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Spillovers in Prices: The Curious Case of Haunted Houses

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Abstract

Exploiting the unique institutional setting of Hong Kong's real estate market, we uncover a curious ripple effect of haunted houses on the prices of nearby houses. Prices drop on average 19% for units that become haunted, 9% for units on the same floor, 6% for units in the same block, and 1% for units in the same estate. Our study makes two contributions. First, we provide an estimate of a large negative spillover on prices caused by a quality shock. Second, we find that the demand shock rather than the fire sale supply shock explains most of the spillover.

JEL Classification: D62, H23, R21, R31
Key Words: fire sales, negative spillovers, haunted houses

I. Introduction

Spillovers in prices occur in many financial markets. They are caused by an idiosyncratic shock that affects the price of just one asset, which in turn affects the price of other assets. Empirically, it is challenging to identify shocks that are idiosyncratic, rather than systematic. Even when shocks are idiosyncratic, it remains a challenge to quantify how much of the spillover in prices is caused by the idiosyncratic demand shock or the idiosyncratic supply shock.[1]

The purpose of this paper is to employ a unique institutional setting that allows us to identify a well-defined quality shock, and to isolate the effect of the demand and supply shocks in the spillover on prices. Specifically, we identify a negative psychological shock to the perceived quality of a house – a house being declared as "haunted" due to a murder, suicide or other unnatural death. This exogenous shock to perceived quality may cause a negative demand shock, a positive supply shock, or both. There will be a negative demand shock if the lower perceived quality makes prospective buyers reluctant to buy nearby houses – a negative externality – and there will be a positive supply shock if haunted house owners decide to sell their houses fast, resulting in price pressure – again, a negative externality. Both effects may cause the price of nearby houses to drop. Using the setting of haunted houses, we analyze the spillover effect on prices of neighboring houses, and examine whether it is driven by the fire sale of the haunted house (a supply shock) or lower perceived quality (a demand

[1] Prior empirical literature on spillovers in prices has been preoccupied with identifying the effect of fire sales on prices (see survey by Shleifer and Vishny, 2011) using transaction price based data sets on airplanes (Pulvino, 1998), corporate bankruptcies (Eckbo and Thorburn, 2008; Bernstein et al, 2017), foreclosures (Campbell, Giglio, and Pathak, 2011: Anenberg and Kung, 2014), and mutual funds (Coval and Stafford, 2007). Collectively, these studies have established that fire sales lead to substantial reductions in prices, and result in negative spillover effects on prices of similar assets. Spillovers in prices, however, might occur not just due to the supply shock (price pressure) from a fire sale, but also from a demand shock.

shock), or both. We can separate these two channels because the prices of nearby houses are observed, irrespective of whether the affected unit is sold or not.

We analyze Hong Kong's residential real estate market because it offers four institutional features that help our identification strategy. First, since a population of 7.3 million (2015) lives in a small area that is less than 25% of its 1,106 square kilometers (most of the other area is reserved for country parks and nature reserves), residential real estate mainly consists of units in high rise blocks sharing common facilities on a small plot of land, called an estate. Although estates are heterogeneous, blocks within an estate and the units within a block are fairly homogeneous.[2] This helps in our identification because it makes spillovers in prices easier to identify, and allows us to control for unobserved heterogeneity in the cross-section of units as well as in the time-series.

Second, residents are very wary of haunted houses, and sellers have to disclose whether a house is haunted.[3] In Hong Kong, the psychological component of the value of a house, given the beliefs of locals, is related to the principles of *Feng Shui*. An unnatural death, it is believed, causes excess negative energy, and impairs the value of a house. As a result, real estate companies maintain

[2] In our sample, each estate has an average of 12 blocks, each block has an average of 26 floors, and each floor has an average of 5 units. Thus, the average estate in our sample consists of 1,560 apartments in a small area.

[3] In Jopard Holdings Limited v. Ladefaith Limited and Centaline Property Agency Limited (HCA3775/2001), the Property Agent lost the case because "the Agent did not exercise reasonable care and skill in the collection and passing on of information concerning the Property." The information that was not revealed was the tragic death of a 4-year-old boy who had fallen from the balcony of the unit a year before the sale.
(http://legalref.judiciary.gov.hk/lrs/common/search/search_result_detail_frame.jsp?DIS=43673&QS=%2B&TP=JU)

databases of haunted houses compiled from local press reports covering these tragic events.[4] The focus on haunted houses helps our identification, because unnatural death is a negative shock to the perceived quality of the unit. Third, as the Hong Kong real estate market is very liquid and the flow of haunted houses is large in number (in our sample of large estates, from 2000 to 2015, 1,032 units were identified as haunted), we have a sample size with sufficient statistical power to detect spillovers in a small geographic area with homogeneous quality of units within an estate.[5] Fourth, and finally, the institutional setting makes it unlikely that local economic shocks at the district level (Hong Kong has 18 districts) differentially affect haunted and non-haunted units, floors or blocks within an estate, because of the close proximity.[6] This bolsters our identification strategy and makes it reasonable to attribute the effect of haunted houses on the prices of nearby units to the spillover effect.

To examine the effect of haunted houses on prices, we follow a standard approach in real estate economics and regress the logarithm of the transaction price per square foot on time-varying unit characteristics, unit fixed-effects, and year-month fixed effects. We find that the haunted unit drops in price by 19.9% after it becomes haunted; the units in the affected floor drop in price by 9.7%; the units in floors 1 to 3 floors above or below the affected floor drop in price by 8.9%; the units in

[4] See, for example, http://www.squarefoot.com.hk/haunted/

[5] Andersen and Nielsen (2017), who use sudden deaths as the exogenous event to document price drops in houses that have fire sales, cannot analyze spillovers because of a small sample size.

[6] Haunted houses provides an ideal solution to the identification problem. To quote Campbell, Giglio and Pathak (2011): "Ideally, we would like an instrument that influences foreclosures but that does not influence house prices except through foreclosures: however, we have not been able to find such an instrument."

the affected block drop in price by 7.1%; the units in the affected estate drop in price by 1.4%. Local economic shocks in Hong Kong cannot explain this highly granular ripple effect within an estate.

Amongst the tragic events that we consider, murder has the most dramatic ripple effect. Interestingly, price recovery is slow. We find that prices of the haunted units do not seem to recover during our 16-year sample period. The prices of its affected neighbors on the same floor do recover, albeit very slowly. The affected block and the affected estate even have further discounts later.

A legitimate issue is how we define a haunted house. In Hong Kong, a haunted house is where an unnatural death occurred. According to this definition, a unit will not be considered haunted if the unnatural death occurred outside the unit. We check this hypothesis using a placebo test. We construct a placebo sample of unnatural deaths that occurred outside the home of the deceased (deaths in traffic accidents, accidental deaths during medical procedures and accidental deaths due to drowning). We find no discounts in units in this placebo sample, and neither do we find any negative spillovers on the prices of nearby houses. A second issue is that haunted houses due to deaths before 2000 are unobserved, but might affect prices in the 2000-2015 period. We address this issue by re-running our tests for estates constructed after 2000. Our results do not change. A third issue is that house price growth might be different in locations with haunted houses. We address this concern by showing that there is no pre-trend in house prices before units become haunted and by re-running our tests using high-dimensional location-time fixed effects. The inclusion of high-dimensional fixed effects also addresses potential concerns about pre-trends in house prices due to geographic location, because the spillover effects are estimated using variation in house prices within a location at a given time. Again, our results do not change.

Our main result is that most of the spillover effect in prices is driven by the demand shock caused by the perceived drop in quality. We document this by comparing the spillover effect when the affected unit is sold (supply shock and demand shock) to spillover effects when the affected unit is not sold (only demand shock). Both these spillover effects are the same for affected floors, for affected blocks, and for affected estates, implying that the demand shock is mostly responsible for the spillover. We corroborate this finding by examining transactions before and after the unnatural death. We notice that turnover increases for units after they become haunted implying that there is a supply shock at the unit level. However, turnover does not change for affected floors, for affected blocks, and for affected estates, implying that there is no supply shock at these levels, and so the spillover in prices seems to be caused by the demand shock. To this end, our study is the first to identify a negative quality shock that causes a spillover effect on prices primarily driven by a demand shock.

Our study contributes to a growing literature on spillovers in prices. Prior literature has documented that macroeconomic shocks cause spillover in prices of stock and bonds due to rebalancing by institutional investors (Jotikasthira, Lundblad and Ramadorai, 2012; Manconi, Massa and Yasuda, 2012) or due to similarity in investment style (Boyson, Stahel and Stulz, 2010). Bankruptcy announcements might cause return contagions, leading to distress events for strategic partners (Boone and Ivanov, 2012) and creditors with large exposures (Jorion and Zhang, 2009), or to increased interest rates for industry rivals (Hertzel and Officer, 2012). Financial contagion might also be propagated through liquidity and risk-premium channels as suggested by Longstaff (2010). In relation to these papers, our study identifies a shock that causes a spillover effect on prices, which is primarily driven by a demand shock caused by a perceived drop in quality, rather than a supply shock caused by forced

sales. The perceived drop in the quality of units in the immediate vicinity of the haunted unit is because of the principles of Feng Shui.[7]

We also contribute to the literature in real estate economics studying (dis)amenity spillovers due to foreclosure (Lin, Rosenblatt and Yao, 2009; Campbell, Giglio, and Pathak, 2011; Anenberg and Kung, 2014), large house sizes (Leguizamon, 2010), home ownership (Coulson and Li, 2013), and urban revitalization (Rossi-Hansberg, Sartre and Owens, 2010). The study that is closest to ours is Anenberg and Kung (2014), who decompose spillover effects of foreclosures into a supply and demand effect. Their identifying assumption is that the demand effect occurs at the time of the eviction, while the supply effect occurs at the time of the foreclosure. In comparison, our identification comes from the timing of unnatural deaths. Our decomposition into supply and demand effects is based on the simple idea that there cannot be a supply effect if the haunted house is not sold.

Section II presents our data, and explains the institutional setting surrounding residential real estate and haunted houses in Hong Kong. Section III presents the spillover results. Section IV presents a simple model that tells us how to disentangle the demand channel from the supply channel in our case. We then use this idea to do the disentangling. Section V discusses some concerns like the external validity of our research. Section VI concludes.

[7] Joyce Lam, Director of Savills Realty Limited, a large real estate broker in Hong Kong, explains: "According to traditional Chinese thought, someone who dies an unnatural death becomes a hungry ghost: angry, restless and liable to do you harm. If they met their untimely demise at home, the market price of that apartment can drop by an average of 15 percent. The effect can spread throughout the building – adjacent units and even the whole floor are affected, too." (https://www.savills.com.hk/blog/article/147919/hong-kong-articles/the-myths-about-buying-a-haunted-house-in-hong-kong.aspx?locale=).

II. Data

II.A. Estates in Hong Kong

The residential real estate market in Hong Kong consists of a private and a public sector. This study focuses on the private sector, whose market share is around 50%. We exclude the public sector, because their property values are distorted by large government subsidies and sales restrictions.

The institutional setting of Hong Kong's private market for residential real estate is helpful for our identification strategy. Due to Hong Kong's rugged topography with steep hills, buildable land is scarce. The scarcity of buildable land combined with population growth has led to pervasive construction of high-rise blocks, resulting in one of the highest population densities in the world. In the most densely populated district, Kwun Tong, around 57,000 people live per square kilometer of land. Economies of scale, combined with Hong Kong Government's monopoly on land, have led to large scale real estate developments that are referred to as estates. The typical estate consists of several identical high-rise blocks sharing amenities such as carparks, fitness center, shuttle buses, swimming pool, and security. Each block typically consists of 20 to 80 floors sharing a lobby area, while each floor is subdivided into four to eight units with shared access by elevators and staircases. This helps in our identification because it alleviates the concern that district-level economic conditions differentially affect haunted and non-haunted units or floors or blocks within an estate, because units within a block are homogeneous, and blocks are very close to each other and share the same amenities. These institutional features also make it easier to convincingly identify spillovers in prices.

To understand the nature of an estate, it is helpful to zoom into one: Dawning Views. We start with a drone view of Hong Kong. Hong Kong consists of three territories: Hong Kong Island, Kowloon and New Territories. These territories are further divided into districts. Hong Kong Island has four districts, Kowloon has five districts, and New Territories has nine districts. Internet Appendix A1 shows a map of the 18 districts. Internet Appendix A2 zooms in on one estate, Dawning Views, in the North District of the New Territories. Internet Appendix A3 shows a picture of the blocks of Dawning Views. Internet Appendix A4 gives the estate layout of Dawning Views, while Internet Appendix A5 shows the floor plan of floors 8 to 17 in Block 12 of Dawning Views, which have 8 units per floor. Collectively, Internet Appendices A2 to A5 visualize the advantage of using Hong Kong's residential real estate market to identify spillovers in prices and uncover whether spillovers are driven by demand shocks, supply shocks, or both.

Our data cover all private residential real estate transactions in Hong Kong between 2000 and 2015. There were 1,056,918 of them. The data are maintained by EPRC Ltd., a commercial real estate agency in Hong Kong, and the data are available for sale to the public. The data include the estate name and location, the address of the block, floor, and unit, some property characteristics, transaction date, and transaction price.

The average unit in Hong Kong costs 4.23 million HKD (541,000 USD), and has an interior size of 606.3 square foot (56.3 square meter), making Hong Kong one of the most expensive cities in the world with an average transaction price of 6,209 HKD (791 USD) per square foot, equivalent to 66,833 HKD (8,514 USD) per square meter. Most transactions occur in the New Territories, followed by Kowloon and Hong Kong Island. There is a lot of heterogeneity in these real estate transactions.

The median growth in unit prices is 8.8% per year in the period 2000 to 2015, the 25th percentile being 5.4% and the 75th percentile being 12.6%.[8]

Although there are 7,352 estates in Hong Kong, we focus on the largest estates, because such estates provide us with a better ability to control for location-time effects due to a large number of transactions. A large estate is defined as an estate with 1,000 or more transactions over our sample period, equivalent to around 5 transactions per month. Following this definition, 211 estates are classified as large (2.9% of all estates). Although this is a small fraction of all estates in our sample, more than half of the transactions (57.5%) in our data are located in a large estate. Figure 1 shows that the market share of large estates has been almost constant over the sample period both in terms of number of transactions and value of transactions. In comparison, large estates make up 57.3 percent of the private residential real estate units as illustrated by the red horizontal line in Figure 1, implying that the market for units in large estates has the same turnover as the market for units in small estates. Figure 2 shows that the prices per square foot in large and small estates have followed a parallel trend, with the exception of 2011 and 2012 where prices of small estates appreciated more than for large estates. We note that this difference is driven by location as properties on Hong Kong Island appreciated faster than units in Kowloon and New Territories during these years. We conclude that our sample of transactions in large estates is fairly representative for the residential real estate market in Hong Kong.

[8] We analyze units with at least two transactions in our sample period. The growth rate in unit price per year is calculated from the price of the first transaction to the price of the last transaction.

Table 1 reports detailed descriptive statistics showing the difference between large and small estates. Panel A of Table 1 shows that units in large estates are slightly smaller (592 vs. 628 square feet), younger (10.5 vs. 19.7 years), sell at lower prices (3.84 vs. 4.80 million HKD) and are cheaper (6,033 vs 6,467 HKD per square foot) compared to small estates. These differences are statistically significant. Part of the difference in price can be attributed to location as large (small) estates are in New Territories (Hong Kong Island)—see Panel B of Table 1—and property prices in the New Territories compared to property prices in Hong Kong Island, due to the longer distance to the central business district around Victoria Harbor, are lower. The number of transactions across years, as seen in Panel C of Table 1, has an inverse U pattern in the period 2000 to 2015 for both large and small estates. Panel D of Table 1 shows no seasonal pattern for both large and small estates.

While we focus on the largest estates, there is substantial heterogeneity even in this subset. The largest estate in our sample of large estates, *Mei Foo Sun Chuen*, consists of 99 high-rise unit blocks with around 13,500 units. During our sample period, 13,867 units in Mei Foo Sun Chuen are sold for a total transaction value of 45.2 billion HKD (5.76 billion USD). The smallest estate in our sample of large estates, LaGrove, consists of only 542 units. During our sample period, 1,000 units in LaGrove are sold for a total transaction value of 2.7 billion HKD (340 million USD).

II.B. Haunted Houses

A haunted house is a house where an unnatural death occurred. Unnatural deaths include accidents, murder, and suicide. To identify haunted houses we rely on data from the Coroner's Court in Hong Kong, which details all unnatural deaths in Hong Kong during the period 2000 to 2015. As

the focus of our current research is the largest 211 estates, we extract haunted houses only in these estates from the territory-wide databases of unnatural deaths from the Coroner's Court using a name-matching algorithm. Further, we manually confirm that the haunted houses picked up by the name-matching algorithm do indeed belong to the 211 estates. We obtain 1,032 records of haunted houses in the 211 largest estates from 2000 to 2015.

