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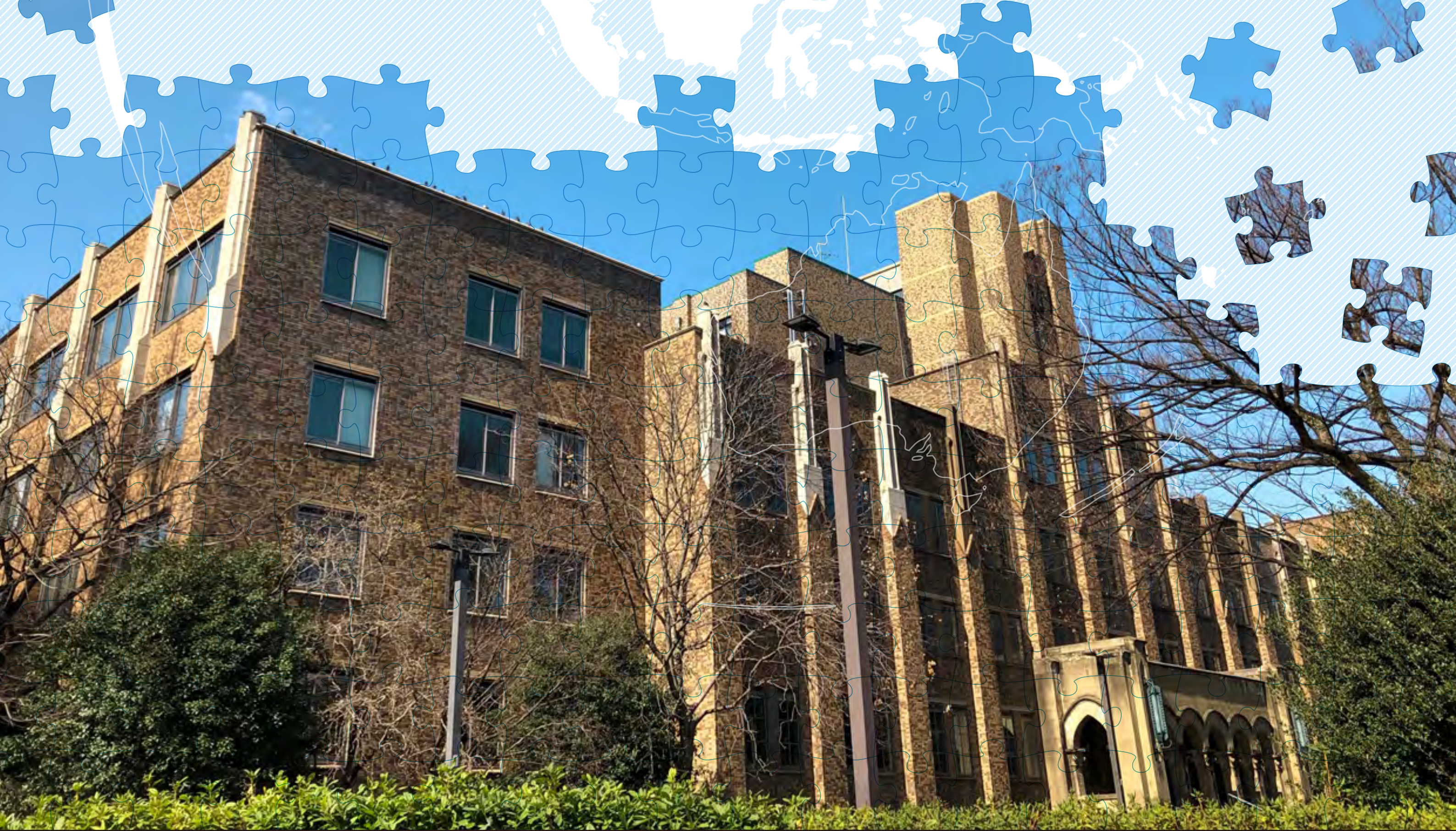
The stigma of in-home death: Impact on housing prices and rents in the Tokyo Metropolitan Area



No. 72

Date Feb. 2024

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The stigma of in-home death: Impact on housing prices and rents in the Tokyo Metropolitan Area *

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June 26, 2024

Abstract

This study investigates the impact of death incidents on property prices and rents within residential buildings in the Tokyo Metropolitan Area, Japan. Employing a staggered difference-in-differences approach on a comprehensive dataset of death incidents and property transactions, the analysis reveals that in-home deaths lead to a persistent 5% reduction in sale prices for properties in the same building. However, the negative spillover effect on rents is minimal. The differential outcomes likely stem from buyers being more informed than renters about incidents before signing contracts. The negative impact exhibits substantial heterogeneity, intensifying in housing markets with low demand or adverse conditions, such as high vacancy rates, high murder rates, and during off-seasons. Deaths from murder, during summer, and in older properties also amplify the effect. The findings highlight deficiencies in Japan's current in-home death disclosure policies, which only mandate disclosure for the affected property. The significant negative spillover effect suggests that the disclosure requirement should extend to the entire building to align with the current law's intent.

*We deeply appreciate the helpful comments provided by Junya Kumagai and Masatomo Suzuki. We would also like to thank the participants at the Annual Meeting of the Applied Regional Economics Workshop in June 2023, the Special Lecture at Osaka Metropolitan University in July 2023, the Rokko Forum at Kobe University in July 2023, the Annual Meeting of the Society for Environmental Economics and Policy Studies in October 2023, the Annual Meeting of the North American Regional Science Council in November 2023, and the Annual Meeting of the Applied Regional Science Conference in December 2023. This work is financially supported by the Housing Research and Advancement Foundation of Japan, Seijo University, JSPS KAKENHI Grant Number JP23K12473, and JP22K13401. Data for in-home death incidents were collected and generated by Oshimaland.com. Transacted property data were collected and provided by Real Estate Information Network for East Japan. The views expressed are those of the authors and do not necessarily reflect those of any organizations with which the authors are affiliated. All remaining errors are our own.

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1 Introduction

Some cultures conceive of death as ominous. In the Japanese cultural mindset, the spirit of a person who experienced an unfortunate death with regret is believed to stay and wander around the current world with grudge, resentment, and sadness. The invisible spirit of a deceased person with a deep-seated grudge is perceived as sinister, which may evoke a fear of being haunted or possessed by ghosts (Toelken and Iwasaka, 1994; Komatsu, 1997).

Such a cultural mindset surrounding death in Japan is rooted in Shinto, an ancient Japanese religion that has significantly influenced Japanese culture and daily life. Shinto interweaves religious practices with cultural attitudes, one of which is the concept of "*kegare*" (impurity). Impurity, particularly associated with death, is considered a major source of spiritual misfortune. In Shinto animism, where everything is believed to possess a spirit, impurity is thought to bring spiritual bad luck. This belief implies that places or objects connected to death can be spiritually harmful. Consequently, the idea of impurity linked to death has profoundly shaped Japanese societal attitudes, giving rise to numerous folktales and stories about earthbound spirits causing misfortune in certain locations.[1]

The concept of death as impure is not confined to Japan; analogous perspectives are evident across various Asian cultures. Within Hinduism, widely practiced in India and Nepal, a belief in reincarnation prevails, whereby traumatic demises may lead to the deceased becoming troublesome spirits. Ancient Chinese beliefs also underscore the potential transformation of the deceased into malevolent ghosts in the absence of appropriate burial rites and sacrificial offerings. Ancestor veneration in China, shaped by Confucian and Taoist influences, accentuates the significance of honoring the departed to prevent their transition into menacing entities. Furthermore, Feng Shui is another Chinese cultural practice used to counteract negative influences associated with death. Collectively, Asian societies tend to harbor greater apprehension and aversion towards death.[2]

Since housing is an essential element in daily life, people living in cultures with such beliefs in earthbound spirits may harbor a strong sense of defilement against residences connected to other people's deaths, perceiving such places as having negative and ominous atmospheres. Residential properties where an in-home death has occurred, meaning that past residents have died inside the house, may induce psychological discomfort, which could affect potential buyers' or renters' willingness to pay to live in such properties or their neighborhood. The negative association between the occurrence of

[1] See Section 2.1 for more details about the cultural background in Japan.

[2] See Section 2.3 for more details about the cultural background in other Asian countries regarding the perception of death.

in-home death incidents and housing prices reflects the unfavorable impression of death in cultures that perceive it as a sinister phenomenon.

This study investigates the severity of psychological discomfort associated with human death in the Japanese context by examining the impact of in-home death on housing values using the hedonic approach. One distinct feature in our study, compared to other studies in the hedonic literature, is that not all buyers and renters are aware of the death incidents analyzed in this study. Therefore, the estimated impact in our study represents a combination of the psychological impact and awareness level of buyers and renters concerning the incident, unlike other hedonic studies assuming the complete information regarding events being studied. As a result, the impact of in-home death on housing values depends not only on people's perceptions of human death in their culture but also on rules governing the disclosure of in-home death in real estate transactions.

Another distinct feature is that the impact of in-home death reveals the presence of stigma stemming from past incidents independent of material defects and expectations toward future events. Generally, residents may feel uneasy about their residence for a variety of reasons, including poor neighborhoods, environmental issues, and crime and disaster risks. The negative impacts of such aspects can be ascribed to at least one of three types of anxieties, which pertain to anticipated future events, present events, or past events. An example of the first type includes the perceived risk of a future natural disaster.[3] The second type of anxiety arises from the disutility that residents are experiencing in the present, such as environmental contamination.[4] The third type is attributed to the stigma from a past event, such as a suicide in a property. Although the former two types have predominantly been explored in the previous hedonic literature, research focusing on the third type is scarce.[5] In-home deaths are unique in the sense that their impacts are primarily attributed to the third type rather than the former two types of anxiety: A past occurrence of suicide does not involve any physical or material impact in the present, unlike the second type, and is not associated with the

[3]People adjust their perceived risk of living in a particular area by reviewing published hazard maps, sex offender registries, and crime rates (Klimova and Lee, 2014; Linden and Rockoff, 2008; Pope, 2008; Tang and Le, 2023). Calamities such as earthquakes, typhoons, and epidemics can also elevate subjective perceived risk and consequently influence housing prices (Gibson and Mullins, 2020; Liu and Tang, 2021; Wolf and Takeuchi, 2022; Zhu et al., 2016).

[4]The example includes instances of environmental contamination, pollution, and noise (Boyle and Kiel, 2001; Congdon-Hohman, 2013; Dealy et al., 2017; Jensen et al., 2014; Walsh and Mui, 2017).

[5]In many studies, the estimated impact can result from a combination of multiple types of anxiety. For instance, Zhu et al. (2016) found a negative impact of the Fukushima Daiichi nuclear disaster in 2011 on land prices near nuclear power plants in China, arising from stigma and changes in perceived risk associated with nuclear power plants. A study by Dealy et al. (2017) on methamphetamine labs estimates the decline in housing prices upon the discovery of labs, attributed to stigma and material defects. They also assessed the price recovery after the removal of labs and contaminations and noted that the price did not fully recover to its initial level; they interpreted the gap as due to stigma stemming from the previous existence of methamphetamine labs.

likelihood of another in-home death in the future in the property, unlike the first type.

Despite numerous news articles and reports across countries highlighting the significant impact of in-home death on the property itself (Cahill, 2022; Goh, 2022; Vasel, 2016), empirical assessments based on sophisticated econometric methods are scarce. There are, however, some studies surrounding the impact of in-home death on the housing market based on surveys and the hedonic approach. Chapman et al. (2019) conduct questionnaire surveys of business students at three universities in the United States. The survey results indicate that the anticipated impact of a murder on housing prices varies among respondents. The majority (58%) state that the impact would be minimal (less than 10%), while 18% of respondents indicate that the price loss would be more than 30%. Alias et al. (2014) and Nallathiga et al. (2017) also conduct surveys in Malaysia and India, respectively, demonstrating the potential negative impact of in-home death on housing markets.

In the context of hedonic price theory (Rosen, 1974), the individual with the highest bidding price on a property purchases it. This implies that the impact of in-home death on property price cannot be represented simply by the weighting average of potential buyers' willingness to pay to avoid such a property. Instead, estimating the hedonic price function is useful for examining the price impact. Among the limited studies, Chang and Li (2018) and Bhattacharya et al. (2021) analyze sales data in Hong Kong and discover a significant decline in property prices following the occurrence of a death incident within the condominium building. In Japan, Sadayuki (2020) analyzes cross-sectional rent data for Tokyo Prefecture and shows that rent is lower for an apartment building with an in-home death incident than for a building without such an incident. In his study, however, there remains a possibility of endogeneity, where a death incident might be more likely to occur in buildings with unobservably unfavorable features, which may have led to lower prices.

Our study makes four contributions to the literature. First, this study analyzes using the most sophisticated methods available along with detailed datasets on in-home deaths and housing transactions. In particular, building-level fixed effects are incorporated in the regression to fully account for locational endogeneity and the unobservable effect of building-specific attributes. In addition, we employ the staggered difference-in-differences (SDiD) approach proposed by Sun and Abraham (2021) to address the potential estimation biases related to treatment effects that stem from differential treatment timings (in our case, the timing of death) and heterogeneous impacts across treatment cohorts. While Chang and Li (2018) and Bhattacharya et al. (2021) employed the canonical two-way fixed effects DiD method under staggered treatments, such an approach is unsuitable for situations where treatment effects differ according to the treatment cohorts. Sun and Abraham (2021) provide robust estimates of such a situation.[6]

Second, our transaction data enable us to examine impacts on sales and rents rather than focusing on one or the other, as done in the previous in-home death studies. Recent discussions in the field of regional science highlight the heterogeneity between rental housing and sales housing markets, especially concerning the impacts of dwelling amenities (Caplan et al., 2021; Klimova and Lee, 2014; Kuroda and Sugasawa, 2023). Our analysis shows that in-home death induces a reduction in prices but not in the rents of neighboring properties within the building. These results on price and rent remain robust across various estimations employing different samplings and model specifications. We then delve into potential mechanisms for the differential outcomes between sales and rents. After examining several mechanisms with available data, the most plausible explanation for the differential outcomes appears to be the difference in awareness levels between prospective buyers and renters regarding in-home deaths in the building into which they move. Compared to renters, buyers invest more time and effort searching for housing and, thus, are more likely to be aware of incidents in the building before signing contracts. One notable observation which partially supports this explanation is a sharp rise in lease transactions following an incident, suggesting that properties from which incumbent renters move after the incident are immediately replaced by new renters who are not aware of the death incident in the building.

Third, our study encompasses a broad geographic scope, including four prefectures—Tokyo, Saitama, Chiba, and Kanagawa—which together constitute the Tokyo Metropolitan Area, one of the world's largest cities. This approach contrasts with that of previous studies, which focused on a limited geographic area, such as Hong Kong and Tokyo Prefecture, where housing markets exhibit a high degree of homogeneity in terms of regional and socioeconomic characteristics.[7] Our study area shows remarkable diversity, spanning from urban areas characterized by the 9th highest cost of living globally (Parakatil, 2022) to rural areas featuring the second highest vacancy rates in OECD countries (OECD, 2020) and the highest elderly population rates worldwide (PRB, 2019). This variation in regional characteristics allows us to investigate the heterogeneous impacts of in-home death. The data

[6]As detailed further in Section 3, the *Oshimaland* website, which we use to compile in-home death record data, has been gaining popularity over time. This growing popularity suggests that consumer interest in or concern about properties where in-home deaths have occurred has also increased. Consequently, the impact of a property becoming stigmatized varies depending on the year (cohort) in which the in-home death occurred.

[7]The significance of regional heterogeneities in influencing residents' behavior has been emphasized in previous research on various disamenities, including disasters (Bakkensen and Barrage, 2017), epidemics (Liu and Tang, 2021), and crime (Kim and Lee, 2018).

show that the negative impact of in-home deaths is more pronounced in areas with high vacancy rates and murder rates, suggesting that the impact is more severe in a housing market with low demand and specific adverse conditions. This insight is corroborated by additional analyses, which reveal larger negative impacts on transactions during the off-season in the real estate market, as well as in older buildings.

Finally, based on the empirical results of the study, we discuss deficiencies of the current Japanese disclosure rules regarding in-home deaths. Japan's property transaction law mandates that property dealers inform potential buyers/renters of any matter that could influence their decisions. However, the law does not specify situations where dealers must disclose in-home deaths. This ambiguity has led to many problems, including discriminatory practices by landlords against minorities and court cases filed against dealers for failure to disclose, resulting in significant social costs. In response to these issues, the Japanese government issued guidelines for in-home death disclosure in 2021 (MLIT, 2021). According to the guidelines, dealers are advised to inform counterparts about a death incident if it occurred in the property being transacted, but not if the death occurred in another property. In other words, the government asserts that in-home death causes psychological stigma exclusively within the property itself, not in another property in the same building. However, the obtained results reveal that the stigma around death incidents extends beyond the in-home death property itself, contrasting with the assertion in the government's guidelines. Our result suggests that, to abide by the current law in Japan, property dealers must inform transaction partners about previous death incidents that occurred in the same building, even when these deaths did not occur on the specific property under consideration.

The rest of the paper is structured as follows. In Section 2, we review how death is perceived as ominous in Asian societies, particularly in Japan, from the viewpoint of religious and cultural background. Section 3 outlines this study's empirical design, data sources, and variables. Section 4 demonstrates the main results and robustness checks, followed by the policy implication of Japanese disclosure rules. Section 5 discusses potential mechanisms contributing to the differential impacts on prices and rents. Then, Section 6 provides heterogeneity analyses. Finally, Section 7 concludes the paper.

2 Cultural background

2.1 Japanese perspectives of death

Shinto, which means the "Way of Gods (or Spirits)", is said to be the ancient and indigenous religion of the Japanese (Anesaki, 2012).[8] According to the Religious Yearbook *Shukyo Nenkan* (Agency for Cultural Affairs, 2023), Shinto is a collective term for a religion that originated and developed based on the indigenous gods and spirits of the Japanese people. When referring to Shinto, it may encompass not only beliefs about gods and spirits and traditional religious practices but also attitudes and ways of thinking that are widely transmitted within daily life.[9] Shinto as a religion is based on the unorganized worship of spirits, characterized by ancestor worship with a background of nature worship or animism (Anesaki, 2012).[10] Animism attributes conscious life to nature and natural objects, believing in innumerable spirits inhabiting sacred places and influencing human affairs closely (Davies, 2016). Veneration of ancestors is frequently depicted as a pivotal aspect of contemporary Shinto, which places significant importance on ancestor worship, filial piety, reliance on superiors, and belief in the spirits of the deceased (Davies, 2016; Chart, 2022).

One important conception of Shinto closely related to death is "*kegare*" or impurity (Chart, 2020). Impurities come from blood, birth, disease, and corpses, and contact with any of these impurities requires "*harae*" or purification (Anesaki, 2012; Chart, 2022). Among these, death is the greatest source of *kegare* (Chart, 2020). The conception of *kegare* is viewed as something dangerous or contagious. This perception resembles responses to infection or contamination, emphasizing the need to isolate the affected individual to prevent the spread of disease or impurity through contact (Chart, 2020).[11] In an animist perspective where everything possesses a spirit, *kegare* associated with a place or object can be seen as a form of spiritual misfortune tied to it (Chart, 2020).[12] As *kegare* is thought of as

[8]Opinions on the origin of Shinto are still divided. Shinto's origin may date back to the Jomon period (c.12,000–400 BCE) or to the subsequent Yayoi period (c.400 BCE–300 CE), when rice cultivation was introduced in Japan (Mori, 2003).

[9]Shinto today can be broadly classified into Shrine Shinto, which centers around Shinto shrines, Sectarian Shinto established since the late Edo period (late 1850s to the early 1860s, leading up to the Meiji Restoration in 1868), and Ethnic Shinto practiced in households or by individuals without forming religious organizations like the former two (Agency for Cultural Affairs, 2023).

[10]Contemporary Japanese religious and philosophical thought is shaped by the fusion of indigenous animistic practices rooted in Shintoism and religious philosophies imported from East Asia, such as Mahayana Buddhism, Taoism, and Confucianism. Japanese religious culture is seen as a multiple-layered structure, with Shinto as the bedrock, overlaid by Buddhism, Taoism, and Confucianism. This syncretism is possibly due to the Shinto's animism characterized by the co-existence of innumerable spirits that are thought to inhabit sacred places, which may lead to the Japanese synthesis and consensus formation rather than the assertion of one belief system over another (Davies, 2016).

[11]Because *kegare* is thought of as being contagious, contact with death should be avoided. Such a behavior is called "*imi*" or abstention (Davies, 2016).

[12]Another perspective on impurity tied to a location can be considered. Originally, *kegare* refers to a weakening of a

being contagious, visiting or living in such places attached with *kegare* may be harmful for people in that they may experience spiritual bad luck.

