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Effects of Multifaceted Street Art on Price Premium of Pre War Commercial Buildings: The Case of Georgetown UNESCO World Heritage Site

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Abstract: Street art is promoted in most countries to intensify the cultural elements of the cityscape. Although street art provides cultural and social values, its impact on the prices of prewar historic property is still unknown. Therefore, an empirical study that examines the relationship between prewar shophouse prices and street art is needed to improve real estate professionals' understanding of the historic preservation market. Using pre- and post-models for the years 2009 to 2019, this study systematically determined the actual location of 119 street art objects (in the form of sculptures and murals) and the 852 prewar shophouses sold in George Town, Penang. The price change of prewar shophouses correlates with the number of street art objects within 100 m, 500 m, and 1000 m of the properties. Due to the heterogeneous characteristics of the properties, six primary hedonic models were developed to extract the price premium of street art. This study has shown the impact of street art on a prewar commercial building, where an additional unit of sculpture could increase its price by 8.32%, 1.62%, and 0.74%, based on radii of 100 m, 500 m, and 1000 m, respectively, in the post-model (after 2012–2019). However, a mural painting has no significant effect on the price change of prewar shophouses. In addition, the position of street art (representing visibility) in the model was tested. The result shows that, unlike sculptures that were located at the back of prewar houses, such street art effects contributed positively to the price premium when they were located at the front of the buildings, with each additional unit of sculpture increasing the price premium of prewar houses by 1.13%. Sculptures as street art thus created a positive externality for the city, particularly with respect to the price premium for prewar shophouses.

Keywords: prewar shophouse; street art; price premium; hedonic model; heritage site

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1. Introduction

In recent years, street art has attracted the attention of governments because it plays an important role in preserving the cultural and social values of a city. Liang [1] claims that cities such as New York, Bristol, and Berlin allow artwork on the walls of public and private buildings. Street art is used to convey cultural information about the city to the public. George Town was officially recognized as one of the World Heritage Cities by UNESCO in 2008. As a result, the Penang state government also promoted street art projects between 2009 and 2012 to shape the city's cultural identity. Therefore, street art is highlighted as one of the cultural elements that cannot be neglected in heritage cities. Street art and heritage city are comparable in terms of promoting tourism activities, especially in George Town. Street art is a form of cultural innovation in transforming public spaces for the purpose of urban regeneration. Since 2012, street art in George Town has been well received and has

become an attraction for tourists who not only visit the city's valuable historic buildings and cultural landscape.

Street art not only enhances the uniqueness of the landmarked city, but also ensures that customer traffic flows near the street art. As a result, prewar commercial buildings have become more visible from areas concentrated by street art. In theory, a visible property has a greater advantage in promoting business and results in higher sales revenue. Businesses that rely on visibility include restaurants, cafes, hotels, retail stores, etc. However, there is a lack of empirical studies to investigate how street art affects the price change of prewar commercial buildings. In the literature, most of the previous studies focus on the intangible value of street art to the city and society, for example, the social value or the cultural value. In addition to the intangible value of street art, it is also important to study the impact of street art on the price premium of prewar houses. The elements that contribute to the price change of prewar shophouses are important to the public and real estate professionals because they would influence decision-making in real estate valuation and investment. This study is critical to examining the economic value of street art before the current street art model in George Town can be applied to other historic cities. In addition to the cultural perspective of street art, it is also important to ensure that landlords' interests are protected as the mural or sculpture is painted or installed on their properties. The landlord hopes that the street art will not negatively affect their property, especially the property value.

1.1. Public Art of Heritage Town

Public art is defined as permanent or temporary works of art outside conventional institutions such as museums and galleries [2]. Yan et al. [3] also mentioned that public art includes various forms, including sculptures, statues, architecture, installations, and murals. Street art is a subset of public art that includes graffiti and non-commercial murals to enhance community tourism [4].

However, street art could be called graffiti or guerrilla art if it is not approved by the government. Baumgarth and Wieker [5] claim that graffiti is perceived as vandalism in public places in Europe or the United States [6]. Graffiti vandalism is a crime in the United States, punishable by imprisonment, a fine, or community service [7]. Unlike graffiti, commissioned street art requires the consent of the property owner and local authorities. This type of street art usually remains untouched/unchanged and therefore has a positive effect on the cityscape. According to Tarihi, Kızılkan, and Ocakç [8], street art commissioned by local authorities has enhanced and enriched physical and social spaces. As the public appreciates street art as part of the community in the city, the aesthetic value is created and converted into economic value in the form of promoting tourism activities [9].

A historical town carries collective social experience and memory which recognizes the nature of different cultures and places. Past beliefs and values are the elements contributing to the uniqueness of the historical building. They express the particular culture and reflection of national identity. The social value provides spiritual and traditional linkages between the past and present, together with the essential community function that develops into an attachment [10].

Cercleux [11] conducted a study to investigate the impact of street art in making culture and heritage visible in cities. The results showed that street art in the context of a grey image of socialist blocks brings a promotion for tourism, especially for those places in the city centre. Compared to graffiti, street art allows a clearer and more meaningful message about culture, history, and heritage. TCC [12] also claimed that the city government promotes public art for cultural tourism to reactivate the low-rise Central Business District (CBD) with its heritage buildings. Williams [13] mentioned that UNESCO has started to consider street art as one of the cultural heritage objects that are evaluated under the value-based approach. In recent years, street art has gained more attention in the cultural landscape. This phenomenon may be related to the fact that the expectations of cultural heritage sites are changing from the past to the present generation [14]. According to other relevant

studies [11,15–18], street art seems to harmonize well with heritage sites in promoting cultural identity.

1.2. Background of George Town's Street Art

In 2009, the Penang State Government initiated the "Marking George Town" project to make George Town a UNESCO World Heritage Site. This project aims to tell the history of the streets and the stories of the communities of George Town through the steel bar sculptures with a local voice. There were 52 steel rod sculptures deciphered and placed in each street to explain the history of past events in George Town. In addition, the mural is part of the street art projects in George Town. It was launched in 2012 under the theme "Mirrors George Town". The six murals were designed by the famous artist Ernest Zacharevic. The murals not only have a high artistic value, but also convey some messages about the phenomenon or culture of a city. Before 2012, there were hardly any murals or sculptures and now they are a feature of George Town [19]. Some examples of steel bar sculptures and murals are shown in Figures 1 and 2.

Figure 1. Murals in George Town. Source: [20].

Figure 2. Steel Rod Sculptures in George Town. Source: [21].

As Liang [1] claims, street art is part of George Town's cultural landmark, and many tourists are interested in posing with the murals and uploading their photos to social media to prove that they were there. Tourists have also responded well to the street art, which adds appropriate meaning and local cultural flair to the area. However, according to Sadatiseyedmahalleh et al. [22], street art made of steel bars (sculptures) is far more practical compared to murals when it comes to maintaining its quality in the long run. The quality of murals deteriorates over time because they are exposed to a large volume of

rainfall every year in George Town and are also frequently touched by the people who photograph them.

1.3. Amenity Value and Property Prices

The natural environment or cultural heritage creates good feelings or experiences for the visualization of real estate buyers. There is also the possibility of improving psychological well-being, artistic aspiration, and ecological literacy. As Spennemann [23] points out, cultural heritage also contributes to the mental health and well-being of individuals and the community as a whole. Although the value of amenities is intangible, it will be reflected in the price premium of goods such as real estate. Many previous studies examined the relationship between environmental amenities and real estate prices using a hedonic approach [24–26]. One of the studies conducted by Gibbon et al. [26] demonstrated the direct relationship between house prices and natural amenities such as rivers, national parks, and national trusts.

Corrigan and Egan [27] claimed that the value of aesthetic quality can be measured by house prices. For example, homebuyers are willing to pay a premium for a home near a water resource with high aesthetic quality. Ahlfeldt and Mastro [28] found that residential buildings designed by famous architects have a positive effect on real estate prices. For example, the houses located within 50 m of the buildings receive a premium of 8.5% compared to the houses located farther away. Fu et al. [29] also investigated the correlation between environmental features and house prices. The results showed that both green space and perception of the sky add a price premium of 0.2273% and 0.0899%, respectively. Wen, Zhang, and Zhang [30] came to a similar conclusion. Their study showed that the Qiantang River, its proximity to the lake, proximity to the mountains, and proximity to the river significantly promoted the prices of houses in the surrounding area.

Moro et al. [31] pointed out that the premium created by a historic building decreased from 20–24% to 13–15% for properties within a radius of 500 m to 2.5 km. This result is also confirmed by Wright and Eppink [32], who found that historic buildings have a higher value in areas with higher population density. Jayantha and Yung [33] studied the impact of the revitalization of historic sites. Their study found that it had a positive impact on retail properties. The price of retail real estate was inversely related to the distance from the historic site. Andersson, Kopsch, and Palm [34] claimed that homes near buildings with a high cultural value would sell at a 1% premium. Bade et al. [35] also found that for each cultural monument or landmark within 50 m, 100 m, and 200 m of a house, there was a price premium of 1.7%, 1.4%, and 0.5%, respectively.