We also collect data from property information websites and real estate agents in Hong Kong that spend effort compiling databases on haunted houses. Property websites maintain their databases by tracking local news and make their data publicly accessible online to attract browsing flow. We draw from four of the websites with the longest and most detailed lists.[9] Internet Appendix B1 gives a screenshot of one of these websites—Squarefoot—where the first page shows the tab called "Haunted House" and the second page gives the list of haunted houses. Internet Appendix B2 gives a screenshot of another of these websites—Spacious—where the first page shows the tab called "Haunted houses," the second page shows a spooky ghost, and the third page shows the exact location of a haunted house. We merge this data set with our data from the Coroner's Court and find that 898 out of 1,032 (87%) haunted houses have data that are publicly available.

An important point to make here is that although the real estate websites give us the names and addresses of the haunted estates and the haunted blocks, there is little information on haunted units. The purpose of the websites is to allow prospective buyers to assess whether a specific block in an

[9] The first is property.hk, the second is Squarefoot, the third is hk-compass.com and the fourth is Spacious. The respective URLs of the four haunted house lists are:
http://www.property.hk/unlucky.php, http://www.squarefoot.com.hk/haunted, http://www.hk-compass.com/badfile.php, and https://www.spacious.hk/en/hong-kong/resources/tragic-events

estate contains a haunted unit or not. To identify haunted units, prospective buyers have to ask their real estate broker, who keeps a register of these haunted units. The 'Code of Conduct' issued by the Estate Agency Authority (EAA) – a statutory body formed to regulate real estate agencies in Hong Kong – requires agencies to give an answer to an unambiguous question, including questions about addresses of haunted houses.[10] We contacted one such broker, Ricacorp, on August 16, 2017, to obtain their register of haunted houses. Ricacorp kindly declined our request, because we were not prospective buyers asking about a specific location. We therefore obtained data from the Coroners Court to ensure that we systematically identify haunted units.

Panel A of Table 2 classifies these 1,032 haunted houses according to the type of unnatural death that caused the house to become haunted. Suicides are the major reason that a house becomes haunted (88% of our sample). Accidents (7% of the sample) are the second most common cause. Murder, on the other hand, accounts for only 2% of our sample. The residual 7% are classified as miscellaneous. This classification is important because, as we will see later, though the negative spillover effect is greatest for murder, it exists for all other classifications as well.

Panel B of Table 2 documents that in our sample most haunted houses are in New Territories. Panel C of Table 2 shows that the flow of haunted houses into our panel data set from 2000 to 2015

[10] We quote a relevant paragraph from the website of the Estate Agency Authority: "Whether an estate agent has a duty to disclose to the buyer that the property he intends to buy was previously involved in a murder or is a "haunted flat" depends on the circumstances of the case. Generally speaking, if you have not made direct enquiries with your agent or if the agent does not know or could not have known that such things ever happened in the property, the agent has not breached the Code of Ethics. Therefore, the EAA would like to remind you that if you are concerned about whether the flat you intend to buy is "haunted", you should ask the agent or the vendor through the agent…You should ask, for example, whether a suicide or homicide took place in the flat before, and not use vague terms, such as whether the flat is "haunted" or "cursed"" (https://www.eaa.org.hk/en-us/Consumer-Corner/Frequently-Asked-Questions).

has no particular trend over the years. Finally, Panel D of Table 2 shows the number of transactions that occur after a house becomes haunted. We report the number of transactions involving: i) haunted units (the unit where the death occurred), ii) haunted floors (units on the same floor as the haunted unit, excluding the haunted unit), iii) haunted blocks (units in the same block as the haunted unit, excluding the haunted unit and haunted floor), and iv) haunted estates (units in the same estate as the haunted unit, excluding the haunted unit, haunted floor, and haunted block). Panel D shows that a significant number of transactions (around one third) are of haunted units or occur in haunted floors, haunted blocks or haunted estates.

III. Spillover in Prices

Table 3 reports the average transaction price per square foot before and after a unit becomes haunted. Panel A shows the average transaction price in HKD per square foot for transactions occurring one year before to one year after, whereas Panels B and C report the same for the period of two and three years before and after, respectively. To control for time-trends in prices we also report the average transaction price per square foot in the same district in the same period, and provide a difference-in-differences estimate of the effect of haunted houses on the price per square foot.[11]

[11] Internet Appendix Figure C1 reports the distribution of the price per square foot 3 years before and 3 years after a unit becomes haunted. We note that the distributions are similar before the unnatural death, but different after the unnatural death. In particular, after the unnatural death, the distribution of prices for haunted units are to the left of the distribution of prices in the control group, and that this difference is larger for haunted units, followed by haunted floors, haunted blocks and haunted estates. Collectively, Appendix Figure C1 shows that our results are not driven by outliers. Internet Appendix Table C2 compares house characteristics of units, floors, blocks and estates that sell before the unnatural death to the average unit in the same district. We report the following house characteristics that we have data on: price, size, price per square foot, age, new unit indicator and carpark indicator. The only significant differences between units that will become haunted and units that will not become haunted are that the former are smaller in size and transaction price – though price per square foot is about the same – and have fewer car parks.

We notice from Panel A that the affected unit decreases in price by 2% from one year before to one year after the unit becomes haunted. This is much lower than for units in the district as a whole, where prices rise by 9% from one year before to one year after.[12] The difference-in-difference is -11%. The ripple effect can be seen if we look at floors. The affected floor—here we remove the affected unit from the floor—decreases in price by 1% from one year before to one year after the floor becomes haunted. This is lower than for the floors in the district as a whole, where prices rise by 1% from one year before to one year after. The difference-in-difference is -1% (rounding off error). The affected block – here we remove the affected floor from the block – increases in price by 1% from one year before to one year after the floor becomes haunted. This is slightly lower than for the blocks in the district as a whole, where prices rise by 3% from one year before to one year after. The difference-in-difference is -2%.

The ripple effect continues to be seen in Panel B (two years before to two years afterwards). The difference-in-difference is -15% for the unit, -5% for the floor and -2% for the block. The ripple effect continues to be seen in Panel C (three years before to three years afterwards). The difference-in-difference is -18% for the unit, -6% for the floor and -4% for the block. In addition, by comparing Panels A, B and C, we observe that the price drops are not temporary for the affected units, floors, or blocks. They do not recover even after three years.

[12] As shown in Figure 2, houses prices go up by a factor of three from 2000 to 2015. The 9% increase in non-haunted units in a given district reflects this overall time trend in house prices in Hong Kong during the sample period. Note that trends in house prices are absorbed by time fixed effects in the main specification, and by local-time fixed effects in Table 10. Thus, spillovers in prices are not an artifact of time trends in house prices.

While Table 3 provides descriptive statistics that suggests that haunted houses have negative spillover effects on nearby houses, we caution against making strong conclusions based on the preliminary evidence. Table 3 just provides a simple comparison of the price per square foot of units that are becoming haunted with the price per square foot of unaffected units in the same district without controlling for determinants of house prices. To formally estimate the relationship between the price of houses and their characteristics we use a hedonic regression that is typically used in the academic real estate literature. We use all transactions during our sample period and include unit fixed-effects to ensure that we track the house price development of the same unit around the unnatural death. This is different from Table 3, which compares the average prices of any unit that is sold in a short-time window either before or after the unnatural death.

The hedonic regression for estimating the haunted house price is specified in Equation (1), where the dependent variable is the log. of the transaction price per square foot, y_{it}, of unit i in year-month t.

$$y_{it} = \alpha_i + \beta_t + \gamma' X_{it} + \theta' H_{it>k} + \epsilon_{it}, \quad (1)$$

Here α_i captures unit fixed effects, β_t is a vector of year-month fixed effects, X_{it} is a vector of unit characteristics that change over time, and $H_{it>k}$ is a vector of indicators denoting an unnatural death occurring in year k, where $t>k$. The purpose of k is to differentiate the year of an unnatural death from that of the time of the transaction. Any unnatural death before the transaction of unit i in year-month t will make $H_{it>k}$ equal one. Unit characteristics that change over time in our sample are interior size (due to alterations) and block age. We are also interested in two other unit

characteristics: whether the transaction is of a new unit (primary transaction) and whether the transaction includes allocated space in the carpark.

The inclusion of unit fixed effects imply that we estimate the effect of haunted houses using a repeat sales approach, which is common in real estate economics. Our sample consists of 615,998 units and 1,056,918 transactions; this implies that the average unit is sold 1.7 times. Around 45% of the units are sold more than once (see distribution in Appendix Figure C3); 717,565 out of 1,056,918 transactions (68%) are repeat sales. Figure 3 plots distributions of the number of times a unit is sold during the sample period from 2000 to 2015 for haunted units, haunted floors, haunted blocks, and haunted estates, and compare them to the distributions for units in the same district. We note that haunted houses are more likely than non-haunted houses to have repeat sales, but that the distributions are similar conditional on having a repeat sale. While we address concerns about general selection into repeat sales in Column 5 of Table 4, we acknowledge that our empirical specifications cannot address concerns about differential selection into repeat sales for haunted and non-haunted houses.

In our main specification, we cluster standard errors at the estate level. Internet Appendix C5 shows that we obtain consistent results when we alternatively cluster at the unit or block level, or at the block-year-month or estate-year-month level.

The vector of indicators, $H_{it>k}$, are: "Haunted unit" is an indicator for haunted units (units in which an unnatural death occurred). "Haunted floor" is an indicator for units on the same floor as the haunted unit, but is set to zero for the haunted unit. "Haunted block" is an indicator for units on the same block as the haunted unit. It is set to the count of the number of haunted units in the block, but

is set to zero for haunted units and all units on a haunted floor. "Haunted estate" is an indicator for units in the same estate as the haunted unit. It is set to the count of the number of haunted units in the estate, but is set to zero for haunted units, units on the haunted floor, and units on the haunted block. "Same block, proximity to haunted floor (1-3)" is an indicator for units that are 1 to 3 floors above or below a haunted floor in a haunted block. "Same block, proximity to haunted floor (4-6)" is an indicator for units that are 4 to 6 floors above or below a haunted floor in a haunted block. "Same estate, neighbour to haunted block" is an indicator for units that are in a block that is the neighbour to a haunted block.

Notice that the indicator variable is 1 or 0 for units or floors, but the indicator variable is the count or 0 for blocks or estates. The reason for this is that in our sample, though there are no more than one haunted unit per floor, there are sometimes more than one haunted unit per block, and sometimes more than one haunted unit per estate. Since the effects of haunted units occurring over time in a block or estate may cumulate, we use the count to ameliorate this.

The coefficients of interest in equation (1) are the different θ coefficients. A negative θ reveals the discount for being haunted, and if negative, the magnitude of θ reveals the percentage discount. As our empirical strategy relies on repeat sales through the inclusion of unit fixed-effects, it follows that we identify the effect of haunted houses on prices, θ, in a setting that compares the house price development of units that become haunted to the house price development of houses that are sold at the same time, but that did not become haunted.

Table 4, which is the main table of this paper, shows the results of the above estimation. Column (1) reveals that the haunted unit drops in price by 19.9% after it becomes haunted; the units in the affected floor—here the affected unit is excluded from the affected floor—drop in price by 9.7%; the units in the affected block—here the affected floor is excluded from the affected block—drop in price by 7.1%; and units in the affected estate—here the affected block is excluded from the affected estate—drop in price by 1.4%. Notice that all price drops, though statistically significant, diminish in magnitude as we move geographically outwards from the affected unit. This confirms the ripple effect documented in Table 3.

To ensure that the estimated spillover effects do not pick up trends in house prices, we change the specification in Column (1) of Table 4 to an event study by including pre-trend indicators for haunted units, floors, blocks and estates that are sold in each of the 3 years before the unnatural death occurs as well as indicators for haunted units, floors, blocks and estates that sold 1, 2, 3 and >3+ years after the unnatural death. Figure 4 plots the coefficients from the event study in four panels: one for units, floors, blocks, and estates, respectively. Each of the four panels compares the estimated pre-trend in prices to the estimated spillover effects after the unnatural death. The panels show no pre-trend in house prices, and large spillovers in prices after unnatural deaths. To address the concern that the event study in Figure 4 lacks statistical power, we supplement the analysis with an event study that aggregates the pre-trends into indicators for transactions 3 years before the unnatural death, and include them in our main specification with indicators for transaction after the unnatural death. Appendix Figure C4 confirms the conclusion from Figure 4 with greater statistical power. We therefore conclude that the estimated spillover effects do not pick up pre-trends in house prices.

Column (2) shows an even more granular spiral effect. The haunted unit drops in price by 19.9% after it becomes haunted; the units in the affected floor drop in price by 9.7%; the units in floors 1 to 3 floors above or below the affected floor drop in price by 8.9% (6.8%+2.1%); the units in the affected block drop in price by 6.8%; and units in the affected estate drop in price by 1.4%.

Column (3) tries to show another geographical spiral effect. It shows that the units in the block that is the neighbour of the haunted block drop in price by 3.3% (1.3%+2%), but this number is not statistically significant.

Column (4) brings all these indicators together. We find that the haunted unit drops in price by 19.1% after it becomes haunted; the units in the affected floor drop in price by 8.9%; the units in floors 1 to 3 floors above or below the affected floor drop in price by 8.3% (6.2%+2.1%); the units in the affected block drop in price by 6.2%; the units in the affected estate drop in price by 1.3%.

As mentioned above, the estimated spillover effects of haunted houses are estimated using a repeat sales approach. This raises a concern about sample selection bias if the likelihood of repeat sales depends on the development of house prices. To address this concern, we include unit transaction sequence fixed-effects in Column (5) of Table 4. These fixed effects takes the number of the transaction sequence of each unit, implying that we estimate spillover effects while holding constant the general selection into repeat sales. We note that the estimated spillover effects in Column 5 are consistent with those in Column 1, implying that the estimated spillover effects are not an artefact

of general selection into repeat sales.[13] We note from Figure 3 that haunted houses are more likely than non-haunted houses to have repeat sales, but that the distributions are similar conditional on having a repeat sale. We acknowledge that our empirical specification in Column 5 of Table 4 can only address concerns about general selection into repeat sales, but not differential selection into repeat sales for haunted and non-haunted houses.

As our sample of unnatural deaths that cause houses to become haunted begins in 2000, it is possible that the estimated spillover effects are biased because unnatural deaths before 2000 are unobserved and these may have spillover effects of their own. Column (6) corrects for this potential source of bias by restricting the sample to only new estates that are constructed during the sample period. By definition, new units start the count at zero when they enter our sample, ensuring that our methodology correctly counts the number of haunted units within an estate for this sample. As can be seen in column (6), though our sample size is much smaller, our results do not qualitatively change.

To conclude, a unit becoming haunted has a significant price drop, both economically and statistically. More importantly, price drops are seen for all units that are close to the haunted unit. The closer is the unit, the larger is the price drop.

The fact that the negative externality dissipates away within an estate suggests that local conditions in Hong Kong like economic hardship and crime are unlikely to be responsible. Alternate explanations like economic hardship or crime would predict a common discount across units, floors

[13] Consistent with a positive selection into repeat sales, we note that the estimated unit transaction sequence fixed effects are positive and increasing with the transaction sequence number. For instance, the second (third) transaction of a unit sell at 6.5% (12.5%) higher prices compared to the first transaction of the same unit.

and blocks within an estate. Our main specification shows that haunted units are selling at larger discounts than haunted floors, which in turn are selling at larger discounts than haunted blocks, which in turn are selling at larger discounts than haunted estates. We also address this last concern in Table 10 where we add high-dimensional location time-fixed-effects.

The coefficients on age, new units and carpark have the expected signs. Older units are valued less, new units are valued more, as are units with carparks. The inclusion of unit-fixed effects takes care of all time-invariant unit characteristics. The year-month fixed effects controls for all market-wide demand and supply shocks over time.

Though Table 4 does show the ripple effect, it does not show whether the price drops are temporary or persistent. To do this we estimate Equation (2):

$$y_{it} = \alpha_i + \beta_t + \gamma' X_{it} + \theta' H_{it>k} + \lambda' * Time * H_{it>k} + \epsilon_{it}, \quad (2)$$

Equation (2) is the same as Equation (1) with one extra term added: the interaction between *Time* and $H_{it>k}$. Here *Time* is the difference between the transaction date and the date where the unit becomes haunted, i.e. time equals *t-k* measured in years.[14] For the interaction with haunted block and haunted estate, we use the timing of the last event whenever there are multiple haunted units in a block or estate. The coefficients of interest in Equation (2) are the different λ coefficients. A positive

[14] As Equation (2) is estimating whether spillover effects of haunted houses decay, *time* is always zero for units that are not haunted.

λ reveals that prices of discounted haunted houses recover over time, and if positive, the magnitude of λ reveals the speed of recovery.

