

***Principle of Selectivity in Housing Rehabilitation Subsidies:
A Case Study in Hong Kong***

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ABSTRACT

In view of tight public budget and public accountability, housing subsidies have to be selective. Different criteria are used to screen off ineligible applicants but inappropriately chosen criteria can result in inefficient resource allocation. This study investigates the subsidies offered by the public sector for rehabilitating private housing in Hong Kong. In light of the age-old problem of urban decay in the city, grants and loans have been offered to homeowners as an incentive to stimulate voluntary housing rehabilitation. Yet, whether the eligibility criteria of the subsidy schemes entail efficient resource allocation is in question. Upon the regression of the dilapidation assessment results of multi-owned housing in Hong Kong on the eligibility criteria, older and unmanaged housing is found to be more derelict. Development scale and rateable value are also correlated to the dilapidation level. Policy and practical implications then follow.

Keywords: Housing rehabilitation; subsidies; dilapidation index; selectivity; rationalization

INTRODUCTION

Cities and housing can be viewed as living organisms which deteriorate over time while also growing, developing and changing (Andersen, 2003). The built environment has to be kept up and adapted to changes in social needs and economic conditions. Yet, market processes of maintenance and renewal, in many cases, do not take place at an acceptable speed and extent. As a result, the cities decline, and housing becomes obsolete and deteriorates. Very often, governments take actions like subsidizing the processes of urban renewal and housing rehabilitation to arrest the urban decay. However, state interventions by means of subsidies always attract politics. Since the responsibility for proper upkeep of private housing should be vested in the homeowners, the use of taxpayers' money to subsidize private homeowners needs strong justifications. Besides, constraints in the public account also limit the ability of the public sector to help the private owners. Therefore, public money has to be spent wisely and responsibly, and this explains why the principle of selectivity is often adopted in the subsidy schemes for housing rehabilitation.

While redistribution of resources in the pursuit of social equity is a most important aim of social policy in many jurisdictions, selectivity in social policy could sometimes result in allocation inefficiency (Le Grand, 1991). Upon the employment of inappropriate eligibility criteria, the subsidies may not go to the very people who need them most. Against this background, it is interesting to study whether the principle of selectivity works well in the subsidization of housing rehabilitation. This study aims to explore whether the eligibility or screening criteria of the subsidy schemes are justified or not. Hong Kong serves as a good laboratory for this study because a number of subsidy schemes for rehabilitating private housing have been launched since the outbreak of the Severe Acute Respiratory Syndrome in early 2003 in the city. Moreover, as evidenced by Wong *et al.* (2005), resources dedicated to the improvement of the built environment in Hong Kong may not be directed to the most derelict buildings when some exogenous factors like building age are generally used as proxies of building conditions. In fact, the local subsidy schemes often use factors like building age, presence of homeowners association and rateable value as screening criteria. Therefore, these schemes may also be liable for the problem of wastage or resource mismatch.

This article is organized as follows. The following section offers an overview of the needs of housing rehabilitation and explains why subsidization is required. What comes next is the discussion over the principle of selectivity adopted in the subsidization of housing rehabilitation. The fourth section presents the analytical model which attempts to justify the screening criteria in the subsidy schemes in Hong Kong, and the data for the empirical study are also described. In

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the fifth section, the analysis results are presented and the corresponding practical and policy implications are discussed. Lastly, the article is concluded in the sixth section.

HOUSING REHABILITATION AND ITS SUBSIDIZATION

Needs of housing rehabilitation

Ageing of housing stock is a global issue, and urban regeneration is in urgent need to arrest urban decay. In many jurisdictions, redevelopment was once the dominating approach to urban regeneration with an eye to eradicating urban sores and releasing under-utilized urban land (Dimuna and Omatsone, 2010). Besides, open space and other amenity facilities can be provided to local community through area redevelopment (Yau and Chan, 2008). Nevertheless, on account of the lengthy process of property acquisition involved, the pace of redevelopment can seldom catch up with that of building dilapidation (Yau, 2009a). Moreover, redevelopment is seen as socially and environmentally unsustainable. It displaces original residents, destroys existing social networks and inflicts land-use conflicts (Couch, 1990; Alexandre, 1992; Li and Song, 2009). Redevelopment also creates a large volume of construction and demolition waste, which is eco-unfriendly and imposes a burden on waste disposal facilities (Pearce *et al.*, 1996; Poon, 1997; Itard and Klunder 2007).

In view of the negative impacts of redevelopment, housing rehabilitation has been proposed as an alternative approach to urban regeneration. The basic goal of rehabilitation is to extend the life of a building by compensating for previous underinvestment (Whalley, 1988). In spite of the smaller positive externalities to the neighbourhoods, housing rehabilitation brings about fewer negative environmental and social impacts to the community. Therefore, housing rehabilitation has gained popularity around the world (e.g. Balchin and Rhoden, 2002; Mallach, 2006; Ribeiro, 2008).

Why subsidise housing rehabilitation?

Yet, voluntary housing rehabilitation is costly and thus not automatic. State interventions by means of subsidy are often needed to promote housing rehabilitation for several strong justifications. First, the relationships between investment in housing, housing condition and occupants' health have been well documented (e.g. Nutt *et al.*, 1976; Lawrence, 2004; Shaw, 2004). Through subsidization, the financially unable can be assisted in order to stop the poor-housing-poor-health cycle (Thomas *et al.*, 2001). Secondly, the subsidization of housing rehabilitation can be justified from the perspective of market failure. Scanlon (2010) suggested that it would be efficient for the state to provide subsidies to individuals under certain conditions of market failure. In the case of housing, two types of market failure, namely merit goods and positive externalities, may be particularly relevant.

As revealed by Whalley's (1988) study in the US, housing rehabilitation can be stimulated or intensified by the presence of public incentives such as low-interest rehabilitation loans or matching grants. When the subsidies were not available, the households' capital would be used for immediate repairs, and was withdrawn from additional improvements. Moreover, housing rehabilitation can help retard building dilapidation which could result in excessive depreciation and undermine the economic sustainability of the built environment (Yiu, 2007; Hui *et al.*, 2008). In this regard, housing rehabilitation can boost up public health and preserve the asset value in a community. In addition, housing improvements through rehabilitation can be a means to increase the supply of housing space in the market (Dipasquale, 1999; Plaut and Plaut, 2010). By subsidizing rehabilitation, the state can increase housing supply and achieve the aim of lowering the rental level and overall housing cost. On these accounts, the outcomes of housing rehabilitation are 'merit goods' in nature as they are what society believes all people should have, whether or not the latter are able to pay for them.

