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Heterogeneous preferences for urban scattered greenery: Evidence from two-stage hedonic estimation in Tokyo*

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Abstract

This study uses two-stage hedonic estimation to examine household preferences for scattered greenery (e.g., roadside trees and yard bushes) in highly developed urban areas. We use proprietary survey data to obtain a wealth of property and resident characteristics and link these to scattered greenery based on high-resolution satellite images and surrounding amenity characteristics for analysis. The results showed that the preferences for scattered greenery were highly heterogeneous and that a few households were willing to pay a hefty amount. The average household pays about 1,540 yen per month for scattered greenery if they live on their owned property and about 300 yen per month if they live on rented property. Also, regardless of the type of residence, wealthy people prefer scattered greenery, while those who plan to move within a few years tend to like it less. Additionally, even if they live on an owned property, single households have little willingness to pay for greenery, and even if they live on a rented property, people with a high level of health awareness or people living with children have a high willingness to pay. The results of this study shed light on the causes of heterogeneity in preferences for greenery by decomposing the property and resident characteristics that have been confused in previous studies.

JEL classifications: Q51, R3, R21, Q57

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Keywords: Environmental amenities, Urban greenery, Housing value, Hedonic pricing, Preference heterogeneity

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Declaration of competing interests

This study was funded by the Housing Research and Advancement Foundation of Japan. The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability statement

The raw survey data cannot be shared because it contains personal information. All other datasets are publicly available. Processed datasets to reproduce our results can be provided upon request.

1. Introduction

Urban greenery plays a crucial role in enhancing residential well-being, offering both use values—such as opportunities for walking and forest bathing—and non-use values, including improved neighborhood aesthetics and reduced air pollution. Reflecting this broader perspective, recent studies have highlighted the importance of small-scale or "scattered" greenery, including private gardens, street trees, and small vegetated plots, rather than focusing solely on large parks or urban forests (Kuroda and Sugasawa, 2023; Li, 2023). Because such greenery can be installed in narrow or irregular spaces along roadsides or between buildings, it plays a particularly vital role in dense urban areas where land is scarce and expensive. At the same time, its relatively flexible placement means that its distribution may closely reflect planning decisions or local demand, increasing the potential for spatial inequality in its provision. Indeed, empirical studies have shown that greenery is often unevenly distributed across neighborhoods, closely aligning with socioeconomic disparities (Łaszkiewicz et al., 2019; Schaeffer et al., 2016). This spatial inequity raises concerns about environmental justice and underscores the need to understand how individual residents perceive and value local greenery, beyond aggregate market effects (Nesbitt et al., 2019; Wolch et al., 2014).

A growing literature uses hedonic pricing models to reveal the implicit prices of environmental amenities through housing markets (Rosen, 1974; Kuminoff, Smith, and Timmins, 2013). Traditional hedonic studies focus on the first-stage estimation, which relates property prices to structural and locational characteristics, and thus primarily capture average willingness-to-pay. Yet, in the context of urban greenery, resident heterogeneity is likely critical: even when living in otherwise similar properties, households with different income, age, education, or environmental attitudes may value the surrounding greenery very differently (Sander & Zhao, 2015). While a small number of studies have employed the second stage of the hedonic framework to link implicit prices to household attributes (Jensen et al., 2021; Panduro et al., 2018; Poudyal et al., 2009), most research on urban greenery omits this stage due to data limitations. As a result, the heterogeneity of preferences for scattered greenery remains insufficiently understood, limiting the design of equitable and targeted urban greening policies.

This study investigates household preferences for scattered urban greenery using a two-stage hedonic framework. We conducted an original survey of approximately 800 residents living in both owned and rented dwellings, linking detailed household characteristics to property attributes. We also generated high-resolution measures of scattered greenery from satellite imagery and compiled amenity data from OpenStreetMap and official statistics. Our analysis recovers individual-level implicit prices for greenery and reveals substantial heterogeneity in preferences. Both homeowners and renters with higher incomes consistently value scattered greenery, whereas residents planning to relocate within ten years value it less. Among homeowners, single-person households exhibit low willingness to pay, while even renters living with children show strong preferences. Furthermore, residents who habitually notice greenery from their windows or along streets exhibit higher valuation, whereas frequent park use has no significant effect.

This study makes two key contributions. First, it explicitly incorporates resident attributes into the evaluation of small-scale urban greenery, moving beyond prior studies that lacked data linking properties to individual households. By comparing owned and rented dwellings, we provide new evidence on whether differences in hedonic estimates arise from ownership form or underlying household heterogeneity—a distinction relevant for designing targeted greening policies. Second, by adopting a two-stage hedonic framework, we recover individual-level implicit prices and link them to household characteristics, allowing us to identify heterogeneous preferences using revealed rather than stated preferences. This approach also provides new insights into how self-selection by households with specific preferences may contribute to the uneven distribution of greenery, complementing discussions of environmental justice and the equitable provision of urban green spaces.

The remainder of this paper proceeds as follows. Section 2 introduces the data used in the analysis. Section 3 presents the empirical strategy. Section 4 presents the main results and describes a series of robustness checks, and Section 5 concludes.

2. Data and settings

2.1. Study area and survey design

The survey area comprises the Setagaya and Suginami wards, located west of central Tokyo, Japan's capital city. Together, these two wards cover approximately 92 km^2, with the average size of a single cho-cho (a neighborhood-level administrative unit) being about 0.22 km^2. This area borders the city's central business district and represents one of Japan's most attractive and expensive residential markets. In 2020, Setagaya and Suginami had populations of approximately 940,000 (16,000/km^2) and 590,000 (17,000/km^2), respectively, both showing an upward trend. The average taxable income is high, and the land is fully urbanized, leaving almost no natural forests, farmland, or vacant lots. Consequently, most greenery is concentrated in parks, public facilities, roadside trees, and vegetation surrounding buildings.

2.2. Property and household data

We conducted an online survey from March 29 to March 31, 2024, in collaboration with RJC Research Inc. The questionnaire collected detailed information on both property attributes and household characteristics, with summary statistics reported in Appendix Tables A1 and A2. We obtained 3,243 valid responses, corresponding to a collection rate of 79%, after excluding responses that were contradictory, excessively fast, or contained uncorrectable errors. Among respondents, 1,772 were homeowners and 1,471 were renters, yielding a rental rate of 45.36%, which closely matches the 45.94% reported in the 2023 Housing and Land Survey, indicating that the sample is not systematically biased with respect to tenure composition. The average response time was 7.5 minutes, suggesting that respondents engaged adequately with the survey questions.

The survey collected detailed information on each property, including rent or purchase price, floor area, the number of rooms (bedrooms, living rooms, dining rooms, and kitchens), floor level, total floors, and building age. In addition, the presence of south-facing windows, gardens, parking spaces, and automatic locks was recorded as dummy variables. Respondents provided residential addresses at varying levels of precision: 15.4% at the building or room level, 24.1% at the ban-chi (block) level, and 33.7% at the cho-cho level. If floor level and building age allowed unique identification within a ban-chi, we treated it as building-level precision. For geocoding, we used coordinates at the building level whenever possible, and for cho-cho-level addresses we assigned the centroid coordinates. Given that cho-cho areas are small (approximately 0.22 km^2), the impact on measured surrounding amenities is minimal.

The survey also collected information on gender, age, occupation, education, annual household income, time discount rate, relocation plans, family composition, frequency of greenery use, and environmental attitudes (including affection for greenery, knowledge of forests, and health awareness). Income questions were not mandatory, and responses with missing income information were excluded from the analysis, and potential nonresponse bias should be considered. To mitigate the influence of outliers, we excluded the top and bottom 0.5% of rent and greenery values. After these exclusions, the final analysis sample comprised 411 homeowners and 434 renters, whose geographic distribution within the survey area is shown in Figure 1.

