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RESEARCH ARTICLE

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Economic sustainability of heritage conservation in Hong Kong: The impact of heritage buildings on adjacent property prices

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Abstract

Informed by the theoretical framework of sustainable development and economic theories including the cluster theory and the corollary of the Coase Theorem, this paper empirically investigates the economic impact of architectural heritage in Hong Kong. Using the hedonic price model, the research examines the economic impact of 50 publicly owned versus 50 privately owned heritage buildings on adjacent residential property prices with a sample size of over 43,240 property transaction records spanning a time period of 10 years. The research supports that heritage conservation can promote economic sustainability aside from cultural sustainability and social engagement. This research benefits government policymakers, urban planners, architects, and heritage conservationists by contributing new knowledge to the studies on sustainable urban development, heritage conservation, and cultural economics.

KEYWORDS

architecture, economic impact, environmental policy, hedonic price model, heritage conservation, stakeholder engagement, sustainable development

1 | INTRODUCTION

Although there is a growing global interest in conserving built heritage (Coulson & Leichenko, 2001; Go & Lai, 2019; Listokin, Listokin, & Lahr, 1998), much heritage research and many paradigms are still predominantly based in the western context (Aygen, 2013). With an increase in demand for sustainable development in Asian cities, this paper presents the findings of the evaluation of the economic impact of heritage conservation in Hong Kong, one of the highest density metropolitan cities in Asia. Using hedonic price model, the study examines the economic impact of heritage buildings on adjacent residential property prices. The research examines a sample of over 43,240 property transaction records of 50 publicly owned versus 50 privately owned heritage buildings to investigate and compare the economic impact and other positive externalities of cultural heritage. This paper also discusses other architectural, social, and environmental values of heritage conservation towards sustainable development. The research will add knowledge to the studies on sustainable urban development, heritage conservation, and cultural economics.

The paper will be organized into several sections. First, section 2 will present a brief history of various mainstream heritage practices. Section 3 covers various theories related to sustainable development and heritage conservation. Section 4 outlines the data collection process and the baseline hedonic price model estimated in this research. The regression results of the baseline model will be presented and discussed in the next section. After that, the paper will examine the economic effect of heritage sites cluster and the effectiveness of the heritage grading system, as well as the impact of state ownership, in section 6. Finally, a conclusion will be given by summarizing the implications of this study.

2 | BACKGROUND

2.1 | The heritage conservation and cultural values

As part of the 2030 Sustainable Development Goals of the United Nations Educational, Scientific and Cultural Organization, heritage conservation is now placed on the agenda for sustainable development, and its contribution across the three pillars of sustainable development — economic, social, and environmental is widely recognized. Under the United Nations Educational, Scientific and Cultural Organization, both movable or immovable architecture of great cultural heritage value has gained wider recognition in the world (O'Keefe, 1999). Hong Kong, one of Asia's most urbanized cities, had been under the British colonial rule since 1841, and the city was handed back to China in 1997. Therefore, the city has been under the strong influence from both Chinese and Western cultures, its hybrid culture has been manifested in the making of the city's unique urban fabric and built heritage. In Hong Kong, the intangible heritage values lie in the unique confluence of Chinese and Western architectural styles of buildings. This paper identifies an under-researched area by examining the economic sustainability of architectural heritage. It focuses on the economic value of heritage conservation and demonstrates the effectiveness of the current grading system in the overall sustainable development of the city.

2.2 | Research objectives and hypotheses

There are three main objectives of this research study. First, it examines what are the major attributes for the economic impact on property prices. Second, it studies the relationship between the external economic impact and the heritage grading system. Third, it aims to prove that publicly owned heritage buildings have a higher economic sustainability factor compared with those privately owned. It is hypothesized that the private owners and the government have their own respective motives in heritage conservation, which would yield different economic impacts on the overall sustainability of the city (Jansson & Biel, 2011). Private owners would have a stronger incentive to make use of the heritage sites to maximize its potential long-term business returns and would only be willing to invest resources and capital in conservation or revitalization of built heritage for their direct commercial benefits. It has been criticized that some private companies' sustainable development agendas are sometimes ineffective and lack overall strategic thinking (Pinelli & Maiolini, 2017). In contrast, the government has a more genuine intention in preserving the built heritage for the overall sustainability of the community. Compared with the private owners, the government would be more willing to plough in resources for the long-term welfare of the society, such as providing public facilities and improving the overall neighbourhood of the heritage sites. As a result, four specific hypotheses are identified as follows:

- H1: Neighbouring properties should experience a positive price effect after the confirmation of heritage grading;
- H2: Properties neighbouring an ensemble of heritage sites should experience higher positive price effect due to the cluster effect;
- H3: Properties neighbouring to heritage with higher grading should experience higher positive price effect;
- H4: Properties neighbouring to publicly owned heritage should experience higher positive price effect when compared with those located next to privately owned heritage.

This research, which examines the economic impact of heritage conservation, is significant for the contemporary society because it has been identified that the question of how heritage conservation can contribute to urban sustainability is of importance as the discourse on heritage practices are under debate (Heritage, 2000; Strange & Whitney, 2003). Some argue that heritage conservation needs to reposition its purposes and roles if it is to maintain its place in the urban planning system (Townshend & Pendlebury, 1999). This research offers new knowledge to the discussion of economic sustainability of heritage conservation by providing a quantitative study to measure its economic impact, so future government policymakers, property developers, and conservationists can have a more in-depth insight into the economic value of cultural heritage in high-density urban settings.