At the same time, housing rehabilitation improves the quality of built environment of the whole area (MacLennan, 1993). As evidenced by Yau *et al.* (2008), the rehabilitation of a housing development in Hong Kong increased the prices of properties nearby by 6.6%. All these impacts are actually positive externalities brought about by housing rehabilitation to the neighbourhoods and the community as a whole. In general, the more dilapidated the housing stock the more likely there are to be positive externalities associated with improvements (Scanlon, 2010). Without any state intervention, beneficial rehabilitation is undertaken at a suboptimal level. Therefore, if housing rehabilitation is considered to be merit goods or provide positive externalities, there may be a justification for subsidising them. More importantly, public money invested in housing rehabilitation subsidization is not necessarily a net outlay. The study by Simons *et al.* (2003) evidenced that substantial economic benefits, such as increased property value, enhanced tax base and job creation, could be returned from the state's investment in assisting housing rehabilitation.

In the UK, renovation grants for the improvements of sub-standard housing were first introduced in the 1949 Housing Act (Boyne *et al.*, 1991). The grants were matching in nature, and applicants were required to meet a percentage of

housing improvement costs from their own resources. The grants were funded by the central government but disbursed by local authorities. Staff from the local authorities assessed the eligibility of the works for grant aid, and checked that the works had been undertaken (Scanlon, 2010). In the US, the Housing Act of 1949 authorized slum clearance and redevelopment only. Even after enactment of the Housing Act of 1954 which enabled the paradigm shift from slum clearance and redevelopment to urban renewal and planned rehabilitation, federal financial assistance for housing rehabilitation was still unavailable (Osgood and Zwerner, 1960). A systematic loan scheme was finally institutionalized in the Community Development Block Grant programme launched in 1974. In comparison with the UK approach, more emphasis has been placed on the provision of assistance with borrowing in rehabilitation subsidization in the US (Leather, 2000).

SELECTIVITY IN HOUSING REHABILITATION SUBSIDIES

Irrespective of the type of subsidy, subsidization of housing rehabilitation was likely to focus on a minimum standard given limited public resources (Leather, 2000). In point of fact, like many other state interventions, rehabilitation subsidization attracts politics. Political arguments often stress the need for legitimizing welfare in the eyes of the ‘abused taxpayers’ (Rose and Peters, 1978). The assumption underpinning these arguments is that the taxpaying middle class dislike paying for the welfare of others. Welfare should be residualized so as to targeted at the truly and most needy only. It is particularly true because, as far as private housing is concerned, the responsibility for proper housing upkeep should vest in the homeowners, and over-subsidization can be faulty. In the UK, for instance, the expansion of the financial aid for housing rehabilitation in 1969 resulted in speculative renovations – after renovating their privately rented housing occupied by low-income tenants with the financial aid from the state, homeowners sold the improved properties subsequently to more affluent homebuyers with an eye to considerable economic profits (Gibson and Langstaff, 1982; Leather, 2000).

In the case of financial retrenchment, public funding in sponsoring housing rehabilitation could be reduced (Leather, 2000). Besides, other social objectives such as community care, public health, energy efficiency and environmental concerns have further eroded the resources available for subsidizing housing rehabilitation. In this light, it is necessary for the state to make sure that the public money devoted to housing rehabilitation is widely used. This raises the highly political issue of selectivity in subsidy (Hout, 2007). Selectivity is opposite to universality such that a scheme or measure is selective when it is addressed to or has effect of benefiting only some people (Alderstam, 2005). Advocators of selectivity suggest that better resource allocation in social policy (or better use of social resources) can be achieved by discriminating consumers with different utilities (Davies and Reddin, 1978).

In spite of the benevolent goal of the principle of selectivity, the outcomes are not intended in real practice. It is rather common that one set of selected factors or criteria are deemed important and worth counting while others are marginalized or ignored altogether. Moreover, the reliance on selectivity may lead to the adoption of an incorrect set of eligibility criteria. All these inherent challenges may result in ‘the tragedy of selectivity’ – trying to target welfare to the truly needy inherently means that a part of them will not be reached (van Oorschot, 2002). As a result of the budget constraint and residualization, sensible rationing of housing subsidies (including those tailored for housing rehabilitation or urban renewal) is essential, and it is necessary for the public authorities to have a clear demarcation of the neediest welfare recipients. It is, therefore, beyond any reasonable doubt that rehabilitation subsidies should be allotted to the poorest households in the worst-conditioned properties or used to address the most distressed areas (Keating and LeGates, 1978).

To ration welfare to the most needy, the state needs to pick up a select group with the use of some eligibility criteria. For the contemporary housing rehabilitation grants in the UK, for example, the emphasis has been put on housing condition (Scanlon, 2010). Age and value of the property, rather than household income or wealth, are taken as eligibility thresholds. The deployment of these criteria is explainable. Previous empirical studies (e.g. O’Dell, 1991; Spivack, 1991; Wong *et al.*, 2006; Yau, 2008; Yau *et al.*, 2008) evidenced that older housing tended to be more derelict or dilapidated. Besides, mortgage lending policies issued by the banks usually discriminate against old properties (Hetzel, 1981). This may likely limit the financially capacity of the owners to improve these properties. That is why public organizations need to provide grants or loans to the owners of older housing. Moreover, it is common that improvement or rehabilitation grants were restricted to dwellings below a certain rateable value. Unlike open market value or rack rent, rateable value of a property is mainly determined by its locality and amenities (McKie and Kumar, 1971). Generally speaking, building condition is not a factor affecting rateable value. For example, in Hong Kong, even if a property is in a very rundown condition, its rateable value should be assessed on a refurbished basis unless the improvements are uneconomical (Pang, 2006). However, whether the application of these commonly used criteria leads to a rational allocation of rehabilitation resources is still an unanswered question. That is why this study attempts to explore whether the eligibility or screening criteria of the subsidy schemes are justified or not, using Hong Kong as a case study.

RATIONALIZING THE SCREENING CRITERIA FOR REHABILITATION SUBSIDIES: A CASE STUDY IN HONG KONG

Promotion of housing rehabilitation in Hong Kong

Building dilapidation has been a long-lasting urban problem in Hong Kong (Pryor, 1971; Hui *et al.*, 2008; Yau, 2008; Yau *et al.*, 2008) but financial aids for housing rehabilitation were available only after the handover in 1997 because a strategic framework incorporating building rehabilitation as a means of urban renewal had yet been developed. Following the recommendation by the Planning, Environment and Lands Branch (1996), an Urban Rehabilitation Fund amounting HK\$500 million was committed by the new government in the first Chief Executive's Policy Address (Tung, 1997). However, it was not established eventually, and the initiative was subsequently replaced by the Building Safety Improvement Loan Scheme (BSILS, which is also known as Building Safety Loan Scheme) (Tung, 1998). As the only incentive scheme administered by the government, the BSILS was launched in August 1998 to promote voluntary rehabilitation via low-interest loans for the owners of private buildings. A maximum of HK\$1 million non-means-tested loan is offered for building owners to carry out works for improving the safety of their buildings (Buildings Department, 2011). In the beginning, only residential and composite buildings were covered.² The scheme was later rolled out to cover all building types.