2.2 Japanese folktales of earthbound spirits

In Japan, numerous folktales and legends recount the existence of earthbound spirits of the deceased, reflecting the Shinto beliefs that death sites bring misfortune. These ghosts are known as "*jibaku-rei*" in Japanese, which appear visually and are fixed in specific locations (Oshima, 2007). Stories of earthbound spirits date back to at least Japanese medieval times. *Konjaku-Monogatarishu*, the anthology of tales from the past, is a Japanese collection of over one thousand tales written in late Heian period (794–1185) and contains several tales about earthbound spirits (Takeishi, 2016).[13] A tale in the collection is about a man who was struck by lightning and killed. It is said that his spirit lingered in the area for a long time, causing various misfortunes there.[14] Another tale in the same collection is about a ghost who linger in a mansion he owned during his lifetime, while asserting to a new resident that the mansion still belongs to him even after his death.[15]

Tales called "dish mansion legends" ("*Sara-Yashiki-Densetsu*") in the Japanese early modern times, during the Edo period under Tokugawa shogunate (1603–1868), are other examples of famous stories featuring *jibaku-rei*.[16] The narratives often revolve around a woman who tragically died and her spirit remains in the place of her death, counting dishes and causing disturbances that lead to misfortune for the inhabitants. These folktales are found in various regions, highlighting their enduring relevance in Japanese culture.

Furthermore, in the modern Meiji period (1868–1912), there is a description of a cursed house in a biography of a naval investigator on *Kanrin-Maru*, one of Japan's first modern-style ocean-going ships. According to the biography, which was compiled by a descendant of the investigator, the house where he had lived was considered ominous, as all of the subsequent residents (approximately 6–7 heads of

person's life force. Therefore, when *kegare* is associated with a place or object, it could be seen as a weakening of the spirit of that place or object. This idea is certainly present in Shinto practices and beliefs (Chart, 2020).

[13] *Konjaku Monogatarishu* was originally comprised of 31 volumes, though only 28 remain today. The collection covers stories from India, China, and Japan, divided into sections based on geographical regions. The first five volumes focus on tales set in India (*Tenjiku*), the next five on tales from China (*Shintan*), and the remaining volumes feature stories from Japan (*Honcho*).

[14] The tale of spirits of the Demon Palace at Sanjo Higashidono-in ("*Sanjo-No-Higashi-No-Toin-No-Onidono-No-Ryo-No-Koto*") in *Konjaku-Monogatarishu: Honcho* Vol. 27, Tale 1 (Takeishi, 2016).

[15] The tale of Emperor Uda witnessing the spirit of Minister Toru of Kawara-in ("*Kawaranoin-No-Toru-No-Sadaijin-No-Ryo-Wo-Udanoin-Mitamau-Koto*") in *Konjaku-Monogatarishu: Honcho* Vol. 27, Tale 2 (Takeishi, 2016).

[16] "*Bancho-Sara-Yashiki*," "*Seiban-Kaidan-Jikki*" published in 1754, and "*Unshu-Sara-Yashiki*" are examples of *Sara-Yashiki-Densetsu* (Oshima, 2007).

household) experienced untimely deaths.[17] This ill fortune is thought to be the result of the initial inhabitant being reproached by the domain lord, which caused him distress and ultimately led to his suicide (Ikeda, 2002). During the Meiji period, numerous news articles emerged discussing haunted houses by depicting unquiet ghosts of past residents who had died in their houses.[18]

2.3 Perspectives of death in Asian countries

The idea that death is impure extends beyond Japan and can be observed in other countries, particularly in Asia (Chapman and Ludlum, 2014; Rittichainuwat, 2011).[19] Doctrines about death similar to what is observed in Japan are also found in Hinduism, which is centered on reincarnation and widely practiced in India and Nepal. They suggest that reincarnation can take the form of a human ("*manusya*") or an animal ("*tiryak*"), while in the case of traumatic death, the person becomes a ghost ("*Preta*") that roams around the former home and causes trouble for people dwelling in the house.[20]

In addition, in China, the belief that deceased people become ghosts has existed since at least before the Qin dynasty. By the Warring States period, deceased people were believed to become evil ghosts ("*ligui*") and haunt people unless they were given a proper burial and sacrifices (Poo, 2004). Regarding ancestor worship in China, which has been supported by the teachings of Confucianism and Taoism, it is believed that ancestors watch over their descendants as wandering spirits (Al-Ghananeem, 2022). It is also believed that if the deceased are not properly memorialized, they may become ghosts and pose a threat to the living (Chiu, 1986). Chinese culture has also relied heavily on Feng Shui, one of the traditional Chinese philosophical systems, in architecture, urban planning, and moving. It is believed that the death of a person generates excess negative energy ("*sha qi*") and brings misfortune to people (Chang and Li, 2018).

2.4 Attitudes toward in-home death in contemporary Japan

While not many Japanese people formally adhere to Shintoism today, its long-lasting impact is primarily evident in daily customs and behaviors, influencing how people think, behave, and value things

[17] The bibliography of Gondayu Yoshioka, a naval investigator, who accompanied Fukuzawa Yukichi on the ship *Kanrin-Maru* when he crossed over to America in 1860, is titled "*Yoshioka Gondayu Ko-Den*" and published in 1932 (Ikeda, 2002).

[18] Examples of news articles about haunted houses appear in *Aichi-Shimbun* Newspaper issued in 1878, *Mutsu-Nichinichi-Shimbun* Newspaper issued in 1882, and *Ehime-Shimpo* Newspaper issued in 1899 (Oshima, 2007).

[19] Chapman and Ludlum (2014) posits that individuals in Asia are more profoundly affected by the in-home death than those in the West. Appendix A demonstrates surveys that support this view and discusses potential contributing factors to the differences in cultural attitudes towards in-home death.

[20] Detailed descriptions can be found in vv. 8–12 and 45 in Shastri (1979) and vv. 8–13 in Shastri (1980) in *Garuda Purana*, a Hindu scripture.

in modern Japanese society. According to the "Survey of the National Character of Japanese People" by the Institute of Statistical Mathematics (Yoshino et al., 2015),[21] about 70% of respondents express no interest or belief in religion. However, when asked about the importance of a "spiritual mindset," approximately 70% consider it important, regardless of formal religious affiliation. This suggests that contemporary Japanese individuals maintain some spiritual mindset rooted in traditional Shinto beliefs and practices, whether they are consciously aware of it or not. Particularly, the belief in *kegare* ligering at the site of someone's death has persisted into current times from long ago (Davies, 2016).

Evidence of this inherited mindset can be observed in the Japanese occult boom of the 1970s, during which terms like *jibaku-rei* and "*fuyu-rei*," or floating spirits, became commonplace in everyday conversation. As an explanation for the spread of terms and conceptions used in spiritual research becoming popular in everyday language, one can point to this past boom (Oshima, 2007; Hirota, 2021). The widespread use of terms such as *jibaku-rei* and *fuyu-rei* is significantly attributed to the influence of famous Japanese comic books "*Ushiro-No-Hyakutaro*" (Davisson, 2020; Oshima, 2007). Notably, *Ushiro-No-Hyakutaro* (vol. 2 and 3) includes an episode about a property haunted by the spirit of a past resident who committed suicide, causing harm to subsequent residents. Another piece of evidence is the emergence and continued presence of the website "*Oshimaland*," which will be detailed in Section 3.3. In Okamoto (2021), the author discusses this website and the concept of "incident properties," suggesting that avoiding such properties reflects underlying negative impressions and subtle emotional shifts rather than a firm belief in Shinto.

Drawing from Japan's religious and cultural background, particularly Shinto beliefs, and their enduring influence on contemporary Japanese customs, beliefs, and spiritual mindsets, this paper posits that the occurrence of a death within a home may lead to a decrease in property prices or rents. This reflects a prevalent societal aversion to death, rooted in notions of impurity and foreboding. Given that housing is fundamental to daily life and intimately tied to our existence, it is both pertinent and logical to explore whether the perception of death as negative is reflected in real estate transaction data.

[21] Survey of the National Character of Japanese People (*Nihonjin-No-Kokuminsei-Chosa*) has been conducted by the Institute of Statistical Mathematics every five years since 1953. This survey is a sample survey targeting men and women aged 20 and over (however, the 11th and 12th surveys target those aged 20 to under 80, and the 13th survey targets those aged 20 to under 85). For each survey, a stratified multistage random sampling method was used to select a sample of 2,254 to 6,400 individuals, and it was conducted using individual interview methods.

3 Empirical strategy and data

In this section, we present our empirical strategy and data. We apply a staggered difference-in-differences (SDiD) method, given that death incidents occur at different times across buildings (i.e., treatment timings are staggered across buildings). To estimate the average treatment effect on the treated (ATT) of such an impact with staggered treatment timings, the canonical two-way fixed effects DiD method under staggered treatments employs an indicator variable, which equals one for treated individuals after the treatment period, along with individual and time fixed effects and time-varying covariates. However, recent studies have highlighted that the two-way fixed effects DiD approach under staggered treatments does not provide a valid estimate of the ATT unless the treatment effect is homogeneous across treated cohorts (Athey and Imbens, 2022; Baker et al., 2022; Callaway and Sant' Anna, 2021; De Chaisemartin and d'Haultfoeuille, 2020; Goodman-Bacon, 2021; Sun and Abraham, 2021), even when the treatment timings are random. Although in-home deaths seem to occur randomly in terms of timing, the homogeneity of the treatment effect across cohorts is unlikely to hold. This is because the stigma of death incidents is in general expected to diminish over time. Moreover, the *Oshimaland* website, based on which we create a dataset of properties that experienced in-home death occurrences, gains more recognition over time, and the potential buyers' or renters' interest and concern about such incident properties grow. Then, the impact of becoming an incident property on the sale prices or rents varies by the year of the in-home death occurrence (treatment cohort). The incremental popularity of the website will be explained more in Section 3.3. This study adopts the SDiD estimation proposed by Sun and Abraham (2021) to address the potential estimation bias inherent in the canonical DiD approach.

To estimate the impact of in-home deaths on prices and rents within buildings, the SDiD requires information on transactions before and after the occurrence of death incidents in buildings where an incident occurred. For this purpose, our analysis draws on two extensive datasets. As noted above, the first dataset comprises information on in-home deaths recorded in the *Oshimaland* website, an online platform that compiles death-related information from user-contributed posts. The second dataset contains property transactions sourced from the Real Estate Information Network System (REINS), furnished by the Real Estate Transaction Promotion Center (RETPC), Japan.

The following two subsections detail the estimation strategy and data manipulation to clarify our estimation strategy.

3.1 Empirical model

Our baseline SDiD model, constructed based on the hedonic price model (Rosen, 1974) with Sun and Abraham's (2021) procedure, is as follows:

$$\ln price_{ijt} = \boldsymbol{\beta} \boldsymbol{X}_{ijt} + \sum_{e} \sum_{l \neq -1} \gamma_{e,l} \mathbb{1}\{f(t - E_j) = l\} * \mathbb{1}\{g(E_j) = e\} + \mu_j + \boldsymbol{\tau}(t) + \epsilon_{ijt}, \quad (1)$$

where the dependent variable, $\ln price_{ijt}$, is the natural logarithm of the nominal price or rent of property i in building j, transacted in year-month t. On the right side of the equation, we control for the building-level fixed effect, μ_j, and time fixed effects, $\boldsymbol{\tau}(t)$. The building fixed effects address the endogeneity attributable to locational and building-specific characteristics, allowing us to focus on the price variation within the building.[22] The time fixed effects consist of year fixed effects and month fixed effects, which capture the unobservable housing price dynamics over the years and the seasonal price fluctuations.[23] To account for the within-building price variation across properties, we include a vector of property-level attributes, $\boldsymbol{X}_{ijt}$, such as the floor area, floor level, and age of the building at the time of the transaction. $\boldsymbol{\beta}$ is a vector of parameters associated with the property-level attributes. Note that building-specific attributes commonly used in hedonic analysis, such as the distance to the CBD and building structure, are omitted from the model because their effects are encapsulated within the building-level fixed effect. ϵ_{ijt} is an error term.

Our variables of interest are the interactions of two indicators, $\mathbb{1}\{f(t - E_j) = l\} * \mathbb{1}\{g(E_j) = e\}$, where $\mathbb{1}\{x = 1\}$ if x is true and $\mathbb{1}\{x = 0\}$ otherwise. Here, E_j represents the Gregorian calendar year-month of death incident occurrence in building j, l denotes the number of years, and e denotes a Gregorian calendar year. In the first indicator, the function $f(\cdot)$ converts the number of months into the integer number of years.[24] Therefore, the first indicator indicates the relative treated years, which equals 1 if property i is transacted l years after the incident occurred in building j. In the second indicator, the function $g(\cdot)$ converts a Gregorian calendar year-month to a simple Gregorian year.[25] Therefore, the second indicator indicates a treatment cohort, which equals one if the incident

[22] As explained in Section 3.3, death incidents may be detectable not at the property level but only at the floor or building level. In addition, the sample size becomes too small for our empirical analysis when the sample is restricted to repeat sales where multiple transactions in the same property take place. Therefore, we control for building-fixed effects instead of property-fixed effects in our specification.

[23] We employ a robustness check in Section 4.2 and Appendix C.2, controlling for municipality-by-year fixed effects, and show that the main result is not influenced by the potential area-specific time trends.

[24] For instance, $f(11) = 0$, $f(12) = 1$, and $f(100) = 8$.

[25] For instance, $g(\text{January 2020}) = 2020$.

in the building occurred in year e.[26] A set of properties for which the second indicator equals one is referred to as the e-year-death-building cohort. For instance, if a death incident occurred in building j in 2020, then all the transaction properties in building j belong to the 2020-death-building cohort. Finally, given the interaction of these two indicators, the parameter $\gamma_{e,l}$ reflects the impact, l years after the incident occurred in year e, on the price or rent within the building. Here, one year before the incident, $l = -1$, serves as the reference period. For $l \leq -2$, the parameter is expected to serve as a placebo coefficient, allowing us to test the assumption of parallel trends. To obtain the ATT (or the placebo effect) at relative treated period l, we take the weighted average of $\widehat{\gamma_{e,l}}$ over the cohorts: $\widehat{v_l} = \sum_e w_e \widehat{\gamma_{e,l}}$, where w_e is the estimated share of the e-year-death-building cohort.

The canonical two-way fixed effects DiD approach under staggered treatments discards the second indicator of the treatment cohort, $\mathbb{1}\{g(E_j) = e\}$, and uses only the first indicator of relative treatment time to directly estimate the impact l years after the incident, as in previous studies on in-home deaths (Bhattacharya et al., 2021; Chang and Li, 2018). However, under such a canonical DiD approach under staggered treatments, the estimate of ATT not only reflects the pure comparison between the treatment and control groups but is also influenced by comparisons of price evolution among the treatment group. As proposed by Sun and Abraham (2021), the introduction of the second indicator allows us to extract the effects only from comparisons between the treatment and control groups. In our case, the sample size is insufficient to construct treatment cohorts at every monthly level, while we employ treatment cohorts at the yearly level to mitigate the potential influence of intra-treatment group comparisons on the estimation result.

In addition to the issue of staggered treatment timing, another challenge of applying the DiD method to in-home death studies, including ours and previous studies (Bhattacharya et al., 2021; Chang and Li, 2018; Sadayuki, 2020), is the lack of comprehensive official data on in-home death. The DiD method requires a sample of treatment and control groups. In this study, as we are interested in estimating the effect of in-home death within the building, the sample for the treatment group comprises property transactions in buildings that experienced an in-home death incident during the study period, and the sample for the control group comprises those in buildings that had no in-home death incident during the study period. However, the construction of a control group in our study setting is challenging because, as will be discussed later in more detail, the in-home death data in

[26] This specification follows the approach of Bhattacharya et al. (2021) and Chang and Li (2018), which examines the yearly aggregated ATT of in-home death on property prices, utilizing the monthly data. For a robustness check, we estimate the ATT over three and six months, respectively.

our study and previous studies are based mostly on public postings and do not cover all incidents; therefore, the absence of posting for a specific building does not necessarily mean that no death incident occurred in the building.

To address the issue of potentially incomplete data, we exploit the estimation procedure proposed by Sun and Abraham (2021). In particular, we restrict our sample to property transactions in buildings in which a death incident occurred during the study period and use the last-year-death-building cohort (i.e., property transactions in buildings in which a death incident occurred during the final year of our study period) as a control group. In other words, we use property transactions that occurred before incidents in the last-year-death-building cohort as the (not-yet-treated) control group. While it remains possible that some buildings with recorded incidents may have unrecorded incidents, we adopt this approach based on the assumption that buildings with a recorded incident are less likely to have unrecorded incidents than buildings with no record. Another advantage of this sample selection process is that excluding buildings with no incident recorded allows us to construct treatment and control groups that have similar characteristics, such that both groups have experienced death incidents at some point in time.

3.2 Study area

This study centers on the Tokyo Metropolitan Area, an expansive region comprising Tokyo, Saitama, Chiba, and Kanagawa prefectures. The area boasts a population of approximately 35.6 million people as of 2020, accounting for more than a quarter of the population in Japan and covering 13,600 km^2 across 212 municipalities. A notable distinction from previous study areas, such as Hong Kong (7.3 million people in 1,100 km^2) and Tokyo Prefecture (13.2 million people in 2,100 km^2), lies in the sheer scale and diversity of the study area.

The Tokyo Metropolitan Area contains the central business district (CBD) of Tokyo, characterized by its highly expensive housing market akin to that of Hong Kong. This study area also encompasses suburban and rural areas encircling the Tokyo CBD. Some of these rural areas exhibit a decline in real estate markets, often marked by dwindling housing demand and elevated vacancy rates. We leverage this substantial regional heterogeneity within our study area to unravel the underlying mechanisms of the impact of in-home death incidents on property transactions.

3.3 In-home death data

The in-home death data originate from the website of *Oshimaland*, a privately operated online platform that aggregates information regarding deaths that occurred on residential properties. Public users contribute to this database by posting details about death incidents that they find, such as the date of occurrence, address, and description of the incident, rendering it the most comprehensive source of in-home death information accessible in Japan. As of November 2020, the dataset encompassed approximately 61,000 records of in-home death incidents across Japan, with a subset of approximately 23,000 incidents recorded in the Tokyo Metropolitan Area.[27]

The website's access is increasing over time according to the Google search trends on "*Oshima-Teru*," the name of the *Oshimaland* website in Japanese (Yajima and Sadayuki, 2023). This increasing trend simultaneously suggests that the website is still accessed by just a portion of individuals searching for housing, indicating that buyers and renters are not necessarily informed of the incidents recorded on the website. In extreme cases where recorded in-home deaths in a particular area are not searched by any buyers and renters, housing values in the area remain unaffected by the incidents. Thus, the effect on housing values in our analysis can be interpreted as the lower bound of the psychological impact, and any price change detected due to in-home death ensures the presence of stigma associated with the incident.

Figure 1 shows an example of a snapshot from the *Oshimaland* website.

[Figure 1 around here]

Locations of in-home deaths posted on the website are represented by flame symbols on the map. When one of the symbols is clicked, a window describing the selected incident pops up (the left panel in Figure 1), which provides information on the occurrence date, the street address (masked by the authors), and a description of the incident. For example, the snapshot in Figure 1 shows a case in which a suicide occurred in November 2015 in a certain residential building, along with the address at the parcel level. Although not all postings provide the address of the incident on the parcel or floor level, the location of the incident is identified, at least at the building level, by the street address or the name of the building on the map where the flame symbol is pinned.

Given that these data are based on anonymous postings, there may be concerns about reliability.

[27] On November 19, 2020, the administrator of the *Oshimaland* website kindly provided us with the raw data of public postings registered on the website. The volume of postings has consistently risen since that date. As of January 2024, the number of postings was approximately 82,000.

For instance, some landowners and real estate agents might intentionally post incorrect information on their competitors' properties. To address such potential false postings, the website implements a comment field (Figure 1) where public users can report any misinformation about the incident. Once comments are posted, the website administrator investigates and removes any postings deemed to be misinformation. In addition, we thoroughly checked registered information on each incident and the associated comments while constructing the data for our analysis. By our visual confirmation, an additional 286 (394) properties in 18 (31) apartment buildings are removed from our sales (rental) sample used in the estimations, as there are comments in the comment fields that negate the authenticity of the information or are contradictory.[28]

Figure 2 presents scatter plots between the number of records on the *Oshimaland* website and the number of officially reported in-home death occurrences across municipalities. These numbers are in a linear relationship (left panel)[29] and the elasticity is close to one (right panel). This implies that the distribution of incidents recorded on the *Oshimaland* website is spatially unbiased in the sense that it is directly proportional to the distribution of the population of in-home deaths.[30] In other words, it is unlikely that users of the *Oshimaland* website who live in high-population areas are disproportionately more likely to report in-home deaths occurring in those areas.

[Figure 2 around here]

3.4 Property transaction data

The property transaction data are sourced from the REINS, which serves as Japan's most comprehensive multiple listing service (MLS). Spanning from 2012 to 2020, the dataset encompasses approximately 750,000 sales and 1,700,000 leases in our study area. Each entry in the dataset contains information about the contracted price or rent, contract date, address, and a range of attributes about both the contracted property and its building, such as room count, floor area, floor level, building age, and proximity to the nearest station.