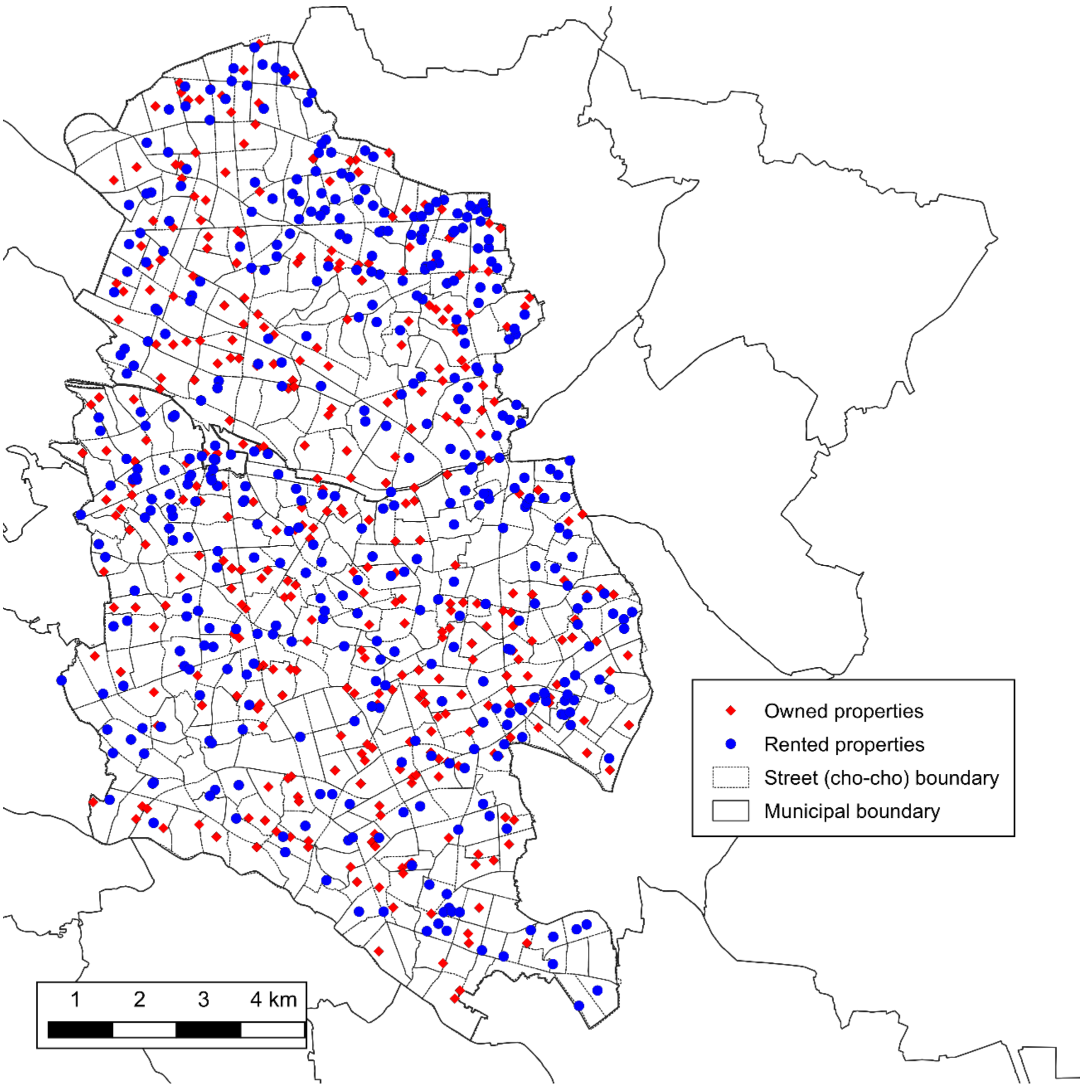

Figure 1. Locations of surveyed owned and rented properties in Setagaya and

Suginami wards

Note: Dots indicate the geocoded locations of surveyed properties, with blue representing owned dwellings and red representing rented dwellings. Properties with only cho-cho level address accuracy are plotted at the centroid of the corresponding cho-cho.

To analyze willingness to pay on a monthly basis, we converted purchase prices of owned properties into imputed monthly rents following Naoi et al. (2009). The purchase year was inferred from reported tenure length, and current values were estimated using the 2020 consumer price index. The imputed monthly rent was calculated assuming a 3% depreciation rate and an infinite expected service life (Day et al., 2007). The resulting average imputed rent was approximately 169,000 JPY, higher than the 97,000 JPY average for rental units, reflecting the larger size and higher quality of owner-occupied properties. As shown in Appendix Table A3, when we compare properties with similar characteristics, such as the number of rooms and building age, the imputed rents for owner-occupied units closely match the actual rents for comparable rental units. For instance, restricting the sample to studio apartments less than 10 years old yields an estimated imputed rent of approximately 94,600 JPY, which is very close to the corresponding rental price of 97,300 JPY. This comparison reinforces the validity of our imputed rent calculation method.

Because our survey sample is relatively small, we validated its representativeness using transaction data from the Real Estate Transaction Promotion Center (RETPC), which operates Japan’s largest Multiple Listing Service (MLS), the Real Estate Information Network System (REINS). REINS records a vast number of property transactions handled by real estate agents and is widely regarded as highly representative of the housing market. Figure 2 compares the distributions of actual and imputed rents between our survey and REINS data, showing a close similarity and suggesting minimal bias in our rent distribution. This validation supports the reliability of our survey data for subsequent hedonic analysis.

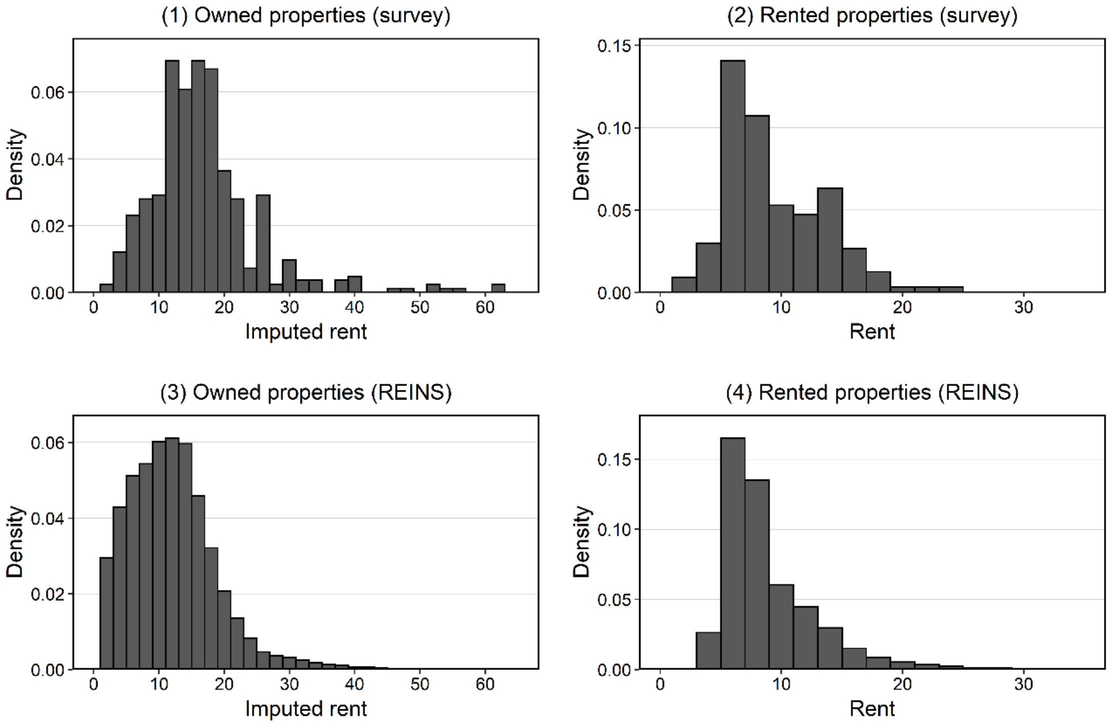

Figure 2. Distribution of (imputed) rent in survey and REINS data

Note: The vertical axis represents density, and the horizontal axis represents monthly (imputed) rent in 10,000 JPY. Panels (1)–(2) show the distributions from our survey, and Panels (3)–(4) show the distributions from REINS, Japan's largest MLS. Panels (1) and (3) correspond to owner-occupied properties (imputed rent), while Panels (2) and (4) correspond to rental properties (actual rent).

2.3. Urban greenery measures

We utilized high-resolution optical satellite imagery from Maxar Technologies to identify green-covered areas and construct GIS data. The selected image, captured on May 4, 2022, had the lowest cloud cover among all images taken near the survey period. It provides four spectral bands—blue, green, red, and near-infrared—at a spatial resolution of 1.5 meters. Green coverage was extracted using the normalized difference vegetation index (NDVI), following the approach of Franco and Macdonald (2018) and Kuroda and Sugasawa (2023). The NDVI threshold was iteratively adjusted and visually inspected to minimize misclassification, producing a dataset that the most accurate representation of green coverage.

We classified greenery into cohesive and scattered types by overlaying NDVI-based green coverage with OpenStreetMap (OSM) data. Using OSM, greenery located in vacant lots, farmland, parks, school grounds, and other public facilities was categorized as cohesive greenery, whereas vegetation along streets and around buildings was classified as scattered greenery. Figure 3 illustrates these two categories separately. Following Kuroda and Sugasawa (2023), who employed similar satellite imagery, we use the proportion of scattered greenery within a 100-meter radius of each property as our primary greenery variable. Because scattered greenery is not typically a destination amenity but rather an environmental feature of the immediate surroundings, its local coverage ratio is more relevant than accessibility measures. The study area is a densely developed urban environment with limited vegetation, and the average proportion of scattered greenery is approximately 12%.

