REGULATION OF SIZE DISTRIBUTION OF NEW APARTMENTS IN KOREA: CONSEQUENCES AND SOCIAL COSTS

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(Very rough draft for comments)

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I. Introduction]

Korean housing and land markets have been heavily regulated in various ways. Included among the many regulations were the price control on new apartments and the regulation on their size distribution. The price control was introduced in 1979 and lasted in some form until it had been lifted altogether in early 1998. The main objective of the regulation was to ensure that the prices of new apartments be kept within an affordable limit the middle- and low-income households. Since the regulation created an excessive demand for new apartments, a rationing scheme was needed. The most important feature of the rationing system was a set of requirements for households who can be eligible to purchase a new apartment. For example, a household must subscribe to a deposit for a specified period of time before she can apply for an apartment. The amount of deposit varied with the size of the apartment to be purchased. Under this scheme, the total gain to the buyer of a new apartment increases with its size. In order to assure that small and medium-sized apartments be supplied in reasonably large quantities, the government introduced a supplementary regulation on the size distribution of apartments. To be specific, the developer of apartments was required to supply at least 20 per cent of all new units which are no larger than 60 square meters of net floor space, and 40% between 60 and 85 square meters. Since the vast majority of new housing supply is in the form of apartments and since the regulations applied to both private and public sector developers, they virtually shape the supply of all new housing.

Over the period during which these regulations applied, arguably too many small apartments and too few larger apartments had been produced. This was evidenced by the bunching of distribution of new apartments around several sizes, and by the fact that the price per square meter of floor space increases with the size of the apartment. In a well-functioning housing market, the price per unit floor space should be decreasing in size because the unit construction cost falls with size and the unit land cost is invariant with size. The distortion in size distribution of new apartments has important welfare implications. It obviously limits the range of choices of dwelling size. And as the demand for housing space increases with income growth, larger apartments will become more scarce and hence become less affordable.

The main objective of this paper is to quantify the social cost of the regulation on the size distribution of new apartments. In the next section, we will describe the key features of the regulation and present empirical evidence for the relative shortages of large dwelling units. In section III, we present a simple model of housing market consisting of a regulated submarket and an unregulated submarket. We then derive a measure of the change in welfare to the households who occupy housing subjected to the regulation and that for those who live in the unregulated apartments. A simulation exercise is carried out to combine these two measures to compute the aggregate welfare gain associated with the regulation. Section IV concludes the paper.

II. Regulations on the Size Distribution of New Apartments

1. Evolution of the Regulation

Bluntly put, the Korean government has controled the whole process governing housing supply, i.e. what types and sizes of housing to build, where and for whom. Each year, the Ministry of Construction and Transport (MOTC) drafts a detailed plan for housing supply and implements it using various policy instruments. Among the major instruments were the price control on new houses and regulations on the size distribution of new dwelling, eligibility rules for purchases of subsidized houses, control on the conversion of agricultural and forest land into residential use, and housing finance offered at subsidized interest rates. What a typical private sector developer does is to purchase plots of serviced land and build houses for the customers who are essentially selected by government to purchase the dwellings at the regulated prices. The role of local government is also limited to issuing building permits and extending trunk infrastructure where appropriate.

The price control on new apartments had existed for about 20 years. The regulated price was determined as a mark-up to the cost of production and was much lower than the market price. Since the size of the windfall gain from the price control gets bigger with the size of the dwelling, the purchasers of new apartments prefer larger units as long as they are eligible to buy the units and have the ability to mobilize funds. The developers also had an incentive to maximize the share of large units in a project because the controlled price on the large units (exceeding 85 square meters of net floor space) was set higher than that on the small units while the cost of production of an apartment decreases with its size and also because larger units sold better. For these reasons, too many large units would have been supplied if the size of new housin were allowed to be determined by market forces.

