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Murders, Externalities, and Market Efficiency – Empirical Evidence From Hong Kong

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Abstract

There are a lot of different factors affecting the market value of properties. However, to the best of my knowledge, there has been no study on the effect of brutal murders in apartments on their market values and the market values of nearby properties. This study attempts to examine the effects of murders on property prices of nearby units and how such effects change over time.

In a Chinese society, a murder is believed to have a bad influence on the *feng shui* of the property, and thus diminishes its market value. This effect will also spread to nearby properties, and thereby creates a negative externality. This external effect is likely to be much more noticeable in high development density areas such as Hong Kong, where residential units are predominately high-rise apartments.

Five murder cases that occurred in high density housing estates were chosen for analysis. The results showed that not only were the property values of the incident apartments negatively affected, but the negative impact also extended to nearby apartments. After the murder cases were revealed to the public, the price levels of all the units within the same building of the incident property declined. Moreover, this adverse effect is sometimes so strong that nearby buildings (within the same estate) were also affected. Furthermore, the magnitude of this negative effect is directly related to distance from the incident property. The effect diminishes as the

distance, both horizontal and vertical, increases.

The results also suggested that the negative impact of murder cases on the value of nearby properties does not seem to have declined over time. This implies that people have not 'forgotten' about these incidents. This seems to suggest that the real estate market is very efficient with respect to publicly available information.

Keywords

Hedonic price model, Hong Kong, market efficiency, murder, stigma effects.

Introduction

There have been very few studies on the effects of the market price intangible attributes of housing units. Unlike the structural, neighborhood, and environmental characteristics of housing units, the intangible housing attributes do not seem to give the tenant immediate tangible benefits (or cost) and yet, they have a significant influence on housing prices.

To the best of my knowledge, there have been no studies on the effect brutal murders in an apartment have on its market value, and the market value of nearby properties. This study attempts to examine the effects of murders on the property prices of nearby units and how such effects change over time.

It is a common belief amongst Chinese that the souls of people who died from unnatural deaths (e.g. murder) do not rest in peace. The more brutal the murder, the more restless the soul of the dead. The ghost of the dead will come back to visit the place they used to live. It will disturb and bring bad luck to the new occupants. This results in a stigma effect that has a negative impact on the market value of the property. All other things being equal, people would not choose to live in units where an unnatural death was known to have occurred in the past.

Hong Kong is densely populated. More than 99 % of its housing units are apartments in multi-storey buildings. This stigma effect arising from murder will affect nearby properties. Some people believe that the spirits of the murdered will disturb their neighbours as well. This means that a murder in a housing unit will result in a negative externality on the nearby properties. This externality is likely to

be more easily observed in high-density developments.

The study examines how a brutal murder in a housing unit affects its market value and the market value of nearby properties. Since the murder cases are reported in newspapers, they are known to the public. We will also examine how quickly the stigma effect due to murder is reflected in property prices and whether such a factor will be forgotten by the market.

Literature Review

There have been a lot of studies on the effects of the characteristics of a housing unit on it market value. The basic approach is to estimate a hedonic price model on the examination of the significance of the coefficients of the housing characteristics of interest. The hedonic price model has become a popular tool for studying the effects of the contribution of housing attributes on housing prices after a theoretical work by Rosen (1974). There are numerous examples of empirical studies utilizing hedonic price models. Examples of studies outside Asia, which involves estimation of hedonic price models to analyze the effects of locational, structural, and environmental attributes of a housing unit on its market value include Linneman (1980), Dubin et. al. (1990), Mok et al (1995), Evan(1973), Wolverton (1997) , Brotman (1990), Grether and Mieszkowski (1974), So et al (1997), Chau and Ng (1998), Darling (1973), Simons et. al. (1997), Nelson et. al. (1992), Blomquist (1974), Clark et al (1997), Correll et al (1978), Ridker and Henning (1967), Poon (1978), Gautrin (1975), DeVany (1976), Vandell and Zerbst (1984), Galster and Williams (1994), Li and Brown (1980), and Chau el.at. (2000). This list of examples is not meant to be comprehensive, but it does illustrate the nature of empirical studies on the pricing of various housing attributes that affect housing prices.

