrification proxies at the prefectural scale—clarifying what they explain and what they leave unresolved under broadly similar metropolitan exposure—and (ii) it implements a county-wide, unanchored MSSD screen to identify a disciplined micro-case. Its results provide a directly comparable lens on urban change—aligning measures, models, and periods with earlier work—thereby preparing the ground for Chapter 6, where neighbourhood conditions in Toda City in the absence of tourism as a dominant driver.

5.1 Introduction — Saitama Prefecture: Prefectural Screening and MSSD

This chapter uses Saitama Prefecture—specifically the Saitama–Toda corridor—as the transitional scale between the metropolitan baseline and the neighbourhood analysis in Chapter 7. The vantage point deliberately shifts to a smaller observational grain and to a non-tourism, off-metropolitan-core context.

The chapter has two aims. First, it tests whether metropolitan/tourism-oriented gentrification proxies continue to account for VACANCY at this intermediate scale; where they do not, the analysis pivots to neighbourhood conditions more directly connected to residents' everyday environments, consistent with Japan-specific trajectories where occupational restructuring and state-led redevelopment—rather than classic income/class polarisation—have shaped urban change (Lützel, 2008; Wakabayashi & Koizumi, 2018). Second, it screens for candidate areas that satisfy the small-scale perspective while avoiding confounding influences from tourism and inner-core dynamics—contrasting with tourism-linked neighbourhood change documented elsewhere (Gotham, 2005; Cocola-Gant, 2016).

Methodologically, the chapter adheres to the unified protocol established in Chapter 3—identical indicators, time windows, data cleaning, and estimation settings. It first reports prefectural correlations and OLS regressions under shared metropolitan exposure; then applies a most-similar-systems design (MSSD) with k-nearest neighbours to contrast vacancy outcomes within structurally comparable sets and identify the micro-scale observation site without introducing new constructs (Przeworski & Teune, 1970; Seawright & Gerring, 2008). Substantively, Saitama functions as a selection filter that provides a transparent, data-driven rationale for choosing Toda City—an outlier with a distinctively low vacancy profile under broadly similar conditions—and thereby justifies a neighbourhood-based mechanism in Chapter 6.

5.2 Methods

5.2.1 Data and units of analysis

The analysis follows the unified protocol established in Chapter 3. The observational units are municipalities within Saitama Prefecture over the dissertation's established window. Variables are employed exactly as previously constructed: HRB, WCW (recorded in the dataset as WCEP), TIE, HO, HH, LP, and the VACANCY outcome (2003–2018). No new indicators are introduced; temporal coverage, boundary treatment, and cleaning rules are identical to those

used in earlier chapters.

5.2.2 Prefectural analyses

Two complementary procedures are implemented at the prefectural scale:

Pairwise correlations. Pearson correlations profile co-movement among HH, HRB, HO, TIE, WCEP, LP and VACANCY; two-tailed significance accompanies all entries (Wooldridge, 2010).

OLS regressions. Multiple linear regressions estimate VACANCY on the study covariates using the Chapter-3 conventions (robust errors, fit statistics, diagnostics), preserving comparability with the metropolitan models (Wooldridge, 2010). Potential spatial dependence is handled explicitly in Chapter 6 via Moran's I/LISA (Moran, 1950; Anselin, 1995).

5.2.3 Comparative screening (MSSD with k-nearest neighbours)

To conduct a county-wide, unanchored screen consistent with the prefectural analyses, municipalities are compared on the shared metropolitan exposure represented by HH, HRB, HO, TIE, WCEP, LP. Each screening covariate is standardised within Saitama (z-scores):

$$\text{Eq 5.1: } Z_{x,j} = \frac{x_j - \bar{x}}{s_x}, \quad x \in \{\text{HH, HRB, HO, TIE, WCEP, LP}\}$$

Structural similarity between municipalities j and m is measured by Euclidean distance in the six-dimensional z-score space,

$$\text{Eq 5.2: } d(j, m) = \sqrt{\sum_x (Z_{x,j} - Z_{x,m})^2}$$

For each municipality j , the k nearest structural neighbours $\mathcal{N}_k(j)$ are defined by the k smallest distances with $m \neq j$. The main specification uses $k = 5$; sensitivity to $k = 3, 4$ is examined separately. Outcome differences are summarised by a deviation statistic that contrasts each municipality's vacancy level with the mean vacancy of its most-similar set (Przeworski & Teune, 1970; Seawright & Gerring, 2008; Hastie, Tibshirani & Friedman, 2009; Everitt et al.,

2011):

$$\text{Eq 5.3: } \Delta \text{VACANCY}(j) = \text{VACANCY}_j - \frac{1}{k} \sum_{m \in \mathcal{N}_k(j)} \text{VACANCY}_m$$

Negative values indicate lower vacancy relative to structurally comparable peers, and positive values the reverse. This screening device does not introduce new indicators or re-estimate the model family; it holds metropolitan exposure approximately constant and identifies municipalities whose outcomes diverge under comparable structural conditions, thereby informing the micro-scale case selection in Section 5.4.

5.3 analysis and result

5.3.1 Correlation analysis

Figure 5.1 visualises pairwise correlations across Saitama municipalities; Table 5.1 reports summary characteristics ($N = 38$). Overall, VACANCY (2003–2018) shows strong negative associations with LP ($r = -.605$, $p < .001$) and WCEP ($r = -.519$, $p = .001$). Other links with VACANCY are statistically indistinct: HRB ($r = -.067$, $p = .689$), HH ($r = -.109$, $p = .516$), HO ($r = .111$, $p = .506$), TIE ($r = .071$, $p = .671$).

Among covariates, several structured co-movements emerge: WCEP–LP ($r = .422$, $p = .008$) and WCEP–TIE ($r = .324$, $p = .047$) are positive; TIE–HRB is negative ($r = -.348$, $p = .032$); HRB–LP is near threshold positive ($r = .274$, $p = .096$). Remaining pairs are weak or indistinct at the 5% level, including HH with most covariates and HO across the matrix. In sum, at the prefectural scale, VACANCY aligns most closely with land-price and white-collar structure, while HRB and household dynamics (HH, HO) show limited direct association in this setting.

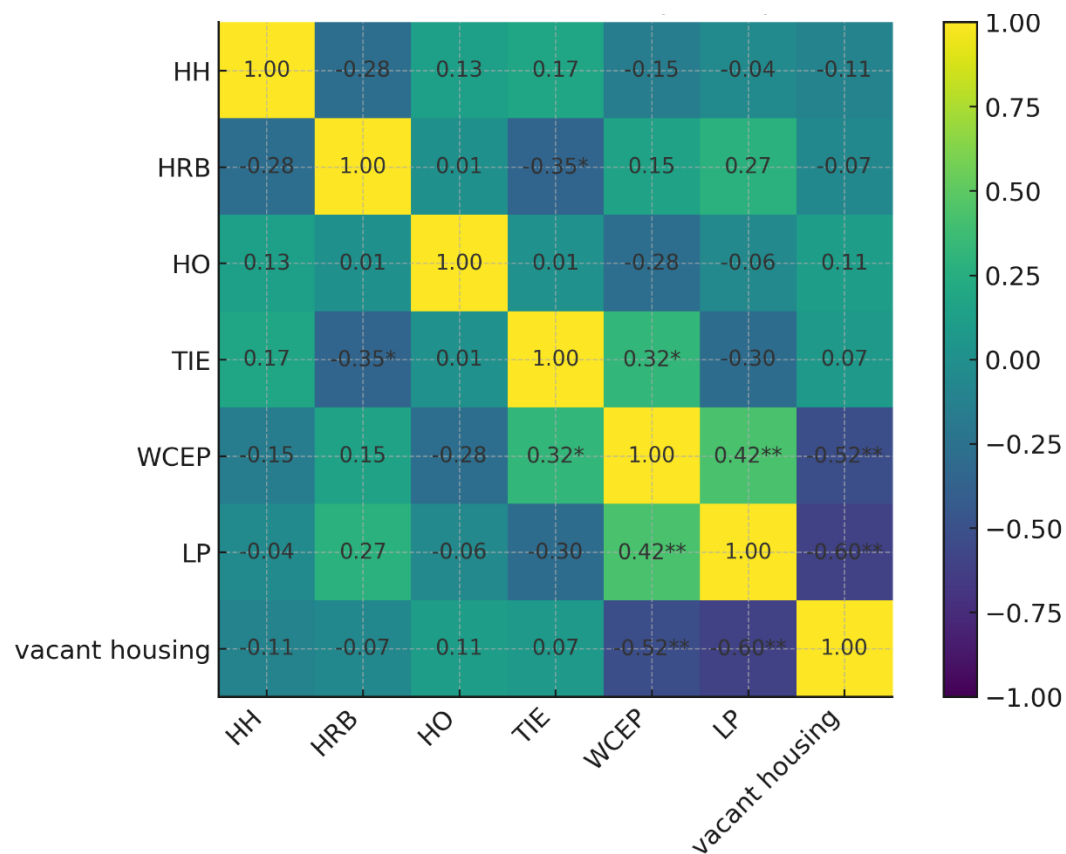


Figure 5.1. Correlation heatmap (Saitama municipalities, N = 38).

Table 5.1. Descriptive statistics (Saitama municipalities, N = 38).

	Minimum	Maximum	Mean	Std. Deviation
HH	.981	1.952	1.236	.160
HRB	.567	1.539	1.0676	.2321
HO	.747	1.38	1.01	.093
TIE	.995	1.138	1.060	.0261
WCEP	1.06	1.448	1.221	.088
LP	-.452	.210	-.082	.154
2003-2018 vancant	-.017	.095	.023	.027

5.3.2 Regression analysis

Table 5.2 reports the prefectural OLS with VACANCY as the dependent variable and HH, HRB, HO, TIE, WCEP, LP entered jointly ($N = 38$). The model attains $R = .711$, $R^2 = .505$, adjusted $R^2 = .409$; $F = 5.271$, $p = .001$, indicating substantive explanatory power at this scale. Signs align with the correlations: WCEP and LP are statistically significant and negative; HH, HRB, HO, TIE are not significant when included simultaneously. Diagnostics are satisfactory (tolerances ≥ 0.48 ; vifs ≤ 2.09). Overall, LP and WCEP are the principal covariates explaining VACANCY, while HH, HRB, HO, TIE contribute little once controls are applied. This reinforces the correlation findings and clarifies the limits of aggregate modelling for discriminating outcomes among structurally similar municipalities.

Table 5.2. Prefectural OLS on VACANCY with HH, HRB, HO, TIE, WCEP, LP ($N = 38$).

Factors	2003–2018
HH	−0.191($p = 0.170$)
HRB	0.124($p = 0.398$)
HO	−0.020($p = 0.886$)
TIE	0.179($p = 0.309$)
WCEP	−0.463($p = 0.017$)
LP	−0.400($p = 0.022$)

Notes: Robust standard errors; $R = .711$, $R^2 = .505$, adj. $R^2 = .409$, $F = 5.271$ ($p = .001$). Vifs ≤ 2.09 ; tolerances ≥ 0.48 .

5.3.3 MSSD screening: setup and procedure

A county-wide, unanchored MSSD screen is applied using standardised HH, HRB, HO, TIE, WCEP, LP and $k = 5$ nearest structural neighbours for each municipality. For municipality jjj , the deviation statistic contrasts outcomes against the mean of the most-similar set. Figure 5.2 presents the prefecture-wide ordering of $\Delta VACANCY$ ($k = 5$). Many inner-metropolitan units cluster near zero, indicating outcomes broadly consistent with shared exposure, while a subset exhibits negative deviations—lower VACANCY than structurally comparable peers.

Table 5.3. Nearest neighbours to TODA under MSSD ($k = 5$)

MUNICIPALITY	VACANCY	K-NEIGHBOURS ($k=5$)	MEAN VACANCY (NEIGHBOURS)	$\Delta VACANCY$ (= VACANCY – MEAN)
TODA	–0.01129	KAWAGUCHI (0.00264); WARABI (0.01762); SAITAMA–ŌMIYA (0.00756); SAITAMA–cho (0.01667); SAITAMA– MINAMI (0.03005)	0.01491	–0.02620

Notes: Screening only; membership stability for $k=3,4,5$ and full distance matrix in Appendix H.

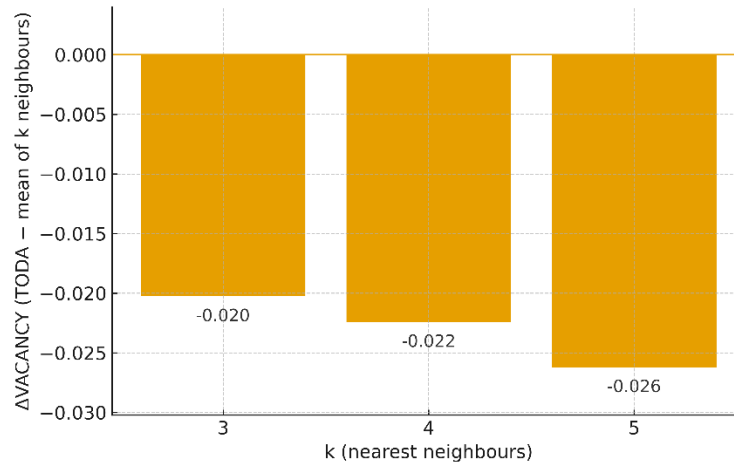


Figure 5.2. Δ VACANCY ordering under MSSD ($k = 5$).

Within the inner-ring, high-WCEP/positive-LP cluster, TODA records VACANCY = -0.01129 , below structurally close peers such as KAWAGUCHI (0.00264), WARABI (0.01762), SAITAMA-ŌMIYA (0.00756), SAITAMA-CHŪŌ (0.01667), and SAITAMA-MINAMI (0.03005). Several other municipalities also show negative VACANCY (e.g., SAITAMA-URAWA -0.01652 , SŌKA -0.01168 , KOSHIGAYA -0.00836 , SAITAMA-MIDORI -0.00633 , KASUKABE -0.00511), but their six-dimensional profiles are less proximate to Toda's and therefore fall outside its most-similar set. Read together, the county-wide screen indicates that VACANCY remains differentiated even under comparable metropolitan exposure, with TODA persistently at the lower end among its nearest structural peers.