The property transaction data are matched to the in-home death data at the building level using the street address and building name to extract samples from buildings in which death incidents

[28] Appendix B.1 describes the data cleaning process in detail.

[29] When the number of records is regressed on the number of in-home deaths and its quadratic term, the coefficient of the quadratic term is not statistically different from zero at the 10% significance level.

[30] In Figure 2, we use 242 municipalities of the Tokyo Metropolitan Area, excluding nine municipalities of Tokyo located on islands in the Pacific Ocean (Oshima town, Toshima village, Nijima village, Kodsushima village, Miyake village, Mikurajima village, Hachijo town, Aogashima village, and Ogasawara village). The scatter plots including the nine island municipalities show a similar trend to Figure 2, and are available upon request.

occurred. To simplify the analysis, we retain buildings in which only one death incident occurred. As mentioned above, property transactions between 2012 and 2019 from the 2020-death-building cohort (i.e., property transactions in buildings in which death incidents occurred in 2020, the last year of the study period) serve as the control group, and transactions between 2012 and 2019 from other cohorts are used as the treatment group.[31] To facilitate the SDiD estimation, the sample of the treatment group is restricted to those in buildings in which at least one transaction took place both before and after the occurrence of an in-home death incident in the building. These selections narrow the sample to 3,536 sales across 305 buildings and 6,327 leases across 558 buildings. Figure 3 shows the geographic distribution of buildings with properties in our estimation sample and buildings recorded in *Oshimaland*.[32]

[Figure 3 around here]

Table 1 displays the numbers of property transactions, buildings with any transaction, and death incidents by year.[33]

[Table 1 around here]

Summary statistics of the variables used in the estimation are described in the top panel of Table 2, along with statistics for the overall transaction sample before selection in the bottom panel. In the estimation sample, the average housing price is JPY 39.8 million (approximately USD 265 thousand, based on an exchange rate of JPY 150/USD 1), and the average monthly housing rent is JPY 96.4 thousand (USD 643). Properties for sale tend to be superior to properties for lease in terms of housing attributes, reflecting the general socioeconomic difference between buyers and renters; housing owners generally have higher incomes than renters (MIC, 2018).

[Table 2 around here]

Compared to the overall sample, buildings of our estimation sample properties tend to be tall (20.82 vs. 9.38 floors for sales and 10.40 vs. 4.59 floors for leases, on average) and old (19.96 vs. 17.89 years for sales and 24.91 vs. 19.64 for leases, on average). These differences are due to the nature of the

[31] An alternative estimation is conducted by adding the 2019-death-building cohort to the control group to support the robustness of the main results in Section 4.2 and Appendix C.2.

[32] Figure A1 provides illustrations of the spatial distributions for sale samples and lease samples separately.

[33] Table A2 describes the numbers of property transactions and average prices by the cause of in-home death and by the number of years elapsed since the incident.

sample construction for the SDiD analysis. Since the SDiD regression using the building fixed effects requires that the treatment group have at least one transaction both before and after the in-home death incident in each building, a building with a larger number of properties has a higher probability of being a part of the estimation sample. In addition, a larger and older building is more likely to experience an in-home death and transactions within the study period.

It should be noted that the REINS data only includes finalized transactions and is therefore unable to capture properties that are listed but do not result in transactions or those that withdraw from the market. Properties that fail to be transacted are more likely to have faced a more significant negative impact than transacted properties. Consequently, the estimated impact would be more negative and significant when considering such properties that ended up not being transacted in the market. This is a common issue in any hedonic studies examining negative externalities using transaction data. In our analysis, a statistically significant negative sign ensures the presence of a negative impact, given the potential underestimation of the negative impact.

As mentioned above, not all locations of in-home deaths are identified at the property level. Of the 3,536 sale observations (6,327 rental observations), 2,591 (4,492) are confirmed not to be properties where an in-home death occurred, while 12 (133) are identified as properties where an in-home death occurred. The remaining 933 sale observations (1,702 rental observations) are ambiguous as to the location of the in-home death property. Throughout the analyses in this paper, except in Sections 4.3 and 4.4, we employ all the available samples, regardless of whether a death incident occurred on the property, to retain a sufficient sample size. Therefore, the estimated impacts of in-home death demonstrate a mixture of two effects: the direct effect on the in-home death property itself and the spillover effect on other properties in the same building. Because the weight of the direct effect is expected to be substantially small, the estimate represents mostly the spillover effect within the building. In Section 4.4, we attempt to disentangle these two effects by employing two sets of subsamples.

4 Estimation results

This section presents the primary results on the impact of in-home death on property price and rent within a building. We begin by presenting the estimation and the interpretation of the baseline model results, followed by introducing alternative estimations that use different samples and model specifications to ensure the robustness of the findings.

4.1 Main results

Figure 4 displays the evolution of SDiD estimates for sales (left panel) and rents (right panel) across time elapsed from an in-home death. The 95% confidence intervals are represented by light blue shading with clustered standard errors at the building level.[34]

[Figure 4 around here]

Before the occurrence of an in-home death incident, there are no statistically significant differences between the treatment and control groups in either sale prices or rents, supporting the validity of the parallel trend assumption. Post-trendlines, however, show distinct patterns for the two panels.

In the left panel, we observe a significant decline in prices following the occurrence of an in-home death. The negative effect appears to persist over time, rather than dissipating. The estimated coefficients indicate that an in-home death leads to a reduction of 4.8–5.4% in the property prices within the same building. This reduction is equivalent to JPY 1.91–2.15 million or USD 12,700–14,300 (assuming an exchange rate of JPY 150/USD 1) for a property with the sample average price. Our estimates are in close alignment (or are slightly lower than) estimates concerning the negative effect of an incident on the property price within the same building in Hong Kong—4.2–5.9% in Chang and Li (2018) and 7.1–9.7% in Bhattacharya et al. (2021)—, while the results are not directly comparable across studies due to methodological differences.[35]

The right panel reveals no discernible effect on rents after an in-home death. The result fails to indicate any evidence of a negative effect on rents and is clearly different from the result for the price effect. The possible mechanism of the different results for price and rent will be discussed in Section 5.

4.2 Robustness checks for the main finding

To ensure the robustness of our main results, we perform nine additional estimations: (1) using a sample excluding the properties with the top 5% and bottom 5% of prices or rents instead of excluding those with the top 1% and bottom 1%, (2) using the natural logarithm of per-floor-area price or rent as the dependent variable instead of the natural logarithm of price or rent, (3) using clustered standard

[34]The samples with prices or rents at the top and bottom 1% of the distribution are excluded from the estimation. All the estimated coefficients and standard errors, including those of control variables, are demonstrated in Appendix C.1.

[35]Previous studies conduct the difference-in-differences approach and compare properties with a death incident to those in other buildings in the same estate (Chang and Li, 2018) or to those in other estates where no death incident is recorded (Bhattacharya et al., 2021).

errors at the district ("*cho-cho*")[36] level instead of at the building level, (4) controlling for predicted year-by-municipality fixed effects instead of considering only year fixed effects, (5) using the 2014–2018 death-building cohort as the treatment group and the 2019–2020 death-building cohort as the control group instead of the 2012–2019 death-building cohort as the treatment group and the 2020 death-building cohort as the control group, (6) using a sample including the properties of buildings with in-home deaths with comments on *Oshimaland* website that deny or contradict the facts, (7) defining a death-building cohort by half-year instead of one year, (8) using a model excluding covariates X_{ijt}, and (9) using a model including interaction terms between covariates and year dummies.

Regarding (4), the predicted year-by-municipality fixed effects are estimated by employing hedonic regression using all the REINS samples, which are subsequently used as an explanatory variable in the SDiD estimations. This approach allows us to address multicollinearity while controlling for region-specific time trends at a finer level. For (8) and (9), Lin and Zhang (2022) shows that the inclusion of time-varying covariates can lead to biased estimates of ATTs if the effect of the covariates varies over time. To provide robustness of the main result against the potential threat of covariate-effect bias, we provide two additional estimation results: (8) a result on the model without controlling for any covariates and (9) a result on the model using interaction terms between covariates and year dummies to allow the coefficient of each covariate to vary across years.

The results of the SDiD estimates for these robustness checks from (1) to (9) are presented in Figures A2–A8 in Appendix C.2. These results collectively demonstrate that our main findings remain robust and are unaffected by (1) varying levels of sample trimming, (2) changes in the functional form of the dependent variable, (3) the choice of standard error assumption, (4) the incorporation of municipality-specific time trends, (5) the adjustment of treatment and control group cohorts concerning the presence of major external events, such as the Great East Japan Earthquake in 2011 and the COVID-19 pandemic, (6) the credibility of the posted case descriptions, (7) the choice of disjoint sets of relative periods from an incident, and (8) and (9) the potential covariate-effect bias.

4.3 Sources of incident information for residents: Based on data from user posts

This section delves deeper into the primary analysis, focusing on insights gleaned from user-generated post data, which we utilized to compile data on in-home death incidents. While our main analysis

[36] *Cho-cho* is a unit of administrative division in Japan, roughly equivalent to the census track in the US Census in terms of population size. Each municipality is composed of 50–100 *cho-cho* districts. The estimation sample encompasses 84 municipalities for the sale analysis and 111 municipalities for the rent analysis.

initially identified properties associated with in-home death incidents based on flame symbols on the *Oshimaland* website, potential buyers and renters have alternative avenues to access information about properties where in-home death incidents have occurred. Possible channels accessible to buyers/renters include (1) information disclosed by real estate dealers, (2) self-searching online based on apartment building names/addresses, and (3) browsing the *Oshimaland* website, which serves as a centralized platform for properties associated with in-home deaths.

In the main results shown in Section 4.1, we initially considered the occurrence of incidents as the timing of the events. However, considering the various channels through which buyers/renters acquire information, we now utilize the timing when incident information was posted on the *Oshimaland* website as the event timing.[37] Analogous to how we constructed the dataset in the baseline analysis, we extracted properties in buildings in which at least one transaction took place both before and after the occurrence of an in-home death incident and the subsequent user post on the *Oshimaland*, to construct a treatment group.[38] Property transactions between 2012 and 2019 from the 2020-posted-building cohort (i.e., property transactions in buildings in which users posts occurred in 2020, the last year of the study period) serve as the control group, and transactions between 2012 and 2019 from other cohorts are used as the treatment group.

Figure 5 displays the results based on the posting shock.

[Figure 5 around here]

The lease transaction result in Panel 5b is similar to the result based on the incident occurrence as the shock timing, i.e., there does not seem a significant effect given by the user posts. Turning to the sale transaction result shown in Panel 5a, the sale prices significantly declined after the posts, but the negative impact appears less clear than that based on the incident occurrence as the event timing, which is displayed in Figure 4. This reduced impact might be because potential buyers often find out about the incident through their own web searches before it appears on *Oshimaland*. Moreover,

[37] Some readers might wonder if it is possible to distinguish the impact of the actual incident occurrences from the effects of user posts on the *Oshimaland* website, as these are considered different types of shocks. Initially, properties affected by in-home deaths might experience a negative shock due to the incident itself and then face an additional impact when the incident information is posted on the *Oshimaland* website. However, our dataset does not allow us to separately estimate these two effects. To isolate the impact of the posting, we would ideally compare "the prices/rents of properties that have experienced incidents but whose incident information has not yet been posted" with "those of properties that have experienced incidents and whose information has already been posted." Since our dataset relies on user posts to construct the in-home death incident data, all the properties included have experienced both the incident occurrence and subsequent posting by users. This means we cannot create an appropriate control group to separately identify the effect of the postings on property prices/rents.

[38] The timeline of the events in the treatment group in this analysis is: $\cdots$"transaction"$\rightarrow$"in-home death occurrence"$\rightarrow$"user post"$\rightarrow$"transaction"$\cdots$.

potential buyers might be notified of in-home deaths by real estate agents before they browse the *Oshimaland* website. Hence, analyzing the impacts of death incidents based on the event timing of user posts may end up reflecting the incident's impact even before the corresponding user post.

To support this conjecture, we next conduct regressions on a subsample of transactions involving properties located on different floors from the incident properties.[39] Since it is reasonable to assume that dealers disclose incident information before it appears online, finding a clearer negative impact of postings on the *Oshimaland* website after removing the information channel of dealer disclosures would support our hypothesis.

As discussed further in Section 4.5, dealers typically inform their clients only if a death incident occurred in the specific property being transacted, and not if it happened in another unit within the same apartment building. As shown in Table 3, not all incidents are identified at the unit level; some are only recognized at the floor or building level.

[Table 3 around here]

By restricting the estimation sample to transactions involving properties on different floors, we ensure that the properties in this subset have not experienced in-home death incidents themselves. This approach allows us to entirely eliminate the possibility of potential buyers receiving information through disclosure by real estate agents. That is, one of the two information channels available to potential buyers before the user posts on the *Oshimaland* website would be eliminated—specifically, we would exclude the dealers' disclosure channel, leaving only the self-web search channel by the potential buyers. If we observe a more pronounced decrease in sale prices compared to what was shown in Panel 5a of Figure 5, it would provide some support for our conjecture.

Figure 6 displays the result based on the subsample of properties located on other floors than the incident properties.

[Figure 6 around here]

When we compare Panel 5a of Figure 5 with Figure 6, we notice a slightly more negative response to the user-post shock when we restrict the sample to transactions involving properties on different floors from those where incidents occurred. This discovery, to some extent, reinforces our hypothesis that

[39] To retain a sufficient sample size in the estimations, the sample before the user posts includes all properties in the posted buildings, irrespective of whether they are on the incident floors posted or those not posted on the *Oshimaland*.

the less distinct negative effect of in-home deaths when user posts were chosen as the event timing was due to these estimated coefficients reflecting the incident's impact before the user posts.[40]

Despite the explanation provided above for the less pronounced effect estimated based on user posts as the event timing, there is still concern regarding the impact of user posts on *Oshimaland*—potential buyers/renters may not diligently browse and inspect the posts on it. To address this concern, we undertake another analysis focusing solely on the incidents recorded on the platform, particularly those with comments refuting the occurrence of the incident or pointing out ambiguities or contradictions in the incident descriptions. Such incident records are viewed as misinformation or unreliable information posted on *Oshimaland*. If we fail to observe a negative effect on sale prices/rents caused by unreliable user posts or misinformation, we can conclude that potential buyers/renters indeed investigate the posts on the platform thoroughly. Otherwise, the concern that potential buyers/renters do not carefully check the *Oshimaland* platform becomes more convincing.

Figure 7 shows results based on the sample consisting of the transactions of properties whose incident information was unreliable or thought to be misinformation.[41]

[Figure 7 around here]

Since we do not observe any significant decline in prices/rents following the posting of misinformation incidents, it indicates that potential buyers/renters carefully investigate the posts on *Oshimaland*. This finding suggests that potential buyers/renters do more than simply browse the flame symbols pinned to incident properties; they also read the comments on *Oshimaland*. We will revisit this point in Section 4.4. Furthermore, it has been confirmed that just having a flame symbol pinned on the property location on the *Oshimaland* map has no effect. In other words, there is no "flame symbol effect."

4.4 Spillover effects and direct effects

As mentioned in the previous section, not all locations of in-home deaths are identified at the property level. In this subsection, we employ subsamples to disentangle the spillover effect (the impact of an incident on other properties in the same apartment building) and the direct effect (the impact on the

[40] This analysis, which focuses on the property transactions on the non-incident floors, will be revisited from another angle in Section 4.4.

[41] The timeline of the events in the treatment group in this misinformation analysis is: $\cdots$"transaction"$\rightarrow$"incident property information was posted by users"$\rightarrow$"comment refuting the incident occurrence was posted by users"$\rightarrow$"transaction"$\cdots$.

incident property itself). What we do in this subsection is almost identical to what we have done in the analysis displayed in Figure 6. Namely, for the subsample to examine the spillover effects within the apartment building, we limit the sample to transactions of the properties located on floors other than floors on which incident properties are located. For the subsample to examine the direct effects, we limit the sample to transactions of the incident properties.[42] If we observe a significant decline in prices/rents after an in-home death incident, using a sample of property transactions from the same building but on different floors from the incident, it would suggest that the negative impact of such incidents extends throughout the entire apartment building.

Figure 8 displays the estimation results on the spillover effect for sale transactions (left panel) and for lease transactions (right panel).

[Figure 8 around here]

The results, consistent with the baseline findings in Figure 4, indicate that the adverse impact of a death incident on property prices extends beyond the incident floor, showing a significant negative spillover effect at the building level.

One important aspect to consider here is that the observed spillover effect might not accurately reflect true spillover due to the display format of *Oshimaland*. As explained in Section 3.3, visitors on the website initially encounter a flame symbol pinned to an apartment building. By clicking on this flame symbol, they can access descriptions of incident property information. From a cognitive standpoint, this display format may give website visitors the impression that "this building is associated with in-home death." In other words, users may only collectively recognize the incident at the building level, rather than at the property level. However, as shown in the analysis in Figure 7, potential buyers and renters can often determine that their prospective residences are not incident properties by reading comments on the *Oshimaland* website indicating that the incident occurred on a different floor. Additionally, merely having flame symbols pinned on the buildings has no effect as discussed in Section 4.3. Therefore, it is reasonable to conclude that potential buyers/renters are hesitant to purchase/rent non-incident properties within the same apartment building. This suggests a negative spillover effect from the incident property to other properties in the building.[43]

[42]To retain a sufficient sample size when running regressions, the pre-incident sample includes all properties in the incident buildings, irrespective of whether they are on the incident floor or non-incident floors.

[43]An interesting observation in the indirect effect analysis for lease transactions, displayed in Panel 8b in Figure 8, is the increase in rents four years after the incident. One possible explanation for this delayed rent increase is that owners might have subscribed to security services or upgraded security systems in their apartment buildings following the incidents. However, they may find it difficult to raise rents immediately after installing these systems due to the

As for the direct effect investigation, the limited number of sale transactions of the incident properties in our dataset prevents us from running regressions for the sale prices.[44] As a result, we concentrate solely on estimating the direct effects for the lease transactions. Moreover, due to the limited number of observations even for the lease transactions of incident properties, we estimate the average aggregated treatment effect over the entire post-treatment period, rather than estimating the effects separately for each year since the incident.[45]

Figure 9 shows the results of this analysis.

[Figure 9 around here]

In contrast to the indirect effect analysis for lease transactions, we observe a notable decrease in rents, amounting to approximately 6.4%, in the direct effect estimation.[46] The presence of a negative direct impact, despite the absence of a negative spillover effect, on rents may be attributable to the difference in the awareness of incident and/or magnitude of stigma between renters of in-home death properties and renters of other properties. It can be imagined that the stigma is more pronounced in properties where incidents occurred than in other properties. In addition, regarding the awareness, as will be discussed in the following subsection in detail, property dealers would notify potential renters of death incidents that occurred at properties being negotiated, but not of incidents that occurred at other properties in the building. Therefore, the result suggests that renters may tend to be unaware of death occurrences in the building they will move into unless they are notified by dealers.

4.5 Policy implications for disclosure rules

Disclosure rules regarding past in-home death incidents vary across countries. Most U.S. states and Canadian provinces follow the common law doctrine of caveat emptor and impose no obligation on the dealer to disclose (Edmiston, 2010; SpauldingDecon, 2023). Conversely, Hong Kong and Japan, along with some U.S. states, including Alaska and California,[47] require dealers to inform their counterparts

initial effects of the incident. As time passes and the negative impact of the incident diminishes, owners gradually raise rents to reflect the improved security facilities in the building.

[44] We only have 12 sale transactions in our dataset.

[45] The treatment indicators for the post-treatment period ($l > 0$) in Eq. (1) are replaced by a single indicator that always takes 1 after the in-home death occurrence in property i at period t.

[46] Properties in which an incident occurred may experience an increase in quality due to specialized cleaning or extensive renovations following the in-home death incident. However, the REINS data does not record renovation information, which precludes the ability to identify this aspect within the sample. It is anticipated that a larger impact on the price and rent will be observed when renovation information is considered in the regression.

[47] According to Arora (2024), as of January 2024, disclosure of past deaths is required in Alaska, California and South Dakota for certain types of incidents and time periods, Vermont only if it affects the value of the home, New Jersey if

about in-home death incidents. The existence of such regulations implies that in-home deaths considerably impact people's anxiety and property transactions in the region. For instance, the reason why California mandates dealers to disclose such incidents to their counter partners may be partly due to the large proportion of Asian people residing in the state.

Japan's property transaction law prohibits dealers from "misrepresenting or intentionally failing to disclose a fact when soliciting for the conclusion of a contract if the fact has a critical influence on decisions by counter partners".[48] However, the extent to which an in-home death influences counterparties' decisions can depend on various factors, such as when, where, and how the incident occurred, while the law lacks clarity on when disclosure is required. In response to the ambiguity of the law, property dealers have established their own unspoken rules. Generally, dealers would notify their counterparties only if a death incident occurred on the property being transacted, but not if it took place in a different property even within the same apartment building. Additionally, if someone previously lived in the property where the incident occurred, subsequent occupants would not be informed.

