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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 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. 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

**Keywords:** Fire sales, Negative spillovers, Haunted houses

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## 1. 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 article 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 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 $km^2$ (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,

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.

2 In our sample, each estate has an average of twelve blocks, each block has an average of twenty-six floors, and each floor has an average of five 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

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 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 are 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 on the affected floor drop in price by 9.7%; the units on floors one to three floors above or below the affected floor drop in price by 8.9%; the units in 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.

Among 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

skill in the collection and passing on of information concerning the Property." The information that was not revealed was the tragic death of a four-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.

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 provide 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."

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 locations, 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 the spillover effect 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, Sarte, and Owens, 2010). The study that is closest to ours is Anenberg and Kung (2014), who decompose the

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%. 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=).

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 2 presents our data and explains the institutional setting surrounding residential real estate and haunted houses in Hong Kong. Section 3 presents the spillover results. Section 4 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 5 discusses some concerns like the external validity of our research. Section 6 concludes.

## 2. Data

### 2.1 Estates in Hong Kong

The residential real-estate market in Hong Kong consists of a private and 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 the pervasive construction of high-rise blocks, resulting in one of the world's highest population densities. In the most densely populated district, Kwun Tong, around 57,000 people live per square kilometer. Economies of scale, combined with the 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 centers, shuttle buses, swimming pools, and security. Each block typically consists of 20–80 floors sharing a lobby area, while each floor is subdivided into four to eight units with shared access to 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, 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 identify spillovers in prices convincingly.

In order 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. Online Appendix A1 shows a map of the eighteen districts. Online Appendix A2 zooms in on one estate, Dawning Views, in the North District of the New Territories. Online Appendix A3 shows a picture of the blocks of Dawning Views. Online Appendix A4 gives the estate layout of Dawning Views, while Online Appendix A5 shows the floor plan of floors 8–27 in Block 12 of Dawning Views, which have eight units per floor. Collectively, Online Appendices A1–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 are 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 feet (56.3 $m^2$), 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 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 from 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 five 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 large estates. Figure 1 shows that the market share of large estates has been almost constant over the sample period both in terms of the number of transactions and value of transactions. In comparison, large estates make up 57.3% 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 when 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.

Table I reports detailed descriptive statistics showing the difference between large and small estates. Panel A of Table I shows that units in large estates are slightly smaller (592 versus 628 square feet), younger (10.5 versus 19.7 years), sell at lower prices (3.84 versus 4.80 million HKD) and are cheaper (6,033 versus 6,467 HKD per square foot) compared with 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 I—and property prices in New Territories compared with 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 I, has an inverse U pattern in the period from 2000 to 2015 for both large and small estates. Panel D of Table I 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

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 and the price of the last transaction.