Table 5 shows the results of the above estimation. Column (1), which includes the entire sample, reveals that the price of the haunted unit does not seem to recover at all. Notice that the coefficient on the interaction term is 0.0053 and statistically insignificant. The affected floor—here the affected unit is excluded from the affected floor—does seem to recover about 0.37% per year after an immediate price drop of 10.5%. The recovery is very slow. The affected block where the affected floor is excluded, and the affected estate where the affected block is excluded do not seem to recover either. In fact, the coefficients are negative, suggesting there are further discounts as time goes by. This means that the discounts are not temporary, a result suggested by the difference-in-difference estimates documented in Table 3. Column (2), which includes only new estates, has similar results. In an unreported regression, we have further examined whether the spillover effects are persistent across transactions. Thus, rather than interacting the haunted house indicators with time (as in Equation 2 above), we interact the haunted house indicator with the transaction number sequence (after becoming haunted). We find results of similar magnitude, suggesting that price recovery over time and transactions is indeed slow.

It would be interesting to know which cause of death is associated with the largest drop in price, and which cause of death has the highest spillover effect on prices. The answers are given in Table 6. The numbers in Table 6 come from the same estimation of Equation (1), except now the regressions are run for sub-samples related to the cause of death.

Table 6 shows that murder has the most adverse effect on the price of a unit: the house price drops by 34.4% (see Column 3 of Table 6). Murder also has the most negative adverse effect on neighbouring house prices. This is in line with the principles of *Feng Shui*. According to real estate agents, it is commonly believed murder is worse than suicide.[15] The units in the affected floor drop in price by 19.2%, the units in the affected block drop in price by 10.2%, and units in the affected estate drop in price by 4.7%. The magnitudes of the drops are statistically significant, which is remarkable considering that our sample only includes 21 murders.[16] Column (2) of Table 6 shows that the ripple effect exists even if we drop murder from our sample. Columns (4) and (5) of Table 6 shows that price drops for suicides and accidents and other types of unnatural deaths. These drops, though statistically significant, diminish in magnitude as we move geographically outwards from the affected unit. So the ripple effect occurs for all types of unnatural deaths.

IV. Disentangling Spillovers in Prices: Demand Shock vs Supply Shock (Price Pressure)

To further our understanding of the spillover effects, we now examine the underlying channels. Prior literature recognizes that foreclosures of houses have negative spillovers on prices of neighboring houses because of two effects. The first effect is the demand shock, which occurs if foreclosures negatively affect the perceived quality of neighboring houses. The second effect is the supply shock, also called price pressure or fire sales, which occurs because potential buyers of houses

[15] See media coverage in Reuters, June 28, 2018: "Spooked no more? Hong Kong's "haunted apartment" prices levitate with white-hot market" and New York Times, November 16, 2016: "House-hunting in Hong Kong with the app that sees dead people".

[16] Gautier et al. (2009) and Klimova and Lee (2014) also show the effect of murder on nearby house prices. Our paper focuses more on the decomposition of the supply shock effect and the demand shock effect.

in the neighborhood revise downwards their reservation prices when they observe discounted prices on foreclosed houses. Our research design allows us to disentangle these two effects, because the focal event is an idiosyncratic unnatural death, rather than the sale of the property.

It is useful to develop a simple model to illustrate the two underlying channels. As all the units in an estate are fairly homogeneous, we model the demand for houses, D, as a function of price, P:

$$D = H + k - cP, \quad (3)$$

where H is an indicator variable equal to –a for a haunted house and 0 otherwise, k is a constant and c is the price sensitivity of demand. Intuitively k captures among other things, the quality of the house, while H captures the perceived drop in quality due to the unnatural death.

We model the short-term supply for houses, S, as

$$S = F + j, \quad (4)$$

where F is an indicator variable equal to +b if there will be a fire sale and 0 otherwise, and j is a constant. Intuitively, F captures the additional supply effect due to a fire sale, while j implies that the short-term supply of houses is constant.

The above formulation takes into account the conventional assumption that demand is negatively affected by price, while short-term supply is unaffected by price because it takes time for units to be built. The new assumption is that haunted houses due to *Feng Shui* are perceived to be of low quality and so there is a drop in demand. Given these formulations of linear demand and supply curves, the equilibrium price of the house equals:

$$P^* = \frac{[(H+k)-(F+j)]}{c} \quad (5)$$

It follows that if a house becomes haunted, but the unit is not sold, the price of its neighbor's house drops by a/c. In Figure 5, this is the movement in price from X to Y. We call this the spillover because of the "demand shock". If a house becomes haunted and the affected unit is about to be sold at fire sale price Z, its neighbor's price drops by (a+b)/c. In Figure 5, this is the movement in price from X to Z. So the spillover because of the "supply shock (price pressure)" is the movement in price from Y to Z, and this equals b/c.

In our setting we can measure the spillover due to the "demand shock" – a/c - because we can observe the effect on price of neighboring houses before and after a house becomes haunted, but the haunted house is not sold. Similarly, we can measure the spillover due to the "demand shock" plus the "supply shock" – (a+b)/c – because we can observe the effect on price of neighboring houses before and after a house becomes haunted, and the haunted house is sold at a fire sale price. The spillover caused by the "supply shock (price pressure)" – b/c – is then the difference between the latter spillover and the former spillover.

We now empirically separate the effect of "supply shock" and the effect of "demand shock" on the negative spillover in house prices.

The first methodology we employ is based on the intuition that a necessary condition for a "supply shock" (price pressure) is that turnover dramatically increases after a unit becomes haunted. Figure 6 shows the fraction of haunted units sold per year before and after being haunted, the fraction of units on the same floor as the haunted unit (excluding the haunted unit) that are sold per year before

and after, the fraction of units on the same block as the haunted unit (excluding the haunted unit and units on the haunted floor) that are sold per year before and after, and the fraction of units on the same estate as the haunted unit (excluding the haunted unit and units on the haunted floor and in the haunted block) that are sold per year before and after. The benchmark is the fraction of units in the same district that are sold per year before and after. The conclusion we draw from Figure 6 is that there is a supply shock for haunted units, but there is no supply shock for haunted floors or haunted blocks or haunted estates.

Table 7 shows the above results more formally. As in Figure 6, we measure liquidity as the fraction of haunted units, haunted floors and haunted blocks that are sold before and after the event. As in Table 3, we restrict ourselves to the windows one year before to one year after, two years before to two years after, and three years before to three years after. Similar to Table 3, the benchmark is the difference in the same district.

Panel A in Table 7 shows that the fraction of haunted units sold increased from 6.0% to 13.3% from one year before to one year after. The fraction of the control sample just increased from 7.2% to 7.3%. The difference-in-differences is 7.2%. This implies that haunted units are sold disproportionately more, suggesting a "supply shock" caused by haunted units. What is interesting, however, is that the difference-in-differences for units in haunted floors is zero. There is no "supply shock" for haunted floors. The difference-in-differences for units in haunted blocks is negative, which implies that there is no "supply shock" for haunted blocks either. The results are similar when we look at Panel B (two years before to two years after) and in Panel C (three years before to three years after). We conclude that there is a supply shock for haunted units (though that attenuates over time), but

there is no supply shock for haunted floors or haunted blocks. Therefore, it seems that the spillover effect works only through prices and not through quantities. This is surprising because if being "haunted" carries a stigma, the demand for such houses should fall as well as their prices. So why are only prices affected but not quantity sold?

We do not have a conclusive answer to this question. Our view is that a house offers a tangible benefit and an intangible benefit, and being "haunted" impairs only the intangible benefit. A market for the tangible benefit exists in Hong Kong. So a stigmatized unit sells, but at a lower price. The results of a recent survey in Hong Kong informally corroborates this view: Half of respondents are willing to live in a haunted unit if the price is right.[17] Why does a market for the tangible benefit exist if the intangible has such a huge cost? It could be that since residential real estate is so expensive in Hong Kong, there are potential buyers (like half the respondents in the above survey) who are willing to suppress their distaste for haunted units if these units sell at a discount. Or maybe these potential buyers do not care that much about a house being haunted. We do not have data, unfortunately, to tease out the motivations of these buyers.

The second methodology we employ is a regression framework. We estimate Equation (6):

$$y_{it} = \alpha_i + \beta_t + \gamma' X_{it} + \theta H_{it>k} + \lambda * Haunted\ \ Unit\ \ Sold_{it>k} * H_{it>k} + \epsilon_{it}, \quad (6)$$

[17] See Squarefoot (2019) as well as their press release of survey results: https://www.squarefoot.com.hk/en/news/squarefoot.com.hks-2019-h1-hong-kong-real-estate-market-outlook-survey-more-than-of-respondents-will-consider-buying-a-haunted-house-6437.

Equation (6) is the same as Equation (1) with one crucial difference: the interaction between *Haunted Unit Sold* $_{it>k}$ and $H_{it>k}$. Here *Haunted Unit Sold* $_{it>k}$ takes a value of one if an affected unit is sold after the unnatural death.[18] Equation (4) is estimated for the whole sample, as well as for three subsamples: if the unit is sold in the last year, in the last 3 years, and in the last 5 years, relative to the transaction date of a given unit, respectively.

The coefficients of interest in (4) are θ and λ. A negative θ reveals the immediate percentage drop in prices of neighbouring houses that is due only to the "demand shock" caused by a change in perceived quality of the neighbourhood. A negative λ reveals the percentage drop in prices of neighbouring houses that is due only to the "supply shock" which is the price pressure caused by the fire sale of the affected unit.

Table 8 shows the results of the above estimation. Column (1) reveals that the affected floor – here the affected unit is excluded from the affected floor – sees an immediate price drop of 9.9% (θ) after the floor becomes haunted. The coefficient of the interaction term between the indicator for haunted house and the indicator for whether the affected unit is sold, λ, is negative, but statistically insignificant. This reveals that for the floor the discount is coming from mainly the demand shock caused by a perceived drop in quality of units on the affected floor. The affected block—here the affected floor is excluded from the affected block—sees an immediate price drop of 8.5% (θ), and a price gain of 1.4% (λ) if the affected unit is sold. This reveals that for the block the discount is coming also mainly from the demand shock caused by a perceived drop in quality of units on the affected

[18] As Equation (4) is estimating whether spillover effects of haunted houses depends on whether the haunted unit is sold, the indicator for *haunted unit sold* is always zero for units that are not haunted.

block. The affected estate—here the affected block is excluded from the affected estate—sees an immediate price drop of 2.2% (θ), and a price gain of 0.8% (λ) if the affected unit is sold. This reveals that for the estate the discount is coming also mainly from the demand shock caused by a perceived drop in quality of units on the affected estate.

Columns (2), (3) and (4) show the results of the above test, respectively, for three subsamples: if the unit is sold in the last year, in the last 3 years, and in the last 5 years, relative to the transaction date of a given unit, respectively. The results are similar. Interestingly, if there was a supply shock effect, we would see a negative λ everywhere, especially if the haunted unit is sold in the last year. We do not see any significant negative λs in column (2). We do not see any significant negative λs in columns (3) or (4) either.

The results in Table 8 suggest that the "demand shock" is the main explanation for negative spillovers. That corroborates our findings from Table 7 and Figures 6 and 7. In both Table 7 and Figure 6, we only saw a turnover increase for the affected unit, but no change in turnover for the affected floor, block or estate after a unit becomes haunted. In Figure 7, we see no change in turnover for the affected floor, block or estate after a haunted is sold. In other words, there seems to be no "supply shock" (price pressure) for the affected floor, block or estate. The small supply effect is also consistent with the finding of a 1% effect of sales pressure on prices in Aneberg and Kung (2014). Aneberg and Kung (2014) estimate this effect based on the assumption that the demand effect occurs at the time of the eviction, while the supply effect occurs at the time of the foreclosure. In comparison, the magnitude of our supply effect is easier to interpret because our setting takes into account that the

demand effect might have a long-term effect on prices because the haunted unit appears on the transaction history of the estate.

VI. Discussion and Alternative Specifications

There are a few issues to address.

First, how valid is our definition of a haunted house? We define a haunted house in our paper as a house where an unnatural death occurred. According to this definition, a unit will not be considered haunted if the unnatural death occurred outside the unit. We now test this proposition by doing a placebo test.

The treatment sample of 1,032 unnatural deaths is from our baseline specification in Column 1 of Table 4. The placebo sample (coded in similar fashion as the treatment sample) are 235 unnatural deaths that occur outside the residence of the deceased. We obtain information on these deaths from the Coroner's Court as they do not feature on the real estate websites tracking haunted houses. The placebo sample consist of 183 deaths in traffic accidents, 23 accidental deaths during medical procedures, and 29 accidental deaths due to drowning while swimming in the ocean.

We estimate Equation (1) using a joint specification for the treatment sample and for the placebo sample. Column (1) of Table 9 gives the coefficients of the treatment sample. The signs and magnitudes of the θ coefficients are similar to the signs and magnitudes of the θ coefficients in column (1) of Table 4. Thus, adding the indicators for the placebo effects to Equation (1) do not affect the estimated spillover effects. Column (2) of Table 9 gives the coefficients of the placebo sample. The θ

coefficients are either insignificant or positive and significant. We take the placebo test one step further by excluding murder cases from the treatment group. As a result, the sample size declines with about 44,000 transactions in estates affected by murder. This insures that we compare the effect on prices of deaths due to accidents and suicides that occur at home (treatment group) to deaths due to accidents and suicides that occur outside the residence of the deceased. We find slightly smaller treatment effects and no placebo effects in Columns 3 and 4, respectively. Collectively, Table 9 tells us that when the owner of a unit dies unnaturally outside the unit, there is no discount on the unit's price and no spillover effect on nearby houses. This is consistent with our conclusion that a house becomes haunted and is discounted only when there is an unnatural death in the house.

Second, can the effects of idiosyncratic shocks be persistent? Yes. Unnatural deaths in a home cause a house to be declared haunted, and unnatural deaths in a home are, by definition, home-specific and unpredictable. This leads to a sudden drop of perceived quality. We find that house price recovery is slow, which implies that our idiosyncratic shock to perceived quality has persistent effects. This is different from the typical fire sales shock where effects on prices tend to be transient.

Third, one might challenge whether it is rational for owners of neighboring units to sell at a discount. They could postpone sales until prices recover. We cannot address this concern directly because we do not have data on the amount of time that a unit has been on the market. So we address this concern with the following argument. As seen in Table 5, house price recovery is slow. Given this, it would seem that there is no point postponing sales until prices recover. So liquidity should not change much before and after the event for neighbors. Figures 6 and 7 show that it does not.

Fourth, how can discounts of 20% be sustained in equilibrium? The answer is straightforward. The belief in *Feng Shui* is quite strong among Chinese, and the population in Hong Kong is about 94% Chinese. Caucasians make up at most 5% of the population in any district, implying that most buyers have a large disutility for haunted houses. The few prospective buyers that do not themselves get disutility for haunted houses will, however, care about the resale value of their houses, and the resale value is expected to be low because many future buyers would dislike haunted houses.

Fifth, a potential concern with the specification in equation (1) is that haunted houses are located in different areas than houses that are unaffected. If the demand for houses and/or the supply of houses in these locations are different, time-varying location effects might drive the results. For instance, a suicide might reveal economic hardship in the neighbourhood, or a murder might reveal crime in the neighbourhood. If the house price growth is slower in these districts, this effect might confound the estimated spillover effects in prices.

We address the concern that our results are driven by slower price growth in affected districts by introducing high-dimensional fixed-effects to control for time-variant location effects. Table 10 reports the results, when we change the estimation (1) to

$$y_{it} = \alpha_i + \beta_{jt} + \gamma' X_{it} + \theta' H_{it>k} + \epsilon_{it}, \quad (7)$$

Here α_i captures unit fixed effects, β_{jt} captures location-time fixed effects, X_{it} is a vector of unit characteristics that change over time, and $H_{it>k}$ is a vector of indicators due to an unnatural death occurring before year *t*. Table 10 reports results. Column (1) shows the results from the baseline specification in Column (1) of Table 4. We note that although the coefficients in Columns (2) to (5)

are slightly smaller than in Column (1), the results are qualitatively similar when we include location-time fixed effects, both at the territory and district level. We conclude that our results are unaffected when we include high-dimensional fixed-effects that effectively controls for the development in house prices at different locations over time. These high-dimensional fixed effects also addresses potential concerns about pre-trends in house prices due to geographic location, because the spillover effects in Table 10 are estimated using variation in house prices within a location at a given time.

Sixth, and finally, how relevant are our research findings for other parts of the world? We address this question in four ways. First, we find anecdotal evidence of a 25 percent discount on haunted houses in Australia, United Kingdom, and United States in a sample of 101 newspaper articles from Australia, United Kingdom and United States. For example, New York Times (Nov 24, 2016) interviewed Randall Bell, an economist who has consulted on the appraisals of notorious properties, like the homes of O. J. Simpson and Jon Benet Ramsey. According to Bell, the stigma can result in 25 percent lower prices. In comparison, we find that affected units in Hong Kong decline by 19 percent following an unnatural death. Second, we note that the U.S. legal system, as in Hong Kong, makes it illegal for a seller to hide the fact that the property being sold has a reputation of being haunted.[19] Third, it is possible for prospective buyers in the U.S. to check whether anyone has died at a given address using web-based services like the website, www.diedinhouse.com. Fourth, Hong Kong is not an outlier in terms of suicide rates. The annual suicide rate in Hong Kong during our sample period is 14 per 100,000 people and is fairly stable over time. The corresponding numbers in Australia, China,

[19] In the case of Stambovsky v. Ackley, the Supreme Court of New York, Appellate Division, ruled in 1991 that a seller must disclose that a house has a reputation for being haunted when there is a fiduciary relationship or in cases of fraud or misrepresentation, because such a reputation impairs the value of the house.