Most previous studies have examined the effects of environmental, natural, cultural, and heritage reputation on real estate (housing) prices. Although many studies mention the importance of street art in a heritage setting in terms of promoting cultural identity, they lack clear evidence on how the amenity value of street art can translate into the price premium of prewar shophouses. For example, they focused on how street art can promote tourism and cultural identity without addressing the impact on property prices, especially in heritage sites such as George Town in Penang. As mentioned by Yang et al. [36], increasing tourist traffic is a positive signal for the increase in retail property prices. Therefore, a price premium for street art in prewar shophouses is a form of tangible value that can be measured for decision-making by policymakers and real estate professionals. Policymakers can decide whether to preserve street art in historic buildings based on monetary value. This hypothesis was formulated based on the previous literature. For example, the phenomenon of street art in the city of Turin showed a 25–30% increase in property value [37]. Homeowners in the UK would pay 5–30% more for a property that has artwork by the famous graffiti artist Bansky [38]. However, the percentage given is based only on a simple survey and calculation. Williams [13] points out that street art is becoming more popular and that UNESCO has considered it as part of the cultural heritage. It is one of the value-adding elements of cultural heritage by connecting people to places and promoting social cohesion. Therefore, real estate investors might pay a price premium to

buy listed prewar shophouses with more street art in exchange for a location with a strong cultural image.

2. Materials and Methods

This study collected 852 records of traded prewar shophouses in George Town, Penang, from 2009 to 2019 (10 years). These properties fall under the II category of heritage sites based on the UNESCO World Heritage Guidelines. The locations of street art (sculptures and murals) in George Town were plotted using QGIS, as shown in Figure 3. In addition, Figure 4 shows the number of sculptures and murals in the surrounding prewar listed buildings within 100 m, 500 m, and 1000 m radii. According to the Heritage Management Plan [39], there are only 4649 buildings in George Town in the core zone and buffer zone, with a size of 109.38 hectares and 150.04 hectares, respectively. As for the category of listed buildings II, it includes 3572 units. In addition, there are 119 pieces of street art, either in the form of murals or sculptures, distributed in George Town, as listed in Table 1.

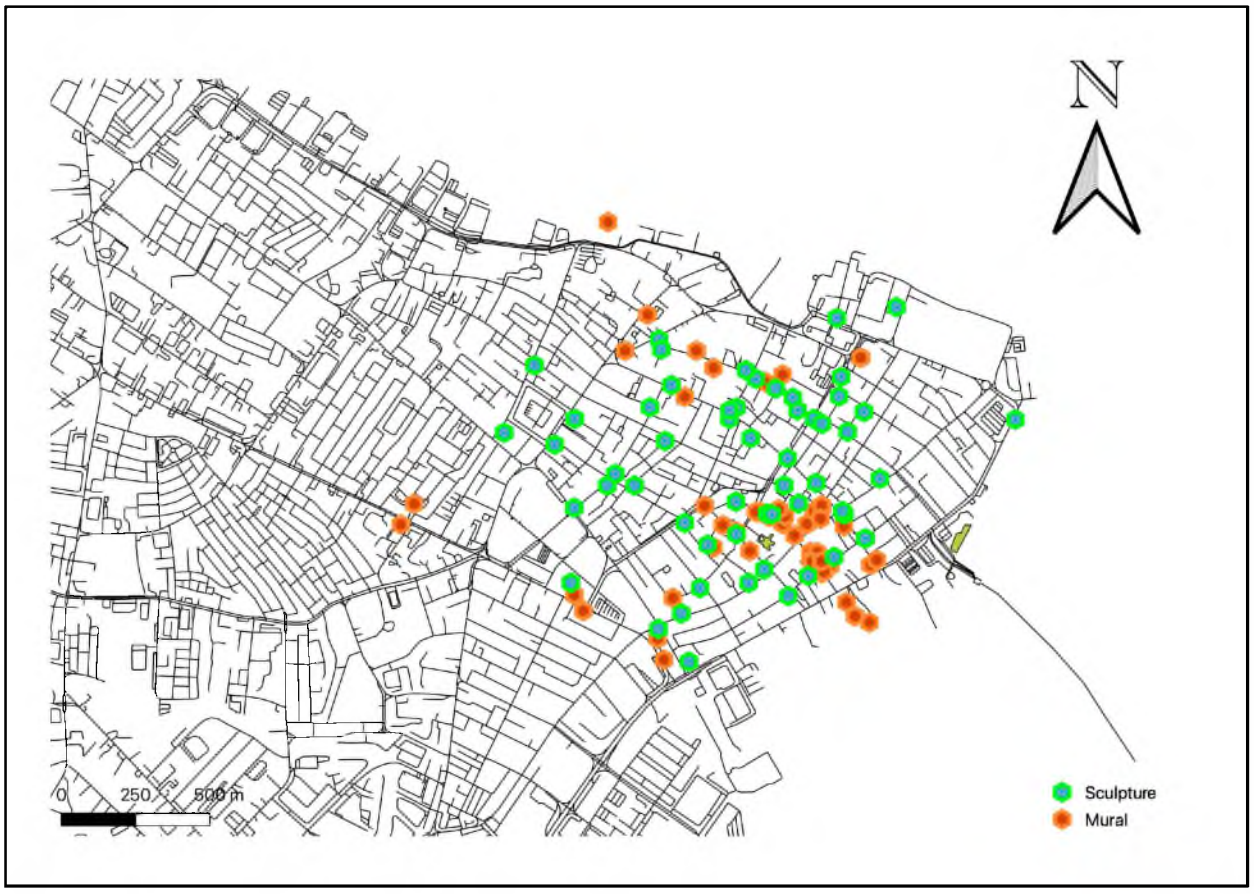

Figure 3. Locations of Sculptures and Murals in the George Town City.

