The Externality of Building Violations in Urban Environment-Empirical Observation in Taiwan

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ABSTRACT

Building violations are currently one of the most important building management issues faced by all city and county government building authorities in Taiwan. The existence of widespread building violations in Taiwan may derive from the gap between "legal building usage," which means that a building has been legally constructed in accordance with the Urban Planning Act, the Construction Act, and the Building Code and Regulations, etc., and has obtained legal permits, and "reasonable building usage," which reflects the user's point of view about reasonable use of the building's space to meet the user's needs.

This paper takes cases of building violations in Tainan City as its empirical research subject, and classifies, analyzes, and compares the characteristics and influence of building violations in terms of the dimensions of time and space. Externality theory is used to explore the difference between "legal building usage" as prescribed in laws and regulations and "reasonable building usage" in the eyes of users. In addition, a questionnaire survey is used to gain an understanding of residents' spatial use needs and analyze the reasonableness of building spatial management laws and regulations, so that recommendations concerning appropriate building management strategies can be provided. Lastly, the hedonic price method is used to establish a hedonic price model for building violations, which is used to analyze the actual effects of the different building management strategies.

KEYWORDS: Building violations, Externality, Hedonic Price, Taiwan

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1. Introduction

Possible problems about building management in urban areas mainly include building violations and usage violations, which is also one of the key subjects for the building authorities on building management. The so-called building violations mean all buildings constructed within areas carrying out urban planning, urban regional planning or areas applicable to the Construction Act designated by the Ministry of the Interior without receiving examination carried out by and the building permit issued by the building authorities. Said usage violations mean all applications in legal buildings violating the urban planning or non-urban land use control regulations in terms of nature or categories of usage.

Building violations still generally exist despite urban planning and building management codes in Taiwan at present. This may be due to the fall between "Legal Building Usage" and "Reasonable Building Usage". Said "legal building usage" means buildings are legally constructed according to the Urban Planning Act, the Construction Act and the Building Code and Regulations, etc. and have obtained legal permits. While said "reasonable building usage" means the space of usage of buildings are provided according to the personal demands and the natures of the buildings based on the viewpoints of the users. Should there be a consistent reorganization on both concepts, theoretically, there should be no building violations. However, the actual existence of building violations shows that the fall of a certain degree does lie between the both.

Therefore, the purpose of this study is to, through the analysis of externality, discuss how to propose appropriate management strategies according to the demands of the users from the aspect of laws and regulations according to the fall between the "legal usage of buildings" stipulated by laws and regulations and the "reasonable usage of buildings" from the aspect of the users. This study also tries to take Tainan City as the object to find out the fall between the legal usage of buildings and the reasonable usage of buildings through the data of building violations reports and the questionnaires on the characteristics of the demands of the residents for the usage of building spaces so as to educe proper and reasonable building management strategies and to explain the expected benefits of relevant strategies from the analysis on the eternality.

2. Externality theories and documents relating to building violations

The rapid increase in building violations in Taiwan is a thorny problem that government would like to resolve. Despite the many papers concerning this issue (Lai & Ho, 2001; Yiu & Yau, 2005; Yiu, 2005; Ho, 2007), there have been few empirical studies on the subject. Furthermore, most literature on the handling of building violations investigates the subject from the point of view of legal and administrative considerations, and there has been little discussion of the externalities produced by building violations.

In the discussion of Kuen-Tsing Shieh (2006) on building violations in Kaohsiung City, Taiwan, he proposed his viewpoints on the causes of building violations from aspect of law, society, economy and administration. Targeting at the treatment modes of building violations in Taiwan, Ting-Yi Lin (2005) pointed out in his study that, there are 6 main causes why building violations cannot be eradicated, including: Insufficient awareness of laws and regulations on construction of the people; Most people still have the mind of fluke or illegal lobby of elected representatives; Inability of existing laws and regulations to thoroughly and effectively punish building violations; The lack of outlays and manpower, failure of implementation of bans; Most citizens of Taipei believe that the existence of building

violations will influence the rights of citizens and the overall residential environments; There's still flexible space left by authorities of Taipei City Government for the treatment of building violations. Hung, Tsun-Shan (2002) pointed out 5 points in his study including the treatment modes of building violations that the influence of building violations on residential quality and safety includes, he also provided 8 recommended modes for treatment of building violations including bidding for compulsory dismantlement, etc. Chiu, Hung-Che (2001) has proposed policies for treatment of building violations and divided them into two types of "Instructive" and "Banning".