3 | LITERATURE REVIEW AND RESEARCH FRAMEWORK

3.1 | Cluster theory

A vast amount of literature on sustainable development is focused on environmental sustainability (Darko & Chan, 2017) and cultural sustainability (Hristova, 2019) or examines the issue from a policy approach (J. Hou & Chan, 2017), whereas studies that specifically assess economic sustainability are mainly from an urban renewal perspective (Chan & Lee, 2008). Other literature on built heritage conservation focuses on the positive attributes associated with environmental sustainability include minimizing wastes in reusing old buildings, savings on construction time, resources and labour, as well as benefits from extended building life cycle (Iyer-Raniga & Wong, 2012). Heritage conservationists advocate not only benefits to the physical built forms as a result of conservation, but also other benefits associated with social and cultural sustainability. In particular, most of the heritage research focuses on non-economic values of heritage conservation such as cultural, aesthetic, historical, social, or spiritual values. The heritage research that analyzed the issue from an economic perspective included how heritage conservation can contribute to sustainable tourism (Timur & Getz, 2009), or how conservation can catalyze sustainable development in the rehabilitation of historic districts (Yung, Chan, & Xu, 2014).

On the other hand, the Burra Charter (2013) establishes the concepts of cultural significance by recognizing the aesthetic, historical, and social values of places. Although these values are not easily quantifiable, built heritage is crucial in framing the intrinsic cultural sustainability of a city. In particular, older buildings possess unique characteristics that can reflect the significant culture of a society and its history. Demolition of these buildings means a loss to such historical association; hence, the loss of the senses of place. Therefore, aside from giving a new life to the physical building envelope, heritage conservation brings about sustainability in the overall sense of place (Lowenthal & Binney, 1981; McKercher & Du Cros, 2002; Rossi & Eisenman, 1982). The community gains not only aesthetic and artistic significance of its architecture by recognizing its cultural symbols but also acquires a better sense of belonging and ownership as a result of the heritage designation (Stubbs, 2004).

This research demonstrates that an ensemble of heritage sites in an area creates a cluster effect as such groupings can generate more beneficial externalities and positive impulses for local and regional development. It aims to prove that particular districts in Hong Kong where there are high geographic amalgamations of graded heritage buildings, these heritage sites in clusters can achieve more sustainable positive externalities and generate greater economic impact on adjacent property prices. Overall, the cluster phenomenon can be interpreted as largely due to the fact that clustering can foster the emergence of diverse complementary businesses and activities in the areas. It refers to Marshall's cluster theory (1890) which explains how competitions can lead to innovation and striving for uniqueness and high quality as well as cooperation in the promotion of a culturally valuable and sustainable urban landscape (Kuah, 2002; Morosini, 2004).

Cluster theory has been applied to explain many cultural heritage phenomena. For instance, Alberti and Giusti's research (2012) on cultural heritage, tourism, and regional competitiveness uses a case study of the Motor Valley cluster around the Italian City, Modena, to demonstrate the formation and development of regional identity and heritage on the motor industry since 1800. Their study shows how a new form of cluster is formed and sustained by major firms in the related industries, artisans, tourism organizations, facilities, institutions, as well as tangible and intangible cultural heritage (Alberti & Giusti, 2012). All the corporates, industry museums, private collections, archives, expertise, and practices have become the beneficiaries tied together in a self-reinforcing mechanism of competitiveness. Moreover, such cluster is further sustained by the increase in tourism flows, employment, and business activities. On the other hand, Murzyn-Kupisz (2013) investigates the socio-economic impact of built heritage projects conducted by private investors. The study shows that there is a strong and positive socio-economic influence on local and regional development processes when a cluster of similar projects develops within a small area that is richly endowed with a specific type of heritage (Murzyn-Kupisz, 2013). The cluster analysis confirms that when a spatially concentrated group of individuals and private firms are attracted to an area, the social-economic landscape within the built heritage environment can be enhanced in accordance with the cluster theory.

A third example using cluster theory in heritage study is Pessoa's "The cluster policy paradox: externalities vs. comparative advantages" (2011), where cluster theory is applied to explain the several advantages of industrial agglomerations. As a result of clustering, many companies have been benefited from a surge of innovation and production activities by having neighbouring companies that are of similar nature or related industries (Pessoa, 2011). Pessoa's paper echoes with Marshall and Porter's argument that clustering generates more positive externalities in the optimization of benefits (Swords, 2013).

3.2 | Cultural heritage and economic impact

Aside from clustering, the paper pinpoints the significant difference between the economic impacts of privately owned heritage and publicly owned heritage on nearby residential property prices. Leichenko, Coulson, and Listokin (2001) illustrated that the impact of historic preservation in US cities has a huge differentiation between nationally and locally designated historic properties. Their study, which investigated the effects of private historic designation on residential property values, suggested that historic preservation generally has a positive impact on surrounding property values (Leichenko et al., 2001). All other things being equal, nationally or state-designated properties are more likely to have higher values than properties with local designation only. Such difference can be explained to some extent as nationally or state-designated properties have distinct advantages by having more available information in the state-run registry and better coordination with the presence of state involvement. R. Ball (1999, 2002) suggested that critical components such as collaboration between private and public sectors, and stakeholder engagement from specialist firms and local authorities, are essential to contribute to the sustainability of adaptive reuse projects. Proactive private initiatives and public support are both critical in influencing the real estate community to adapt obsolete buildings for economically viable new uses. His studies have shed light on the research in defining the external impact of private versus public heritage, but the result was inconclusive.