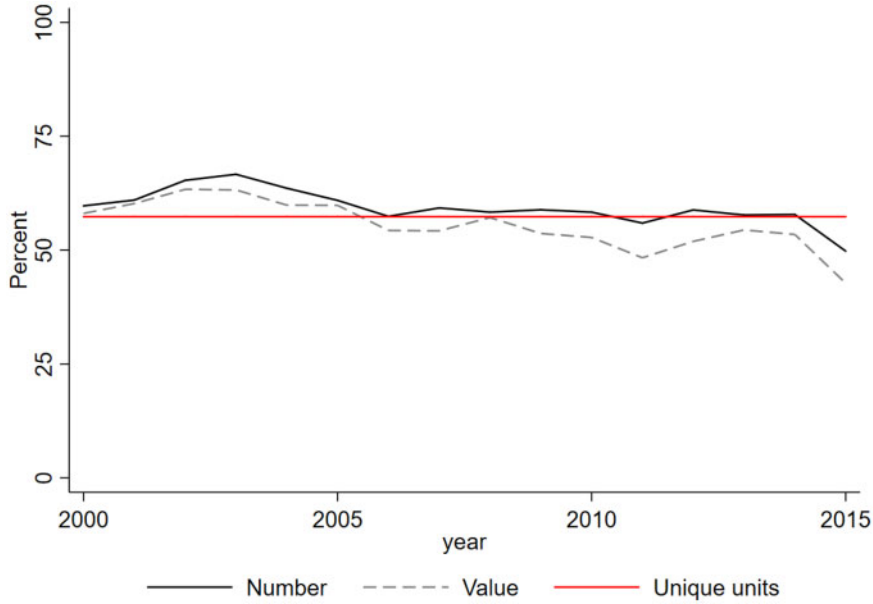


**Figure 1.** Market share of large estates. This figure shows the market share of large estates between 2000 and 2015. A large estate is defined as estates with 1,000 or more transactions over our sample period, equivalent to around five transactions per month. We calculate the market share in large 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.

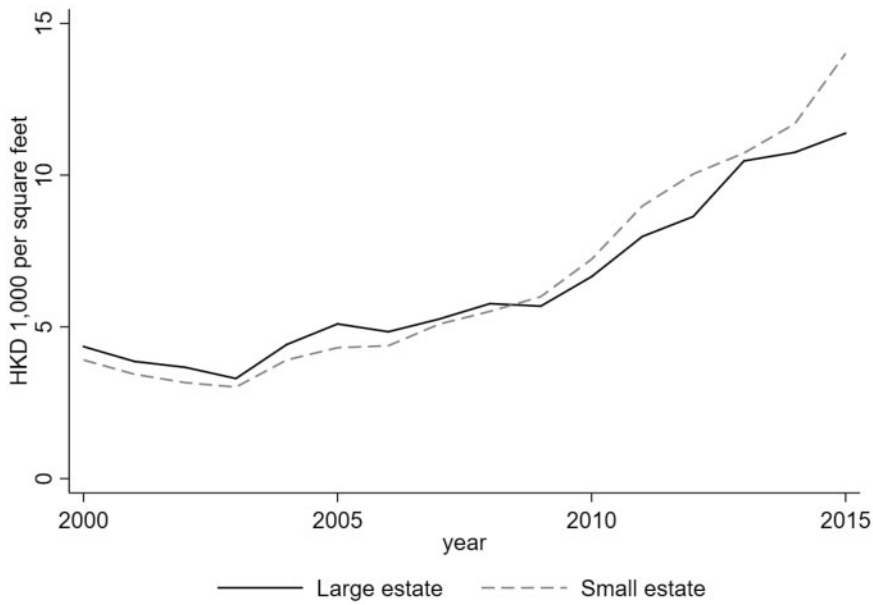


**Figure 2.** House price development, 2000–2015. This figure shows the average transaction price per square foot for large and small estates between 2000 and 2015. A large estate is defined as estates with 1,000 or more transactions over our sample period, equivalent to around five transactions per month.

**Table I.** 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 five 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–D report the distribution of transactions by territory (i.e., region), year, and quarter of year, respectively. *** denotes statistical significance at the 1% level.

| | All | Large estate | | Difference |
|---|---|---|---|---|
| | | Yes (1) | No (2) | (1)−(2) |
| A. Transaction characteristics | | | | |
| Price (million HKD) | 4.23 | 3.84 | 4.80 | 0.97*** |
| Size (square feet) | 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 | |

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).

### 2.2 Haunted Houses

A haunted house is a house where an unnatural death occurred. Unnatural deaths include accidents, murders, and suicides. To identify haunted houses, we rely on data from the Coroner's Court of Hong Kong, which details all unnatural deaths in Hong Kong. As current research focuses on 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 most extended and most detailed lists.[9] Online 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. Online 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 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

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.

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

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 II 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. Murders, on the other hand, account 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 II documents that in our sample most haunted houses are in New Territories. Panel C of Table II shows that the flow of haunted houses into our panel data set from 2000 to 2015 has no particular trend over the years. Finally, Panel D of Table II 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.

## 3. Spillover in Prices

Table III 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]

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).