3. Analysis on the features of the usage of building space by urban residents in Taiwan

In order to the features of the usage of building space by urban residents so as to explore the opinion of the users for "reasonable usage of buildings" and probe into possible causes for different types of building violations, this article analyzes the demands of users by collecting data on building violators surveyed by means of questionnaires on data of building violations investigated and reviewed. Moreover, in order to find out the externality of building violations, questionnaires have also been handed out to neighbors of building violators so as to collect data on the impact on physical environment of buildings.

3.1 Questionnaire

In order to fully compare the differences in the demands of building violators before and after full implementation of the capacity control, this study adopts the 8,304 building violators investigated in Tainan City in the 5 years (1992~2002) before and after the implementation of the capacity control (1997) as the targets and carry out sampling with the cooperation of registered households in different administrative districts, with the sampling rate of 3%, it has been estimated that 250 building violators would be sampled. However, due to the sensitive content of the questionnaire and the particularity of respondents, a high reject rate has occurred during our door to door survey, after repeated sampling continuously, altogether 2,716 replied have been received, which is less than 1/3 of all targets, including only 172 households as valid samples.

As for the questionnaire survey for impact of building environment on neighbors of building violators, one household was randomly sampled in the neighborhood of each building violator willing to receive the survey; therefore, respondents of the survey on neighbors of building violators were also 172. The questionnaire survey was carried out in the door-to-door mode during Jul and Sep of 2008.

3.2 Results analysis

3.2.1 Analysis on results of the questionnaire survey on building violators

Altogether 172 building violators were surveyed and the results are as follows.

a. Basic data of respondents

The respondents are during the age span of 41~60, mainly with the education background of junior or senior high school, most of them are commercial operators with the monthly income of below NT\$ 40,000, families with 3~5 members take up a high proportion.

b. General survey of real properties of respondents

Most of all building violators surveyed have land and buildings under their own ownership (about 70%, see Table 1), with the land of building of about $36\sim99m^2$, most of them have the structural area of 69-198 m², etc.. In term of building structure, most of their buildings are 1-store~4-store buildings, most are with $3\sim4$ bedrooms, 2 halls, $2\sim3$ bathrooms, $0\sim1$ terrace and $0\sim1$ parking space (See Table 2).

Land title	Times	%	Building title	Times	%
Privately-owned	123	71.51	Privately-owned	120	69.77
Tenanted	49	28.49	Tenanted	52	30.23
Total	172	100.00	Total	172	100.00
Land acreage (unit: 3.3m ²)	Times	%	Land acreage (unit: 3.3m ²)	Times	%
Below 10	7	4.07	Below 20	1	0.58
11~20	19	11.05	21~40	22	12.79
21~30	51	29.65	41~60	16	9.30
31~40	12	6.98	61~80	10	5.81
41~50	8	4.65	81~100	11	6.40
Over 50	5	2.91	Over 101	17	8.14
Subtotal	102	59.30	Subtotal	77	44.77
Missing value	70	40.70	Missing value	95	55.23
Total	172	100.00	Total	172	100.00