This research echoes the Fourth Coase Theorem by Lai and Lorne (2015), which advocates that the state can be a significant party to a Coasian solution. The main idea holds that state rules can enlarge an existing market or industry. The theorem is readily applicable to explain the market of heritage conservation where public heritage under state planning has more support in information and innovation so that it can generate a more economically sustainable condition to the neighbourhood (Go & Lai, 2019).

4 | DATA AND METHODOLOGY

4.1 | Baseline hedonic pricing model

Using the hedonic price model, the economic impact of heritage conservation on adjacent residential property prices is explained by examining over 43,240 transaction records of private residential property prices within 100 m radius of selected heritage sites, spanning a period of 10 years. A log-linear model, Model 1, which allows nonlinearity is chosen as below:

$$\begin{aligned} Ln(RP) = {} & c + \beta_1(SFA) + \beta_2\left(SFA^2\right) + \beta_3(FL) + \beta_4\left(FL^2\right) \\ & + \beta_5(AGE) + \beta_6\left(AGE^2\right) + \beta_7(SV) + \beta_8(MTR) + \beta_9(COMP) \\ & + \beta_{10}(DIST) + \beta_{11}(COMP^*DIST) + \beta_{12\ldots37}(DISTRICT) + \varepsilon \end{aligned} \tag{1}$$

where RP is the real transaction price of property measured in HKD millions, which is deflated by the corresponding residential price index published by the Rating and Valuation Department, HKSAR; SFA is the saleable floor area measured in ft^2; FL is the floor level; AGE is the building age measured in years, which is the difference in time between the property completion date and its transaction date; Mass Transit Railway (MTR) is the distance of the property to the nearest MTR station measured in metres; SV is a dummy variable taking the value of one if sea view is available and zero otherwise; COMP is a dummy variable taking the value of one if the building is transacted after the heritage grading being confirmed and zero otherwise; DIST is the distance of the residential property to the heritage building measured in metres; DISTRICT is a dummy variable to identify heritage buildings locating in the same district for the study of cluster effect; ε is an idiosyncratic error term; and $\beta_{1\ldots37}$ are parameters to be estimated.

At the same time, the COMP variable is interacted with the DIST variable as a spatial component to measure the distance decay of property price effect after the confirmation of heritage grading. The quadratic forms of SFA, AGE, and FL are also included to identify the nonlinear effect of structural characteristics. Table 1 shows a summary of the variables included in the baseline model.

4.2 | Data collection and sample size

Over 43,240 residential property transaction records are extracted from the Economic Property Research Center (EPRC) database (2018), and this dataset is used as the primary source for the analysis. The Economic Property Research database has comprehensive coverage of registered transaction records in Hong Kong; thus, it is reputable among the industries with its data being adopted and utilized by banks, surveying consultant firms, and real estate agency companies. From the database, information on the addresses of the properties, their transaction prices, and various structural characteristics, such as gross and saleable floor area in ft^2, floor level, year of completion, are obtained. For each property, its distance to the nearest heritage site and to the closest MTR station is calculated using GeoInfo Map. Meanwhile, transaction records with missing information are verified by Centadata, which is provided by professional real estate agencies. Table 2 shows the descriptive statistics of the variables included in our model. The target group is defined as the private apartment units that are within 100 m radius distance to the selected historic buildings and being transacted over a 10-year span, that is, 5 years before to 5 years after the heritage grading has been confirmed. The radius has been set as 100 m to avoid geographic distortion due to terrain changes, and such arrangement is comparable with similar research (van Duijn, Rouwendal, & Boersema, 2016). Meanwhile, this study examines a total of 100 heritage sites specifically selected in the urban areas of Hong Kong, of which 50 are publicly owned, and another 50 are privately-owned. The reasons behind the selection of these particular sites are (a) to exclude distant village heritage with little residential neighbourhood around, or ancient heritage sites which are located at remote areas without road access, and residential properties are scarce nearby so that the study can have sufficient data to show the impact; (b) these 50 private and 50 public heritage sites are situated in urban areas where property transactions are readily available to public access; and (c) the selections are relatively even distributed in all districts to ensure that there is no location bias in this study.

TABLE 1 The baseline model and its variables

Model	$Ln(RP) = c+\beta_1(SFA)+\beta_2(SFA^2)+\beta_3(FL)+\beta_4(FL^2)+\beta_5(AGE)+\beta_6(AGE^2)+\beta_7(SV)+\beta_8(MTR)+\beta_9(COMP)+\beta_{10}(DIST)+\beta_{11}(COMP * DIST)++\beta_{12\ldots37}(DISTRICT)+\varepsilon$; in which,
1	Ln (RP) = Natural log of real transaction price of property measured in HKD millions, which is deflated by the corresponding residential price index published by the Rating and Valuation Department, HKSAR
2	SFA = Saleable floor area measured in ft^2 (+)
3	SFA^2 = Quadratic form of SFA to determine the non-linear effect of saleable floor area (−)
4	FL = Floor level (+)
5	FL^2 = Quadratic form of FL to determine the nonlinear effect of floor level (−)
6	AGE = Building age measured in years, which is the difference in time between the property completion date and its transaction date (−)
7	AGE^2 = Quadratic form of AGE to determine the nonlinear effect of AGE (+)
8	SV = Sea view; dummy variable taking 1 if the property can enjoy sea view and 0 otherwise (+)
9	MTR = Distance to the nearest MTR station measured in m (−)
10	COMP = Dummy variable taking 1 if the property is transacted after the confirmation of heritage grading and 0 otherwise (+)
11	DIST = Distance to heritage buildings measured in m (−)
12	COMP*DIST = Interactive variable between variables COMP and DIST to identify the distance decay of property price effect after the confirmation of heritage grading (−)
13	DISTRICT = Dummy variable classifying heritage buildings by their district (total 26 subgroups)
14	ε = Idiosyncratic error term
15	$\beta_{1\ldots37}$ = Parameters to be estimated