However, in the aftermath of the Severe Acute Respiratory Syndrome outbreak in early 2003, the urgent need to promote voluntary building rehabilitation surfaced. Two incentive schemes, namely the Building Rehabilitation Materials Incentive Scheme (BRMIS) and the Building Rehabilitation Loan Scheme (BRLS) were introduced by the Urban Renewal Authority (URA) in October 2003 and May 2004, respectively. Under the BRMIS, owners of private residential or composite buildings were granted incentive materials of an amount up to HK\$3,000 per dwelling unit, or 10% of the total cost of the rehabilitation work, whichever was lower. In 2005, the 10% cost ceiling was relaxed to 20%, and on top of reimbursement of the material cost, building owners in financial difficulties could also apply for a hardship grant of up to \$10,000 per unit. Professional and technical supports were also provided to ensure the quality of rehabilitation projects. Nonetheless, only those premises subject to statutory orders were eligible for the incentives. On the other hand, the BRLS was an interest-free non-means-tested loan scheme offered to owners of private residential or composite buildings to support repair and maintenance works in the common area of a building as well as works carried out at the same time to the interiors of individual dwelling units. In spite of the long repayment period (up to 60 months), the coverage of the BRLS is geographically limited to the URA's action areas only. Up until the end of March 2010, financial assistance had been given to the owners of about 39,700 units in over 510 buildings through these incentive schemes (Urban Renewal Authority, 2010).

In parallel with the BRMIS and BRLS, the Building Management and Maintenance Scheme (BMMS) was introduced by the Hong Kong Housing Society (HKHS) in February 2005. The HKHS committed \$HK3 billion to fund the scheme over a ten-year period. Under the BMMS, there is a grant scheme called the Building Maintenance Incentive Scheme (BMIS) which funds repair and maintenance works in relation to safety, hygiene and environmental protection in common areas of buildings.³ To be eligible for this incentive scheme, buildings need to have an owners' corporation which is also commonly known as incorporated owners (IO).⁴ As a complement to the BRMIS administered by the URA, the BMIS targets private residential or composite buildings outside the URA's action areas.⁵ Although its subsidy ceiling is same as that of BRMIS, BMIS also subsidizes costs in addition to material costs like professional fees. Furthermore, the Home Renovation Loan Scheme (HRLS) was also launched by the HKHS to help flat owners to carry out repair and maintenance works related to safety and hygiene of individual dwelling units. The maximum amount of interest-free and non-means-tested loan offered under this scheme is HK\$50,000. By the end of March 2010, 2,375 and 1,159 applications for the BMIS and HRLS, respectively, were received by the HKHS (Hong Kong Housing Society, 2010).

² Composite buildings refer to a development comprising both domestic and non-domestic (usually commercial) parts.

³ There is another scheme called the Building Management Incentive Scheme operated under the BMMS. This scheme offers grant to property owners for the formation of owners' corporations for their buildings.

⁴ IO is a statutory homeowners association formed pursuant to the Building Management Ordinance.

⁵ There are seven action areas in which the BRMIS operates, including Yau Ma Tei, Mongkok, Tai Kok Tsui, Ma Tau Kok, Shum Shui Po, Tsuen Wan, Kwun Tong, Wanchai, and Central and Western District.

To preserve jobs after the global financial crisis in 2008, the Hong Kong Government launched the Operation Building Bright (OBB) in collaboration with the HKHS and URA. The scheme was originally designed to last for two years, and it intended to provide subsidies and one-stop technical assistance to assist owners of about 1,000 old buildings with or without IO to carry out improvement works. As shown in Table 1, the subsidies offered under the OBB were the most attractive among all the schemes. It provided non-repayable cash subsidy up to HK\$16,000 per unit for repair and maintenance works in buildings' common areas. Owing to the great overlapping of all these subsidy schemes, there was an initiative to restructure and integrate them into a new scheme, called the Integrated Building Maintenance Assistance Scheme (IBMAS), in April 2011 (Urban Renewal Authority, 2011).

Table 1: Summary of the subsidy schemes for building rehabilitation in Hong Kong immediately before 1 April 2011

Scheme	BSILS	HRLS	BMIS	BRMIS	BRLS	OBB
Administer	Buildings Department	HKHS	HKHS	URA	URA	HKHS and URA
Date of Launch	August 1998	February 2005	February 2005	October 2003	May 2004	May 2009
Nature of Subsidy	Low-interest non-means-tested loan	Interest-free non-means-tested loan	Non-repayable grant	Non-repayable grant	Interest-free non-means-tested loan	Non-repayable grant
Maximum Amount of Incentive	HK\$1 million per unit	HK\$50,000 per unit	HK\$3,000 per unit for buildings with 50-400 units; or HK\$150,000 per building for buildings less than 50 units	HK\$3,000 per unit for buildings with more than 50 units; or HK\$150,000 per building for buildings with 5-49 units	HK\$100,000 per unit	HK\$16,000 per unit
Types of work or item subsidized	All types of works for reinstating or improving the safety conditions e.g. building and slope repairs, upgrading works on fire services installations, and removal of unauthorized building works	Repair and maintenance works in flat interior relating to safety and hygiene of the premises	Repair and maintenance works in common areas of buildings relating to safety, hygiene and environmental protection	Incentive materials offered in forms of a) wall paint; b) piping materials for plumbing and drainage; c) water-proofing materials; d) fire protection materials; and e) environmental friendly materials	Not specified	Repair and maintenance works in common areas of buildings relating to the structural and first safety of buildings as well as sanitary facilities

Table 2 summarizes the eligibility criteria of the subsidy schemes immediately before the restructuring. Generally speaking, these incentive schemes were offered to assist the homeowners of private housing to carry out repair and maintenance works. Therefore, all the schemes except the BSILS targeted private residential or composite buildings

only. In addition to the building type, building age was another common eligibility criterion adopted in the incentive schemes. Other than the BSILS and OBB, all schemes barred buildings less than 20 years old from application. Only buildings not less than 30 years old were eligible under the OBB and there was no age limitation for BSILS. Moreover, to be eligible for the BMIS, BRMIS and BRLS, the buildings were required to have an IO. The rationale behind is rather straightforward. Since these schemes subsidized improvements of buildings' common areas, the IO, which is a legal entity representing the interests all owners in a building, can be the sole contracting party with the funding agencies. This reduces the administrative burden and complexity of the subsidization process. In addition, scale of development is another important eligibility condition. The BMIS and OBB both required buildings to have not more than 400 residential units within the development. Moreover, property owners were eligible for the subsidies via the HRLS, BMIS and OBB if the residential properties in their buildings had an average rateable value not exceeding HK\$100,000 per annum for urban properties (including Tsuen Wan, Kwai Tsing and Shatin), or not exceeding HK\$76,000 per annum for properties in the New Territories.