11 Online Appendix Figure C1 reports the distribution of the price per square foot three years before and three 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, Online Appendix Figure C1 shows that our results are not driven by outliers. Online 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, and 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 carparks.

**Table II.** 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 distribution of unnatural deaths by cause. 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 death | | |
| Murder | 21 | 2.0 |
| Suicide | 910 | 88.2 |
| Accident | 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 III.** Difference-in-differences estimates of haunted house effects 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 for haunted units, units on the haunted floor (excluding the haunted unit), and 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% |

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-differences 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-differences 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-differences is −2%.

The ripple effect continues to be seen in Panel B (two years before to two years afterward). The difference-in-differences 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 afterward). The difference-in-differences is −18% for the unit, −6% for the floor, and −4% for the block. In addition, by comparing Panels A–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.

While Table III provides descriptive statistics that suggest that haunted houses have negative spillover effects on nearby houses, we caution against making strong conclusions based on the preliminary evidence. Table III 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 prices 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 III, which compares the average price 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, $\alpha_i$ captures unit fixed effects, $\beta_t$ 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

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 X. Thus, spillovers in prices are not an artifact of time trends in house prices.

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 implies 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 IV, we acknowledge that our empirical specifications cannot address concerns about differential selection into repeat sales for haunted and non-haunted houses.

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

The indicators in the vector $H_{it>k}$ are the following. "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 in 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 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 in the haunted block. "Same block, proximity to haunted floor (one to three floors)" is an indicator for units that are one to three floors above or below a haunted floor in a haunted block. "Same block, proximity to haunted floor (four–six floors)" is an indicator for units that are four–six 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.

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 is no more than one haunted unit per floor, there is 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 $\theta$ coefficients. A negative $\theta$ reveals the discount for being haunted, and if negative, the magnitude of $\theta$ 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, $\theta$, in a setting that compares the house price development of units that became haunted to the house price development of houses that are sold at the same time, but that did not become haunted.

Table IV, 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

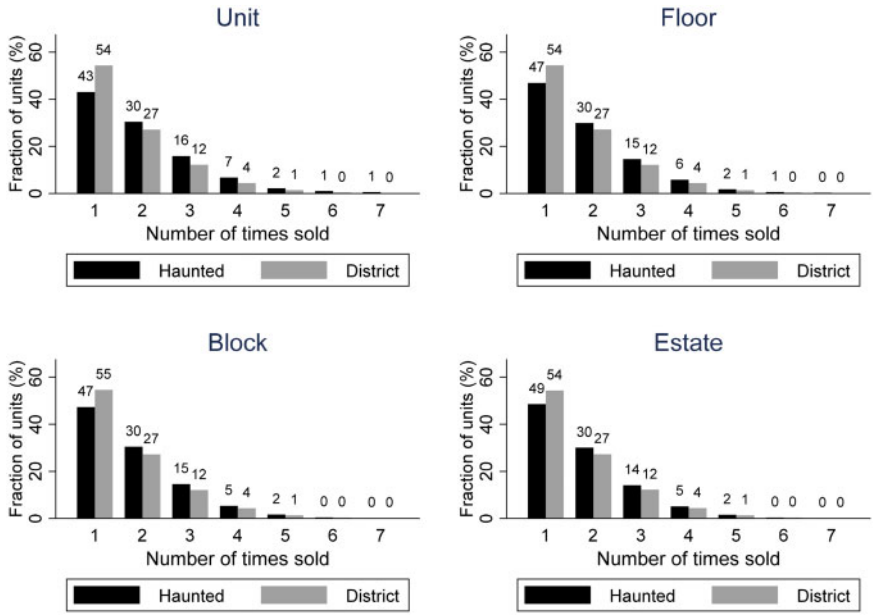


**Figure 3.** Fraction of units with repeated sales 2000–2015. This figure plots distributions of the number of times sold during the sample period from 2000 to 2015 for haunted units, haunted floors, haunted blocks, and haunted estates, and compares them to the distributions for units in the same district.

haunted; the units on 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 outward from the affected unit. This confirms the ripple effect documented in Table III.