Note. Expected effect (+/−) of each variable on the housing price is reported between parentheses. The effect of the dummy variable DISTRICT on housing price is varied from place to place, the actual effect is an empirical question.

5 | REGRESSION RESULTS OF THE BASELINE MODEL

5.1 | Interpretation of research results

In this section, the regression results of the baseline model will be discussed to explain the economic effect of heritage on residential properties within 100 m distance.

TABLE 2 Descriptive statistics of 100 heritage buildings (*N* = 43,241) of the baseline model

Independent variable	Mean	*SD*	Min.	Max.
Structural characteristics				
Deflated transaction price RP (in HK$ million)	10.21298	14.86808	0.001571	1113.286
Saleable floor area SFA (in ft^2)	541.3763	326.1484	83	2999
Squared saleable floor area SFA^2	399458.7	647849	6889	8994001
Building age AGE	24.95317	14.15928	0.002738	68.93908
Squared building age AGE^2	823.1412	750.5579	7.50e-06	4752.597
Floor level FL	12.58336	10.50376	1	63
Squared floor level FL^2	268.6673	460.2174	1	3969
Locational characteristics				
Sea view SV (1 = yes)	0.183298	0.386915	0	1
Distance to the nearest MTR station MTR (in m)	360.8528	327.8432	6	2000
Distance to heritage buildings DIST (in m)	73.17424	21.96781	7.6	100
Transaction Period				
After confirmation of heritage grading COMP (1 = yes)	0.35168	0.4775	0	1

Abbreviations: MTR, Mass Transit Railway; *SD*, standard deviation.

Table 3 shows the regression results of the baseline model. After excluding duplicated records and those with missing values, a sample of 43,241 transaction records is examined. The adjusted R^2 is above 0.77, suggesting that the model has a satisfactory performance in predicting the natural log of the deflated transaction price. Furthermore, its F-statistic is significant, which rejects the null hypothesis that all coefficients in the model are zero; thus, the model is useful for the explanation.

The coefficients of the structural characteristics' variables, as well as their quadratic forms, are significantly different from zero at the 5% significance level. The results indicate that with 1 ft^2 increase in SFA, the natural log of property price will be 0.17% higher, whereas it will be increased by 0.42% if the property is 1 floor higher. At the same time, if the building is 1 year older, the dependent variable will drop by 1.84%. Furthermore, the natural log of the price of the property with sea view will have a premium of 0.81% compared with those without sea view. These suggest that large saleable floor area, high floor level, and the provision of sea view contribute significantly to an apartment's attractiveness, whereas the increase in building age has a price-depreciating effect, which is in line with the findings of previous studies (Chau & Chin, 2003; Jim & Chen, 2009).

On the other hand, accessibility is the ease for residents to travel from one place to another and has a certain influence on the price of properties. Hui, Chau, Pun, and Law (2007) stated that there is a 0.8% drop in the sale price for every minute increase in the time for a resident to travel from his or her apartment to Central Business District, whereas they find the accessibility to railway station has no impact on resident price. Conversely, Table 3 shows that there will be a discount of 0.40% in the dependent variable when the residential property is 100 m further away from the MTR station. It implies that properties price will change inversely with its accessibility, which is consistent with our expectation in consideration of the uniqueness of the dense living environment and fast living pace in Hong Kong, households are willing to pay more for convenience.

5.2 | Justification of research hypotheses

The variable COMP is positively correlated to the dependent variable, justifying Hypothesis H1 that neighbouring properties will experience a positive price effect after the confirmation of heritage grading. An 11.1% increase is reflected in the natural log of the real transaction price after the heritage grading is confirmed. The negative coefficient of the interactive variable COMP*DIST, suggesting a distance decay of property price effect after the confirmation of grading. When the property is further away from the heritage, it will experience a smaller positive price effect from the heritage site. The dependent variable will be reduced by 0.04% for every metre away from the heritage.

6 | ALTERNATIVE ANALYSES

In this section, the analysis of the effect of different heritage ownership, grading, heritage density, as well as their popularity among tourists are provided. A revised model, which takes into account the ownership, grading, popularity rating of selected heritage sites, and the number of nearby historic buildings situated in the study area, is used.