The ambiguity of the disclosure rule has led to numerous court cases where buyers and renters took legal action against dealers for failing to disclose, resulting in significant social costs. Moreover, this ambiguity could encourage discriminatory practices by landlords against elderly tenants, as landlords seek to mitigate the risk of death due to disease or solitary death, which has been increasing and will continue to increase due to population aging.[49]

In response to this situation, the Japanese government established a committee in 2019, which subsequently issued "the guidelines for in-home death disclosure" in 2021. The guidelines provide instructions for more detailed disclosure requirements (MLIT, 2021). They advise that dealers inform counterparts about a death incident if it occurred in the property being transacted. The notice period for lease contracts extends for three years following the incident, while there is no time limit for sale contracts. In the event of death due to disease or solitary death that does not necessitate special cleaning, there is no need to disclose. The special cleaning is conducted when a corpse has been left unattended for a long time without being noticed by anyone and has rotted away. This is more likely to take place during the summer season when high temperatures accelerate the decomposition process.

the death was due to property conditions, Delaware, Georgia, Kentucky and Wisconsin only upon written request, while other states have no disclosure requirements.

[48] Article 47 item 1 of the Building Lots and Buildings Transaction Business Act.

[49] According to Vital Statistics published by Ministry of Health, Labour and Welfare (2024), 88% of accidental in-home death occurrences are due to deaths of elderly residents aged over 65 ("Deaths and percent distribution from nontransportation accidents by age (specified age groups) and place of occurrence"). Nakagawa (2004) and Suzuki et al. (2022) provide evidence of discrimination by landlords against single elderly applicants seeking to move into apartments.

Importantly, any death that occurs on another property does not require disclosure. Given that property transaction law mandates the disclosure of any information influencing people's decisions, the government alleges that people do not view a death incident in a different property as a significant factor when making a housing selection, even if it occurred in the same residential building. According to the committee meeting minutes, the guidelines were formulated based on past practices and legal precedents rather than being grounded in evidence-based research.

Our finding suggests, however, that the stigma around death incidents extends beyond the in-home death property itself, contrasting with the assertion in the government's guidelines. To abide by the current law in Japan, property dealers must inform transaction partners about previous death incidents that occurred in the same building, even when these deaths did not occur on the specific property under consideration.

5 Mechanisms of differential spillover effects on price and rent

The analysis in the preceding section confirmed that in-home deaths have a negative spillover effect on nearby property prices but not on rents. In this section, we explore three potential channels that could explain these different results: (1) the difference in awareness of incidents between buyers and renters, (2) the difference in preferences between buyers and renters, and (3) the rigidity of rents.

5.1 Differences in awareness

The first potential explanation is that, compared with renters, buyers are more aware of in-home deaths in the building into which they move. According to the disclosure guidelines issued by the government, dealers generally have to notify counterparts about past death incidents if they occurred in the transactional property, but not if they occurred at another property. Therefore, buyers and renters could learn about an incident that occurred on a different property within the same building only through self-initiated exploration, such as searching the *Oshimaland* website or asking the dealers.

The empirical findings reported in the previous section reveal that an in-home death incident results in a price reduction at least for other properties within the same building. This finding indicates that potential buyers are aware of past death incidents in the building they are moving into, regardless of the disclosure rule. In contrast, rent is negatively associated with a death incident only for the in-home property, not for other properties in the building. These results strongly suggest that renters move in without awareness of a death incident in a building unless they are informed about the incident by dealers under legal obligation. Buyers, who typically dedicate more time to their housing search than renters do (AlbaLink, 2021b; NAHB, 2023; Suumo, 2024), are more likely to have checked the *Oshimaland* website, such that more buyers than renters are aware of any incidents. This information disparity could partly account for the more pronounced negative impact on price compared to rent.

5.2 Differences in preference

The second possibility is that the psychological impact, or the degree of stigma, of in-home death is more substantial for buyers than for renters. Given the concern, we employ a subsample analysis to explore the potential difference in psychological impacts between buyers and renters. We hypothesize that higher-income households, which are prevalent among buyers, have a greater willingness to pay to avoid living near properties with death incidents due to their lower tolerance for such events. If this is true, we anticipate that a more substantial impact on prices will be observed for properties purchased by higher-income households.[50] Unfortunately, we cannot directly test this hypothesis because information on individual income is not available in our data. Instead, we divide samples by median price (or rent) and compare SDiD estimates between higher-priced and lower-priced properties, assuming that household income and housing values are positively correlated. Contrary to our expectation, the result in the left panel of Figure 10 indicates that the impact on price is more pronounced for low-priced properties.[51]

[Figure 10 around here]

There results fail to support the hypothesis that an in-home death has a greater psychological impact on buyers than on renters.

5.3 Rent rigidity

The third possibility is that landlords are resistant to reducing rents. This hypothesis is rooted in two underlying factors. First, Japan's property transaction law stipulates that existing tenants can request rent reductions if their rents are higher than the rents of comparable properties in the neighboring

[50] Another possible reason for why higher-income households may be more sensitive to a death incident in their housing decisions is that they have more flexibility in housing choices than lower-income households, who are more likely to face financial constraints.

[51] An online survey conducted by AlbaLink (2021a) in Japan reports that higher-income respondents demonstrate a higher willingness to move to a property where a death incident occurred, which aligns with our findings. AlbaLink (2021a) points out the possibility that this questionnaire result may be because richer people tend to be more realistic and rational.

area.[52] Consequently, landlords of rental apartment buildings, who own multiple units in buildings, may be reluctant to lease vacant units at a lower rate because incumbent renters could request a reduction in their rents. However, this does not apply to individual condominium owners who own a single property. Therefore, condominium rents can be more susceptible to the impact of death incidents than rents in rental apartment buildings. To examine this possibility, we narrow down the sample to transactions in buildings where both rent and sale transactions are observed, ensuring that the selected buildings are indeed condominiums. Then, we use this sample to estimate the impact on condominium rents. The result in Figure 11 shows a negligible impact on condominium rents, implying that rent rigidity is not due to landlords' concern about existing renters requesting rent reductions.

[Figure 11 around here]

The second factor relates to landlords facing difficulties in raising rents for their rental properties due to the standard lease contract prevalent in Japan, which offers tenants substantial protection.[53] In contrast to fixed-term lease contracts, which are more common in Western countries, standard lease contracts allow renters to remain in apartments as long as they abide by the law. Landlords feel reluctant to reduce rents for vacant properties following an incident because this could cause them to miss out on an opportunity to raise rents when the stigma fades. To address this situation, landlords might consider making the prospect of renting more attractive by reducing move-in fees for new renters. This approach could involve lowering the deposit, brokerage fee, or "*reikin*" (nonrefundable payment to landlords or key money) or even offering a short-term period of free rent.

To examine the effect of in-home death on landlords' decisions on move-in fees, we run the following estimation:

$$movein_{ijt} = \sum_{e} \sum_{l \neq -1} \gamma_{e,l}^{movein} \mathbb{1}\{f(t - E_j) = l\} * \mathbb{1}\{g(E_j) = e\} + \mu_j + \epsilon_{ijt}, \tag{2}$$

where the dependent variable $movein_{ijt}$ is the number of months of rent equivalent to move-in fees (i.e., the sum of the deposit and *reikin* divided by the monthly rent). On the right-hand side of the equation, we control for building fixed effects μ_j to examine landlords' decision-making on move-in fees within the building.[54] The outcome depicted in Figure 12 shows no significant effect on move-in

[52] Article 32 of the Building Lots and Buildings Transaction Business Act.
[53] Article 28, Act on Land and Building Leases.
[54] The number of months of rent equivalent to deposit and *reikin* may vary across residential buildings. However, it is reasonable to assume that this amount does not vary by characteristics of the property in the same building or across

fees after an in-home death. The result does not reveal any evidence that in-home death decreases move-in fees within the same building.

[Figure 12 around here]

Therefore, landlords are unlikely to reduce move-in fees in response to such incidents as a means to attract new renters.

5.4 Discussion

In the previous subsections, we explored potential mechanisms contributing to the different results on price and rent. In Section 5.1, we postulated that buyers are more likely than renters to be aware of incidents in the building they move into when signing their contracts. The minimal impact on the rent can be partly (or fully) explained by the possibility that renters who are not aware of the in-home death in the building move into the building. The rent is negatively impacted only by an in-home death that occurred on the property because the renter is informed about the incident by the dealer before finalizing the rental agreement. In Section 5.2, we attempted to discern differences in psychological impacts between buyers and renters by segmenting properties for sale based on typical demographic differences between buyers and renters and observing whether distinct effects on price exist. However, our data did not provide evidence to support the hypothesis that different outcomes were driven by varying preferences between buyers and renters. In Section 5.3, we assessed whether landlords avoid reducing rents due to the potential risk that existing tenants might request rent reductions. This assumption was refuted by examining condominium rents. In addition, we explored whether landlords opt to reduce move-in fees to attract new tenants without lowering rents. However, our findings did not substantiate this possibility. In sum, the most likely channel leading to the differential results for prices and rents is the difference in awareness level between buyers and renters.

To offer further insights, we regress the following estimation equation:

$$transaction_{jt} = \sum_{e} \sum_{l \neq -1} \gamma_{e,l}^{transact} \mathbb{1}\{f(t - E_j) = l\} * \mathbb{1}\{g(E_j) = e\} + \mu_j + \boldsymbol{\tau}(t) + \epsilon_{jt}. \tag{3}$$

The building j is the unit of observation for this analysis. The dependent variable, $transaction_{jt}$, is the number of transactions normalized by the average annual transaction count before the incident

different years without an event like in-home death in the building so that the covariates X_{ijt} and time fixed effects are not included in Eq. 2.

occurred. The estimation employs building and time-fixed effects (μ_j and $\boldsymbol{\tau}(t)$), along with indicators regarding the relative treated years. To prevent the influence of a high frequency of transactions in newly built apartments, the samples are limited to buildings older than 10 years.

Figure 13 presents the SDiD estimates of Eq. (3), concerning transaction frequencies for sales and rentals within buildings.

[Figure 13 around here]

The result depicted in the right panel displays an immediate surge in rental transactions within the building following a death incident. In contrast, the increase in transactions for sales following an incident is less pronounced, as shown in the left panel. While a comprehensive understanding of the effect of in-home deaths on residents' movements requires additional information, such as vacancy and listing data, these findings suggest the significant possibility that the surge in rental apartment vacancies stems from existing renters moving out due to the incident and these vacancies being swiftly filled by new renters. Given the absence of a negative spillover effect on rents, the sudden increase in transaction frequency following a death incident within the building implies that new renters likely moved in without being aware of the incident that occurred in the building.

6 Heterogeneity in the negative effects of in-home death: sale transactions

In this section, we focus on sale transactions to investigate the heterogeneity of the impact of in-home death from various viewpoints, including trading seasons, property characteristics, regional characteristics, and incident characteristics. Based on these results, we investigate possible mechanisms underlying the negative effects of in-home death incidents.

6.1 Trading season

Von Graevenitz (2018) argues that the impact of disamenities, such as noise, on property prices can be mitigated in a booming market. Building upon this insight, we shift our focus toward understanding how the impact of in-home deaths varies contingent upon circumstances on both the demand and supply sides.

First, we investigate the heterogeneous effect from the viewpoint of a seasonal demand for sale properties. In Japan, as business and academic years start in April, housing contract volumes skyrocket in February and March. Alternatively, the number of potential buyers is the largest during these months, implying that, in a busy season, less attractive properties, such as those in buildings where death incidents occurred, have a greater possibility than usual to be matched with a buyer who is not aware of the death incident in the building or who is less reluctant to pay than other people to live in such a building, thus enabling sellers to sell the property without a discount on the price.

Figure 14 displays a comparison between the coefficients of the sale prices in the busy season (from February to March) and in the off-season (from April to January).

[Figure 14 around here]

During the off-season, we observe a persistent and significant negative impact (red points and ribbons). In contrast, we do not observe such negative effects in the busy seasons (blue points and ribbons). This finding suggests that the negative impact found in the baseline analysis is mainly driven by the contracts made during the off-season. Sellers are more likely to find a buyer with a high willingness to pay to live in a condominium building where a death incident occurred during the busy season than during the off-season. Buyers who are in a hurry to purchase a property during the season are also less likely to explore the *Oshimaland* website before entering the contract.

6.2 Property characteristics: Number of rooms, number of floors, and age of the building

Tokyo, with a notable concentration of population and economic activity, has witnessed the construction of numerous high-rise and luxury buildings, often referred to as "*tower mansions*" in Japanese (hereafter, tower condominium buildings). These buildings typically feature more than 18 to 20 floors and consist primarily of single rooms. Nonetheless, these buildings are highly sought after places to reside and represent attractive investment opportunities due to their prestige, convenience, and prime locations. In this subsection, we delve into how in-home death impacts such properties, with a specific focus on buildings considered popular, such as single-room properties, properties in tower mansions, and newer properties.

First, we investigate the heterogeneity of impacts in terms of the number of rooms in a property. We hypothesize that the effect of in-home death may be less pronounced for single-room properties than for multiple-room properties because the former are often purchased for investment purposes. When property transactions are conducted not only for residential purposes but also for investment purposes, the negative effect of in-home death on property prices may be attenuated because buyers with investment intent may not necessarily intend to reside in the building.

Figure 15 presents the coefficient plot and corresponding confidence intervals for single-room properties and for multi-room properties.

[Figure 15 around here]

The impact of in-home death on the price of single-room properties is not statistically significant, while there is a negative and significant effect on the price of multi-room properties.

This outcome aligns with Von Graevenitz (2018) and supports our hypothesis that the price of single-room properties is less impacted by in-home death than is the price of multi-room properties because single-room properties are more likely to be purchased for investment purposes. As shown in the estimation results for rents in condominium buildings (Figure 11), owners of single-room properties can lease their properties to renters without reducing the rent even after the occurrence of a fatality in the same building. Therefore, the willingness of owners with investment purposes to pay for a single-room property, calculated as the present value of rental revenues over the future, remains unchanged. In contrast, multi-room properties work differently because their share in the rental housing market is much smaller than that in the sales market such that the chance for owners of multi-room properties to find a tenant is small.

To further scrutinize the characteristics of these markets, we conduct an additional subsample analysis in which buildings with a total number of floors greater than or equal to 18 are defined as tower condominium buildings. Figure 16 shows the coefficient plot and corresponding confidence intervals for properties in tower condominium buildings and properties in buildings with fewer than 18 floors.

[Figure 16 around here]

The results indicate that the negative impact of in-home death for properties in high-rise buildings is not as pronounced as that for properties in low-rise buildings.

Toward the conclusion of this subsection, we present an investigation of whether the building age is relevant to the magnitude of the impact of in-home death on prices. Figure 17 presents the coefficient plots and corresponding confidence intervals for properties in buildings above (in red) and below (in blue) the median apartment age when in-home death occurred.

[Figure 17 around here]

The results suggest that the negative impact is more pronounced for older buildings. If this divergence in results is attributable to the demand side, then the level of awareness and magnitude of psychological impact should differ between potential buyers of old and new condominiums, while it is not possible at this time to verify these two factors. When these factors are the same across buyers, then this differential result is attributed to the supply side: More residents move out following a death incident in older buildings than newer buildings. People living in older condominiums have likely lived there longer and changed lifestyles more substantially since they first moved in compared to those living in newer condominiums. One possible explanation is that the increasing mismatch between lifestyle and property layout over time may decrease residents' reservation price and increase their probability of moving out, resulting in a greater reduction in transaction prices in older condominium buildings following an in-home death incident.

6.3 Regional characteristics: Vacancy rate and crime rate

This subsection explores the heterogeneous impacts of in-home deaths, shedding light on the regional (neighborhood) characteristics of properties. In particular, we focus on regional variations in vacancy rates, crime rates, and murder rates.[55]

The first heterogeneity analysis in terms of the vacancy rate is intended to investigate how the excess housing supply contributes to the magnitude of price decline following an in-house death incident. Based on housing vacancy rates at the municipality level obtained from the Housing and Land Survey of Japan (MIC, 2018),[56] we split the whole sample into two subsample regions, one with a higher neighborhood vacancy rate above the median and the other with a lower vacancy rate below the median. In this exercise, our conjecture is that the negative impact on price is more severe in an area with a higher vacancy rate because sellers have to lower offering prices more to find a transaction partner in areas where potential buyers have abundant alternatives.

Figure 18 shows the coefficient plots and corresponding confidence intervals for the properties in the high- and low-vacancy areas. As expected, high-vacancy areas experience a significant reduction

[55]For more discussions on regional heterogeneity, see Appendix D, in which we focus on socioeconomic regional variations.

[56]The Housing and Land Survey of Japan provides statistics only at the municipality level, issued once every five years. The vacancy rate used to split the sample into high and low vacancy rates in the neighborhood comes from an entry in 2018 (MIC: 2018). We choose the year 2018 as our reference year because it lies in the middle of our study period (2012–2020).

in prices immediately after the occurrence of an in-house death within the building.

[Figure 18 around here]

The magnitude of this negative effect persists for more than five years, while the impact becomes statistically insignificant after three years as the confidence intervals widen over the years. Turning to the evolution of the effects in low-vacancy areas, the negative effect is not significant for the first two years, while the effect amplifies and becomes statistically significant three years after the incident.

We attribute this interesting evolution of the effect in low vacancy areas to the time lag required for current residents to leave the building after the incident. Recall that our findings on transaction frequency (Figure 13 in Section 5.4) imply that the replacement of tenants in the rental market takes place immediately after the incident, while transactions for sales peak two years after the incident. This finding suggests that owners take more time to find a new place and move out than renters. Since areas with low vacancy rates are sellers' markets, buyers are forced to buy properties in such areas for somewhat higher prices. A few years after the incident, the transaction price gradually decreased as incumbent residents in the building found new properties and sold their current properties.

Next, we categorize areas by crime rate. This analysis is intended to examine whether the impact of in-home death incidents on price differs by the crime rate in the neighborhood. Higher crime rates in a neighborhood could either attenuate or amplify the impact on prices. High crime rates attenuate the negative effect of in-home deaths due to the decreasing marginal effect of an incident. In other words, residents in such areas may be more accustomed to incidents, and potential buyers in the area may also anticipate such incidents there. Thus, the marginal impact of the additional incident is not as significant as it would be in an area with less crime. However, the impact on the price can be greater in high crime rate areas if the potential buyers in those areas are better informed about incidents because they intensively search the *Oshimaland* website. Moreover, areas with lower housing demand tend to be buyers' markets and can be more strongly affected by the occurrence of an additional incident, as observed in municipalities with high vacancy rates.

To examine this matter, we use different datasets to construct two crime rate variables. One of the two datasets comes from Crimes in Tokyo statistics, published by the Tokyo Metropolitan Police Department in 2015. The statistics are available at the district (*cho-cho*) level, and the coverage is limited to Tokyo Prefecture, which has 5,150 districts. Crimes are classified as serious violent crimes (robbery, etc.), violent crimes (assault, intimidation, etc.), burglary theft, non-burglar theft, and other (fraud, etc.). In 2015, an average of 25.7 crimes per year were recorded in each district of Tokyo, with the most common crime category being nonburglary theft (19.8 crimes per year, on average). The Crimes in Tokyo statistics mainly allow us to determine the geographic distribution of petty crimes. We use the index to consider regional characteristics related to public safety within Tokyo. The crime rate is calculated by dividing the count of crimes by the number of households in each district. Unfortunately, the statistics do not include district-level information of particular interest to us, such as the number of murders, the number of in-home incidents versus incidents in public places, or the number of fatal versus nonfatal incidents.

The other dataset employed consists of in-home death data from the *Oshimaland* website. Yajima and Sadayuki (2023) compare incident counts from in-home death data based on government statistics and reveal that almost all existing in-home murder incidents are recorded on the website. By assuming that the properties of murder sites recorded on the *Oshimaland* website represent the geographic distribution of in-home murder incidents, we construct a municipality-level in-home murder rate by dividing the count of average annual in-home murders by the number of households in each municipality. The murder rates are calculated for municipalities in all four prefectures.

Figure 19 shows the coefficient plots and corresponding confidence intervals for properties in the high crime rate area and low crime rate area.

[Figure 19 around here]

The result in the left panel, employing the Tokyo crime rate, demonstrates a similar evolution of coefficients and statistical significance between subsamples. However, in the right panel, using the in-home murder rate, a clear difference in the trends of coefficient plots is shown between subsamples. In particular, the coefficients for the sample with a high murder rate exhibit a strong decreasing trend, and these magnitudes are relatively large compared with those of the other subsample analyses.