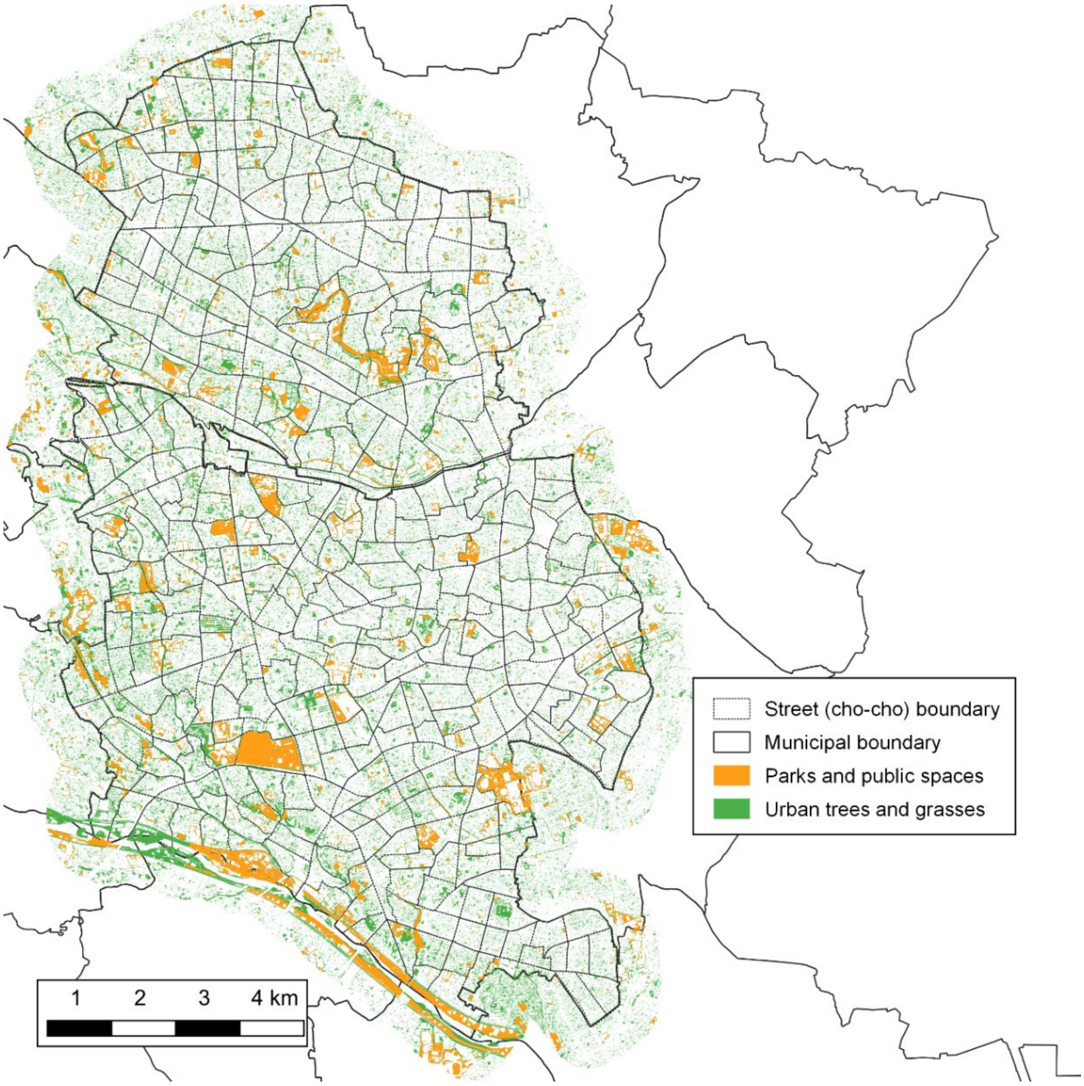

Figure 3. Distribution of cohesive and scattered urban greenery in the study area

Note: Green coverage is derived from high-resolution satellite imagery acquired in May 2022. Cohesive greenery includes parks, school grounds, and other public or vacant spaces, while scattered greenery represents street trees and vegetation around buildings. Classification is based on 2024 OpenStreetMap data.

2.4. Other control variables

We control for a comprehensive set of neighborhood and accessibility characteristics that may influence property values in the first-stage hedonic estimation. First, we incorporate demographic and safety indicators at the cho-cho level, including total population, the shares of residents younger than 20 and older than 65, and average household size from the 2020 National Census. We also include the number of reported crimes in 2023 from the Tokyo Metropolitan Police Department as a proxy for neighborhood safety. Second, to capture local housing market conditions, we calculate the number of property transactions—both sales and rentals—within a 300-meter radius of each dwelling since 2010, using the REINS multiple listing service database. Third, we account for local amenities by computing the number of convenience stores, restaurants, supermarkets, and cafés within a 500-meter radius, based on 2024 OpenStreetMap data.

Finally, we construct accessibility measures to public facilities and transportation. Using GIS data from government sources, we identify the locations of train stations, bus stops, hospitals, schools, police and fire stations, libraries, post offices, city halls, parks, pools, playgrounds, highways, and major roads. For each property, we calculate the Euclidean distance to the nearest facility of each type and take the logarithm, reflecting the diminishing marginal effect of proximity on property value. To account for unobserved spatial heterogeneity, we also include elementary school district fixed effects (obtained from MLIT), implemented as district-level dummy variables. Summary statistics for these control variables are reported in Appendix Table A1.

3. Empirical strategy

We estimate a hedonic pricing model following Rosen (1974), in line with prior studies evaluating environmental amenities. In the first stage of the hedonic framework, housing prices are regressed on property characteristics, neighborhood attributes, and measures of greenery to obtain marginal implicit prices. Prior studies using real estate transaction data typically rely on this first-stage analysis to estimate willingness to pay (WTP) for marginal changes in environmental amenities. However, these first-stage estimates primarily capture the effect of average and marginal changes in amenities on housing prices and, therefore, on welfare. In contrast, amenities such as urban greenery often generate heterogeneous values across households and can produce both marginal and discrete changes in perceived utility. Understanding the welfare implications of such heterogeneity requires the estimation of household-specific preference parameters rather than relying solely on market averages.

The second stage of Rosen's (1974) model is designed to recover household-level preference parameters by linking the implicit prices of amenities to household characteristics. However, standard hedonic applications face an endogeneity challenge because each household is observed in only one dwelling, and housing choices are affected by spatial sorting based on unobserved preferences. Previous studies have addressed this identification problem using instrumental variable and utility function approaches considering multiple markets. In particular, Bajari and Benkard (2005) proposed a method for recovering preference parameters by imposing functional form restrictions on the utility function, and Panduro et al. (2018) applied a similar approach to environmental amenities.

Following this literature, we adopt a three-step strategy to estimate heterogeneous preferences for scattered greenery. First, we estimate the first-stage hedonic pricing function to recover the implicit price of greenery for each property. Second, we implement the structural approach proposed by Bajari and Benkard (2005), assuming that utility is logarithmic in housing services and linear in the numeraire consumption good, to recover household-level preference parameters from these implicit prices. Third, we link the recovered preference parameters to household attributes—such as income, family composition, environmental awareness, and planned mobility—to identify how socioeconomic characteristics shape heterogeneous preferences for scattered greenery. This framework allows us to analyze how heterogeneous and discrete changes in greenery affect welfare, while mitigating endogeneity concerns arising from spatial sorting.

3.1. 1st step: estimating the hedonic housing price function

In the first step, we estimate a hedonic housing price model using a generalized additive model (GAM) following Panduro et al. (2018). We apply a gamma distribution with a log-link function to account for the skewed distribution of housing rents. The GAM framework allows flexible functional forms through spline-based smoothers for key variables, while other covariates enter the model parametrically:

$$\ln(P_{is}) = \alpha_1 + f(G_{is}; S_{is}) + X_{is} + Y_{is} + S_s + \varepsilon_{is} \tag{1}$$

where $\ln(P_{is})$ is the natural logarithm of the (imputed) monthly rent of household i in school district s. The main explanatory variable G_{is} is the share of scattered greenery within a 100-meter radius of the property. The function $f(\cdot)$ is a non-parametric smooth function, and S_{is} represents the spline's basis dimensionality, which controls the flexibility of the fit.

The vector X_{is} includes structural property characteristics such as the number of rooms, building floor level, and the presence of amenities (e.g., parking, auto-lock, air conditioning). The vector Y_{is} captures neighborhood and accessibility characteristics, including distances to facilities and other environmental conditions affecting rents. To mitigate omitted-variable bias from unobserved neighborhood attributes, we include school-district fixed effects S_s in the model.

3.2. 2nd step: recovering household-level preference parameters

In the second step, we recover household-specific preference parameters for scattered greenery, denoted by $\widehat{\gamma_{is}}$. Following the hedonic framework, we first compute the marginal willingness to pay (MWTP) for a small change in scattered greenery around each property using finite differencing of the predicted housing price function. Specifically, the MWTP reflects the derivative of the predicted (imputed) monthly rent with respect to the share of scattered greenery:

$$\widehat{\gamma_{is}} = P_{is} \times \frac{\partial P_{is}}{\partial G_{is}} \tag{2}$$

where P_{is} is the (imputed) monthly rent for household i in school district s, and G_{is} is the observed proportion of scattered greenery within a 100-meter radius. This approach yields household-level preference parameters $\widehat{\gamma_{is}}$ is as the product of the imputed monthly rent P_{is} and the estimated slope of the hedonic price function with respect to scattered greenery. The resulting $\widehat{\gamma_{is}}$ is captures the household's implicit price for an infinitesimal increase in nearby scattered greenery, providing a foundation for analyzing heterogeneous preferences in the third step.