5.4 Chapter conclusion: testing proxy applicability and justifying the case selection

This chapter addressed two objectives. First, it tested whether metropolitan/tourism proxies generalise to a suburban, non-tourism corridor; the selective reach observed here is consistent with Japan-specific restructuring—occupational upgrading and redevelopment rather than classic class polarisation. Second, it implemented a county-wide, unanchored MSSD screen to identify a

micro-scale case under comparable exposure, using standardised covariates and k-nearest neighbour sets. Within the inner-ring, high-WCEP/positive-LP cluster, TODA shows a negative $\Delta VACANCY$; administrative statistics for 2018 corroborate this low-vacancy profile (overall 8.4%, second lowest; “other vacant houses” 0.9%, lowest in prefecture; cite the official Saitama/Toda statistical bulletin you used). Together, these results provide a transparent, data-driven rationale for selecting Toda City and for pivoting to a neighbourhood-conditions lens operationalised in Chapter 6.

Second, it implemented a county-wide, unanchored MSSD screen to identify a micro-scale study site under comparable structural exposure. Using standardised HH, HRB, HO, TIE, WCEP, LP and a kkk-nearest procedure (mainly $k=5$), the screening demonstrated that VACANCY remains differentiated even among structurally similar municipalities (Section 5.3.3). Within the inner-ring, high-WCEP/positive-LP cluster, TODA shows a negative $\Delta VACANCY$, i.e., lower vacancy than its most-similar peers. Administrative statistics for 2018 corroborate this low-vacancy profile (overall vacancy 8.4%, second lowest; “other vacant houses” 0.9%, lowest in prefecture). Together, these results provide a transparent, data-driven rationale for selecting Toda City as the neighbourhood-scale case.

In sum, the chapter (i) establishes the limits of gentrification proxies at the prefectural scale and the need for a neighbourhood-conditions lens, and (ii) selects Toda City through a disciplined comparative screen that avoids tourism-led and inner-core confounds. Chapter 6 operationalises this shift for Toda City, employing spatial diagnostics (Moran’s I/LISA) and locally varying models (MGWR) to examine how accessibility, road adjacency, and built-environment attributes relate to VACANCY over time.

5.5 Summary of Chapter 5

This chapter tested whether metropolitan/tourism proxies still explain vacancy in a suburban, non-tourism corridor and used a county-wide screen to choose a micro case. Using standardized indicators (HH, HRB, HO, TIE, WCEP,

LP) and an unanchored MSSD with k-nearest matches (mainly k=5), the analysis showed that vacancy remains different even among municipalities with similar macro exposure. Within the inner-ring high-WCEP / positive-LP cluster, Toda stands out with a negative $\Delta VACANCY$ —that is, lower vacancy than its most-similar peers. Administrative figures for 2018 support this profile (overall vacancy 8.4%, second lowest in the prefecture; “other vacant houses” 0.9%, the lowest), giving a clear, data-based reason to select Toda City as the neighborhood case.

Placed alongside the nationwide metropolitan baseline and the Kyoto tourism findings, the Saitama results show the selective reach of metropolitan/tourism proxies: they structure patterns in some places but fade in others. In a non-tourism suburban setting like Saitama’s inner ring, this points to the need to shift from macro proxies to neighborhood conditions when explaining vacancy differences.

Building on this screening, the next chapter turns to Toda City and applies neighborhood-scale tools—Moran’s I / LISA and MGWR—to examine how everyday access, road connection, and service layout (captured by S/F and A/N) relate to vacancy over time.

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Appendix J – MSSD details and sensitivity

Screening covariates: HH, HRB, HO, TIE, WCEP, LP (z-scores). Distance: Euclidean. Outcome: VACANCY.

K	Neighbours (k)	Meanvacancy (neighbours)	Toda vacancy	Δ vacancy (=todamean)
3	KAWAGUCHI (0.00264); SAITAMA-ŌMIYA (0.00756); SAITAMA-CHŪŌ (0.01667)	0.00896	−0.01129	−0.02025
4	+WARABI (0.01762)	0.01112	−0.01129	−0.02241
5	+SAITAMA-MINAMI (0.03005)	0.01491	−0.01129	−0.02620

Notes: Δ VACANCY remains negative and becomes more pronounced as k increases from 3→5, indicating that TODA's vacancy level stays below the average of structurally comparable peers across reasonable neighbour-set sizes.

Chapter6

Toda City: Neighbourhood Conditions and Spatial Mechanisms

Chapter 6 Position within the Dissertation

This chapter advances the dissertation to the neighbourhood scale by examining Toda City in Saitama Prefecture as a non-tourism suburban pathway. Building on the metropolitan foundations established in Chapter 3 and the tourism-driven mechanism demonstrated in Chapter 4, it operationalises a setting where vacancy outcomes are shaped primarily by local conditions under metropolitan influence rather than by tourism pressures. Following the prefectural screening in Chapter 5, Toda City is selected for its consistently low vacancy profile and stable everyday urban functions, enabling a clear test of neighbourhood mechanisms without altering the original findings. The chapter deploys the study's predefined data and spatial methods (e.g., PLATEAU-based indicators, spatial autocorrelation, and geographically weighted modelling) to trace how road adjacency, retail provision, and residential renewal relate to vacancy patterns across time. By retaining the dissertation's established variables and periodisation, it provides a directly comparable lens alongside the national and Kyoto cases while avoiding new constructs or interpretations. In doing so, Chapter 6 supplies the micro-scale evidence needed to integrate metropolitan drivers, tourism pressures, and neighbourhood conditions into a multi-path account of Japan's gentrification–vacant housing nexus, preparing the ground for the cross-scale synthesis in Chapter 6

6.1 Introduction — Toda City: Neighbourhood Conditions and Spatial Mechanisms

The prevalence of vacant houses—propelled by demographic ageing, shrinking household size, and housing overhang—has become a salient challenge in Japan and elsewhere (Gu & Asami, 2016; Suzuki & Hino, 2018). Negative externalities of vacancy depress nearby land values and degrade neighbourhood conditions (Benediktsson, 2014; Sadayuki et al., 2020). In metropolitan regions, the redistribution of population and amenities between cores and satellite cities has gained policy salience (Westerink et al., 2013; Lee et al., 2015; Mouratidis, 2019), with evidence that larger dwelling sizes and suburban living preferences can stabilise residence outside the core (He & Zhang, 2023; Segú, 2020; Myers et al., 2023; Park et al., 2021).

Compared with complex dynamics in central cities, vacancy in satellite cities is often more prevalent and tractable for intervention (Nishiyama, 2020; Statistics Bureau, 2019). Yet much empirical work still concentrates on central areas—U.S. metropolitan counties, Shenzhen, Guiyang, Chengdu, Shenyang, Tokyo, and Utsunomiya—leaving a gap in neighbourhood-scale analyses for satellite contexts (Zhu et al., 2024; Liang, 2021; Shi et al., 2022; Zhang et al., 2023; Williams et al., 2019; Sadayuki et al., 2020; Nishiyama, 2020).

To explain vacancy in such settings, neighbourhood conditions are central. Living convenience—green space, transit accessibility, proximity to public spaces and services—can shape residential satisfaction and location choices and vary by age (Tao et al., 2022; Shen et al., 2021; Chiang et al., 2015; Zhu & Wang, 2022; Kikuchi et al., 2022; Zhuang & Ye, 2023). Land-use mix and everyday accessibility influence whether areas with lower convenience are avoided (Szabó et al., 2014; Ouyang et al., 2017). Housing supply factors also matter: unit floor area, adjacency to roads, and local facilities have been linked to vacancy patterns in Japan and across East Asia (Baba & Asami, 2017; Baba & Hino, 2019; Chiang et al., 2015; Yang et al., 2023). Policy signals—from urban renewal announcements to housing finance regimes—can shift local property values and vacancy dynamics (Cho et al., 2020; Monkkonen, 2019; Park et al., 2021; Hsiao, 2022). Selected via the Saitama screen, Toda City enables a neighbourhood-scale

examination of vacancy under accessibility, road adjacency, service density, and built-form attributes. This chapter applies spatial diagnostics and locally varying models to identify clustered patterns and heterogeneous associations between neighbourhood conditions and vacancy, following the shared spatial protocol in

6.2 Literature Review

6.2.1 Global research directions on vacant housing

International studies approach vacant housing from (i) detection/measurement, (ii) spatial structure and clustering, and (iii) market/system dynamics. On detection, new data and algorithms distinguish vacant from occupied dwellings using very-high-resolution imagery and ancillary signals (Zou & Wang, 2020) and social-media traces to map vacancy distributions (Williams et al., 2019). On spatial structure, research identifies statistically significant clustering and neighbourhood predictors of abandonment (Morckel, 2014). On market dynamics, work in the U.S. frames vacancy within real-estate cycles and institutional conditions, clarifying links to turnover, finance, and mobility (Molloy, 2016). Cross-nationally, nationwide analyses examine drivers and remedies in South Korea (Joo et al., 2022; Jeon & Kim, 2023), Taiwan (Hsiao, 2022), Syria (Wind & Ibrahim, 2020), and France (Segú, 2020). These strands jointly motivate a neighbourhood-scale analysis attentive to both measurement and contextual mechanisms.

6.2.2 Research background on vacant housing in Japan

Japan's official usage defines vacant housing through administrative categories and survey protocols (MLIT, 2015). According to the Statistics Bureau, the number of vacant houses rose from approximately 7.56 million (2008) to 8.48 million (2018), with a national vacancy rate of 13.6% (MIC, 2018; 2019). In response, the 2014 Special Measures Act targeted the activation and management of underutilised stock. Methodologically, recent Japanese studies move beyond registry and water-meter records—still the mainstream basis for municipal monitoring (Akiyama et al., 2018; Sayuda et al., 2022)—toward machine-learning

estimation from municipal data (Tomita et al., 2022) and ambient Wi-Fi-based inference (Konomi et al., 2019), while acknowledging blind spots in neighbourhood-embedded vacancy patterns (Ouchi, 2018).

Geographically, research has concentrated on core metropolitan areas—especially Tokyo—reflecting the scale of the problem there (MIC, 2019) and the region’s demographic/economic centrality (Gu & Asami, 2016; Sadayuki et al., 2020; Suzuki & Hino, 2018). Yet metropolitan dependence is counterbalanced by satellite cities in Chiba, Saitama, and Kanagawa (Kidokoro et al., 2023; Gu et al., 2023). The relative paucity of studies centred on satellite cities leaves a clear gap in understanding how non-core, everyday living environments shape vacancy outcomes—precisely the gap the Toda neighbourhood study addresses.

6.2.3 Neighbourhood characteristics and vacancy

While neighbourhood effects on well-being are well documented (Hackman, 2019; Chen, 2023), links to vacancy are less frequently analysed. Stated preference and observational evidence in Japan highlight residents’ valuation of shopping convenience, public transport access, commuting conditions, streetscape, and environmental hygiene (Yamada et al., 2016). Empirical studies connect vacancy (or decay proxies) to local amenities and accessibility—supermarkets/retail, bus stops, and parks—using OLS and logistic models (Deng & Ma, 2015), with land-price sensitivity to urban landscape attributes also reported (Gao & Asami, 2007). Built-environment correlates—including infrastructure, public facilities, and green space—feature in occupancy and awareness outcomes across multiple settings (Liu et al., 2015; Shi et al., 2023)(see Table 1.1).

A focused set of studies ties vacancy distributions to building size, road adjacency/conditions, and facility presence: positive or negative associations are reported across Japanese municipalities and international cases (Oda et al., 2018; Baba & Asami, 2017; Baba & Hino, 2019; Joo et al., 2022; Williams et al., 2019; Gu et al., 2019; Kim et al., 2016). Two implication streams follow. First, living convenience—captured through retail/service accessibility and transit—likely conditions vacancy in satellite-city contexts where residential choice hinges on everyday reachability. Second, housing supply attributes (e.g., floor area and

adjacent-to-road conditions) may shape letting prospects and non-occupation spells under local market frictions.

Guided by this literature, Chapter 7 operationalises neighbourhood-scale variables (e.g., accessibility, road adjacency, service density, built form) under the unified protocol from Chapter 3, then evaluates spatial structure (Moran's I, LISA) and spatially varying relations (MGWR) to explain VACANCY patterns within Toda.

6.3 Research Framework

6.3.1 Research purpose and study area

Despite an overall upward trend in Japan's house vacancy rate, there are distinct regional and municipal variations characterising this phenomenon, and certain areas with different changes in vacancy rate drew our attention. According to Statistical JSB (2019), regional cities such as Wakayama Prefecture observed a 2.3% increase in their vacancy rate from 2013 to 2018. In contrast, the vacancy rate in Saitama Prefecture, a suburb of Tokyo, decreased from 9.1% to 8.4% over the same period (Saitama Prefecture Government, 2023). Satellite cities also displayed a trend of decreasing house vacancies in comparison to other metropolitan regions. As shown in Figure 6.1, most satellite cities near Tokyo experienced a decreasing trend in the number of vacant houses from 2013 to 2018. For instance, in Toda City, there was a relative decrease of -20.67% in the number of vacant houses over five years. While Musashino City's decreasing vacant houses are notable, its inclusion in the Tokyo metropolis likely mirrors the dynamics of larger urban areas.