Table 1 Land and building title and area of building violators surveyed

Source: Investigation data of this study

 Table 2 Overview of building spaces of building violators surveyed

Item	Sto	ries	Bedr	ooms	Ha	alls	Bath	room	Terr	ace	Parkin	g space
Number	Times	%	Times	%	Times	%	Times	%	Times	%	Times	%
0	0	0	17	9.88	24	13.95	10	5.81	86	50	108	62.79
1	31	18.02	7	4.07	38	22.09	32	18.60	49	28.49	53	30.81
2	32	18.60	19	11.05	103	59.88	55	31.98	16	9.30	9	5.23
3	40	23.26	40	23.26	5	2.91	42	24.42	12	6.98	1	0.58
4	43	25.00	47	27.33	1	0.58	19	11.05	5	2.91	0	0
5	16	9.30	19	11.05	0	0	7	4.07	2	1.16	0	0
6~12	6	3.48	22	12.78	0	0	6	3.48	1	0.58	0	0
Missing	4	0.22	1	0.59	1	0.59	1	0.59	1	0.59	1	0.50
Value	4	2.35	1	0.58	1	0.38	1	0.58	1	0.58	1	0.58
Total	172	100.00	172	100	172	100.00	172	100.00	172	100	172	100.00

Source: Investigation data of this study

In term of parking problem in urban area, over 60% of building violators surveyed have no parking spaces, 30% have only one parking space each, according to our investigation, the car ownership rate in Tainan City as of the end of 2007 was about 245 cars/1000 persons, or about 0.73 car/household, therefore, the parking spaces of most building violators are highly insufficient, which may cause building violations or traffic problems like occupation of roads or parking violations, etc.

c. Analysis on the places of building violation of building violators surveyed

In term of location, most of building violations are of privately owned land (about 90%), in term of places, legal space (about 50%) and roofing (about 34%) are leading.

The cause checked the most by respondents is "Insufficient Space" (about 40%), "Unawareness of laws and regulations" follows (about 25%), near 25% have checked "others",

which, in detail, mainly include "existing building violations due to former owners" and "existing building violations in houses tenanted", etc.. From the fact that about 40% building violators surveyed have reflected "Insufficient Space" as the main cause, we can see that the building spaces of existing design of buildings are obviously incapable of meeting the demands of users. The weighted average on the basis of the statistical data of land acreage for buildings of building violators surveyed (See Table 1) is about 86m²/household, according to the members per household, it is estimated that in average, there're about 4.5 members in each household, if we calculate by the average capacity rate of 200%, the average living space for each person is about 38m², which was slightly lower than the living space standard of 50 m² of urban planning. This may be one of the main causes of building violations due to insufficient spaces of building violators.

d. Analysis on the satisfaction for building spaces

In term of the usage and acreage of the overall building, about 1/4 (slightly lower) of all building violators surveyed have been unsatisfied. In term of specific building spaces, including the usage, acreage and quantity of rooms, parking spaces and kitchens, over 1/4 of all building violators surveyed have been unsatisfied, which shows a general trend of dissatisfaction of building violators surveyed for those spaces, which then resulted in building violations, such as building violation of the roofing, extension of rooms in quantity and acreage, violation of the legal spaces as well as extension of parking spaces and kitchen in acreage, etc..

The weighted average of the number of bedrooms per building violator is 3.4 according to the number of bedrooms shown in Table 2, and according to the average number of family members of 4.5 in the family of each building violator as mentioned above, each person holds only about 0.75 bedroom in average, which may easily result in building violations.

In term of satisfaction for parking spaces, each household in Tainan city owns 0.73 car in average, about 1 car per household, from the cross analysis of the quantity of parking spaces and the satisfaction for parking spaces we can see that 48 building violators surveyed are unsatisfied, near 65% (31) are families without cars, the other 35% (17) have 1 parking space each. This shows that in term of the economic capacity of residents in Tainan City, it is general that each household owns 1 car, however, due to the expensive land price, the land acreage of each building unit is too small, it is hard to design sufficient parking spaces, which therefore leads to the problem of utilizing legal spaces as parking spaces.