3.3. 3rd step: estimating heterogeneous preferences

In the third step, we examine how household characteristics explain the heterogeneity in preferences for scattered greenery. Specifically, the estimated preference parameters $\widehat{\gamma_{is}}$ is from the second step are regressed on individual characteristics Z_{is} using ordinary least squares (OLS):

$$\ln(\widehat{\gamma_{is}}) = \alpha_2 + \beta Z_{is} + \omega_{is} \tag{3}$$

where Z_{is} is a vector of observed household attributes, and β captures how these characteristics systematically influence the implicit value of greenery. The resulting estimates provide a direct measure of how socioeconomic and behavioral factors shape heterogeneous preferences for scattered greenery.

4. Results

4.1. Hedonic pricing model estimates

Figure 3 presents the estimated smooth functions of scattered greenery from the first-stage hedonic models. Panels (1)–(3) report the primary results for owned, rented, and pooled properties, respectively.[1] For owned properties, the implicit price of scattered greenery is close to zero at low coverage levels (below roughly 10%) but rises markedly thereafter, indicating a nonlinear capitalization pattern. Rental properties exhibit a consistently positive but more moderate effect, while the pooled sample shows an initially flat relationship that becomes positive once greenery coverage exceeds approximately 15%. These patterns suggest that owner-occupied housing capitalizes scattered greenery more strongly than rental units.

Panels (4)–(6) restrict the sample to households with a length of residence of 20 years or less to mitigate potential bias from measurement error: properties with very long

[1] Pooling rental and owner-occupied properties in the same hedonic regression requires caution in interpretation because these markets differ in several fundamental ways. Suppliers differ, as do demanders with respect to income levels and liquidity preferences. Even for the same dwelling, perceived value may diverge due to contract duration (temporary lease vs. perpetual ownership) and the underlying price-formation mechanism: transaction prices capitalize future flows, whereas rents reflect a single-period usage value, often with different scales and distributions.

occupancy histories may have experienced substantial changes in surrounding greenery since move-in. The results remain broadly consistent with the full-sample estimates, reinforcing the finding that the marginal willingness to pay for scattered greenery is heterogeneous across tenure types and is most pronounced among owned properties.

Table 2 and Appendix Table A4 report the estimation results of the generalized additive hedonic pricing models. Columns (1)–(3) present the main results for owned, rented, and pooled properties, while columns (4)–(6) report the results from the restricted sample that excludes households with a length of residence exceeding 20 years. Across all specifications, the coefficients on control variables align with both theoretical expectations and findings from prior studies. The estimated effects of scattered greenery remain small at low coverage levels but increase substantially as the proportion of nearby greenery rises, with stronger effects observed for owned properties than for rented ones, which is consistent with previous research (Kuroda & Sugasawa, 2023).

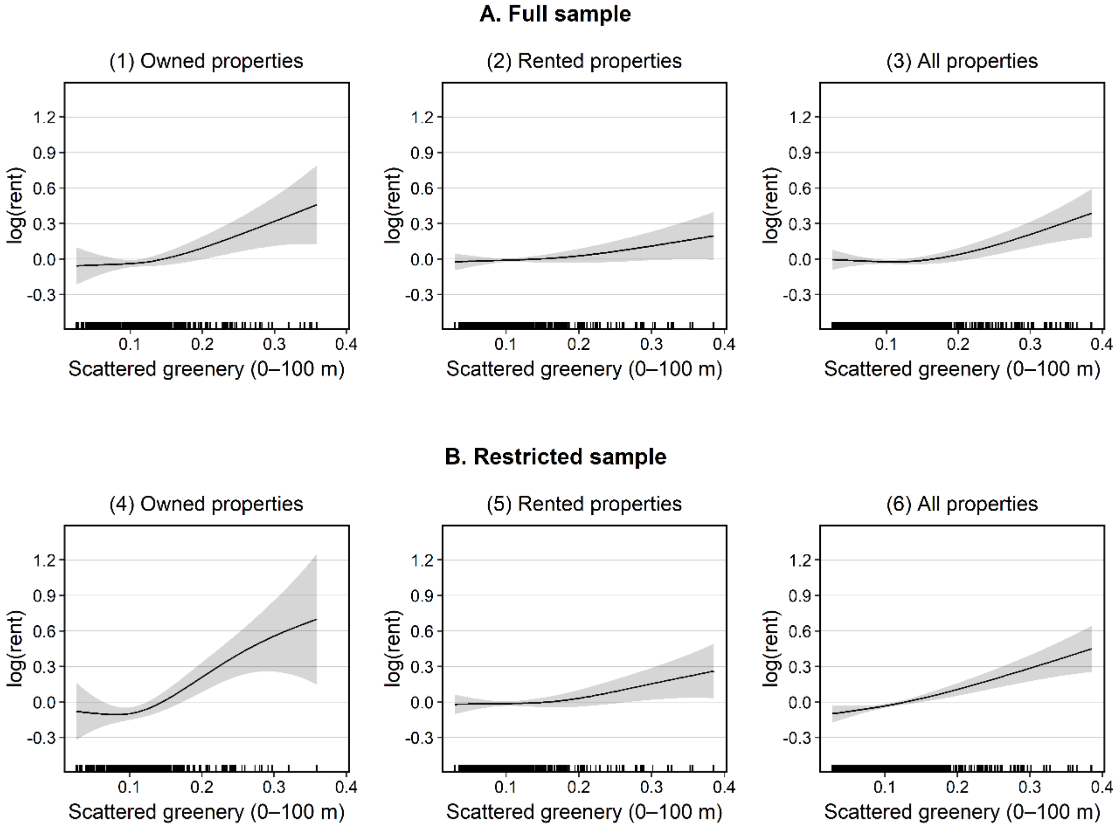

Figure 4. Non-parametric smooth functions of the hedonic price with respect to scattered greenery

Note: The horizontal axis represents the proportion of scattered greenery within 0–100 m of each property, and the vertical axis shows the natural logarithm of the (imputed) monthly rent. Shaded areas denote 95% confidence intervals. Panels (1)–(3) report the primary results for owned, rented, and pooled properties, respectively. Panels (4)–(6) restrict the sample to households with a length of residence of 20 years or less, to reduce potential bias from changes in surrounding greenery over long occupancy periods.

	Full sample			Restricted sample		
	Owned	Rented	All	Owned	Rented	All
	(1)	(2)	(3)	(4)	(5)	(6)
Scattered greenery	df = 1.9256*	df = 1.6434	df = 2.2692***	df = 2.5702***	df = 1.9553	df = 1.7968***
Property characteristics	YES	YES	YES	YES	YES	YES
Neighborhood characteristics	YES	YES	YES	YES	YES	YES
Accessibility characteristics	YES	YES	YES	YES	YES	YES
House type dummies	YES	YES	YES	YES	YES	YES
School district fixed effects	YES	YES	YES	YES	YES	YES
Observations	411	434	849	252	389	646
Adjusted R-squared	0.2667	0.6652	0.4964	0.5910	0.6752	0.6061
Log Likelihood	-1229.9036	-866.2871	-2254.8605	-664.5263	-762.5980	-1600.6077

Table 2. Results of the first-stage hedonic price estimations

Note: This table reports the results from the first-stage generalized additive hedonic pricing models. Columns (1)–(3) use the full sample of owned, rented, and pooled properties, while columns (4)–(6) use the restricted sample that excludes households with a length of residence exceeding 20 years. Reported values for "Scattered greenery" indicate the estimated degrees of freedom (df) from the non-parametric smooth function. House type dummies classify properties by combining tenure (owned or rented) with structural type (apartment, condominium, or detached house). *, **, and *** denote statistical significance at the 5%, 1%, and 0.1% levels, respectively. Adjusted R-squared values and log-likelihoods are shown at the bottom of the table. The full results are shown in Appendix A4.

4.2. Recovering household preference parameters

Building on the first-stage estimates, Table 3 presents summary statistics of the recovered household preference parameters ($\widehat{\gamma_{is}}$), reported separately for the full sample and the restricted sample that excludes households residing in the same property for over 20 years. In the full sample, nearly all households in both owned and rented properties exhibit a positive WTP for scattered greenery. The average WTP is substantially higher for owners (approximately 1,540 JPY/month) than for renters (approximately 300 JPY/month). However, when combining all properties, only about half of households display positive preferences, indicating that some renters or long-term residents may not value nearby greenery in monetary terms. Following Panduro et al. (2018), when the estimated implicit price of greenery is negative, the corresponding preference parameter is set to zero to reflect the non-negativity constraint on WTP.

