Art Places and Their Impact on Property Prices of Condominiums in Singapore

Xinyu Zeng$^{(\boxtimes)}$ and Bige Tunçer$^{(\boxtimes)}$

Singapore University of Technology and Design, 8 Somapah Road, Singapore 487372, Singapore
xinyu_zeng@mymail.sutd.edu.sg, Bige_tuncer@sutd.edu.sg

Abstract. During its formative years, the designation of spaces for arts was often deemed to be a luxury in Singapore, which is a land-scarce country. As her economy progresses to one of the world's highest GDP per capita, art development is now deemed as a part of the greater service sector. The idea of how arts have any actual positive impact on the economy is often based on a theoretical discussion but with little data-driven evidence. As art development in Singapore is in a rather early stage, it relies strongly on government policies and support. This paper explores if arts can have a positive impact on Singapore's condominium projects to quantify the economic benefits rather than to tackle the macro-economic benefits, which might be compounded with other factors. The quantitative methods used in this paper include comparative methods using GIS, single factor regression, and two-factor regression.

Keywords: Art places · Condominium property price · Quantitative methods · GIS

1 Introduction

Singapore is a major global city with one of the highest GDP per capita and a financial hub in the world. Kong (2015) highlighted that a global city is not only a site of economic activities but also has increasing needs for creative production and consumption of culture and arts. However, the art and culture developments in Singapore seem not to match its economic growth, as Chang (2000) stated that Singapore still has challenges to achieve its ambitious goal of being the "Global City for the Arts".

The gap between arts and economic development in Singapore has a historical reason. In the early days of Singapore's independence, faced with a complex international situation, and scarce land area and resources, survival was the most important issue. Arts were regarded as a luxury and were encouraged not to have. At the start of Singapore's independence, her immediate concerns were mostly pragmatic ones. As highlighted by Lim (2019), Singapore needed a "rugged society" that can help to contribute to Singapore's economic growth instead of chasing "rock idols and pop dreams" during the formative years. As Singapore's economy began to take off in the 1980s, arts were planned as a creative field that would contribute to the economy and be supported by the state. According to Kong (2012), Singapore started to view arts as part of the greater

service sector to generate economic benefits as Singapore progressed from a manufacturing economy to a service-oriented economy in the late 1980s to 1990s and as living conditions improved.

Singapore's arts rely heavily on government policies, and government policies are selective and cannot be supported without supervision. Chong (2014) summarized the art development in Singapore as "bureaucratic imagination of the art". In other words, art development in Singapore is top-down and planners only support the development of arts and its generic that the planners deem to support Singapore's progress towards a global city. This may on the other hand hinder the diversity of Singapore's artworks.

Compared with other disciplines, the definition of arts is inherently vague and fuzzy. It is not difficult to understand that in most studies on the importance of arts, there seems to be a lack of quantitative studies.

This research primarily aims to quantify the economic impact of art development in Singapore and can hopefully create a dialogue with government authorities for their cultural planning processes. This study intends to quantify the impact of art by refining the questions to more specific areas, such as focusing on the art places and their immediate impact on the property price of condominiums within the catchment area of art places.

The economic impact from the creative sectors can be classified at different levels, such as GDP and employment rate, innovation industry, and cultural identity. Due to the numerous and intricate factors affecting the economy, it is difficult to quantify the contribution of arts to the economy alone. For example, it is understood that art places might improve tourism revenue. However, the actual impact of art places on tourism revenue is difficult to quantify, as there are many spillover effects. As such, in this research, property price is singled out and regarded as a projection of economic impact to be studied. Quantitative studies are done by comparing the property prices within and outside the catchment area of art places, as well as studying the impact on the surrounding property prices before and after the opening of the art places.

The selection of 'art places' for this study is not straightforward. The definition of arts is broad, as it can be regarded as the unique creation from artists and expression of identity. This definition encompasses a diversity of genres, such as theatre, dance, music, traditional arts, and literary arts. Arts could also be seen as part of the creative cluster where individual creativity, skill, and talent can generate wealth and create jobs. Hence, it is difficult to conduct a comprehensive study that covers every aspect of arts. Therefore, art places in this study are selected as an entry point of the artistic concept, as this is more tangible and understandable compared to other art forms.

Chanuki (2016) also highlighted that there is a significant lack of quantitative evidence to support arts help to improve economic conditions of urban neighborhoods despite many inherently believe it. The approach adopted in his study uses the metadata of geotagged photographs of arts in London neighborhoods and compared them to test the relative gain in property prices.

Fabiana and Pierfrancesco (2019) believe that street arts can add socio-economic value to properties, and used Naples, Italy as a city for a case study. In their research, theoretical quantitative methods are discussed but the actual numbers are not presented. This again illustrated the actual challenges faced by researchers on quantifying art places' impact on the economy and urban environment.

My research seeks to use advanced computer-aided methodologies to address the gaps between the quantitative evidence and common understanding of how art places add value to the urban environment and help to improve the quality of the built environment.

2 Methodology

The key variables used in this study are (1) property prices of all new apartments sold and (2) identified art places or art clusters. The property prices are then adjusted using the property price index collected by Singapore authorities to remove potential inflation and gentrification effects.

Data Processing is also conducted to aggregate the time-series of the property price of each town after removal of the inflation and gentrification effects.

The data sampling used in this study is intended to be comprehensive and covers all possible data points available from the public domain.

The methodologies used are from a (1) observational research method and (2) statistical regression approach.