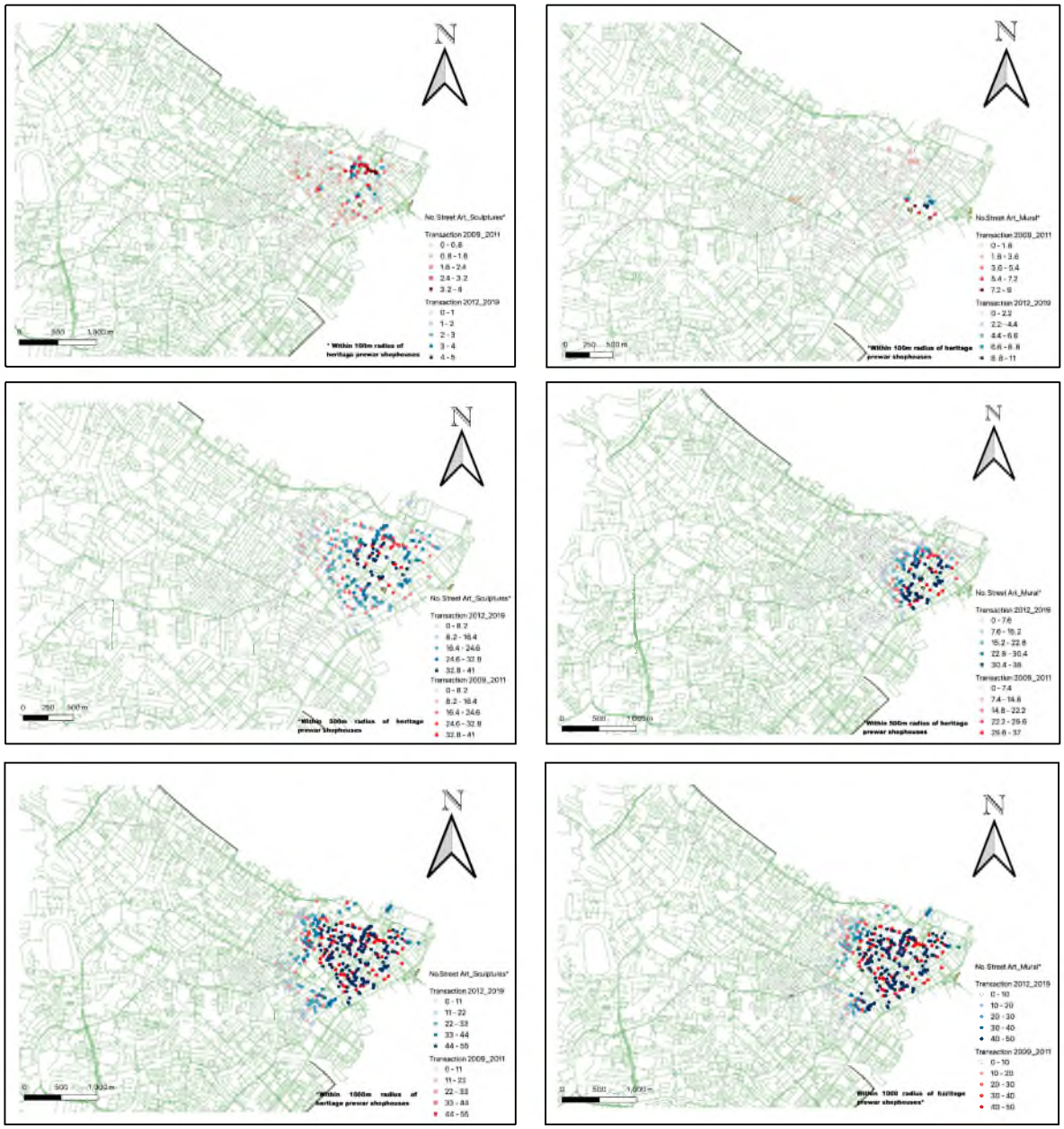

Figure 4. Number of Sculptures and Murals within 100 m, 500 m, and 1000 m radii of Heritage Prewar Shophouses.

Table 1. List of Street Art in George Town, Penang.

1. "One Leg Kicks All" Sculpture	26. "Too Narrow" Sculpture	51. "Children in a Boat" Mural	74. "Reaching Up" Mural	97. "Jimmy Choo" Sculpture
2. "Cheating Husband" Sculpture	27. "Ting Ting Thong" Sculpture	52. "Boy on a Bike" Mural	75. "This Old Man" Mural	98. "Labourer to Trader" Sculpture
3. "No Plastic Bag" Sculpture	28. "Tok Tok Mee" Sculpture	53. "Little Boy with Pet Dinosaur" Mural	76. "Little Girl in Blue" Mural	99. "Untrained Parakeet" Sculpture
4. "Cow and Fish" Sculpture	29. "Narrowest Five Foot Way" Sculpture	54. "Little Children on a Bicycle" Mural	77. "Three Generations" (also known as "Char Koay Teow" Sculpture)	100. "Procession" Sculpture
5. "Property" Sculpture	30. "The Main Street" Sculpture	55. "Penang: Past, Present & Future" Mural	78. "The Real Bruce Lee Would Never Do This" Mural	101. "Traffic Policeman" Mural
6. "Mr Five Foot Way" Sculpture	31. "Double Role" Sculpture	56. "Ironsmith" Sculpture	79. "Please Care & Bathe Me" Mural	102. "The Indian Boatman" Mural
7. "Win Win Situation" Sculpture	32. "Gedung Rumput" Sculpture	57. "Amah & Asoon" Mural	80. "Shade Me If You Love Me" Mural	103. "Feed the Stray" Mural
8. "Bullock Cart Wheel" Sculpture	33. "Temple Day" Sculpture	58. "Children Playing Basketball" Mural	81. "Fine 500 For Littering" Sculpture	104. "Woman Construction Workers" Mural
9. "Rope Style" Sculpture	34. "Cannon Hole" Sculpture	59. "Brother & Sister on a Swing" Mural	82. "Take Time To Sit With Your Pet" Sculpture	105. "Poh Hock Seah Ink Painting" Mural
10. "Kopi-O" Sculpture	35. "Then & Now" Sculpture	60. "Too Salty" Sculpture	83. "Cats Walking For Animal Awareness" Mural	106. "Teach You Hokkien" Mural
11. "Waterway" Sculpture	36. "Spy" Sculpture	61. "Rotan" Sculpture	84. "Cats & Humans Happily Living Together" Mural	107. "Minion Rickshawman" Street Art Sculpture
12. "Too Hot" Sculpture	37. "Retail Paradise" Sculpture	62. "Born Novelist" Sculpture	85. "I Can Help Catch Rats" Mural	108. "Minion/Marge Simpson" Bollard Mural
13. "Escape" Sculpture	38. "Nostalgic Meal Order" Mural	63. "Kandar" Sculpture	86. "No Animal Discrimination Please" Mural	109.George Town 3D Model Sculpture
14. "Limousine" Sculpture	39. "Chingay Procession" Sculpture	64. "Gold Teeth" Sculpture	87. "Mama Cat" Sculpture	110. "Tan Tong Tong" Mural
15. "Awaiting Trishaw Paddler" Mural	40. "Haj Pilgrimage" Sculpture	65. "Budget Hotels" Sculpture	88. "Pau Seller" Mural	111. "The Balloon Safari" Mural
16. "Ah Quee?" Sculpture	41. "Roti Benggali" Sculpture	66. "Duck" Sculpture	89. "Flowered Heart" Mural	112. "Girl On A Turtle" Mural
17. "High Counter" Sculpture	42. "Street Fighters" Sculpture	67. "Shorn Hair" Sculpture	90. "Children At Play" Mural	113. "Man and Turtles" Mural
18. "Yeoh Only" Sculpture	43. "Mahjong Bird" Sculpture	68. "Theatre of Ships" Sculpture	91. "Japan Myth" Mural	114. "Big Mouth" Mural
19. "Happy Hour" (also known as "No More Red Tape") Sculpture	44. "Beca" (also known as "Trishaw Paddler" Sculpture)	69. "Skippy for Penang" Mural	92. "I Want Pau" Mural	115. "Girl by the Sea" Mural
20. "Same Taste, Same Look" Sculpture	45. "Akong & Amah" Mural	70. "Love Me Like Your Fortune Cat" Mural	93.Julia Volchkova: Child Mural at Prangin Canal	116. "102nd Cat" Mural
21. "In A Kopitiam Kitchen" Mural	46. "Bukit Tambun" Murals	71. "Celebration of Our Blue Sky" Sculpture	94. "Lorong Siong" Mural	117. "Bicycles" Sculpture
22. "Old Indian Woman" Mural	47. "Greedy Boy" Mural	72. "Rhythm of Light" Sculpture	95. "Raja Uda" Mural	118. "Coastal Runners" Sculpture
23. "Old Fisherman" Mural	48. "Harmony Fly" Sculpture	73. "Wave of Harmony" Sculpture	96. "Sibling Secrets" Mural	119. "1st Avenue" Mural
24. "Indian Water Bearer" Mural	49. "Silat" Mural			

Source: [40].

A heritage site has a different identity than a traditional community or city because it creates intangible cultural assets for the public. Street art is a part of cultural heritage that cannot be neglected by property owners, the public, and local government. The local government has been valuing street art, which can reform the cityscape in heritage areas, since 2012, and as a result, this action has attracted many local and international artists to express their creativity on the walls of historic buildings.

2.1. Research Methodology

2.1.1. Hedonic Pricing Model

The price of a property is easily influenced by micro and macro factors, such as the structural and legal characteristics of the property, economic factors, population, etc. Therefore, the economic value of street art, whether with positive or negative impacts, can be evaluated using the hedonic price model. According to Rosen, a hedonic model can be used to separate the marginal contribution of each factor affecting the property price [41]. This method has also been used by various researchers to study the relationship between real estate prices and amenities [42–46].

2.1.2. The Mechanism of Forming Price Premium of George Town's Street Art

There are 119 pieces of street art in the vicinity of the 3527 units of prewar shophouses. Due to the large number of street artworks, it is difficult to measure the effect of street art based on the distance from the prewar shophouses. Therefore, in this study, the price premium is calculated based on the total number of street artworks in the vicinity of the prewar shophouses for radii of 100 m, 500 m, and 1000 m. The price premium of street art in George Town for prewar stores can be obtained by the coefficient of price premium ($\hat{\beta}_{k+1}$) of the hedonic model. $X'Y$ is the covariance matrix of property prices and heritage characteristics, while $X'X$ is the covariance matrix of heritage characteristics.

$$\hat{\beta}_{k+1} Street\ Art = \frac{X'Y}{X'X}$$

The pricing model for prewar shophouses includes several factors (X_{it}) along with their effects (β_k), such as lot size, tenure, building condition, and time effect. The prewar shophouse can be freely traded between willing buyers and willing sellers. Therefore, the price premium for street art occurs when buyers are willing to pay more to secure a prewar shophouse surrounded by more units of street art. As explained in Figure 5, the price trend of prewar shophouses shifts from $Price_1$ to $Price_2$ after the price premium is taken into account. This action could be triggered by the high customer traffic in street art areas, which is seen as a good opportunity for owners to promote their businesses.