The restricted sample yields sharper distributions of preference estimates. Once long-term residents are excluded, the proportion of households with positive WTP increases, particularly in the pooled sample. The mean and median WTP for owned properties also rise substantially. These results imply that including long-term residents—whose initial housing decisions likely reflected past environmental conditions—may introduce measurement error due to changes in greenery over time. Removing these observations improves internal validity by aligning measured greenery with actual exposure at the time of the survey.

Figure 5 displays the distribution of the estimated preference parameters. In all cases, the distributions are right-skewed, indicating that while many households exhibit modest WTP for scattered greenery, a smaller group places significantly higher value on it. These patterns highlight the heterogeneous nature of preferences for local greenery and suggest that such amenities are positively valued by most households, albeit to varying degrees. This result is consistent with Panduro et al. (2018), who similarly found substantial heterogeneity in household valuations of urban parks.

	N+	N-	Mean	Median	Std. Dev.	Min.	Max.
Full sample							
Owned properties	411	0	1539.8567	759.9975	1745.1040	89.7589	12493.1869
Rented properties	434	0	298.8481	195.9767	320.2215	45.9848	2368.6726
All properties	403	446	533.7270	0.0000	1071.8174	0.0000	10158.0577
Restricted sample							
Owned properties	188	64	3225.4597	2127.6735	3430.1273	0.0000	18639.1386
Rented properties	389	0	297.5656	97.9009	492.5077	16.4833	3230.8689
All properties	646	0	1550.7610	1268.4678	1126.7058	264.4780	9903.5025

Table 3. Summary statistics of the estimated preference parameters

Note: This parameter indicates the amount of monthly money households are willing to pay for the scattered greenery they currently have. N+ and N- represent the number of households that showed positive and negative preferences, respectively, and the preference parameter for households with negative preferences is converted to zero.

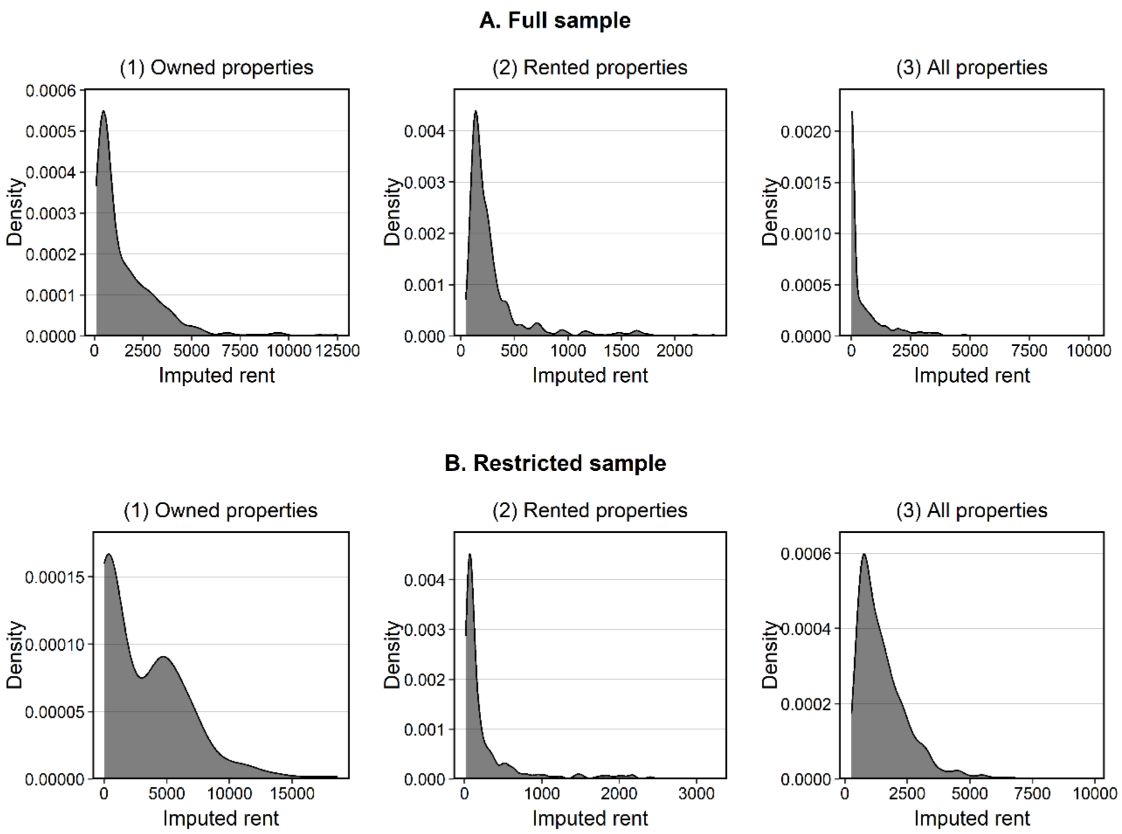

Figure 5. The distribution of the preference parameter (willingness to pay) for

scattered greenery

Note: The horizontal axis represents monthly (imputed) rent, and the vertical axis represents density. Panels (1), (2) and (3) show the distribution for owned properties, rented properties and all properties, respectively.

4.3. Results on the heterogeneity of household preferences

To explore the determinants of heterogeneous preferences for scattered greenery, we regress the estimated household-specific preference parameters from the second step on a set of observed characteristics. Table 4 presents the results for both the full sample (columns 1–3) and the restricted sample that excludes households with over 20 years of residence (columns 4–6), across owned, rented, and all properties. Across specifications, income is consistently and positively associated with WTP for scattered greenery, reinforcing the notion that environmental amenities may be considered a luxury good (Panduro et al., 2018). The positive association is statistically significant in five out of six specifications, underscoring the robustness of the income effect.

While the effects of gender and age are not entirely consistent across specifications, we observe a generally negative association between being under age 30 and WTP for scattered greenery, although this relationship is not always statistically significant. Personality-related attributes such as affection for greenery, knowledge of forests, health consciousness, and time discount rates appear to have little influence on preferences for scattered greenery. In contrast, individuals who report frequently viewing greenery through their windows (at least once per week) consistently exhibit significantly higher WTP across most specifications. On the other hand, frequent park usage is associated with statistically insignificant and often negative coefficients, underscoring the importance of distinguishing scattered greenery from formal parks in both conceptual and empirical analyses.

Interestingly, households planning to move within the next 10 years demonstrate significantly lower WTP for scattered greenery in the restricted pooled sample. Although the effect is not always statistically significant, the negative association between future mobility and preferences for greenery is observed in other specifications as well. Moreover, even among homeowners, those living alone tend to show weaker preferences for scattered greenery. Conversely, renters who live with children under the age of 18 exhibit significantly higher WTP. These results suggest that both residential stability and expectations regarding long-term benefits meaningfully shape household preferences for scattered greenery. Since many of the benefits of scattered greenery—such as improved living environments and enhanced physical and mental health—tend to accumulate over time, it is plausible that households anticipating a longer stay or those caring for more vulnerable members (e.g., young children or the elderly) assign greater value to such amenities. In contrast, short-term residents or single-person households may undervalue the long-term benefits of greenery, such as stress reduction or improved air quality, and may therefore be less willing to pay for its presence.

	Full sample			Restricted sample		
	Owned	Rented	All	Owned	Rented	All
	(1)	(2)	(3)	(4)	(5)	(6)
Male	-0.0819	-0.1354	0.0700	0.8149	-0.1867	-0.1088*
	(0.1318)	(0.0744)	(0.2902)	(0.6416)	(0.1369)	(0.0465)
Under age 30	-0.6866	-0.2045	-1.2897	-2.6982	-0.2195	-0.2220*
	(0.5708)	(0.1327)	(0.6597)	(2.7088)	(0.2323)	(0.0954)
Above age 60	-0.0202	0.2054*	-0.2013	-1.1276	0.2604	0.1261*
	(0.1251)	(0.0924)	(0.3095)	(0.5885)	(0.1799)	(0.0522)
Stable employment	-0.0370	-0.0085	-0.4452	0.6835	-0.0824	0.0429
	(0.1566)	(0.0814)	(0.3318)	(0.8567)	(0.1506)	(0.0552)
Unemployment	0.2015	0.1258	0.2311	1.8377	0.1020	0.1313
	(0.1646)	(0.1239)	(0.4101)	(0.9628)	(0.2332)	(0.0735)
College graduate or above	0.2104	0.1350	0.3544	0.0298	0.1990	0.1325**
	(0.1354)	(0.0687)	(0.2832)	(0.6906)	(0.1271)	(0.0459)
Annual income (1 million yen)	0.0388***	0.0488***	0.0663**	0.0429	0.0609**	0.0387***
	(0.0088)	(0.0105)	(0.0248)	(0.0399)	(0.0194)	(0.0040)
Affection for greenery	-0.0498	0.0159	0.0071	-0.0971	0.0505	-0.0092
	(0.0298)	(0.0178)	(0.0673)	(0.1371)	(0.0329)	(0.0107)
Knowledge of forests	0.0007	0.0012	0.0095	0.0084	0.0050	0.0008
	(0.0046)	(0.0021)	(0.0089)	(0.0213)	(0.0037)	(0.0014)
Health awareness	-0.0077	0.0202	0.0274	0.0643	0.0334	0.0056
	(0.0216)	(0.0142)	(0.0523)	(0.1059)	(0.0259)	(0.0085)
Time discount rate	-0.0056	0.0110	0.0179	0.0461	0.0302	-0.0028
	(0.0234)	(0.0138)	(0.0530)	(0.1177)	(0.0252)	(0.0085)
Use park (weekly+)	-0.1086	-0.0894	-0.4509	-0.0831	-0.1822	-0.0454
	(0.1251)	(0.0892)	(0.3158)	(0.6199)	(0.1659)	(0.0523)
Use street trees (weekly+)	0.1445	0.1164	0.6486*	-0.6917	0.2642	0.0362
	(0.1230)	(0.0795)	(0.2963)	(0.6165)	(0.1451)	(0.0487)
Use window greenery (weekly+)	0.2190*	0.1616	0.8134**	1.6338**	0.2984	0.1626**
	(0.1109)	(0.0911)	(0.2942)	(0.5578)	(0.1681)	(0.0500)
Planned move within 10 years	-0.2588	-0.0776	-0.3355	-1.6054	-0.1773	-0.0883*
	(0.1694)	(0.0651)	(0.2770)	(0.8270)	(0.1206)	(0.0433)
Living with children under 18	-0.1331	0.3585**	0.0784	-0.1923	0.5912**	0.0628
	(0.1459)	(0.1204)	(0.3863)	(0.6161)	(0.2165)	(0.0589)
Living alone	-0.5791**	-0.1667*	-0.1689	-0.5885	-0.0788	-0.3266***
	(0.1872)	(0.0818)	(0.3136)	(0.8946)	(0.1513)	(0.0500)
Observations	364	365	733	217	327	549
Adjusted R-squared	0.1223	0.2197	0.0491	0.0383	0.1198	0.4608