For the observational research method, the property price of apartments within the catchment area of the art places are compared to the property price of their respective towns in the same period. Another observational comparison is to compare the property prices in the town before and after the art places are opened in the affected townships; furthermore, the difference of the property prices observed has already accounted for the inflation and gentrification effects by using the local property price index compiled by Singapore authorities for each region.

As for the statistical regression approach, there are a simple single-factor approach and a two-factor approach to remove the potential causality of the Central Business District (CBD) effect on property price.

2.1 Data Collection and Processing

Property Price Data. In this study, property price refers to the median price of condominium prices sold by developers from June 2007 to December 2019 and adjusted by the specific Property Price Index (PPI) for each locality, namely Core Central Region (CCR), Rest of Central Region (RCR) and the Outside Central Region (OCR) (Fig. 1). The earliest start time available from the public domain starts from June 2007.

PPI is computed by Urban Redevelopment Authority (URA) to track housing price movement over each quarter and there are specified PPIs for different localities. This PPI is used to adjust and rebase the transaction to remove the effects of inflation and price movements due to time differences. The base level is set at 100, as of Q1 2009. The data is obtained from the official website www.ura.gov.sg, and www.data.gov.sg. The inflation for each period is adjusted, to compare apples to apples. The impact from potential gentrification or improved quality of the neighborhood and the property are indirectly adjusted and accounted for, as the PPI index is only tracking the general price movement and is not a quality constant index. In other words, the increase in the property price over the years due to inflation or gentrification is reflected in the index. Hence, by

reversing and rebasing the index to a single date (Q1 2009), these improved property prices due to inflation or improved quality in neighborhoods are eliminated.

The data excludes landed properties, meaning single-family houses, as these are less homogenous, such as the land area, design, and their built-up area. Similarly, public housing apartments, such as (Housing Development Board) HDB flats and executive condominiums are excluded as they are subsidized by the government or with a pricing ceiling, making the price is less market-driven and hence difficult to make a reasonable comparison. The secondary sales are also excluded as there could be different maintenance conditions.

There are 899 properties in the database. The GPS coordinate of each property is collected from www.onemap.sg and transferred into excel. This data is further imported into QGIS to measure the distance to art places.
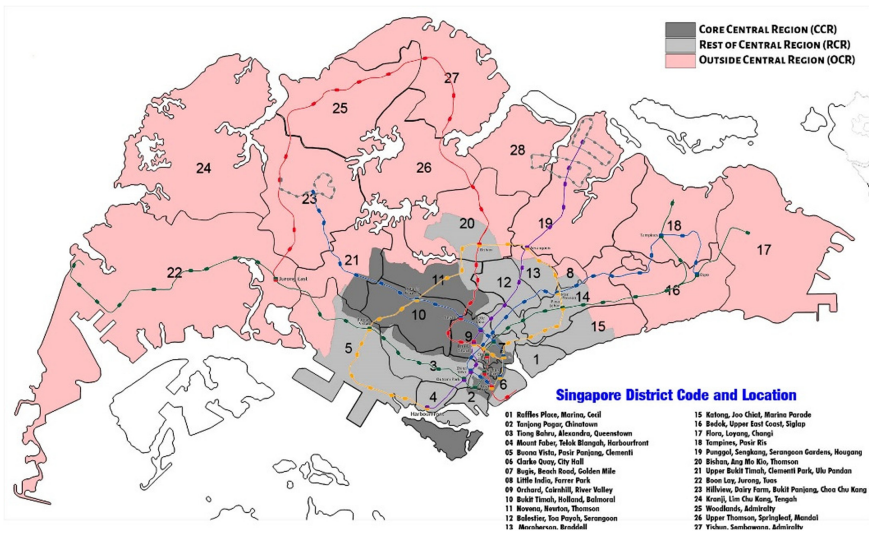

Fig. 1. Singapore map in different regions classifications, such as CCR, RCR, and OCR (URA)

55 Town Planning Areas in Singapore. In order to do a comparison study on the impact of art places on property prices, Singapore city needs to be studied in more detail, as individual towns. This will allow a more meaningful study of how art places affect the property price in each town rather than the whole city of Singapore. For simplicity and for the purpose of this research, the property price of each town is assumed to be homogenous and similar in nature.

The selection of Singapore's towns in this study is based on the Planning Area Census 2010 which was obtained from data.gov.sg. In this Planning Area Census 2010, there are 55 planning areas (towns) in Singapore. This is used in the Census 2010 published by the Department of Statistics, Singapore. The map boundaries used in the Planning Area are also based on URA's Masterplan 2008.

Art Places Data. The list of art places in this study was collected from the Ministry of Culture, Community and Youth (MCCY), National Art Council (NAC), National Heritage Board (NHB), and visitsingapore.com by Singapore Tourism Board (STB). First, 193 art places were collected. After the removal of repetitions, a total of 143 art places, including 89 art places and 54 public arts (sculpture and graffiti) remained. Public arts were also removed as they were too scattered and not a social focal point.

The distances between the property and the art places were calculated through QGIS. Similarly, the distance between properties and the CBD, art places (including 2 art places clusters), and the CBD were also calculated through QGIS. In this study, the CBD will be represented by Raffles Place MRT Station. The years of the opening time of each art place were also collected and recorded.

Art Places Clusters. The art places clusters were formed to reduce the potential cross effect due to the close of the proximity of the major art places. In other words, it is hard to quantify the effect of each art place as there could be spillover effects by other major art places. Two clusters are with similar characteristics are considered in this study (Fig. 2).