To ensure that the estimated spillover effects do not pick up trends in house prices, we change the specification in Column (1) of Table IV to an event study by including pre-trend indicators for haunted units, floors, blocks, and estates that are sold in each of the three years before the unnatural death occurs as well as indicators for haunted units, floors, blocks, and estates that are 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 three years before the unnatural death, and include them in our main specification with indicators for transactions 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.

**Table IV.** Spillover effects of haunted houses on price

This table shows the spillover effect of haunted houses on transaction prices. The dependent variable is the log of transaction price per square foot. In Columns (1)–(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 in 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 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 in the haunted block. Same block, proximity to haunted floor (one–three floors) is an indicator for units that are one–three floors above or below a haunted floor in a haunted block. Same block, proximity to haunted floor (four–six floors) is an indicator for units that are four–six 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 transaction sequence fixed effects. Standard errors are clustered at the estate level, and reported in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% 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 (one–three floors) | | –0.0213** | | –0.0206** | | –0.0183 |
| | | (0.0095) | | (0.0095) | | (0.0136) |
| Same block, proximity to haunted floor (four–six 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) |

(continued)

**Table IV.** Continued

| Sample | All estates | | | | | New estates |
|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| 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 |
| Adjusted $R^2$ | 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 |

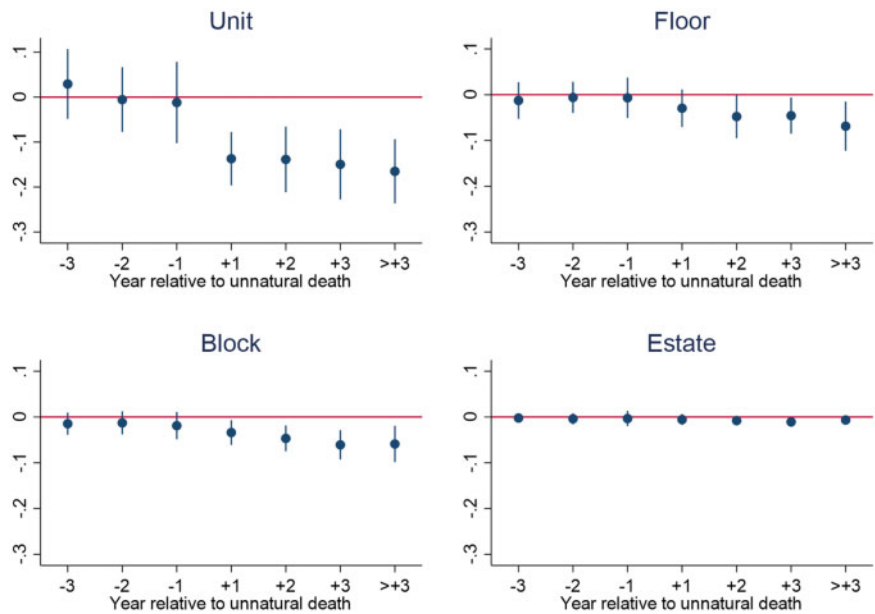


**Figure 4.** Pre-trends in house prices of haunted houses. This figure reports coefficients from an extension of Equation (1) to include pre-trends in house prices for haunted houses. To capture pre-trends, we include indicators for units, floors, blocks, and estates that are sold in years −3, −2, and −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 coefficients and the corresponding standard errors in four panels focusing on units, floors, blocks, and estates, respectively.

Column (2) shows an even more granular spiral effect. The haunted unit drops in price by 19.9% after it becomes haunted; the units on the affected floor drop in price by 9.7%; the units on floors one–three 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 neighbor 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 on the affected floor drop in price by 8.9%; the units on floors one–three 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 IV. These fixed effects control 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 artifact 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 IV 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, 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 X where we add high-dimensional location-time fixed effects.