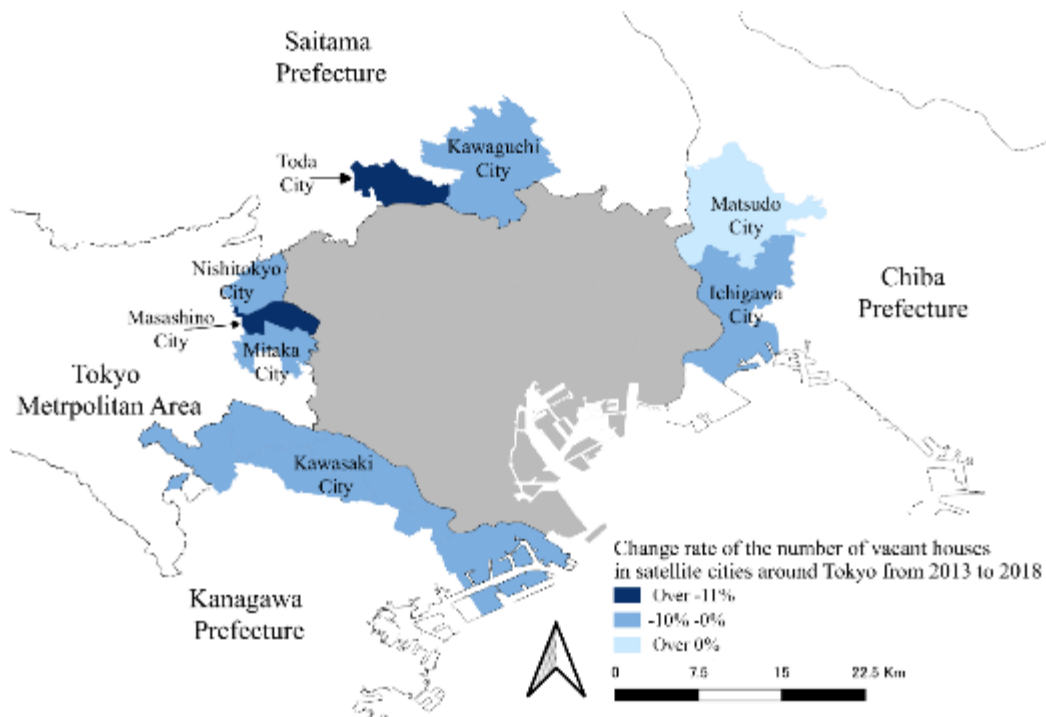


Figure 6.1. Changes in the number of vacant houses in satellite cities of Tokyo from 2013 to 2018

Considering the unique characteristics of roads in Japanese cities, the distance between houses and roads is considered an influencing condition for the occurrence of vacant houses and the specifics of local policy support. Employing three analytical perspectives and 10 influencing factors, this study endeavoured to create a correlation model for the distribution of vacant houses in Toda City. The study innovatively examined the distribution of vacant houses using data from Japan's MLIT.

In 2023, Toda City had a population of 1.42 million people, which is comparatively small compared to the top three cities in Saitama Prefecture: Saitama City (13.25 million people), Kawaguchi City (5.94 million people), and Kawagoe City (3.55 million people). Despite the overall decline in population, Toda City demonstrates an upward trend, as indicated in the Toda City Urban Transportation Master Plan (2019). According to data released by the Toda City government in 2023, the vacancy rate decreased from 10.9% in 2013 to 8.4% in 2018, ranking second lowest in Saitama Prefecture. Thus, compared to other regions, Toda City exhibits a distinctive dynamic regarding vacant housing.

Considering this data, we selected Toda City, as a satellite city of Tokyo, our research setting to investigate the occurrence of vacant houses within an urban context in Japan. This choice was designed to facilitate a comprehensive understanding of the reasons for and mechanisms behind the changes in vacant houses. Figure 6.2 shows the distribution of vacant houses and major neighbourhood characteristics, including land use, the distribution of public facilities, and the road network, in Toda City. A survey by the Toda City Government in May 2018 identified 263 vacant houses in the city. Vacant houses were more highly concentrated in some areas, as shown in panel (1) of Figure 6.2.

This study aimed to contribute to the knowledge on the increasing number of vacant properties both globally and across Japan by using traditional statistical data analysis and spatial data analysis for comprehensive comparison and cross-verification. We sought to determine which factors are significant and their status to clarify the influencing mechanism behind the decreasing trend of vacant houses in Toda City. We also compared the overall model results and spatial analysis to determine which method is more suitable for analysing vacant houses using urban data. Our results provide insights for future efforts to identify key factors and suitable methods for curbing vacant housing in Japan.

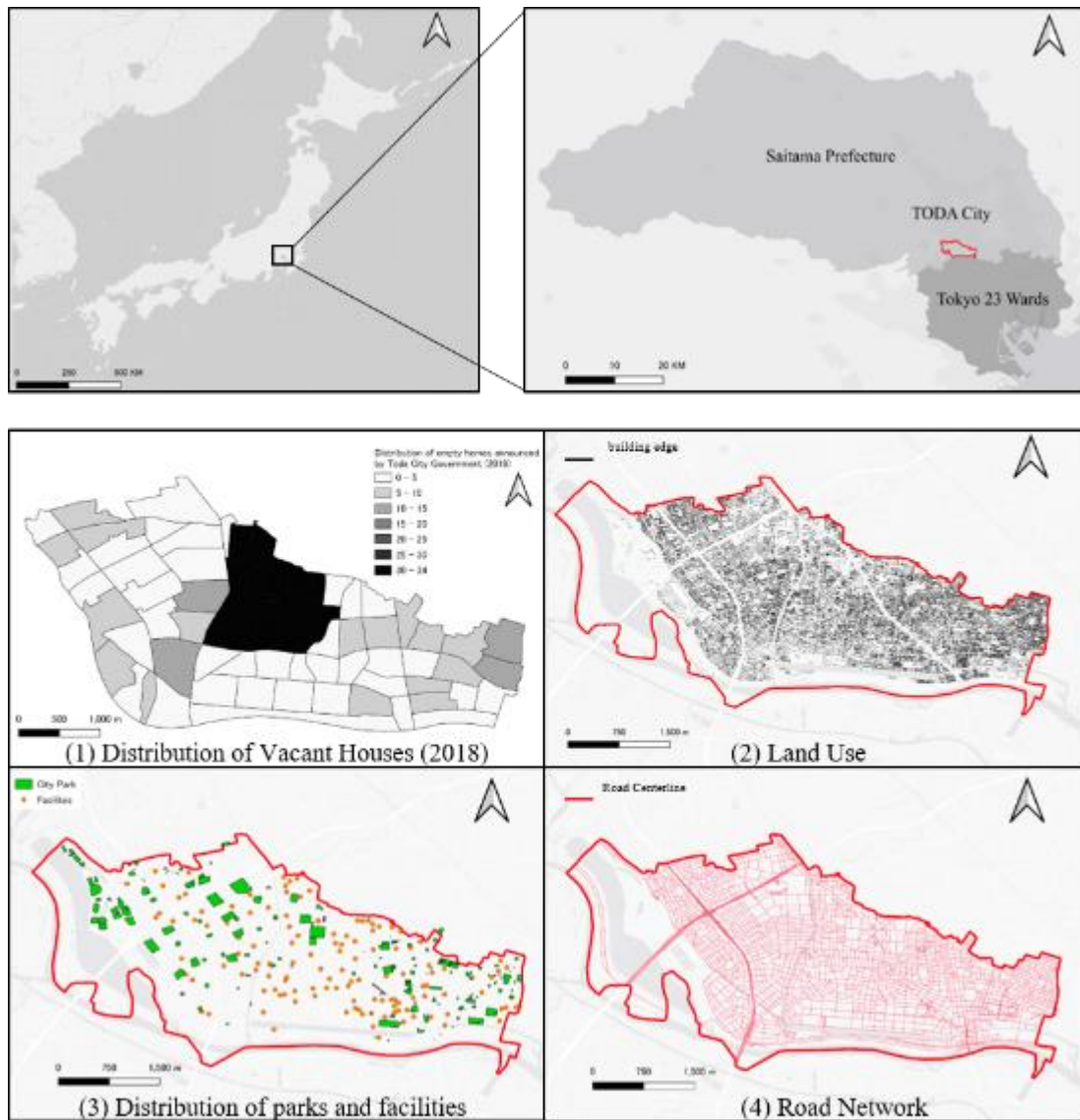


Figure 6.2. Characteristics of Toda City

6.3.2 Research Methodology

We selected both statistical data analysis and spatial data analysis methods. In terms of statistical data analysis, we followed, Shi (2022) and Segú (2020), who underscored the feasibility of linear correlation and the significance of p-values generated through t-tests for analysing vacant house distribution. Additionally, considering the suboptimal model fit, we employed a statistical visualisation method, the discretisation scatter plot proposed by Cabitza and Campagner

(2019), to examine the distribution intervals and concentration trends of the factors most correlated with vacant houses. Based on this, we conducted correlation analysis and multiple regression analysis of the various factors using the statistical data.

The spatial data analysis began with a spatial autocorrelation analysis including both global and local Moran's I analysis. The feasibility of this method for studying vacant houses has been demonstrated by Williams et al. (2019) and Lee et al. (2021). This approach helps elucidate the distribution patterns of vacant houses.

Following the preliminary examination of whether the distributions of vacant houses exhibited spatial clustering based on global and local Moran's I analysis, we employed multiscale geographically weighted regression (MGWR) to empirically analyse its feasibility in urban data studies (Yin et al., 2022; Lu et al., 2023; Yu and Lee, 2023). We used MGWR to determine the impact of various factors on the distribution of vacant houses in different areas within Toda City and to evaluate the spatial model fit for each factor.

Following the methods proposed in the abovementioned research, the major novelty of our study is its proposal of a two-step method for examining vacant houses. In this two-step method, an initial correlation analysis examines the linear relationships between various urban factors and housing vacancies. Subsequently, a multiple regression analysis quantifies the impact of these variables. MGWR enhances this analysis by accounting for spatial heterogeneity, thereby improving the model's accuracy in representing the neighbourhood characteristics of Toda City. The visualisation of the data on the most influential factors identified by MGWR provides deeper insights into their spatial distribution.

Overall, we employed two similar research methods, seeking to compare the results of statistical data analysis with those of spatial data analysis. This approach aimed to determine which model better explained the distribution of vacant houses in Toda City according to the selected neighbourhood characteristics. This comparative analysis framework enabled us to gain a deeper understanding of the mechanisms underlying patterns in vacant house

distribution (e.g., Zhang et al., 2023; Zhu et al., 2024; Yilmaz, 2023).

6.3.3 Neighbourhood Characteristics Associated with Vacant Houses

a) Living convenience variables

First, from the perspective of living convenience, this study mainly selected the facility building, service range of bus stations, and facility configuration of each town, a total of five influencing factors. The MLIT survey revealed resident concerns regarding commuting facilities, support for older adults, and child support. The survey selected five types of facilities that had been clarified as important in previous studies: convenience stores, large supermarkets (Jeon & Kim, 2020), kindergartens (Theisen, 2017), parks (Gai et al., 2023), and elderly support facilities (Kwon, 2017).

To delineate the service range for public facilities, we referred to research by NILIM (2021), which categorised daily convenience facilities into five types: commercial facilities selling fresh produce, stores for daily goods, older adult care facilities, childcare facilities, and office spaces. We determined a service range of 300 meters for two primary reasons. First, research within Japan (e.g., Chosokabe & Ogawa, 2016) indicates that residents prefer to live within 300 meters of public facilities. Similarly, international studies (e.g., Chiang et al., 2015) suggest that adjusting the service range of convenience stores better suits local contexts. The second reason is that a 500-meter service range is too large in the context of Toda City, where it would lead to an excessive number of residential building samples within that range, which might skew the statistical analysis results. Based on these considerations, residential properties located more than 300 meters from any of the five public facilities were considered more likely to be vacant, with this influencing factor denoted as 300F/N.

Determining that the service range of a bus station is 200 meters, we considered the number of buildings within the service range of a bus station in each town of Toda City as an influencing variable of living convenience, denoted

as B/N. Discussed as one of the service range, the scope of services is considered.

For a more in-depth analysis of the living convenience across various types in Toda City, we also employed the area ratio method as an independent variable. This variable was derived by dividing the area of supermarkets, convenience stores, and park facilities in each town by the area of houses in that town, represented as S/F, C/F, and P/F, respectively. Additionally, adhering to the definition in the Urban Structure Assessment Manual (MLIT, 2014), discussing the service area in terms of convenience.

b) Housing supply variables

To analyse housing supply, this study primarily considered two influencing factors: floor area and access conditions. Concerning road adjacency, the greater the distance between a house and the road, the poorer the living and site conditions of the house, and the higher the likelihood of it being vacant. In this study, the criterion for determining a house's access conditions was based on the premise that a building is road adjacent if either of its sides is close to a certified road. Buildings not connected to certified roads are classified as disconnected structures and are exempt from road proximity requirements. However, assessing a building's road adjacency merely by visually examining publicly available map data is insufficient. As illustrated in Figure 6.3, Usui and Asami (2010) proposed a GIS method for determining touchpoints using buffers, with the optimal buffer distance set at 4 m. We employed QGIS software to establish a 4-meter buffer zone starting from the road boundary. Following the logical premise of road adjacency, buildings intersecting with the road buffer zone were classified as connected, whereas those not intersecting were labelled as disconnected. The proportion of buildings with road access in each town in Toda City was designated as A/N, serving as one of the factors of access conditions.

For the dwelling's floor area, the GIS data used determined that residential buildings with an area of 15 to 150 square meters should be included, focusing the analysis on residential structures. However, the geometric area represented in publicly available building data from PLATEAU reflects the area projected by the eaves. To enhance the accuracy of the identification of vacant houses in Toda City, this study categorised floor areas into three groups: 15–64 square meters,

65–99 square meters, and 100–150 square meters. The proportion of floor area in each town was calculated for these categories, establishing the impact factors as 15–64/N, 65–99/N, and 100–150/N.



Figure 6.3. Criteria for determining adjacent conditions

c) Policy support

This study incorporated the current residence promotion district (RPD) area published by the MLIT as a judgment condition to consider policy support. When the Japanese government revised the Act on Special Measures Concerning Urban Renaissance in 2014 in the face of a shrinking population and urban constraints, specific areas were designated as part of the RPD to maintain a certain population density, as illustrated in the upper part of Appendix 1. The relationship between vacant house distribution and the RPD policy is crucial; therefore, whether each town was part of the RPD was considered an evaluation criterion in this study. According to the Toda City Land Adaptation Plan announced by the local government (bottom of Appendix 1), the total RPD area in Toda City covered 1.086 hectares in 2019, constituting 81% of the RPD. Considering that the residential inducement area is not demarcated by town boundaries, the area ratio in each town was calculated binarily. If the residential inducement area was below 50%, the ratio was 0. If it exceeds 50%, the ratio was 1.

This study's research methodology involved analysing 10 parameters related to housing supply and living convenience as independent variables, with policy support acting as the control variable for the final analysis results and the

distribution of vacant houses in Toda City.