Cluster A comprises Sands Theatre/ArtScience Museum, Asian Civilisations Museum, Esplanade, National Gallery Singapore, National Museum of Singapore, Victoria Theatre. These are the highly recognizable art places.

Cluster B comprises of School of the Arts, LASALLE College of Arts, Nanyang Academy of Fine Arts, National Design Centre, Singapore Art Museum, Stamford Arts Centre, Selegie Arts Centre. These are the art places that focus more on arts education.

The centroids of Cluster A and Cluster B were computed to represent the clusters for further analysis.

Fig. 2. Art cluster A and cluster B

2.2 Comparative Method (with 3 km Radius vs Town)

The research question of this study is whether art places have a positive influence on property prices. The assumption is that a property's proximity to an art place or cluster increases its price per square foot compared to the properties that are further away from the art places.

In order to quantify the impact of art places on property prices, a catchment area with a 3 km radius from the art places was set. The 3 km radius was chosen as it takes approximately 10 min to drive or within 30 min to travel via public transportation, making it a reasonable distance to test the influence of art places on the neighborhood. The average medium property price in the catchment area is compared with the property price of all towns that are included or partially included in the catchment area.

To be more specific about each town's comparison, the average medium price of the property that falls into the catchment area of a particular town is compared with the average medium property price of the corresponding town.

Below is a diagram to illustrate how the comparison is being done. For example, the average of Town A property prices (P1 to P5) is compared to the average of properties that are within town A and 3 km radium of the art places (P4 to P5). Similarly, town B (P6 to P11) is compared to P6 to P8. On the overall basis, the average of properties within all towns that are intersected by 3 km radium, namely Town A and Town B for this instance (P1 to P11), are compared to the average of all properties within the radius (P4 to P8) (Fig. 3).
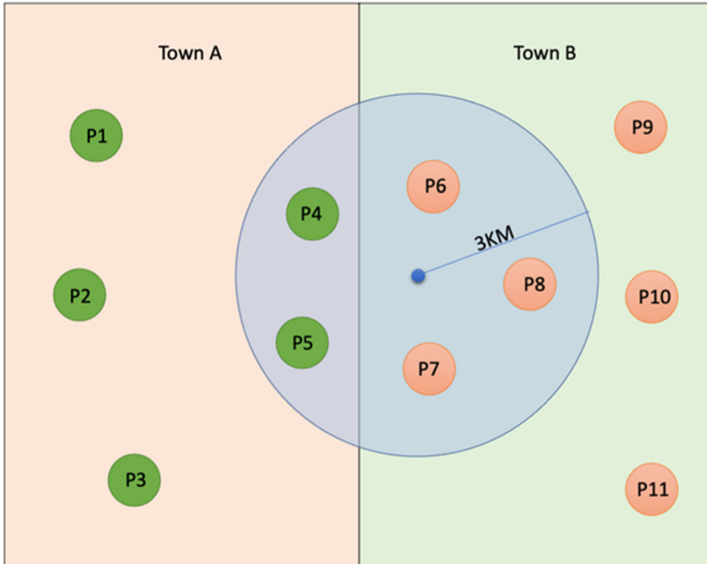

Fig. 3. Illustration of catchment area vs town in the analysis of the comparative table method

After the GPS coordinate of all art places was compiled into QGIS, 7 representative art places were chosen as the object of comparison. The selection of the 7 representative art places was based on general principles described below and experience.

One of the general principles is that the catchment art places should not be overlapping each other, as the overlapping effect will make it difficult to quantify the specific impact from a particular art place. Hence, most of the art places within the Museum Planning Area, which is located in the Central Area of Singapore with many art places and historical buildings, are not selected. Similarly, Clusters A and B are not selected.

However, Holland Village and Singapore Botanic Garden are selected despite that they are slightly overlapped because these two art places are significantly important. Holland Village is a creative community and incubator for local artists given its strong cultural and community background that fuse the European culture and Singapore's local lifestyle. Botanic Gardens, on another hand, is the only tropical garden on the UNESCO's World Heritage List and is also an important area for Singapore residents to gather and to enjoy free musical performances.

The second general principle, with its reason similar to the first principle, is that art places within large institutions are not considered as such institutions could also have an impact on property price, making it difficult to test the influence of art place on its own merit. For example, the NUS museum and NTU Centre for Contemporary Art are excluded in this test as the institution of higher learnings such as NUS might have a positive impact on the property price. The value brought forth by the NUS museum which is being part of NUS could not be individually accounted for and separated from the overall positive impact.

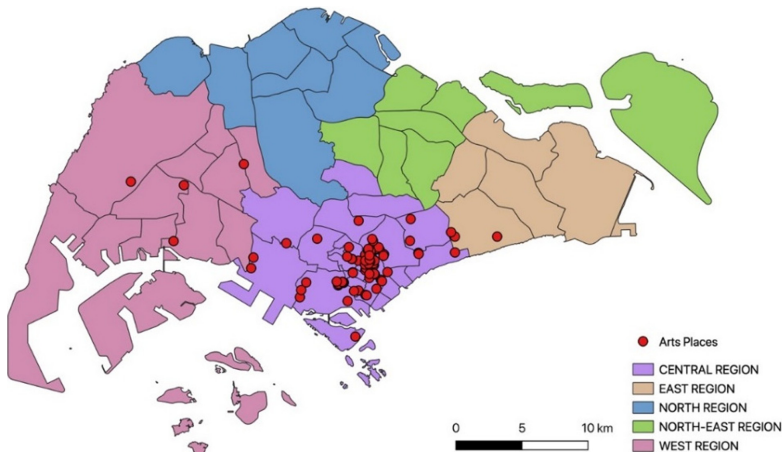Lastly, art places of less significance, such as small studios are not considered (Figs. 4 and 5).