The coefficients on *Age*, *New unit*, 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

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 sells at 6.5% (12.5%) higher prices compared with the first transaction of the same unit.

fixed effects takes care of all time-invariant unit characteristics. The year-month fixed effects control for all market-wide demand and supply shocks over time.

Although Table IV does show the ripple effect, it does not show whether the price drops are temporary or persistent. To understand this, we estimate the equation

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

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 when the unit becomes haunted, that is, 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 $\lambda$ coefficients. A positive $\lambda$ reveals that prices of discounted haunted houses recover over time, and if positive, the magnitude of $\lambda$ reveals the speed of recovery.

Table V 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 indicated by the difference-in-differences estimates documented in Table III. 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 VI. The numbers in Table VI come from the same estimation of Equation (1), except now the regressions are run for sub-samples related to the cause of death.

Table VI 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 VI]. Murder also has the most negative adverse effect on neighboring 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 on the affected floor drop in price by 19.2%, the units in the affected block drop

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

15 See media coverage in Reuters, June 28, 2018: "Spooked no more? Hong Kong's 'haunted apartment' prices levitate with white-hot market" (https://www.reuters.com/article/us-hongkong-property-haunted-insight/spooked-no-more-hong-kongs-haunted-apartment-prices-levitate-with-white-hot-market-idUSKBN1JO01O) and New York Times, November 16, 2016: "House-hunting in Hong Kong with the app that sees dead people" (https://www.nytimes.com/2016/11/24/world/asia/hong-kong-haunted-apartments-app.html).

**Table V.** Decay in spillover effects

This table estimates the decay in the spillover effect of haunted houses on transaction prices. The dependent variable is the 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 in 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 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 in the haunted block. Time is the difference between the transaction date and the date when 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 IV for definitions). All specifications include unit fixed effects and year-month fixed effects. Standard errors are clustered at the estate level, and reported in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% level, respectively.

| Sample | All estates (1) | New estates (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 |
| Adjusted $R^2$ | 0.979 | 0.983 |
| $N$ | 1,056,918 | 368,394 |

**Table VI.** 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 the log of transaction price per square foot. Column (1) replicates the baseline specification from Column (1) of Table IV, whereas Column (2) reports the results for the sample where murders are removed. Columns (3)–(5) report results conditional on the cause of death: Column (3) reports results for murders, Column (4) for suicides, and Column (5) for accidents and other causes of death. 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 in 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 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 in the haunted block. Control variables include: Size, Age, New unit, and Carpark (see Table IV for definitions). All specifications include unit fixed effects and year-month fixed effects. Standard errors are clustered at the estate level, and reported in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% 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 |
| Adjusted $R^2$ | 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 |

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 twenty-one murders.[16] Column (2) of Table VI shows that the ripple effect exists even if we drop murder from our sample. Columns (4) and (5) of Table VI show that price drops for suicides, accidents, and other types of unnatural deaths. These drops,

16 Gautier, Siegmann, and Van Vuuren (2009) and Klimova and Lee (2014) also show the effect of murder on nearby house prices. Our paper considers other unnatural deaths and further provides a decomposition of the supply shock effect and the demand shock effect in spillovers.

though statistically significant, diminish in magnitude as we move geographically outward from the affected unit. So, the ripple effect occurs for all types of unnatural deaths.

## 4. Disentangling Spillovers in Prices: Demand Shock versus 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 the 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 in the neighborhood revise their reservation prices downward 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, $P$:

$$D = H + k - cP, \tag{3}$$

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 an unnatural death.