6.1 | Alternative model for the impact of ownership

Similar to the baseline model, the target group is defined as the residential apartments within the 100 m radius of the selected heritage sites. Taking Model (1) as base, the alternative model is extended to test for the impact of ownership, grading, popularity, and heritage density as below:

TABLE 3 Regression results of the baseline model

Number of heritage buildings	**100 (50 Public + 50 Private)**	
Treatment radius	0–100m	
Independent variable	Coefficient	Standard Error
SFA	0.002281***	(2.00e-05)
SFA^2	−4.99e-07***	(9.41e-09)
FL	0.001307**	(0.000588)
FL^2	0.000113***	(1.28e-05)
AGE	−0.03458***	(0.000615)
AGE^2	0.000324***	(1.15e-05)
SV	0.008133	(0.006294)
MTR	−4.02e-05***	(1.40e-05)
COMP	0.114998***	(0.015081)
DIST	−0.00032***	(0.000119)
COMP*DIST	−5.91e-05	(0.000197)
AP LEI CHAU	−0.32616***	(0.093968)
CENTRAL	−0.03729	(0.095467)
CAUSEWAY BAY	0.067496	(0.094738)
HAPPY VALLEY	0.445584***	(0.091769)
KENNEDY TOWN	−0.08852	(0.094647)
MID-LEVEL (CENTRAL)	0.336571***	(0.092922)
MID-LEVELS (EAST)	0.409907***	(0.093205)
MID-LEVELS (WEST)	0.349747***	(0.093665)
NORTH POINT	0.013093	(0.095317)
TIN HAU	0.242168**	(0.109642)
THE PEAK	2.333009***	(0.198529)
QUARRY BAY	−0.28808***	(0.095385)
SHOUSON HILL	1.13043***	(0.147432)
STANLEY	0.099851	(0.099576)
SHEUNG WAN	0.231951**	(0.093763)
SAI YING PUN	−0.05672	(0.09467)
WAN CHAI	0.023565	(0.094247)
HOMANTIN	0.138594	(0.098293)
KOWLOON CITY	−0.3716***	(0.092887)
KOWLOON TONG	−0.14608	(0.114888)
MONGKOK	−0.36272***	(0.094451)
SHAM SHUI PO	−0.67356***	(0.094315)
TAI KOK TSUI	−0.60835***	(0.095932)
TSIM SHA TSUI	0.01001	(0.095538)
YAU MA TEI	−0.36744***	(0.094649)
FANLING	−0.86535***	(0.094721)
Observations	43,241	
Adjusted R^2	0.777457	
F-statistics	4083.695***	

Note. Dependent variable is ln (RP). Words in italics are the 26 districts of the residential towers included in the study. Robust standard errors are reported between parentheses.

*$p < 0.10$.**$p < 0.05$.***$p < 0.01$.

$$
\begin{aligned}
Ln(RP) = {} & c + \beta_1(SFA) + \beta_2\left(SFA^2\right) + \beta_3(FL) + \beta_4\left(FL^2\right) \\
& + \beta_5(AGE) + \beta_6\left(AGE^2\right) + \beta_7(SV) + \beta_8(DENSITY) \\
& + \beta_9(TOURIST) + \beta_{10}(COMP) + \beta_{11}(PRI) \\
& + \beta_{12}(COMP * PRI) + \beta_{13}(COMP * GRADE\_1) \\
& + \beta_{14}(COMP * GRADE\_2) + \varepsilon
\end{aligned} \tag{2}
$$

where all variables are the same as the baseline model, except that the interactive variable COMP*DIST is replaced by COMP*PRI to compare the property price effect of private heritage with that of public heritage after the confirmation of heritage grading. Two interactive terms, COMP*GRADE_1 and COMP*GRADE_2, are included to compare the property price effect of different grading of heritage buildings, that is, Grades 1 and 2 with other gradings, respectively. Moreover, independent variables DENSITY, TOURIST, and PRI are added. DENSITY is measured by counting the number of overlapping study areas where more than one heritage buildings are situated in; TOURIST is the popularity rating of heritage buildings among tourists with 1 being the least popular and 5 being the most popular, which is rated with reference to various travel-related websites, such as *TripAdvisor and DiscoverHongKong*. PRI is a dummy variable taking one for private ownership and zero otherwise. Table 4 shows a summary of the variables being included in this analysis.