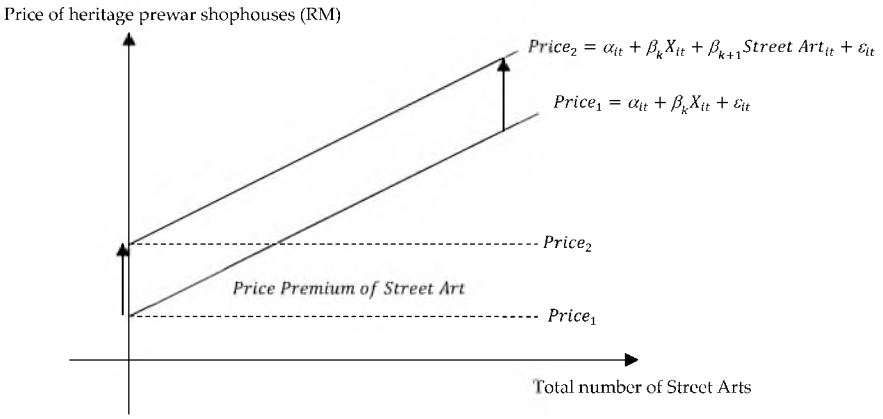

Figure 5. Illustration of Forming Price Premium of George Town's Street Art.

In this study, six models were used to examine the impact of street art on historic property prices.

a. Model 1: Basic Hedonic Pricing Model of Prewar Shophouse

$$lnPRICE_{it} = \alpha_{it} + \beta_1 lnLA_{it} + \beta_2 SHARE_{it} + \beta_3 YEAR_{it} + \beta_4 GOOD_{it} + \beta_5 POOR_{it} + \beta_6 FAIR_{it} + \beta_7 SHOP_{it} + \varepsilon_{it} \quad (1)$$

Model 1 includes several factors that show a significant relationship with the prewar shophouse. Absolute transaction prices of prewar shophouses were transformed into logarithmized prices ($lnPRICE$) as the dependent variable for this model. This transformation can minimize large price variances among properties and improve the predictive power of the price model. In addition, independent variables such as the log shape of the land area ($lnLA$), share units transacted ($SHARE$), year transacted ($YEAR$), good building condition ($GOOD$), poor building condition ($POOR$), good building condition ($FAIR$), and prewar commercial/patio house ($SHOP$) follow this model. Both are the constant and error term in the model, respectively, while i and t represent the number of transactions made over the years.

This model was extended to Model 2, Model 3, and Models 5 & 6 by including the impact of street art on prewar shophouse prices. Model 2 evaluated the price change between the models before and after the implementation of street art in historic George Town. In Model 2, the term pre-model means "before the full implementation of street art", i.e., the street art was just officially recognized by the government and was not yet installed and thus not accessible to the public, while the post-model refers to the period after the full implementation of street art. Next, Models 3 & 4 examined the relationship between property prices and the number of street art pieces prior to the full implementation of street art projects in George Town in order to later qualify the results in Models 5 & 6. As described, Models 5 & 6 was developed to validate the impact of street art on prewar house prices after the full implementation and installation of street art projects by the Penang local government by involving local and international artists in redesigning the landscape of the historic city. The street art impacts for Models 3 & 4 and Models 5 & 6 were based on the number of street artworks in the vicinity of the prewar shophouses. They were determined by three types of distances, namely, 100 m, 500 m, and 1000 m radii. In addition, in both Models 3 & 4 and Models 5 & 6 the effects of street art were tested in terms of the type (i.e., whether it was a mural or a sculpture) and location (visibility) of the street art (whether it was placed in front of or behind a prewar shophouse).

b. Model 2: Global Price Premium of Street Art Model

$$lnPRICE_{it} = \alpha_{it} + \beta_1 lnLA_{it} + \beta_2 SHARE_{it} + \beta_3 PSPI_{it} + \beta_4 GOOD_{it} + \beta_5 POOR_{it} + \beta_6 FAIR_{it} + \beta_7 SHOP_{it} + \beta_8 PRE\_POST_{it} + \varepsilon_{it} \quad (2)$$

H_0 = Global price premium of street art ($\beta_8 PRE\_POST$) does not exist when the street art is available to the public
H_1 = Global price premium of street art ($\beta_8 PRE\_POST$) does exist when the street art is available to the public

Model 2 is an extension of Model 1 by adding two new independent variables, namely, the prewar shophouse price index ($PSPI$) and "PRE_POST" (dummy variable) to the basic prewar shophouse price model. The price index (PSPI) was included in this model to capture the inflated prices of prewar shophouses over the years. This element is important to avoid spurious regression because the global effect of street art is assessed by the dummy variable "before the model" (2009–2011) and "after the model" (2011–2019) of street art implementation. The time effects and the PRE_POST variables are dummy variables that introduce a serious multicollinearity problem. Transactions made are evaluated as 1 if the transaction was made in a certain year or the period before or after the implementation of street art, and 0 otherwise. Therefore, the PSPI variable is more suitable to control for the

annual price trend of prewar shophouses than the dummy variable because the former is a continuous variable. In addition, the effect of street art on the economic value of total listed properties can be determined by the sign of the coefficient and the *p*-value for the variable *PRE_POST*.

c. Models 3 & 4: Price Premium of Pre-Street Art Model

$$lnPRICE_{it} = \alpha_{it} + \beta_1 lnLA_{it} + \beta_2 SHARE_{it} + \beta_3 YEAR_{it} + \beta_4 GOOD_{it} + \beta_5 POOR_{it} + \beta_6 FAIR_{it} + \beta_7 SHOP_{it} + \beta_8 PRE\_STREET\_ART_{it} + \varepsilon_{it} \quad (3)$$

H_0 = Price premium of street art ($\beta_8 PRE\_STREET\_ART$) does not exist in 2009–2012
H_1 = Price premium of street art ($\beta_8 PRE\_STREET\_ART$) does exist in 2009–2012

$$lnPRICE_{it} = \alpha_{it} + \beta_1 lnLA_{it} + \beta_2 SHARE_{it} + \beta_3 YEAR_{it} + \beta_4 GOOD_{it} + \beta_5 POOR_{it} + \beta_6 FAIR_{it} + \beta_7 SHOP_{it} + \beta_8 PRE\_STREET\_ART\_M_{it} + \beta_9 PRE\_STREET\_ART\_S_{it} + \varepsilon_{it} \quad (4)$$

H_0 = Price premium of mural street art ($\beta_8 PRE\_STREET\_ART\_M$) does not exist in 2009–2012
H_1 = Price premium of mural street art ($\beta_8 PRE\_STREET\_ART\_M$) does exist in 2009–2012
H_0 = Price premium of sculpture street art ($\beta_9 PRE\_STREET\_ART\_S$) does not exist in 2009–2012
H_1 = Price premium of sculpture street art ($\beta_9 PRE\_STREET\_ART\_S$) does exist in 2009–2012

This model examined the impact of street art on the prices of prewar shophouses before they were open to the public. In other words, more murals or sculptures in surrounding listed properties could have a positive effect on their prices. The number of street artworks can be calculated according to the 100 m, 500 m, and 1000 m radius for each prewar house sold. The variable *PRE_STREET_ART* in Model 3 represents the number of street artworks in the surrounding prewar shophouses before local government recognition (2009–2012). The impact of murals (*PRE_STREET_ART_M*) and sculptures (*PRE_STREET_ART_S*) would also be assessed separately using Model 4. In addition, this variable is not expected to have a significant impact on the price of prewar shophouses because street art is not available to the public. Therefore, the results of Models 3 and 4 are expected to accept the null hypothesis or H0.

d. Models 5 & 6: Price Premium of Post-Street Art Model

$$lnPRICE_{it} = \alpha_{it} + \beta_1 lnLA_{it} + \beta_2 SHARE_{it} + \beta_3 YEAR_{it} + \beta_4 GOOD_{it} + \beta_5 POOR_{it} + \beta_6 FAIR_{it} + \beta_7 SHOP_{it} + \beta_8 POST\_STREET\_ART_{it} + \varepsilon_{it} \quad (5)$$

H_0 = Price premium of street art ($\beta_8 POST\_STREET\_ART$) does not exist in 2012–2019
H_1 = Price premium of street art ($\beta_8 POST\_STREET\_ART$) does exist in 2012–2019

$$lnPRICE_{it} = \alpha_{it} + \beta_1 lnLA_{it} + \beta_2 SHARE_{it} + \beta_3 YEAR_{it} + \beta_4 GOOD_{it} + \beta_5 POOR_{it} + \beta_6 FAIR_{it} + \beta_7 SHOP_{it} + \beta_8 POST\_STREET\_ARTM_{it} + \beta_9 POST\_STREET\_ART\_S_{it} + \varepsilon_{it} \quad (6)$$

H_0 = Price premium of mural street art ($\beta_9 POST\_STREET\_ART\_M$) does not exist in 2009–2012
H_1 = Price premium of mural street art ($\beta_8 POST\_STREET\_ART\_M$) does exist in 2009–2012
H_0 = Price premium of sculpture street art ($\beta_9 POST\_STREET\_ART\_S$) does not exist in 2009–2012
H_1 = Price premium of sculpture street art ($\beta_9 POST\_STREET\_ART\_S$) does exist in 2009–2012

The variable "*POST_STREET_ART*" is determined by the number of street artworks in 100 m, 500 m, and 1000 m radii of prewar houses after full implementation of street art projects (2012–2019) and can be easily observed by the public. It is insufficient to

study the impact of street art with a single variable because George Town is mainly dominated by murals and sculptures, as explained in the previous section. Both artistic values could be different from each other. Therefore, two variables, *POST_STREET_ART_M* and *POST_STREET_ART_S*, are created in Model 6 to capture the effects of murals and sculptures, respectively. Hypothetically, landmarked properties that have a large amount of street art in their surroundings would attract more tourists, thus improving customer traffic to the area. The products or services offered by these properties would be better marketed compared to others, resulting in higher rents and prices for historic properties. It is expected that the results of Models 5 and 6 would confirm the alternative hypothesis (H_1) that street art may cause a price premium for historic shophouses in George Town.