A list of this type of empirical study in Asian countries before mid-1997 can be found in Chau (1998). Most of these studies, and also studies done outside Asia, concentrated on the housing characteristics that brought tangible benefits or costs to the tenant, such as size, number of bathrooms, the presence of a pleasant view, accessibility, availability of facilities, and so on. There have been very few studies that have examined the effects of housing characteristics with no observable tangible effects on the tenant but nonetheless affects people's subjective valuation of

the property. The importance of the effects of culture and superstition on property values is recognized and discussed by Cadogan (1999).

The effects of intangible characteristics could be real of purely psychological. However, previous studies suggested that these intangible characteristics do have an impact on property prices. One example is the observation that ethnic Chinese seem to be willing to pay a premium for addresses with lucky numbers. An example is the work by Bourassa, and Peng (1999). Using housing transaction data in an area with a relatively high percentage of Chinese households in Auckland, New Zealand, they have found that people were willing to pay more for units in buildings with lucky numbers. They attributed this phenomenon to *Feng Shui*, but went on to explain the meaning of *Feng Shui.* In fact, there is often a misconception that *Feng Shui* is a purely superstitious belief. It is perhaps true that there is an element of superstition in *Feng Shui*. More systematic studies on *Feng Shui* in recent years suggest that there seems to be logic in *Feng Shui* that can be explained scientifically. Although there are many schools of thought, none of them suggest that what was considered lucky in Chinese (i.e. the number 8) has any positive impact on *Feng Shui*. What was referred to as *Feng Shui* by Bourassa and Peng was in fact no more than superstition.

Chau et al. (2001) put forward a different explanation for the lucky number premium. Using data from a homogeneous housing estate in Hong Kong, they showed that the premium for lucky floor units only exist during boom markets. The premium disappeared in property slumps. These results suggested that the attributed lucky number has similar characteristics to luxury goods, so its demand is very elastic. The reason why people are willing to pay a premium for a lucky number in the address is similar to people's willingness to bid for lucky car registration numbers, jewels, brand-name clothes, watches, etc. It is also a means to display one's wealth.

Methodology and data

For this study, we have chosen five brutal murder cases that occurred in apartments in private, high-density housing estates. All five cases were on the front page headlines of newspapers for several days and were the "talk of the town" for long

periods of time. We have chosen cases that occurred in housing estates so that we could assess the effect of these murder cases on not only the incident properties, but also on nearby units. A high-density development consists of a number of high-rise buildings closely situated within the boundary of a development site. The housing units within the same development are very homogenous. This means that the number of variables in the hedonic price model could be minimized.

The data used have been drawn from a database purchased from a value-added data provider. The database is comprised primarily of transaction records registered with the government during the period January 1992 through December 1999. In addition to the information registered with the Land Registry, the data provider adds other information such as the size of unit to the database. The data provider also provides to subscribers search routines in the package to facilitate information retrieval. The transaction records contain information on the physical characteristics of each transacted apartment, including its size (gross floor area), selling price, floor level, address, the date the building was completed, and the date of transaction (the date of the signing of the sales and purchase agreement).

In some of the cases, the view of a housing unit (such as a sea view) is an important factor affecting residential price, so it is included in our analysis. The information on views of individual apartment units is obtained from the master layout plan of the housing estates.

All transaction prices are deflated by the Residential Price Indices for estate type development. The indices are transaction-based constant quality monthly indices constructed by the Rating and Valuation Department of the HKSAR government. The indices are based on actual transaction prices per m^2 of saleable floor area of apartments in the major private housing estates in Hong Kong. Since these units vary in location, age, and design, the transaction prices cannot be used directly to construct a constant value index. The transaction prices are adjusted by a ratable value (or the assessed rent) index so that quality is kept constant. There are four sub-indices and one overall index for ratable values. The four sub-indices are defined according to the size of the units and location of the estate: large urban, small urban, large suburban, and small suburban.

