An Empirical Study on the Neighbourhood Effect of Refurbishment

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[Abstract]

An important portion of property value comes from property location, which is a function of the quality of surrounding environment (e.g. external views). In a congested living environment like Hong Kong, it is difficult, if not impossible, to have a view unobstructed by buildings. As such, the quality of views is dependent upon the aesthetic quality of surrounding buildings. It is likely that poorly maintained buildings will emit negative visual effects to their immediate neighbourhood. Refurbishing these poor buildings should, therefore, reduce or even counter this negative externality.

This study aims to empirically identify the effect of refurbishment on the prices of neighbourhood properties based on an analysis of panel data in Hong Kong. The data consists of property transactions in a large housing estate located in Pokfulam. This estate was chosen because its surrounding buildings underwent refurbishment in 1998. Results show that the refurbishment brought a significant increase in the price of properties facing the refurbished buildings, keeping other things constant. Given the aging building problem in most urban areas, the results pose significant practical implications on building refurbishment and urban rehabilitation as a whole. Developers or property owners may be lured to invest in the refurbishment of adjacent dilapidated properties with a view to a value enhancement of their own properties.

[Keywords]

Refurbishment, Apartment properties, Hedonic price model, Urban rehabilitation, Hong Kong

1. Introduction

Buildings, after wear and tear, will eventually fall into a state of dilapidation if there is no maintenance in place. Tackling urban decay has always been a major challenge to many well-developed cities. In Hong Kong, the incidents of falling concrete pieces and windows are frequent and have killed or injured a number of people. The government and quasi-government bodies advocated that refurbishment and proper maintenance are essential to curb building dilapidation (e.g. Housing, Planning and Lands Bureau, 2004). In fact, even in the absence of government intervention, there was evidence that refurbishment or maintenance works enhanced the market value of refurbished properties (for a comprehensive literature review, see Chau *et al.*, 2003). For example, BSP Writers (2004) reported an increase of HK$1,000 per ft^2 in property value after the comprehensive refurbishment of a large residential estate in Hong Kong. Chau *et al.* (2003), based on applying hedonic price analysis, found that refurbishment brought about a nine percent increase in property prices, which far exceeded the cost of refurbishment.

However, all of these studies presumed that the benefits of refurbishment are confined to the refurbished properties only. The external effects of refurbishment on neighbourhood properties have been largely ignored. With reference to Lancaster's (1966) seminal customer behaviour theory, housing can be regarded as a multi-dimensional good differentiated into a bundle of attributes that vary in both quantity and quality. An important portion of property value comes from the locality, which is a function of the quality of surrounding environment. Therefore, it is reasonable to conjecture that the increases in property values in BSP Writers (2004) and Chau *et al.* (2003) are, to a certain extent, attributed to two forces: the improvement in the subject buildings and the improvement in other buildings of the same estate.

This study aims to empirically identify the effect of refurbishment on the price of neighbourhood properties based on an analysis of a set of panel data in Hong Kong. The data consist of property transactions in a large scale housing estate located in Pokfulam. This estate was chosen because the buildings surrounding the estate have undergone

refurbishment. Results show that the refurbishment brought a significant increase in the price of properties facing the refurbished buildings, keeping other things constant. These results bear noteworthy practical implications on the building refurbishment and urban rehabilitation as a whole.

2. Neighbourhood Effect of Building Refurbishment

Although there is a large body of literature focusing on the effects of the neighbourhood quality on the property value (for example, Jacobs, 1941; Li and Brown, 1980; Colwell *et al.*, 2000; Boyle and Kiel, 2001), studies on the aesthetical impact of the surrounding environment on property value are not rich. Among these studies, most showed that the visual quality of the surrounding environment posed great influence on property value. For example, Benson *et al.* (1998) found that various qualities and types of water view commanded different premiums for waterside properties in the United States. Hamilton and Schwann (1995) found that the removal of visually unpleasant high voltage electric transmission line towers from adjacent properties in the United States increased their property value significantly by 5.7 percent.