The results of the murder rate analysis suggest that the persistent negative impact on sales prices is driven mainly by property transactions in high murder rate areas. The finding that areas with high murder rates experience more severe negative effects supports two hypotheses. First, potential buyers looking for properties in areas with high murder rates are more informed about the incidents recorded on the *Oshimaland* website. Second, areas with high murder rates tend to be buyers' markets due to lower demand, and the price is susceptible to additional negative influences.[57][58]

6.4 Incident characteristics: Incident types, occurrence seasons, and proximity

The effect on property prices may differ depending on the features of the incident. This subsection delves into heterogeneous impacts concerning the incident characteristics.

First, we scrutinize the negative effects on sale prices by death types. Figure 20 shows coefficient plots and corresponding confidence intervals for suicide, murder, and other types of death.[59]

[Figure 20 around here]

The negative effect is more severe in cases of murder than in cases of suicide and other types of death. Deaths other than suicide and murder exhibit a statistically significant negative impact only immediately after the incident. These diverse effects can be attributed to differences in the awareness and stigma that people possess toward each type of incident. Murder incidents are often broadcasted by the media and known among the public, even those who do not look at the *Oshimaland* website. Moreover, the occurrence of murder directly evokes images of crimes, creating a less safe atmosphere and altering the risk perception of residing in the building.

Next, we investigate the heterogeneous impact of incidents according to whether the incident occurred in the summer. Because corpses become rotten and emit a foul odor at high temperatures, death events in summer may induce more negative externalities. Figure 21 shows the results based on subsamples, one of which includes properties in buildings where in-home death incidents occurred

[57] The recent study by Tang and Le (2023), which examines the impact of the move-in of ex-gun offenders on nearby property prices, shows a contradictory result: the negative impact is larger in areas with lower crime rates. This is attributed to the distinct feature between our study and Tang and Le's (2023) study: the occurrence of in-home death does not mean a deterioration of public safety in the neighborhood like the move-in of gun offenders does. In other words, the move-in of a gun offender alters people's perception of public safety more substantially in a neighborhood with fewer crimes, while people's perception of public safety may change minimally following the occurrence of in-home death because it does not threaten the safety of the living environment in the neighborhood. Another possibility is that the move-in of a gun offender is more publicly acknowledgeable in areas with lower crime rates.

[58] Another important finding from this analysis is that the negative effect in areas with high murder rates is increasing over time. This finding relates to the literature examining the long-run persistence of income inequality across regions due to specific factors that are thought to have direct effects for a much shorter term (Ambrus et al., 2020; Bleakley and Lin, 2012; Dell, 2010; Hanlon, 2017). For instance, Ambrus et al. (2020) examine the long-run impact of the cholera epidemic on housing prices in a neighborhood of nineteenth-century London. They find that prices inside the catchment area fell 15 percent within ten years of the epidemic relative to prices outside the catchment area and that the price differential doubled 160 years after. They highlight the potential for negative shocks to alter tenant composition over time, which can result in persistent and amplifying negative effects on neighborhoods. In our context, the result suggests that the historical records of in-home murders posted on websites may contribute to tenant sorting and persistent deterioration of the neighborhood environment.

[59] Of the 3,536 properties for sale (6,327 properties for rent), 362 (985) experienced "murder," 1,237 (1,290) experienced "suicide," and 1,935 (4,056) experienced incidents involving "other" causes. Table A2 in Appendix D shows the type of death shares in the sale and rental samples. In the cases of both sales and rental properties, "other" death has the largest share (55% in sales and 64% in rental), and "suicide" is second (35% in sales and 20% in rental).

from June to September and the other includes properties in buildings where incidents occurred in other seasons.

[Figure 21 around here]

We find a striking difference between the two coefficient evolutions. Although both show negative coefficient estimates, the coefficients for the summer sample are larger in magnitude and more significant. This result indicates that the greater disamenity of an in-home death can translate into a greater decline in property sale prices.

Finally, we investigate whether there are larger spillover effects on properties closer to the incident property within the same building by employing the differences in floor levels between properties where in-home death occurred and transacted properties. The sample is divided into a subsample of properties whose floor difference is less than or equal to three (properties closer to the incident property) and another subsample of properties whose floor difference is larger than three (properties farther from the incident property). Observations on the same floor as the incident floor are excluded from the sample.

The results in Figure 22 show that the magnitude of the negative coefficients does not diverge between the two subsamples, indicating that there is no systematic tendency for larger negative spillovers to occur on closer floors.

[Figure 22 around here]

Contrary to our expectation that closeness to the incident property matters, the result suggests that the magnitude of the negative spillover effect does not depend on closeness to the location of the death incident within the building.[60] Nevertheless, the presence of negative spillover effect confirms that buyers are concerned about death incident in the building, even if no fatality has occurred at the property they are interested in purchasing. Although the government guidelines state that property dealers are generally not required to inform their counterparties about death incidents that occurred on properties other than those being transacted, our results suggest that complying with Japan's current property transaction law requires disclosing death incidents within the same building, particularly those recorded on the *Oshimaland* website, regardless of the proximity between the in-home death property and the property being transacted.

[60]We repeatedly conduct the same exercises with floor differences from 2 to 12, confirming that the results of the constant impact across floor differences are robust. For the exercises with floor differences of 1 and more than 12, the results are not stable because there is an insufficient number of observations in these subsamples, but the implications remain the same.

7 Conclusion

Utilizing extended datasets on in-home deaths and property transactions, we estimated the impact of a death incident on the prices and rents of properties within the building. We employed the staggered difference-in-differences analysis introduced by Sun and Abraham (2021) to address potential biases stemming from variations in treatment timing and heterogeneous effects across properties. Our estimation confirms, under various robustness checks, that in-home deaths are associated with a significant reduction in sale prices for properties within the same building. This implies that, from the buyers' perspective, the stigma not only remain in the property where the incident occurred but also extends to other properties. Different from the observed impact on prices, our estimation does not reveal the negative impact of a death incident on the rents of other properties within the same building. However, this does not necessarily mean that renters are completely indifferent to such incidents because the estimated impact is a combination of psychological impact and awareness level. In fact, in-home deaths have a significant negative impact on the rent of properties where incidents occurred.

To better understand the underlying mechanism, we discussed potential explanations for the differential outcomes between sales and rents and performed several analyses. One notable observation is the significant increase in rental transactions immediately following an incident within a building. This phenomenon, coupled with the absence of a negative spillover effect on rent, strongly suggests that renters sign the lease contract and move into buildings in which a death incident occurred without being aware of the incident. This discrepancy in awareness level between buyers and renters likely contributes to the differential impact on prices and rents.

The Japanese government issued guidelines in 2021 outlining dealers' disclosure requirements regarding in-home death disclosure in response to issues associated with ambiguity in property transaction law and concerns regarding the increasing occurrence of in-home deaths. The guidelines state that, in principle, there is no obligation to disclose deaths that occur in properties other than transactional property. Given that the law mandates disclosure of any information affecting people's decisions, the government's rationale is based on the assumption that people do not consider death incidents on different properties to be a significant influencing factor in their housing decisions. However, this assumption is false according to our findings. Therefore, to abide by the current law in Japan, property dealers must inform transaction partners about previous death incidents that occurred in the same building, even when these deaths did not occur on the specific property under consideration.

Furthermore, we explored additional sources of heterogeneity within sales transactions to gain deeper insights into the underlying mechanisms of the impact of in-home death. Our findings indicate that the negative impact is more pronounced under particular circumstances. For instance, the impact is more severe when a transaction occurs during the off-season in the real estate market (capturing the effect of low housing demand), when an incident occurs in an area characterized by a higher vacancy rate (capturing the effect of housing oversupply), or when it occurs in an older building (capturing the attractiveness of the properties), when it occurs in an area with a higher murder rate (capturing residents' awareness of crimes), when it occurs during the summer season (capturing the effect of decomposition of a corpse). These findings collectively suggest that the impact is amplified in housing markets characterized by lower demand or specific adverse conditions.

We acknowledge certain limitations in this research and propose potential avenues for future investigation. This study primarily focused on relatively large condominium and rental apartment buildings due to the nature of the data construction necessary for the implementation of the SDiD analysis. However, the in-home death may have more significant impact on smaller residential buildings or single-family houses. It can be assumed that, in some extreme cases, the negative impact of a death incident in a particular building or house is so significant that the owner is compelled to demolish the building altogether. Because housing values of such properties are not observed, the potential negative impact is likely underestimated in this study. Therefore, examining the impact on small apartment buildings and single-family houses and exploring how in-home death incidents relate to housing vacancies and building demolition is important to understand the comprehensive impact of in-home death on the overall housing market.

Finally, the discussion of policy implications has been premised on the current law in Japan requiring disclosure obligations. However, most U.S. states and Canadian provinces do not require property dealers to disclose past incidents unless explicitly requested by their transaction partners. Bouwman (2018) recommends that South Dakota, one of the states in the US that require the disclosure of death incidents that occurred on a transactional property, repeal the provisions. If the majority of the public does not like to be informed about past fatalities in properties that they are dealing with, then a policy that prohibits the publication of in-home deaths on websites and the principle of caveat emptor (allowing buyers/renters to verify any potential concerns themselves at the time of contract) would be preferable. Given that individuals vary widely in their perception and level of concern about death incidents, whether the obligation of disclosure is essential in the context of in-home deaths, is a fundamental consideration.

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Figures and Tables

Figures

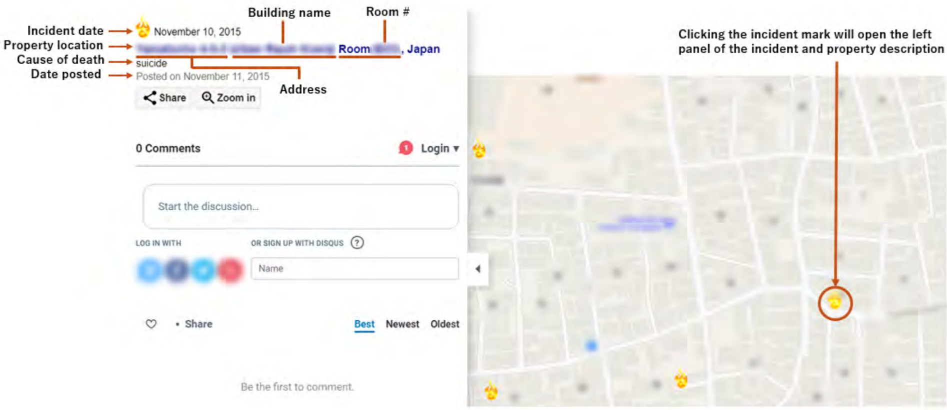
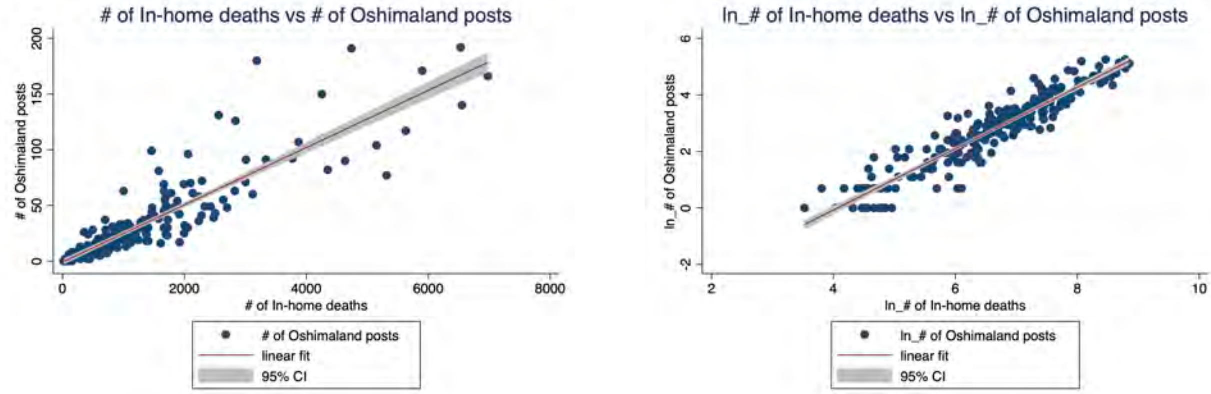


Figure 1: Snapshot from the *Oshimaland* website

Note: This figure is a snapshot of some part of our study area in the *Oshimaland* website. Street and building names are hidden for the sake of ethical issue.



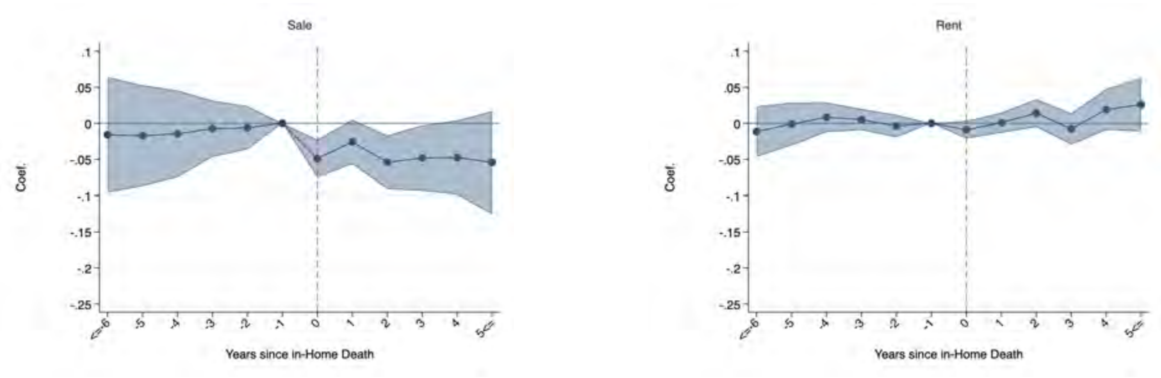
(a) level (b) natural logarithm

Figure 2: Scatterplot of in-home deaths and *Oshimaland* records at the municipality level

Note: The left panel presents scatter plots of the number of in-home deaths and the number of *Oshimaland* records at the municipality level. The right panel presents scatter plots of these numbers evaluated at natural logarithmic values. The number of in-home deaths is defined as the sum of municipality level count of in-home deaths between 2016 and 2020 recorded in the Vital Statistics, compiled by Ministry of Health, Labour and Welfare (2024). The number of *Oshimaland* records refers to the number of records on the *Oshimaland* website, whose incident occurred between 2016 and 2020 in each municipality. These numbers are in a linear relationship (left panel) and the elasticity is close to one (right panel). This implies that the distribution of incidents recorded in the *Oshimaland* website is spatially unbiased in the sense that it is directly proportionate to the distribution of the population of in-home deaths.

Figure 3: Distribution of in-home deaths used in estimations

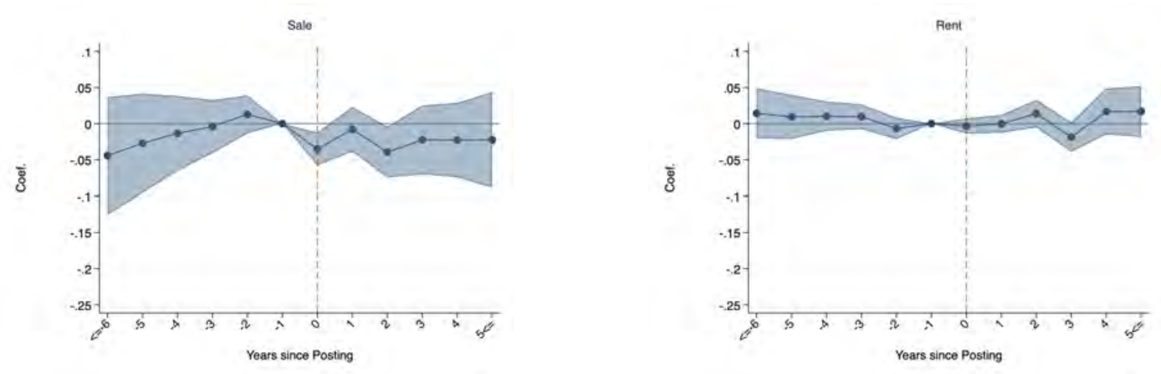
Note: The lines represent the borders of municipalities in the Tokyo Metropolitan Area. Red circles and blue crosses show the locations of sales properties and rental units, respectively, matched with death incidents recorded on the *Oshimaland* website.



(a) Effect on sale prices (b) Effect on rents

Figure 4: Main results

Note: The left panel shows the results for sales prices, and the right panel shows the results for rents. The blue plots are point estimates of treatment effects, with the horizontal axis representing the years from in-home death incidents to property transactions. The light-colored areas are the 95% confidence intervals based on clustered standard errors at the building level.



(a) Effect on sale prices (b) Effect on rents

Figure 5: Results based on the event timing when the incident information was posted

Note: The left panel shows the results for sales prices, and the right panel shows the results for rents. The blue plots are point estimates of treatment effects, with the horizontal axis representing the years from in-home death incidents to property transactions. The light-colored areas are the 95% confidence intervals based on clustered standard errors at the building level.

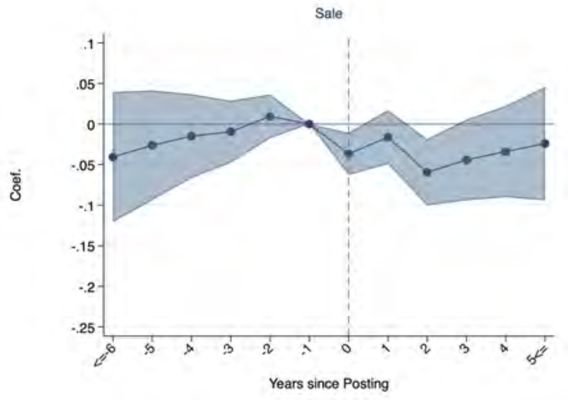
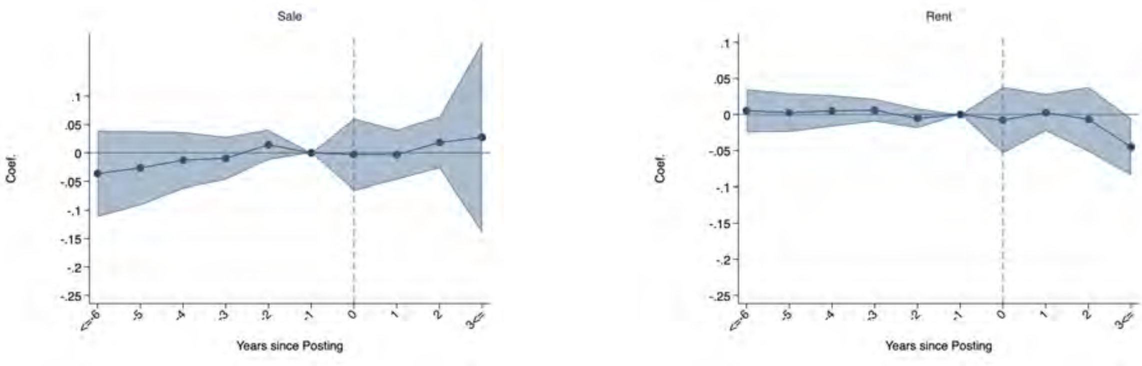


Figure 6: Other floors than incident floors (User post shock)

Note: Blue plots are point estimates of treatment effects, with the horizontal axis representing the years from in-home death incidents to property transactions. The light-colored areas are the 95% confidence intervals based on clustered standard errors at the building level. The sample after the user posts is restricted to properties whose in-home death occurrence was posted on the *Oshimaland*, while the sample before the user posts includes all properties in the posted buildings, irrespective of whether they are on the floors posted or floors not posted on the *Oshimaland*.

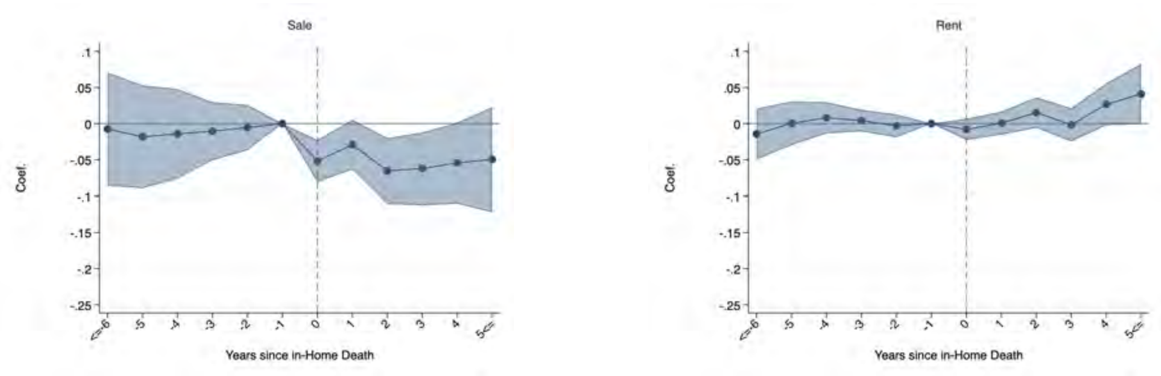


(a) Effect on sale prices

(b) Effect on rents

Figure 7: Results based on the misinformation in-home death incidents

Note: The left panel shows the results for sales prices, and the right panel shows the results for rents. The blue plots are point estimates of treatment effects, with the horizontal axis representing the years from in-home death incidents to property transactions. The light-colored areas are the 95% confidence intervals based on clustered standard errors at the building level.