For each murder case, a hedonic price model will be estimated using the data from

housing estates in which the incident property is located. Hedonic price models include all physical characteristics and distances (both vertical and horizontal) of the units from the incident property. Additional floor and building dummy variables (within which the incident property is located) may be needed to model the extra effects of the murder that are not adequately modeled by the 'distance variables'. A typical hedonic price model to be estimated for each murder case is:

$$RP = f(SIZE, AGE, FL, VIEW, BD, FLD, HD, VD, T) \qquad \text{Eqn (1)}$$

where *RP* is the transaction price deflated by the relevant price index, *SIZE* is the usable floor area in square feet, *AGE* is the age of the property at the time of transaction, *VIEW* is a view dummy (sea view or river view), *BD* is a dummy variable which equals one for the units located in the same building as the incident property and zero otherwise, *FLD* is a dummy variable which equals one for the units located on the same floor as the incident property and zero otherwise, *HD* is the horizontal distance from of the incident property measured in metres, *VD* is the vertical distance from the incident property measured in the number of floors, and *T* is a time dummy which equals one for transactions that took place after the incident date. Since the data set does not contain records prior to 1992, *T* will not appear in the hedonic price model for cases where the incident data is before 1992 (cases 1, 2, and 3).

To minimize the effect of heteroskedasticity, we have employed a semi-log model. The semi-log model is the most popular specification for the hedonic price models. Since the effects of the variables may not be linear (or log-linear in this case), the square terms of the quantitative variable are added to model the possibility of non-linearity. Therefore, the full specification of the general model to be estimated is:

$$\begin{aligned} RP = {} & a_0 + a_1\boldsymbol{SIZE} + a_2 SIZE^2 + a_3\boldsymbol{AGE} + a_4 AGE^2 + a_5\boldsymbol{FL} + a_6 FL^2 + a_7 VIEW + a_8 BD + \\ & a_9 FLD + a_{10}\boldsymbol{HD}\times T + a_{12} HD^2\times T + a_{13}\boldsymbol{VD}\times T + a_{14} VD^2\times T + \varepsilon \end{aligned} \qquad \text{Eqn (2)}$$

However, not all variables will be present in all hedonic price models. The basic variables that are expected to appear in all models are in bold. We hypothesized that the external effects created by the murder incidents will after nearby properties, and that the negative effects will diminish as the distance from the incident property

increases. The coefficients of HD and VD will be positive. The expected sign of the coefficients are shown in .

Furthermore, we also expect that the information on murder cases is quickly capitalized into the market value, and that prospective buyers are not ignorant of this public information. Therefore, the negative impact of murder incidents will not decline over time. This could be tested by added that involves a time variable, which measures the time from the incident date, and the incident related variables (i.e. FLD, BD, HD and VD). If these interaction terms are insignificant, the market is likely to be efficient with respect to the public information on the murder cases.

Table 1: expected signs of the coefficients

Variable	Expected sign
SIZE	**+ve**
$SIZE^2$	?
AGE	**+ve**
AGE^2	?
FL	**+ve**
FL^2	?
VIEW	+ve
$FLD \times T$	non+ve
$BD \times T$	non+ve
$\boldsymbol{HD} \times T$	**+ve**
$HD^2 \times T$	?
$\boldsymbol{VD} \times T$	**+ve**
$VD^2 \times T$	?

Brief Description of the Murder Cases and Summary Statistics

This section gives a brief description of the cases and descriptive statistics of the

data used for the estimation of the hedonic price models.

Case 1:

Location: A2, 26/F, Elizabeth House, Causeway Bay

Date: March 31, 1984

Two decomposed bodies were found in Flat A2, 26/F, in the Elizabeth House in Causeway Bay. Both bodies were determined to be that of two Singaporean Chinese brothers who were businessmen and heirs to a goldsmith business. They were believed to be victims of a kidnap/ransom plot.

The bodies were found in an 8-ft. long flower box on the windowsill of the apartment. The box had been sealed with cement, but that did not stop a foul odor from being emitted from the box. Neighbors next door noticed this odor, and notified police. It took firefighters several hours to break open the concrete to get to the bodies.

The flat was rented by an Indonesian Chinese man. Two other Chinese men were believed to share the flat with him. The Indonesian Chinese man was being sought for questioning. Police were also searching for another man who either followed or accompanied the brothers from Singapore to Hong Kong for questioning. They were arrested and convicted later.