In order to counter such possibility, the government regulated the size distribution of apartments in order to ensure that smaller units were to be supplied in large quantities so that a large segment of population could benefit from the price control. For this reason, it had been mandatory for land development projects to set aside at least 60 % of developed residential sites to houses smaller than 85 square meters in net floor space, and 20 % to those smaller than 60 square meters. In short, the regulation on the size distribution of new apartments were an add-on to the price control on them. This regulation was lifted in January 1998. However, it was reintroduced in a weaker form effective in November 2001 to require that a minimum of 20 % of new apartments built in the Seoul metropolitan region be of a size less than 60 square meters in net floor space.

Since the price control created a long queue of households wishing to purchase new apartments at subsidized prices, qualifying buyers were selected based on a set of criteria set by the government. The eligibility for purchasing apartments was granted in three different size categories i.e., 85 square meters and smaller, between 85 and 102 square meters, between 102 and 135 square meters, 135 meters and above. The required deposit increased with dwelling size. In order to qualify for bidding to purchase a new dwelling, a household had to fulfill requirements by subscribing to a contractual savings scheme for a certain amount of time. Eligible homebuyers were selected on the basis of the bid within the specified limit and then by a random draw. However, all dwellings with a net floor space under 60 square meters and 50 % of those with a net floor space ranging from 60 to 65 square meters were reserved for households who did not own any other dwelling.

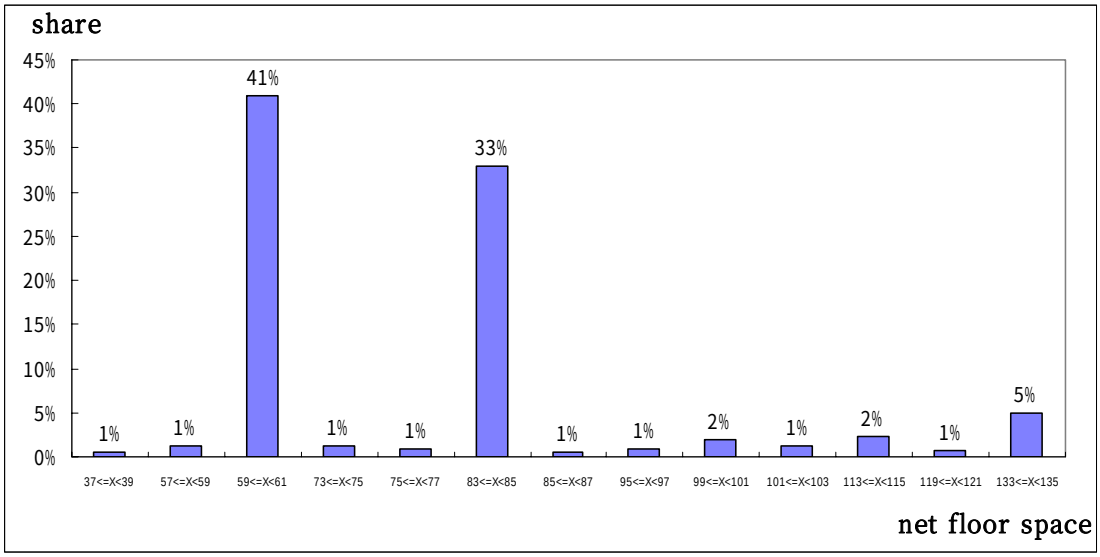
The reason that price control on new houses had been maintained for so long was its political palatability. There was a strong demand for deep housing subsidies by the general public and the government was able to meet the demand through an elaborate system of regulations that did not require its own resources. Such coincidence of wants supported the Korean governments approach to housing policy and also contributed to expanding the middle class of the society. Consequently, it was very difficult for government to repeal the various regulations even after it felt the strong need for a reform. In fact, the government took a piece-meal and lukewarm approach to deregulating the price control starting in 1995. The price control was first lifted in small and medium cities outside of the Seoul metropolitan region, where it had become unbinding because of a large stock of unsold new apartments. It was not until after the outbreak of the Asian economic crisis when the price control and the regulation on the size distribution of new apartments were completely removed. This was possible because deregulation emerged as an essential ingredient for reform across the board and because housing prices fell sharply in the aftermath of the economic crisis. The possibility that the regulation could have survived had it not been for the economic crisis can be appreciated by the recent call for reinstituting the price control and the government decision in August 2000 to reinstitute the regulation on the size distribution of new apartments.