2.2. Data Collection

In this study, 1737 units of transacted prewar shophouses from 2009 to 2019 were recorded by the Valuation and Property Services Department (JPPH) Malaysia. The data were processed and filtered to meet the criteria for model development. It is important to ensure that the data used in this study are reliable and free from misleading results. For example, the raw data included transactions that were not at arm's length and were between family members. Therefore, the prices obtained were extremely low and may not reflect the market price of prewar shophouses. In addition, some of the information is missing and not retrievable, so it is not included in this study. The outliers in the raw dataset were also excluded from the creation of the hedonic pricing model. After several steps of data processing, 852 units of converted prewar shophouses remained in the final dataset.

This section quantifies the proposed variables for the four models before developing the hedonic price model. The price of leasehold properties is the dependent variable to be measured in response to the independent variables, both of which must be either continuous or discrete data types. The details of data quantification and descriptive statistics are also given in Tables 2 and 3, as follows:

Table 2. Data Quantification of Variables.

Description		Unit of Measurement	Data Type	Sources
Dependent variable	Transacted price of heritage prewar shophouses (*lnPRICE*)	Ringgit Malaysia (logarithm form)	Continuous value	Valuation and Property Services Department (JPPH)
Independent variables	Land area of heritage prewar shophouses (*lnLA*)	Square metre (logarithm form)	Continuous value	Valuation and Property Services Department (JPPH)
	Share in property ownership (*SHARE*)	Value	Continuous value	Valuation and Property Services Department (JPPH)
	Transacted period on a yearly basis (*YEAR*)	Dummy Variable: where 1 = if the units of heritage properties were purchased in the respective year and 0 = otherwise	Discrete value	Valuation and Property Services Department (JPPH)
	Prewar shophouse or terrace house (*SHOP*)	Dummy Variable: where 1 = typical shop house and 0 = residential unit permitted for commercial use	Discrete value	Valuation and Property Services Department (JPPH)
	Building condition (*GOOD*, *FAIR*, or *POOR*)	Dummy Variable: where 1 = Good, 0 = otherwise; 1 = Average, 0 = otherwise; 0 = Bad condition	Discrete value	Valuation and Property Services Department (JPPH)/Google Street View

Table 2. *Cont.*

Description		Unit of Measurement	Data Type	Sources
	Heritage Prewar Shophouse Price Index (*PSPI*)	Value	Continuous value	[47]
	Pre-model and post-model of implementing street art projects (*PRE_POST*)	Dummy Variable: where 1 = transaction realized after the implementation of street art and 0 = transaction realized before the implementation of street art	Discrete value	Official news from a reputable publisher
	Number of street artworks in 100 m, 500 m, and 1000 m radii of prewar shophouses (2009–2011) (*PRE_STREET_ART*)	Value	Continuous value	Google Map/QGIS
	Number of a murals in 100 m, 500 m, and 1000 m radii of prewar shophouses (2009–2011) (*PRE_STREET_ART_M*)	Value	Continuous value	Google Map/QGIS
	Number of sculptures in 100 m, 500 m, and 1000 m radii of prewar shophouses (2009–2011) (*PRE_STREET_ART_S*)	Value	Continuous value	Google Map/QGIS
	Number of street artworks in 100 m, 500 m, and 1000 m radii of prewar shophouses (2012–2019) (*POST_STREET_ART*)	Value	Continuous value	Google Map/QGIS
	Number of mural street artworks in 100 m, 500 m, and 1000 m radii of prewar shophouses (2012–2019) (*POST_STREET_ART_M*)	Value	Continuous value	Google Map/QGIS
	Number of sculpture street art in 100 m, 500 m, and 1000 m radii of prewar shophouses (2012–2019) (*POST_STREET_ART_S*)	Value	Continuous value	Google Map/QGIS

Table 3. Descriptive Statistics of Variables.

Variables	Mean	Minimum	Maximum	Std Deviation
lnPRICE	13.852	10.127	16.706	0.836
lnLA	5.067	2.966	7.994	0.709
SHARE	0.937	0.083	1	0.198
SHOP	0.806	0	1	0.395
PSPI	3.163	1.000	4.850	1.341
PRE_POST	0.623	0.000	1.000	0.485
PRE_STREET_ART				
100 m radius	1.078	0	11	1.821
1-5 500 m radius	22.819	0	75	22.953
1000 m radius	60.938	0	104	38.454
PRE_STREET_ART_M				
100 m radius	0.408	0	9.000	1.232
500 m radius	10.184	0	37	11.874
1000 m radius	27.611	0	50	18.745
PRE_STREET_ART_S				
100 m radius	0.667	0	4	1.036
500 m radius	12.636	0	41	11.979
1000 m radius	33.178	0	55	19.879

Table 3. *Cont.*

Variables	Mean	Minimum	Maximum	Std Deviation
POST_STREET_ART				
100 m radius	1.106	0	12	1.939
500 m radius	24.004	0.000	78.000	23.812
1000 m radius	63.809	0.000	105.000	37.287
POST_STREET_ART_M				
100 m radius	0.422	0	11	1.354
500 m radius	11.053	0	38	12.668
1000 m radius	29.751	0	50	17.78
POST_STREET_ART_S				
100 m radius	0.691	0	5	1.046
500 m radius	13.667	0	41	12.668
1000 m radius	35.053	0	55	18.709
YEAR				
2009	0.079	0	1	0.269
2010	0.219	0	1	0.414
2011	0.079	0	1	0.269
2012	0.141	0	1	0.348
2013	0.153	0	1	0.360
2014	0.103	0	1	0.305
2015	0.100	0	1	0.300
2016	0.058	0	1	0.233
2017	0.063	0	1	0.244
2018	0.053	0	1	0.224
2019	0.025	0	1	0.155
Building Condition				
GOOD	0.265	0	1	0.442
FAIR	0.493	0	1	0.500
POOR	0.242	0	1	0.428

Table 3 presents the descriptive statistics of the variables for the hedonic models. The 852 units of prewar shophouses transacted were quantified into discrete values and continuous values for further investigation of the street art price premium. As for the variables, the value of *lnPRICE* ranges from 10.127 to 16.706 and is the only dependent variable for all six models tested in this study. The price change of prewar buildings could be the result of several factors, such as inflation, building conditions, proportion of real estate ownership, impact of street art, and types of prewar shophouses.

Moreover, the share of property ownership should not be neglected, because it is part of the transactional prices recorded in the data. Therefore, the price transacted would be low compared to the transaction of a single share. Single-share transactions also dominate this dataset. The Prewar Shophouse Price Index (PSPI) is used as a control variable for time effects. Based on the results above, the standard deviation is 1.341 and the mean ranges from 1 to 4.85, indicating high volatility in prewar house prices. George Town's prewar shophouses were actively traded in 2010 after being recognized as a World Heritage Site by UNESCO. The variable *PRE_POST* shows that more transactions occurred after street art projects were implemented, as indicated by the mean value of 0.623. The variable *POST_STREET_ART* shows that in a radius of 1000 m around the prewar shophouses, there are on average 63.9 street artworks in the vicinity of each property. This number reduces to

24.004 and 11.06 when the radius is reduced to 500 m and 100 m, respectively. In addition, the number of sculptures is higher than the number of murals on the surrounding historic prewar shophouses, and this scenario applies to both pre- and post-street art projects. For example, the variable *POST_STREET_ART_S* indicates an average of 35,053 sculptures within 1000 m of each property. In contrast to the sculptures, there are 29,751 murals in the vicinity of each property within a 1000 m radius. This information is important for examining how the number of sculptures/murals responds to the change in the price of listed prewar shophouses.