Table 2: Eligibility criteria for the subsidy schemes for building rehabilitation in Hong Kong immediately before April 2011

Scheme	BSILS	HRLS	BMIS	BRMIS	BRLS	OBB
Building Type	All private buildings	Private residential properties	Private residential or composite buildings	Private residential or composite buildings	Private residential or composite buildings	Private residential or composite buildings
Building Age	Nil	≥ 20 years	≥ 20 years	≥ 20 years	≥ 20 years	≥ 30 years
Building Location	Nil	Nil	Outside the URA's action areas	Within the URA's action areas	Within the URA's action areas	Nil
Presence of IO	Not required	Not required	Required	Required	Required	Required only for Category 1 buildings
Average Rateable Value	Nil	≤ HK\$100,000 for urban properties; and ≤ HK\$76,000 for properties in the New Territories	≤ HK\$100,000 for urban properties; and ≤ HK\$76,000 for properties in the New Territories	Nil	Nil	≤ HK\$100,000 for urban properties; and ≤ HK\$76,000 for properties in the New Territories
Development Scale	Nil	Nil	≤ 400 units	Nil	Nil	≤ 400 units
Other Requirement(s)	Nil	Eligible applicants cannot hold other properties in Hong Kong	Nil	Only buildings subject to statutory actions or other relevant statutory orders are eligible	Nil	Nil

Research design

To reiterate, the aim of this study is to investigate whether the eligibility criteria for the incentive or subsidization schemes for private housing rehabilitation in Hong Kong are justified or not. Instead of exploring whether the subsidies go to the poorest people, this study attempts to justify the eligibility criteria by looking at whether the financial aids are directed to housing that is most problematic. This research direction is vindicated for the common goal of nearly all incentive schemes is to improve the quality of housing. With reference to the housing rehabilitation incentive schemes in Hong Kong overviewed afore, the level of dilapidation of multi-owned housing (*DILAP*) is modelled as a function $f(\cdot)$ of three vectors of determinants. Mathematically,

$$DILAP = f(S, M, V) \quad (1)$$

where S denotes structural characteristics of the housing (e.g. building age and development scale); M is a vector representing the management structure of the housing; and V refers to the house value. To operationalize the model, the elements in function are transformed or broken down so that

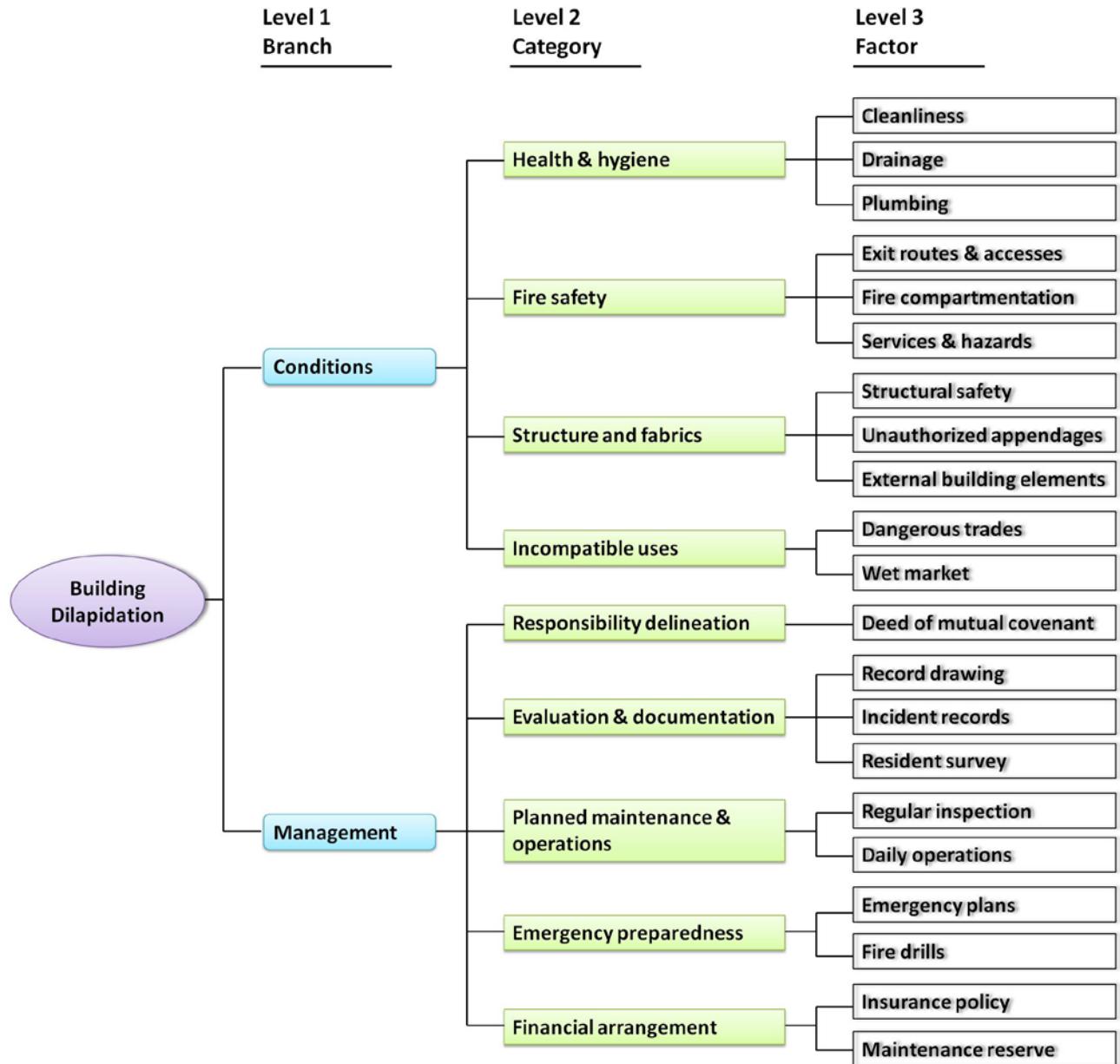
$$DILAP = f(AGE, UNIT, PMA, IO, RV) \quad . \quad (2)$$

The descriptions of these operationalized exploratory variables are tabled in Table 3. The dependent variable *DILAP* is measured using some measurable indicator of housing dilapidation. Among a handful of indicators gauging quality of high-rise housing, including the Building Health and Hygiene Index (Ho *et al.*, 2004), Building Safety and Conditions Index (Yau *et al.*, 2008) and Building Condition Index (Yau, 2008), the Dilapidation Index (DI) developed by Ho *et al.* (2012) is most suitable for this study. Observing scientific rigorous and practicability, the DI was designed to benchmark the degree of and proneness to dilapidation of buildings in Hong Kong and many other high-rise cities. An expert panel of members who specialized in building assessment in Hong Kong constructed the DI assessment framework which included 21 building factors (Ho *et al.*, 2012). These chosen factors were arranged in a hierarchy in Figure 1. As a matter of factor, the evaluation of both existing degree of dilapidation and proneness to dilapidation in the future is the distinctive feature of the DI assessment framework is. As shown in Figure 1, the *Conditions* factors measure various aspects of the existing conditions of the buildings under assessment. They collectively indicate the degree of dilapidation of a building as of the day of assessment. On the other hand, the *Management* factors affect the likelihood of a building to perform well. In other words, they give an indication of the proneness of an assessed building to dilapidation or dereliction in the future.