However, only few studies focused on the quality of neighbourhood buildings on property value. Bourssa *et al.* (2004), by studying property transactions in New Zealand, found that the presence of attractive buildings in the neighbourhoood of a property added 37 percent to its value. By the same token, poorly maintained buildings should depress the value of neighbourhood properties. Negative externalities are created by the unsightliness of the poor properties. Refurbishing these poor buildings should reduce or even counter the externalities to their neighbourhoods.

As suggested by Pavlov and Blazenko (2005), a property owner tends to under-maintain his/her properties because he/she does not recognize the positive externality of maintenance for his/her neighbours. However, Pavlov and Blazenko only presented their ideas analytically. There is still a lack of empirical studies on the externality of building refurbishment or maintenance.

3. Methodology and Data

This study aims to empirically identify the externality effect of refurbishment on the values of neighbourhood properties. As refurbishment of buildings helps eliminate the unsightliness, the visual quality of neighbourhood properties is improved (particularly those facing the refurbished buildings). In this regard, it is hypothesized that *refurbishment added more value to neighbourhood properties which face the refurbished buildings than those not facing them*.

To separate the value enhancement effects of refurbishment from other factors, a hedonic price model[1] is employed to estimate the implicit prices of different property attributes based on a set of panel (i.e. cross-sectional inter-temporal) data. To select a suitable sample for this study, we followed the work of Chau *et al.* (2003) and studied two adjacent large scale housing estates in Hong Kong, namely Pokfulam Garden (PFLG) and Chi Fu Fa Yuen (CFFY). The properties in these two estates have been actively transacted so there are adequate observations for the estimation. PFLG underwent a comprehensive refurbishment, including complete replacement of external wall tiles and re-plumbing, in 1998. The works started in the mid 1998 and was completed in late 1998, involving a total gross floor are of about 0.91 million. The whole project cost about HK$50 millions (at 1997 price level). During the sample period, no improvement work was undertaken in CFFY except for routine maintenance. As shown in Figure 1, some properties in Blocks 16, 17, 18, 19 in CFFY face PFLG, while others do not. This makes CFFY a very good case to study its property prices before and after the refurbishment of PFLG. Thus, the transaction data of CFFY are employed in this study.

[Take in Figure 1]

To estimate the visual externality of refurbishment on properties in CFFY, a hedonic price model is established:

$$\ln P_{it} = \alpha_0 + \alpha_1 X_i + \beta_1 FACING_i \times PRE\_RFM + \beta_2 FACING_i \times POST\_RFM_i + \sum_{n=1}^{T} \gamma_n TIME_i + \varepsilon_i$$

where P_{it} is the transaction price of property i at time t;

X_i is a vector of property attributes (see Table 1 for details);

[1] Rosen (1974) is the classic reference on the theory of hedonic price model.

$TIME_i$ is a vector of monthly time dummies;

PRE_RFM_i is a dummy which equals 1 if the transaction was engaged before the refurbishment and zero otherwise;

$POST\_RFM_i$ is a dummy which equals 1 if the transaction was engaged after the refurbishment and zero otherwise;

$FACING_i$ is a dummy which equals 1 if the unit faced the refurbished building(s) and zero otherwise;

α_i, β_i and γ_n are coefficients to be estimated; and

ε_i is the stochastic term.

[Take in Table 1]

The coefficients of the variables (AGE_i, $AREA_i$ and $FLOOR_i$) in vector X_i capture the effects of structural attributes of the transacted properties. To cater for their non-linear marginal effects, square terms of these variables are added. Building age is expected to be negatively correlated with natural log of transacted price due to the deterioration of the properties. The coefficients of $AREA_i$ and $FLOOR_i$ are expected to be positive while those of their square terms are expected to be negative in view of the diminishing effects of the factors. Other than the above structural attributes, environmental attributes like the orientation of transacted properties and enjoyment of seaview are also considered in the model. The time effects on the property price are reflected in the coefficient γ_n.

The focus of this study lies in the coefficients β_1 and β_2. The former measures the price differential between the PFLG-facing properties and the non-PFLG-facing properties before the refurbishment. The latter measures the price differential after the refurbishment. As other factors have been controlled, the difference between these coefficients should reflect the price effect due to the change in the quality of view, i.e. the visual externality of the refurbishment. It is expected that the difference between the coefficients (β_2 -β_1) is positive.