2. Consequences of the Regulation

A major efficiency consequence of the price control and its supplementary regulations is the distortion of the size distribution of new apartments supplied. The combined result of the regulation on size distribution and the preference for larger units emanating from the structure of the price control was that the supply was concentrated in a few size groups.

Figure 1 taken from Kim and Kim(2000) illustrates the size distribution of all apartments supplied during the 1993-96 period. The graph shows that 41 % of new supplies were clustered between 59 and 61 square meters in net floor space, 33 % between 83 and 85 square meters, and 5 % between 133 and 135 square meters. One could recall that the line was drawn at 60 square meters, 85 square meters and 135 square meters to divide up the would-be home purchasers into three size categories. On the other hand, two other categories accounted for 2 % each, eight other size categories had 1 % each, while no units were found in other categories in more than 1 % of the total supply. Most interestingly, no units within the range of 62 to 82 square meters or 85 to 133 square meters are supplied. In short, the price control and the supplementary regulations led to skewed and concentrated size distribution of new apartments. If apartments are built under no such regulations, their size distribution will more or less resemble the distribution of household income, and hence very different from the current pattern of distribution.

< Figure 1> Size Distribution of New Apartments built from 1993 till 1996



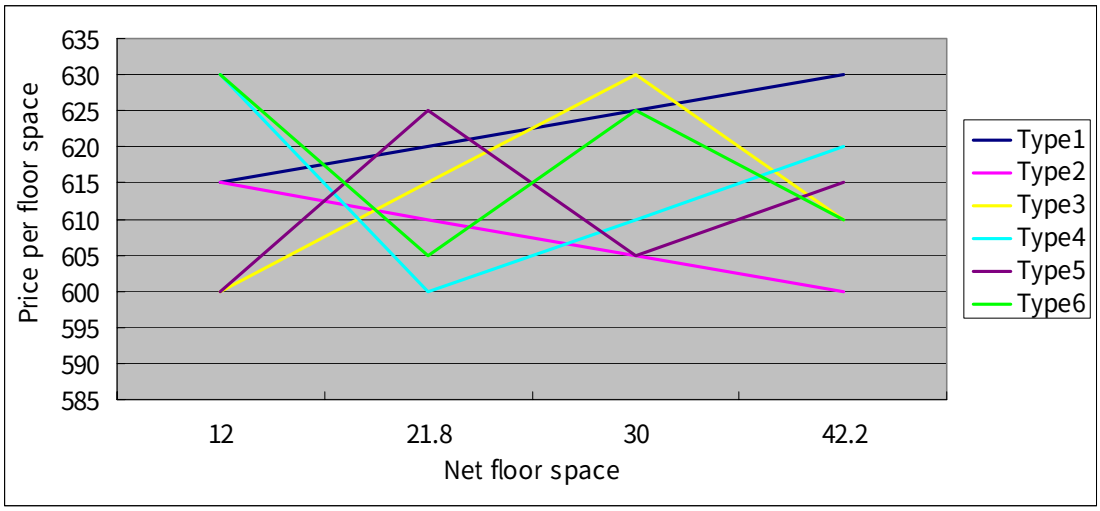
Source: Kim and Kim(2000)

Another consequence of the regulation is that it had created an artificial scarcity of large apartments and consequently the price per square meter of floor space rises more than proportionately with size. Empirical evidence clearly points to a positive relationship between the price of unit floor space of an apartment and its size. A hedonic price study by Chung and Lee (2002) using a sample of about 4,700 apartments located in Seoul confirms this. The study reports that the unit price of a small apartment (up to 60 square meters in floor space) was 3 % lower than the medium-sized apartment(60 to 85 square meters in floor space) while the unit price of a large apartment (85 square meters and up) is 8.5 % higher than that of the medium-sized apartment.