Table 3: Descriptions of exploratory variables

Variable	Description	Unit of Measurement
<i>AGE</i>	The age of the housing development, which equals the difference between the date of the issue of the occupation permit and the date of dilapidation assessment	Years
<i>UNIT</i>	The total number of dwelling units in the housing development	Number of counts
<i>PMA</i>	A dummy variable that equals 1 when an external property management agent is managing the housing development at the date of dilapidation assessment, and zero if otherwise	Not applicable
<i>IO</i>	A dummy variable that equals 1 when the housing development has an owners' corporation at the date of dilapidation assessment, and zero if otherwise	Not applicable
<i>ARV</i>	The average rateable value of the dwellings in the housing development	Hong Kong Dollars

Figure 1: Hierarchy of factors for the DI assessment framework (Ho *et al.*, 2012, pp. 155)



Mathematically speaking, the overall DI of building k , DI_k , is an aggregate of the ratings ($F_{H,ik}$) and weightings ($w_{H,i}$) of all 21 building factors:

$$DI_k = \sum_{i=1}^{21} w_{H,i} F_{H,ik} . \quad (3)$$

As the DI operates like a penalty point system, each building factor receives a rating ranging from 0 (for the best scenario) to 100 (for the worst scenario). There are four steps in the assessment of the 21 factors of a building: a) desk study on the background information of the building; (b) on-site inspection in and outside the building; (c) questionnaire survey on the property management staff or residents; and (d) validation and consolidation of the data (Ho *et al.*, 2012). With the use of the analytic hierarchy process, an expert panel comprising 48 local building professionals determined the weightings of the building factors (Ho *et al.*, 2011). After rating aggregation, each building's DI also ranges from 0 (for the best scenario) to 100 (for the worst scenario).

As for the independent variables, information about building age, development scale and management structure of the assessed buildings can be obtained from the Private Building Database administered by the Hong Kong Government

(Home Affairs Department, 2010). The average rateable value of each building can be calculated from the per-annum rateable values of all domestic properties in the building. The rateable values can be retrieved from the Rating and Valuation Department at cost.

Descriptions of data

In 2008, the study randomly selected and assessed 393 multi-owned housing developments in four districts in Hong Kong, namely Sham Shui Po, Yau Tsim Mong, Central and Western and Wanchai, using the DI framework. These four districts were chosen because they were target areas the URA set out for action prioritization (Planning and Lands Bureau 2001). Since no information on the rateable values of three buildings could be found, these three buildings were taken away from the sample. Table 2 describes the statistics of the continuous variables with regard to the remaining 390 buildings. *DILAP* ranges from 7.8 to 80.3, with a mean of 47.3 and a standard deviation of 14.3. Table 5 presents the correlation matrix of the independent continuous variables, and no strong correlation (i.e. $\rho > 0.4$) is identified. That means the dataset is free from the problem of multi-collinearity. 141 out of 390 buildings (36.2%) had a property management agent and 209 (53.6%) had an IO. 157 buildings (40.3%) had neither a property management agent nor an IO.

Table 4: Descriptions of exploratory variables

Variable	Minimum	Maximum	Mean	Standard Deviation
<i>DILAP</i>	7.8	80.3	47.3	14.3
<i>AGE</i>	3.8	67.3	32.6	14.0
<i>UNIT</i>	2.0	410.0	38.2	53.0
<i>ARV</i>	21,400.0	531,000.0	70,355.3	64,502.5

Table 5: Correlation matrix of the independent continuous variables

	<i>AGE</i>	<i>UNIT</i>	<i>ARV</i>
<i>AGE</i>	1.0000	-0.2554	-0.2225
<i>UNIT</i>	-	1.0000	0.1026
<i>ARV</i>	-	-	1.0000

ANALYSIS RESULTS AND DISCUSSION

Since the functional form of Equation (2) is not known *a priori*, three different specifications, namely linear, quadratic and log-log forms, are used for model estimation. The estimation results are summarized in Table 6. The adjusted R^2 of the estimations ranges from 0.70 to 0.74, indicating that the models in different specifications are able to explain about 70% of the total variations in the dilapidation of the sampled buildings. Irrespective of the functional forms adopted, building age has positive and significant (at the 1% level) correlation with housing dilapidation. Across the three models, the estimations return significant coefficients (at least at the 5% level) for development scale, existence of property management agent and average rateable value. As for the dummy variable *IO*, its estimated coefficient is significant (at the 1% level) in the linear and quadratic models but insignificant even at the 10% level in the log-log model.

On account of the highest adjusted R^2 , the explanatory power of the quadratic model is the greatest among the three. Therefore, discussions here are made over the results of this model. *DILAP* is found to increase monotonously with *AGE*. Every one-year increase in building age will lead in a rise in the DI by 0.51. Keeping other things constant, there is a gap of 15.3 DI score between a 10-year-old housing development and a 40-year-old one. This positive relationship

is straightforward because a building deteriorates when it ages. More importantly, the discriminative policies of banks or lending institutions against old properties limit the financial sources for housing improvements for this type of properties, delaying timely maintenance and repairs and increasing the potential of building dilapidation. Although building age alone accounts for 53.4% of the total variations in the dilapidation of the sampled buildings in this study, Wong *et al.* (2006) warned that building age should not be taken as a perfect proxy of housing quality. Other previous empirical studies such as Ho *et al.* (2008), Yau (2008) and Yau *et al.* (2008) evidenced that building age was only one of the many factors determining housing conditions and the extents of building problems (e.g. proliferation of unauthorized building works).