3.2.2 Analysis on the results of the questionnaire survey on neighbors of building violators

Altogether 172 neighbors of building violators have been surveyed in this study, the purpose is mainly to learn their opinions on the impact of building violators on physical environments of buildings, and the results are shown below.

a. Basic data of respondents

The respondents are during the age span of 41~60, mainly with the education background of junior or senior high school, most of them are commercial operators with the monthly income of below NT\$ 40,000, families with 4~5 members take up a high proportion.

b. Analysis on the impact of building violators on physical environments of buildings

The survey is carried out on neighbors of building violators to learn their opinions on the impact of building violators on physical environments of building including: public safety,

urban landscape, rights and interests of the others, sound environment, light environment, thermal environment, air environment, water environment, green environment, vibration environment and electromagnetic environment, etc.. When asked on the impact of building violators on various environments, many respondents considered that the impact is great on "public safety", "urban landscape" and "rights and interests of the others", with over 40% having checked "Impacted"; in term of physical environments of relevant buildings, it is possible that some people are not so sensitive to the change in physical environments of relevant buildings, the proportion of respondents checking "Not Impacted" is higher than that of those checking "Impacted".

4. Analysis on Strategies of the management of building violations externality

4.1 Strategies of the management of building violations externality

As for solutions of externality problems, different measures should be taken according to different subject factors of externality, comparison of objects to levy on, objective of levy and standard of levy from different aspects. Basic concepts include "paid by users", "paid by beneficiaries", "growth payment", "return of added value" and "special common levies", etc. Objectives of levy adopted include internalization of external costs, recycling of facility costs, reducing development impacts and levying on gains from alteration without pains. Those should also be applied to the actual strategies on land development, including Burden of redeemed land in urban land readjustment, Impact fee for non-urban land development and air pollution prevention fees, etc.

However, for the externality relationship resulting form building violations as well as the differences in their impacts, different management strategies should be taken for the treatment of externality. There are two causes of building violations, one is that the laws and regulations on construction may to too strict to allow users to get sufficient building area while complying with the existing laws and regulations; the other is the people's insufficient awareness or indifference to relevant laws and regulations. Results of the questionnaire survey on building violators also show that among all causes of building violators, "Insufficient space" is the main cause of most building violators surveyed, however, "Insufficient space" is mainly caused by expensive land price in urban areas and the reduction of floorage due to the implementation of capacity control, making it hard to realize the per capita living space specified in existing urban plans, the result is that users can only extend their living spaces by building violations. In this case, if the externality derived from the building violations of building violators is not so serious, it may be feasible and reasonable to levy compulsory impact fees on building violators for building violations. In the future, by amendment of urban plans and relevant laws and regulations on building management, the capacity control in urban areas may be relieved as proper so as to improve the living quality of people, and by reviewing relevant standards on parking spaces, problems like building violations and violations of traffic rules may be avoided or reduced.

For suggestions on treatment of building violations externality, the study mainly focuses on the impacts of externality, i.e., impacts on public safety, urban landscape, rights and interests of the others and urban physical environment, and then, considering legal factors and factors of users, researches to propose corresponding management countermeasures. According to the questionnaire survey on neighbors of building violators, most neighbors of building violators consider "public safety", "urban landscape" and "rights and interests of the others", etc. as

main externality impacts of building violations, and that the impact on other urban physical environments are slight. Therefore, for management strategies, existing laws and regulations on the treatment of building violations should be taken as the basic spirits, corresponding management countermeasures include: 1) Compulsory dismantlement; 2) Improvement within limited period; 3) Levying of impact fee.

4.2 Compulsory impact fee

The foregoing discussion of externality strategies in building management indicates that the collection of impact fees for different types of building violations is an effective means of internalizing the external costs of the building violations, while also improving the urban environment. If impact fees are collected, however, what standards should be used to set the fees?

In order to establish a guidelines for the setting of fee assessment standards, this study used basic information from building violator respondents, along with the location of the building violations of each respondent building violator (urban or suburban area, taking 10,000 persons per square kilometer as the dividing line for administrative areas within Tainan City) and the type of building violation as the independent variables. In addition, the study also employed regulations governing fines assessed on unauthorized construction (building violations) in Articles 25 and 86 of the Building Act and the building construction price standards announced by Tainan City in 2001 (see Table 3). After using the building violation type, structure, and area for each building violator to estimate construction cost, the fine due was calculated as 50 one-thousandths of construction cost in accordance with Article 86, Subparagraph 1 of the Building Act. The amount of fine was used as the maximum willing-to-pay price for each respondent building violator, which constituted the dependent variable. The hedonic price method was then used to establish a maximum willing-to-pay price hedonic equation for building violations.