(a) Effect on sale prices

(b) Effect on rents

Figure 8: Spillover effect to other floors

Note: The left panel shows the results for sales prices, and the right panel shows the results for rents. The blue plots are point estimates of treatment effects, with the horizontal axis representing the years from in-home death incidents to property transactions. The light-colored areas are the 95% confidence intervals based on clustered standard errors at the building level. The post-incident sample is restricted to properties on a different floor than the floor on which an in-home death incident occurred, while the pre-incident sample includes all properties in the incident buildings, irrespective of whether they are on the incident floor or non-incident floors.

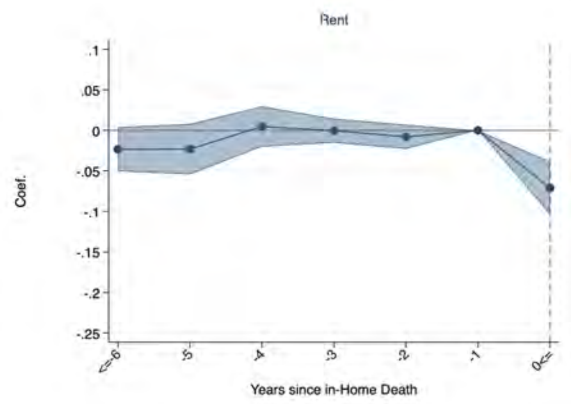
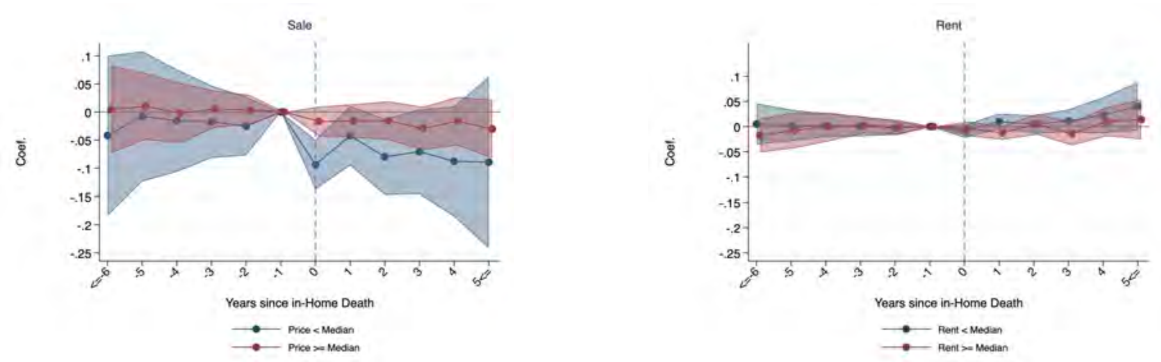


Figure 9: Direct effect on in-home death properties

Note: Blue plots are point estimates of treatment effects, with the horizontal axis representing the years from in-home death incidents to property transactions. The light-colored areas are the 95% confidence intervals based on clustered standard errors at the building level. The post-incident sample is restricted to properties in which an in-home death incident occurred, while the pre-incident sample includes all properties in buildings where post-incident samples exist.



(a) Effect on sale prices (b) Effect on rents

Figure 10: High- and low-priced properties

Note: Blue plots are point estimates of treatment effects for the low-priced subsample (lower than the median), and red plots are those for the high-priced subsample (higher than the median), with the horizontal axis representing the years from in-home death incident to property transaction. The light-colored areas are the 95% confidence intervals based on clustered standard errors at the building level. The left panel shows the results for sales prices, and the right panel shows the results for rents.

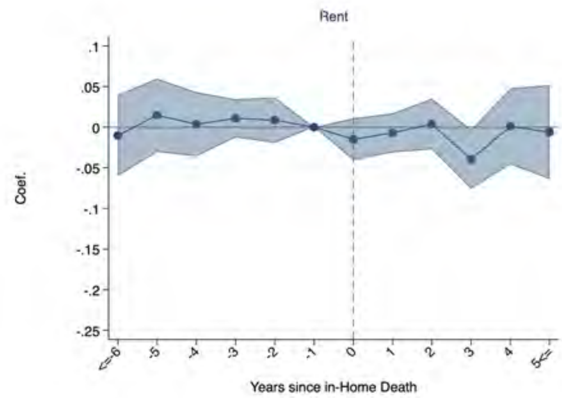


Figure 11: Condominium rent

Note: Blue plots are point estimates of treatment effects for rents. Samples are limited to transactions in condominium buildings. The light-colored area is the corresponding 95% confidence interval based on clustered standard errors at the building level.

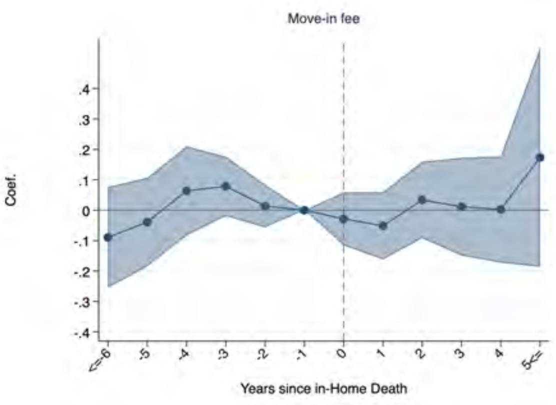
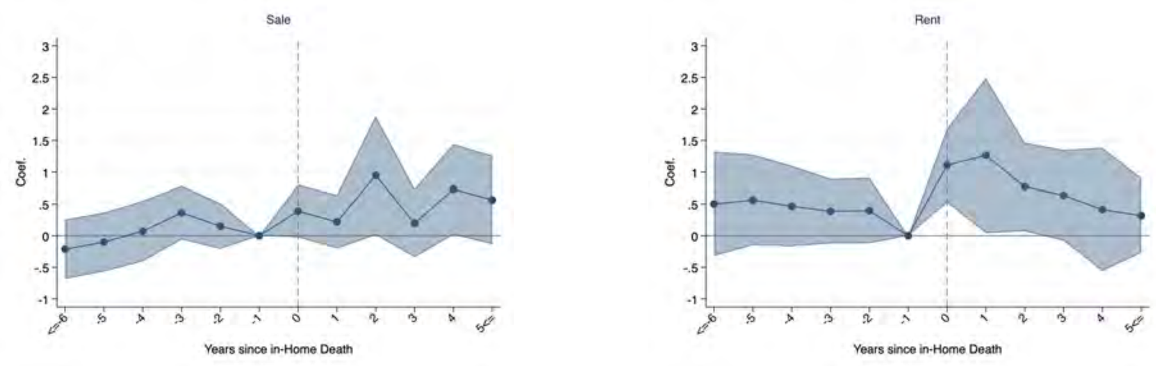


Figure 12: Move-in fees

Note: Blue plots are point estimates of treatment effects, with the horizontal axis representing the years from in-home death incidents to property transactions. The light-colored area is the 95% confidence interval based on clustered standard errors at the building level.



(a) Effect on sale prices

(b) Effect on rents

Figure 13: Transaction frequencies

Note: The left panel shows the results for sales prices, and the right panel shows the results for rents. The blue plots are point estimates of treatment effects, with the horizontal axis representing the years from in-home death incidents to property transactions. The light-colored areas are the 95% confidence intervals based on clustered standard errors at the building level.

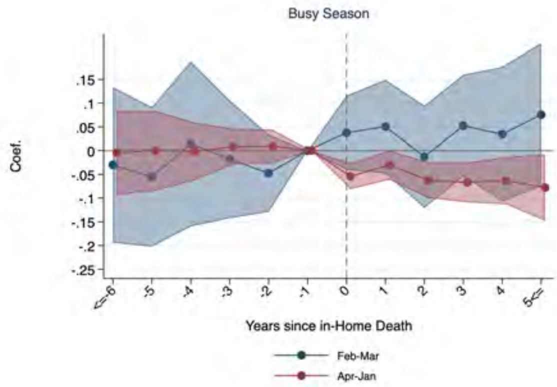


Figure 14: Busy season and off-season data

Note: Blue plots are point estimates of treatment effects for the busy season subsample (February and March), and red plots are those for the off-season subsample, with the horizontal axis representing the years from in-home death incident to property transaction. The light-colored areas are the 95% confidence intervals based on clustered standard errors at the building level.

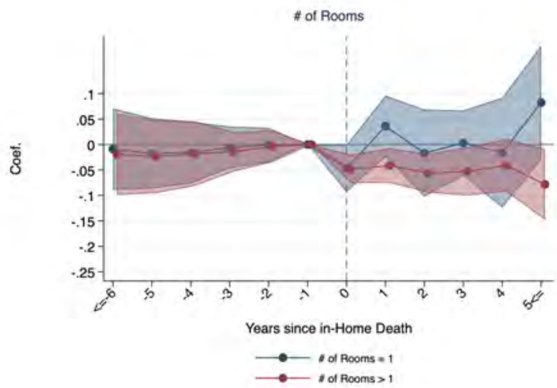


Figure 15: Single- and multiple-room properties

Note: Blue plots are point estimates of treatment effects for the single-room property subsample, and red plots are those for the multiple-room property subsample, with the horizontal axis representing the years from the in-home death incident to the property transaction. The light-colored areas are the 95% confidence intervals based on clustered standard errors at the building level.

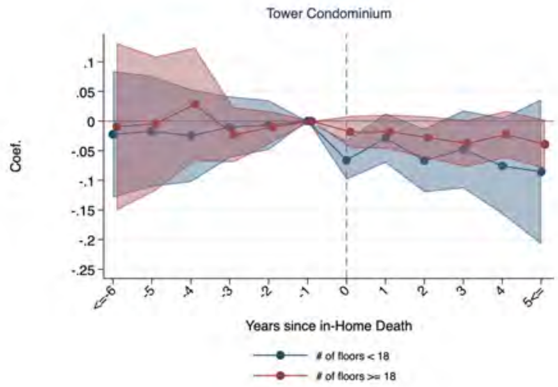


Figure 16: Tower condominiums (18 or more floors) and shorter condominium buildings

Note: Blue plots are point estimates of treatment effects for the subsample of condominium buildings with fewer than 18 floors, and red plots are those for the tower condominium subsample, with the horizontal axis representing the years from in-home death incident to property transaction. The light-colored areas are the 95% confidence intervals based on clustered standard errors at the building level.

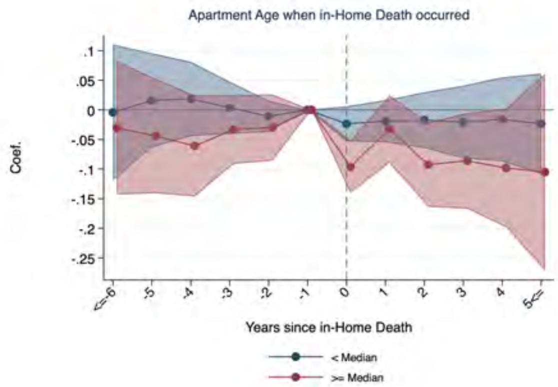


Figure 17: Apartment age when in-home death occurred

Note: Blue plots are point estimates of treatment effects for the subsample of properties in newer buildings (less than the median age), and red plots are those for the subsample of properties in older buildings (higher than the median age), with the horizontal axis representing the years from in-home death incident to property transaction. The light-colored areas are the 95% confidence intervals based on clustered standard errors at the building level.

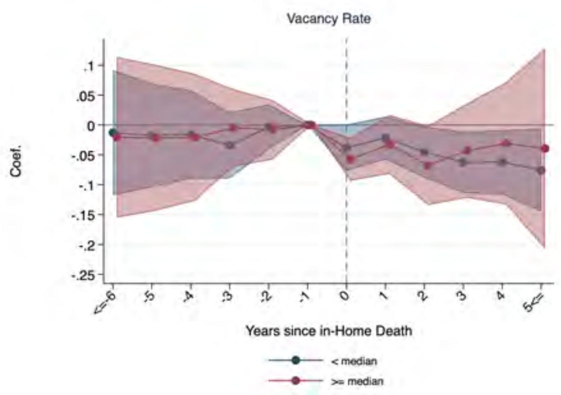
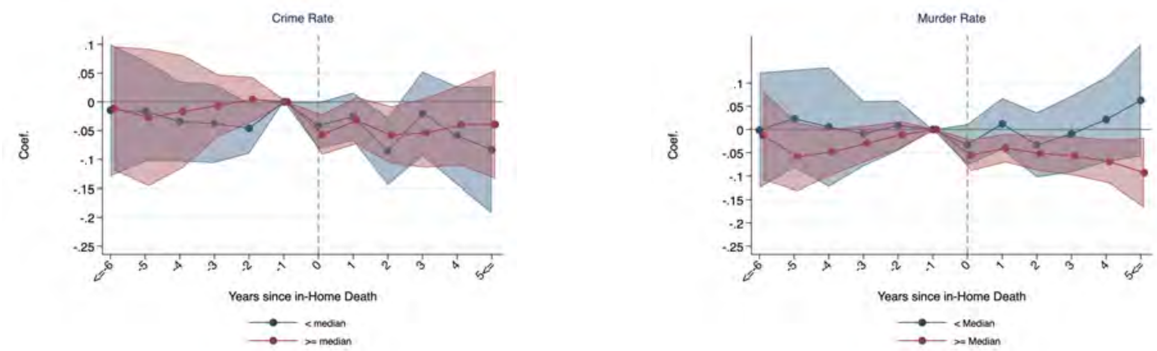


Figure 18: High and low vacancy rates in neighborhoods

Note: Blue plots are point estimates of treatment effects for the low-vacancy subsample (lower than the median), and red plots are those for the high-vacancy subsample (higher than the median), with the horizontal axis representing the years from in-home death incident to property transaction. The light-colored areas are the 95% confidence intervals based on clustered standard errors at the building level.



(a) Crime Rate in Tokyo

(b) Murder Rate

Figure 19: Tokyo crime rate and murder rate

Note: Blue plots are point estimates of treatment effects for low crime rate (lower than the median) subsample in Panel 19a and low murder rate (lower than the median) in Panel 19b subsamples, and red plots are those for high crime rate (higher than the median) subsample in Panel 19a and high murder rate (higher than the median) subsample in Panel 19b, with the horizontal axis representing the years from the in-home death incident to the property transaction. The light-colored areas are the 95% confidence intervals based on clustered standard errors at the building level.

Figure 20: By causes of death

Note: The blue points are the estimated coefficients on the variable in-home deaths for the subsample of murders, the red points are for suicides, and the green points are for other types of death. The ribbons are the corresponding 95% confidence intervals based on the standard errors clustered at the building level.

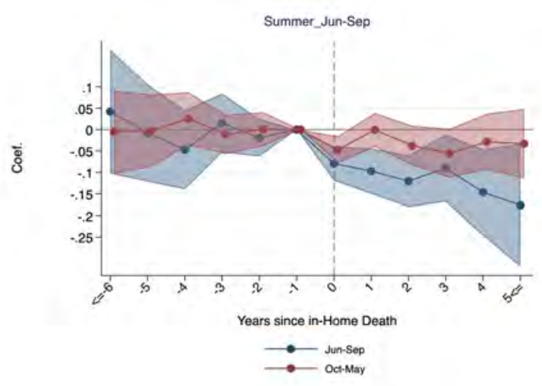


Figure 21: Death events that occurred in the summer

Note: Blue plots are point estimates of treatment effects for the summer death subsample (June–September), and red plots are those for the non-summer death subsample, with the horizontal axis representing the years from in-home death incident to property transaction. The light-colored areas are the 95% confidence intervals based on clustered standard errors at the building level.

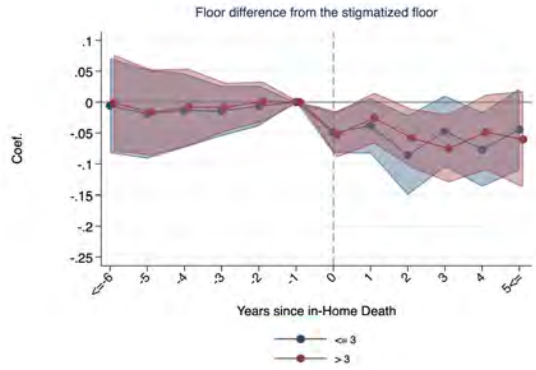


Figure 22: Floor difference from the incident floor

Note: Blue plots are point estimates of treatment effects for the closer-to-incident subsample (whose floor difference from the incident floor is up to three), and red plots are those for the farther-from-incident subsample (whose floor difference from the incident floor is greater than three), with the horizontal axis representing the years from in-home death incident to property transaction. The light-colored areas are the 95% confidence intervals based on clustered standard errors at the building level.

Tables

Table 1: The numbers of transactions, buildings with transacted properties and incidents by year

Sale										
Year	2012	2013	2014	2015	2016	2017	2018	2019	2020	Total
# of transactions	210	369	385	337	441	462	478	470	384	3,536
# of buildings w/ transaction(s)	86	154	167	149	174	179	176	184	173	
# of death incidents	6	15	34	22	37	28	38	23	102	305
Rent										
Year	2012	2013	2014	2015	2016	2017	2018	2019	2020	Total
# of transactions	689	699	648	678	769	723	769	717	635	6,327
# of buildings w/ transaction(s)	256	274	253	246	273	267	288	275	253	
# of death incidents	15	30	40	44	58	42	72	34	223	558

Notes: The table shows the numbers of property transactions, buildings with transaction(s), and death incidents recorded in our dataset used in estimations for each year between 2012 and 2020. The number of death incidents equals the number of buildings in which a death incident occurred each year because the study sample of buildings is restricted to those with a single incident.

Table 2: The numbers of transactions, buildings with transacted properties and incidents by year

Sample used in estimations								
	Sale				**Rent**			
	Mean	Std.Dev	Min	Max	Mean	Std.Dev	Min	Max
Property characteristics								
Property price or rent (in 1,000 JPY)	39,772.64	29,240.01	1,200	270,000	96.43	68.42	20	1,035
# of rooms	2.21	0.89	1	5	1.42	0.68	1	5
Floor area (in m^2)	62.34	22.75	12.59	188.16	34.30	28.11	7.38	1,714.31
# of stories in the building	20.82	15.41	1	55	10.40	10.69	1	55
Floor level	11.10	10.57	1	55	5.44	5.91	1	55
Age of the building (in year)	19.96	13.44	0	52	24.91	13.22	0	77
Since in-home death occurrence								
Months from a death incident occurrence	-5.04	41.49	-103	97	-14.62	39.93	-104	101
Observations								
# of buildings	305				558			
# of properties	3,536				6,327			
Whole sample in REINS								
	Sale				**Rent**			
	Mean	Std.Dev	Min	Max	Mean	Std.Dev	Min	Max
Property characteristics								
Property price or rent (in 1,000 JPY)	26,080.65	18,872.51	1,000	850,000	82.93	136.59	20	30,500
# of rooms	2.54	0.84	1	9	1.39	0.64	1	6
Floor area (in m^2)	64.40	20.42	5.16	820.90	33.50	16.35	5.00	710.13
# of stories in the building	9.38	6.59	1	60	4.59	4.16	1	60
Floor level	5.20	4.56	1	59	2.84	2.61	1	60
Age of the building (in year)	17.89	11.10	-6	92	19.64	12.29	-2	93
Observations								
# of properties	754,659				1,698,340			

Table 3: The number of transactions whose incident occurrences are identified at the building, floor, and unit levels

	Sale	Rent
Identified at the building level	3,536	6,327
Identified at the floor level	2,756	5,190
Identified at the unit level	807	2,643

Notes: The table shows the number of properties in the sample used in the estimations identified at building level, floor level, and unit level both in REINS data and *Oshimaland* data. Since REINS data and *Oshimaland* data are matched by using apartment name, the numbers of transactions identified at the building level equal to the number of total sample used in the estimations.

Appendix A Cultural attitudes toward death in the East and West

Chapman and Ludlum (2014) point out that people in Asian societies tend to see death as more sinister and ominous, often associating it with fears and other negative impressions, compared to Western societies. Recent surveys support this view. For instance, the Asian Pacific Values Survey (Yoshino et al., 2015)[A1] revealed that over 30% of respondents from Asian countries harbor some kind of fear of "ghosts/apparitions/curses," compared to approximately 10% in the US and Australia.[A2] Nevertheless, this does not imply an absence of interest in the paranormal in Western culture. In fact, Chapman Survey of American Fears Wave 7 (CSAF, Wave 7) [A3] revealed that a majority (53%) of American respondents consent to the belief that "place can be haunted by spirits," and this tendency does not statistically differ by ethnicity. Yet, 17% of Asian American responded in the same survey that they are "very afraid/afraid" of "ghosts," compared to 8% of other Americans, which corroborates findings from Yoshino et al. (2015). Intriguingly, Yoshino et al. (2015) suggests that a notable fraction of respondents from the US (15.5%) and Australia (16.6%) perceive ghosts as "interesting/amusing," a sentiment less commonly shared in non-Pacific Asia (on average, 3.2% for Asian countries, with Singapore reporting the highest at 6.8%).