Japan, United Kingdom and the United States are 13, 11, 23, 8 and 13, respectively. The annual homicide rate in Hong Kong during our sample period is a very low 0.6 per 100,000 people and is fairly stable over time. The corresponding numbers in Australia, China, Japan, United Kingdom and the United States are 1.3, 1.3, 0.4, 1.3 and 5.3, respectively. We therefore conclude that house price discounts due to unnatural deaths are relevant outside of Hong Kong. In Hong Kong, this may be due to *Feng Shui,* but in other parts of the world, the reason would be more universal: few like to buy a house where a recent unnatural death occurred.

VIII. Conclusion

Empirically it is difficult to convincingly conclude that price drops for houses are being caused by a negative shock in a neighboring house without completely ruling out that shocks to the local economy are affecting both. The first contribution of our study is that we exploit the unique institutional setting of Hong Kong's residential real estate to overcome this identification problem. We uncover a curious ripple effect of haunted houses on the prices of nearby houses. Prices drop on average 20% for units that become haunted, 10% for units on the same floor, 7% for units in the same block, and 1% for units in the same estate. There is no effect on the neighboring estate. The ripple effect is strongest for murders. Price recovery is slow.

The second, and more important contribution of our paper, is that since we observe that negative spillovers exist even if the haunted house is not sold, we can isolate the demand shock channel from the supply shock (price pressure) channel. We find that the demand shock caused by a perceived drop in quality explains most of the spillover.

REFERENCES

Andersen, S., Nielsen, K.M., 2017. Fire sales and house prices: Evidence from estate sales due to sudden death. Management Science 63, 201-212.

Anenberg, E., Kung, E., 2014. Estimates of the size and source of price declines due to nearby foreclosures. American Economic Review 104, 2527-2551.

Bernstein, S., Colonnelli, E., Giroud, X., Iverson, B., 2017. Bankruptcy spillovers. NBER working paper no. w23162.

Boone, A.L., Ivanov, V.I., 2012. Bankruptcy spillover effects on strategic alliance partners. Journal of Financial Economics 103, 551-569.

Boyson, N.M., Stahel, C.W., Stulz, R.M., 2010. Hedge fund contagion and liquidity shocks. Journal of Finance 65, 1789-1816.

Campbell, J.Y., Giglio, S., Pathak, P., 2011. Forced sales and house prices. American Economic Review 101, 2108-2131.

Coulson, N.E., Li, H.R., 2013. Measuring the external benefits of homeownership. Journal of Urban Economics 77, 57-67.

Coval, J., Stafford, E., 2007. Asset fire sales (and purchases) in equity markets. Journal of Financial Economics 86, 479-512.

Eckbo, B.E., Thorburn, K.S., 2008. Automatic bankruptcy auctions and fire-sales. Journal of Financial Economics 89, 404-422.

Gautier, P., Siegmann, A., Van Vuuren, A., 2009, Terrorism and attitudes towards minorities: The effect of the Theo van Gogh murder on house prices in Amsterdam, Journal of Urban Economics 65, 113-126.

Hertzel, M.G., Officer, M.S., 2012. Industry contagion in loan spreads. Journal of Financial Economics 103, 493-506.

Jorion, P., Zhang, G.Y., 2009. Credit contagion from counterparty risk. Journal of Finance 64, 2053-2087.

Jotikasthira, C., Lundblad, C., Ramadorai, T., 2012. Asset Fire Sales and Purchases and the International Transmission of Funding Shocks. Journal of Finance 67, 2015-2050.

Klimova, A., Lee, A., 2014, .Does a Nearby Murder Affect Housing Prices and Rents? The Case of Sydney," The Economic Record 90, 16-40.

Leguizamon, S., 2010. The influence of reference group house size on house price. Real Estate Economics 38, 507-527.

Lin, Z., Rosenblatt, E., Yao, V., 2009. Spillover Effects of Foreclosures on Neighborhood Property Values. Journal of Real Estate Finance and Economics 38, 387-407

Longstaff, F.A., 2010. The subprime credit crisis and contagion in financial markets. Journal of Financial Economics 97, 436-450.

Manconi, A., Massa, M., Yasuda, A., 2012. The role of institutional investors in propagating the

crisis of 2007–2008. Journal of Financial Economics 104, 491-518.

Pulvino, T.C., 1998. Do asset fire sales exist? An empirical investigation of commercial aircraft transactions. Journal of Finance 53, 939-978.

Rossi-Hansberg, E., Sarte, P.D., Owens, R., 2010. Housing externalities. Journal of Political Economy 118, 485-535.

Shleifer, A., Vishny, R., 2011. Fire sales in finance and macroeconomics. Journal of Economic Perspectives 25, 29-48.

Squarefoot (2019). *Hong Kong Real Estate Market Outlook (2019 H1)*.

Table 1, Descriptive statistics

We report descriptive statistics for all transactions, and transactions in estates that are classified as large or not, respectively. A large estate is defined as estates with 1,000 or more transactions over our sample period, equivalent to around 5 transactions per month. Panel A reports transaction characteristics: *Price* is in million HKD (one USD equals 7.78 HKD), *Size* is measured in square feet (one square meter equals 10.76 square feet), *Price per square foot* is in HKD, and *age* is measured in years. *New unit* is an indicator for primary transactions. *Carpark* is an indicator for whether the transaction includes allocated space in the carpark. Panels B, C, and D report the distribution of transactions on territory (i.e. region), year, and quarter of year, respectively. *** denotes statistical significance at the 1% level.

	All	Large estate		Difference
		Yes	No	
		(1)	(2)	(1)-(2)
A. Transaction characteristics				
Price (million HKD)	4.23	3.84	4.80	0.97***
Size (square foot)	606.3	591.7	627.7	-36.0***
Price per square foot (HKD)	6,209.0	6,033.2	6,467.2	-433.2***
Block age (years)	14.2	10.5	19.7	-9.2***
New unit (%)	17.5	22.6	10.2	12.4***
Carpark (%)	6.5	2.3	12.7	-10.4***
B. Territory (%)				
Hong Kong Island	22.4	11.8	37.9	
Kowloon	27.7	23.4	33.9	
New Territories	50.0	64.8	28.2	
C. Year				
2000	48,302	28,847	19,455	
2001	55,430	33,806	21,624	
2002	54,390	35,529	18,861	
2003	56,801	37,856	18,945	
2004	79,426	50,508	28,918	
2005	75,821	46,191	29,630	
2006	61,276	35,178	26,098	
2007	100,882	59,790	41,092	
2008	66,321	38,694	27,627	
2009	95,447	56,178	39,269	
2010	103,937	60,632	43,305	
2011	63,552	35,547	28,005	
2012	65,071	38,276	26,795	
2013	37,558	21,675	15,883	
2014	51,242	29,629	21,613	
2015	41,462	20,646	20,816	
D. Quarter				
First	271,777	162,699	109,078	
Second	272,399	161,750	111,649	
Third	260,822	156,334	104,488	
Fourth	251,920	149,199	102,721	
N	1,056,918	628,982	427,936	

Table 2, Sample of haunted houses

We report the composition of the sample of haunted houses in large estates between 2000 and 2015. A house becomes haunted if a murder, suicide, accident or some other unnatural death occurs. Panel A reports the cause of death. Panel B reports the distribution of unnatural deaths by territory (i.e. region). Panel C reports the distribution of unnatural deaths by year. Panel D reports the number of transactions involving: haunted units, units on the haunted floor (excluding the haunted unit), units in the haunted block (excluding the haunted floor), units in the haunted estate (excluding the haunted block), and non-haunted units.

	N	%
A. Cause of deaths		
Murder	21	2.0%
Suicide	910	88.2%
Accidents	73	7.1%
Other	28	2.7%
B. Territory		
Hong Kong Island	199	19.3%
Kowloon	246	23.8%
New Territories	587	56.9%
C. Year		
2000	56	5.4%
2001	70	6.8%
2002	69	6.7%
2003	90	8.7%
2004	73	7.1%
2005	70	6.8%
2006	61	5.9%
2007	47	4.6%
2008	64	6.2%
2009	62	6.0%
2010	61	5.9%
2011	48	4.7%
2012	63	6.1%
2013	73	7.1%
2014	71	6.9%
2015	54	5.2%
N	1,032	100%
D. Transactions		
Haunted units	761	0.1%
Haunted floors	3,606	0.3%
Haunted blocks	99,258	9.4%
Haunted estates	267,816	25.3%
Non-haunted	685,477	64.9%
N	1,056,918	100%

Table 3, Difference-in-differences estimate of haunted houses on price per square foot

This table reports the average price per square foot before and after a unit becomes haunted. Panel A shows the average transaction price per square foot for transactions occurring one year before to one year after, whereas Panels B and C report the same for the period of two and three years before and after, respectively. We report the effect of haunted units, units on the haunted floor (excluding the haunted unit), and for units in the haunted block (excluding the haunted floor). To control for time-trends in prices we also report the average transaction price per square foot in the same district, and provide a difference-in-differences estimate of the effect of haunted houses on the price per square foot.

Window	Unit			Floor			Block		
	Price per square foot		%	Price per square foot		%	Price per square foot		%
	Haunted	District	Difference	Haunted	District	Difference	Haunted	District	Difference
A. One year before to one year after									
Before	4,898	5,245	-7%	5,196	5,534	-6%	5,335	5,632	-5%
After	4,785	5,717	-16%	5,151	5,569	-8%	5,401	5,788	-7%
Difference	-2%	9%	-11%	-1%	1%	-1%	1%	3%	-2%
B. Two years before to two years after									
Before	5,028	5,172	-3%	4,987	5,286	-6%	5,205	5,458	-5%
After	4,587	5,512	-17%	5,196	5,746	-10%	5,500	5,897	-7%
Difference	-9%	7%	-15%	4%	9%	-5%	6%	8%	-2%
C. Three years before to three years after									
Before	5,182	5,203	0%	4,961	5,234	-5%	5,199	5,401	-4%
After	4,668	5,627	-17%	5,188	5,771	-10%	5,502	5,927	-7%
Difference	-10%	8%	-18%	5%	10%	-6%	6%	10%	-4%

Table 4, Spillover effects of haunted houses on price

This table shows the spillover effect of haunted houses on transaction prices. The dependent variable is log. of the transaction price per square foot. In Column 1 to 4 the sample consists of transactions in all estates, whereas the sample in Column 5 only consists of new estates that were constructed during the sample period. *Haunted unit* is an indicator for haunted units (units in which an unnatural death occurred). *Haunted floor* is an indicator for units on the same floor as the haunted unit, but is set to zero for the haunted unit. *Haunted block* is an indicator for units on the same block as the haunted unit. It is set to the count of the number of haunted units in the block, but is set to zero for haunted units and all units on a haunted floor. *Haunted estate* is an indicator for units on the same estate as the haunted unit. It is set to the count of the number of haunted units in the estate, but is set to zero for haunted units, units on the haunted floor, and units on the haunted block. *Same block, proximity to haunted floor (1-3)* is an indicator for units that are 1 to 3 floors above or below a haunted floor in a haunted block. *Same block, proximity to haunted floor (4-6)* is an indicator for units that are 4 to 6 floors above or below a haunted floor in a haunted block. *Same estate, neighbor to haunted block* is an indicator for units that are in a block that is the neighbor to a haunted block. *Size* is the size of the unit measured in square feet. *Age* is the block age measured years. *New unit* is an indicator for primary transactions. *Carpark* is an indicator for whether the transaction includes allocated space in the carpark. All specifications include unit fixed-effects and year-month fixed-effects. Column 5 also includes unit transactions sequence fixed-effects. Standard errors are clustered at the estate level, and reported in parenthesis. ***, ** and * indicate statistical significance at the 1, 5, and 10 percent level, respectively.

Sample	**All estates**					**New estates**
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Haunted unit	-0.1988***	-0.1986***	-0.1913***	-0.1910***	-0.2021***	-0.1916***
	(0.0295)	(0.0296)	(0.0281)	(0.0282)	(0.0277)	(0.0461)
Haunted floor	-0.0974***	-0.0971***	-0.0897***	-0.0894***	-0.0970***	-0.0799**
	(0.0226)	(0.0226)	(0.0211)	(0.0211)	(0.0208)	(0.0321)
Haunted block	-0.0714***	-0.0678***	-0.0657***	-0.0622***	-0.0675***	-0.0419*
	(0.0166)	(0.0166)	(0.0151)	(0.0151)	(0.0159)	(0.0216)
Haunted estate	-0.0139***	-0.0140***	-0.0128***	-0.0129***	-0.0130***	-0.0143*
	(0.0039)	(0.0039)	(0.0041)	(0.0041)	(0.0036)	(0.0087)
Same block, proximity to haunted floor (1-3 floors)		-0.0213**		-0.0206**		-0.0183
		(0.0095)		(0.0095)		(0.0136)
Same block, proximity to haunted floor (4-6 floors)		-0.0142		-0.0135		-0.0090
		(0.0090)		(0.0089)		(0.0128)
Same estate, neighbor to haunted block			-0.0195	-0.0195		-0.0218
			(0.0185)	(0.0185)		(0.0221)
Size	-0.0002	-0.0002	-0.0002	-0.0002	-0.0002	-0.0002
	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
Age	-0.0067	-0.0066	-0.0062	-0.0061	-0.0006	0.0131
	(0.0171)	(0.0171)	(0.0171)	(0.0171)	(0.0176)	(0.0197)
New unit	0.1608***	0.1608***	0.1625***	0.1626***	0.1689***	0.1006***
	(0.0183)	(0.0183)	(0.0181)	(0.0181)	(0.0177)	(0.0173)
Carpark	0.0515***	0.0514***	0.0514***	0.0514***	0.0543***	0.0597*
	(0.0190)	(0.0190)	(0.0190)	(0.0190)	(0.0184)	(0.0339)
Unit fixed-effects	Yes	Yes	Yes	Yes	Yes	Yes
Unit transaction sequence fixed-effects	No	No	No	No	Yes	No
Year-month fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Adj. R-squared	0.979	0.979	0.979	0.979	0.980	0.983
N	1,056,918	1,056,918	1,056,918	1,056,918	1,056,918	368,394

Table 5, Decay in spillover effects

This table estimates the decay in the spillover effect of haunted houses on transaction prices. The dependent variable is log. of transaction price per square foot. In Column 1 the sample consists of transactions in all estates, whereas the sample in Column 2 only consists of new estates that were constructed during the sample period. *Haunted unit* is an indicator for haunted units (units in which an unnatural death occurred). *Haunted floor* is an indicator for units on the same floor as the haunted unit, but is set to zero for the haunted unit. *Haunted block* is an indicator for units on the same block as the haunted unit. It is set to the count of the number of haunted units in the block, but is set to zero for haunted units and all units on a haunted floor. *Haunted estate* is an indicator for units on the same estate as the haunted unit. It is set to the count of the number of haunted units in the estate, but is set to zero for haunted units, units on the haunted floor, and units on the haunted block. *Time* is the difference between the transaction date and the date where the unit becomes haunted, measured in years. For the interaction with haunted block and haunted estate, we use the timing of the last event whenever there are multiple haunted units in a block or estate. Control variables include: *size*, *age*, *new unit* and *carpark* (see Table 4 for definitions). All specifications include unit fixed-effects and year-month fixed effects. Standard errors are clustered at the estate level, and reported in parenthesis. ***, ** and * indicate statistical significance at the 1, 5, and 10 percent level, respectively.