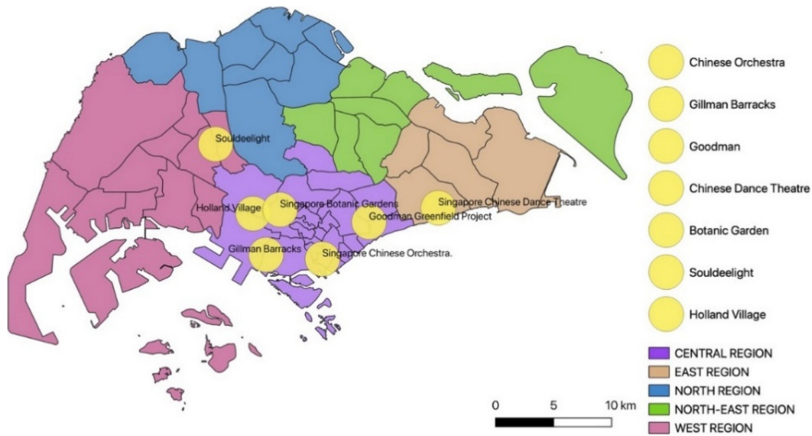**Fig. 4.** Selected art places in Singapore

Fig. 5. 7 Representative art places selected for the comparative table analysis

2.3 Comparative Method (Before and After Years of Opening)

One of the methods to test out whether art places have any positive impact on property prices is to compare the property prices before and after the opening date within a certain catchment area.

In order to do so, art places that opened before 2007 have to be filtered out, as the property data collected from URA is after 2007. There are a total of 11 art places that opened after 2007, which is also the start of the property data collection provided by URA (Table 1). 3 art places are studied as the remaining 8 art places are all overlapping with one another, making it difficult to identify the "before and after" effects.

In this study, it was simplified and assumed that the impact of art places on the property price was only evident after it was opened. In other words, the expectation of art places opening was assumed to be insignificant to homeowners when purchasing the property in this study.

Table 1. List of art places opened after 2007

Name of art places	Year of Opening	Location not overlapped by other art places
The peranakan museum	2008	No
School of the arts	2008	No
Goodman arts centre	**2011**	**Yes**
ArtScience museum/red dot/sands theatre	2011	No
Gillman barracks	**2012**	**Yes**
Singapore dance theatre (SDT)	2013	No

(*continued*)

Table 1. (*continued*)

Name of art places	Year of Opening	Location not overlapped by other art places
Singapore Chinese dance theatre	**2014**	**Yes**
National gallery Singapore	2015	No
Indian heritage centre	2015	No
Arts equator	2016	No
Stamford arts centre	2019	No

2.4 Regression Methods

Comparative tables focus on the immediate catchment areas and the corresponding towns. As the number of property price data points within the catchment areas are relatively small, it is unable to provide statistically significant findings. To improve the data reliance, regression methodology is introduced. There are two regressions tests, namely single-factor regression and two-factor regression.

The regression tests out the relationship between art places and property prices. The hypothesis is that the closer proximity to art places the higher property prices.

There are two types of regressions to be examined in this study. One is Single Factor Regression and the other is the Two-Factor Regression.

For the Single Factor Regressions, the dependent variables are the property price adjusted by PPI for inflation and potential gentrification effects. The independent variables will be the distance between the property and the art places (clusters).

For the Two-Factor Regressions, the independent variable will be the distance to the CBD and whether the properties are within the 3 km radius of the art places(clusters). The reason for adding the new independent variables is to remove the CBD compound effect on property prices.

Single Factor Regression. In Single Variable Regression, Variable "y" equals the property price adjusted for inflation (using PPI index). Variable "x1" means the distance to a certain art place. Coefficient "a" means that the change of the property price for every 1 m away from a certain art place. Coefficient "b" equals the intercept of the property price, thus, hypothetically if the property is located exactly in a certain art place, the property price value is "b".

$$Y = ax1 + b$$

Where,
y = property price adjusted for Inflation (using PPI index),
x1 = distance to the art place
b = intercept

Two-Factor Regression. In Two-Factor Regression, Variable "y" equals the property price adjusted for inflation (using PPI index). Variable "x1" represents the distance to CBD (Raffles Place MRT) while Variable "x2" represents if the property is within a 3 km radius of a certain art place. Coefficient "a" means that the change of the property price for every 1 m away from CBD, of which Raffles Place MRT is used as a proxy. Coefficient "b" means the change to the property price if the property falls into the 3 km radius of a certain art place. Coefficient "c" equals the intercept of the property price, thus, hypothetically if the property is located exactly in a certain art place, the property price value is "c".

$$Y = ax1 + bx2 + c$$

Where,
y = property price adjusted for Inflation (using PPI index),
x1 = distance to CBD (Raffles Place MRT)
x2 = 3 km Radius of the art place
c = intercept

3   Results

The first observation and comparative test are to set a 3 km catchment area and compare its property prices with the average price of corresponding towns. The results are generally positive except for a few towns that have other stronger or unique factors that result in a higher property price compared to the catchment area of the art places within the town. Towns such as Downtown Core, Tanglin, and Geylang do not exhibit higher property prices for the specific catchment area from art places. Similarly, Gillman Barracks based on this test also did not exhibit higher property prices for its catchment area compared to the rest of the towns. This is believed to be due to the lack of amenities for its immediate catchment area compared to the rest of town. In short, this test will show positive results only if the art places have stronger attributing factors compared to the other amenities within the town.