Table 4. Determinants of household-level willingness to pay for scattered greenery

Note: Standard errors are reported in parentheses. *, **, and *** denote statistical significance at the 5%, 1%, and 0.1% levels, respectively.

5. Conclusion

This study examined heterogeneous household preferences for scattered greenery using a two-stage hedonic estimation framework. The findings reveal substantial variation in WTP for such amenities, shaped not only by tenure type (owned vs. rented), but more critically by factors such as expected duration of residence, household composition, and income. While prior studies have highlighted stronger preferences for greenery among homeowners, our results suggest that this association may be driven by underlying characteristics—homeowners tend to have higher incomes, larger families, and longer expected residence durations, all of which are independently associated with stronger preferences for greenery. These findings underscore the importance of considering correlated household traits when interpreting differences across housing tenure.

The analysis further reveals that certain groups—such as short-term residents, single-person households, and low-income individuals—assign relatively low monetary value to scattered greenery. These insights carry important implications for urban planning and housing policy. For instance, neighborhoods with high residential turnover, such as those populated by university students or young professionals, may exhibit weaker demand for green amenities, potentially leading to lower investment in environmental quality and a deterioration in living conditions. In turn, this could discourage longer-term, higher-income residents or families—who tend to place greater value on greenery—from settling in such areas, thereby reinforcing patterns of residential sorting and spatial inequality.

From a policy perspective, these findings suggest that uniform approaches to greening urban spaces may be insufficient. Urban planners might consider tailoring greenery investments to local demographic and residential stability profiles. In areas with more transient populations, efforts could focus on raising awareness of the long-term benefits of greenery (e.g., stress reduction, air quality improvements) or on integrating greenery into spaces with more immediate utility (e.g., along commuting routes or near rental housing). Conversely, in areas with more stable or family-oriented populations, larger-scale or permanent greening initiatives may be more effectively utilized and appreciated.

That said, several limitations must be acknowledged. The relatively small sample size limits the generalizability of the findings and raises concerns about statistical power and measurement error. Endogeneity in the supply of scattered greenery may also bias estimates, particularly if greener neighborhoods attract certain types of households. Furthermore, because housing prices reflect amenities at the time of contract rather than current conditions, temporal changes in greenery could introduce measurement error, especially for long-term residents.

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Appendix

Table A1. Summary statistics for property, neighborhood, and accessibility characteristics

	Owned properties					Rented properties				
	Mean	Std. Dev.	Min.	Max.	N	Mean	Std. Dev.	Min.	Max.	N
Property characteristics										
Imputed rent (100000 JPY)	16.9161	8.5292	2.3911	61.7284	411	9.6687	4.2040	2.5000	25	434
Number of rooms	3.1800	0.9935	1	8	411	1.4839	0.7294	1	5	434
Number of living rooms	0.9100	0.2950	0	2	411	0.2558	0.4368	0	1	434
Number of dining rooms	0.9878	0.1301	0	2	411	0.5622	0.4967	0	1	434
Number of kitchens	1.0000	0.0698	0	2	411	0.8733	0.3331	0	1	434
Number of floors in the building	4.3698	3.4122	2	29	411	3.6198	2.4421	1	15	434
Floor where located	3.0170	2.1679	1	21	411	2.3088	1.5577	1	10	434
South-facing window	0.7835	0.4124	0	1	411	0.5553	0.4975	0	1	434
Gardens	0.5377	0.4992	0	1	411	0.2097	0.4075	0	1	434
Car parking	0.8589	0.3486	0	1	411	0.3571	0.4797	0	1	434
Bicycle parking	0.6715	0.4702	0	1	411	0.6567	0.4754	0	1	434
Pets allowed	0.5450	0.4986	0	1	411	0.0899	0.2863	0	1	434
All-electrified house	0.0608	0.2393	0	1	411	0.0346	0.1829	0	1	434
Self-locking entrance	0.3285	0.4702	0	1	411	0.2650	0.4418	0	1	434
Balcony	0.8662	0.3409	0	1	411	0.6221	0.4854	0	1	434
Air-conditioned	0.9586	0.1994	0	1	411	0.9101	0.2863	0	1	434
Kitchen island	0.0852	0.2795	0	1	411	0.0184	0.1347	0	1	434
Walk-in closet	0.4355	0.4964	0	1	411	0.1313	0.3382	0	1	434
Laundry room	0.7105	0.4541	0	1	411	0.5253	0.4999	0	1	434
Age of property (approximate)	23.1545	14.8264	0.2500	70	411	27.0091	17.2444	0.2500	70	384
Neighborhood characteristics										
Scattered greenery	0.1215	0.0595	0.0256	0.3590	411	0.1157	0.0626	0.0292	0.3853	434
Population in the area (per 1000)	18.7476	5.2022	2.6551	33.7867	411	19.4677	5.1832	5.1613	33.7867	434
% of population under 20 in the area	0.1513	0.0372	0.0709	0.2540	411	0.1353	0.0376	0.0313	0.2539	434
% of population over 65 in the area	0.1995	0.0354	0.0556	0.4491	411	0.2024	0.0492	0.1090	0.6080	434
Average household size in the area	1.9269	0.2670	1.3921	2.8021	411	1.8172	0.2569	1.3921	3.1422	434
Number of crimes in the area	15.9951	15.2929	0	118	411	21.7212	21.1413	0	121	434
Number of properties for sale within 300m	112.7518	60.0174	11	334	411	98.5069	57.5544	9	269	434
Number of properties for rent within 300m	720.6569	421.6581	17	1947	411	845.7788	454.3737	27	2262	434
Number of convenience stores within 500m	4.9173	3.0561	0	21	411	6.2811	3.7949	0	20	434
Number of supermarkets within 500m	2.1046	1.8403	0	11	411	2.6175	2.3447	0	13	434
Number of restaurants within 500m	16.8151	22.0562	0	159	411	26.8157	33.8155	0	157	434
Number of cafes within 500m	3.0608	4.7240	0	30	411	5.1060	6.9593	0	34	434
Accessibility characteristics										
Distance to a station	617.5921	326.4086	23.0180	1798.2552	411	549.4218	325.1310	16.4971	2016.6225	434
Distance to a bus stop	195.7733	118.6004	15.2757	653.4614	411	193.4525	115.5885	20.0529	674.9062	434
Distance to a hospital	688.2852	362.6151	51.9188	1806.9110	411	654.5471	349.9518	44.2221	1801.7473	434
Distance to a school	248.5639	128.6825	14.8770	677.0380	411	250.1982	127.9892	14.3816	692.9110	434
Distance to police	412.4478	193.1516	21.1021	1167.9139	411	373.4598	169.6363	26.6125	1117.2311	434
Distance to a fire station	791.3163	410.9887	43.3175	2062.4182	411	750.0514	358.0165	68.5463	1724.9193	434
Distance to a library	632.4242	282.2419	37.5612	1630.6025	411	619.7514	289.7250	53.3983	1777.9907	434
Distance to a post office	353.2928	156.1010	37.0188	941.3305	411	313.5474	141.2696	16.8403	740.9058	434
Distance to a city hall	2745.2349	1395.8256	82.2968	6814.8076	411	2854.2710	1461.0030	147.4517	6606.3036	434
Distance to a park	174.8603	97.0415	5.4501	517.0354	411	184.2068	102.3296	10.1137	703.2528	434
Distance to a pool	1408.2080	643.4141	53.1935	2926.0023	411	1333.6363	632.8773	158.6966	3092.7220	434
Distance to a playground	1111.2641	624.2277	41.2383	2772.4106	411	1077.4089	574.6415	113.8698	2654.5092	434
Distance to a highway	1513.1505	1054.2148	17.5808	4403.4556	411	1673.5726	1181.7097	13.4033	4549.3746	434
Distance to a major road	557.2414	472.8765	6.2440	2345.0715	411	577.6532	460.7152	3.7642	2229.0315	434