According to the surveys, while a majority acknowledges the existence of earthbound spirits in the United States, the belief that the deceased hold grudges and bring misfortune seems more prevalent in the Eastern belief systems than in the Western ones. The differences in their beliefs may be partly

[A1]The survey by Yoshino et al. (2015) was conducted from 2010 to 2014 across 11 countries and regions, including Japan, the United States, mainland China (Beijing, Shanghai), Hong Kong, Taiwan, South Korea, Singapore, Australia, India, and Vietnam. The target of the survey was adults, selected using stratified random sampling, quota, next birthday method, and Clover Leaf method, to ensure as much randomness as possible while reflecting local demographic and gender composition. The number of valid responses ranges from 800-1005 for each country/region. Although it should be noted that the survey period and sampling method slightly differ by country and region, we believe the survey is useful for comparing the level of psychological discomfort associated with human death in the Asia-Pacific region.

[A2]In Yoshino et al. (2015), participants were asked a range of questions about world views. One of the questions asks, "We now would like to ask you some questions about topics that at least some people take seriously. [...] Looking at categories from 01 to 08 carefully, please choose the one that comes closest to your feeling for each of the following items." Of the four items, our interest is "Ghosts, Apparitions, or Curses." The categories from which respondents choose are "01: Boring," "02: Would like to be," "03: Exist," "04: Dreadful, Scary," "05: Would Not Like To Be," "06: Interesting, Amusing," "07: Nonsense, Does Not Exist," "08: Not Dreadful, Not Scary," "88: Other," "99: DK." The percentage of respondents who chose categories "04: Dreadful, Scary" and "05: Would Not Like To Be," which indicate a sense of fear of "Ghosts, Apparitions, or Curses," exceeds 30% in Japan (39.6%), Taiwan (36.8%), South Korea (37.6%), India (31.1%) and Vietnam (41.3%), while the percent is the lowest in the US (11.2%) and Australia (11.6%). In particular, the percentage of respondents who chose the category "04: Dreadful, Scary," was the highest among India (19.3%) and Japan (17.4%), which contrasts with the US (6.8%) and Australia (5.6%).

[A3]The survey uses the sample of the SSRS Opinion Panel, which is a group of individuals recruited to participate in surveys and studies conducted by SSRS, a survey research company (Bader et al., 2023; Silva and Woody, 2022). Panel members are randomly selected using a nationally representative Address Based Sample (ABS) design that includes households from all US states, including Hawaii and Alaska. Surveys were self-administered online, with panelists receiving electronic gift card incentives and reminder emails to increase response rates. A soft launch was conducted to validate the survey content prior to the full launch. Quality checks ensured data integrity and high completion rates were achieved, with 97% of respondents answering all questions.

traced back to religious philosophies (Rittichainuwat, 2011). On one hand, Christianity, which is prevalent in Western society, emphasizes the transformation of the soul of the deceased for an afterlife in either heaven or hell. Biblical scriptures state that "[...] one who goes down to the grave does not return. He will never come to his house again; his place will know him no more" (NIV, Job 7:9–10) and "people are destined to die once, and after that to face judgement" (NIV, Hebrews 9:27). In their doctrine, the death of a person does not cause misfortune to people living in this life, while evil spirits may sometimes possess people and animals to harm them (Mark 5:1-20). This biblical theology may partly explain the contributing factor to the low percentage of American respondents expressing fear of ghosts. On the other hand, the common belief in Asian societies that the soul intervenes in this life is sustained by the concept of reincarnation, prevalent in Hinduism, and the worship of ancestral spirits, maintained by Confucianism, Taoism, and Shintoism.

Appendix B Data construction and additional characteristics

Appendix B.1 Data cleansing process for in-home death data

The in-home death dataset was provided by the administrator of the *Oshimaland* website in 2020. When the *Oshimaland* website was established in 2005, administrative staff members collected information on in-home deaths. As gradually gaining its recognition in public, the website started to accept postings by public users in June 2011. When users post death information, they first indicate the location of the incident on a map on the website. The system then automatically records the address at the building level based on the selected location, on which users can modify or enter the information of the location more in detail such as the room number and floor level. Then, users provide the date of incident. In case when the exact date is unclear, users have the option to describe approximate dates in free format. The posting form also includes a free entry field where users can provide additional details about the deaths. All of the information is anonymously posted.

We mainly followed Yajima and Sadayuki (2023) regarding the data cleansing procedure. The following briefly explains how we manipulate variables for date of occurrence, address, and description of incidents.

First, regarding the date of occurrence, users provided details on the day, month, and year of the incident, to the best of their knowledge, typically employing either Japanese Era or Western notation. However, some users provided dates in more ambiguous notation, such as "spring/YYYY" or "beginning of MM/YYYY." In such instances, we extracted only the verifiable information. Specifically, we extracted the year for the former case and both the month and year for the latter case.

Next, regarding the location of the in-home death, our raw data contained information on the street address along with longitude and latitude of each death incident. The accuracy of in-home death location is examined based on the geocodes and registered address.

Lastly, deaths were categorized into several types, including suicide and murder. This was done by first automatically classifying each record according to specific keywords associated with each type, and then manually verifying that everything was properly classified. In doing so, duplicate records were removed.

As noted in the main section, the *Oshimaland* website allows public users to enter additional comments to posted information. These comments were used to supplement as much as possible the missing information for the three types of information listed above.

Appendix B.2 Data matching process for in-home death and property transaction datasets

In-home death and property transaction datasets were by using the addresses and names of the apartment buildings recorded in each entry. The process is divided into three parts.

First, in terms of the building addresses, two data points are matched at the district level. The apartment buildings with no recorded addresses at the district level are excluded from this process.

Second, we conduct fuzzy matching by using the names of apartment buildings.[A4] Before undertaking the fuzzy matching process, we removed the noise information contained in the apartment name column of the property transaction data. For instance, some name in the property transaction data contains noise such as "This property is newly built!" to stand out in resident recruitment platforms. We visually checked such noise and removed text from the apartment names column using Stata. We matched the names of apartment buildings within the same district (*cho-cho* level). By the fuzzy matching process, apartment buildings that were not matched with more than 90% accuracy were omitted.

Finally, we manually verified whether the matched names of apartment buildings were the same. The properties in the buildings whose names were correctly matched between the two datasets are used as our estimation sample.

[A4] To conduct fuzzy matching, we used the "matchit" command in Stata.

Appendix C Supplement for the main results

Appendix C.1 Full result for the main analysis

Table A3 shows the full result for the main result shown in Table 4.

[Table A3 around here]

Appendix C.2 Robustness checks for the main analysis

Figures A2–A10 exhibit the graphical results for the robustness checks for the main results.

[Figures A2–A10 around here]

Section 4.2 considers six robustness checks (1)–(7) conducted in this appendix. Robustness check (1) corresponds to Figure A2, (2) to Figure A3, (3) to Figure A4, (4) to Figure A5, (5) to Figure A6, (6) to Figure A7, (7) to Figure A8, (8) to Figure A9, and (9) to Figure A10.

Appendix D Additional heterogeneity analysis

We investigate how the effect of in-home death may be attributed to heterogeneous preferences on the demand side, featuring variations in regional socioeconomic characteristics. We conduct two subsample analyses that specifically consider regional characteristics, which can provide insights into the effects of high demand on buildings. The sample is divided based on the workforce population ratio and the child ratio. For the analyses, we utilize district-level demographic statistics, as our property transaction data do not include buyers' demographic information.[A5]

We start with the analysis focusing on the workforce ratio. In this analysis, the workforce is defined as the population aged between 30 and 60. Among the Japanese workforce (aged between 15 and 60), individuals aged older than 30 are often married and earn a higher income by the seniority rule, which is a popular system among Japanese firms. In contrast, those aged older than 65 cannot take out a loan because of their retirement age. Therefore, the actual demand for residential property is likely to be high relative to the supply level in areas with many people aged between 30 and 60 years. In such a case, even properties where in-home deaths have occurred can be matched with residents with little

[A5]For the demographic data, we use the Japanese Census in 2015, available at the district (*cho-cho*) level with five-year intervals.

discount because of the excess demand for properties. Hence, we expect that the negative effect of in-home deaths may be less crucial in areas with higher workforce population ratios. To investigate this hypothesis, we split the sample into subsamples consisting of properties located in districts (*cho-cho*s) with workforce population ratios higher and lower than the median. We expect that the negative impact of in-home death is smaller in areas with higher workforce population ratios.

Panel A11a in Figure A11 shows the results.

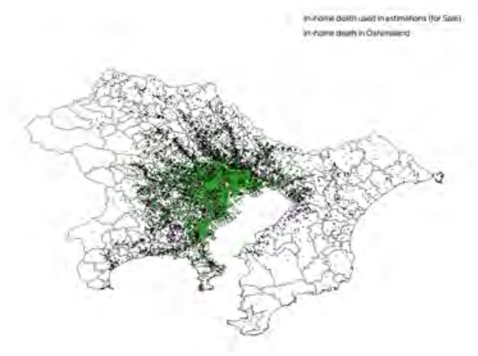
[Figure A11 around here]

Property prices in the areas with higher workforce population ratios significantly decline after the death incidents, while prices in the areas with lower workforce population ratios do not, although we do not find greater coefficient magnitudes for the subsample with a higher workforce population ratio. The insignificance of the in-home death variable in the subsample of the areas with a lower workforce population mainly comes from greater standard errors. One reasonable explanation for the wide confidence intervals in the estimation results for this subsample is that there is considerable heterogeneity and variation in demographic and economic characteristics among household heads younger than 30 and older than 60.

In addition, we consider the child population share in the neighborhood of the transacted properties. We divide the sample into a subsample of properties in areas with a higher child population share (above the median child population share at the district (*cho-cho*)-level) and a subsample of properties with a lower child population share (below the median). We conjecture that property prices in areas with a high child population share may experience a stronger negative impact of in-home deaths than those in areas with a low child population share because the former areas may have a greater share of households able to buy properties to reside in. With this exercise, we aim to reveal whether households with families have a stronger preference for better residential amenities. From Panel A11b, however, we observe no clear difference in the coefficient and significance of the death incidents in the same apartment buildings.

Appendix figures and tables

Appendix figures

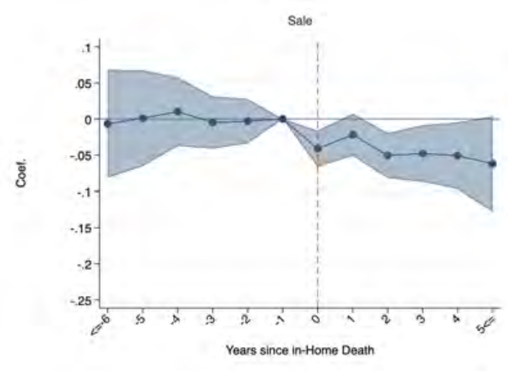


(a) In-home deaths used in estimations for sales properties

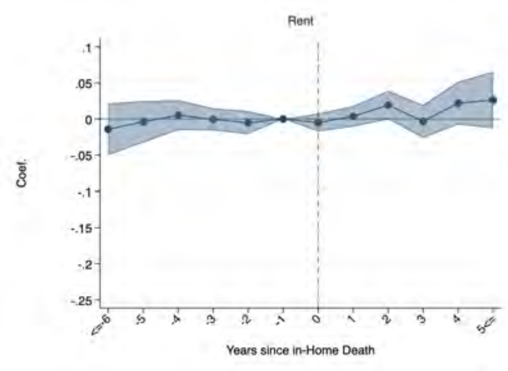
(b) In-home deaths used in estimations for rental properties

Figure A1: Distribution of in-home deaths used in estimations for sales and rental properties

Note: The left panel shows the distribution of buildings with sales properties in our estimation sample, while the right panel presents the distributions of buildings with rental properties in the estimation sample. Both maps also show the distribution of buildings recorded in *Oshimaland* with death incidents occurred between 2012 and 2020.



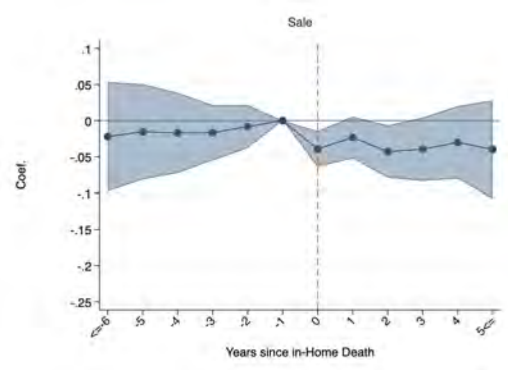
(a) Effect on sale prices



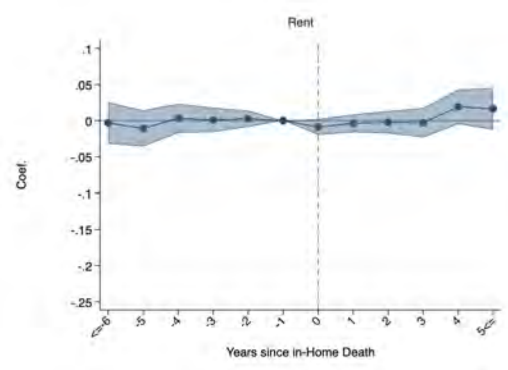
(b) Effect on rents

Figure A2: Sample excluding the properties with the top 5% and bottom 5% of prices or rents

Note: The left panels show the results for the cases of sales properties, while the right panels present the effects of death incidents on rental property deals. The blue points are the estimated coefficients on the variable in-home deaths for the housing price/rent. The ribbons are the corresponding 95% confidence intervals. Standard errors are clustered at the building level.



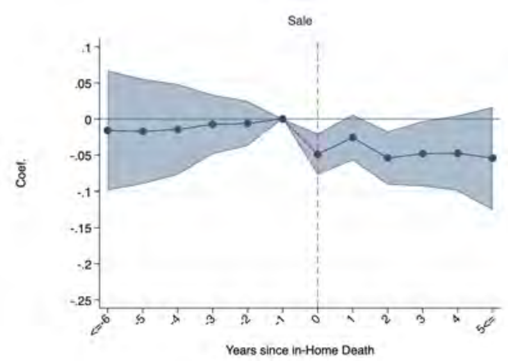
(a) Effect on sale prices



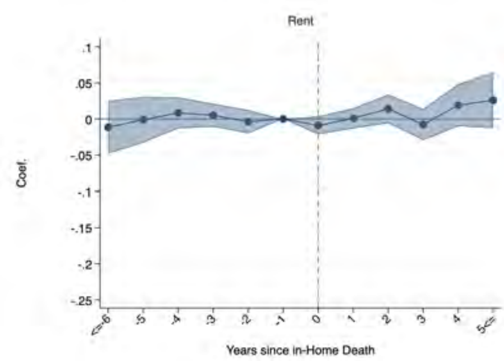
(b) Effect on rents

Figure A3: Log of per-floor-area price or rent as the dependent variable

Note: The left panels show the results for the cases of sales properties, while the right panels present the effects of death incidents on rental property deals. The blue points are the estimated coefficients on the variable in-home deaths for the housing price/rent. The ribbons are the corresponding 95% confidence intervals. Standard errors are clustered at the building level.



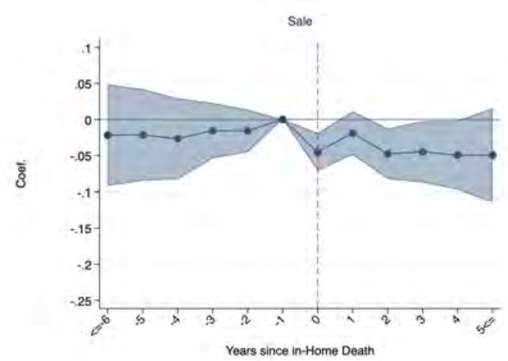
(a) Effect on sale prices



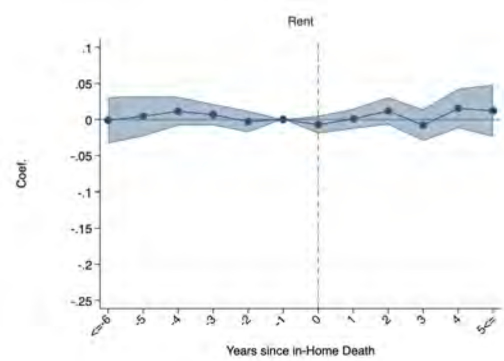
(b) Effect on rents

Figure A4: Clustered standard errors at the district (*cho-cho*) level

Note: The left panels show the results for the cases of sales properties, while the right panels present the effects of death incidents on rental property deals. The blue points are the estimated coefficients on the variable in-home deaths for the housing price/rent. The ribbons are the corresponding 95% confidence intervals. Standard errors are clustered at the district (*cho-cho*) level where the apartment buildings are located.



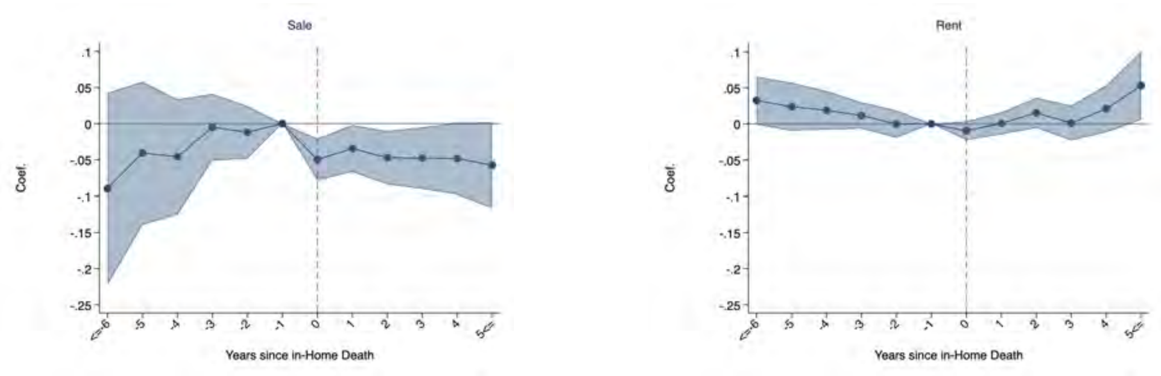
(a) Effect on sale prices



(b) Effect on rents

Figure A5: Controlling for predicted year-by-municipality fixed effects

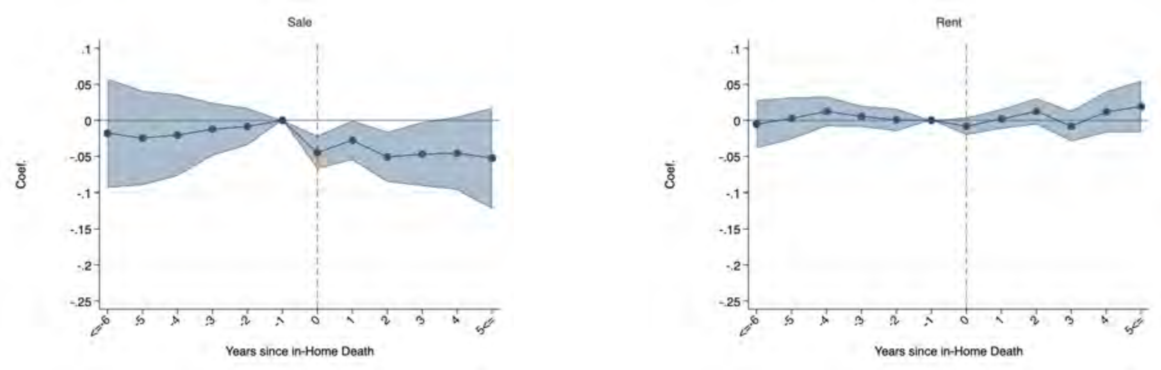
Note: The left panels show the results for the cases of sales properties, while the right panels present the effects of death incidents on rental property deals. The blue points are the estimated coefficients on the variable in-home deaths for the housing price/rent. The ribbons are the corresponding 95% confidence intervals. Standard errors are clustered at the building level.



(a) Effect on sale prices (b) Effect on rents

Figure A6: 2014-2018 death-building cohort as the treatment group and the 2019-2020 death-building cohort as the control group

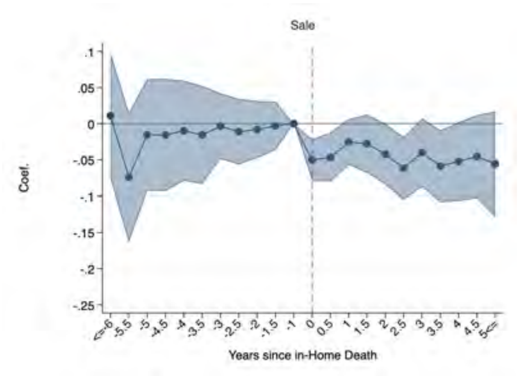
Note: The left panels show the results for the cases of sales properties, while the right panels present the effects of death incidents on rental property deals. The blue points are the estimated coefficients on the variable in-home deaths for the housing price/rent. The ribbons are the corresponding 95% confidence intervals. Standard errors are clustered at the building level.