The second test is to determine the property price of the catchment area and the corresponding towns on a "before and after" basis. As the property price is collected from the year 2007, there are only 3 art places that fulfilled the criteria to do the "before and after" test. In all 3 art places, the test showed that not only do the art places brought higher value to the catchment areas and but also to all the corresponding towns.

In the single-factor regression, the distance to the art places is used to explain the variations to the property prices. The test results for most art places (namely Cluster A, Cluster B, Botanic Garden, Gillman Barracks, and Holland Village) are statistically significant and showed that the closer to art places, the higher their property prices. In this single factor regression, only Goodman Arts Centre did not have a statistically significant result. As such, it was believed that one key variable, namely distance to CBD, might be confounded in the analysis and not accounted for.

Two-factor regression is further introduced to remove the compounding effect of CBD on property price. The distance to CBD and if properties are within the 3 km

catchment area are the two factors tested for this regression. These results are statistically significant and they showed that if properties are within a 3 km catchment area of art places, they have higher property price like-for-like. The results also showed an increase of the R-square to 32.89% to 56.65% from the previous 28.6% to 40.7%, implying that the higher percentage in changes in property price can be accounted for by the introduction of the new variable. However, both Goodman Arts Centre and Gillman Barracks do not have statistically significant results. The reasons for the non-conclusion results are (1) low sample size for the properties sold in the catchment area of Gillman Barrack and (2) Goodman Arts Centre is close to Geylang area which is a 'red-light district'.

3.1 Comparative Method (with 3 km Radius vs Town)

The overall comparison shows that art places have a positive impact on property prices (Table 2). The average property prices within the 3 km radius of art places are 1.60% to 19% higher than the average with all towns touched by the catchment area. The property prices within some specific towns even have an increase as high as 37.7%.

However, 2 out of the 7 selected art places are showing negative results. This is because of a few towns that have other stronger or unique factors that result in higher property prices compared to the catchment area.

Table 2. Summary of the results of the comparative methods for 7 representative art places

	Goodman Art Centre			Singapore Chinese Orchestra			Gillman Barracks			Singapore Chinese Dance Theatre			Botanic Garden			Souldeelight			Holland Village		
		Adjusted Price	Difference %		Adjusted Price	Difference %		Adjusted Price	Difference %		Adjusted Price	Difference%		Adjusted Price	Difference %		Adjusted Price	Difference %		Adjusted Price	Difference %
Average within Circle (3km)		904.19			1733.91			1051.9			838.09			1761.28			819.25			1423.41	
Average with all towns touched by the Circle	All Towns	916.76	-1.40%	All Towns	1552.35	11.70%	All Towns	1143.3	-8.00%	All Towns	811.61	3.30%	All Towns	1480.61	19.00%	All Towns	805.98	1.60%	All Towns	1397.88	1.80%
Average within Circle and within Town 1		1337.78			1852.8			1101.63			838.09			1829.89			918.8			1567.89	
Average within Town 1	Kallang	971.64	37.70%	Downtown Core	1884.86	-1.70%	Bukit Merah	1262.59	-12.70%	Bedok	811.61	3.30%	Tanglin	1703.86	7.40%	Bukit Batok	878.8	4.60%	Tanglin	1703.86	-8.00%
Average within Circle and within Town 2		828.73			1503.3			985.6						1447.29			744.59			972.24	
Average within Town 2	Geylang	829.94	-0.10%	Outram	1503.3	0.00%	Queenstown	1059.35	-7.00%				Bukit Timah	1261.76	14.70%	Bukit Panjang	733.88	1.50%	Queenstown	1059.35	-8.20%
Average within Circle and within Town 3		1335.07			1490.79									1439.26						1441.41	
Average within Town 3	Marina Parade	1033.04	29.20%	Bukit Merah	1262.59	18.10%							Novena	1173.49	22.60%				Bukit Timah	1261.76	14.20%
Average within Circle and within Town 4														2329.76							
Average within Town 4													Newton	2125.81	9.60%						

Goodman Arts Centre: In this instance, the impact was negative. The reason for the negative result is mainly because of the uniqueness of Geylang town as a 'red-light district' or pleasure district that is catering to prostitution and sex-oriented business and there is a higher number of property transactions in Geylang that resulted in a tilt in the results.

The average price within 3 km of Goodman Arts Centre and Geylang town is 0.1% lower than the average price within the same town. There is only a marginal difference between the town and properties within a 3 km radius of Goodman Arts Centre.

However, the results of Kallang and Marine Parade, also within the catchment area of Goodman Arts Centre, show a positive influence on property prices (37.70% and 29.20% increase respectively).

The expected positive impact of art places is not found in Geylang given the unique-ness of its locality. Geylang is highly associated with the red-light district of Singapore. There is also very limited or even non-existent urban rejuvenation within the town, despite its relative closeness to the CBD area. The other neighboring towns to Geylang, such as Marine Parade and Kallang, are deemed to be 'better' towns. Marine Parade is even one of the better residential enclaves in Singapore with mid-high-end condomini-ums. Kallang is also deemed to be good as it has the National Stadium and the Kallang River that is used for water sports, such as canoeing.

Gillman Barracks: The catchment area of Gillman Barracks encompasses 2 towns, Bukit Merah and Queenstown. The average price within the 3 km radius is $1051.9 psf, while the average price within all towns is $1143.3, which is 8.0% higher.