TABLE 4 The alternative model and its variables

Model	$Ln(RP) = c+\beta_1(SFA)+\beta_2(SFA^2)+\beta_3(FL)+\beta_4(FL^2)+\beta_5(AGE)+\beta_6(AGE^2)+\beta_7(SV)+\beta_8(DENSITY)+\beta_9(TOURIST)+\beta_{10}(COMP)+\beta_{11}(PRI)+\beta_{12}(COMP * PRI)+\beta_{13}(COMP * GRADE\_1)+\beta_{14}(COMP * GRADE\_2)+\varepsilon$; in which,
1	Ln (RP) = Natural log of real transaction price of property measured in HKD millions, which is deflated by the corresponding residential price index published by the Rating and Valuation Department, HKSAR
2	SFA = Saleable floor area measured in m^2 (+)
3	SFA^2 = Quadratic form of SFA to determine the nonlinear effect of saleable floor area (−)
4	FL = Floor level (+)
5	FL^2 = Quadratic form of FL to determine the nonlinear effect of floor level (−)
6	AGE = Building age measured in years (−)
7	AGE^2 = Quadratic form of AGE to determine the nonlinear effect of AGE (+)
8	SV = Sea view; Dummy variable taking 1 if the property can enjoy sea view and 0 otherwise (+)
9	DENSITY = Number of nearby heritage buildings in the study area of interest, which is measured by counting the number of study areas that overlaps (+)
10	TOURIST = Popularity rating of the heritage among tourists with 1 being the least popular and 5 being the most popular, which is rated with reference to various travel-related websites, such as *Tripadvisor*, *DiscoverHongKong* (−)
11	COMP = Dummy variable taking 1 if the property is transacted after the confirmation of heritage grading and 0 otherwise (+)
12	PRI = Private ownership; Dummy variable taking 1 if the heritage is a private property and 0 otherwise (+)
13	COMP*PRI = Interactive variables between variables COMP and PRI to compare the property price effect of private heritage with that of public heritage after the confirmation of heritage grading (−)
14	GRADE_1 = Grade 1 heritage; Dummy variable taking 1 if the heritage is rated as grade 1 and 0 otherwise
15	GRADE_2 = Grade 2 heritage; Dummy variable taking 1 if the heritage is rated as grade 2 and 0 otherwise
	**Grade 3 heritage is represented when both variables *GRADE_1* and *GRADE_2* are 0
16	COMP*GRADE_1 = Interactive variable between variables COMP and GRADE_1 to compare the property price effect of grade 1 heritage with heritage of the other grading (+)
17	COMP*GRADE_2 = Interactive variable between variables COMP and GRADE_2 to compare the property price effect of grade 2 heritage with heritage of the other grading (+)
18	ε = Idiosyncratic error term
19	$\beta_{1\ldots14}$ = Parameters to be estimated

Note. Expected effect (+/−) of each variable on the housing price is reported between parentheses.

6.2 | Regression results of the alternative model

Table 5 shows the descriptive statistics of the variables while Table 6 reports the key coefficients and standard errors.

The adjusted R^2 being above 0.66 reveals evidence that the model predicts the deflated transaction price fairly. Furthermore, its F-statistic is significant, rejecting the null hypothesis that all coefficients in the model are zero; thus, the variables included in the model are useful.

Meanwhile, the estimates of structural characteristics are consistent in both models. Coefficients of the structural characteristics' variables and their quadratic forms, except AGE^2, are significantly different from zero at 1% significance level. The price of property is positively correlated to the saleable floor area, the floor level and the availability of sea view and negatively correlated to the building age. One ft^2 increase in SFA leads to a 0.21% increase in the natural log of property price, whereas it will increase by 0.85% if it is 1 floor higher. There will also be a 5.35% increase in the dependent variable if the property has a sea view. On the other hand, apartment flats will be sold at discounts up to 2.30% if the building is 1 year older.

6.3 | Cluster effect on economic impact of heritage

The cluster effect is measured by first identifying more than one heritage buildings in a single study area. For instance, if a property is included in two target groups, it is then under the influences of two heritage buildings; thus, its heritage density is 2. With reference to cluster theory, heritage sites that form an ensemble should have a higher positive economic effect. There is evidence supporting the presence of such cluster effect as the alternative model shows that heritage density is statistically significant with its positive sign.

TABLE 5 Descriptive statistics of 100 heritage buildings (N = 43,241) of the alternative model

Independent variable		Mean	*SD*	Min.	Max.
Structural characteristics					
Deflated transaction price RP (in HK$ million)		10.21298	14.86808	0.001571	1113.286
Saleable floor area SFA (in ft^2)		541.3763	326.1484	83	2999
Squared saleable floor area SFA^2		399458.7	647849	6889	8994001
Building age AGE		24.95317	14.15928	0.002738	68.93908
Squared building age AGE^2		823.1412	750.5579	7.50e-06	4752.597
Floor level FL		12.58336	10.50376	1	63
Squared floor level FL^2		268.6673	460.2174	1	3969
Locational characteristics					
Sea view SV (1 = yes)		0.183298	0.386915	0	1
Number of nearby heritage buildings DENSITY		3.481233	2.197557	1	9
Transaction Period					
After confirmation of heritage grading COMP (1 = yes)		0.35168	0.4775	0	1
Heritage Site Characteristic					
Private Ownership PRI (1 = yes)		0.45029	0.497529	0	1
Popularity rating among tourists TOURIST		3.316551	1.260782	1	5
Grading:	Grade 1 heritage GRADE_1 (1 = yes)	0.417243	0.493109	0	1
	Grade 2 heritage GRADE_2 (1 = yes)	0.385814	0.486793	0	1

Abbreviation: SD, standard deviation.

TABLE 6 Regression results of the alternative model

Number of heritage buildings	100 (50 Public + 50 Private)	
Treatment radius	0–100 m	
Independent variable	Coefficient	Standard Error
SFA	0.002813***	(2.23e-05)
SFA^2	−6.16e-07***	(1.08e-08)
FL	0.010321***	(0.000694)
FL^2	−7.29e-05***	(1.51e-05)
AGE	−0.02223***	(0.000714)
AGE^2	−1.59e-05	(1.31e-05)
SV	0.053498***	(0.007316)
DENSITY	0.002499**	(0.001166)
TOURIST	−0.02913***	(0.002094)
COMP	0.072825***	(0.011472)
PRI	0.090648***	(0.006455)
COMP*PRI	−0.01839*	(0.01072)
COMP*GRADE_1	0.137624***	(0.011808)
COMP*GRADE_2	0.039691***	(0.01156)
Observations	43,241	
Adjusted R^2	0.668336	
F-statistics	6224.766***	

Note. Dependent variable is ln (RP). Robust standard errors are reported between parentheses.