As the announcement of proposed comprehensive refurbishment of PFLG might have expectation effects on the property prices of CFFY, transactions during the period immediately prior to the refurbishment were discarded. Similarly, it takes time for the

market to 'digest' the news and the actual outcome of the refurbishment. For these reasons, a six-month period before and after the works (i.e. the period between January 1998 and June 1999) is truncated from the sample data. There were in total 3,178 transactions in CFFY during the periods between July 1991 and December 1997, and between July 1999 and March 2001. Table 2 shows the summary statistics of the data.

[Take in Table 2]

4. Results and Discussion

The results of the hedonic price model are shown in Table 3. The adjusted R^2 is about 0.910 which is regarded as high for hedonic price analysis. Most of the coefficients of structural attributes, except building age, are highly significant. The coefficients of *AREA* and *FLOOR* and their square terms are significant at the 1 percent level. It echoes with our expectation that the effects of *FLOOR* on property prices increase at a decreasing rate. Contrarily, the effects of *AREA* increase at an increasing rate although the rate of change is subtle. The coefficient of *AGE* is insignificant while that of its square term is marginally significant. It may be because the buildings in the two estates were completed between 1978 and 1981. The difference between the ages of buildings at any particular time in our sample range is not large. Also, much of the effect of building age on transacted price is absorbed by the time dummies which are thought to have high positive correlation with the variable *AGE* and AGE^2.

Most interaction terms of seaview and orientation identified are significant. The only exceptions are *PVIEW*EAST*, *NVIEW*EAST* and *NVIEW*SOUTH*. The negative and significant coefficient of *NVIEW*WEST* suggests that properties facing west are the least preferred. It may be because of the heat absorption as well as excessive glare in the afternoon; this confirms our traditional wisdom.

The discussion then proceeds to the focus of this study. From the results, it is shown that the coefficient of the interaction term *FACING*PRE_RFM* is insignificant. This means that, before the refurbishment of PFLG, there is no significant difference in value between PFLG-facing and non-PFLG-facing properties in CFFY. On the other

hand, the coefficient of *FACING*POST_RFM* is significantly positive. This suggests that the refurbishment added values to those properties in CFFY facing PFLG compared with those not facing PFLG. The estimated increase in property value is 6.57 percent of the property price. Given the average price of CFFY (HK$2,890 per ft^2 at 1991 price level), the estimated value enhancement due to the refurbishment externality in monetary terms is about HK$190 per ft^2. With 378 flats in CFFY facing PFLG and the average flat size of 598 ft^2, the approximate total value enhancement in CFFY because of the PFLG refurbishment is HK$42.95 million.

[Take in Table 3]

The results of this study bear far-reaching practical implications on the urban rehabilitation in the urban areas in Hong Kong. Owing to the lack of developable land in Hong Kong, redevelopment of existing buildings is a popular means for new development. Nevertheless, it is usually unavoidable to have new buildings developed in the sea of dilapidated old buildings. In view of the results of this study, the developers may be lured to help refurbish the buildings in the neighbourhoods of their development sites in order to enhance the value of their new properties. Alternatively, the developers can consider purchasing these neighbourhood buildings, and carrying out improvement or even redeveloping the sites. Subject to transaction costs (e.g. in measuring contributions), the case also applies to existing property owners who want to improve the quality of their views or reap a value enhancement of their properties. Therefore, it presents a case that the quality of the built environment in dilapidating urban areas can be improved through the market force.

Yet, the effects of positive externality of refurbishment may vary with the scope of the refurbishment and also the characteristics of refurbished properties. For example, the external effect of refurbishment involving only the internal common areas of a building may not be the same as the case involving the external walls. The heights of the buildings underwent refurbishment, relative to the heights of their neighbourhood buildings, may also dictate the external effect. As a result, further studies are needed to find out the determinants of the externality of building refurbishment.

5. Conclusion

Chau *et al.* (2003) showed that refurbishment added value to refurbished properties while the externality of refurbishment was ignored. Although Pavlov and Blazenko (2005) considered the externalities of building refurbishment in the analysis of maintenance decisions of property owners, only analytical derivation was available. This study takes one step further and provides a methodology to empirically identify the externality of refurbishment on neighbourhood properties. Panel data of two actively transacted conjoining housing estates, one of which underwent comprehensive refurbishment in 1998, were employed for the hedonic price analysis. Results show that the refurbishment brought a 6.57 percent increase in the price of properties facing the refurbished buildings, keeping other things constant.