6.3.4 Research Data

A thorough examination of the existing literature and case studies reveals numerous investigations into the correlation between vacant houses and neighbourhood characteristics such as transportation and facilities. Park et al. (2021), who compiled factors related to vacant houses in Korean cities, emphasised population density, ageing, urban structure, housing size, facility distribution, and alleyway layouts. Samoto and Miyagawa (2021) highlighted the impact of urban transportation networks and the development of public transportation facilities on vacant house distribution, focusing on factors like building density, age, and proximity to roads and schools. Ardeshiri (2018) underscored the significance of residents' perspectives in their choices of urban facilities. Figure 6.4 resents this study's research process and framework.

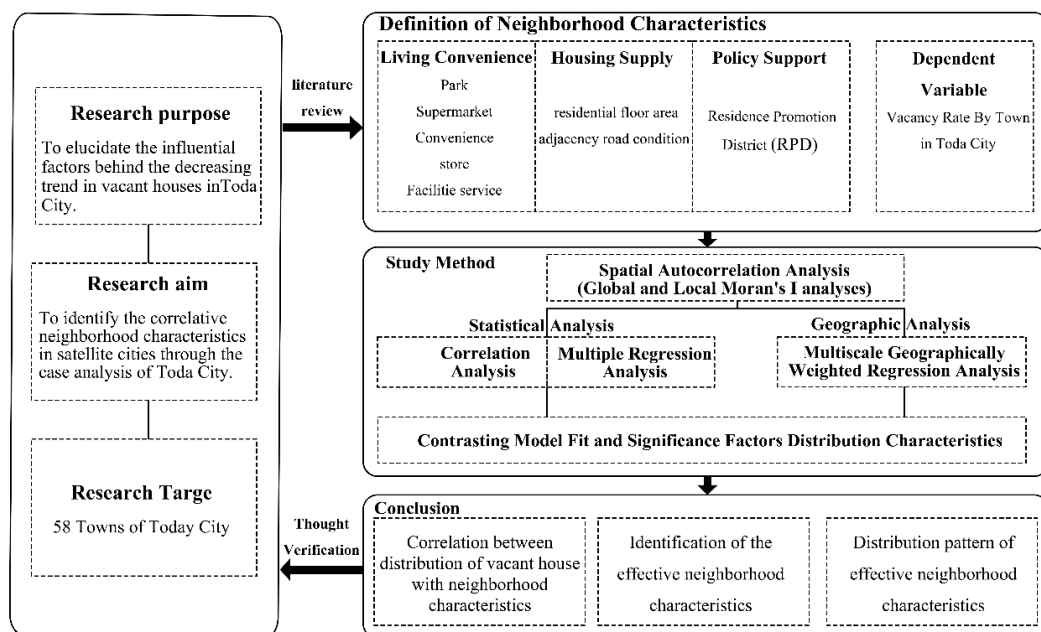


Figure 6.4. Research process and framework

In selecting data, this study specifically chose indicators related to neighbourhood characteristics from urban indicators guiding functions and floor area (MLIT, 2014). Subsequently, factors associated with the distribution of known vacant houses in Toda City (Figure 6.2) were extracted and a comprehensive analysis of their relationship was conducted and verified. Given that the published distribution of vacant houses is organised by the number of vacant houses in each town (Table 2), this study analysed the living convenience of each of the 58 towns in Toda City by reorganising 10 relevant variables into an impact variable model. The town level, referred to as ‘Chome’ in Japanese, serves as the smallest statistical unit for the census and most public statistic surveys (Kidokoro et al., 2023). Through this process, this study aimed to enhance the understanding of how policy support influences the relationship between vacant housing, living convenience, and housing supply and confirm their correlation with the distribution of vacant housing.

The data used in this study was drawn from the latest map data developed by the MLIT, named PLATEAU (<https://www.mlit.go.jp/plateau/>). PLATEAU was selected because, in comparison to other publicly available government geographic information, it offers more detailed information, such as building area, height, and land use, than other datasets. This choice significantly reduced the time required for data analysis and computation, facilitating the research process. From the 2022 edition of the PLATEAU data, this study directly selected geographical information on building area and facilities, the distribution of public facilities, the administrative boundaries of towns, and road information. As shown in Table 3, following the methods described in Section 3.3 for data sourcing and computation, we calculated the proportion of residential areas outside service areas, the proportion of houses with adjacent roads in each town, the ratio of facility areas to residential areas, and other factors, resulting in a total of 10 variables.

Table 6.1. Definition of neighbourhood characteristics and summary of data

Neighbourhood characteristics	Data perspective	Influencing factor	Abbreviation	Type of Data
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Living convenience	Service range	Houses outside a 300-meter service radius of all public facilities in each town	300F/N*	Numeric al ratio
	Service area	Ratio of the total residential floor area of a supermarket to residential floor area in each town	S/F**	Area ratio
		Ratio of the total residential floor area of the park area in each town	P/F	Area ratio
		Ratio of the total area of a convenience store to residential floor area in each town	C/F	Area ratio
		Proportion of houses within a 200-meter service radius of a bus stop in each town	B/N	Numeric al ratio
Housing supply	Access conditions	Proportion of houses with adjacent roads in each town	A/N	Numeric al ratio
	House area	Proportion of residential floor area in each town between 15 and 64 square meters	15-64/N	Numeric al ratio
		Proportion of residential floor area in each town between 65 and 99 square meters	65-99/N	Numeric al ratio
		Proportion of residential floor area in each town between 100 and 150 square meters	100-150/N	Numeric al ratio
Policy support	Policy perspective	Residential-induced regional planning	RPD	Numeric al ratio

* N is the sum of the number of houses in Toda City

** F is the sum of floor area in Toda City

6.4 Analysis Results

Following the research methods and procedures outlined in Section 3.4, we first collected and processed the selected data. After obtaining the data characteristics, we conducted statistical data analysis and an analysis of the vacant house data, and then compared the two. We first analysed the data characteristics of the 10 variables in Toda City, as shown in Table 6.2

Table 6.2. Main characteristics of the variables in Toda City (N=58)

Analysis perspective	Influencing factors	Minimum	Maximum	Mean	Std. Deviation
	VH/N*	0.00	0.05	0.0095	0.00827
Living convenience	300F/N	0.00	0.89	0.2233	0.24836
	S/F	0.00	0.45	0.0229	0.07224
	P/F	0.00	7.76	0.1982	1.01274
	C/F	0.00	0.01	0.0016	0.00282
	B/N	0.20	1.00	0.8664	0.17728
Housing supply	A/N	0.17	0.58	0.3331	0.07439
	15–64/N	0.03	0.68	0.3722	0.10168
	65–99/N	0.05	0.29	0.2059	0.05658
	100–150/N	0.05	0.20	0.1292	0.03504
Policy support	RPD	0	1	0.83	0.381

*VH/N: Vacancy rate in each town

6.4.1 Moran's I results

To assess the distribution of vacant houses in Toda City, this study incorporated spatial autocorrelation analysis, examining whether the vacancies exhibited distinct spatial characteristics across various neighbourhoods. The study utilised both global and local Moran's I analysis to dissect the distribution trends and their significance, with findings despite of 3.981130 and a significantly low p-value of 0.000069 (Table 6.3). These results suggest that there is less than a 0.01% probability that this spatial pattern is the result of random chance, indicating that the spatial distribution of vacant houses in Toda City is not random but significantly clustered.

The Local Moran's I provided more nuanced insights into these patterns, indicating specific neighbourhoods where vacant houses are concentrated. Figure 6.5 illustrates areas of clustering where vacant houses were significantly more prevalent than the average (High-High cluster), such as Sasame 7-chome and Hayase 1-chome, with a total of four chomes located in the southern area of Toda City. The figure also shows clusters where vacant houses are less prevalent than the average (Low-Low cluster), such as Ōaza Bijogi chome and Bijogi Higashi 2-chome, which are clustered in the northwestern direction of Toda City. In addition, it highlights spatial outliers where a high prevalence of vacant houses is surrounded by areas with a low prevalence (High-Low outlier) and vice versa (Low-High outlier), for example, Sasame 8-chome.

Based on these results, we can conclude that certain areas in Toda City exhibit statistically significant clustering of vacant houses. The presence of statistically significant clustering in specific areas implies that random chance alone does not account for the spatial distribution of vacant houses, suggesting the influence of underlying neighbourhood facts.

Table 6.3. Summary of global Moran's I results

Moran's Index	0.256172
Expected Index	-0.017544
Variance	0.004727
Z-score	3.981130
P-value	0.000069

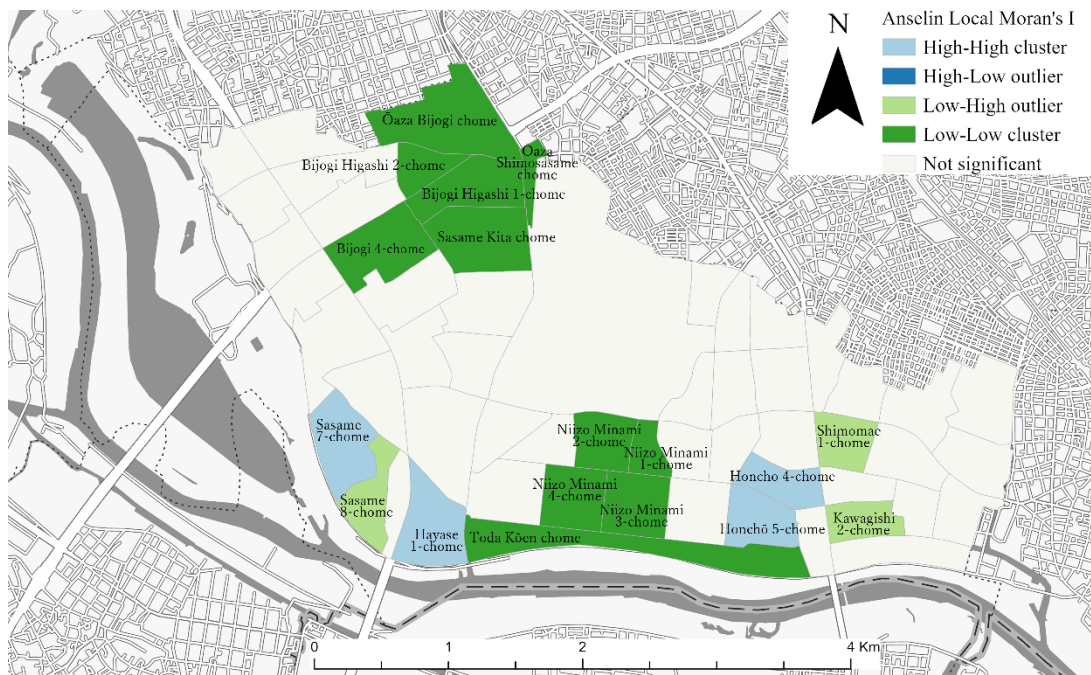


Figure 6.5. Local spatial autocorrelation distributions of vacant house rates in each town of Toda City

6.4.2 Statistical Data Analysis Results

a) Linear correlation between vacant houses and neighbourhood characteristics

This study treated the vacancy rate in each town as the dependent variable, examining other factors as independent variables. A 95% confidence interval was set for the statistical results. This confidence level was used to determine the significance of the correlations, highlighting the robustness of the results for factors where $p < 0.05$ and $p < 0.01$.

The correlations between the 10 independent variables and the vacancy rate in each town are presented in Table 6.4 and Figure 6.6. The variable 65–99/N exhibited the strongest correlation with the vacancy rate in each town, followed closely by the floor area of 100–150, which demonstrated a similar correlation. Other factors, such as 300F/N, did not show a direct correlation with vacant housing; however, we believe this result helped clear potential threats of

collinearity prior to the next step in our linear regression analysis.

Second, concerning linear correlation (Figure 6.6), both the bus stop and access condition variables displayed correlations with the vacancy rate in each town. The proportion of houses within 200 meters of a bus stop showed a positive correlation with the vacancy rate, whereas the proportion of houses with access conditions showed a negative correlation with the vacancy rate in each town.

Residences with larger floor areas were more likely to be vacant. Regarding living convenience, a greater distance to a bus stop and a lower proportion of houses with access conditions were correlated with a smaller vacancy rate. The bus stop variable exhibited a positive correlation with all residential size categories, with larger floor areas displaying a smaller ratio and reduced correlation. Conversely, the access condition variable demonstrated a negative correlation with all floor area categories, with larger floor areas showing a diminished ratio and correlation. Housing supply emerged as a robust explanatory factor for the proportion of vacant houses in each town in Toda City.

Finally, despite the variable S/F not displaying overt significance, its p-value of 0.067 was statistically meaningful, justifying its consideration as a factor influencing the vacancy rate.