Table 6: Estimation results of the OLS analyses (*n*= 390)

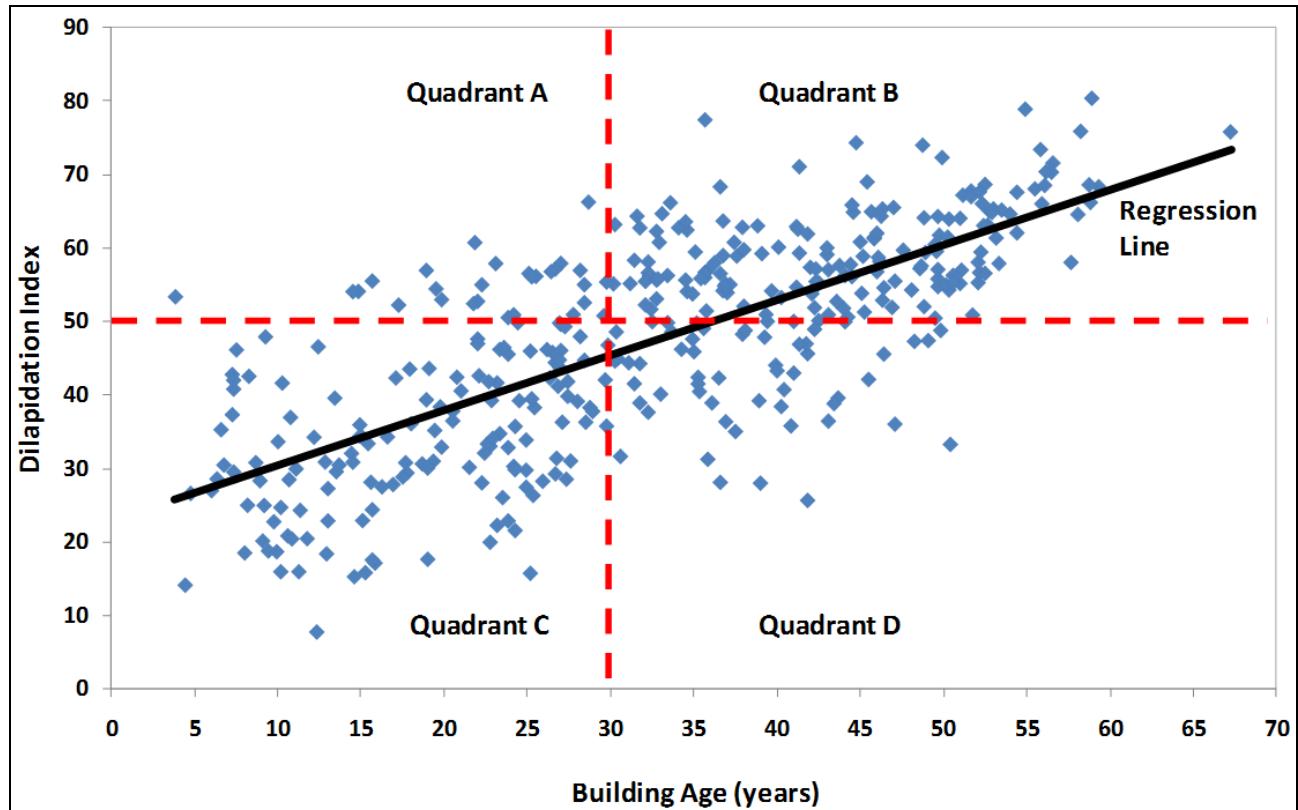
Dependent Variable	<i>DILAP</i>		<i>DILAP</i>		<i>lnDILAP</i>	
	β	<i>t</i> -statistic	β	<i>t</i> -statistic	β	<i>t</i> -statistic
Constant	40.78	23.06 **	44.33	14.61 **	5.55	14.68 **
<i>AGE</i>	0.49	13.23 **	0.51	3.50 **	-	-
<i>AGE</i> ²	-	-	-7.8×10^{-4}	-0.39	-	-
ln <i>AGE</i>	-	-	-	-	0.25	7.81 **
<i>UNIT</i>	-0.05	-3.77 **	-0.12	-5.23 **	-	-
<i>UNIT</i> ²	-	-	2.6×10^{-4}	3.43 **	-	-
ln <i>UNIT</i>	-	-	-	-	-0.08	-5.11 **
<i>PMA</i>	-6.05	-5.21 **	-4.73	-3.95 **	-0.13	-3.94 **
<i>IO</i>	-3.85	-4.12 **	-3.00	-3.26 **	-0.03	-1.10
<i>ARV</i>	-4.6×10^{-5}	-5.79 **	-9.4×10^{-5}	-4.13 **	-	-
<i>ARV</i> ²	-	-	1.1×10^{-10}	2.4 *	-	-
ln <i>ARV</i>	-	-	-	-	-0.21	-6.10 **
Adjusted <i>R</i> ²	0.72		0.74		0.70	
<i>F</i> -statistic	199.72 **		136.23 **		180.54 **	

Notes: (**) and (*) denote the estimated coefficients of the variables and test statistics to be significant at the 1% level and 5% level, respectively.

As a matter of fact, we can obtain insight into the ‘efficiency’ of a subsidy policy using building age as a proxy for building conditions by referring to the scatter plot of *DILAP* against *AGE* in Figure 2. The sloping solid line represents the estimated line of regression of *DILAP* on *AGE*. Based on this scatter plot, there are two different approaches to the rationing of housing rehabilitation subsidy. The more common approach, which is called the ‘vertical delineation’, involves the use of building age as a proxy of housing dilapidation. Given many subsidy schemes in Hong Kong adopt 30 years as an eligibility criterion, let us follow this rule in our illustration. A vertical broken line is drawn at the 30-year level. Only those buildings falling on the right section (i.e. Quadrants B and D) are eligible for the subsidies. Another approach, which is more target-oriented, attempts to delineate buildings according to their degrees of dilapidation. With an aim to improve the quality of urban built environment as a whole, an ideal public policy should direct the constrained resources to the most dilapidated buildings. In this regard, a ‘horizontal delineation’ is warranted.

Without loss of generality, we assumed that buildings with a DI score of 50 or above were deemed rundown or dilapidated. The horizontal delineation severs the plot in Figure 2 horizontally into two sections: the upper section (i.e. Quadrants A and B) contains dilapidated buildings while better buildings falls into the lower section (i.e. Quadrants C and D).