Table 2: Descriptive Statistics of Quantitative Data - Elizabeth House

	Mean	Maximum	Minimum	Std. Dev.
RP	1,221,139	2,460,718	720,503	260,999
SIZE	688.91	1,410.00	623.00	97.91
AGE	16.24	21.08	12.47	2.59
FL	17.48	28.00	8.00	5.85
VD	2.35	19.00	0	4.87

Case 2:

Location: 312, Block D, Kornhill, Hong Kong

Date: January 4, 1988

Police arrested a 58-year old woman on April 1, 1988 in her Wan Chai home for the murder of her 57 or 58-year old businessman husband. The murder was believed to have occurred on February 21 or 22, 1988 in the husband's Kornhill flat.

The couple had fought over the sale of one of their flats and an extra-marital affair (by whom the papers did not say). The wife was said to have killed her husband after a struggle, then cut up his corpse, cooked the body parts, and disposed of them in the garbage. The dead body was never found.

The case came to light when the husband's 27-year old daughter, who had kept in touch with her father, noticed that he had not been answering her correspondence. She then enlisted the help of a lawyer to find her missing father, and this led to the wife.

The woman's 54-year old brother and two men in their twenties were charged with attempted robbery of the husband a day before the murder. None of the three was charged with his murder.

Table 3: Descriptive statistics of quantitative data - Kornhill

	Mean	Maximum	Minimum	Std. Dev.
RP	1,303,450	3,243,736	525,724	270,962
SIZE	733.9	1,236.0	312.0	112.0

AGE	8.8	13.7	3.0	2.4
FL	14	31	1	8
HD	120	240	0	68
VD	1	27	0	3

Case 3

Location: 24D, Block 6, Pierhead Garden, Tuen Mun, NT

Date: April 18, 1990

Three sisters, aged 6, 8, and 12, and their 35-year old father were killed in their Tuen Mun flat. The wounds were apparently inflicted by a knife.

The father's mother, who was not harmed, was admitted into Princess Margaret Hospital and was unable to describe what happened. The girls' mother discovered the carnage when she arrived home at 11:00 PM.

Money problems were believed to be linked to the murders. The family was under strain to repay its monthly mortgage of $8,500 on its three-bedroom flat in Pierhead (Hoi Tsui) Garden. Its monthly income was $13,000.

Table 4: Descriptive statistics of quantitative data - Pierhead Garden

	Mean	Maximum	Minimum	Std. Dev.
RP	1,567,138	2,469,821	1,061,236	238,400
SIZE	601.6	671.0	525.0	52
AGE	7.0	11.2	3.4	2
FL	17	32	1	9
HD	128	236	0	79
VD	1	20	0	4

Case 4

Location: B5, 16/F, Block 5, Plover Cove Garden, Tai Po, NT

Date: July 8, 1993

A woman's headless corpse was found in Tsuen Wan's Golden Hill Country Park. Her head and intestines were found nearby. The victim was determined to be a 32 or 33-year old woman who had been missing for four days. She opened a food shop in Plover Cove Garden Estate in Tai Po with her husband. The husband had a second wife, aged 46, who was charged with the younger woman's murder after a search of her flat in Block 5 of Plover Cove Garden.

Police found bloodstains in the flat, and scorch marks on the toilet. The latter was an indication of body parts or burned clothes being flushed down the toilet. Since no body parts were found in the sewers beneath the estate, the latter scenario was conjectured. Two choppers, a bottle, and a chair were confiscated.

A shop owner in the estate mall reported selling the older woman two pairs of plastic gloves, and noticed that her faced had been burned. The older woman's 11-year old granddaughter was also being detained, because she was believed to have assisted her grandmother in some way.

Table 5: Descriptive statistics of quantitative data - Plover Cove Garden

	Mean	Maximum	Minimum	Std. Dev.
RP	1,548,798	2,485,608	912,770	391,895
SIZE	439.7	563.0	354.0	95.2
AGE	5.5	9.5	1.8	2.0
FL	10.9	20.0	1.0	5.9
HD	51.5	105.6	0	29.5
VD	1.3	15.0	0	3.3

Case 5

5G, Block 17, Tsuen Wan Centre, Tsuen Wan, NT

September 24, 1996

A man killed his wife and three children, as well as two other tenants, by a combination of poison and gas, but failed to kill himself in their Tsuen Wan Centre flat.