Table 6.4. Correlation between house vacancy rate and each neighbourhood characteristic (N=58)

Correlations										
Factors	Living convenience					Housing supply			Policy support	
	300F/ N	S/F	P/F	C/F	B/N	A/N	15- 64/N	65- 99/N	100- 150/N	RPD
Pearson	-0.084	0.242	-0.054	-0.071	0.267	-0.317	0.076	0.448	0.283	0.188
VH/ Cor.					*	*		**	*	

T	Sig.	0.530	0.067	0.685	0.599	0.043	0.015	0.571	0.000	0.032	0.158
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Note: * $p < 0.05$, ** $p < 0.01$

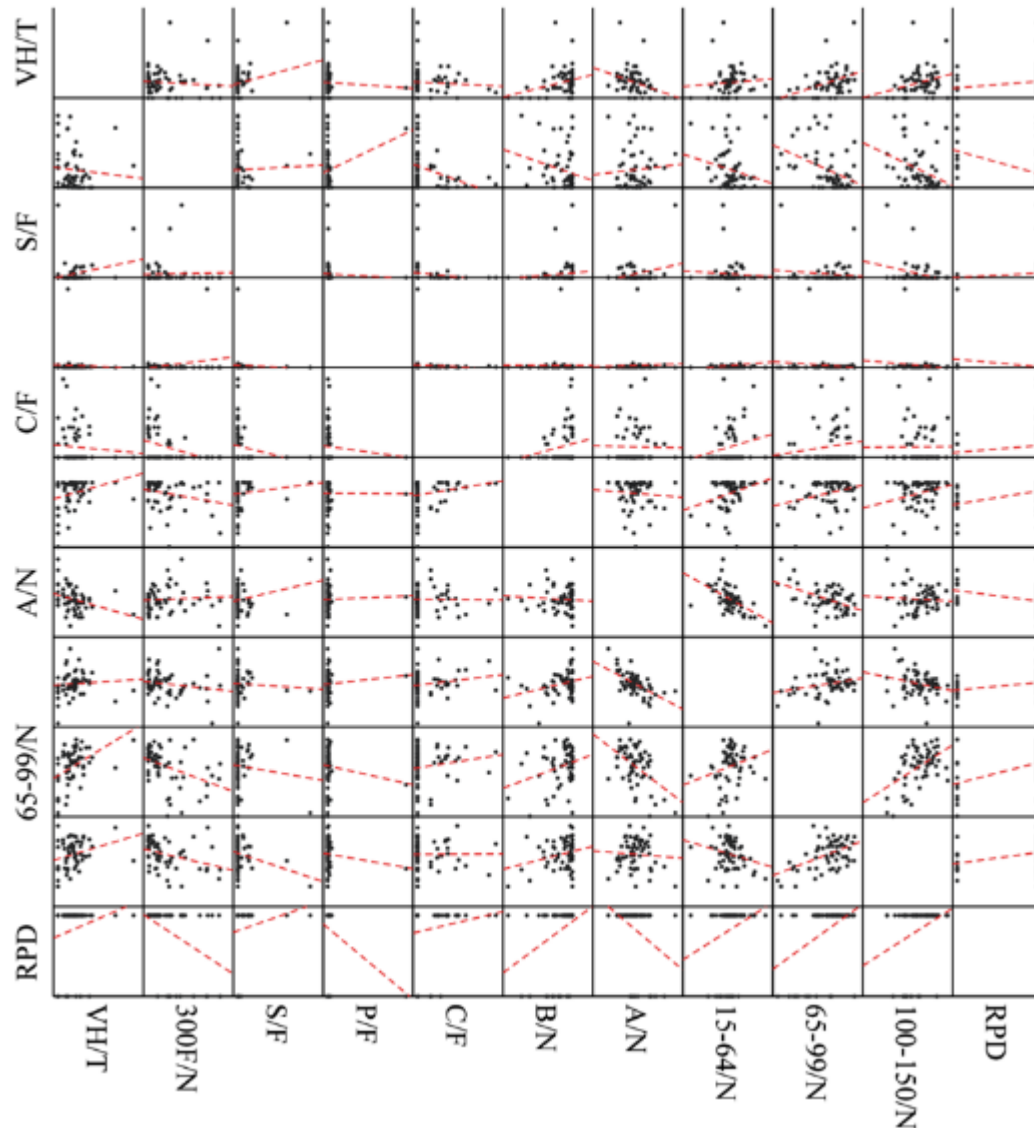


Figure 6.6. Linear correlation results for each variable

b) Multiple regression analysis

We employed linear regression analysis to establish mathematical models, assessing the relationships and correlations between independent and dependent variables. We identified the positive or negative correlations between the 10

independent variables from three perspectives contributing to vacant houses, as shown in Table 6.6.

The overall significance of the multiple regression model, as indicated by the statistical value *F*, was 3.228, with a corresponding *p*-value of 0.003, signifying the model's significance. At 0.281, the adjusted *R* square indicated that the overall fit of the model was not good. This finding supports the earlier correlation analysis results showing that the relationships between the factors were relatively weak.

Overall, the model fit was relatively robust. In the S/F, the model showed a significantly positive influence, signifying that an increase in supermarket facilities correlates with a rise in the vacancy rate of each town in Toda City. Additionally, the coefficients of 65–99/N and 100–150/N on the vacancy rate were noteworthy, at 0.271 and 0.250, respectively. However, other factors (300F/N, P/F, C/F, B/N, 15-64/N, RPD) lacked significance in the model, demonstrating weaker explanatory power. Analysis of the *t*- and *p*-values of each variable revealed that, among the 10 variables, S/F in housing convenience and A/N in housing supply had a high significance for the vacancy rate of each town in this research model.

The traditional multiple regression model failed to fully capture the spatial heterogeneity and dependency that influence housing vacancy rates in Toda City. This limitation may be due to the omission of geographic location and region-specific factors. Consequently, although variables such as living convenience and housing supply showed significance, their explanatory power may have been limited by the lack of spatial data features. Thus, we conducted an analysis from a spatial perspective and compared it with the statistical data analysis.

Table 6.5. Multiple regression analysis results (N=58)

Analysis perspective	Factors	Beta	T	P	VIF	F	Significance	Adjusted R Square
Living	300F/N	0.061	0.419	0.677	1.676			

convenience	S/F	0.419	3.089	0.003	1.459			
	P/F	-0.016	-0.130	0.897	1.167			
	C/F	-0.026	-0.204	0.839	1.272			
	B/N	0.162	1.174	0.246	1.507	3.228	0.003 ^b	0.281
Housing supply	A/N	-0.360	-2.116	0.040	2.298			
	15–64/N	-0.083	-0.482	0.632	2.332			
	65–99/N	0.271	1.618	0.112	2.224			
	100–150/N	0.250	1.437	0.157	2.405			
Policy support	RPD	-0.189	-1.273	0.209	1.741			

6.4.3 Spatial distribution characteristics analysis

This study analysed the spatial distribution characteristics using the MGWR approach. The results are presented in Table 6.6; Figure 6.7. The MGWR analysis elucidated the factors influencing vacant housing within Toda City. The model's statistical integrity was affirmed by an R-squared value of 0.7626, reflecting that a significant portion of the variance in the distribution of vacant housing was explained by the model. An adjusted R-squared of 0.6477, alongside an Akaike information criterion corrected (aicc) of 141.9366, attested to the model's robust explanatory capacity. The sigma-squared value of 0.3494 and a sigma-squared maximum likelihood estimate (MLE) of 0.2374, with an effective degree of freedom of 39.4105, substantiated the model's precision in depicting spatial variation.

In Figure 6.7, blue represents areas where the model overpredicted the dependent variable, red indicates regions where the model underestimated the dependent variable, and green corresponded to areas where the model's predictions closely matched the observed values. These observations align with the model's goodness-of-fit, highlighting the degree to which the model accurately captured the spatial distribution of vacant houses in Toda City.

Table 6.6. MGWR result and model diagnostics

R-Squared	0.7626
Adjusted R-Squared	0.6477
Aicc	141.9366
Sigma-Squared	0.3494
Sigma-Squared MLE	0.2374
Effective Degrees of Freedom	39.4105

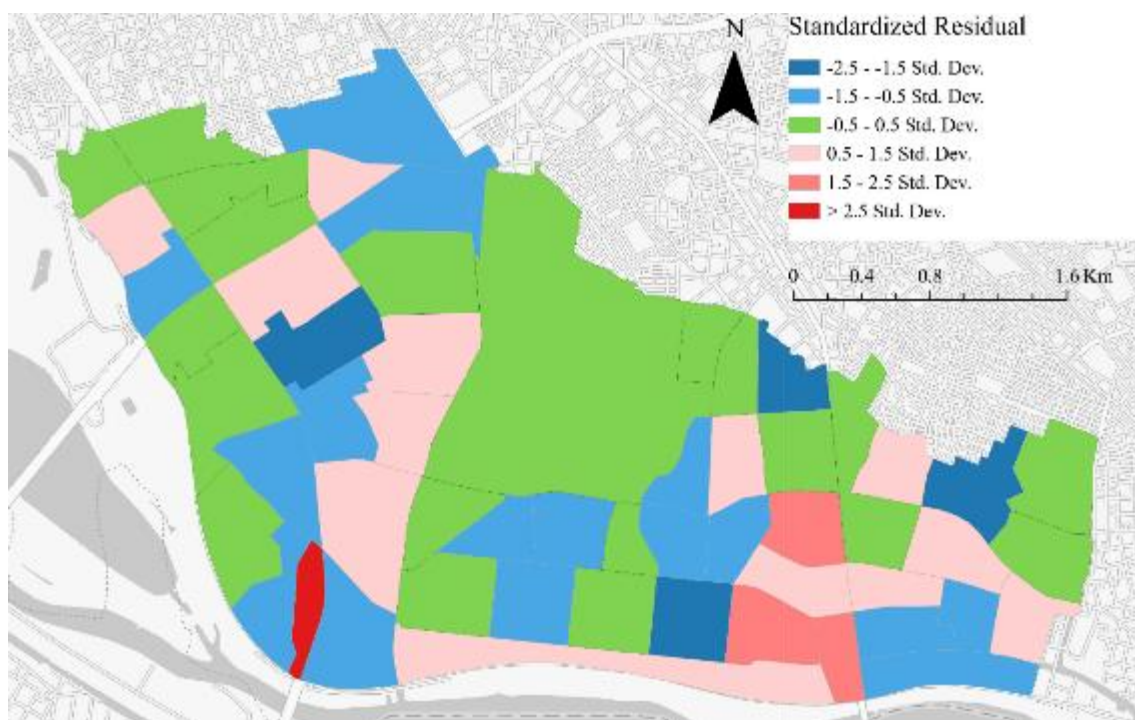


Figure 6.7. MGWR standardised residual distribution characteristics result

We also conducted separate analyses of the distribution characteristics and positive/negative correlations of each factor in the neighbourhoods of Toda City, aiming to compare them with the conclusions drawn from the data feature analysis. These analyses were performed to arrive at conclusions regarding the spatial distribution of significant factors in both data and space. The distribution of MGWR for each factor is shown in Table 6.8 and Appendix 2.

Regarding the distribution characteristics of various factors in Toda City, the results revealed a positive correlation between living convenience variables, such as the number of facilities within a 300-meter radius (300 F/N) and the surface area of facilities (S/F), and vacant house distribution. This positive correlation was observed in 4 and 58 significant towns, respectively, suggesting that enhanced accessibility to amenities is inversely related to housing vacancy, likely due to increased attractiveness for occupancy.

Housing supply, denoted by A/N, inversely affected vacancy rates across 58 significant towns, suggesting that an excess in housing provision is a precursor to higher vacancies. Conversely, specific housing size categories, particularly 65–99/N and 100–150/N, were positively correlated with vacancies in 5 and 17 towns, respectively, indicating a likelihood for certain house sizes to remain unoccupied.

In terms of policy support, the RPD variable exhibited a negative coefficient in a single significant town, hinting at the potential efficacy of policy measures in fostering reduced vacancy rates. This suggests that targeted policy support, particularly in designated residential promotion districts, may be instrumental in mitigating vacancy levels.

There were commonalities between the statistical data analysis and spatial analysis. The statistical analysis identified the most closely related factors affecting the distribution of vacant houses in Toda City. We focused on further analysis of the S/F (living convenience) and A/N (housing supply) factors to understand their forms and influence in Toda City.

Table 6.7. Relationship between the number of significant MGWR towns and positive/negative correlations

Analysis perspective	Influencing factor	Number of Significant Towns	Positive-Negative Correlation
Living convenience	300F/N	4	+
	S/F	58	+
	P/F		
	C/F		
	B/N		
Housing supply	A/N	58	-
	15-64/N		
	65-99/N	5	+
	100-150/N	17	+
Policy support	RPD	1	-

6.4.4 Scatterplot analysis of high-significance factors and vacant houses

Combining the linear correlation analysis with the results of the multiple linear regression analysis, we aimed to understand the relationship between the distribution of vacant houses in Toda City and the two most relevant factors: S/F (living convenience) and A/N (housing supply). The investigation involved the extraction of these two factors individually, followed by a scatter state analysis correlating each town's vacant house rate, as represented in Figure 6.8.

Regarding S/F, the ratio of supermarket area to residential area in each

district of Toda City predominantly fell within the interval of low housing vacancy rates (0–10%), with a concentrated trend of the size of the ratio's data points mainly within the 0–15% range. This suggests that in areas with a lower vacancy rate in Toda City, the distribution of the ratio of supermarket area to residential area is concentrated and more correlated with the vacancy rate when the ratio falls within the range of 0 to 0.15.

Concerning A/N, the scatter plot primarily spread across the higher vacancy rate interval (30%–40%), with the proportion of residences with road access distributed in the 5%–15% range for each town. This indicates that in areas of Toda City with a higher vacancy rate, the proportion of residences with road adjacency is more correlated with the vacancy rate when it falls within the 5%–15% range. The results imply that when the vacancy rate in a town in Toda City is relatively low, it may be more correlated with the distribution of convenient supermarket facilities. Conversely, when the vacancy rate is higher, it may be more correlated with the proportion of residences within that town having road adjacency.

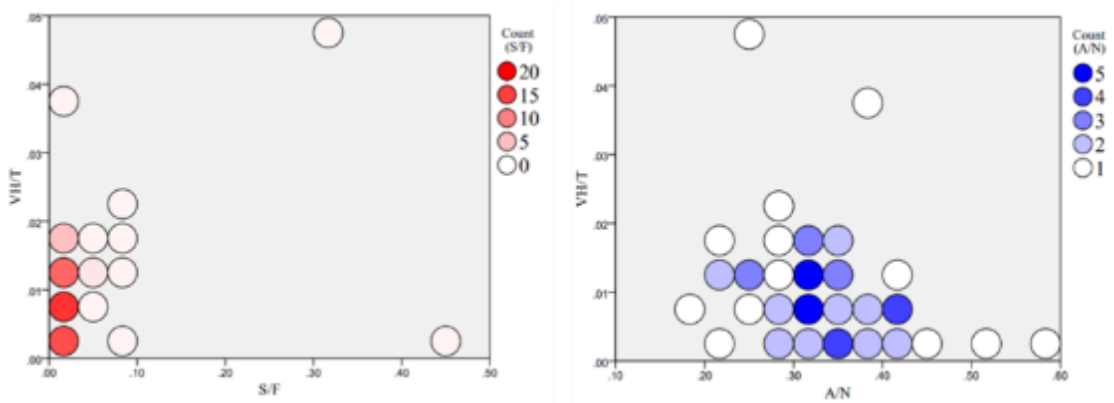


Figure 6.8. Scatterplot and centroid coordinate analysis of S/F & A/N

6.5 Summary of Chapter 6

This chapter analysed vacant-housing dynamics in Toda City, a suburban

municipality within the Tokyo metropolitan area, by comparing conventional statistical techniques (correlation, multiple regression, cluster analysis) with spatial diagnostics (global/local Moran's I and MGWR). The spatial approach demonstrated superior model fit (MGWR over OLS), indicating that neighbourhood-scale heterogeneity is crucial for explaining vacancy patterns in a non-tourism suburban setting. Across methods, two neighbourhood variables consistently stood out: the supermarket-to-residential area ratio (S/F), positively associated with vacancy, and road access conditions (A/N), negatively associated with vacancy, reaffirming the salience of everyday accessibility and built-form connectivity.