*$p < 0.10$.**$p < 0.05$.***$p < 0.01$.

TABLE 7 Representation of each heritage's grading in the alternative model

	GRADE_1	GRADE_2
Grading		
1	1	0
2	0	1
3	0	0

Property value will increase by 0.25% with one additional historic building in the neighbourhood. Although the cluster effect is found to be modest in our model, it should be considered that the total effect could be more substantial in the case of a larger cluster of revitalized heritage sites, and the residential property within such ensemble will experience a more significant positive price effect.

6.4 | Hierarchy of heritage grading on economic impact

Another important aspect of this research is to assess the effectiveness of the current heritage grading system of Hong Kong. Because the three heritage grades (Grades 1, 2 and 3) have a subtle difference in the definition of what values of the historic buildings are to be possessed, it is worthwhile to examine if the heritage grading does have an influence to the neighbouring property prices. The coefficient of the variable COMP is positive, implying that there is

TABLE 8 Regression results of public and private heritage

Number of heritage buildings	50 Public		50 Private	
Treatment radius	0–100 m		0–100 m	
Independent variable	Coefficient	Standard Error	Coefficient	Standard Error
SFA	0.002206***	(2.48e-05)	0.002112***	(3.29e-05)
SFA^2	−4.67e-07***	(1.20e-08)	−4.43e-07***	(1.49e-08)
FL	0.005575***	(0.000655)	−0.00012	(0.001301)
FL^2	3.56e-05***	(1.29e-05)	6.98e-05*	(3.86e-05)
AGE	−0.04323***	(0.000727)	−0.02667***	(0.00108)
AGE^2	0.000513***	(1.43e−05)	0.000168***	(1.90e-05)
SV	−0.0148*	(0.007637)	0.023235**	(0.010306)
MTR	−6.57e-05***	(1.87e−05)	−4.03e-05*	(2.11e-05)
COMP	0.115876***	(0.018158)	0.122484***	(0.024148)
DIST	−0.00044***	(0.000144)	0.000358*	(0.000196)
COMP*DIST	0.000198	(0.00023)	−0.00047	(0.00033)
AP LEI CHAU	−0.30622***	(0.083912)	NIL	
CENTRAL	−0.25553***	(0.086739)	0.379578***	(0.047937)
CAUSEWAY BAY	0.129953	(0.097151)	0.024188	(0.035702)
HAPPY VALLEY	NIL		0.428479***	(0.037328)
KENNEDY TOWN	−0.03849	(0.086668)	−0.24436***	(0.034279)
MID-LEVEL (CENTRAL)	0.227588***	(0.083404)	0.344421***	(0.033959)
MID-LEVEL (EAST)	0.419415***	(0.082212)	0.16655	(0.478768)
MID-LEVEL (WEST)	0.267632***	(0.084936)	0.474094***	(0.034104)
NORTH POINT	−0.06598	(0.08719)	0.143301***	(0.039788)
TIN HAU	NIL		0.172789**	(0.069071)
THE PEAK	2.341744***	(0.171631)	NIL	
QUARRY BAY	−0.33458***	(0.086511)	NIL	
SHOUSON HILL	1.137211***	(0.128198)	NIL	
STANLEY	0.168882*	(0.086328)	NIL	
SHEUNG WAN	0.166676**	(0.084606)	0.282765***	(0.033904)
SAI YING PUN	−0.07071	(0.086307)	−0.11228***	(0.033556)
WAN CHAI	−0.00734	(0.085445)	NIL	
HOMANTIN	NIL		0.10355**	(0.04861)
KOWLOON CITY	−0.71173***	(0.083178)	−0.15053***	(0.050248)
KOWLOON TONG	−1.55258***	(0.201)	−0.00623	(0.087547)
MONGKOK	−0.44308***	(0.086397)	−0.34835***	(0.033244)
SHAM SHUI PO	−0.68633***	(0.085538)	−0.70546***	(0.031727)
TAI KOK TSUI	−0.63564***	(0.086276)	NIL	
TSIM SHA TSUI	NIL		−0.01176	(0.036373)
YAU MA TEI	−0.44967***	(0.086207)	NIL	
FANLING	−0.84016***	(0.08386)	NIL	
Observations	23,770		19,471	
Adjusted R^2	0.820294		0.750956	
F-statistics	3288.785***		2097.745***	

Note. Dependent variables is ln (RP). Words in italics are the 26 districts of the residential towers included in the study. Robust standard errors are reported between parentheses.

$^{*}p < 0.10$. $^{**}p < 0.05$. $^{***}p < 0.01$.

an increase in property price after the nearby heritage's grading is confirmed. This research also examines the magnitude of the economic impact of the three distinctive grades; the positive signs of COMP*GRADE_1 and COMP*GRADE_2 show that compared with heritage buildings with other grading, Grade 1 and Grade 2 historic buildings will have a greater price effect on residential properties nearby. The grading of each heritage is being represented by two dummy variables as shown in Table 7.

The property will sell at a premium up to 21.0% if it is located within a 100 m radius of Grade 1 heritage building, and such premium is up to 11.3% for those properties within 100 m radius of Grade 2 buildings. The dependent variable will only be 7.28% higher if the property is located within the radius of Grade 3 historic buildings, which is 13.8% and 3.97% lower than the Grade 1 and grade 2 historic buildings, respectively. Hypothesis H3 is justified, confirming that residential properties neighbouring to heritage with more significant grading will experience a greater positive price effect.