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

$$S = F + j, \tag{4}$$

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 assumptions 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

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

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 the price of neighboring houses before and after a house becomes haunted, but the haunted house is not sold. Similarly, we can measure the spillover

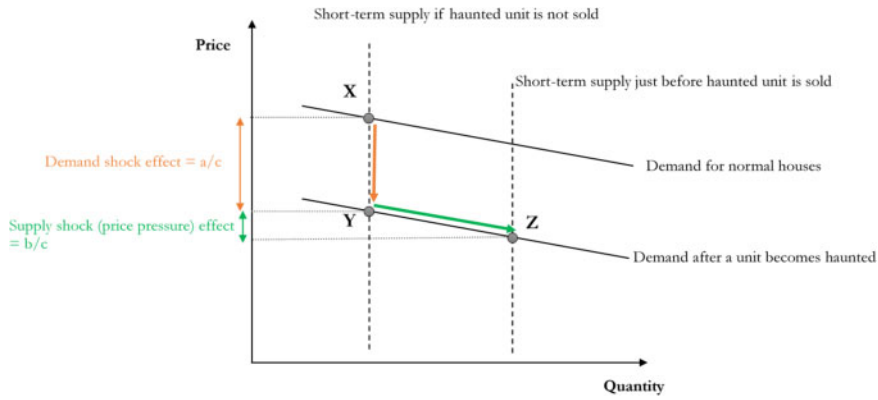


**Figure 5.** Disentangling spillovers in prices: demand shock effect versus supply shock (price pressure) effect. This figure illustrates the decomposition of the spillover in prices into the demand shock effect versus supply shock (price pressure) effect. Before a unit becomes haunted, the point *X* shows the price of its neighbor's house. The price of the neighbor's house drops to point *Y* when the unit becomes haunted, but is not sold. The price of the neighbor'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*–*Y*) and the effect from the supply shock (price pressure) caused because the haunted unit is sold at a fire sale price (*Y*–*Z*).

due to the "demand shock" plus the "supply shock"—$(a+b)/c$—because we can observe the effect on the 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 in 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 in 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, haunted blocks, or haunted estates.

Table VII 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 III, 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 III, the benchmark is the difference in the same district.

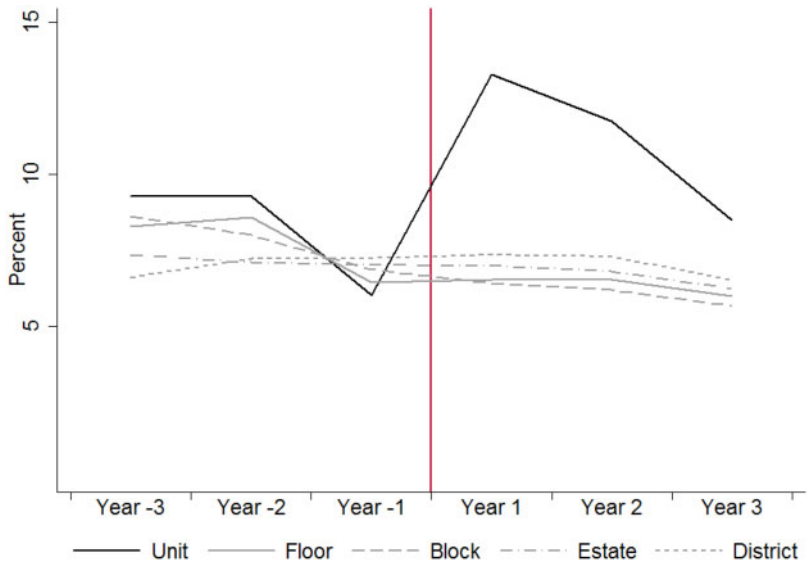


**Figure 6.** Effect of haunted houses on liquidity (measured as fraction of units sold per year). This figure shows the fraction of haunted units sold per year before and after being haunted, the fraction of units on the same floor as the haunted unit (excluding the haunted unit) that are sold per year before and after a unit is haunted, the fraction of units in 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 in 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.