3. Results

This section assesses the economic value of street art as a contributor to prewar shophouses in George Town using the four hedonic models developed in this study. Model 1 explains the influence of control variables on the hedonic pricing model of prewar shophouses. Model 2 is an extension of Model 1 to evaluate the price premium of street art projects before and after the model. In this model, the price premium of street art for prewar shophouses is examined by comparing prices in two different time periods. Models 3 & 4 and Models 5 & 6 will then validate the street art effect by examining the response of prices based on the (i) number of street artworks in the form of sculptures and murals in a different radius; (ii) types of street art; and (iii) location (visibility) of street art around prewar shophouses.

Table 4 shows the results of the Ordinary Least Square (OLS) regression for Model 1. It shows that 78.1% of the price change of prewar shophouses can be explained by Model 1. There is no contradiction between the expected and actual signs of the coefficients. In other words, the effects of these variables are consistent with previous studies. For example, a property with a larger land area is more expensive because it has a higher capacity for stores or apartments. In addition, a better structural condition has a positive effect on overall property prices compared to a poor structural condition. The increasing value of the coefficient for the period 2010–2019 indicates a positive price trend for the years 2009–2010.

In Model 2, there were two new variables, namely, *PSPI* and *PRE_POST* listed in Table 5. To solve serious multicollinearity problems between the variables *PRE_POST* and *YEAR*, *PSPI* was used instead of the variable *YEAR* in Model 1. The significance of the price change between post-model and pre-model street art projects was evaluated in this model. Although the general results above show that there was no statistically significant difference between the pre- and post-models in the price premium of shophouses, or no significant increase in the price premium of prewar shophouses even after street art projects were fully implemented, this does not necessarily mean that street art effects do not exist at all. In order to effectively validate the tangible effects of street art, this study examined the effects using, among other factors, the number of street artworks near prewar shophouses, which could be one of the significant factors influencing property prices. For example, prewar shophouses located in areas with a high concentration of street art have the advantage of improving customer traffic. Street art exerts a positive external effect on the area surrounding the prewar shophouses, as these are the places preferred by tourists. As a result, it creates commercial value for the business owner in the form of sales and marketing. Therefore, the null hypothesis of the global price premium of street art is rejected.

Table 4. OLS Regression Results of Model 1.

Variables	Coefficient (β)	t-Value	Expected Sign
Const	7.5304 ***	51.899	+/−
lnLA	0.7011 ***	35.816	+
GOOD	0.3398 ***	8.722	+
FAIR	0.1578 ***	4.593	+
SHARE	1.4718 ***	6.490	+
SHOP	0.2279 ***	20.809	+
YEAR 2010	0.4597 ***	8.028	+/−
YEAR 2011	0.6940 ***	10.132	+/−
YEAR 2012	1.2512 ***	17.589	+/−
YEAR 2013	1.2542 ***	20.760	+/−
YEAR 2014	1.4625 ***	22.525	+/−
YEAR 2015	1.5837 ***	24.429	+/−
YEAR 2016	1.4441 ***	19.507	+/−
YEAR 2017	1.5386 ***	21.453	+/−
YEAR 2018	1.5031 ***	19.633	+/−
YEAR 2019	1.4399 ***	14.662	+/−
Dependent Variable: *lnPRICE*			
Adjusted R-squared = 0.781			
Sample Size (N) = 852			

Notes: Significant at 1% level ***. The year 2009 is the base year for 2010 until 2019. Therefore, its effect is not determined in this model. The POOR variable is not shown, as it is a reference group to the *GOOD* and *FAIR* variables.

Table 5. OLS Regression Results of Model 2.

Variables	Coefficient (β)	t-Value	Expected Sign
Const	7.4480 ***	50.956	+/−
lnLA	0.7132 ***	36.232	+
GOOD	0.3172 ***	8.231	+
FAIR	0.1358 ***	3.962	+
SHARE	1.4080 ***	19.898	+
SHOP	0.2201 ***	6.237	+
PSPI	0.3354 ***	11.174	+
PRE_POST	0.1305	1.568	+
Dependent Variable: *lnPRICE*			
Adjusted R-squared=0.773			
Sample Size (N) = 852			

Notes: Significant at 1% level ***. The POOR variable is not shown, as it is a reference group to the *GOOD* and *FAIR* variables.

Table 6 shows the OLS regression results of Model 3. In this section, we test the changes in the prices of prewar shophouses as a function of the number of street artworks. In general, the results for radii of 100 m, 500 m, and 1000 m perform moderately well in explaining the changes in prewar house prices. As shown in the table above, the Adjusted R-squared ranges from 0.630 to 0.640. Moreover, there are no conflicts between the expected

sign and the actual sign of the coefficients for the control variables tested with the three types of radii. In other words, the effect of the control variables is consistent with previous research [47]. Surprisingly, the above results indicate that the number of street artworks has a direct negative relationship with prewar shop prices. This is true for radii of 100, 500, and 1000 m around the historic buildings. However, prior to the implementation of street art projects, the number of street art pieces within 100 m of the property is not significant in explaining the relationship between street art and property prices. The uncertainty of street art projects could be one of the factors contributing to such a scenario. Table 7 shows that both the variables *PRE_STREET_ART_M* and *PRE_STREET_ART_S* have no significant effect on the price change of prewar shophouses at radii of 100 m, 500 m, and 1000 m. Although the variable *PRE_STREET_ART_S* shows a negative effect for a 1000 m radius with a significance level of 10%, the effect appears to be weak and negligible. Overall, the results are consistent with the expected hypothesis presented in the previous section, where the null hypothesis was accepted.

In contrast to Models 3 and 4, street art in Models 5 and 6 show a significant positive effect on the price change of prewar shophouses. This is indicated by the positive sign of the coefficient for the variable *POST_STREET_ART* in Table 8. The completion of street art in 2012 created social and cultural values in the historic city. Therefore, the street art would attract local and international tourists to this area to explore this cultural heritage. According to the above statistical results, an additional unit of street art could increase the price of prewar shophouses between 0.24% and 2.53%, with the radius ranging from 1000 m to 100 m. Thus, the alternative hypothesis for Model 5 is accepted.

Table 6. OLS Regression Results of Model 3.

Variables	Coefficients (β)			
	100 m	**500 m**	**1000 m**	**Expected Sign**
Const	7.6538 ***	7.7003 ***	7.7156 ***	+
lnLA	0.7184 ***	0.7105***	0.7127 ***	+
GOOD	0.3071 ***	0.2834 ***	0.2831 ***	+
FAIR	0.0727	0.0445	0.0441	+
SHARE	1.4592 ***	1.4878 ***	1.4987 ***	+
SHOP	0.1143 *	0.1490 **	0.1750 **	+
YEAR 2010	0.4053 ***	0.4102 ***	0.4148 ***	+/−
YEAR 2011	0.6695 ***	0.6666 ***	0.6700 ***	+/−
PRE_STREET_ART	−0.0171	−0.0028 ***	−0.0021 ***	+/−
Adjusted R-squared	0.630	0.637	0.640	
Dependent Variable: *lnPRICE*				
Sample Size (N) = 321				

Notes: Significant at 1% level ***, Significant at 5% level **, Significant at 10% level *. The year 2009 is the base year for 2010 until 2011. Therefore, its effect is not determined in this model. The POOR variable is not shown, as it is a reference group to GOOD and FAIR variables.

Table 7. OLS Regression Results of Model 4.

Variables	Coefficients (β)			
	100 m	**500 m**	**1000 m**	**Expected Sign**
Const	7.6923 ***	7.7221 ***	7.8279 ***	+
lnLAND	0.7141 ***	0.7085 ***	0.7105 ***	+
GOOD	0.2879 ***	0.2710 ***	0.2748 ***	+
FAIR	0.0441	0.0223	0.0127	+
SHARE	1.4643 ***	1.4929 ***	1.4720 ***	+
SHOP	0.1170 *	0.1566 ***	0.1722 ***	+
YEAR 2010	0.3985 ***	0.4042 ***	0.3777 ***	+/−
YEAR 2011	0.6637 ***	0.6615 ***	0.6464 ***	+/−
PRE_STREET_ART_M	−0.0122	−0.0015	0.0057	+/−
PRE_STREET_ART_S	−0.0222	−0.0043	−0.0094 *	+/−
Adjusted R-squared	0.628	0.635	0.637	
Dependent Variable: *lnPRICE*				
Sample Size (N) = 321				

Notes: Significant at 1% level *** and Significant at 10% level *. The year 2009 is the base year for 2010 until 2011. Therefore, its effect is not determined in this model. The *POOR* variable is not shown, as it is a reference group to the *GOOD* and *FAIR* variables.