The results show that Gillman Barracks has a negative impact on property prices. One of the reasons for this is that Gillman Barracks might not be deemed as a successful art place, as it was also reported that many art owners/tenants in Gillman Barracks were out of business. Shetty (2015) reported in a local newspaper Straits Times that nearly a third of Gillman Barracks galleries have decided not to renew their leases because they feel that "the infrastructural additions to the barracks, such as better signage, covered walkways, and more food and beverage options, and programming of pop-up events, came too late. They were introduced about a year after the opening of the barracks."

Other than a lack of amenities for its immediate catchment area compared to the rest of the town, another reason is that most properties outside of the circles in towns are near the southern waterfront, which is the luxury residence cluster in Singapore.

Similarly, towns such as Downtown Core, Tanglin, and Queenstown do not exhibit higher property prices for the specific catchment areas from art places.

Downtown Core: The average price within a 3 km radius of the Chinese Orchestra is 1.7% lower than the average price within Downtown Core. The reason for the impact of art places in Downtown Core is less obvious because there are other attractions and major amenities, such as integrated resort (Marina Bay Sands), Clarke Quay, Boat Quay, and CBD, are in Downtown Core.

Tanglin: The average price within the catchment area is 8% lower than the average price in Tanglin. The reason for the negative result is because only a small amount of the properties in Tanglin are in the 3 km circle of Holland Village, the rest are near Orchard, which is the upscale shopping area and tourist attraction of Singapore.

Queenstown: The average price within the catchment area is 8.2% lower than the average price in Queenstown. The reason for the negative result is due to the property locations within the 3 km circle are considered not as prime, as other properties are either close to Orchard or near to Southern Waterfront, which is the luxury residential cluster in Singapore.

In summary, this method shows positive results only if the art places have a strong attributing factor compared to the other amenities within the town.

3.2 Comparative Method (Before and After Years of Opening)

The impact of art places is assessed based on the before and after opening year. For example, Gillman Barracks opened in 2012, and the average property price within the catchment area, defined as within the 3 km radius, is compared to between those in and before 2012 versus those in 2013 and after (Table 3).

Table 3. Summary of the results of the 3 art places under "before and after" analysis

	Gillman Barracks			Goodman Art Centre			Singapore Chinese Dance Theatre		
		Adjusted Price	Difference%		Adjusted Price	Difference%		Adjusted Price	Difference%
Year of Opening		2012			2011			2014	
Average within Circle (3Km) before and on year of opening		1004.76			814.82			811.64	
Average within Circle (3Km) after year of opening	All Towns	1169.76	16.40%	All Towns	1009.6	23.90%	All Towns	956.76	17.90%
Average within Town 1 before and on year of opening		1186			876.1			796.64	
Average within Town 1 after year of opening	Bukit Merah	1331.53	12.30%	Kallang	1157.9	32.20%	Bedok	1002.4	25.80%
Average within Town 2 before and on year of opening		876.49			738.88				
Average within Town 2 after year of opening	Queenstown	1229.14	40.20%	Geylang	951.35	28.80%			
Average within Town 3 before and on year of opening					923.18				
Average within Town 3 after year of opening				Marina Parade	1291.54	39.90%			

Gillman Barracks. The average property price within the catchment area of Gillman Barracks after the year of opening 2012 (from 2013 onwards) was $1,331.53 psf while the average property price within the same catchment area before the year 2012 was $1,186 psf, reflecting a 16.4% premium. This implied that the Gillman Barracks might have positively contributed to the increase of the property within the catchment area, as these prices were already adjusted for inflation, using the PPI for its region to adjust back the price to the Q1 year 2019 (index rebased to 100).

Goodman Arts Centre. The average property price within the catchment area of Goodman Arts Centre after the year of opening 2011 (from 2012 onwards) was $1,009.6 psf while the average property price within the same catchment area before and on the year 2011 was $814 psf, reflecting 23.9% premium. This implied that the Goodman Arts Centre has a positive influence on property prices within the catchment area.

Singapore Chinese Dance Theatre. The 3 km radius catchment area of Singapore Chinese Dance Theatre only encompasses one town: Bedok. The average property price within the catchment area of Singapore Chinese Dance Theatre after the year of opening 2014 (from 2015 onwards) was $956.76 psf while the average property price within the same catchment area before and on the year 2014 was $811.64 psf, reflecting 17.9% premium. This implied that the Singapore Chinese Dance Theatre has a positive influence on property price within the catchment area.

The results all showed that not only have the art places brought higher property values to the 3 km radius catchment areas but also all the corresponding towns in this "before and after" analysis.

3.3 Single Variable Regression

Table 4. Summary of results for single factor regression

Single Factor Regression	Cluster A	Cluster B	Botanic Garden	Goodman Arts Centre	Gillman Barracks	Holland Village
R-square	28.61%	27.60%	39.92%	0.10%	40.67%	32.70%
Coefficient "a"	-0.078	-0.077	-0.086	-0.055	-0.078	-0.071
Intercept "b"	1603.59	1559.21	1718.78	697.58	1818.08	1733.41
P-Value for "a"	0.00%	0.00%	0.00%	24.20%	0.00%	0.00%
P-Value for "b"	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%

Most of the results are statistically significant, except for Goodman Arts Centre. These results showed that the nearer to Art Places, the higher the property price. Every decrease of 1 m resulted in a decrease of between $0.071 to $0.086 psf to the property price (Table 4).

Using Cluster A for example, the coefficient "a" has a value of −0.078, it implied that for every 1 m away from Cluster A, the property price will decrease by $0.078 psf. Intercept "b" has a value of 1,603.59, implying property price will be highest and at $1,603.59 psf if it is located at the hypothetical point at Cluster A.