Positioned alongside the nationwide metropolitan study and the Kyoto tourism case, the Toda analysis contributes a suburban, non-tourism pathway in which local conditions modulate vacancy outcomes under metropolitan influence. The chapter underscored the limits of purely statistical models for neighbourhood phenomena and highlighted the value of spatially explicit methods for interpreting fine-scale variation without introducing constructs beyond the dissertation's established framework.

Building on these findings, the next chapter integrates evidence from the metropolitan (Chapter 3), tourism-led regional (Chapter 4), and suburban neighbourhood (Chapter 6) analyses to articulate a multi-path account of the gentrification–vacant housing nexus in Japan, drawing comparative implications for theory and policy.

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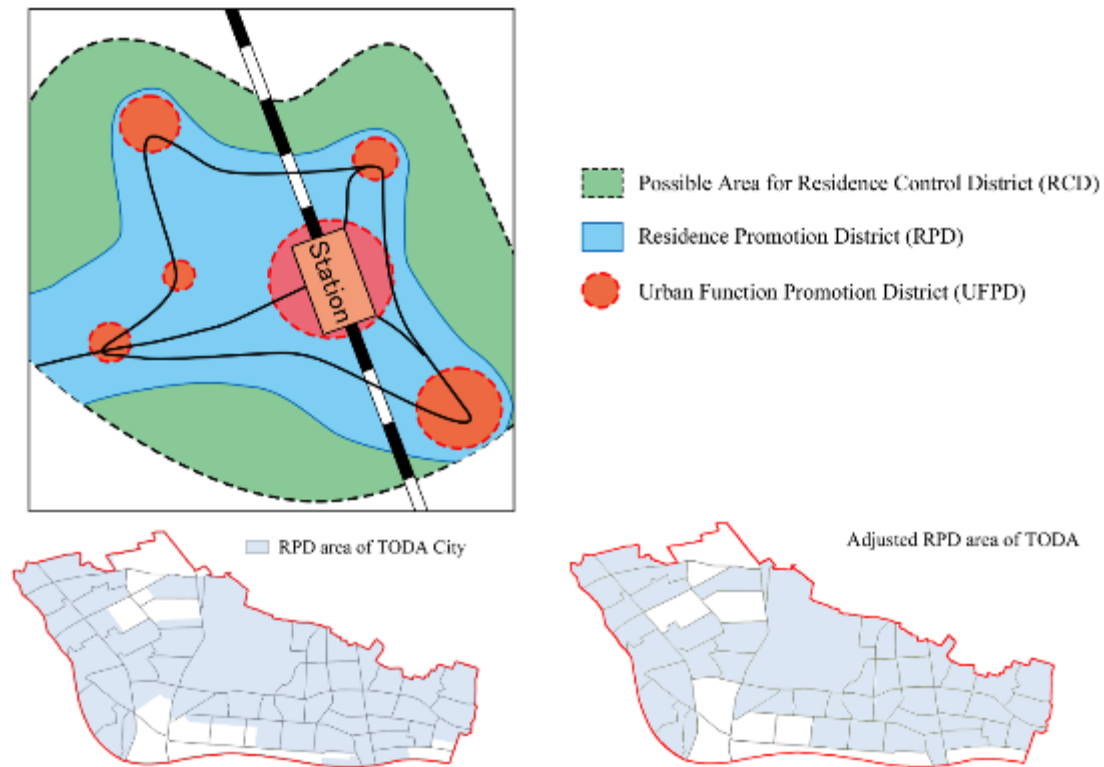
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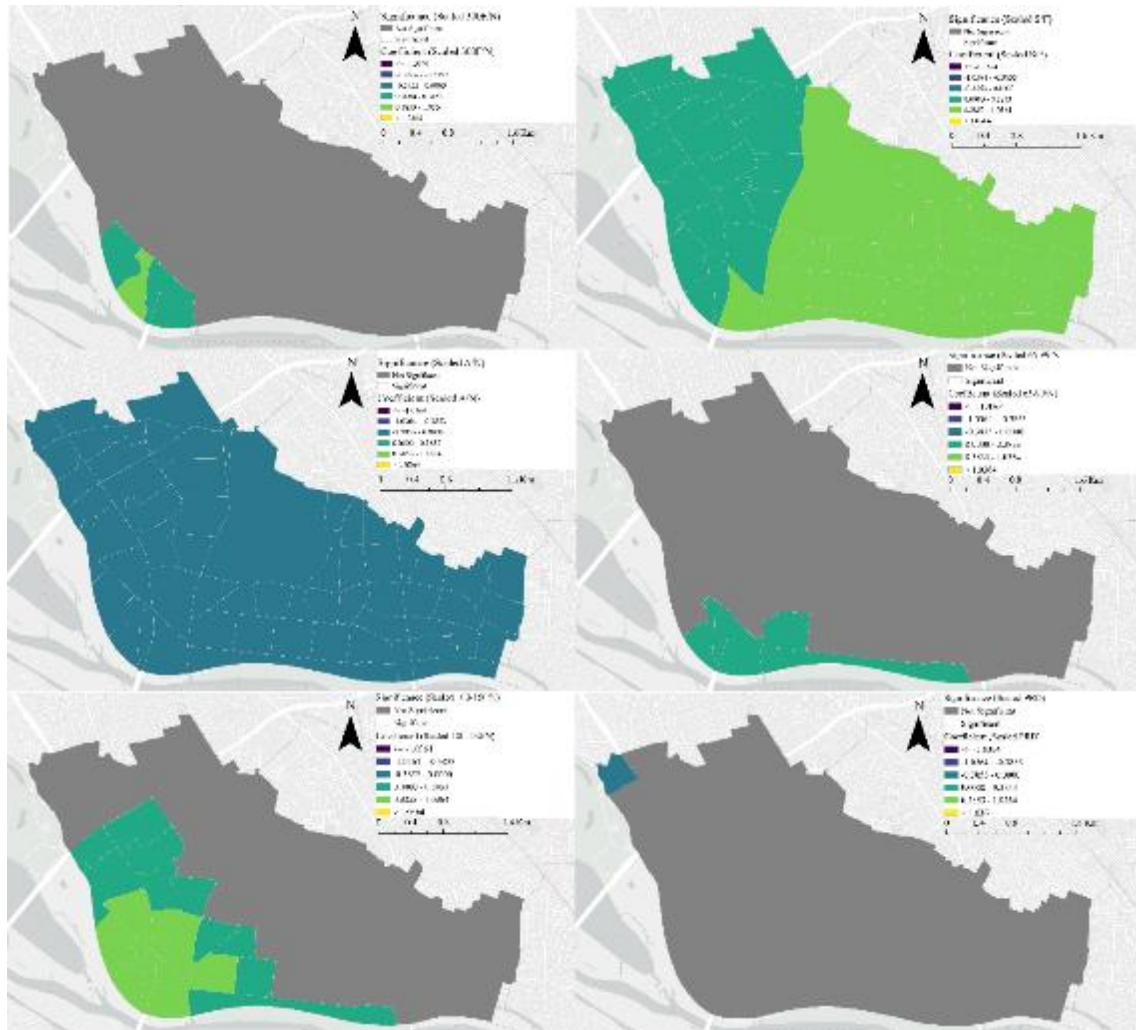
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Appendix L. Regional localization of RPD and adjusted RPD distribution by town in Toda City



Appendix M. Distribution characteristics of each factor in MGWR



Chapter7

General Discussion

7.1 Combined discussion

This section synthesizes the evidence from Chapters 4–6—metropolitan areas, Kyoto Prefecture, and Saitama–Toda—and frames the discussion that follows.

- a) Metropolitan areas (Chapter. 4). Changes in WCEP and LP consistently track where vacant housing tends to rise or fall across metropolitan areas, while core zones and outer zones do not move in the same way. These broad signals are useful for the overall picture, but they do not explain every place equally well.
- b) Kyoto Prefecture (Chapter. 5). Where visitor activity is strong, the link runs through the price–rent channel: tourism pressure reshapes LP and rents and expands SLTR. Effects are clearer over longer time windows than over short windows. This connects the metropolitan signals to a concrete mechanism in a tourism context.
- c) Saitama—screening under similar conditions (Chapter. 6). When municipalities are made structurally comparable (standardised HH, HRB, HO, TIE, WCEP, LP; k-nearest, mainly k=5), vacant housing still differs. Within the inner-ring group with high WCEP and positive LP, Toda shows negative Δ VACANCY; administrative statistics for 2018 support this (overall 8.4%, second lowest in the prefecture; “other vacant houses” 0.9%, lowest). This provides a clear, data-driven reason to study Toda more closely.
- d) Toda—neighbourhood patterns (Chapter. 6). Two local measures point in opposite directions and remain stable across checks: service floor area per housing floor area (S/F) is linked with higher vacancy, while frontage on main roads (A/N) is linked with lower vacancy.

7.2 Metropolitan areas discussion

This subsection consolidates the metropolitan-area results to clarify how

WCEP and LP relate to vacancy, and how differences between core and outer zones motivate finer-scale analysis in the next sections.

To explore the driving factors of gentrification in Japan's three metropolitan areas, we focused on two main aspects: statistical data analysis and INDEX quadrant classification. The statistical analysis provided insights into the correlation coefficients and explanatory power of the models for each metropolitan area. The INDEX classification illustrated the geographic distribution of the gentrification characteristics over the past 15 years, highlighting the spatial distribution patterns in the context of increasing white-collar populations within each metropolitan area.

The data analysis revealed significant regional diversity, with both correlational and multiple regression analyses highlighting the critical role of WCEP in the gentrification process in these areas. The clustering of high-income occupations and intensification of land prices were particularly evident in the Tokyo and Kansai metropolitan areas. WCEP emerged as a consistent driver of rising land prices and high-rise building development, indicating that occupational restructuring plays a key role in shaping urban spatial change. This relationship was especially pronounced nationwide and in Tokyo Metropolitan Area and Kansai Metropolitan Area. This supports similar findings in studies focusing on the Japanese region, such as Dantsuji et al. (2023), which highlighted fluctuations in population mobility and densities. These conclusions align with findings from previous global experiences, such as that of St. Petersburg (Axenov, 2014), Amsterdam (Hochstenbach & Musterd, 2021) and six coastal settlements in New Zealand (Freeman & Cheyne, 2008).

The INDEX quadrant classification and spatial distribution characteristics, as discussed by Yoshimichi et al. (2017), revealed diverse urban forms across metropolitan and city spaces. Previous studies (López-Gay et al., 2021; Smith et al., 2021) highlighted that rural areas with increasing in-migration rates may signify new frontiers of gentrification. The central wards of Tokyo Metropolitan Area displayed mismatched housing demands, a phenomenon documented by Kidokoro et al. (2023). The complex gentrification processes in Osaka, within Kansai Metropolitan Area, aligned with Kirmızı (2019), indicating a consistent pattern of urban transformation and socioeconomic shifts.

These findings echo broader international perspectives that gentrification today is often driven more by socio-occupational change than direct displacement. For example, in Guangzhou, rising income groups—not the removal of low-income residents—were central to urban change (Zhu et al., 2022). In Paris, household composition rather than workforce composition was key (Clerval, 2022), while in New Zealand and the US, indicators like youthification and professionalisation were significant (Bereitschaft, 2020; Freeman & Cheyne, 2008). These comparative insights reinforce the relevance of applying tailored indicators in Japan’s context, where conventional class-based gentrification models are less applicable.

While metropolitan-scale trends offer a general picture, the neighbourhood-level results captured internal fragmentation often obscured in larger wards. For instance, the coexistence of both first and fourth quadrant wards within Chuo-ku and Taisho-ku illustrates the uneven geography of gentrification pressures—emphasizing the need for multi-scalar approaches in urban analysis.

In summary, this study validates the usefulness of combining statistical regression with a quadrant-based typology to understand urban change in the Japanese context. The INDEX framework, by linking occupational shifts and housing supply dynamics, provides a robust lens through which the spatial unevenness of gentrification can be visualised and compared across scales.

These metropolitan-area results frame the discussion in §7.3 on Kyoto Prefecture, where price–rent dynamics and SLTR help explain how market signals relate to VACANCY in a tourism context.

7.3 Kyoto Prefecture discussion

Tourism-related pressures in Kyoto Prefecture are examined with a focus on how they relate to SLTR through changes in land price over 2008–2018.

This study analyzed how tourism gentrification reshaped the housing structure in Kyoto Prefecture between 2008 and 2018, focusing on its influence on SLTR and the mediating role of land price. Four hypotheses were tested using

descriptive, regression, and Bootstrap methods across three periods.

Tourism gentrification has occurred in Kyoto. Rapid increases in tourism consumption and land-use shifts toward commercial development are evident in the data. Public infrastructure, such as parks and residential land, declined in tourist-saturated areas, echoing tourism gentrification patterns observed in Barcelona (Cocola-Gant, 2016), Thessaloniki (Katsinas, 2021), and Seville (Jover & Díaz-Parra, 2020).

The regression models indicate a positive relationship between CTS and the ratio of SLTR change over the full 2008–2018 period, reflecting the conversion of long-term rental into short-term rental. This aligns with the findings from Greece (Katsinas, 2021) and Iceland (Mermet, 2017). Additionally, home ownership rate consistently correlates with increased SLTR ratio, suggesting that owner-occupation reduces long-term rental supply—a trend observed by Sequera and Nofre (2020) and Robertson et al. (2022).

CTS is negatively associated with land price change, potentially because of saturation or declining residential desirability in tourism-heavy districts. Land price change, in turn, negatively impacts SLTR, indicating a mediating mechanism. This aligns with insights from Kim and Holifield (2024), Wachsmuth and Weisler (2018), and Martin and Beck (2018), who highlighted how tourism-induced stress can destabilize housing markets.

The Bootstrap test confirmed a significant mediation effect via land price only in the 2008–2018 model. The absence of significance in the short 2008–2013 and 2013–2018 periods suggests that the tourism gentrification–housing relationship evolves cumulatively, requiring longer observation windows.