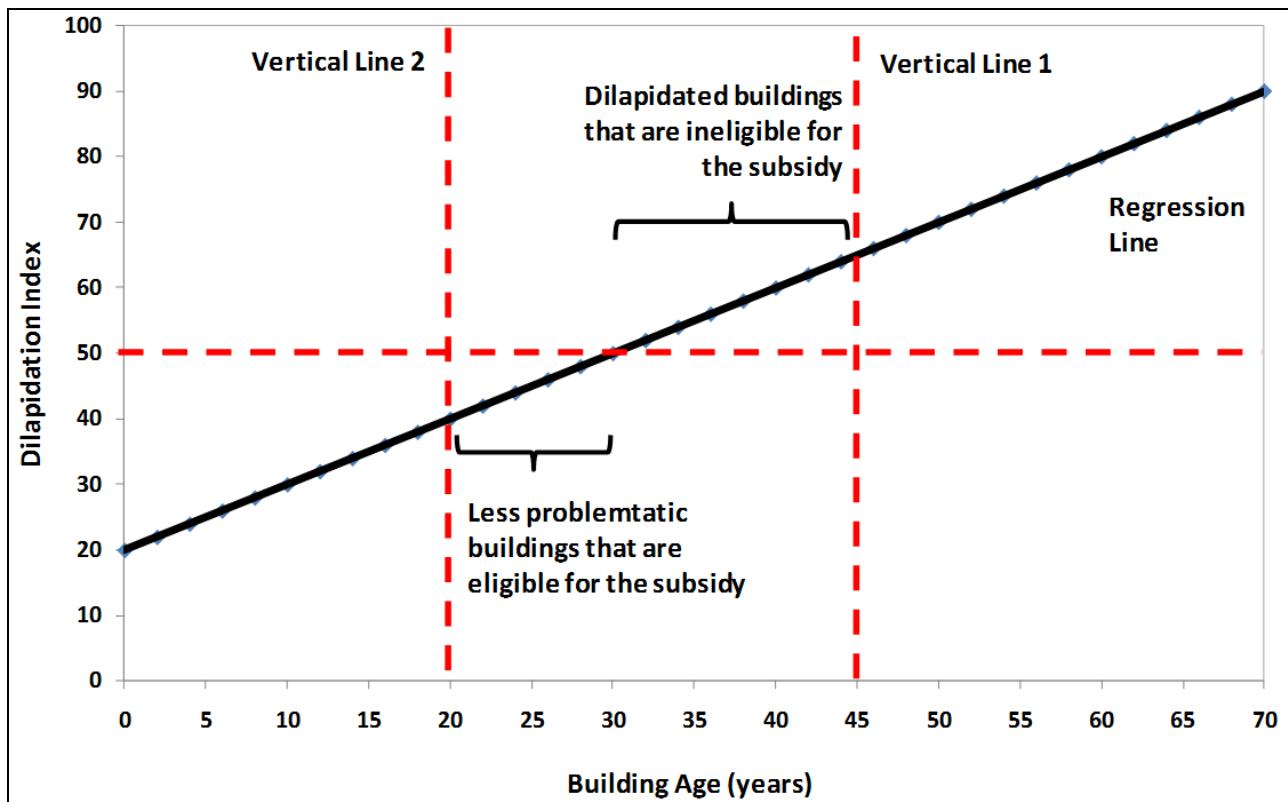
Figure 2: Scatter plot of DI against AGE



Nonetheless, the second approach of welfare rationing is rather costly to implement because some kind of building assessment or benchmarking is required before the public authority makes a funding decision. On the other hand, the vertical delineation is simpler in operation but selecting a suitable building age threshold is always thorny. In the ideal situation, all the observations in the scatter plot lie on the regression line. In other words, they are exact fits. Moreover, the determination of the socially accepted level of dilapidation (i.e. the level of the horizontal line) is easy and costless. The vertical delineation, which draws a vertical line to cut through the intersection point of the horizontal line and regression line, will yield an efficient outcome. In this case, no matter which criterion, building age or actual dilapidation level, is used, the same screening result will be given. The better-performing properties scatter to the left (or bottom), while the dilapidated ones scatter to the right (or top).

If the vertical line is not drawn through the intersection point of the horizontal line and regression line, inefficiency in resource allocation will occur. Figure 3 helps illustrate this point. Let us assume that a DI score greater than 50 is unacceptable. If the vertical line is drawn to the right of the intersection point (say in the position of Vertical Line 1), there exist some buildings that are dilapidated but ineligible for any subsidy. Homeowners of these excluded buildings may defer improvement works, aggravating the dilapidation problem. Conversely, some less problematic buildings are covered by the subsidy scheme when the vertical line is drawn to the left of the intersection point (say in the position of Vertical Line 2). Competition for financial aid will be keener because of the increased number of eligible buildings. In the absence of other eligibility or prioritization criteria, subsidy is offered on a first-come-first-served basis or the subsidy recipients are chosen by lot such that every eligible building has an equal chance of getting the subsidy. The highly limited public fund is probably diverted from some severely derelict buildings to the well-performing buildings. At this point, it is crystal clear that inefficiency in resource allocation will be the outcome if the vertical delineation deviates from the optimal level determined by the intersection point.

Figure 3: Inefficient allocation of subsidy resources



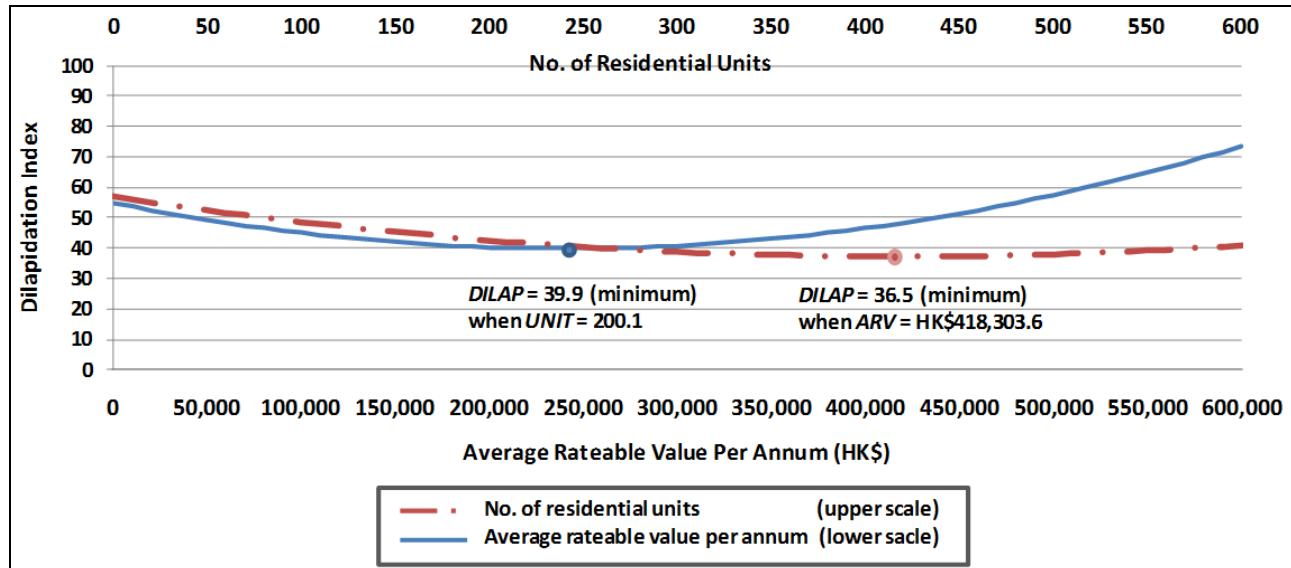
From above, the efficiency of the vertical delineation depends on two factors, namely the correlation of *AGE* and *DILAP* and the acceptable level of dilapidation. In reality, however, the relationship between *DILAP* and *AGE* is rarely a perfect correlation. Referring back to Figure 2, when the URA and HKHS provide loans or grants for buildings aged 30 years or older, buildings within Quadrants B and D were eligible for the subsidies while those in Quadrants A and C were excluded. In fact, those buildings in Quadrant D were in the good shape but those in Quadrant A warrant immediate improvements. This would be a case of public resources being directed not to the neediest buildings (i.e. Quadrant A), but to those well-performing (i.e. Quadrant D). More importantly, the acceptable level of dilapidation and thus the location of the intersection point cannot be determined easily. All these challenges render the use of any vertical line to partition the pool of buildings inefficient. In this regard, the use of additional eligibility criteria for screening applications for housing rehabilitation subsidy is warranted.