Panel A in Table VII 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 on 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 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 corroborate this view: Half of the respondents are willing to live in a haunted unit if the price is

**Table VII.** Difference-in-differences estimates of haunted house effects 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 becomes haunted. Panel A shows the fraction of units sold one year before to one year after an unnatural death, whereas Panels B and C report the same for the period of two and three years before and after an unnatural 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 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% |

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 the equation

$$y_{it} = \alpha_i + \beta_t + \gamma' X_{it} + \theta H_{it>k} + \lambda^* \text{Haunted unit sold}_{it>k}{}^* H_{it>k} + \epsilon_{it}. \quad (6)$$

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 1 if an affected unit is sold after the unnatural death.[18] Equation (6) is estimated for the whole sample, as well as for three subsamples: if the unit is sold in the last year, in the last three years, and in the last five years, relative to the transaction date of a given unit, respectively.

The coefficients of interest in (6) are $\theta$ and $\lambda$. A negative $\theta$ reveals the immediate percentage drop in prices of neighboring houses that is due only to the "demand shock" caused by a change in perceived quality of the neighborhood. A negative $\lambda$ reveals the percentage drop in prices of neighboring houses that is due only to the "supply shock," which is the price pressure caused by the fire sale of the affected unit.

Table VIII 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% ($\theta$) after the floor becomes haunted. The coefficient of the interaction term between the indicator for the haunted house and the indicator for whether the affected unit is sold, $\lambda$, 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% ($\theta$), and a price gain of 1.4% ($\lambda$) if the affected unit is sold. This reveals that for the block the discount is also coming mainly from the demand shock caused by a perceived drop in quality of units on the affected block. The affected estate—here the affected block is excluded from the affected estate—sees an immediate price drop of 2.2% ($\theta$), and a price gain of 0.8% ($\lambda$) if the affected unit is sold. This reveals that for the estate the discount is also coming mainly from the demand shock caused by a perceived drop in quality of units on the affected estate.

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

17 See Squarefoot (2019) as well as their press release of the 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.

18 As Equation (6) is estimating whether spillover effects of haunted houses depend on whether the haunted unit is sold, the indicator for Haunted unit sold is always zero for units that are not haunted.

**Table VIII.** 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 the 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 in 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 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 in 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)–(4), we consider transactions of haunted units that occur in the last year, last three years and last five years relative to the transaction date of a given unit, respectively. Control variables include: Size, Age, New unit, and Carpark (see Table IV for definitions). All specifications include unit fixed effects and year-month fixed effects. Standard errors are clustered at the estate level and reported in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% level, respectively.

| | Anytime (1) | Last year (2) | Last three years (3) | Last five 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 |
| Adjusted $R^2$ | 0.979 | 0.979 | 0.979 | 0.979 |
| $N$ | 1,056,918 | 1,056,918 | 1,056,918 | 1,056,918 |

The results in Table VIII suggest that the "demand shock" is the main explanation for negative spillovers. That corroborates our findings from Table VII and Figures 6 and 7. In both Table VII and Figure 6, we only see 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 unit 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 Anenberg and Kung (2014). Anenberg