Overall, the results underscore that tourism gentrification transforms urban spaces and indirectly destabilizes housing by dampening the growth in land price. These findings challenge the assumption that tourism-driven development uniformly raises property values. Instead, nuanced pathways shape housing stress in heritage cities.

7.4 Saitama Prefecture Discussion

This section examines whether metropolitan/tourism proxies extend to a suburban, non-tourism corridor and discusses what the prefecture-wide screening reveals for selecting a neighbourhood-scale study site.

The results show a selective reach of the metropolitan/tourism proxies. Signals tied to WCEP and LP are informative in inner-ring settings but do not explain vacant housing uniformly across the prefecture. This pattern is consistent with Japan's recent restructuring, where occupational upgrading and redevelopment—rather than classic class polarisation—shape where and how change occurs.

To examine differences under comparable structural conditions, a prefecture-wide, unanchored MSSD screen was run with k -nearest comparisons (primarily $k = 5$) using standardised HH, HRB, HO, TIE, WCEP, LP. Even among municipalities that look similar on these covariates, vacancy remains differentiated. Within the inner-ring, high-WCEP/positive-LP group, Toda exhibits negative Δ VACANCY, i.e., lower vacancy than its most-similar peers. Administrative statistics for 2018 support this profile.

These findings justify a shift to a neighbourhood-conditions lens. First, the prefecture-wide evidence indicates that similar structural exposure can still yield different vacancy outcomes, which calls for tools that allow relationships to vary by place. Second, Toda provides a transparent, data-driven case for close-up analysis under comparable conditions while avoiding strong influences from tourism corridors and inner-core dynamics.

In short, the Saitama analysis (i) clarifies the limits of proxy generalisation at the prefectural scale and (ii) establishes Toda as an appropriate site for neighbourhood-level investigation into how accessibility, road adjacency, and built-environment attributes relate to vacancy over time.

7.5 Toda City Discussion

Based on the methods and processes of this study, we primarily focused on traditional data analysis, including correlation analysis, multiple regression analysis, and cluster analysis, and compared these with spatial data analysis to evaluate their respective outcomes. In terms of goodness of fit, the MGWR model (Adjusted R-squared: 0.6477) is superior to the multiple regression model (Adjusted R-squared: 0.281). This suggests that, for Toda City, spatial variation matters: neighbourhood context explains vacancy patterns better than a single city-wide set of coefficients. In future studies of vacant-house distribution in satellite cities, analysis methods that capture spatial distribution characteristics should be prioritised.

From the perspective of significant factors and their distribution characteristics, both analytical approaches consistently highlight the area ratio of supermarkets to houses (S/F) and road adjacency (A/N) as pivotal determinants of VACANCY. Specifically, S/F exhibits a positive correlation with vacancy in each town, while A/N exhibits a negative correlation. The conclusions in Baba and Hino (2019) and Baba and Asami (2017) on adjacency conditions differ from the present findings. Because this study introduces a novel indicator—the ratio of supermarket facility area to residential area—direct comparison with prior work is difficult. Even so, in terms of urban convenience, the findings align with evidence on grocery stores in Japan (Baba & Asami, 2017) and convenience stores in Taiwan (Chiang et al., 2015), but differ from other evidence in Tokyo (Gu et al., 2019). No other studies were found that directly establish a relationship between facility distance and vacant houses. The observed negative association for A/N may reflect the highly developed street network in Toda and the influence of nearby facilities; together these may channel demand toward better-exposed plots along main roads.

The primary limitation of this study is the narrow geographic scope: it focuses solely on Toda City. This limited sample may not represent other satellite cities, reducing the generalisability of the findings. Moreover, the statistical analysis indicates that the selected factors do not fully explain the variance in vacancy rates.

Regarding the significance of these conclusions, international discussions often emphasise resident numbers, income, and urban location (e.g., China: Yang, Xiao et al., 2023; Zhang et al., 2016; Dong et al., 2021). With the emergence and decentralisation of global cities, future research should examine how land use and land-use change shape vacancy (Zhang et al., 2023; Li et al., 2019). The role of satellite cities around metropolitan areas is increasingly important not only in Japan but also in the Global South, including Egypt (Salem et al., 2020), Ethiopia (Koroso et al., 2021), and Iran (Sabet Sarvestani et al., 2011). Well-developed satellite cities within comprehensive metropolitan regions will interact more closely with the centre (Yang, Wang et al., 2023). As Kidokoro et al. (2023) note, the emergence of urban suburbia may contribute to decline and vacancy in surrounding satellite cities; multipolarity within satellite systems may also stimulate local vitality (Chen et al., 2019). Considering a city's internal dynamics, it is necessary to account for a broader set of urban facilities (Campos et al., 2018; Abe et al., 2014), while the lens of gentrification—driven by housing demand and supply—remains a relevant part of the explanation (Lee et al., 2021). Studying satellite cities is therefore significant for both the cities themselves and the wider metropolitan region.

We visualised the geographic distribution of MGWR residuals and the local significance of each neighbourhood characteristic, which strengthens the interpretation of the statistical results by showing where relationships are strongest or weakest. Future research should probe the internal mechanisms of vacancy through population mobility, economic change, and planning decisions, acknowledging the complex nature of satellite cities. Compared with similar studies (Deng et al., 2023; Pan et al., 2020), the explanatory power for vacant houses here remains relatively limited. It is important to recognise that vacancy is influenced by broader socio-economic factors—land-use mix, land-price trajectories, transport accessibility, and quality of life—beyond the ten analysed variables.

7.6 Overall discussion

Read together, the results show that indicators work differently at different levels. In metropolitan areas, changes in WCEP and LP describe broad contrasts, but core and outer zones do not move in the same way. In Kyoto Prefecture,

tourism pressure works through the price–rent channel and reshapes SLTR, and this is clearer over the longer 2008–2018 window than in shorter periods. Across Saitama, municipalities that look similar on the standardised indicators can still end up with different vacancy. In Toda City, letting relationships differ by place improves fit (MGWR vs. OLS) and gives two stable directions: S/F is positively linked to VACANCY, A/N is negatively linked.

Three simple conclusions come from this integration. (i) Outcomes reflect both the broader setting and local conditions; either one alone is incomplete. (ii) In tourism settings, time matters: the price–rent → SLTR link is easier to see over several years than in short sub-periods. (iii) Screening among similar municipalities is not only a way to pick a case; it is also a signal to move to neighbourhood analysis when broad indicators no longer explain the differences.

At neighbourhood scale, two directions are stable while their magnitudes are not: S/F is positively associated with VACANCY, and A/N is negatively associated. Publishing local effects (maps or tables of coefficient surfaces) is therefore more informative than reporting a single city-wide coefficient.

Finally, using one protocol across scales has analytic value but also a warning: it enables comparability, yet it can tempt over-extension of proxies beyond their effective domain. The combined evidence supports a scale-aware reading—start broad, verify comparability, and, when needed, let the relationships be local.

Chapter8

Conclusions

Chapter 8 Overview

This chapter synthesizes findings from Chapters 3–6, offering a cross-scale account of common mechanisms and differentiations across metropolitan, tourism, prefectural, and neighborhood lenses. The chapter also articulates the trigger logic for methodological choices, scale-aligned policy implications, and statements on the conclusions.

8.1 Metropolitan-scale Conclusion

To establish a national baseline against which later scales can be interpreted, this section consolidates metropolitan-level evidence from Chapter 3, coupling regression estimates with the INDEX quadrant classification.

This study examined gentrification in Japan's three major metropolitan areas using regression analysis and the INDEX quadrant classification. The findings showed that WCEP is a consistent and significant factor associated with LP increases in the Tokyo, Nagoya and Kansai metropolitan areas. Although WCEP did not strongly affect TIE in the three central cities, its positive correlation with LP suggested that occupational shifts are a major driver of land value changes. In contrast, HH and HO exhibited regionally varied effects, sometimes accelerating and other times constraining gentrification processes. These results support the argument that occupational restructuring, particularly the expansion of WCEP, is a more sensitive indicator of urban change in Japan than income-based measures. This aligns with previous findings that gentrification in post-industrial societies may occur without overt class polarisation but through professional re-stratification (Fielding, 2004; Koizumi & Wakabayashi, 2019).

Viewed through the spatial lens, the three metropolitan areas display distinct yet comparable internal configurations that sharpen the interpretation of the quadrant scheme. In the Tokyo Metropolitan Area, central wards faced housing shortages despite high WCEP levels, as indicated by the prevalence of areas in the fourth quadrant. Suburban areas displayed a more fragmented

distribution between the first and fourth quadrants, reflecting uneven development. In Nagoya, the spatial distribution is more balanced, with most areas falling into the first quadrant, indicating coordinated growth between housing supply and occupational change. Kansai Metropolitan Area presented a more complex pattern, where central Osaka experienced supply pressure, while peripheral cities such as Kyoto and Kobe demonstrated more stable dynamics. Such patterns reinforce the necessity of comparative, intra-urban analyses that move beyond core-periphery dichotomies and capture spatially uneven restructuring processes (López-Gay et al., 2021; Sho et al., 2024).

To verify that these metropolitan patterns are not artefacts of aggregation, a small-area perspective is introduced to test the quadrant approach at finer spatial resolutions. Small-area analysis validated the quadrant classification's effectiveness at finer spatial scales. Variations within single wards, such as Chuo-ku and Taisho-ku, underscored the uneven nature of urban transformation. These results emphasize the value of spatial disaggregation in revealing localized dynamics that are often masked at aggregate levels. To enhance this framework, future studies should incorporate a broader set of indicators, including infrastructure provision, environmental quality, and institutional intervention. These dimensions are essential for understanding how gentrification processes are shaped not only by market forces but also by planning regimes, governance structures, and state-led redevelopment strategies.

Two caveats qualify the claims drawn from this baseline. This study is limited by its reliance on cross-sectional data and relatively simple statistical models, which restrict causal inference and dynamic interpretation. Future research should adopt longitudinal data and more advanced modelling techniques to better capture path dependencies and temporal-spatial feedbacks between key variables such as WCEP, LP, and housing development.

Extending the analytical scope also implies widening the institutional and environmental lenses through which metropolitan change is read. Expanding analytical scope to include regulatory, infrastructural, and ecological factors will improve the structural understanding of gentrification. Moreover, comparative research across cities with varying institutional and spatial configurations can further refine theoretical insights and enhance the generalisability of

gentrification models across diverse urban contexts.

Taken together, the metropolitan-scale synthesis provides the benchmark against which the next section evaluates tourism-mediated restructuring in Kyoto, where valuation–rental dynamics and SLTR reallocation become central.

8.2 Kyoto-scale synthesis Conclusion

To build on the metropolitan baseline, this section consolidates Kyoto-specific evidence on tourism-led restructuring, focusing on long-term mechanisms (2008–2013–2018) and the mediating role of land values.

This study contributes to the growing literature on tourism-led urban change by demonstrating how tourism development in Kyoto Prefecture has affected rental housing dynamics through long-term structural mechanisms.

Using a multilevel analysis of tourism intensity, land use, and rental housing availability across the periods 2008–2013–2018, we find that increasing tourism pressure has contributed to residential displacement and the reconfiguration of urban space toward commercial and visitor-oriented functions.

This observation aligns with findings by Cocola-Gant (2016), who identified similar tourist-driven transformations in formerly residential neighborhoods. Moreover, tourism development influences shift in the supply of rental housing—particularly by expanding rentable vacant stock. These shifts are linked to ownership concentration and speculative holding, reflecting broad patterns of displacement and housing commodification under tourism gentrification.

Turning to mechanism, mediation analysis clarifies how valuation channels connect tourism pressure to housing outcomes. Importantly, our mediation analysis reveals that land price change mediates the relationship between tourism intensity and rental housing outcomes. In oversaturated areas, high tourism demand appears to suppress land price appreciation, likely due to declining appeal for long-term residential use. This finding echoes insights from González-Pérez (2020) and Mixa and Loftsdóttir (2023), who suggest that tourism

gentrification may generate speculative underuse and disrupt traditional land value signals.

The temporal mediation results further suggest that these effects are cumulative and become statistically significant only over the full 2008–2018 period, rather than within shorter timeframes. This supports the understanding of tourism gentrification as a long-term, structurally embedded process. In contrast, rental price changes did not significantly mediate housing outcomes, underscoring the dominant role of land value dynamics in this context.

Beyond empirical insights, the study offers two key contributions to global urban research. First, it expands the geographical focus of tourism gentrification scholarship to a Japanese context shaped by tourism saturation and population decline. Second, it introduces a mediation-based framework using publicly available vacancy data, further providing a scalable method for evaluating housing transitions in tourism-affected cities.

However, this study has certain limitations. It draws on data ending in 2018 and focuses solely on one prefecture. Future research should incorporate more recent data to account for the impacts of COVID-19 and subsequent shifts in tourism. In addition, qualitative research could help capture community responses and lived experiences. Exploring alternative mediators—such as regulatory frameworks, tax incentives, or demographic factors—could further refine understanding of tourism gentrification’s mechanisms.

Together, these Kyoto-scale conclusions motivate the subsequent prefectural screening in Saitama to test the selective reach of metropolitan/tourism proxies and to identify an appropriate micro-observation site for neighborhood-scale diagnostics.

8.3 Saitama-Toda city scale conclusion

To assess whether metropolitan/tourism proxies travel into a suburban, non-tourism corridor and to justify the micro-scale case, this section consolidates the Saitama-prefectural conclusions using a county-wide, unanchored MSSD screen under comparable exposure.

This chapter addressed two objectives. First, it tested whether metropolitan/tourism proxies generalise to a suburban, non-tourism corridor; the selective reach observed here is consistent with Japan-specific restructuring—occupational upgrading and redevelopment rather than classic class polarisation. Second, it implemented a county-wide MSSD screen to identify a micro-scale study site under comparable structural exposure. Using standardised HH, HRB, HO, TIE, WCEP and LP with a k-nearest procedure (primarily k=5), the screening showed that VACANCY remains differentiated even among structurally similar municipalities. Within the inner-ring, high-WCEP/positive-LP cluster, Toda exhibits a negative Δ VACANCY—i.e., lower vacancy than its most-similar peers. Administrative statistics for 2018 corroborate this low-vacancy profile (overall vacancy 8.4%, second lowest; “other vacant houses” 0.9%, the lowest in the prefecture, per the Saitama Prefecture/Toda City statistical bulletin).