Table 8. OLS Regression Results of Model 5.

Variables	Coefficients (β)			
	100 m	**500 m**	**1000 m**	**Expected Sign**
Const	8.7016 ***	8.4809 ***	8.5325 ***	+/−
lnLA	0.6936 ***	0.7153 ***	0.7004 ***	+
GOOD	0.3637 ***	0.3889 ***	0.3834 ***	+
FAIR	0.2173 ***	0.2186 ***	0.2270 ***	+
SHARE	1.5116 ***	1.5446 ***	1.5292 ***	+
SHOP	0.2683 ***	0.2405 ***	0.2074 ***	+
YEAR 2013	−0.0072	0.0226	0.0174	+/−
YEAR 2014	0.2042 ***	0.2435 ***	0.2498 ***	+/−
YEAR 2015	0.3187 ***	0.3723 ***	0.3552 ***	+/−
YEAR 2016	0.1613 **	0.1954 ***	0.1994 ***	+/−
YEAR 2017	0.2506 ***	0.2722 ***	0.2580 ***	+/−
YEAR 2018	0.2374 ***	0.2476 ***	0.2533 ***	+/−
YEAR 2019	0.1297	0.1436	0.1579 *	+/−
POST_STREET_ART	0.0253 ***	0.0038 ***	0.0024 ***	+
Adjusted R-squared	0.736	0.746	0.743	
Dependent Variable: *lnPRICE*				
Sample Size (N) = 531				

Notes: Significant at 1% level ***, Significant at 5% level **, Significant at 10% level *. The year 2012 is the base year for 2013 until 2019. Therefore, its effect is not determined in this model. The *POOR* variable is not shown, as it is a reference group to *GOOD* and *FAIR* variables.

The Model 6 shown in Table 9 tested the effects of murals and sculptures on the price premium of prewar shophouses. Based on the above results, the effect of wall painting is interpreted by the coefficient *POST_STREET_ART_M*, which establishes a negative relationship with the price premium of prewar shophouses. This effect appears to be significant when the number of murals within 500 m of the property is considered. However, the effect is not significant when the number of murals within radii of 100 m and 1000 m of the property is calculated. Thus, statistically, the effect of murals is not consistent in explaining the impact of murals on the price premium of prewar shophouses. This scenario could be due to the maintenance issues of murals that are of concern to the public. Penang Travel Tips reported that the mural "Little Boy with Pet Dinosaur" was vandalized in 2014 [40]. The same problem was also reported in a news article [48]: "The iconic mural Children on a Bicycle in Armenian Street has been splattered with wax, sprayed with dhal curry and sprayed yellow over the years." Moreover, natural wear and tear is one of the factors contributing to the deterioration of mural quality [22]. A poor mural loses its aesthetic value and is therefore perceived as graffiti.

Table 9. OLS Regression Results of Model 6.

Variables	Coefficients (β)			
	100 m	**500 m**	**1000 m**	**Expected Sign**
Const	8.6356 ***	8.5699 ***	8.5190 ***	+/−
lnLA	0.7023 ***	0.7008 ***	0.7024 ***	+
GOOD	0.3602 ***	0.3438 ***	0.3604 ***	+
FAIR	0.1992 ***	0.1868 ***	0.2117 ***	+
SHARE	1.5290 ***	1.5477 ***	1.5215 ***	+
SHOP	0.2620 ***	0.1924 ***	0.2077 ***	+
YEAR 2013	−0.0123	0.0417	0.0188	+/−
YEAR 2014	0.2105 ***	0.2615 ***	0.2560 ***	+/−
YEAR 2015	0.3178 ***	0.3781 ***	0.3643 ***	+/−
YEAR 2016	0.1679 ***	0.1998 ***	0.2066 ***	+/−
YEAR 2017	0.2180 ***	0.2693 ***	0.2531 ***	+/−
YEAR 2018	0.2198 ***	0.2552 ***	0.2604 ***	+/−
YEAR 2019	0.1662 *	0.1410	0.1682 *	+/−
POST_STREET_ART_M	−0.0142	−0.0082 ***	−0.0028	+
POST_STREET_ART_S	0.0832 ***	0.0162 ***	0.0074 **	+
Adjusted R-squared	0.742	0.757	0.743	
Dependent Variable: *lnPRICE*				
Sample Size (N) = 531				

Notes: Significant at 1% level ***, Significant at 5% level **, Significant at 10% level *. The year 2012 is the base year for 2013 until 2019. Therefore, its effect is not determined in this model. The *POOR* variable is not shown, as it is a reference group to *GOOD* and *FAIR* variables.

Unlike mural painting, sculpture is directly related to the price of prewar shophouses. The coefficient of *POST_STREET_ART_S* in radii of 100 m, 500 m, and 1000 m is 0.0832, 0.0162, and 0.0074, respectively. In other words, an additional sculpture could add 8.32% to the prewar shophouses when the number of sculptures within 100 m of transaction objects, etc., is measured. However, the sculpture effect deteriorates when the buffer zone is extended to 500 m and 1000 m radius. For example, the price premium of prewar shophouses decreases from 8.32%, 1.62%, to 0.74% for 100 m, 500 m, and 1000 m radii, respectively. Statistically, these impacts are significant in the 5% to 1% range. According to

Sadatiseyedmahalleh et al., the steel bar sculpture is more durable than a mural. It ensures that the cultural message remains alive to the public [22].

In addition, this model was further tested to determine if the locations and visibility of street art (i.e., behind or in front of a commercial building) were associated with the price change of prewar shophouses. Table 10 shows the price change of prewar shophouses in response to the number of sculptures within 500 m of the transactions made that are placed either on the back (*Street_Art_S_Back*) or the front (*Street_Art_S_Front*) of the building. The effects of *Street_Art_S_Back* and *Street_Art_S_Front* are tested by hedonic regression models before and after the implementation of street art. The results of the model before the implementation of street art show that there is no significant effect of sculptures on the price change of prewar shophouses, regardless of whether they are placed on the back or the front of prewar shophouses. The results are consistent with Model 3 above: Sculptures have no effect on the price premium of prewar shophouses before they are open to the public. According to the post-street art model, the sculpture on the back of the shophouses did not have a significant impact on the price change of the property. However, it also shows that sculptures could make a positive contribution to the price premium if they were placed in front of buildings. The result is that each additional unit of sculpture installed in front of a prewar commercial building increases the price premium of the building by 1.13%.

Table 10. Price Premium of Prewar Shophouses in Response to Display of Sculpture.

	Price Premium %	**t-Value**	***p*-Value**
Pre-Street Art Model (2009–2011) [1a]			
Street_Art_S_Back	−1.06%	−0.551	0.582
Street_Art_S_Front	−0.42%	−0.722	0.471
Post-Street Art Model (2012–2019) [1b]			
Street_Art_S_Back	0.14%	0.112	0.911
Street_Art_S_Front	1.13%***	2.938	0.003

Notes: Street_Art_S_Back represents the sculpture that is displayed at the back of the prewar shophouses; Street_Art_S_Front represents the sculpture that is displayed at the front of the prewar shophouses. There are 46 units and 15 units of sculpture displayed at the front and the back of the prewar shophouses, respectively. [1a, 1b] Dependent Variable: *lnPRICE*; [1a] Independent Variable: *lnLA*; *GOOD*; *FAIR*; *SHARE*; *SHOP*; *YEAR 2010*; *YEAR 2011*; *Street_Art_S_Back*; *Street_Art_S_Fron*; [1b] Independent Variable: *lnLA*; *GOOD*; *FAIR*; *SHARE*; *SHOP*; *YEAR 2013–2019*; *Street_Art_S_Back*; *Street_Art_S_Front*.

Table 11 shows the validation of the street art effect based on the Mean Square Error (MSE) of Model 3 and Model 5. In this method, 30% of the data from each sample were randomly screened out (outsampled) to test the predictive power of both models before and after including the number of street artworks as a variable. The significance of the street art variable was further examined in this study. The above results show that the inclusion of the variable *PRE_STREET_ART* in Model 3 not only worsens the predictive power of the model, but also increases the MSE in the range of 0% to −1.17%. In other words, the number of street artworks does not affect the prices of prewar shophouses before the street art project was fully implemented by the government. In contrast to Model 3, the inclusion of the *POST_STREET_ART* variable will reduce the MSE of the model. The number of street artworks contributes positively to the predictive power in Model 5, ranging from +1.06% to +3.84%. This analysis strengthened in Models 5 & 6, where the price premium for street art existed in prewar shophouses. In summary, the amount of street art is directly related to the price change of prewar shophouses.

Table 11. Cross Validation for the Models of Price Premium of Street Art.