The R-Square value for this case is 28.61%, implying that other variables were not accorded for in this study. In other words, there are about 71.39% of the property price could not be explained by the distance to the art place Cluster A. This regression is statistically significant as the p-value for Coefficients "a" and Intercept "b" is 0.00% and 0.00% respectively, both are below 0.05 or 5% probability that they occurred by chance. In other words, the probability of coefficients "a" and "b" occurred by chance is only 0.00% and 0.00% respectively.

In this test, only the result of Goodman Arts Centre is statistically not significant as the p-value for Coefficient "a" is 24.2%, which is high above 0.05 or 5% probability. The reason for the high P-Value for coefficient "a" may be due to the fact this is only a single variable and the distance to CBD was not accounted for, resulting in an inconclusive finding for Goodman Art Centre.

Overall, most of the art places are statistically significant and showed that the closer to art place has a positive effect on property prices. Coefficient "a" has a value between −0.071 to −0.086, which means 1 m away from a certain art place, the property prices drop from $0.071 to $0.086 psf respectively. R-square values range from 27.60% to 40.67% suggesting that other variables were not ac-corded for in this study. In other words, there are about 59.33% to 72.40% of the property prices that could not be explained by solely the distance to a certain art place. As property price is a function of many inputs, it is impossible to obtain a high r-square value in this single variable regression.

3.4   Two-Factors Regression

Table 5. Summary of results for single factor regression

Two-Factor Regression	Cluster A	Cluster B	Botanic Garden	Goodman Arts Centre	Gillman Barracks	Holland Village	National Gallery
Adjusted R-square	33.81%	39.11%	54.65%	39.15%	31.08%	32.89%	35.86%
Coefficient "a"	-0.064	-0.048	-0.055	-0.086	-0.08	-0.08	-0.058
Coefficient "b"	268.81	424.48	697.58	-368.76	-39.26	325.13	347.96
Intercept "c"	1495.24	1321.72	1355.91	1764.98	1651.19	1631.34	1434.04
P-Value for "a"	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
P-Value for "b"	0.00%	0.00%	0.00%	0.00%	58.37%	0.00%	0.00%
P-Value for "c"	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%

Most of the results are statistically significant, except for Gillman Barracks. These results showed that being within the 3 km catchment area of Art Places, properties can have higher prices in a like-for-like situation. The art places are found to provide to increase the catchment area property price by $268.81 to $697.58 psf compared to others with the same distance to CBD (Table 5).

Using Botanic Garden as an example, its coefficient "a" has a value of −0.055, it implied that for every 1 m away from Raffles Place, the property price will decrease by $0.055 psf. Its coefficient "b" has a value of 697.58, implying that the property within the 3 km radius catchment area of Botanic Garden, the price is $697.58 psf higher than those not. The coefficient "c" has a value of 1355.97, implying property price will be highest and at $1,355.97 psf if it is located at the hypothetical point at Raffles Place MRT. This regression is statistically significant as the p-value for coefficients "a", "b", and "c" are all 0.00%, below 0.05 or 5% probability that they occurred by chance. In other words, the probability of "a", "b", and "c" occurred by chance is only 0.00%.

The Adjusted R-Square value for this case is 54.65%, which implies that other variables were not accorded for in this study. In other words, about 45.35% of the property prices could not be explained by the distance to CBD and whether it is within the 3 km radius catchment area of Botanic Garden.

In this test, only the result of Gillman Barracks is statistically not significant as the p-value for Coefficient "b" is 58.37%, which is high above 0.05 or 5% probability that they occurred by chance. In other words, the probability of "b" occurred by chance is 58.37%. The reason for the high P-value is because the properties within the 3 km catchment area of Gillman Barracks are too few (only 7 properties), thus the sample size is too small to be statistically meaningful.

Overall, the rest of the art places have statistically significant results. All results showed a negative number for Coefficient "a", implying that the further from CBD, the lower the property price. Most art places have positive values for Coefficient "b", between 268.81 to 697.58, implying that the presence of an art place within the 3 km added about $268 psf to $697.58 psf to the property price. Goodman Arts Centre is the only exception in this study, with a negative value for Coefficient "b". As discussed earlier on the comparative table, the reason for the negative result is mainly because of the uniqueness of Geylang and the higher number of transactions in Geylang that resulted in a tilt in the results for Goodman Arts Centre.

The R-square values have improved in the two-factor regression compared to the Single Factor regression. The R-Square Values for the Single Variable Regression are between 28.61% to 40.67%, while the R-Square Values for the Two Variables Regression are between 32.89% to 54.65%. The introduction of one additional variable, namely the distance to CBD, improves the value of R-Square for the Single Variable Regression. Since property prices are influenced by multiple factors, it is not unusual for the R-square for even the two variable regressions to be below 70%.

4 Discussion

4.1 Summary of Major Findings

In this paper, we have adapted quantitative research methods to test out whether art places have a positive influence on property prices and the community. We have managed to analyze the influence art places on property prices as a reflection of how art impacts the economy.

As discussed earlier, the property prices are adjusted and rebased using the Property Price Index computed by Singapore authority, the effects of inflation and potential gentrification or improved quality are already accounted for and removed from the comparison. PPI is not a quality constant index but only tracks general price movements. In other words, the increase in the property price over the years due to inflation or gentrification is reflected in the index. Hence, by reversing and rebasing the index to a single date (Q1 2009), these improved property prices due to inflation or improved quality in neighborhoods are eliminated.