Note: This table reports descriptive statistics for the sample of properties used in the hedonic analysis, separately for owned and rented dwellings. Property characteristics include imputed monthly rent (in 100,000 JPY), structural features (number of rooms, floors, and floor level), and the presence of amenities such as south-facing windows, gardens, parking, and security features. Neighborhood characteristics are measured primarily at the cho-cho level, including population, age composition (share of residents younger than 20 or older than 65), average household size, the number of reported crimes (2023), and local market conditions based on the number of transactions within 300 m of the property. Counts of nearby commercial amenities (convenience stores, supermarkets, restaurants, and cafés) are calculated within a 500 m radius. Accessibility characteristics represent the Euclidean distance (in meters) from each property to the nearest transportation, public service, and recreational facilities. The final analysis sample consists of 411 owned properties and 434 rented properties after applying the geocoding and outlier exclusion criteria described in Section 2.2.

Table A2. Summary statistics for household characteristics

	Owned properties					Rented properties				
	Mean	Std. Dev.	Min.	Max.	N	Mean	Std. Dev.	Min.	Max.	N
Individual characteristics										
Male	0.7299	0.4445	0	1	411	0.5576	0.4972	0	1	434
Under age 30	0.0122	0.1098	0	1	411	0.0622	0.2418	0	1	434
Above age 60	0.5474	0.4984	0	1	411	0.2097	0.4075	0	1	434
Stable employment	0.5645	0.4964	0	1	411	0.6313	0.4830	0	1	434
Unemployment	0.2871	0.4530	0	1	411	0.1083	0.3111	0	1	434
College graduate or above	0.7859	0.4107	0	1	411	0.5622	0.4967	0	1	434
Annual income (1 million yen)	10.3043	6.6387	0	45	373	5.4515	3.6402	0	25	377
Affection for greenery	3.4161	1.9011	1	11	411	3.9194	2.0059	1	11	434
Knowledge of forests	26.4380	12.9139	8	80	411	31.6866	16.4917	8	80	434
Health awareness	4.7518	2.5059	0	10	411	3.5415	2.4152	0	10	434
Time discount rate	3.7880	2.1639	0	7	401	4.0598	2.4018	-1	7	418
Use park (weekly+)	0.3382	0.4737	0	1	411	0.2235	0.4171	0	1	434
Use street trees (weekly+)	0.5596	0.4970	0	1	411	0.4124	0.4928	0	1	434
Use window greenery (weekly+)	0.4453	0.4976	0	1	411	0.2028	0.4025	0	1	434
Planned move within 10 years	0.0925	0.2900	0	1	411	0.4332	0.4961	0	1	434
Living with children under 18	0.1898	0.3926	0	1	411	0.0991	0.2991	0	1	434
Living alone	0.0925	0.2900	0	1	411	0.5945	0.4916	0	1	434

Note: This table reports descriptive statistics for households residing in owned and rented properties in the analysis sample (411 owned, 434 rented). Stable employment is a dummy variable equal to 1 if the respondent is a company employee, public servant, self-employed, company director, or company owner. Annual income is reported in million JPY and was an optional (non-mandatory) question; missing responses were excluded from the statistics. Affection for greenery is an index reflecting the respondent's general attachment to urban greenery. Knowledge of forests is the sum of self-assessed understanding of eight statements (e.g., "Forests help prevent sediment disasters and conserve soil" and "Forests mitigate global warming and stabilize the climate system"), each rated on a 1–10 scale. Health awareness is the number of behaviors (out of 10) practiced by the respondent, such as "going to the gym," "jogging," or "getting enough sleep." Time discount rate is an eight-level index indicating how much the respondent would be willing to wait one year to receive, relative to 10,000 JPY after one month. Planned move within 10 years is a dummy variable for relocation intentions. Use park (weekly+), Use street trees (weekly+), and Use window greenery (weekly+) are dummy variables indicating whether the respondent observes or interacts with nearby greenery—such as parks, street trees, or greenery visible from windows—at least once per week. “Use” includes passive interactions such as viewing or noticing greenery, not only active utilization. Living with children under 18 and Living alone capture household composition.

Table A3. Validation of imputed rent using REINS data

	Owned (imputed rent, π = 0.03)					Rented				
	Mean	Std. Dev.	Min.	Max.	N	Mean	Std. Dev.	Min.	Max.	N
Number of rooms = 1 Age of property < 10	9.4566	4.5593	1.5416	38.7500	2,216	9.7296	2.7710	3.5000	33.0000	59,555
Number of rooms = 2 Age of property < 10	14.2955	4.7115	3.5828	41.4573	4,554	16.5839	4.6145	5.5000	33.4000	6,553
Number of rooms = 1 10 <= Age of property < 20	7.3052	4.3369	1.4902	32.1888	2,733	8.0296	2.2949	3.5000	33.0000	57,736
Number of rooms = 2 10 <= Age of property < 20	12.5513	5.1668	2.6178	45.0000	4,242	13.2394	3.6877	4.4000	33.0000	10,871

Note: This table compares imputed monthly rents for owner-occupied properties (calculated with a 3% depreciation rate) and actual monthly rents for rental properties, using REINS transaction data. Properties are grouped by the number of rooms (1 or 2) and approximate building age (<10 years and 10–20 years).

Table A4. Full results of first-stage hedonic regressions

	Full sample			Restricted sample		
	Owned	Rented	All	Owned	Rented	All
	(1)	(2)	(3)	(4)	(5)	(6)
Scattered greenery	df = 1.9256*	df = 1.6434	df = 2.2692***	df = 2.5702***	df = 1.9553	df = 1.7968***
Property characteristics						
Number of rooms	0.0679*	0.1641***	0.1142***	0.0906*	0.1864***	0.1545***
	(0.0297)	(0.0250)	(0.0170)	(0.0382)	(0.0279)	(0.0187)
Number of living rooms	0.1712	0.2142***	0.2182***	0.1755	0.2157***	0.2424***
	(0.0887)	(0.0388)	(0.0388)	(0.1242)	(0.0422)	(0.0403)
Number of dining rooms	0.1490	0.1695***	0.1478***	0.1298	0.1688***	0.1228**
	(0.2308)	(0.0382)	(0.0440)	(0.2548)	(0.0409)	(0.0427)
Number of kitchens	-0.7959	0.0568	0.0965	-0.6120	0.0433	0.0878
	(0.4401)	(0.0484)	(0.0572)	(0.4418)	(0.0515)	(0.0534)
Number of floors in the building	-0.0328*	0.0345***	-0.0026	-0.0314*	0.0242*	-0.0025
	(0.0139)	(0.0102)	(0.0080)	(0.0155)	(0.0109)	(0.0080)
Floor where located	0.0217	0.0108	0.0070	0.0340	0.0166	0.0119
	(0.0166)	(0.0130)	(0.0099)	(0.0177)	(0.0145)	(0.0101)
South-facing window	0.1349*	-0.0086	0.0313	0.1903**	-0.0291	0.0109
	(0.0603)	(0.0297)	(0.0286)	(0.0677)	(0.0335)	(0.0289)
Gardens	0.0524	-0.0569	0.0224	0.0356	-0.0394	0.0232
	(0.0522)	(0.0366)	(0.0292)	(0.0669)	(0.0420)	(0.0316)
Car parking	0.1509	0.0299	0.0843*	0.0604	0.0338	0.0430
	(0.0770)	(0.0362)	(0.0340)	(0.0986)	(0.0408)	(0.0356)
Bicycle parking	0.0233	-0.0112	-0.0086	-0.0245	-0.0172	-0.0117
	(0.0608)	(0.0334)	(0.0308)	(0.0793)	(0.0357)	(0.0324)
Pets allowed	-0.0259	0.0355	0.0193	0.0785	0.0690	0.0371
	(0.0489)	(0.0532)	(0.0314)	(0.0624)	(0.0570)	(0.0352)
All-electrified house	0.2009	-0.1242	0.0633	0.2678*	-0.1292	0.0427
	(0.1034)	(0.0858)	(0.0603)	(0.1234)	(0.0916)	(0.0622)
Self-locking entrance	0.0239	0.0828*	0.1000**	0.1726*	0.1060**	0.1116**
	(0.0698)	(0.0381)	(0.0350)	(0.0812)	(0.0407)	(0.0351)
Balcony	-0.0268	0.0470	0.0251	0.0211	0.0418	0.0288
	(0.0729)	(0.0332)	(0.0328)	(0.0915)	(0.0353)	(0.0330)
Air-conditioned	-0.0488	0.0057	-0.0571	0.2409	-0.0034	0.0132
	(0.1268)	(0.0502)	(0.0536)	(0.1589)	(0.0560)	(0.0546)
Kitchen island	0.0604	-0.1805	0.0931	0.1051	-0.3077*	0.1126
	(0.0884)	(0.1204)	(0.0600)	(0.0965)	(0.1327)	(0.0626)
Walk-in closet	0.1542**	0.0097	0.0708*	0.0675	0.0248	0.0407
	(0.0505)	(0.0471)	(0.0320)	(0.0653)	(0.0499)	(0.0346)
Laundry room	-0.0299	0.0984**	0.0740**	-0.0869	0.1087**	0.0812**
	(0.0575)	(0.0312)	(0.0284)	(0.0821)	(0.0329)	(0.0300)
Age of property: 1 to 5 years	-0.9987*	-0.0588	-0.0583	-1.1469**	-0.0488	-0.0087
	(0.4569)	(0.1363)	(0.1337)	(0.4259)	(0.1377)	(0.1199)
Age of property: 5 to 10 years	-1.1074*	-0.0808	-0.1199	-1.2944**	-0.0480	-0.1043
	(0.4460)	(0.1305)	(0.1301)	(0.4156)	(0.1324)	(0.1164)
Age of property: 10 to 20 years	-1.2301**	-0.0391	-0.1286	-1.3791**	-0.0101	-0.0929
	(0.4456)	(0.1257)	(0.1264)	(0.4181)	(0.1272)	(0.1133)
Age of property: 20 to 30 years	-1.2180**	-0.1032	-0.1511	-1.5105***	-0.0911	-0.1563
	(0.4441)	(0.1276)	(0.1265)	(0.4448)	(0.1291)	(0.1156)
Age of property: 30 to 50 years	-1.3626**	-0.2176	-0.2674*	-1.3550**	-0.1932	-0.2369*
	(0.4494)	(0.1289)	(0.1277)	(0.4284)	(0.1314)	(0.1161)
Age of property: over 50 years	-1.4417**	-0.2262	-0.3136*	-1.8970***	-0.1835	-0.2994*
	(0.4615)	(0.1367)	(0.1360)	(0.4426)	(0.1474)	(0.1281)
Age of property: unknown		-0.2230	-0.2425		-0.1839	-0.2104
		(0.1337)	(0.1356)		(0.1372)	(0.1238)