Sample	**All estates**	**New estates**
	(1)	**(2)**
Haunted unit	-0.1933***	-0.1788***
	(0.0372)	(0.0477)
Haunted unit * Time	0.0053	-0.0091
	(0.0051)	(0.0147)
Haunted floor	-0.1049***	-0.0883***
	(0.0296)	(0.0303)
Haunted floor * Time	0.0037	0.0005
	(0.0028)	(0.0046)
Haunted block	-0.0833***	-0.0476**
	(0.0151)	(0.0203)
Haunted block * Time	-0.0007	0.0019
	(0.0028)	(0.0050)
Haunted estate	-0.0224***	-0.0216*
	(0.0087)	(0.0118)
Haunted estate * Time	-0.0029	0.0036
	(0.0042)	(0.0079)
Control variables	Yes	Yes
Unit fixed-effects	Yes	Yes
Year-month fixed effects	Yes	Yes
Adj. R-squared	0.979	0.983
N	1,056,918	368,394

Table 6, Cause of death and spillover effects

This table shows the spillover effect of haunted houses on transaction prices, conditional on the cause of death. The dependent variable is log. of transaction price per square foot. Column 1 replicates the baseline specification from Column 1 of Table 4, whereas Column 2 reports the results for the sample where murders are removed. Columns 3 to 5 report results conditional on the cause of death: Column 3 report results for murder, Column 4 for suicides, and Column 5 for accidents and other causes of deaths. *Haunted unit* is an indicator for haunted units (units in which an unnatural death occurred). *Haunted floor* is an indicator for units on the same floor as the haunted unit, but is set to zero for the haunted unit. *Haunted block* is an indicator for units on the same block as the haunted unit. It is set to the count of the number of haunted units in the block, but is set to zero for haunted units and all units on a haunted floor. *Haunted estate* is an indicator for units on the same estate as the haunted unit. It is set to the count of the number of haunted units in the estate, but is set to zero for haunted units, units on the haunted floor, and units on the haunted block. Control variables include: *size*, *age*, *new unit* and *carpark* (see Table 4 for definitions). All specifications include unit fixed-effects and year-month fixed effects. Standard errors are clustered at the estate level, and reported in parenthesis. ***, ** and * indicate statistical significance at the 1, 5, and 10 percent level, respectively.

	All	**Excluding Murder**	**Cause of death**		
			Murder	**Suicide**	**Accident and other**
	(1)	**(2)**	**(3)**	**(4)**	**(5)**
Haunted unit	-0.1988***	-0.1883***	-0.3443***	-0.2049***	-0.1239
	(0.0295)	(0.0308)	(0.1012)	(0.0300)	(0.0757)
Haunted floor	-0.0974***	-0.0939***	-0.1923**	-0.1065***	-0.0482
	(0.0226)	(0.0243)	(0.0566)	(0.0237)	(0.0457)
Haunted block	-0.0714***	-0.0731***	-0.1015*	-0.0823***	-0.0598*
	(0.0166)	(0.0183)	(0.0566)	(-0.0176)	(0.0348)
Haunted estate	-0.0139***	-0.0142***	-0.0470	-0.0260***	-0.0084
	(0.0039)	(0.0044)	(0.0396)	(0.0056)	(0.0247)
Control variables	Yes	Yes	Yes	Yes	Yes
Unit fixed-effects	Yes	Yes	Yes	Yes	Yes
Year-month fixed effects	Yes	Yes	Yes	Yes	Yes
Adj. R-squared	0.979	0.979	0.978	0.979	0.978
N	1,056,918	1,012,126	1,056,918	1,056,918	1,056,918

Table 7, Difference-in-differences estimate of haunted houses on liquidity (measured by fraction of units sold)

This table reports the fraction of haunted units, haunted floors and haunted blocks that are sold before and after a unit become haunted. Panel A shows the fraction of units sold one year before to one year after death, whereas Panel B and C report the same for the period of two and three years before and after death, respectively. We report the fraction of units sold for haunted units, haunted floors (excluding the haunted unit), and haunted blocks (excluding the haunted unit and haunted floor). To control for time-trends in market liquidity we also report the fraction of units sold in the same district in the same time period, and provide a difference-in-differences estimate of the effect of haunted houses on liquidity, measured by the fraction of units sold.

Window	Unit			Floor			Block		
	Fraction sold		%	Fraction sold			Fraction sold		
	Haunted	District	Difference	Haunted	District	Difference	Haunted	District	Difference
A. One year before to one year after									
Before	6.0%	7.2%	-1.2%	6.4%	7.2%	-0.8%	6.9%	7.2%	-0.3%
After	13.3%	7.3%	6.0%	6.5%	7.3%	-0.8%	6.4%	7.3%	-0.9%
Difference	7.3%	0.1%	7.2%	0.1%	0.1%	0.0%	-0.5%	0.1%	-0.6%
B. Two years before to two years after									
Before	7.7%	7.2%	0.5%	7.5%	7.2%	0.3%	7.4%	7.2%	0.2%
After	12.5%	7.3%	5.2%	6.5%	7.3%	-0.8%	6.3%	7.3%	-1.0%
Difference	4.8%	0.1%	4.7%	-1.0%	0.1%	-1.1%	-1.1%	0.1%	-1.2%
C. Three years before to three years after									
Before	8.2%	7.0%	1.2%	7.8%	7.0%	0.8%	7.8%	7.0%	0.8%
After	11.2%	7.1%	4.1%	6.4%	7.1%	-0.7%	6.1%	7.1%	-1.0%
Difference	3.0%	0.1%	2.9%	-1.4%	0.1%	-1.5%	-1.7%	0.1%	-1.8%

Table 8, Causes of spillover effects: demand shock or supply shock (price pressure)

This table examines whether the spillover effect of haunted houses on transaction prices is driven by demand shock or supply shock (price pressure) or both. The dependent variable is log. of transaction price per square foot. *Haunted floor* is an indicator for units on the same floor as the haunted unit, but is set to zero for the haunted unit. *Haunted block* is an indicator for units on the same block as the haunted unit. It is set to the count of the number of haunted units in the block, but is set to zero for haunted units and all units on a haunted floor. *Haunted estate* is an indicator for units on the same estate as the haunted unit. It is set to the count of the number of haunted units in the estate, but is set to zero for haunted units, units on the haunted floor, and units on the haunted block. *Haunted unit sold* takes the value one if the haunted unit is sold before a given transaction. In Column 1 we consider transactions of haunted units that occur in the period between the unnatural death and the transaction date of a given unit. In Columns 2 to 4, we consider transactions of haunted units that occurred in the last year, last 3 years and last 5 years relative to the transaction date of a given unit, respectively. Control variables include: *size*, *age*, *new unit* and *carpark* (see Table 4 for definitions). All specifications include unit fixed-effects and year-month fixed-effects. Standard errors are clustered at the estate level, and reported in parenthesis. ***, ** and * indicate statistical significance at the 1, 5, and 10 percent level, respectively.

	Anytime (1)	**Last year (2)**	**Last 3 years (3)**	**Last 5 years (4)**
Haunted floor	-0.0994***	-0.0998***	-0.0978***	-0.0934***
	(0.0263)	(0.0208)	(0.0219)	(0.0249)
Haunted floor * Haunted unit sold	-0.0010	0.0062	-0.0011	-0.0087
	(0.0275)	(0.0165)	(0.0201)	(0.0254)
Haunted block	-0.0849***	-0.0723***	-0.0749***	-0.0801***
	(0.0191)	(0.0152)	(0.0154)	(0.0176)
Haunted block * Haunted unit sold	0.0142	0.0017	0.0038	0.0088
	(0.0196)	(0.0107)	(0.0132)	(0.0174)
Haunted estate	-0.0215**	-0.0153***	-0.0175***	-0.0205***
	(0.0086)	(0.0043)	(0.0055)	(0.0080)
Haunted estate * Haunted unit sold	0.0078	0.0026	0.0043	0.0069
	(0.0081)	(0.0026)	(0.0047)	(0.0075)
Control variables	Yes	Yes	Yes	Yes
Unit fixed-effects	Yes	Yes	Yes	Yes
Year-month fixed effects	Yes	Yes	Yes	Yes
Adj. R-squared	0.979	0.979	0.979	0.979
N	1,056,918	1,056,918	1,056,918	1,056,918

Table 9, Placebo test using deaths that occurred outside the residence of the deceased

This table shows the spillover effect of haunted houses on transaction prices. The dependent variable is log. of transaction price per square foot. Column 1 reports coefficients using the treatment sample of 1,032 unnatural deaths coded in similar fashion as in the baseline specification of Column 1 of Table 4, whereas Column 2 reports coefficients from a placebo sample (coded in similar fashion) of 235 unnatural deaths that by definition occurs outside the deceased residence. The placebo sample consist of 183 deaths in traffic accidents, 23 accidental deaths during medical procedures, and 29 accidental deaths due to drowning while swimming in the ocean. In Column 3 and 4 we exclude murders from the treatment sample. *Haunted unit* is an indicator for haunted units (units in which an unnatural death occurred). *Haunted floor* is an indicator for units on the same floor as the haunted unit, but is set to zero for the haunted unit. *Haunted block* is an indicator for units on the same block as the haunted unit. It is set to the count of the number of haunted units in the block, but is set to zero for haunted units and all units on a haunted floor. *Haunted estate* is an indicator for units on the same estate as the haunted unit. It is set to the count of the number of haunted units in the estate, but is set to zero for haunted units, units on the haunted floor, and units on the haunted block. Control variables include: *size*, *age*, *new unit* and *carpark* (see Table 4 for definitions). All specifications include unit fixed-effects and year-month fixed effects. Standard errors are clustered at the estate level, and reported in parenthesis. ***, ** and * indicate statistical significance at the 1, 5, and 10 percent level, respectively.

Sample	**Treatment**	**Placebo**	**Treatment excluding murder**	**Placebo**
	(1)	**(2)**	**(3)**	**(4)**
Haunted unit	-0.2057***	-0.0170	-0.1907***	-0.0214
	(0.0306)	(0.0479)	(0.0247)	(0.0557)
Haunted floor	-0.1054***	0.0273	-0.0971***	0.0085
	(0.0229)	(0.0281)	(0.0247)	(0.0320)
Haunted block	-0.0767***	0.0028	-0.0754***	-0.0081
	(0.0170)	(0.0191)	(0.0188)	(0.0210)
Haunted estate	-0.0152***	0.0107	-0.0148***	0.0045
	(0.0038)	(0.0067)	(0.0043)	(0.0089)
Control variables	Yes		Yes	
Unit fixed-effects	Yes		Yes	
Year-month fixed effects	Yes		Yes	
Adj. R-squared	0.979		0.979	
N	1,056,918		1,012,126	

Table 10, Spillovers in prices controlling for high-dimensional fixed-effects

This table reports the spillovers in house prices with additional high dimensional fixed-effects capturing variation in house prices due to location and/or time effects. The dependent variable is log. of transaction price per square foot. *Haunted floor* is an indicator for units on the same floor as the haunted unit, but is set to zero for the haunted unit. *Haunted block* is an indicator for units on the same block as the haunted unit. It is set to the count of the number of haunted units in the block, but is set to zero for haunted units and all units on a haunted floor. *Haunted estate* is an indicator for units on the same estate as the haunted unit. It is set to the count of the number of haunted units in the estate, but is set to zero for haunted units, units on the haunted floor, and units on the haunted block. *Haunted unit sold* takes the value one if the haunted unit is sold before a given transaction. In Column 1 we report the results from the main specification in Column 1 of Table 4. Column 2 includes territory-year-quarter fixed effects. Column 3 includes territory-year-month fixed-effects. Column 4 includes district-year-quarter fixed effects, while Column 5 includes district-year-month fixed-effects. All specifications include the following (unreported) time-variant house characteristics: *size*, *age*, *new unit* and *carpark* (see Table 4 for definitions). All specifications include unit fixed-effects. Standard errors are clustered at the estate level, and reported in parenthesis. ***, ** and * indicate statistical significance at the 1, 5, and 10 percent level, respectively.

	(1)	(2)	(3)	(4)	(5)
Haunted unit	-0.1988***	-0.1765***	-0.1754***	-0.1602***	-0.1608***
	(0.0295)	(0.0261)	(0.0255)	(0.0245)	(0.0232)
Haunted floor	-0.0974***	-0.0632***	-0.0634***	-0.0544***	-0.0540***
	(0.0226)	(0.0209)	(0.0204)	(0.0183)	(0.0175)
Haunted block	-0.0714***	-0.0486***	-0.0480***	-0.0418***	-0.0411***
	(0.0166)	(0.0153)	(0.0146)	(0.0137)	(0.0128)
Haunted estate	-0.0139***	-0.0099***	-0.0097***	-0.0081***	-0.0078***
	(0.0039)	(0.0032)	(0.0031)	(0.0030)	(0.0028)
Control variables	Yes	Yes	Yes	Yes	Yes
Unit fixed-effects	Yes	Yes	Yes	Yes	Yes
Year-month fixed effects	Yes	No	No	No	No
Territory-year-quarter fixed effects	No	Yes	No	No	No
Territory-year-month fixed effects	No	No	Yes	No	No
District-year-quarter fixed effects	No	No	No	Yes	No
District-year-month fixed effects	No	No	No	No	Yes
Adj. R-squared	0.981	0.981	0.981	0.983	0.983
N	1,056,918	1,056,918	1,056,918	1,056,918	1,056,918

Figure 1, Market share of large estates

This figure shows the market share of large estates between 2000 and 2015. A large estate is defined as estates with 1,000 or more transactions over our sample period, equivalent to around 5 transactions per month. We calculate the market share in large estates based on the *number* and *value* of transactions in each year. The horizontal red line shows the fraction of unique units located in large estates.

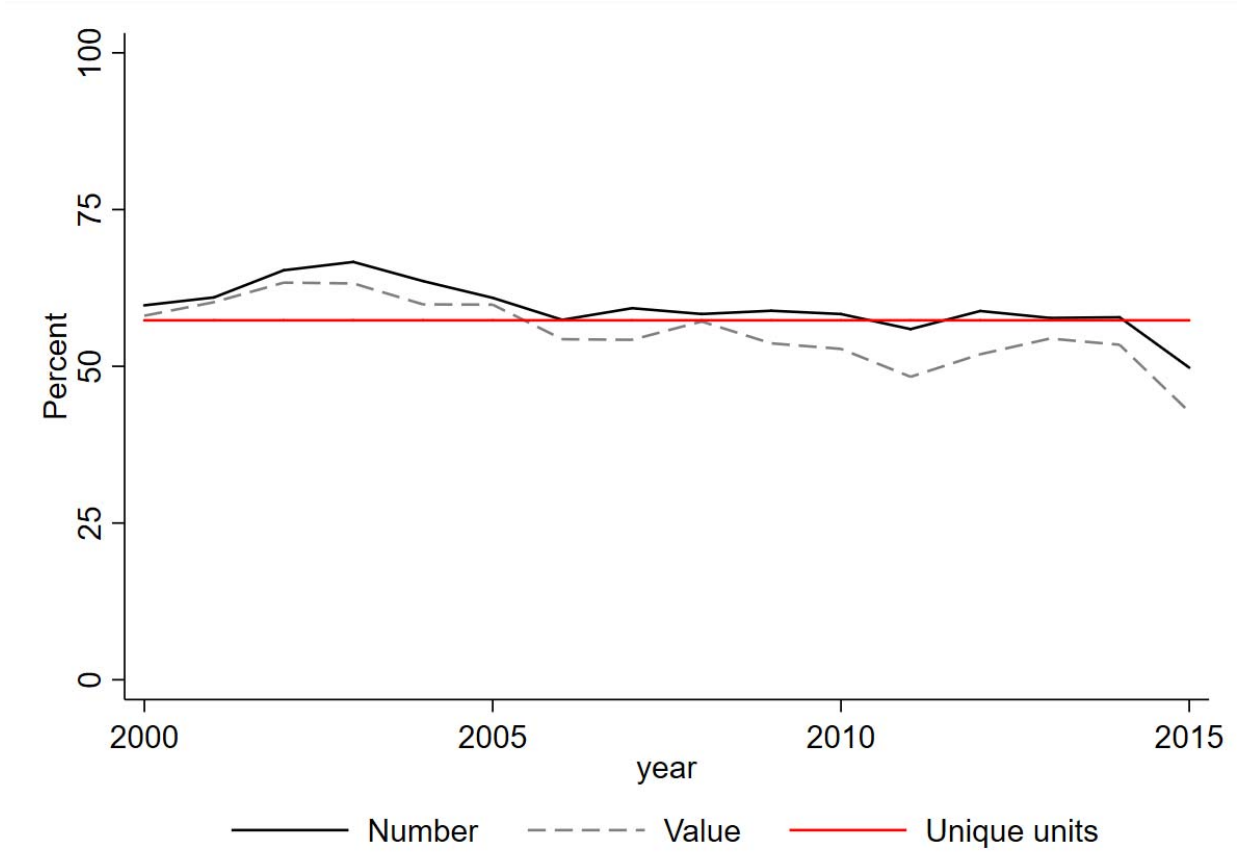


Figure 2, House price development, 2000-2015

This figure shows the average transaction price per square foot for large and small estates between 2000 and 2015. A large estate is defined as estates with 1,000 or more transactions over our sample period, equivalent to around 5 transactions per month.