In the first comparative method test, the results are generally positive, showing that the average property price within the 3 km radius of art places is higher than the average with all towns touched by the catchment area.

In the second comparative test of "before and after" analysis, all catchment areas and corresponding towns have higher property prices after the art places were established. This further suggests that art places do have a positive impact on both the catchment areas as well as the corresponding towns.

As there are externalities other than art places that might have a stronger influence on property prices, the first test of 3 km catchment areas might not fully explain if art places have a positive impact on property prices. For example, if there were two properties in the same town but one is nearer to an art place while another is nearer to a Shopping Belt or CBD, it is more likely that the one near to Shopping Belt or CBD has a higher property price. This does not imply that art places do not have a positive impact on property prices.

The comparative table focuses on the immediate catchment area and the corresponding towns. As the number of property price data points within the catchment areas are relatively small, it is unable to provide statistically significant findings.

In order to improve the data reliance, regression methodology is introduced. There are two regressions tests, namely single-factor regression and two-factor regression.

In the single-variable regression test, most of the art places are statistically significant and showed that the closer to art place has a positive effect on property prices. As property

price is a function of many inputs, it is impossible to obtain a high R-square value in this single variable regression. The causality of art place to property price might be weak due to the low R-square of between 28% to 41%.

In the two-factor regression, there are two improvements from the single variable regression. First, the potential compounding effect from Central Business District (CBD) is removed as the distance to CBD is included as one of the factors. Second, the R-square value has increased significantly from 32% to 55%. Coefficient "b" value between 268.81 to 697.58, in this test, means that the presence of an art place within 3 km catchment areas added $268 psf to $697 psf to the property price.

Summing up the results from comparative tables and regression tests, the art places do provide higher property prices from different analysis approaches.

4.2 Study Strength and Limitations

This study has managed to provide plausible and statistical observations that art places improved property prices, even after removing the inflation and gentrification effects. Most of the past research did not provide quantitative evidence of how art places help to improve property prices, especially in Singapore's context.

However, there are several limitations to this study. Property price is also influenced by other factors that are not accounted for in this study. First, the study of property prices is solely based on two key factors, which are distance to CBD and distance to art places. This resulted in only an R-square of between 33% to 57%. If the number of factors could be expanded in a further study, the reliance of the regression could be further strengthened. It is believed that the other factors that are not considered in this research and might have an impact on property price are factors such as amenities around the neighborhood, different facilities within the condominium project, distance to prominent schools, the total gross floor area, the floor level, etc. If these variables are introduced in a future study, there could be an improvement to the R Square value.

Second, the regression can be further refined to test the nonlinear relationship between art places and property prices. The basic assumption used in the model is that the relationship is linear. In a complex environment, the actual relationship might be nonlinear and therefore this research might have over-simplified the current assumptions.

Third, there could be other socio-economic benefits that were not tested and examined in this study. Hence, the socio-economic benefits from art places might not have been fully accounted for.

4.3 Implications on Practice

One key recommendation is that there is a need to have decentralized art places. It was observed that most of the art places are in the central region.

The introduction of art places in the neighborhood will improve the property prices in its corresponding town. For example, under the "before and after" analysis, the results all showed that not only have the art places brought higher property values to the 3 km radius catchment areas but also all the corresponding towns. This is a shred of strong evidence that art places help to drive prosperity to their neighboring area. Do note that

all property prices in this study are already adjusted for the inflation and other potential effects using URA Property Price Index to rebase the property price to Q1 2009. Hence, for equality basis, the need to have decentralized art places is crucial.

4.4 Future Research

Given the limitations discussed, it is interesting to also examine the socio-economic benefits of art places. For example, in future research, a survey can be conducted to understand the community perception of the art places and to understand their behavior towards art places.

There could be a further refinement to examine the economic benefits, including expanding the number of factors and using more advanced methodologies, including deep learning to unravel the economic linkages between art places and the economy.

References

Chanuki, I.S., Tobias, P., Helen, S.M.: Quantifying the link between art and property prices in urban neighbourhoods. Roy. Soc. Open Sci. **3**(4), 160146 (2016)

Chang, T.C.: Renaissance revisited: singapore as a 'Global City for the Arts.' Int. J. Urban Reg. Res. **24**(4), 818–831 (2000)

Chong, T.: Bureaucratic imaginations in the global city: arts and culture in singapore. In: Lee, H.-K., Lim, L. (eds.) Cultural Policies in East Asia, pp. 17–34. Palgrave, London (2014). https://doi.org/10.1057/9781137327772_2

Fabiana, F., Pierfrancesco, D.P.: How can street art have economic value? Sustainability **11**, 580 (2019)

Lim, C.T.: Chapter 2: The Anti-Yellow Culture Campaign in Singapore: 1953–1979. In The State and The Arts In Singapore Policies and Institutions, pp. 31–48. World Scientific Publishing Co. Pte. Ltd, Singapore (2019)

Kong, L.: Ambitions of a global city: arts, culture and creative economy in 'Post-Crisis' Singapore. Int. J. Cult. Policy **18**(3), 279–294 (2012)

Kong, L., Ching, C., Chou, T.: Arts, Culture and the Making of Global Cities: Creating New Urban Landscapes in Asia. Edward Elgar, Cheltenham (2015)

Shetty, D.: Nearly a third of Gillman Barracks galleries have decided not to renew their leases. In: Straits Times (2015). https://www.straitstimes.com/lifestyle/arts/nearly-a-third-of-gillman-barracks-galleries-have-decided-not-to-renew-their-leases