	Mean Square Error (MSE)		
	100 m	**500 m**	**1000 m**
Model 3			
Model without *PRE_STREET_ART* variable [1a]	0.4632	0.4564	0.4635
Model with *PRE_STREET_ART* variable [1b]	0.4639	0.4564	0.4689
Changes in MSE (%)	−0.15%	0.00%	−1.17%
Model 5			
Model without *POST_STREET_ART* variable [2a]	0.3694	0.3694	0.3694
Model with *POST_STREET_ART* variable [2b]	0.3655	0.3552	0.3648
Changes in MSE (%)	+1.06%	+3.84%	+1.25%

[1a, 1b, 2a, 2b] Dependent Variable: *lnPRICE*; [1a] Independent Variable: *lnLA*; *GOOD*; *FAIR*; *SHARE*; *SHOP*; *YEAR 2010*; *YEAR 2011*; [1b] Independent Variable: *lnLA*; *GOOD*; *FAIR*; *SHARE*; *SHOP*; *YEAR 2010*; *YEAR 2011*; *PRE_STREET_ART*; [2a] Independent Variable: *lnLA*; *GOOD*; *FAIR*; *SHARE*; *SHOP*; *YEAR 2013–2019*; [2b] Independent Variable: *lnLA*; *GOOD*; *FAIR*; *SHARE*; *SHOP*; *YEAR 2013–2019*; *POST_STREET_ART*; [1a, 1b] Sample size (N) = 321; [2a, 2b] Sample size (N) = 531.

4. Discussion

Street art plays an important role in shaping the social and cultural identity of the historic city. Previous research has shown the intangible value of cultural heritage and street art to the public. In addition, this value could be monetized through the sale of historic buildings at a high premium if these properties are surrounded by a large amount of street art. Currently, most prewar shophouses have been preserved and restored for commercial use, including cafes, boutique hotels, restaurants, and others. Local and international tourists are attracted by the construction of the historic buildings. In addition, street art should not be neglected as it conveys the cultural, historical, and social elements of the heritage city. Street art is also one of the attractions in George Town and is frequently visited by tourists, which can improve customer traffic in these areas. As a result, the prewar shophouses will gain visibility, which will contribute to their business growth.

In this study, six hedonic models (Models 1, 2, 3, 4, 5, and 6) were used to evaluate the impact of street art on the prices of historic properties. This method was commonly used in previous studies to evaluate the significance of independent variables for dependent variables. The marginal effect of each variable can be easily examined via coefficients and *p*-values. The first model was used to determine the control variables for the prewar shophouse pricing model, such as lot size, building condition, types of listed properties, ownership types, and time effects. These control variables were found to be significant in influencing the prices of prewar shophouses. In addition, this model was extended to Model 2 to distinguish prewar shophouse prices before and after the implementation of the street art project. However, the results showed that not all prewar shophouses traded at a higher price even after the street art project was fully implemented in George Town, Penang. In other words, the actual impact of street art cannot be demonstrated in the historic heritage market by simply answering the "yes or no" question, i.e., whether street art was implemented in the urban area. Instead, other influential factors, namely, the number, type, and visibility of street art, should be considered. This is indeed the case, because although street art was recognized as of 2012, buyers did not pay a higher price premium for prewar shophouses because there was not a significant amount of street art present and accessible in the vicinity of the property. This result is defensible because not all listed properties have access to street art, so only listed properties near street art would receive the benefit. Therefore, the effect of street art was further examined in subsequent models 3 and 4, and 5 and 6.

The literature indicates that there are 119 pieces of street art in George Town. Models 3 & 4 and Models 5 & 6 consist of the number of street artworks in radii of 100 m, 500 m,

and 1000 m around the prewar houses. Both the model before and the model after the introduction of street art started in 2009–2011 and 2012–2019, respectively, were constructed, but it is expected that these two models will lead to an opposite result. In 2009–2011, street art was not available to the public, and street art spots had no effect on the price change of monument properties. For example, the variable *PRE_STREET_ART* in Models 3 & 4 shows a significant negative impact on prices based on the amount of street art within a 500 m and 1000 m radius of the prewar houses. Uncertainty in street art projects is expected to have a negative impact on market sentiment, and prewar shophouses with an additional unit of street art could trade 0.21% to 0.28% lower compared to standard prices. Unfortunately, the significance of the *PRE_STREET_ART* variable cannot be justified in the model validation, as shown in Tables 4 and 5. There is no improvement in the MSE after including this variable.

The street art effect is determined in Models 5 and 6 when the street art price premium consisted of prewar shop locations. The results of Model 5 are consistent with this study's hypothesis that the number of street artworks leads to higher transaction prices. In general, an additional unit of street art could increase the prices of prewar shophouses by an average of 2.53%, 0.24%, and 0.38% at radii of 100 m, 500 m, and 1000 m, respectively. This result is consistent with the study of Bade et al. that the price premium of historic features is reduced by 1.7%, 1.4%, and 0.5% at radii of 50 m, 100 m, and 200 m, respectively [3]. Model 6 shows that murals do not have a significant effect on the price premium of prewar shophouses, likely due to the durability issues highlighted in the last study. The government may need to revisit the maintenance issue on the mural to unlock its value in the heritage town. It seems that sculpture is more effective in promoting street art in a heritage city. Based on the empirical result, street art in the form of sculpture can be extended to other heritage cities for bringing value to society and heritage properties as it gives a positive response to the price change of prewar shophouses in the range of 8.32% to 0.74%. It is also found that the inclusion of the street art variable improves the MSE of the street art model by +1.06% to +3.84%. Thus, the presence of a street art price premium is further strengthened after model validation. Not only the type and number of street artworks open to the public, but also the strategic location and visibility of the street art (behind or in front of the shophouse) contribute significantly to the increase in the price premium for prewar shophouses. This is because street art can be seen as a form of beautification and can potentially enhance the overall appeal of the commercial area.

5. Conclusions

In terms of practical significance, street art is integrated as part of the identity of the historic city and should be preserved by the government and the public. This is because street art creates not only intangible value but also tangible value for the public and owners, as stated in this study. In addition, this study also contributed to the findings on the amenity value and social value of street art, especially sculptures, on the price premium of real estate, apart from the surrounding environment [27,29] and cultural and heritage elements [33,34]. According to Pozzo et al. on the definition of cultural innovation, street art in George Town can be considered as cultural innovation if it improves social well-being by creatively, reflectively, and inclusively processing the content of cultural heritage charged with beauty [49]. Street art also plays an important role in urban regeneration by transforming public spaces [50]. For example, in Philadelphia, USA, 3000 murals and artworks have been created in public spaces. This city has more than 12,000 visitors who explore the uniqueness of the street artworks [51]. In George Town, street art takes the form of a mural or sculpture and conveys the cultural messages of the local context. It also promotes local tourism, as most people take the opportunity to pose with the mural or sculpture and share it on social media. This phenomenon will attract more people to visit the street art and stimulate customer traffic in the commercial area. The price change of prewar shophouses in response to the number of street art pieces could be one of the factors to consider when evaluating historic preservation properties or investing in prewar

shophouses in the future. This empirical study is important for quantifying the value of street art through mathematical formulas. It provides real estate professionals with insight into the price premium of street art to support the market value of prewar shophouses in George Town, Penang.

Nevertheless, this study only focuses on the effect of street art at the regional level. In a future study, the geographically weighted regression (GWR) can be used to examine the street art geographical effect for each location in the historic city. This is to ensure that the effect of street art in George Town, Penang, is generally applicable. The existing models have measured the effect of street art primarily based on its quantity (number) in the surrounding prewar shophouses, the type, and the location (visibility) of the street art. Although the study's models suggest that sculpture can generally contribute to higher property values, this study does not conclude that more street art should be installed in the George Town Historic Preservation Area. This is due to the provisions of the UNESCO World Heritage Site Special Area Plan [39], which requires property owners to obtain local agency approval for any enhancement or installation of street art or redevelopment of landmarked prewar storefronts. Therefore, to confirm and corroborate this study's findings of the price effects of multifaceted street art, future studies should also include other historic (UNESCO recognized) cities of Malaysia, such as Malacca City. In addition, it would be interesting for future research to investigate whether street art effects are significant on property prices (encompassing both housing and commercial buildings) in other historic (non-World Heritage status) cities or any contemporary cities such as Kuching in Sarawak State and Taiping in Perak State, with less stringent planning and development controls. With the aforementioned suggestions, this study's findings would be even more convincing and useful to policymakers, urban managers, and property investors to consider the installation of street art if more empirical findings demonstrate the positive economic effects as well as potential social and health benefits of street art. Other factors, namely, architectural elements of the listed buildings such as façade, style, and interior design are also worth further study, to examine the marginal contribution of these elements to the price premium of prewar shophouses.

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