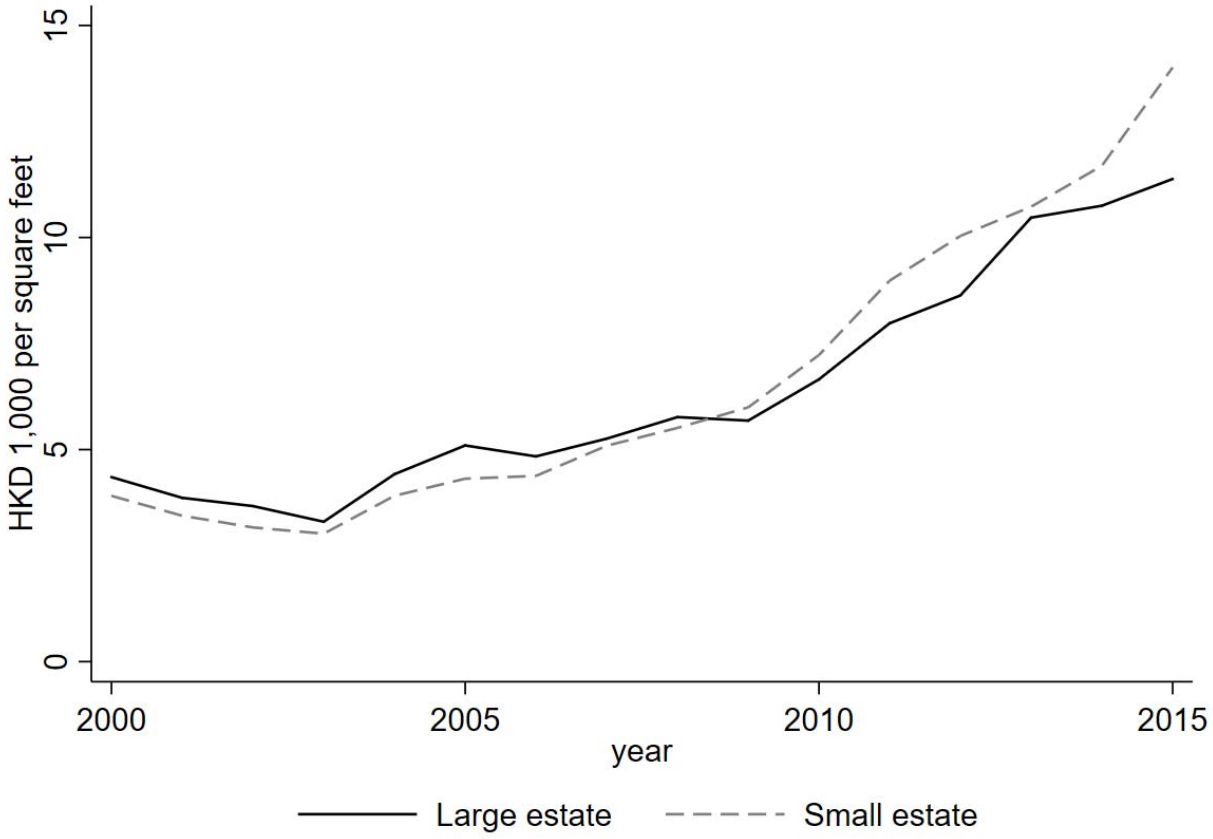


Figure 3, Fraction of units with repeated sales 2000-2015

This figure plots distributions of the number of times sold during the sample period from 2000 to 2015 for haunted units, haunted floors, haunted blocks, and haunted estates, and compares them to the distributions for units in the same district.

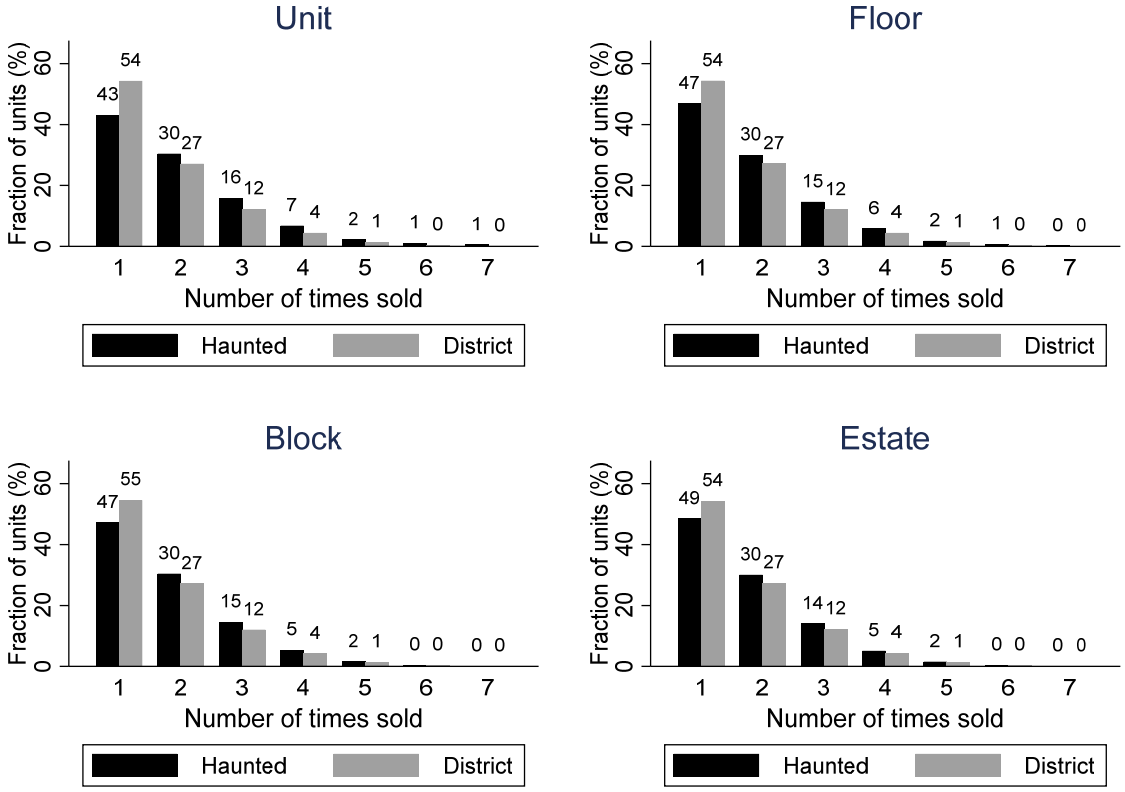


Figure 4, Pre-trends in house prices of haunted houses

This figure reports coefficients from an extension of Equation 1 to include pre-trends in house prices for haunted houses. To capture pre-trends we include indicators for units, floors, blocks and estates that are sold in years -3, -2, and -1 before the unnatural death, and compare the estimated coefficients to coefficients on indicators for haunted units, haunted floors, haunted blocks and haunted estates that are sold in years +1, +2, +3, and >+3 after the unnatural death. We report the estimated coefficient and the corresponding standard errors in four panels focusing on units, floors, blocks and estates, respectively.

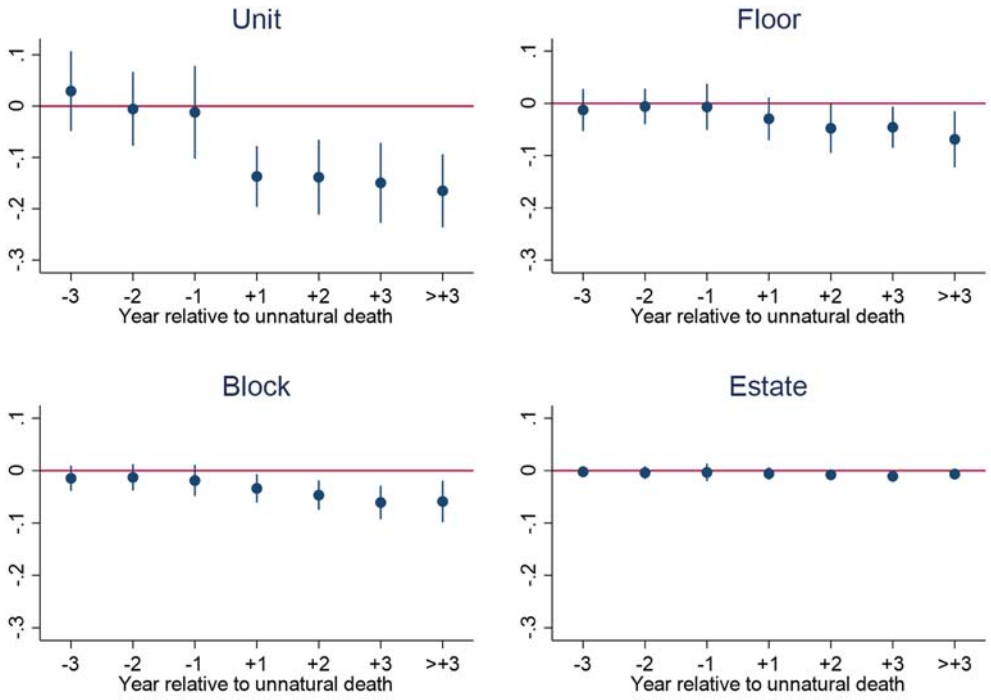


Figure 5, Disentangling spillovers in prices: demand shock effect vs. supply shock (price pressure) effect

This figure illustrates the decomposition of the spillover in prices into the demand shock effect vs. supply shock (price pressure) effect. Before a unit becomes haunted, the point X shows the price of its neighbour's house. The price of the neighbour's house drops to point Y when the unit becomes haunted, but is not sold. The price of the neighbour's house drops to point Z when the unit becomes haunted and is about to be sold at fire sale price Z. The vertical distance from X to Z is the spillover in prices, which is decomposed into the effect from the demand shock caused by a shock to quality (X to Y) and the effect from the supply shock (price pressure) caused because the haunted unit is sold at a fire sale price (Y to Z).

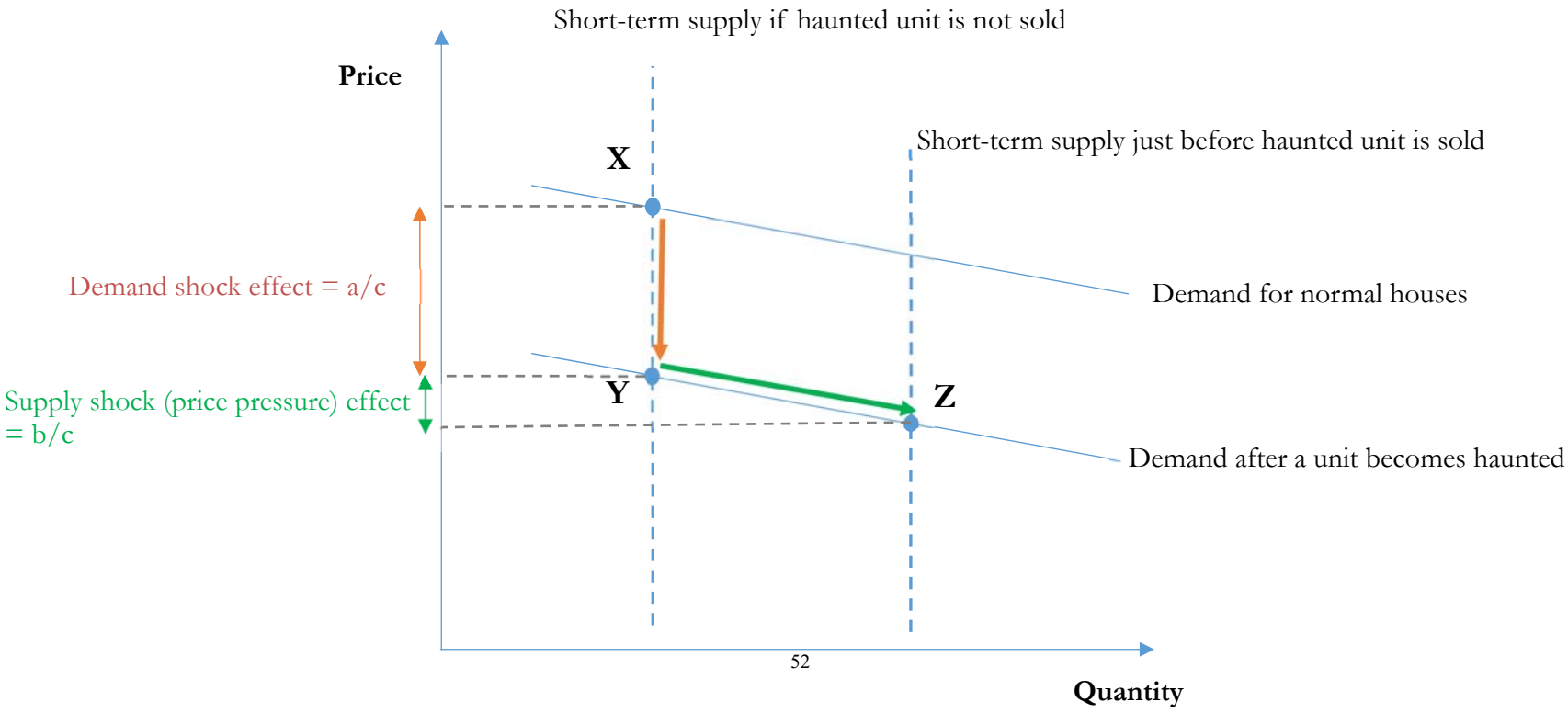


Figure 6, Effect of haunted houses on liquidity (measured as fraction of units sold per year)

This figure shows the fraction of haunted units sold per year before and after being haunted, the fraction of units on the same floor as the haunted unit (excluding the haunted unit) that are sold per year before and after a unit is haunted, the fraction of units on the same block as the haunted unit (excluding the haunted unit and units on the haunted floor) that are sold per year before and after a unit is haunted, and the fraction of units on the same estate as the haunted unit (excluding the haunted unit and units on the haunted floor and in the haunted block) that are sold per year before and after a unit is haunted. The benchmark is the fraction of units in the same district that are sold per year before and after.

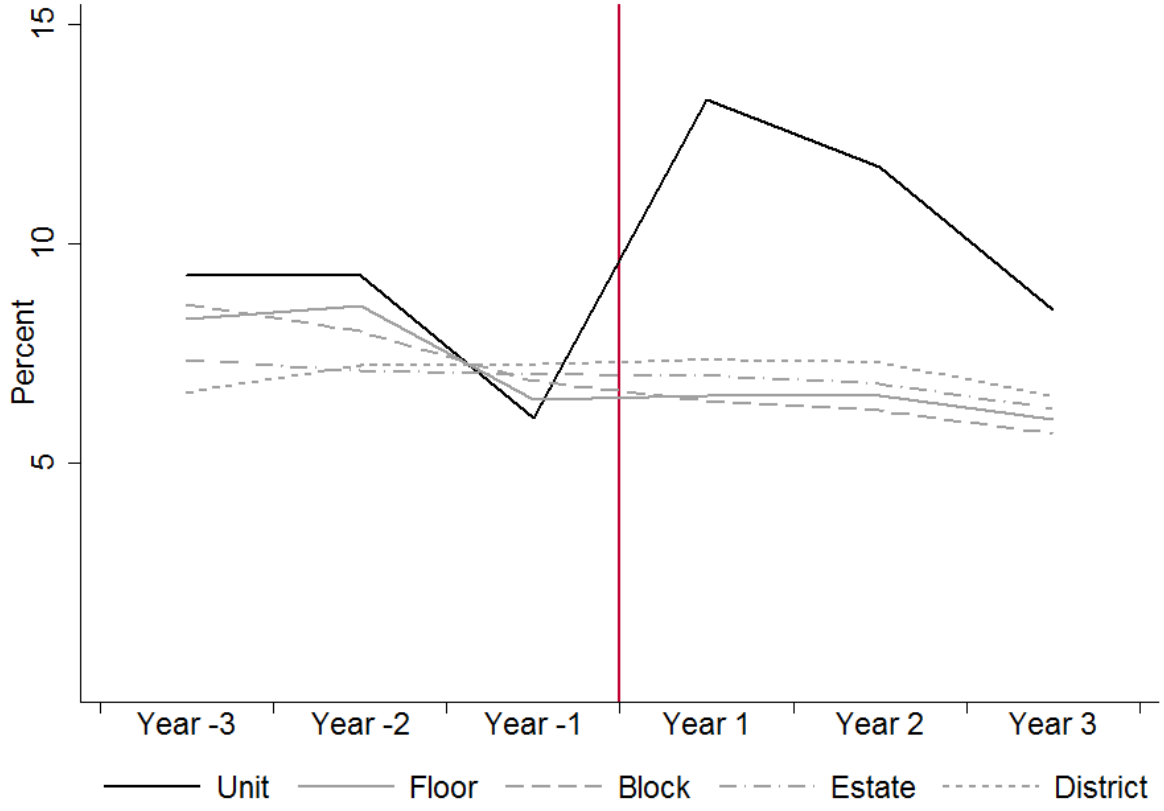
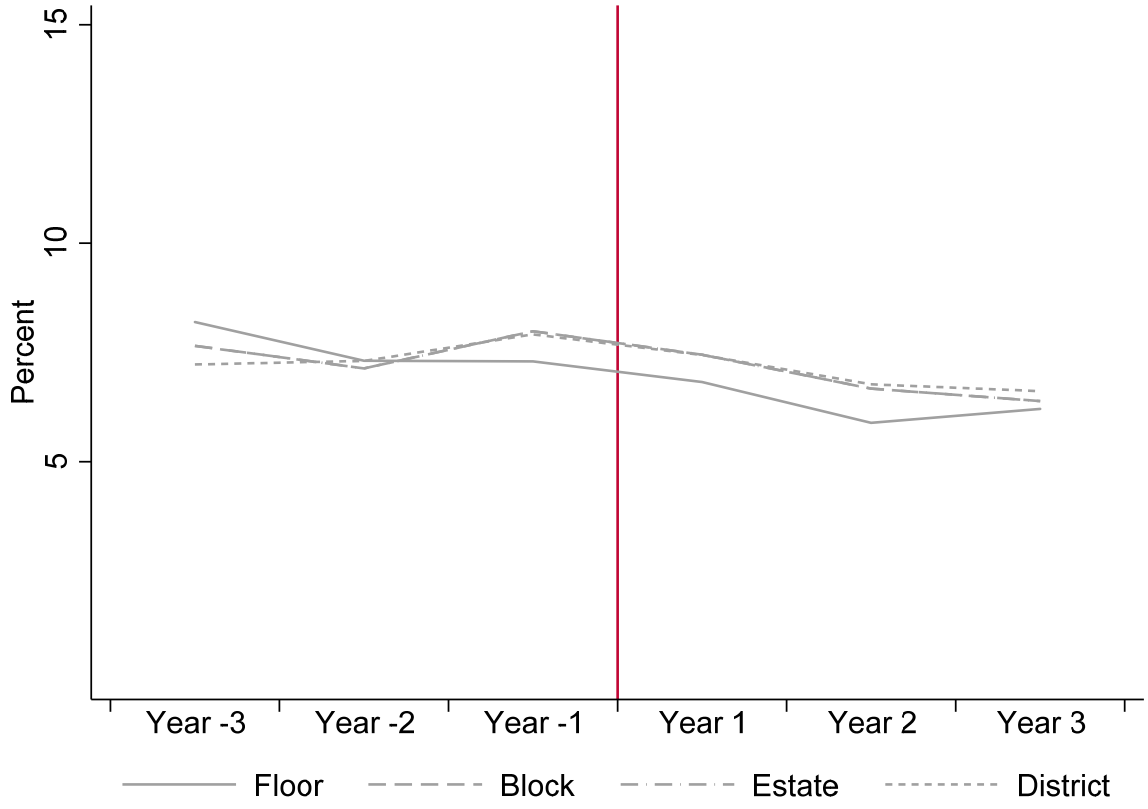