All were immigrants from Fujian Province in China. Tsuen Wan is a popular destination in Hong Kong for Fujianese immigrants. The family had rented the 492-square foot flat for two years for $4,500 a month, but had fallen behind in the rent and maintenance fees.

The man was arrested as he recovered in the hospital. He was charged with murdering his two youngest children (the third one was an adult). But police classified the rest of the deaths as suicide.

Developed by SHK Development and completed between 1979 and 1981, Tsuen Wan Centre Estate comprised 19 33-story blocks which were worth $1.3 to $1.8 million in 1996. Flats usually rented for $5,000 to $7,000 a month.

Table 6: Descriptive statistics of quantitative data - Tsuen Wan Centre, NT

	Mean	Maximum	Minimum	Std. Dev.
RP	1,069,568	2,393,304	531,666	142,733
SIZE	361.7	770.0	151.0	45.3
AGE	14.7	20.0	9.4	2.3
FL	17.3	35.0	1.0	9.2
HD	75.5	164.0	0	41.7
VD	0.8	28.0	0	3.9

A summary of the five murder cases is shown in Table 5.

Table 5: Summary of the five murder cases

Case	**Brief Description of the Incidents**	**Locations and Addresses of the Apartments**	**Incident Times**
1	Two men were killed and their body was buried in the flower box on the windowsill of the apartment	A2, 27/F, Elizabeth House, Causeway Bay	31/3/1984
2	A wife killed her husband and cooked the dead body	312, Block D, Kornhill, Hong Kong	4/1/1988
3	A father and three daughters were knifed to death in their apartment.	24D, Block 6, Pierhead Garden, Tuen Mun, NT	18/4/1990
4	A person was killed and the dead body was deep-fried before being disposed of.	B5, 16/F, Block 5, Plover Cove Garden, Tai Po, NT	8/7/1993
5	A family of 6 all died except the household head who killed his children while his wife committed suicide.	5G, Block 17, Tsuen Wan Centre, Tsuen Wan, NT	24/9/1996

Empirical results

The results of estimating equation (2) are shown in Table 6 through Table 10. In all of the cases the coefficient was significant (at the 5 % level at least) and of the expected sign. The results confirm that the negative external effects created by the murder incidents extend to beyond the incident property. However, the effects decrease (some more rapidly then the others) as the distance from the incident property increases.

When the time from the date of the incident is interacted with the incident variable, all interaction terms turned out to be insignificant. This suggests that the market was efficient with respect to public information on the murder cases. Buyers remained aware of these incidents many years after their occurrence. In one case (the first case), the murder occurred in 1984, and the market still has not 'forgotten' about the case. Hence, the negative impacts on nearby properties have led them to be priced accordingly.

Table 6: Regression Results for Case 1 - Elizabeth House

Variable	Coefficient	t-Statistic	p-value
Intercept***	12.33373	90.43891	<0.01
SIZE***	0.003255	9.752350	<0.01
$SIZE^2$***	$-1.17x10^{-6}$	-6.018418	<0.01
AGE***	-0.010629	-5.287121	<0.01
FL***	0.004354	3.955921	<0.01
SV***	0.163193	14.56583	<0.01
BD**	-0.069564	-2.246043	0.025
VD**	0.014197	2.220898	0.027
VD^2**	-0.000714	-2.370899	0.018
Adjusted R^2	0.716811		
F-statistic	121.2322		
No of observations	381		

*** Significant at the 1% level, ** Significant at the 5% level, * Significant at the 10% level

Table 7: Regression Results for Case 2 - Kornhill

Variable	Coefficient	t-Statistic	p-value
Intercept***	12.30458	222.4713	<0.01
SIZE***	0.002121	16.02589	<0.01
$SIZE^2$***	$-4.59x10^{-7}$	-5.366781	<0.01
AGE***	0.088239	18.41957	<0.01
AGE^2***	-0.005411	-20.02336	<0.01
FL***	0.011492	16.76010	<0.01
FL^2***	-0.000178	-7.881985	<0.01
FLD***	-0.112709	-5.007596	<0.01
BD***	-0.066621	-5.420535	<0.01
HD***	0.000130	5.276658	<0.01
VD***	0.002673	3.175649	<0.01
Adjusted R^2	0.785384		
F-statistic	1378.064		
No of observations	3,764		