Together with the implications of heritage cluster and hierarchy of the grading system, the government can develop more new urban strategies to maximize the economic sustainability of the conservation of historic buildings in Hong Kong. Heritage conservation should be strategized in a way that the economic, social, and cultural perspectives are thoroughly considered. For instance, historic buildings in close proximity should be redeveloped as a group with a particular planning focus so that each historic building can enjoy the synergic effect generated by being developed as a heritage cluster. Urban renewal projects in areas where architectural heritage exists will need to factor in the added dimension from this new understanding of economic impact.

6.5 | Publicly owned heritage has greater economic impact

From the regression results of the alternative model, the positive sign of PRI suggests that there will be an increase in transaction price of a property if it is near a privately owned heritage. Notwithstanding, the coefficient of COMP*PRI is negative, suggesting that the price effect generated by the confirmation of grading of privately owned historic buildings is significantly smaller when compared with the case of publicly owned historic buildings. This is in line with Hypothesis H4 suggesting that public heritage has a greater positive price effect on neighbouring properties when compared with private heritage. Due to this interactive term, the coefficients of COMP and PRI cannot be interpreted independently. The natural log of property price in the residential area near private heritage has only increased 5.44% after the confirmation of grading, whereas that of public historic building has an increase of 7.28%, which shows that after the confirmation of grading, the property price effect of publicly owned heritage outperforms that of privately owned heritage by 1.84 percentage points.

The research findings are consistent with the literature review that publicly led heritage conservation projects are more likely to take the overall sustainability of development into consideration. Table 8 illustrates the regression results of the selected 50 public and 50 private heritages in 26 urban districts. It can be interpreted that heritage conservation can create positive externalities to society including economic significance, public goods, and cultural amenities. Government-owned historic buildings can act as a form of cultural education in the society and also as an urban catalyst for the creation of more social goods. Citizens are more grateful to see buildings with a common sense of place being genuinely recognized with their historic and cultural values and being conserved properly than being overcommercialized. The essence of heritage conservation is to preserve the collective memories of citizens and to ensure that such memories can be passed from one generation to next without jeopardizing the social, environmental, and cultural sustainability (Sharpley, 2000; X. Hou, Liu, & Zhang, 2019).

This research is informed by the general concept of the Coase Theorem and planning theories related to sustainable development (Lai & Lorne, 2015). The proposition of Fourth Coase Theorem, which was built on the model designed by Yu, Shaw, Fu, and Lai (2000), generally supports that the "State plays a role in enlarging an existing industry without getting involved directly as a producer" (Go & Lai, 2019). It is appropriate to apply the Fourth Coase Theorem to the heritage conservation in Hong Kong as many of the existing listed architectural heritage sites are owned by the Government. From this theoretical perspective, this thesis has illustrated how the government can play a more prominent role to assist heritage conservation by state involvement to promote cultural tourism, innovation, and urban sustainability.

However, there are some shortcomings in our study. First, the anticipation effect cannot be reflected by the model. Thus, if there is anticipation effect before the government confirms the heritage grading officially, it is likely that the measured external effects will be underestimated. Second, it is impossible to identify all factors that may affect the housing prices, thus when being unobserved, there may be omitted variable bias.

7 | SIGNIFICANCE AND CONCLUSION

The paper demonstrates the economic sustainability of heritage conservation. Using the hedonic price model to analyze property transaction records of adjacent properties within the proximity of selected heritage locations before and after the confirmation of heritage grading, this paper shows that heritage conservation brings economic sustainability to an urban environment, aside from the intangible cultural and social values.

Heritage conservation brings about urban sustainability in all aspects. The balance between social, cultural, environmental, and economic sustainability is highlighted in the preservation of intangible heritage values and the recognition of the economic benefits of heritage conservation. To maintain the historic wealth of the city while progressing to the future, it is important to appreciate the city's treasures in architectural heritage and to understand the best mechanism to conserve them. Because most previous heritage research concentrates on aesthetic values, social values, and cultural values of architectural heritage, this study fills the gap in research by offering a new perspective of cultural economics to policymakers, conservationists, and property owners. This study offers new knowledge from a real estate perspective for heritage-sites owners or government facing a choice between building demolition or heritage conservation for future practice. In particular, the analysis provides solid evidence to support the four hypotheses, namely, heritage grading results in a positive economic effect on neighbouring properties; and more heritage sites within a cluster can exert an ensemble effect to create a higher economic impact on the neighbourhood. On the other hand, the heritage grading system can have a hierarchical impact, so higher grading assigned by the government results in greater economic externalities. Last but not least, publicly owned heritage shows a higher economic impact, which can possibly be explained by the advantages of state-involvement. The research advocates a sound heritage grading system, heritage cluster development, as well as government and stakeholder engagement in heritage policy can benefit future strategic urban planning and development.

This research sets itself apart from similar studies as it offers added knowledge to a high-density context in an urban setting. It assists urban planning, infrastructure planning, and urban renewal and drives governments to take the external impact on nearby housing prices into consideration during the planning and execution of the overall sustainable development of a city. The research can motivate the government to continue their works on revitalization and conservation of important historical buildings while the city progressing to a more rapidly developed urban environment.

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