Figure 7, Market liquidity relative to timing of sales of haunted units (measured as fraction of units sold per year)

This figure shows the fraction of units on the same floor as the haunted unit (excluding the haunted unit) that are sold per year before and after the haunted unit is sold (year 0), the fraction of units on the same block as the haunted unit (excluding the haunted unit and units on the haunted floor) that are sold per year before and after the haunted unit is sold (year 0), and the fraction of units on the same estate as the haunted unit (excluding the haunted unit and units on the haunted floor and in the haunted block) that are sold per year before and after the haunted unit is sold (year 0). The benchmark is the fraction of units in the same district that are sold per year before and after a haunted unit in the district is sold.

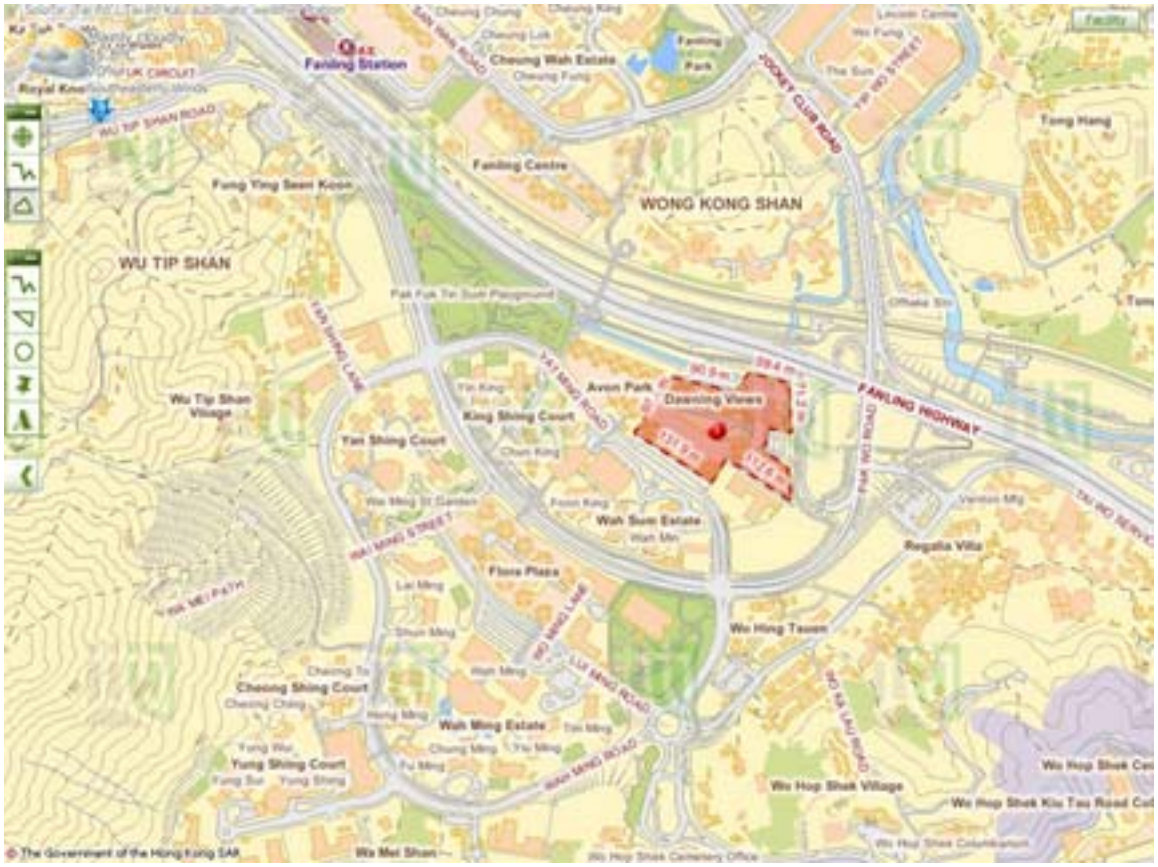


Internet Appendix for "Spillovers in Prices: The Curious Case of Haunted Houses"

- Appendix A1: Map of the 18 districts of Hong Kong
- Appendix A2: Map of Dawning Views in Fanling, North District, New Territories
- Appendix A3: Photo of the blocks of Dawning Views
- Appendix A4: Estate layout of Dawning Views
- Appendix A5: Floor plan of Floors 8-17 of Block 12 in Dawning Views
- Appendix B1: Screenshots of Squarefoot.com.hk
- Appendix B2: Screenshots of Spacious.com.hk
- Appendix C1: Distribution of prices per square foot for haunted houses
- Appendix C2: Differences in observable house characteristics before unnatural deaths
- Appendix C3, Fraction of units with repeated sales 2000-2015
- Appendix C4, Pre-trends in house prices of haunted houses
- Appendix C5: Clustering of standard errors at alternative levels

Appendix A1: The 18 Districts of Hong Kong

Appendix A2: Dawning Views in Fanling, North District, New Territories



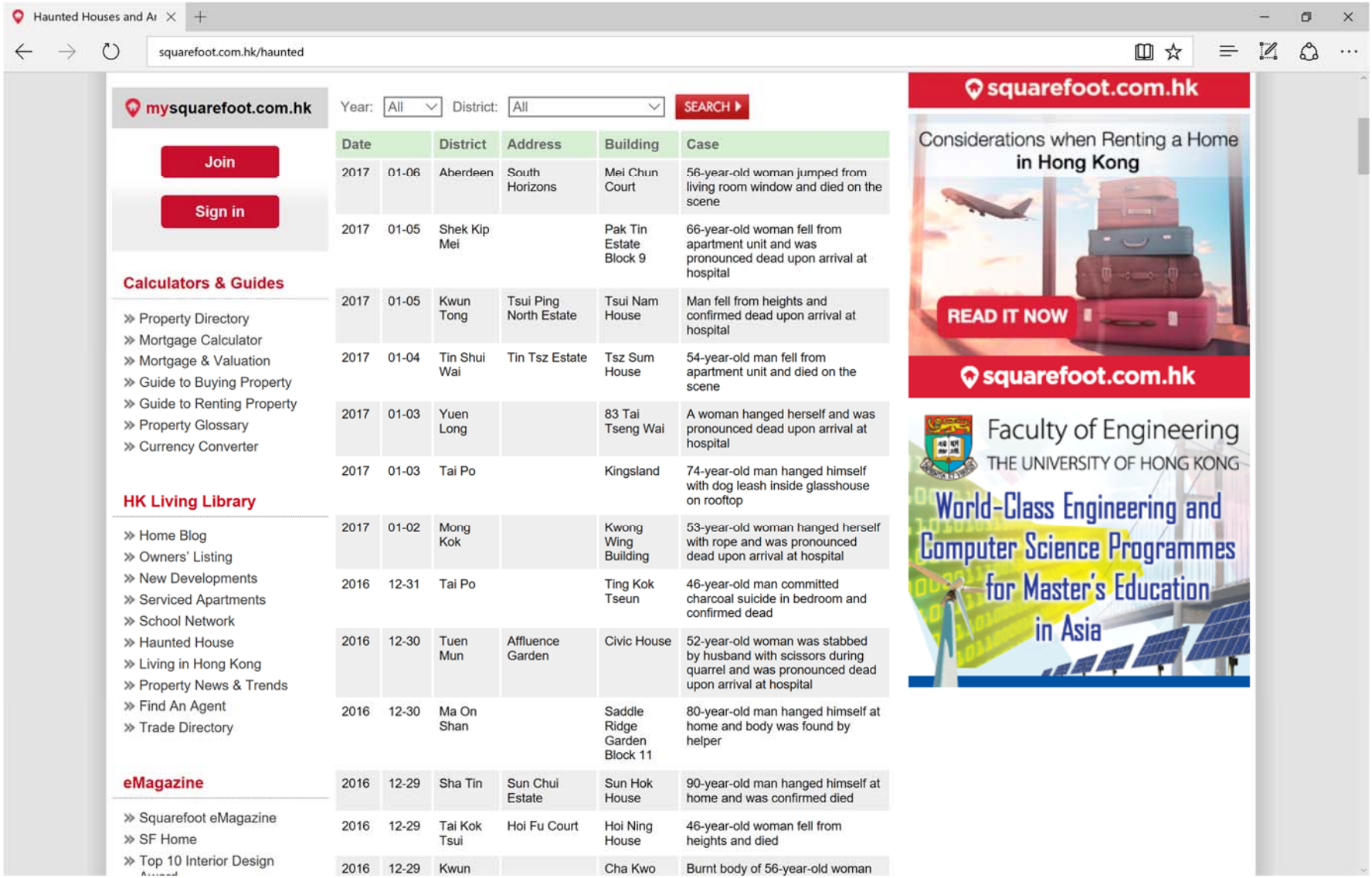
Appendix A3: Blocks of Dawning Views

Appendix A4: Estate layout of Dawning Views

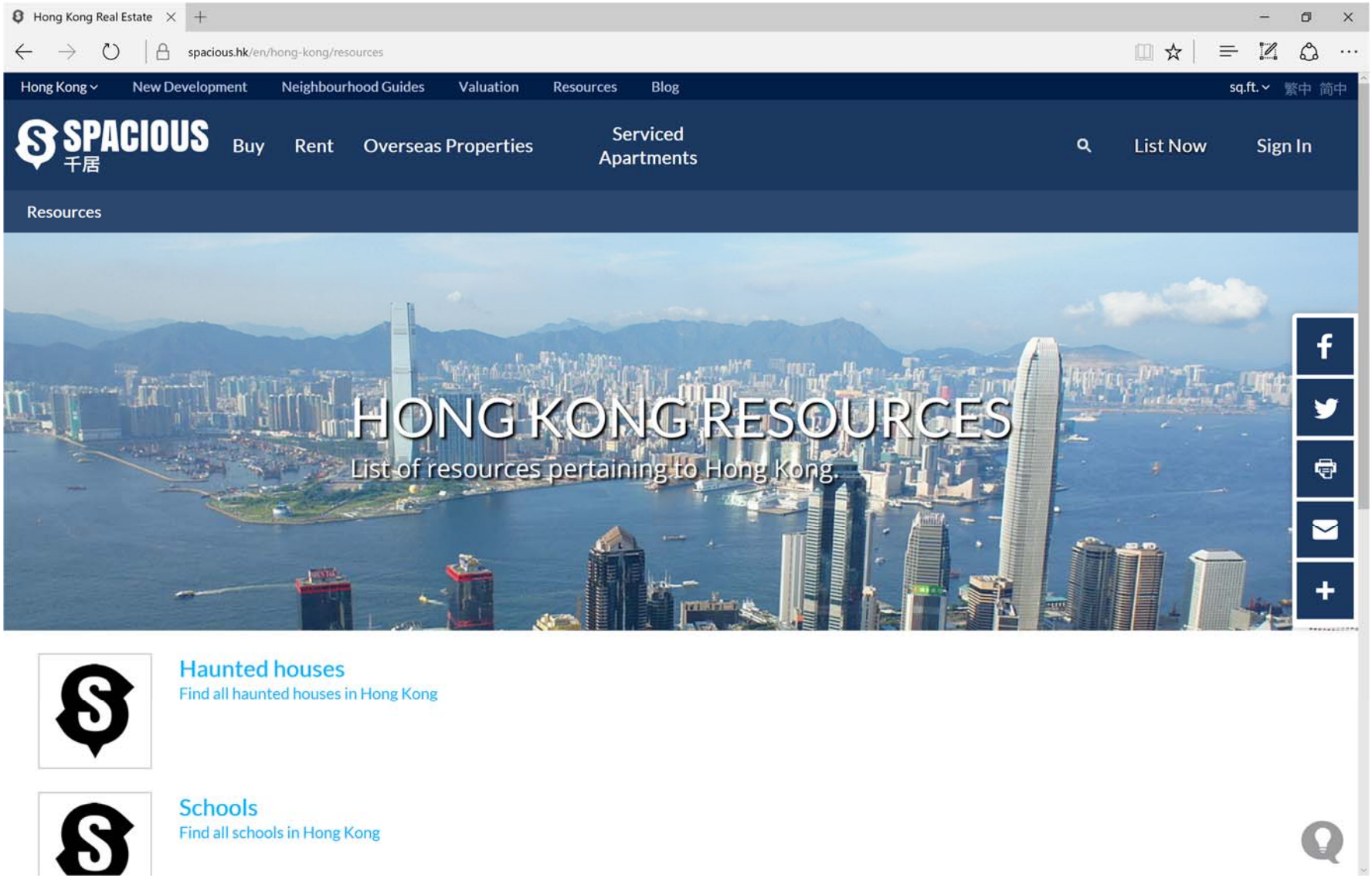
此圖則只供作二手住宅物業參考用途，並不作為任何一手住宅物業銷售之用。
This plan is used for reference of second-hand residential properties only, not for the sale of any first-hand residential properties.