*** Significant at the 1% level, ** Significant at the 5% level, * Significant at the 10% level

Table 8: Regression Results for Case 3 - Pierhead Garden

Variable	Coefficient	t-Statistic	p-value
Intercept***	17.80163	51.60328	<0.01
SIZE***	-0.013907	-11.95902	<0.01
$SIZE^2$***	$1.34x10^{-5}$	13.61400	<0.01
AGE***	-0.068877	-8.381722	<0.01
AGE^2***	0.006240	10.76090	<0.01
FL***	0.007949	6.192720	<0.01
FL^2***	-0.000124	-3.497183	<0.01
SV***	0.074412	15.37847	<0.01
FLD***	-0.117328	-3.360276	<0.01
BD*	-0.043229	-1.909720	0.0564
HD***	0.000598	-2.794538	<0.01
HD^2***	$-2.22\ x10^{-6}$	3.062994	<0.01
VD**	0.009487	2.258506	0.0241
VD^2**	-0.000484	-2.390465	0.0170
Adjusted R^2	0.669458		
F-statistic	198.2364		
No of observations	1,267		

*** Significant at the 1% level, ** Significant at the 5% level, * Significant at the 10% level

Table 9: Regression Results for Case 4 - Plover Cove Garden

Variable	Coefficient	t-Statistic	p-value
Intercept***	12.72306	68.88635	<0.01
SIZE***	0.004825	5.651247	<0.01
$SIZE^2$***	$-2.64x10^{-6}$	-2.798682	<0.01
AGE***	-0.052881	-5.860779	<0.01
AGE^2***	0.002848	3.637108	<0.01
FL***	0.014046	6.583429	<0.01
FL^2***	-0.000356	-3.709761	<0.01
RV	0.007452	1.337981	0.1814
AD*FLD**	-0.078539	-2.379223	0.0176
AD*BD***	-0.076483	-3.473715	<0.01
AD*HD**	0.000264	2.170800	0.0303
AD*VD**	0.015421	2.179892	0.0296
AD* VD^2**	-0.001074	-2.393581	0.0170
Adjusted R^2	0.915561		
F-statistic	625.3673		
No of observations	692		

*** Significant at the 1% level, ** Significant at the 5% level, * Significant at the 10% level

Table 10: Regression Results for Case 5 - Tsuen Wan Centre

Variable	Coefficient	t-Statistic	p-value
Intercept***	13.17098	835.8747	<0.01
SIZE***	0.001944	55.23364	<0.01
AGE***	-0.004866	-6.905463	<0.01
FL***	0.005330	7.706735	<0.01
FL^2***	-7.41×10^{-5}	-3.824684	<0.01
AD*HD***	0.000238	6.466983	<0.01
AD* VD***	0.001506	3.236581	<0.01
Adjusted R^2	0.504618		
F-statistic	680.4352		
No of observations	4,003		

*** Significant at the 1% level, ** Significant at the 5% level, * Significant at the 10% level

Conclusion

The studies examined the stigma effects of murder in housing units. While one cannot give a scientific explanation as to why a murder in a property would have a negative impact on the incident property and nearby properties, our initial conjecture was based on culture and superstitious beliefs.

The negative effects are perhaps self-filling as a risk-averse buyer would choose not to buy a unit that is potentially haunted, and might have a negative influence on his/her day to day life, when there are other choices in the market. Even though there are people with a strong belief that the negative impact of murders is not real and hypothetical, knowing that a large group of potential buyers might think the other way will probably lead them to bargain for a discount, which affects the resale value of the property.

This effect is further perpetuated with the bank's mortgage policy. The banks, being risk averse, are not willing to lend money to buyers to buy units where murder cases occurred previously. Although we don't have solid evidence, it is common

knowledge that most banks have kept database of blacklisted "risky properties," which includes units where unnatural deaths occurred. Applications for mortgage loans for these risky properties are considered with extra caution.

The empirical data in this study suggests that the negative effects of murder are not localized in the incident property. The murders create negative external effects and exert pressure on the market values of nearby properties. However, the negative impact is diminished as the distance from the incident property increases. From a practical point of view, valuation of properties should take this negative effect into consideration.

We have also shown that the negative impacts of murder are capitalized into the values of the affected property quickly, and that negative effects do not diminish over time.

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