Construction type	Unit price (NT\$/m3)	
Steel frame or reinforced concrete, 2 floors or under	4,000	
Steel frame or reinforced concrete, 3-5 floors	5,000	
Steel frame or reinforced concrete, 6-10 floors	6,000	
Steel frame or reinforced concrete, 11-15 floors	8,700	
Steel frame or reinforced concrete, 16-20 floors	9,300	
Steel frame or reinforced concrete, 21 floors or above	10,400	
Reinforced brick	3,900	
Brick	2,800	
Wood	2,800	
Brick and wood	2,800	
Brick and stone	2,800	
Steel construction with walls	3,500	
Steel construction without walls	2.400	

Table 3 Tainan City Building Construction Cost Standards

Source: Tainan City Government

With regard to the establishment of a maximum willing-to-pay price hedonic equation, economy theory does not provide any specific recommendations concerning the form of a hedonic price function. The form of this function chiefly depends on the cause-and-effect logic of the various influencing factors, and must take the goodness-of-fit of the dependent variable following estimation into consideration. In addition, the model must comply with economic analysis and yield reasonable empirical inferences. The flexible function form only

taking into consideration the best fit may not necessarily be the optimal function form. Past research on application of hedonic price functions found that the function can have linear, semi log, inverse semi-log, or double-log forms. In addition, a Box-Cox transformation form may be employed, where the function form can be testing using the data fit. However, Cassel & Mendelsohn (1985) criticize the Box-Cox transformation function on four grounds: (1) Use of the Box-Cox transformation function to estimate a characteristic coefficient will weaken the correctness of any single coefficient estimate, leading to invalid hedonic price estimates. (2) Negative number data cannot be used. (3) The Box-Cox transformation is not suitable for prediction. (4) The Box-Cox transformation makes the estimation of slope and elasticity more complex in the case of a non-linear transformation.

In light of the problems affecting the Box-Cox transformation, this study attempted to establish linear, exponential, and logarithmic function forms, and ultimately determined that a hedonic equation with an exponential form yields the best results. After deriving the natural logarithm, the general form of the hedonic price method is:

$$\ln(P_i) = \hat{\beta}_0 + \hat{\beta}_1 \cdot x_{i1} + \hat{\beta}_2 \cdot x_{i2} + \dots + \hat{\beta}_j \cdot x_{ij} + \dots + \hat{\beta}_k \cdot x_{ik} + \varepsilon_i$$
(1)

In equation (1), Pi is the maximum willing-to-pay price of each respondent building violator, and χij are the relevant attributes influencing the maximum willing-to-pay price of building violator *i*. The results of parameter estimation using the foregoing equation are shown in Table 4.

Variable name	Parameter value	Standard deviation	t-value	Level of significance
Constant term	8.881**	0.487	18.238	0.000
Household size	0.155*	0.084	1.841	0.069
Legal space building violation	-0.946**	0.354	-2.673	0.009
Roof platform building violation	-0.627*	0.358	-1.750	0.083
Light-absorbing shade building violation	-2.948**	1.401	-2.104	0.038
Surrounding wall building violation	-1.298*	0.694	-1.869	0.065

Table 4 Hedonic Price Regression Model for Building Violations

Note 1: "*" indicates that the null hypothesis of 0 can be rejected when the level of significance $\alpha = 0.1$;

"**" indicates that the null hypothesis of 0 can be rejected when the level of significance $\alpha = 0.05$

Parameter estimation results indicate that the model's overall goodness-of-fit (revised R^2) for the maximum willing-to-pay price for building violations is only 0.079, which is certainly not good. This reveals that many factors affecting the maximum willing-to-pay price have not been included in the current empirical model. In the current hedonic price model, factors affecting building violators' maximum willing-to-pay prices, such as household size, whether a legal space building violation is involved, whether a roof platform building violation is involved, whether a light-absorbing shade building violation is involved, and whether a surrounding wall building violation is involved, are all significant. This displays that while the empirical model can still be used to perform cause-and-effect analysis of these variables, it cannot be used to explain variation in maximum willing-to-pay price.