Given the aging building problem in most urban areas, the results pose significant practical implications on the building refurbishment and urban rehabilitation as a whole. For instance, developers or property owners may be lured to invest in the refurbishment of adjacent dilapidated properties with a view to a value enhancement of their own properties. Meanwhile, this paper only took the first step to identify the externality of building refurbishment which is at least applicable to the high density built environment like Hong Kong. Further research is needed to find out the determinants of the externality of building refurbishment and so the optimal level of refurbishment that can maximize the net social gain.

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Table 1: Description of symbols for property attributes used in the hedonic price model

Symbol	Unit	Description
AGE_i	months	The age of the building, which equals the difference between the date of issue of the occupation permit and the date of the transaction
$FLOOR_i$		The floor level of the transacted property
$AREA_i$	ft^2	The gross floor area of the transacted property
$FVIEW_i$		A dummy variable which equals 1 when the property possesses a panoramic seaview and zero otherwise
$PVIEW_i$		A dummy variable which equals 1 when the property possesses a partially obstructed seaview and zero otherwise
$NVIEW_i$		A dummy variable which equals 1 when the property does not possess any seaview and zero otherwise
$EAST_i$		A dummy variable which equals 1 when the property faces east and zero otherwise
$WEST_i$		A dummy variable which equals 1 when the property faces west and zero otherwise
$SOUTH_i$		A dummy variable which equals 1 when the property faces south and zero otherwise

Table 2: Descriptive statistics of property transaction data

	Mean	Standard Deviation	Minimum	Maximum
Property price (HK$ million)	2.42	0.75	0.25	7.90
Flat size (ft^2)	598.06	97.40	507.00	1009.00
Floor level	13.52	7.73	0.00	27.00
Age (months)	182.21	31.75	121.00	269.00
Facing PFLG	378	(11.89%)		

Table 3: Regression results for hedonic price model

Dependent Variable: ln*P*				
Independent Variables	**Coefficient**	**Std. error**	***t*-statistic**	***p*-value**
CONSTANT	-0.340357	0.085430	-3.984061	0.0001 **
AGE	-0.001195	0.000793	-1.507558	0.1318
AGE^2	3.75×10^{-6}	2.15×10^{-6}	1.747879	0.0806 *
AREA	0.000641	0.000158	4.054800	0.0001 **
$AREA^2$	7.37×10^{-7}	1.22×10^{-7}	6.061795	0.0000 **
FLOOR	0.012295	0.000873	14.08193	0.0000 **
$FLOOR^2$	-0.000274	3.14×10^{-5}	-8.740660	0.0000 **
*FVIEW*EAST*	0.033064	0.008044	4.110428	0.0000 **
*FVIEW*SOUTH*	0.032404	0.005699	5.685794	0.0000 **
*FVIEW*WEST*	0.032912	0.007628	4.314839	0.0000 **
*PVIEW*EAST*	0.011870	0.007606	1.560519	0.1187
*PVIEW*SOUTH*	0.038430	0.006313	6.087218	0.0000 **
*PVIEW*WEST*	0.051296	0.010377	4.943316	0.0000 **
*NVIEW*EAST*	0.003939	0.005517	0.713955	0.4753
*NVIEW*SOUTH*	0.008504	0.009278	0.916571	0.3594
*NVIEW*WEST*	-0.009130	0.005050	-1.807817	0.0707 *
*FACING*PRE_RFM*	8.88×10^{-5}	0.008207	0.010823	0.9914
*FACING*POST_RFM*	0.065658	0.019827	3.311502	0.0009 **
Adjusted *R*-squared	0.909685			
F-statistic	281.7015			
Prob (*F*-statistic)	0.000000			
Durbin-Watson stat	2.004120			
Nos. of observation	3178			

Notes: 1. (**) and (*) and mean the estimated coefficients of the variables are significant at 1 percent level and at 10 percent level, respectively.
2. The results for the time dummies are omitted and available upon request.
3. All coefficients are estimated with White's Heteroskedasticity-consistent standard errors.