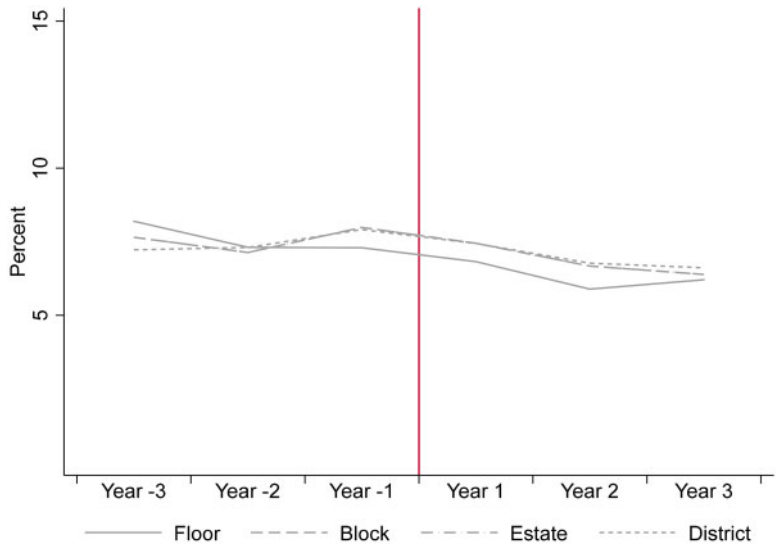


**Figure 7.** Market liquidity relative to the timing of sales of haunted units (measured as the fraction of units sold per year). This figure shows the fraction of units on the same floor as the haunted unit (excluding the haunted unit) that are sold per year before and after the haunted unit is sold (year 0), the fraction of units in 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 in 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.

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 impact on prices because the haunted unit appears on the transaction history of the estate.

## 5. 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 IV. The placebo sample (coded in a similar fashion as the treatment sample) includes 235 unnatural deaths that occur outside the residence of the deceased. We obtain information on these deaths from the Coroner's Court as they are not featured on the real-estate websites tracking haunted houses. The placebo sample consists 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 the placebo sample. Column (1) of Table IX gives the coefficients of the treatment sample. The signs and magnitudes of the $\theta$ coefficients are similar to the signs and magnitudes of the $\theta$ coefficients in Column (1) of Table IV. Thus, adding the indicators for the placebo effects to Equation (1) does not affect the estimated spillover effects. Column (2) of Table IX gives the coefficients of the placebo sample. The $\theta$ 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 by about 44,000 transactions in estates affected by murder. This ensures 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 IX 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 in 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 V, house price recovery is slow. Given this, it would seem that there is no point in 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 distaste for haunted houses. The few prospective buyers that do not themselves get disutility from 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 neighborhood, or a murder might reveal crime in the neighborhood. If 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 X reports the results, when we change Equation (1) to

$$y_{it} = \alpha_i + \beta_{jt} + \gamma' X_{it} + \theta' H_{it>k} + \epsilon_{it}. \tag{7}$$

**Table IX.** 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 the log of transaction price per square foot. Column (1) reports coefficients using the treatment sample of 1,032 unnatural deaths coded in a similar fashion as in the baseline specification of Column (1) of Table IV, whereas Column (2) reports coefficients from a placebo sample (coded in a similar fashion) of 235 unnatural deaths that by definition occur outside the deceased residence. The placebo sample consists 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 Columns (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 in 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 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 in the haunted block. Control variables include: Size, Age, New unit, and Carpark (see Table IV for definitions). All specifications include unit fixed effects and year-month fixed effects. Standard errors are clustered at the estate level, and reported in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% 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 | |
| Adjusted $R^2$ | 0.979 | | 0.979 | |
| $N$ | 1,056,918 | | 1,012,126 | |

Here $\alpha_i$ captures unit fixed effects, $\beta_{jt}$ 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 X reports our findings. Column (1) shows the results from the baseline specification in Column (1) of Table IV. We note that although the coefficients in Columns (2)–(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 control for the development in house prices at different locations over time. These high-dimensional fixed effects also address potential

**Table X.** 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 the 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 in 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 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 in the haunted block. Haunted unit sold takes the value 1 if the haunted unit is sold before a given transaction. In Column (1), we report the results from the main specification as in Column (1) of Table IV. 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 IV for definitions). All specifications include unit fixed effects. Standard errors are clustered at the estate level, and reported in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% 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 |
| Adjusted $R^2$ | 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 |

concerns about pre-trends in house prices due to geographic location, because the spillover effects in Table X 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% discount on haunted houses in Australia, UK, and USA in a sample of 101 newspaper articles from

Australia, UK, and USA. For example, New York Times (November 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% lower prices. In comparison, we find that the prices of affected units in Hong Kong decline by 20% following an unnatural death. Second, we note that the US 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 USA 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, Japan, UK, and the USA 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, UK, and the USA 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.

## 6. 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.

## Supplementary Material

Supplementary data are available at *Review of Finance* online.

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