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Influence of lot size and shape on redevelopment projects

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Abstract

Analyses on the economic effects of living environments provide a useful tool for evaluating the planning policies of urban redevelopment. In Japanese cities, an important issue in redevelopment projects where residents contribute some land for public services such as roads and parks is whether small lot size and poor shape prevent the residents from acquiring sufficient social benefits to compensate for the sacrifice of land. This paper analyzed the influence of lot size and shape on the externalities of local environments using a hedonic approach and applied the results to examine several situations of broadening a road in a densely built residential block. The analyses showed that the benefits of the projects were significantly influenced by the size and shape of the lots. To get adequate benefits to compensate for the land and the additional costs of the projects, the involved lots should be larger than a certain limit and satisfy certain requirements on their shapes. The analyses also revealed that, because of the influence of lot size and shape, relaxing the planning controls on floor-to-area ratio (FAR) for the redeveloped areas does not necessarily create incentives for residents to be getting involved. These results suggested that appropriate considerations for lot size and shape are indispensable for the expedition of redevelopment projects.

Keywords: Planning policy; Redevelopment; Hedonic; Externality; Lot size; Lot shape

Introduction

Redevelopment is significant for urban planning more than ever before. However, there are many obstacles in redevelopment projects. One of the largest ones is probably the resistance of residents due to insufficient incentives to be getting involved or the feelings of unfairness. To address these issues, analyzing the economic effects of living environments is a useful approach.

In Japanese cities, a special issue in the implementation of urban redevelopment is the objections of residents towards the evaluation of lot size and shape. This paper applies the empirical results of hedonic regression analyses to reveal the impact of lot size and shape on the costs and benefits of redevelopment projects and attempts to provide useful implications for planning policies.

The past decades have seen a consistent increase of small properties in large Japanese cities. According to recent survey results in Tokyo metropolitan areas, 45% of land properties are less than 100 m^2. Small lot size has given rise to serious environmental problems in residential areas such as poor sunshine, loss of trees and green space, insufficient public services, and vulnerability to disasters. Therefore, improving the living environments of the densely built areas by redevelopment is a very urgent issue.

In practice, land readjustment projects are the most popular way for urban redevelopment. The basic concept of the projects is that a proportion of the existing lots are contributed for public services (such as roads and parks) and the sacrificed land is compensated by raised land values through the improvement of environments. The values of each involved lot are evaluated, upon which a land contribution rate is decided to ensure the same land values after the implementation of the projects. If a lot is too small to contribute land, a financial contribution corresponding to the land contribution should be made.

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Table 1
Definitions of narrow-width and long-depth factors

a (m) (frontage)	Narrow-frontage factor	b/a (depth/frontage)	Long-depth factor
$a<2.0$	0.80	$b/a<3.0$	1.00
$2.0\leqslant a<2.5$	0.84	$3.0\leqslant b/a<4.0$	0.99
$2.5\leqslant a<3.0$	0.88	$4.0\leqslant b/a<5.0$	0.98
$3.0\leqslant a<3.5$	0.92	$5.0\leqslant b/a<6.0$	0.97
$3.5\leqslant a<4.0$	0.96	$6.0\leqslant b/a<7.0$	0.96
$a\geqslant 4.0$	1.00	$7.0\leqslant b/a<8.0$	0.94
		$8.0\leqslant b/a<9.0$	0.92
		$b/a\geqslant 9.0$	0.90

To evaluate the involved lots, the unit price of land is defined to be the product of 'street price' and four factors: 'narrow-frontage factor', 'long-depth factor', 'irregular-shape penalty', and 'dual-front-road factor'. Street prices are the standard prices of land along main streets of cities announced by National Tax Administration once every three years (based on transaction surveys), which are identical along each street. It is used to represent the general improvement of the environments. The four factors are used to reflect the impact of lot size, shape and front roads on land values. The adjustments by the four factors are quite limited. For example, Table 1 quotes the definitions of narrow-frontage and long-depth factors. According to the definitions, if the frontage of a lot remains 4 m or larger and the ratio of its depth to frontage less than 3.0, the values of the two factors before and after the improvement are all the same. In practice, such cases are quite popular. As a result, the rates of land contribution are almost fixed, regardless of the size and shape of the involved lots.

This evaluation method is questionable. First, there is no reason to assume that the environmental benefits of redevelopment are uniform over streets. For example, a neighborhood park might affect closer properties more and affect farther properties less. Another serious problem is that the effects of improvement may correlate to the size and shape of lots so land contribution rate should differ, but these kinds of effects have not been considered carefully.

In practice, land readjustment projects are especially difficult to be implemented in overcrowded areas. In particular, the identical rate of land contribution is concerned by the owners of small lots. Many people consider that the same amount of land of smaller lots is more valuable for dwelling so small lots should be exempted from land contribution. Sometimes, undesirable changes on the shapes of small lots resulted from redevelopment projects are not evaluated sufficiently. This also raises objections to the projects. To create more incentives for redevelopment projects, policies such as relaxing planning controls on the maximally allowed floor-to-area ratio (FAR) of lots in redeveloped areas have been adopted but they appeared to have little effect.

So far, land readjustment projects have mostly been conducted by public or semi-public sectors. When troubles arise in projects, public revenues are often induced in order to put forward the projects, but it is improper to treat the owners of small lots similar to that of the weak just because their land is small (Asami, 2000). Nowadays, land adjustment projects emphasize the involvement of residents much more than ever. Therefore, an objective evaluation for the relationships between lot size, shape and the social benefits of environmental improvement is increasingly important. Assessing redevelopment projects and planning policies based on such examinations is critical.

Methodology

The issues related to the impact of lot size and shape on property values have been discussed in a certain number of studies. For example, Tabuchi (1996) stated that the price of lots in many American cities decreases with lot size, while he demonstrated that larger residential lots are proportionately more expensive with samples in Osaka city, and this is explained by irreversibility of land subdivision and an oligopolistic market structure with non-decreasing marginal utility of lot size. Hatta and Akai (1996) empirically found that the unit price of land is linearly affected by the reciprocal of lot size. The fact that land values were higher for smaller lots was correlated to the existence of a basic cost for lot development. These works suggest that the effect of lot size is significant enough to be considered in project assessment.

In addition, some analysts raised evaluation models for lot size and shape. For example, Colwell and Scheu (1989) proposed an evaluation model for rectangular lots in the United States, assuming that the benefits for developing a lot are $\pi = \alpha F^{\beta} D^{\gamma} - \delta FD - \psi F$, where π is the benefit of development per lot, F and D represent, respectively, the frontage and depth of lots, α, β, γ, δ, and ψ are parameters. The $\alpha F^{\beta} D^{\gamma}$ term is the value of the developed land; δFD and ψF are the costs of land development. The optimum size and configuration of land lots were derived by maximizing π. Asami (1995a) demonstrated that evaluating an 'island lot' (the main part is away from roads) by letting its price to be proportional to the product of its size and an irregular-shape penalty as in the land readjustment projects was problematic and Asami (1995b) modified the lot evaluation functions to resolve this problem.

A limitations of these studies is that, while they considered the influence of lot size and shape on their values, the studies did not deeply investigate the effects of redevelopment on living environments. When urban redevelopment projects involve many small lots, the external effects of the environments are significant.

Hedonic regression analyses provide a useful method for estimating the external effects of redevelopment projects. The theory of hedonic regression analyses is based on the capitalization hypothesis. That is, improvement in living environments corresponds to the rise in market prices so it