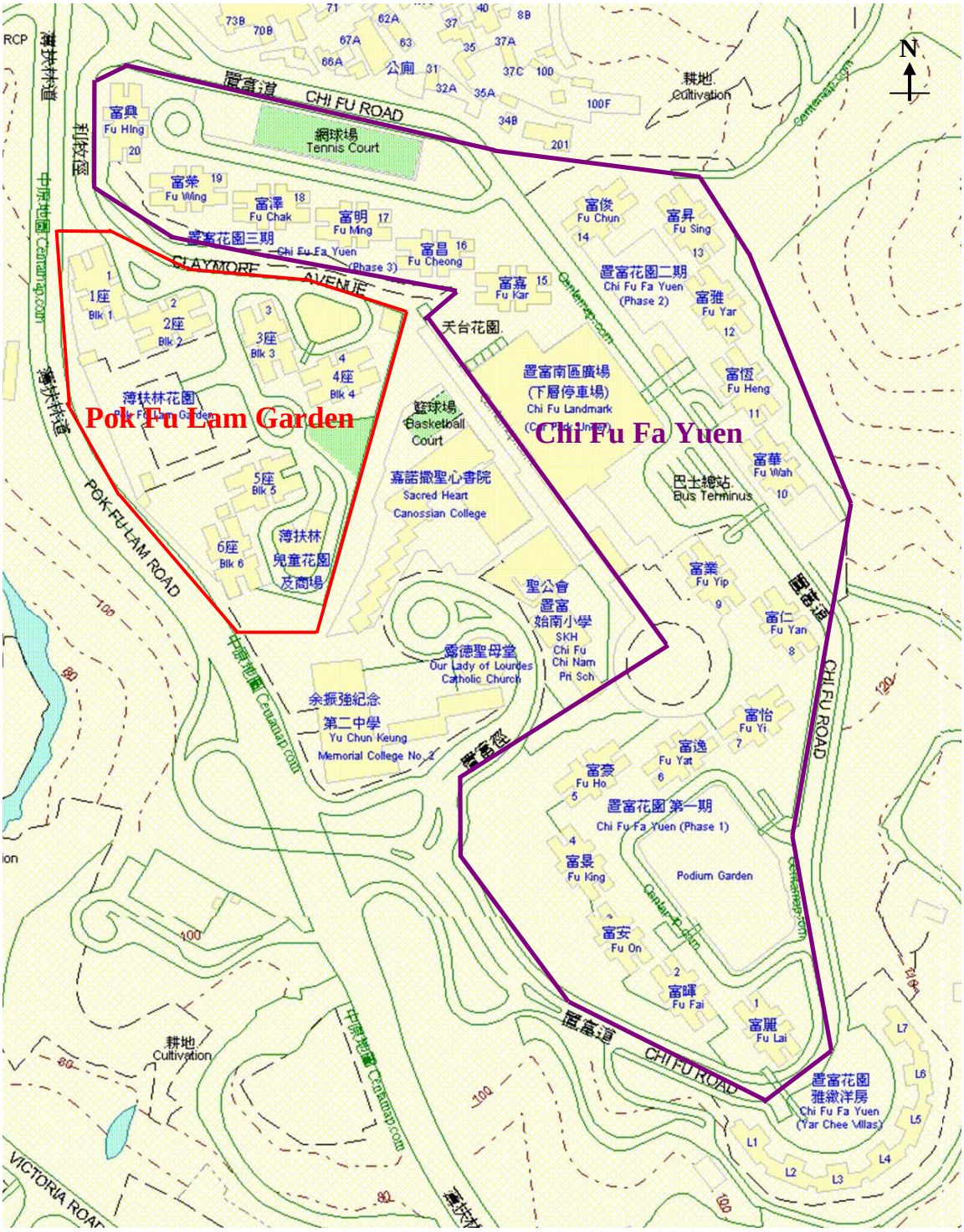

Figure 1: Block plan of Chi Fu Fa Yuen and Pokfulam Garden
(Source: http://www.centamap.com)