The parameter estimation results in Table 4 show that only household size has a positive coefficient, which indicates that the greater the household size of a building violator, the

higher the violator's maximum willing-to-pay price. Since the empirical hedonic function in this study is ultimately determined to be an exponential function, the elasticity of the effect of variable x_j on the maximum willing-to-pay price P is as shown in equation (2).

$$\frac{\partial P}{\partial x_i} \cdot \frac{x_j}{P} = \beta_j \cdot x_j \tag{2}$$

This shows that the magnitude of elasticity is correlated with the estimated coefficient β_j ,

and is also correlated with the independent variable x_j . This is used to calculate the elasticity of the effect of household size on the maximum willing-to-pay price P. If average household size in Tainan City is estimated to be approximately 4 persons, the elasticity coefficient will be approximately 0.62. When one household member is added (i.e., the household size becomes 5 persons), the elasticity coefficient will increase to approximately 0.775. Taking the average willing-to-pay price for the entire sample to be NT\$16,479 (with a standard deviation of 27,242), compared with a household containing four members, the building violation opportunity cost (avoiding immediate removal of illegal structure with payment of a fine) is NT\$2,554 for a household with four members. In other words, the opportunity cost increases by approximately NT\$2,554 each time one more member is added to the household.

The fact that the variable parameter values for other kinds of building violations are all negative indicates that the greater the parameter value, the higher the corresponding maximum willing-to-pay price. Roof platform building violations had the highest willing-to-pay price, followed by legal space building violations, surrounding wall building violations, and light-absorbing shade building violations in that order. Taking the estimated coefficients in this study's empirical model as a basis, roof platform building violations have a greater opportunity cost of approximately NT\$2,404 compared with legal space building violations; legal space building violations have a greater opportunity cost of approximately NT\$3,636 compared with surrounding wall building violations; and surrounding wall building violations have a greater opportunity cost of approximately NT\$3,636 compared with surrounding wall building violations; and surrounding wall building violations have a greater opportunity cost of approximately NT\$1,898 compared with light-absorbing shade building violations. These results can provide the government with a basis for determining building violation impact fee standards.

5. Conclusions and Suggestions

It is found through the analysis of the study on the features of existing building violations in cities of Taiwan: (1) Under existing laws and regulations, during 1984~2007, the quantity of building violations reported in Tainan City has been increasing year after year, especially 1996, when Taiwan announced the full-scale capacity control, which shows that the capacity control did impact users of buildings. (2) In term of "type" of building violations, building violations of legal clearance is still the main type of building violations in Tainan City, the reservation of legal clearance is an important regulation for maintaining urban environment, especially "urban light environment", "urban thermal environment", "urban air environment", "urban water environment" and "urban green environment", however the people generally lack in this consciousness. (3) It can also be found through the questionnaire survey on building violators that the main cause for the building violations of ordinary people is insufficient spaces, at present, under the capacity control, the actual living space standard has not yet reach the standard specified in the urban plan, which makes people to extend their space of usage through building violations of legal spaces or roofing platforms. Therefore, further discussion is required to decide whether to relieve the capacity control when complete

supporting facilities are provided in the future.(4) As for externality problems due to building violations, following the principles of social equity and efficiency, responsibilities of the externality should be borne by producers of the externality, therefore, it is necessary to discuss the externality of building violations by classification, different externality should be subject to different treatment.

The article holds the viewpoint that building violations may cause externality impacts on public safety, urban landscape, rights and interests of the others and urban physical environment, etc., and has discussed the relationships and impacts and proposed recommended management strategies, including Improvement within limited period or compulsory impact fees, etc. When discussion the possibility of the levy of impact fees, this article established the Hedonic Price function of the maximum willingness of building violators to pay for fines of building violations, the results show that the opportunity cost of building violation increases along with the increase in family members, as for the opportunity cost of different types of building violations, that of building violation of roofing platforms is the highest and that of legal space goes next. This result may be provided to public sectors as reference for establishing relevant standards on levying impact fees to internalize the external costs of building violations.

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