Taken together, these results provide a transparent, data-driven rationale for selecting Toda City and for pivoting to a neighbourhood-conditions lens. The subsequent chapter operationalises this shift for Toda City, employing spatial diagnostics (Moran’s I/LISA) and locally varying models (MGWR) to examine how accessibility, road adjacency and built-environment attributes relate to VACANCY over time.

8.4 Neighborhood-scale Conclusion

To operationalize the neighborhood-conditions lens selected via the Saitama screening, this section consolidates Toda City’s conclusion text, highlighting the roles of living convenience, housing supply, and policy support alongside spatial diagnostics and locally varying models.

Focusing on Toda City, a satellite city of Tokyo, our proposed methodology underscores a comprehensive and systematic exploration of urban vacancy dynamics. The findings from Toda City establish a foundational benchmark and contribute to the broader discourse on urban planning and development in satellite cities.

The significance of this study lies in its provision of foundational data on vacant house distribution through the correlation of living convenience, housing

supply, and policy support factors. The outcomes can serve as a strategic foundation for preventing vacant houses, fostering regional vitality, and enhancing the living environment.

We investigate the nexus between vacant housing distribution and neighbourhood characteristics, living convenience, housing supply, and policy support. A comprehensive model comprising ten influencing factors is constructed to analyse the declining trend in Toda City's vacancy rate.

In terms of the overall model, the city data selected for this study shows that the conclusions from the MGWR analysis in Chapter 4.3 are superior to those from the traditional statistical data analysis. Incorporating spatial distribution characteristics provides a better understanding of a satellite city like Toda City. Moreover, from the perspective of the two research methods, both emphasize the significant relationships between certain factors. Both methods conclude that there is a significant positive correlation between vacant house distribution and the proportion of supermarket area, as well as a significant negative correlation with the proportion of buildings with accessibility features in each town. Furthermore, according to the conclusions in Chapter 4.4, the decline in the vacancy rate in Toda City is closely linked to the S/F (supermarket area to residential area ratio) and A/N (accessible buildings to residential area ratio) factors. In areas with low vacancy rates, the ratio of supermarket area to residential area has a stronger correlation with vacancy rates. Conversely, the proportion of buildings connected to roads is more closely correlated with high vacancy rate areas.

Based on the comprehensive analysis and conclusions of this study, future research should explore other factors related to living convenience, housing supply, and policy support. Introducing additional independent variables could enhance the model's explanatory power. For similar satellite cities, it is recommended to incorporate S/F and A/N variables in spatial data analysis methods for vacancy rate assessment or prediction.

However, this study has certain limitations. First, it is limited to Toda, one of Tokyo's satellite cities, and the single sample may not represent all similar satellite cities. Second, the examined variables of living convenience, housing

supply, and policy support, though encompassing 10 influencing factors, may not comprehensively represent these three domains. As factors influencing vacant house distribution extend beyond these perspectives, future investigations should explore alternative perspectives. Additionally, while the publicly available data employed is recent and comprises well-organised mapping data, future studies should integrate and refine data from diverse sources for more precise conclusions.

To deepen our understanding of the relationship between living convenience, housing supply, policy support, and vacant house distribution, future research should increase the sample size and conduct empirical analyses across multiple satellite cities. This approach will contribute to proactive measures and the effective repurposing of vacant houses.

These neighborhood-scale conclusions complete the cross-scale evidence chain and set up the consolidated responses to the research questions presented in Section 8.5.

8.5 Responses to Research Questions

This section provides consolidated answers to the research questions defined in Chapter 1, drawing on the multi-scalar evidence presented in Chapters 4–7.

8.5.1 Metropolitan Scale

RQ-M1. What are the key indicators associated with gentrification-like processes in Japanese metropolitan areas?

Occupational restructuring—captured by the proportion of WCEP—and LP are the most consistent and significant indicators of gentrification-like urban transformation across Tokyo, Nagoya, and Kansai. Both variables outperform income-based measures, underscoring that professional re-stratification rather than class polarization drives metropolitan change in Japan.

RQ-M2. How can a coordinate-axis classification method identify spatial

differences in gentrification-related transformation across multiple urban scales?

The INDEX quadrant classification effectively distinguishes spatial trajectories of occupational and housing dynamics. Its application reveals quadrant-specific contrasts between core and suburban zones, demonstrating uneven restructuring processes within each metropolitan area and confirming the method's diagnostic value at both macro and small-area levels.

RQ-M3. What are the observed spatial patterns of gentrification-related indicators in Tokyo, Nagoya and Kansai, and how do they differ between urban cores and surrounding areas?

Tokyo exhibits high WCW and LP levels but housing shortage in core wards; Nagoya shows more balanced growth; Kansai displays a mixed pattern where Osaka's central supply pressure contrasts with more stable peripheries such as Kyoto and Kobe. These patterns collectively confirm that spatially uneven urban restructuring is a defining feature of Japan's large metropolitan regions.

8.5.2 Kyoto Scale

RQ-K1. At the Kyoto scale, can tourism-related spatial and activity indicators identify tourism-driven signals of urban restructuring?

Yes. Tourism intensity and land-use indicators capture the shift of residential areas toward commercial and visitor-oriented functions, confirming the presence of tourism-led restructuring.

RQ-K2. At the ward scale, does tourism pressure exert a systematic influence on changes in rentable vacancy?

Increasing tourism pressure correlates with the expansion of rentable vacant stock and the displacement of residential functions, reflecting housing commodification under tourism gentrification.

RQ-K3. Do land prices and rents mediate the relationship between tourism pressure and changes in rentable vacancy, and what are the direction and magnitude of this mediation?

Land price change mediates the relationship between tourism intensity and rental housing outcomes: in oversaturated areas, high tourism demand

suppresses LP growth, indicating speculative underuse. Rental prices show weaker mediation effects, confirming the dominance of land-value mechanisms.

RQ-K4. Across adjacent and overlapping time windows, do these effects differ, and what mechanisms account for temporal heterogeneity?

Mediation effects become statistically significant only across the full 2008–2018 period, implying cumulative, long-term structural dynamics rather than short-term fluctuations. This supports the interpretation of tourism gentrification as a slow, embedded process.

8.5.3 Prefectural Scale

RQ-S1. Under broadly comparable exposure conditions, using Saitama Prefecture as the screening field, which smaller city-level unit is most suitable as the micro-observation site?

The multi-site MSSD + k-nearest screening identifies Toda City as the optimal micro-case. Within the high-WCEP / positive-LP cluster, Toda exhibits a negative Δ VACANCY and the second-lowest overall vacancy rate in the prefecture, providing a clear empirical rationale for selection.

RQ-S2. At the city-scale lens within Saitama, do gentrification proxies still account for inter-municipal differences in vacancy, and should neighborhood conditions be incorporated?

Macro-level proxies show selective explanatory power: they differentiate some municipalities but lose strength across the prefecture. This selective reach justifies shifting the analysis to neighborhood-scale conditions in Toda City.

8.5.4 Neighborhood Scale

RQ-T1. Among neighborhood features, which variables are most strongly and consistently associated with vacancy rates, and in which directions?

The MGWR and OLS analyses confirm two robust relationships: S/F shows a positive association with vacancy, while A/N shows a negative association. These

consistent directions highlight service accessibility and housing-supply quality as decisive factors in vacancy variation.

RQ-T2. Do vacant houses in Toda exhibit significant global and local spatial autocorrelation, indicating spatial patterning at the neighborhood scale?

Yes. Significant positive Moran's I and clear high-high / low-low clusters reveal spatial dependence of vacancy at the neighborhood scale. The MGWR model improves fit relative to OLS, demonstrating that spatial heterogeneity is integral to understanding vacancy patterns. Finally, for empirical Chapters 3–6, the key conclusions from each chapter are summarized, see Figure 8.1.

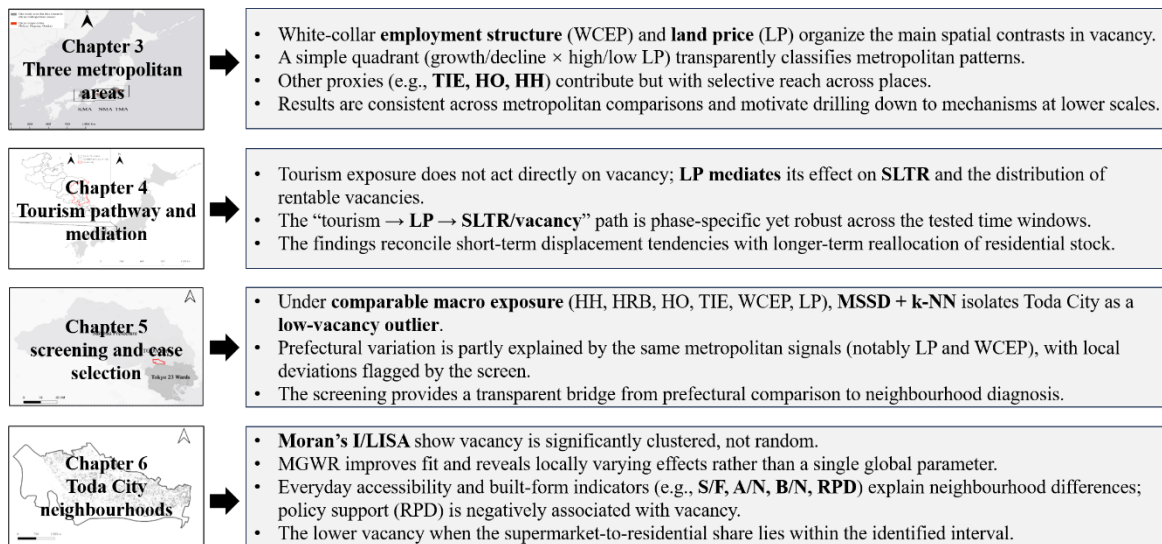


Figure 8.1 Summary of key conclusions from empirical Chapters 3–6

8.6 Consolidated Contributions

Taken together, the multi-scale evidence clarifies when metropolitan gentrification proxies travel across Japan's urban contexts and where they fail to account for observed outcomes. Occupational restructuring and land valuation provide a stable metropolitan baseline. In tourism regions, restructuring proceeds chiefly through long-run land-value mediation rather than short-term rent dynamics. Prefectural screening demonstrates the selective reach of these metropolitan/tourism proxies across municipalities. At the neighborhood scale, spatial heterogeneity becomes decisive: vacancy patterns align with local

conditions—most notably the positive association with S/F and the negative association with A/N—showing how accessibility and service density ultimately shape on-the-ground outcomes. This cross-scale narrative advances a coherent account in which professional re-stratification and valuation change structure macro trends, while neighborhood mechanisms determine their spatial manifestation.

For policy contributions, at the metropolitan level, coordination between occupational upgrading and housing supply/tenure can mitigate core shortages. In tourism regions, governance should confront valuation–rental decoupling and the expansion of rentable vacancy, like SLTR-related will be appropriate. At the prefectural lens, disciplined screening helps prioritise municipalities for targeted intervention and identifies representative micro-cases. In satellite-city neighborhoods, interventions that adjust accessibility, road adjacency, and service layout—guided by S/F and A/N diagnostics—can be paired with strategies to repurpose vacant stock. Together, these contributions provide both an explanatory framework and an operational pathway for diagnosing and governing vacancy under contemporary urban restructuring.

8.7 Limitations

First, parts of the evidence are cross-sectional or hinge on limited time windows. The metropolitan baseline relies on static snapshots, and the Kyoto mediation analysis covers 2008–2018, predating COVID-19 and its aftershocks. These temporal constraints limit causal inference and the ability to trace path dependence or short-run shocks versus long-run adjustments.

Second, external validity is necessarily partial. The neighborhood lens is demonstrated on a single satellite city—Toda—selected via MSSD + k-nearest screening under comparable exposure. While this disciplined comparative procedure reduces confounding, institutional settings, urban morphology, and market composition can differ across municipalities, tempering generalization beyond the case.

Finally, design choices—spatial units and weights, k in the nearest-neighbour sets, and bandwidth/kernel specifications in MGWR—introduce sensitivity. Robustness checks mitigate but cannot eliminate these concerns.

8.8 Directions for Future Research

To make the findings stronger and easier to apply, future work can focus on three practical steps:

- a) Build datasets that cover years before and after COVID-19 and include key policy changes (for example, short-term rental rules or redevelopment designations). Then compare places that were affected by a policy with similar places that were not, before and after the change. This simple design helps separate short-lived shocks from longer trends in occupational structure (share of white-collar jobs), land prices, rents, and housing supply.
- b) Extend the current neighborhood analysis so the strength and direction of relationships can change year by year. Try different ways to define which areas influence each other—next to each other, within a certain distance, or linked by the road network—and check that results are stable at different zoom levels (city, ward, small grid).
- c) Run the same prefectural screening and the same neighborhood modeling in other satellite cities—both around Tokyo and in other metro regions. Compare cities with tourism corridors and without to see when metropolitan/tourism proxies still work and when local neighborhood factors take over. Keep the same indicators and thresholds so results can be compared directly.

8.9 Final Remarks

At the metropolitan scale, changes in the share of white-collar work and land prices set the broad pattern of urban change. In tourism areas, housing shifts happen mainly through slow, long-run effects on land values, not quick swings in rents. The prefectural screen showed that these big signals only reach some places. At the neighborhood scale—seen in Toda—local conditions such as service density (S/F) and road/accessibility (A/N) explain where vacancy is high or low.

In addition, the study determined that the appropriate entry point should be selected according to the scale of the object. In tourism gentrification, manage the gap between valuation and rental markets and the growth of rentable vacancy. In satellite-city neighborhoods, adjust access, road connections, and basic services, and pair that with repurposing vacant stock. Using one set of indicators across all scales makes these steps comparable and transparent.

While the evidence is rooted in Japan, the approach is portable. The same workflow—metropolitan baseline → prefectural screening → neighborhood diagnostics—can help other cities see why similar exposure leads to different outcomes, and where action will matter most. As better time series and policy data become available, this framework can support more precise, fair, and timely decisions about housing and urban renewal.