As unearthed by the empirical findings of this study, buildings that are less susceptible to dilapidation tend to have a PMA. This echoes with the findings of Yau (2008) and Yau *et al.* (2008) that PMA played an importance and effective in the maintenance of private housing quality. As for the existence of an IO, it has a significant and negative effect on the dilapidation level in the quadratic model. Paradoxically, most of the incentive schemes discussed (e.g. BMIS, BRMIS and BRLS) set the presence of an IO as one of the conditions of application. IO formation was not a prerequisite for the HRLS because the scheme did not deal with common areas of buildings. Understandably, targeting buildings with an IO eases the administrative burden of the funding authorities because there is one single point of contact for each building. Nonetheless, this kind of discrimination inevitably excludes many problematic buildings from subsidization. It is, therefore, a sensible move for the URA and HKHS to relax this eligibility constraint under the current IBMAS (Urban Renewal Authority, 2011).

DILAP is found to have non-monotonous quadratic relationships with *UNIT* and *ARV*, with both being concave upwards. These results imply the existence of optimal levels scale of development and property value (measured in terms of average rateable value per annum) for the evasion from the problem of housing dilapidation in Hong Kong. Figure 4 shows that for a housing development without property management agent and IO, its estimated DI score is the lowest when there are 200.1 dwelling units in the development, *ceteris paribus*. This DI estimation is reasonable because maintenance and repairs to the common areas are less likely for the very small and very large developments. In the former scenario, homeowners are reluctant to invest in housing improvements since each of them have to contribute

a relatively larger sum of capital (Yau, 2009b). In the latter scenario, despite the scale economy, the transaction cost incurred in coordinating a large number of homeowners in housing improvements is prohibitively high (Walters, 2002). As far as the BMIS is concerned, the eligibility ceiling for the number of residential units in a housing development was 100 in the very beginning. This ceiling was relaxed to 200 units in October 2005, and further raised to 400 in November 2007. Based on the DI estimation, the first relaxation in 2005 may not be strongly justified. Developments of larger scales are more prone to dilapidation, and thus should warrant subsidization. The funding bodies should consider relaxing the ceiling further.

Figure 4: A graph plotting the relationships between DILAP, UNIT and ARV



Similarly, Figure 4 indicates that the DI score reaches its minimum when the average per-annum rateable value of the housing development is HK\$418,303.6, keeping other things constant. Actually, this optimal level is well above the rateable value of average housing in Hong Kong. Before that level is reached, dilapidation problem is less severe when the property of interest is more valuable. For the HRLS and BMIS, the average rateable value threshold was lifted up several times over the years. The upper limit for residential units in urban areas was lifted from HK\$60,000 to HK\$100,000 while the ceiling for properties in the New Territories increased from HK\$45,000 to HK\$76,000. Seemingly, these uplifting exercises are not justified because they only made more better-performing buildings eligible for the subsidies. However, although intended to act as a rough means test, the rateable value ceiling often discourages improvements or repairs of higher-valued properties. Hetzel (1981) is correct that restriction of this kind makes little sense, particularly in an area improvement programme where comprehensive improvement of all dwellings in order to revitalize the whole neighbourhood is the main objective. Therefore, since 1980, the rateable value eligibility limits in housing rehabilitation assistances in the UK have been withdrawn for the disabled and homeowners in hardship. After all, there is still no strong evidence that the rateable value requirements in rehabilitation subsidy schemes in Hong Kong result in allocation inefficiency.

Other than the choices of eligibility criteria, the design of subsidy schemes can entail selectivity. In Hong Kong, the previous and current rehabilitation grants require matching contributions from the beneficiaries. The advantage of this arrangement is that it gives the beneficiary homeowners a financial stake in their projects (Scanlon, 2010). In this case, wastage and unnecessary works are discouraged, and hence more homeowners can be subsidized in the end. However, as one can imagine, this matching mechanism may exclude the poorest households from the subsidization as they do not have the money to provide matching contributions. Therefore, it is credible for the HKHS and URS to provide additional hardship grants to the poor households who pass a means test under the grant schemes.⁶

⁶ Hardship grants are also offered to the elderly and disabled subject to certain conditions.

CONCLUSION

Subsidies are sometimes granted to households who do not need them (e.g. those living in well-conditioned buildings), and many housing rehabilitation or improvement works have to be undertaken without any subsidies. Therefore, when granting financial aids for rehabilitation, it is necessary to select appropriate recipients. While selectivity should serve as a mechanism to concentrate resources on those in greatest need, it should not be used as an excuse for reductions in public expenditure for the promotion of housing rehabilitation. Yet, the issue of selectivity in housing rehabilitation subsidies has not been the focus of research. In this light, the aim of this study is to investigate whether those screening criteria adopted in the incentive or subsidization schemes for housing rehabilitation are justified or not. This paper outlines the development of a statistical model designed to identify the determinants of the dilapidation level of housing based on the results of dilapidation assessment on 390 housing developments in Hong Kong. Building age, development scale, management structure and rateable value were all found to have significant effects on a building's dilapidation level. The empirical findings suggest that the approaches of screening adopted in the past might have resulted in a bias towards selection. Developments of larger scales and those without IO were excluded from the subsidy schemes. With reference to these findings, the Hong Kong Government and other public organizations should have a comprehensive review on their subsidy schemes to see if the truly neediest buildings are targeted.

Though difficult to quantify, the contribution of this study to the body of knowledge is significant. This study pioneers empirical research on justifying selection or eligibility criteria of subsidy schemes for housing rehabilitation. It helps stimulate more similar studies with regard to rehabilitation subsidization. For example, one can investigate if the funding ceiling is reasonable or attractive enough for the carrying out of typical housing improvement works. While only one city is investigated in this study, implications can be drawn from the research findings onto the rationalization of housing subsidies in other places with a growing concern of housing disrepair and building dilapidation (e.g. US, UK, Japan and China). Given that the success of government strategies aimed at improving the quality of housing has been highly variable (Whalley, 1988), further studies should be directed to the evaluation of the subsidy programmes – which types of subsidy (e.g. loan, grant or tax benefit) are more effective in promoting voluntary housing rehabilitation and addressing the housing dilapidation problem. Besides, it is also valuable to know how the amount of private investment in housing improvement is affected by the incentive schemes, and whether the financial aids substitute for private funds that would have been spent anyway.

ACKNOWLEDGEMENTS

The authors gratefully acknowledge the financial support provided by the Research Grant Council of the Hong Kong Special Administrative Region (Projects #7009-PPR-4 and #CityU 1508/08).

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