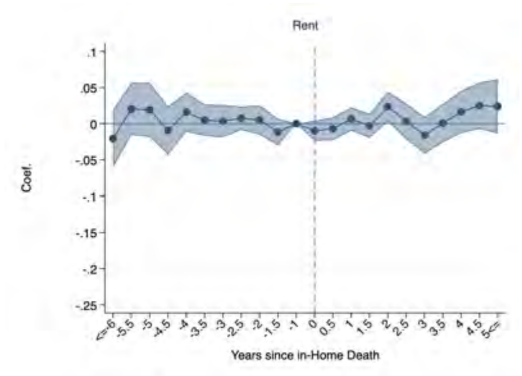
(a) Effect on sale prices (b) Effect on rents

Figure A7: Sample including in-home deaths with any comments denying the fact of incident

Note: The left panels show the results for the cases of sales properties, while the right panels present the effects of death incidents on rental property deals. The blue points are the estimated coefficients on the variable in-home deaths for the housing price/rent. The ribbons are the corresponding 95% confidence intervals. Standard errors are clustered at the building level.



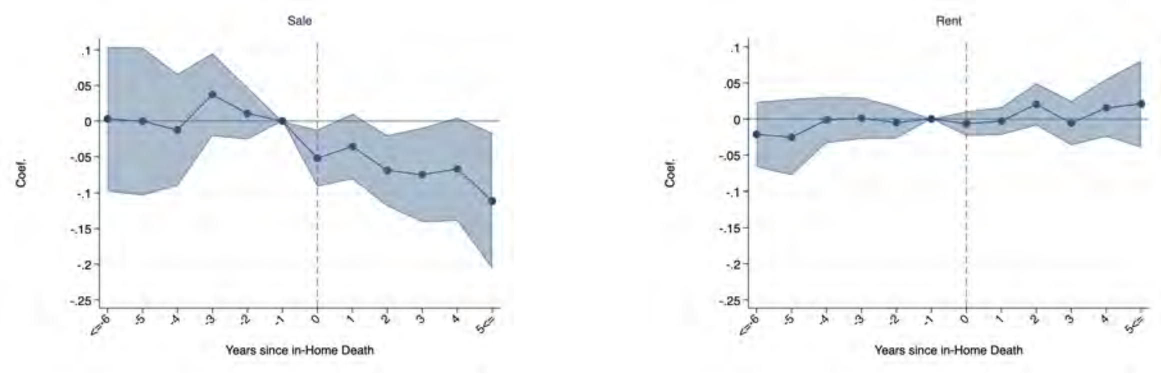
(a) Effect on sale prices



(b) Effect on rents

Figure A8: Sample divided every six months from an in-home death that occurred in each building

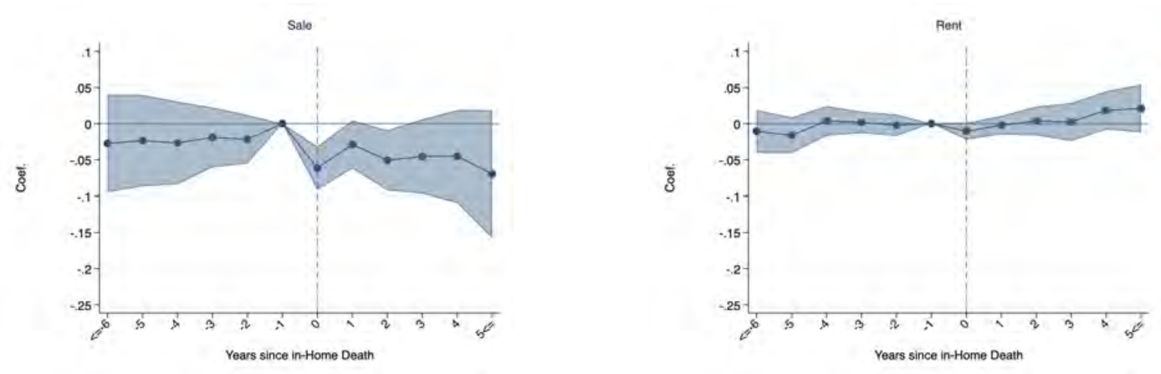
Note: The left panels show the results for the cases of sales properties, while the right panels present the effects of death incidents on rental property deals. The blue points are the estimated coefficients on the variable in-home deaths for the housing price/rent. The ribbons are the corresponding 95% confidence intervals. Standard errors are clustered at the building level. The 2020 death-building cohort serves as the control group.



(a) Effect on sale prices (b) Effect on rents

Figure A9: Excluding covariates

Note: The left panels show the results for the cases of sales properties, while the right panels present the effects of death incidents on rental property deals. The blue points are the estimated coefficients on the variable in-home deaths for the housing price/rent. The ribbons are the corresponding 95% confidence intervals. Standard errors are clustered at the building level. The 2020 death-building cohort serves as the control group.

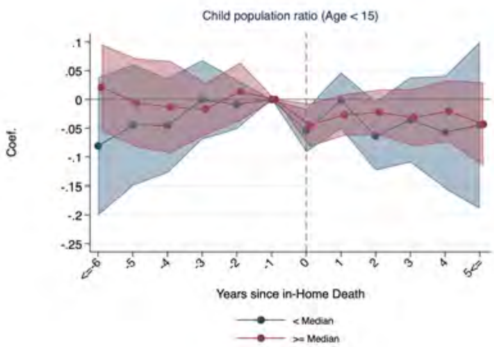


(a) Effect on sale prices (b) Effect on rents

Figure A10: Allowing effects of covariates to vary across years

Note: The left panels show the results for the cases of sales properties, while the right panels present the effects of death incidents on rental property deals. The blue points are the estimated coefficients on the variable in-home deaths for the housing price/rent. The ribbons are the corresponding 95% confidence intervals. Standard errors are clustered at the building level. The 2020 death-building cohort serves as the control group.

(a) Workforce Population Ratio



(b) Child Population Ratio

Figure A11: Neighborhood demographics as a proxy for buyer characteristics

Note: Blue plots are point estimates of treatment effects for low workforce population ratio in Panel A11a and low child population ratio in Panel A11b, and red plots are those for the high workforce population ratio in Panel A11a and high child population ratio in Panel A11b, with the horizontal axis representing the years from the in-home death incident to the property transaction. The light-colored areas are the 95% confidence intervals based on clustered standard errors at the building level.

Appendix tables

Table A1: Data source

Variable	Source	URL
Main transaction & property data:		
Property price (1,000 JPY)	REINS data recorded on Nov 23, 2020. Variable is defined as transacted price of each property.	
Property rent (1,000 JPY)	REINS data recorded on Nov 23, 2020. Variable is defined as transacted monthly rent of each property which contains monthly management fee.	
# of rooms	REINS data recorded on Nov 23, 2020. Variable is defined as the number of rooms of each property.	
Floor area (m^2)	REINS data recorded on Nov 23, 2020. Variable is defined as size of each property.	
# of floors in the building	REINS data recorded on Nov 23, 2020. Variable is defined as the number of floors of each building which transacted properties are located in.	
Floor level	REINS data recorded on Nov 23, 2020. Variable is defined as the floor level where each transacted property is located on.	
Age of building (year)	REINS data recorded on Nov 23, 2020. Variable is defined as age of buildings which transacted properties are located in.	
Room count categorical dummy	REINS data recorded on Nov 23, 2020. Variable is defined as dummy variables which represent the number of rooms of each transacted property.	
Floorplan count categorical dummy	REINS data recorded on Nov 23, 2020. Variable is defined as dummy variable which represents the floor-plan of each transacted property. Floor-plan categories consist of 1R (one room), 1K (kitchen and one room), DK (dining kitchen and at least one room), LK (living room, kitchen and at least one room), LDK (living room, dining kitchen and at least one room), SK (service room, kitchen and at least one room), SDK (service room, dining kitchen and at least one room), SLK (service room, living room, kitchen and at least one room), and SLDK (service room, living room, dining kitchen and at least one room).	
Floor level categorical dummy	REINS data recorded on Nov 23, 2020. Variable is defined as dummy variable which represents floor level of each transacted property.	
Incident information:		
In-home death	Oshimaland.com. Oshimaland data recorded on Nov 19, 2020. We organize the data according to Yajima and Sadayuki (2023)	
Causes of death categorical dummy	Oshimaland data recorded on Nov 19, 2020. Variable is defined as dummy variable represents the cause of death incident in the building which transacted property is located in. Floor-plan categories consist of murder, suicide and other (natural death, accidental death, and death of unrecognized cause).	
Period Information:		
Period since death (month)	Own calculation by using year and month information when each property is transacted of REINS data recorded on Nov 23, 2020 and year and year and month information when each in-home death occurred in the same building of Oshimaland data recorded on Nov 19, 2020. Variable is defined as month level period since each in-home death occurred.	
Other demographics data:		
# of vacant housings	Housing and Land Survey (2018) published by Ministry of Internal Affairs and Communications (MIC). Basic Tabulation on Dwellings and Households Japan, Prefecture, Shi, Ku, Machi and Mura. Table number 38-3: Vacant Dwellings for Rent by Type of Building (4 Groups) and Construction Material (2 Groups) - Japan, Prefecture, Shi, Ku, Machi and Mura. Enumerators recorded building characteristics for approximately 3.7 million housings which randomly extracted households were living in. We use # of vacant housings in "total" category both for type of building and construction material for each municipality.	`https://www.e-stat.go.jp/en/stat-search/files?stat_infid=000031865735`, retrieved 2 May 2024
Annual household income of homeowners and home renters	Housing and Land Survey (2018) published by Ministry of Internal Affairs and Communications (MIC). Basic Tabulation on Dwellings and Households Japan, Prefecture, Shi, Ku, Machi and Mura. Table number 41-2: Basic Tabulation on Dwellings and Households Japan, Prefecture, Shi, Ku, Machi and Mura. Randomly extracted approximately 3.7 million households anonymously recorded their own household characteristics. Households are divided into six groups by their household annual income (lower than 3 million yen, 3–5million yen, 5–7 million yen, 7–10 million yen, 10–15 million yen, or higher than 15 million yen), and into two groups by their tenure of dwelling (owners or renters)	`https://www.e-stat.go.jp/en/stat-search/files?stat_infid=000031865741`, retrieved 1 May 2024
# of households living in rental housing	Housing and Land Survey (2018) published by Ministry of Internal Affairs and Communications (MIC). Basic Tabulation on Dwellings and Households Japan, Prefecture, Shi, Ku, Machi and Mura. Table number 110-3: Rented Houses by Tatami Units of Dwelling Rooms (6 Groups) and Tatami Units of Dwelling Rooms per Household by Monthly Rent of Dwelling (10 Groups) - Japan, Prefecture, Shi, Ku, Machi and Mura. Enumerators recorded building characteristics for approximately 3.7 million housings which randomly extracted households were living in. We use # of households living in rental housings in "total" category both for type of building and construction material for each municipality.	`https://www.e-stat.go.jp/en/stat-search/files?stat_infid=000031865874`, retrieved 2 May 2024
# of in-home deaths	Vital Statistics (2016–2020) published by Ministry of Health, Labour and Welfare (MHLW). Prefecture level statistics; Table number 4: The number of deaths in prefectures and municipalities by places where deaths occurred. We refer municipality level "in-home death" category.	2016: `https://www.e-stat.go.jp/stat-search/files?stat_infid=000032025344`, 2017: `https://www.e-stat.go.jp/stat-search/files?stat_infid=000032025875`, 2018: `https://www.e-stat.go.jp/stat-search/files?stat_infid=000031884228`, 2019: `https://www.e-stat.go.jp/stat-search/files?stat_infid=000031983045`, 2020: `https://www.e-stat.go.jp/stat-search/files?stat_infid=000032119618`, retrieved 26 May 2024 (only in Japanese)
# of unexpected accidental in-home death	Vital Statistics (2022) published by Ministry of Health, Labour and Welfare (MHLW). General mortality. Volume 1; Table number 5-34: Deaths and percent distribution from nontransportation accidents by age (specified age groups) and place of occurrence:Japan, 2022. Unexpected accidental death is divided into seven groups by age of the deceased (0 year old, 1–4 years old, 5–14 years old, 15–44 years old, 45–64 years old, 65–79 years old, and over 80 years old) 10 groups by the place of occurrence, and we focus on the "in-home" group (group code 0).	`https://www.e-stat.go.jp/en/stat-search/files?stat_infid=000040098322`, retrieved 1 May 2024
# of crimes in Tokyo	Crime Statistics (2015) published by the Tokyo Metropolitan Police Department. # of crimes is recorded and published by type of offense for each municipality and street (cho-cho) based on statistics of Police of Japan.	`https://www.keishicho.metro.tokyo.lg.jp/about_mpd/jokyo_tokei/jokyo/ninchikensu.html`, retrieved 2 May 2024 (only in Japanese)
# of population by age groups	National Census (2015) published by Ministry of Internal Affairs and Communications (MIC). Population statistics by census unit district level. Table number 3: Population by five years age groups, sex and nationality. Enumerators collected population and household characteristics by using questionnaire survey allover Japan. Population is divided into 21 groups by every five years age (from 0–4 years old to over 100 years old)	Saitama prefecture: `https://www.e-stat.go.jp/stat-search/files?stat_infid=000031522017`, Chiba prefecture: `https://www.e-stat.go.jp/stat-search/files?stat_infid=000031522026`, Tokyo prefecture: `https://www.e-stat.go.jp/stat-search/files?stat_infid=000031522037`, and Kanagawa prefecture: `https://www.e-stat.go.jp/stat-search/files?stat_infid=000031522047`, retrieved 2 May 2024 (only in Japanese)

Notes: The table shows the data sources of variables used in estimations and discussions. If the data was viewed on the Internet, the URL and date of viewing are listed.

Table A2: The number of transactions per time lag from event and type of death

Sale																	
Years elapsed from in-home death	-8 yrs	-7 yrs	-6 yrs	-5 yrs	-4 yrs	-3 yrs	-2 yrs	-1 yr	0 yr	1 yr	2 yrs	3 yrs	4 yrs	5 yrs	6 yrs	7 yrs	Total
Suicide																	
# of transactions	8	25	31	58	77	97	127	148	166	106	102	90	70	60	45	27	1,237
Mean price (in 1,000 JPY)	45,687.50	44,515.20	40,911.29	56,718.10	55,376.36	48,831.86	52,057.48	52,590.47	45,456.69	46,109.72	41,519.61	48,977.11	47,184.71	51,936.33	54,577.78	38,439.13	48,844.77
Murder																	
# of transactions	2	5	6	11	17	21	24	49	44	37	25	50	26	29	15	1	362
Mean price (in 1,000 JPY)	16,450.00	39,780.00	38,383.33	29,645.45	35,907.06	36,011.90	35,016.67	45,789.80	46,145.45	46,940.54	41,960.00	61,930.00	55,017.31	74,262.07	61,006.67	42,000.00	48,875.19
Other																	
# of transactions	63	101	133	125	160	190	226	239	242	126	116	99	48	36	20	11	1,935
Mean price (in 1,000 JPY)	33,320.63	35,050.99	28,328.57	31,539.20	32,353.62	29,791.74	31,058.41	31,915.65	33,094.96	30,173.02	33,582.67	36,728.79	39,935.42	34,268.06	35,464.00	42,663.64	32,302.40
All																	
# of transactions	73	131	170	194	254	308	378	436	452	270	243	239	144	125	80	39	3,536
Mean price (in 1,000 JPY)	34,213.70	37,037.63	30,977.94	38,959.54	39,570.79	36,212.24	38,306.08	40,492.96	38,905.29	38,646.41	37,776.09	46,613.35	46,182.50	52,027.44	51,004.75	39,721.96	39,772.64
Rent																	
Years elapsed from in-home death	-8 yrs	-7 yrs	-6 yrs	-5 yrs	-4 yrs	-3 yrs	-2 yrs	-1 yr	0 yr	1 yr	2 yrs	3 yrs	4 yrs	5 yrs	6 yrs	7 yrs	Total
Suicide																	
# of transactions	24	31	49	78	74	138	170	211	171	114	78	54	43	20	22	13	1,290
Mean rent (in 1,000 JPY)	76.92	100.21	104.42	149.46	156.85	131.53	130.33	128.11	123.83	122.57	114.21	113.13	121.86	148.50	137.64	124.13	126.89
Murder																	
# of transactions	53	25	20	17	51	82	101	135	169	91	62	67	44	30	24	14	985
Mean rent (in 1,000 JPY)	112.32	116.87	134.33	131.32	73.28	73.53	86.13	81.17	111.36	106.37	146.64	151.97	139.33	141.57	165.35	204.76	109.85
Other																	
# of transactions	246	236	290	283	324	360	461	490	557	293	210	156	86	37	22	5	4,056
Mean rent (in 1,000 JPY)	92.51	78.87	96.63	82.42	80.59	82.21	87.33	81.87	77.62	77.56	81.29	73.05	83.18	104.74	146.93	210.20	83.47
All																	
# of transactions	323	292	359	378	449	580	732	835	895	497	350	277	173	87	68	32	6,327
Mean rent (in 1,000 JPY)	94.60	84.39	99.79	98.45	92.33	92.72	97.15	93.43	92.80	93.14	100.21	99.95	107.07	127.50	150.43	172.85	96.43

Notes: The table shows the number of estimated properties and their average price/rent by each death type and each elapsed year since the death incidents in the cases of sales and rental properties. Since some death incidents fall under multiple death categories, being recorded as murder and suicide, the sums of the estimated properties do not equal the sums of the properties categorized under each death type. The death type "other" is defined as a death incident other than murder or suicide.

Table A3: Full results of the baseline model

	(1)	(2)
Sample:	Transactions for sale	Transactions for rent
Dependent variable:	$\ln price$	$\ln rent$
6 years before in-home death	-0.0159	-0.0122
	(0.0409)	(0.0178)
5 years before in-home death	-0.0173	-0.0015
	(0.0358)	(0.0153)
4 years before in-home death	-0.0146	0.0094
	(0.0308)	(0.0109)
3 years before in-home death	-0.0076	0.0047
	(0.0200)	(0.0076)
2 years before in-home death	-0.0062	-0.0050
	(0.0154)	(0.0081)
0 year after in-home death	-0.0489***	-0.0091
	(0.0134)	(0.0063)
1 years after in-home death	-0.0258	0.0013
	(0.0158)	(0.0072)
2 years after in-home death	-0.0542***	0.0144
	(0.0191)	(0.0100)
3 years after in-home death	-0.0483**	-0.0076
	(0.0232)	(0.0113)
4 years after in-home death	-0.0475*	0.0190
	(0.0263)	(0.0146)
5 years after in-home death	-0.0543	0.0266
	(0.0364)	(0.0190)
Floor area (in m^2)	0.0143***	0.0005
	(0.0006)	(0.0005)
Property age (in year)	-0.0203	-0.0037***
	(0.0153)	(0.0012)
# of rooms (=1)	0.1204**	-0.9018***
	(0.0561)	(0.0408)
# of rooms (=2)	0.1862***	-0.6877***
	(0.0543)	(0.0414)
# of rooms (=3)	0.1814***	-0.5200***
	(0.0531)	(0.0438)
# of rooms (=4)	0.1343**	-0.4075***
	(0.0536)	(0.0443)
Floor plan type (1R)	-0.3427***	-0.4797***
	(0.0368)	(0.0449)
Floor plan type (1K)	-0.3335***	-0.4319***
	(0.0347)	(0.0436)
Floor plan type (DK)	-0.1535***	-0.3138***
	(0.0212)	(0.0417)
Floor plan type (LK)	-0.3049***	-0.1993*
	(0.0316)	(0.1095)
Floor plan type (LDK)	-0.0037	-0.1317***
	(0.0079)	(0.0338)
Floor plan type (SDK)	0.2271*	-0.2330***
	(0.1296)	(0.0854)
Floor plan type (SLK)	-0.0893	
	(0.0615)	
Floor plan type (SK)		-0.1495**
		(0.0726)
Located floor control	Y	Y
Building FE	Y	Y
Year FE	Y	Y
Month FE	Y	Y
# of observations	3,471	6,224
# of buildings	303	552
Adj R-sq	0.97	0.96

The table shows the coefficients and standard errors of the estimation results illustrated in Figure 4. L, D, K, S, and 1R stand for Living room, Dining room, Kitchen, Storeroom, and Studio, respectively. The omitted category regarding the number of rooms is that with more than 4 rooms. The omitted category regarding the floor plan type is other than L, D, K, S, and 1R. Standard errors clustered at the building level are in parentheses.
*** p<0.01, ** p<0.05, * p<0.1