(continued on next page)

(continued)

Neighborhood characteristics						
Population in the area (per 1000)	0.0141	0.0004	0.0025	0.0035	0.0040	-0.0012
	(0.0089)	(0.0054)	(0.0047)	(0.0105)	(0.0060)	(0.0049)
% of population under 19 in the area	1.8518	-1.8184	1.8321	-1.0772	-1.2836	1.2309
	(3.1101)	(1.6671)	(1.5061)	(3.3705)	(1.8211)	(1.5238)
% of population over 65 in the area	1.4544	-0.2510	0.9031	0.0323	0.3127	1.0381
	(1.0748)	(0.5744)	(0.5251)	(1.3422)	(0.6472)	(0.5645)
Average household size in the area	-0.0498	0.2776	-0.1374	0.5036	0.2199	-0.0451
	(0.4118)	(0.2294)	(0.2034)	(0.4360)	(0.2458)	(0.2044)
Number of crimes in the area	0.0020	0.0006	0.0011	0.0065	0.0014	0.0011
	(0.0025)	(0.0011)	(0.0011)	(0.0037)	(0.0012)	(0.0012)
Number of properties for sale within 300m	-0.0008	0.0005	0.0000	0.0002	0.0005	0.0005
	(0.0007)	(0.0004)	(0.0003)	(0.0008)	(0.0004)	(0.0004)
Number of properties for rent within 300m	-0.0002	0.0000	0.0000	-0.0001	0.0000	0.0000
	(0.0001)	(0.0001)	(0.0001)	(0.0002)	(0.0001)	(0.0001)
Number of convenience stores within 500m	0.0019	0.0083	0.0039	-0.0166	0.0157	-0.0067
	(0.0175)	(0.0110)	(0.0094)	(0.0233)	(0.0119)	(0.0100)
Number of supermarkets within 500m	0.0248	0.0080	0.0050	-0.0065	0.0065	-0.0032
	(0.0258)	(0.0139)	(0.0129)	(0.0287)	(0.0147)	(0.0129)
Number of restaurants within 500m	0.0055	-0.0016	0.0009	0.0061	-0.0026	0.0004
	(0.0039)	(0.0019)	(0.0017)	(0.0050)	(0.0020)	(0.0018)
Number of cafes within 500m	-0.0161	0.0072	0.0048	-0.0159	0.0097	0.0131
	(0.0160)	(0.0073)	(0.0069)	(0.0251)	(0.0081)	(0.0074)
Accessibility characteristics						
ln(Distance to a station)	0.0033	0.0011	-0.0458	0.0437	0.0022	-0.0787*
	(0.0618)	(0.0401)	(0.0344)	(0.0786)	(0.0420)	(0.0366)
ln(Distance to a bus stop)	-0.0576	0.0101	-0.0230	0.0358	-0.0211	-0.0357
	(0.0466)	(0.0274)	(0.0248)	(0.0567)	(0.0303)	(0.0259)
ln(Distance to a hospital)	0.0747	0.0142	0.0502	0.0178	0.0301	0.0392
	(0.0490)	(0.0325)	(0.0277)	(0.0651)	(0.0345)	(0.0293)
ln(Distance to a school)	-0.0106	0.0500	-0.0200	0.1175*	0.0478	0.0120
	(0.0462)	(0.0273)	(0.0235)	(0.0582)	(0.0289)	(0.0245)
ln(Distance to police)	-0.0045	-0.0332	-0.0041	0.0508	0.0063	-0.0223
	(0.0592)	(0.0316)	(0.0284)	(0.0714)	(0.0350)	(0.0295)
ln(Distance to a fire station)	0.0451	-0.0595	0.0070	0.0478	-0.0567	-0.0242
	(0.0576)	(0.0347)	(0.0301)	(0.0733)	(0.0379)	(0.0312)
ln(Distance to a library)	-0.1244*	0.0259	-0.0010	-0.0446	0.0391	-0.0054
	(0.0629)	(0.0346)	(0.0305)	(0.0792)	(0.0374)	(0.0311)
ln(Distance to a post office)	-0.0265	0.0133	0.0099	-0.0765	0.0152	0.0280
	(0.0497)	(0.0288)	(0.0254)	(0.0539)	(0.0301)	(0.0251)
ln(Distance to a city hall)	-0.3272*	-0.0815	-0.1167	-0.3333*	-0.0913	-0.0120
	(0.1273)	(0.0791)	(0.0683)	(0.1616)	(0.0887)	(0.0720)
ln(Distance to a park)	0.0095	-0.0101	-0.0019	0.0502	-0.0219	-0.0082
	(0.0360)	(0.0235)	(0.0202)	(0.0428)	(0.0244)	(0.0203)
ln(Distance to a pool)	0.1219	-0.0405	0.0376	0.0035	-0.0654	-0.0126
	(0.0904)	(0.0575)	(0.0463)	(0.1092)	(0.0647)	(0.0475)
ln(Distance to a playground)	0.0030	-0.0589	-0.0180	-0.1195	-0.1060	-0.0224
	(0.0776)	(0.0610)	(0.0441)	(0.0949)	(0.0649)	(0.0459)
ln(Distance to a highway)	-0.0889	0.0782*	0.0165	-0.0274	0.0879**	0.0478
	(0.0480)	(0.0315)	(0.0258)	(0.0563)	(0.0328)	(0.0261)
ln(Distance to a major road)	0.0165	0.0276	0.0064	0.0766*	0.0179	0.0266
	(0.0319)	(0.0209)	(0.0177)	(0.0371)	(0.0222)	(0.0180)
House type dummies	YES	YES	YES	YES	YES	YES
School district fixed effects	YES	YES	YES	YES	YES	YES
Observations	411	434	849	252	389	646
Adjusted R-squared	0.2667	0.6652	0.4964	0.5910	0.6752	0.6061
Log Likelihood	-1229.904	-866.287	-2254.861	-664.526	-762.598	-1600.608

Note: This table reports the coefficients from the first-stage hedonic regressions used to estimate property values as a function of structural, neighborhood, and accessibility characteristics. Columns (1)–(3) use the full sample (owned, rented, and pooled), while columns (4)–(6) use the restricted sample that excludes properties with a length of residence exceeding 20 years. House type dummies classify properties by combining tenure (owned or rented) with structural type (apartment, condominium, or detached house). Standard errors are reported in parentheses. *, **, and *** denote significance at the 5%, 1%, and 0.1% levels, respectively. Adjusted R-squared values and log-likelihoods are reported at the bottom of the table.