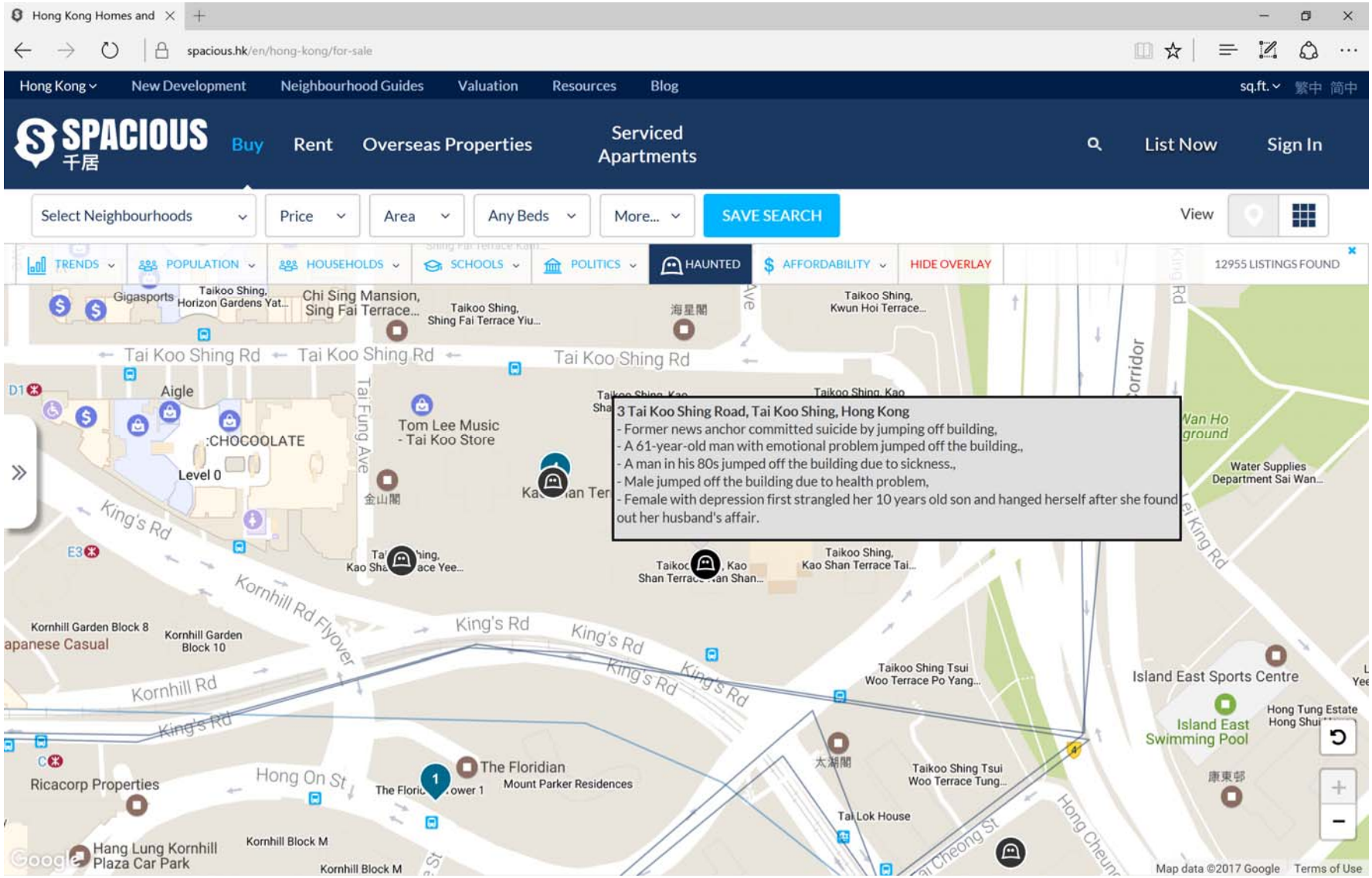
Appendix A5: Floor plan of Floors 8-17 of Block 12 in Dawning Views

Appendix B1: Screenshots of Squarefoot.com.hk



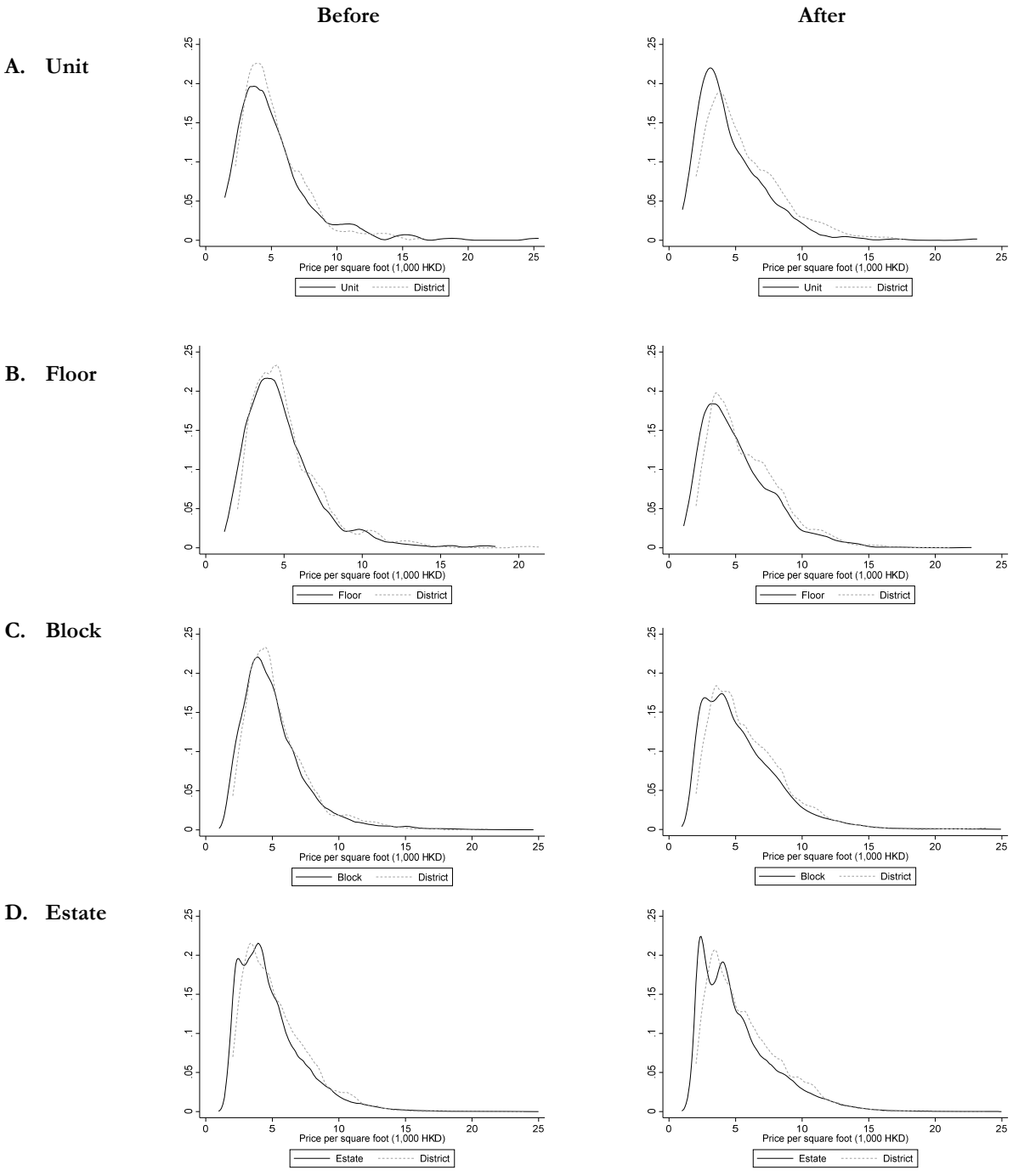
Appendix B2: Screenshots of Spacious.com.hk





Appendix C1: Distribution of prices per square foot for haunted houses

This table reports the distributions of the prices per square foot 3 years *before* and 3 years *after* the unnatural death. Panel A compares the distribution of prices for haunted units to units in the same district, Panel B compares the distribution of prices for units on the haunted floor (excluding the haunted unit) to units in the same district, Panel C compares the distribution of prices for units in the haunted block (excluding the haunted floor) to units in the same district, and Panel D compares the distribution of prices for units in the haunted estate (excluding the haunted block) to units in the same district. Price per square foot are measured in 1,000 HKD.



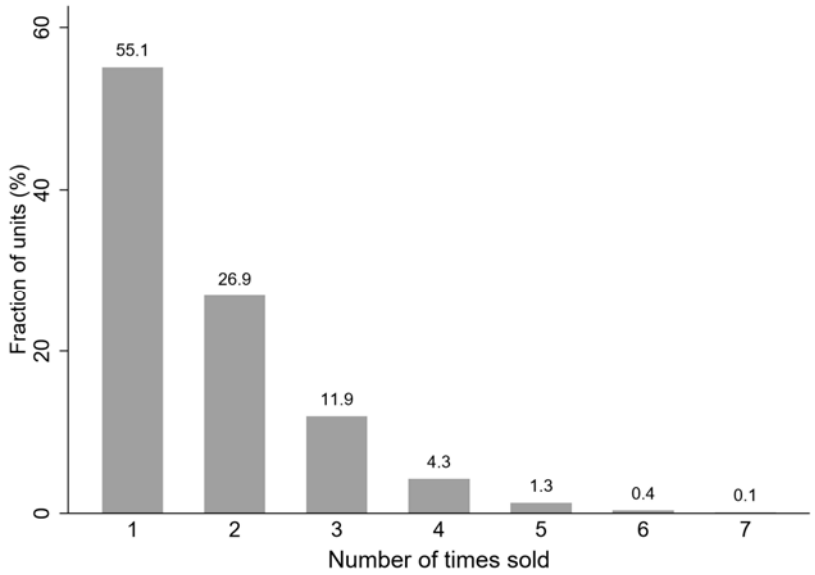
Appendix C2: Differences in observable house characteristics before unnatural deaths

This table reports a comparison of differences in observable house characteristics before the unnatural death. *Haunted* refers to units, floors, blocks and estates that are sold before they become haunted (i.e. before the unnatural death). To control for the timing of sales, we report in the *District* column the average house characteristics for units in the same district that are sold in the same year-month as the unit, floor, block or estate, respectively. We report the following house characteristics: *Price* is in million HKD (one USD equals 7.78 HKD), *Size* is measured in square feet (one square meter equals 10.76 square feet), *Price per square foot* is in HKD, and *age* is measured in years. *New unit* is an indicator for primary transactions. *Carpark* is an indicator for whether the transaction includes allocated space in the carpark. *** denotes significance at the 1% level.

House characteristic	**Unit**			**Floor**			**Block**			**Estate**		
	Haunted	District	Diff.	Haunted	District	Diff.	Haunted	District	Diff.	Haunted	District	Diff.
Price	2.55	2.97	-0.42***	2.26	2.88	-0.62***	2.53	3.02	-0.48***	3.45	3.67	-0.22***
			(0.12)			(0.05)			(0.12)			(0.02)
Size	563.4	620.5	-57.1***	533.7	621.3	-87.5***	549.8	621.3	-71.7***	564.2	621.9	-57.7***
			(14.0)			(5.4)			(1.1)			(0.8)
Price per square foot	4,322	4,349	-19	4,079	4,176	-97***	4,413	4,355	58	5,422	5,126	297***
			(94)			(35)			(1,386)			(72)
Age	8.4	9.0	-0.6	9.5	9.5	0.0	7.2	9.0	-1.7***	8.2	11.6	-3.3***
			(0.6)			(0.2)			(0.4)			(0.3)
New unit	30.3	33.8	-3.5	23.4	30.0	-6.7***	29.1	32.9	-3.8***	18.9	24.7	-5.7***
			(2.8)			(1.0)			(0.2)			(0.1)
Carpark	1.7	7.3	-5.5***	1.5	8.1	-6.6***	1.4	7.6	-6.2***	2.1	8.8	-6.6***
			(1.0)			(0.4)			(0.1)			(0.1)

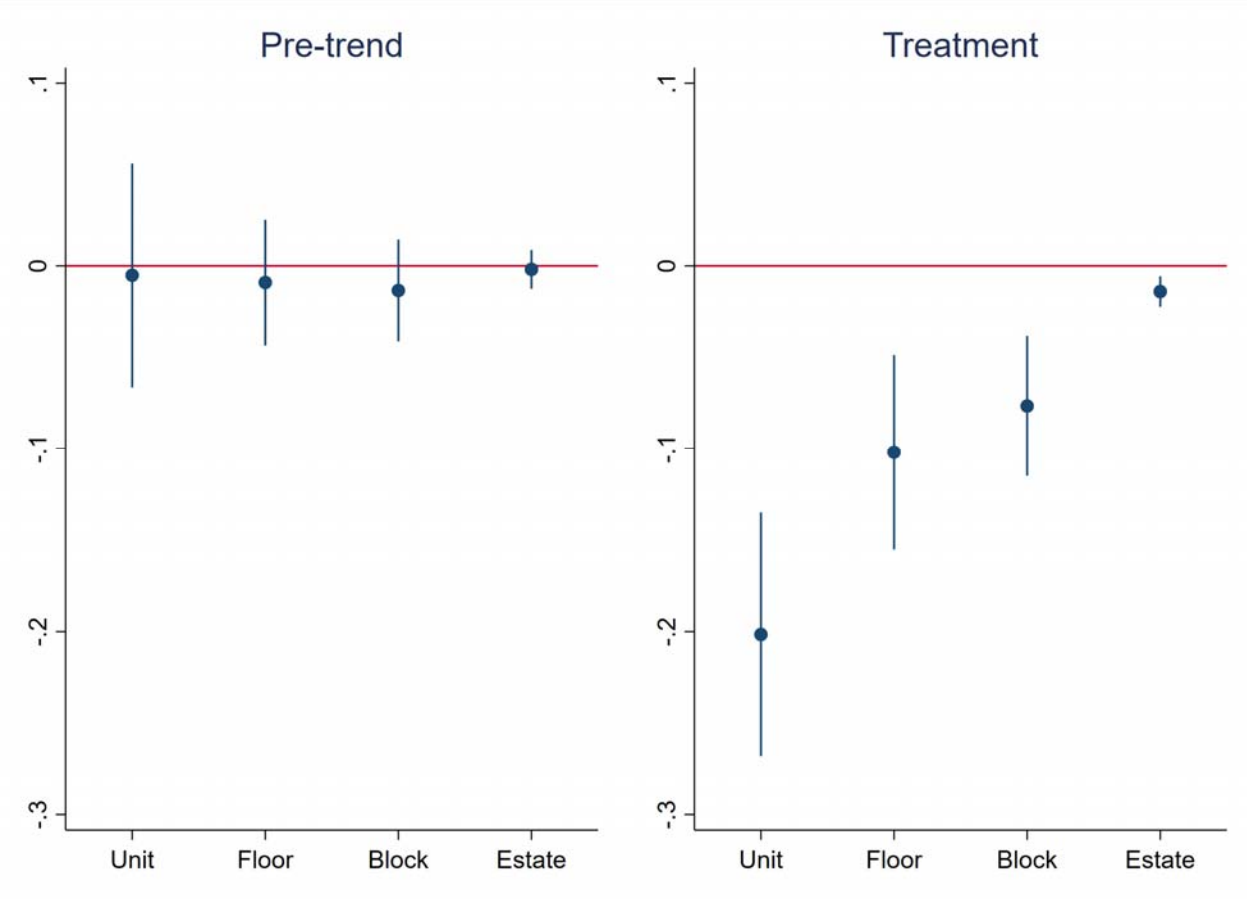
Appendix C3, Fraction of units with repeated sales 2000-2015

This figure shows the distribution of units on the number of times sold during the sample period from 2000 to 2015, i.e. for each unit, we count the number of times the unit is sold during the sample period, and plot the distribution.



Appendix C4, Pre-trends in house prices of haunted houses

This figure reports coefficients from an extension of Equation 1 to include pre-trends in house prices for haunted houses. To capture pre-trends we include indicators for units, floors, blocks and estates that are sold 3 years before the unnatural death. We refer to these coefficients as pre-trends and report the estimated coefficient and the corresponding standard errors in the left panel. The right panel plots the effect of haunted houses on prices after the unnatural death. We refer to these coefficients as treatment effects and plot the estimated coefficient and the corresponding standard errors.



Appendix C5: Clustering of standard errors at alternative levels

This table reports the spillovers in house prices with clustering of standard errors at alternative levels. The dependent variable is log. of the transaction price per square foot. *Haunted floor* is an indicator for units on the same floor as the haunted unit, but is set to zero for the haunted unit. *Haunted block* is an indicator for units on the same block as the haunted unit. It is set to the count of the number of haunted units in the block, but is set to zero for haunted units and all units on a haunted floor. *Haunted estate* is an indicator for units on the same estate as the haunted unit. It is set to the count of the number of haunted units in the estate, but is set to zero for haunted units, units on the haunted floor, and units on the haunted block. Standard errors are clustered at the unit level in Column 1, at the block level in Column 2, at the estate level in Column 3, at the block-year-month level in Column 4 and at the estate-year-month level in Column 5. All specifications include the following (unreported) time-variant house characteristics: *size*, *age*, *new unit* and *carpark* (see Table 4 for definitions). All specifications include unit fixed-effects. ***, ** and * indicate statistical significant at the 1, 5, and 10 percent level, respectively.

	(1)	**(2)**	**(3)**	**(4)**	**(5)**
Haunted unit	-0.1988***	-0.1988***	-0.1988***	-0.1988***	-0.1988***
	(0.0240)	(0.0254)	(0.0295)	(0.0182)	(0.0184)
Haunted floor	-0.0974***	-0.0974***	-0.0974***	-0.0974***	-0.0974***
	(0.0084)	(0.0167)	(0.0226)	(0.0073)	(0.0077)
Haunted block	-0.0707***	-0.0707***	-0.0707***	-0.0707***	-0.0707***
	(0.0017)	(0.0107)	(0.0166)	(0.0030)	(0.0036)
Haunted estate	-0.0139***	-0.0139***	-0.0139***	-0.0139***	-0.0139***
	(0.0003)	(0.0016)	(0.0039)	(0.0004)	(0.0007)
Control variables	Yes	Yes	Yes	Yes	Yes
Year-month fixed effects	Yes	Yes	Yes	Yes	Yes
Level for clustering of standard errors	Unit	Block	Estate	Block-year-month	Estate-year-month
Adj. R-squared	0.979	0.979	0.979	0. 979	0. 979
N	1,056,918	1,056,918	1,056,918	1,056,918	1,056,918