As it was mentioned in the previous subsection, the price control and its companion regulation on the size distribution of new apartments were abolished and the latter was partially restored recently. Therefore, it would be interesting to see if the change in government regulation has affected the pattern of the relationship between the unit price of an apartment and its size. We looked at the price pattern of a sample of 225 apartments compounds located in Seoul in three different points in time; December 1996, December 2000, and May 2002, selected for the following reasons. December 1996 was expected to capture the price before the impact of the economic crisis was felt in the housing market. December 2000 would reflect the price pattern after the full impact of the economic crisis and the recovery from it, and before the possible reinstitution of the regulation on size distribution started being debated. The last date was expected to show the most recent price pattern following a run-up in price during the first few month of 2002.

Each compound in the sample had at least one size group smaller than 85 square meters in net floor space, and at least one size group exceeding it. The relationship between the unit price and the net floor space of apartments located in the same compound was identified. Since all units in a given compound were built by the same private sector developer at the same point in time using the same technology, and the locational, neighborhood, and amenities characteristics are almost identical, the identified pattern should most likely reflect the true correlation between the unit price and the size of net floor space. The unit price-size relationship was grouped into six types as illustrated in Figure 2. Type one and type two represent a monotonic increasing and decreasing pattern, respectively, while the four other types represent more complicated pattern.

<Figure 2> Six Types of Relationship between the Unit Price and Size of Apartments



We then looked into the distribution of the whole sample in terms of the six categories over the three points in time. The result is presented in Table 1.

<Table 1> Distribution of the Unit Price-Size Relationship: 1996-2002

(No. of compounds, %)

Type	Decemner 1996		December 2000		May 2002	
One	135	(60.0)	131	(58.2)	57	(25.3)
Two	24	(10.7)	28	(12.4)	75	(33.3)
Three	28	(12.4)	33	(14.7)	48	(21.3)
Four	28	(12.4)	19	(8.4)	26	(11.6)
Five	7	(3.1)	10	(4.4)	8	(3.6)
Six	3	(1.3)	4	(1.8)	11	(4.9)
Total	225	(100.0)	225	(100.0)	225	(100.0)

An interesting finding from the table is that the relationship between the unit price of an apartment and its size has changed over time. At the end of 1996, 60 % of all compounds included in the sample studied exhibited a monotonic increasing pattern (type one), whereas only 11 % followed a monotonic decreasing pattern (type two). These figures did not change a lot between 1996 and 2000, probably because it took time before the lifting of the regulation on size distribution started impacting the market. But by may 2002, the share of the compounds that follow a monotonic increasing relationship between unit price and size fell dramatically to 25 % while the share of those following a monotonic decreasing relationship jumped to 33 %. Since Type six is quite similar to type two, the share of compounds exhibiting a decreasing relationship more than trippled from 12 % to 38 %. If this changing pattern is suggestive of the impact of the change of policy towards the regulation of size distribution, the partial reinstitution of the regulation is likely to work to reverse the trend in due course.

III. A Welfare Analysis of the Regulation on Size Distribution

1. The Model

Consumer-renters maximize a Cobb-Douglas utility function $U=c^{\alpha}q^{\beta}$ subject to the budget constraint $y=c+pq$, where q is the size of residential land or housing space, c represents all other goods, a numeraire, y is household income, and p is the relative price of land. Parameters α and β represent the budget share of consumption and housing expenditure, respectively.

Each parcel of land is used for either commercial purposes or residential purposes, and the allocation decision is made by profit-maximizing landlords-developers. In equilibrium, profit per parcel of land in residential use equals that from commercial use. This requires that $p^{C}=p^{R}$, where p^{C} is the price of land in commercial use and p^{R} is the price of land in residential use.

We now introduce a hypothetical regulation on the size distribution of houses produced. To be specific, each developer is required to supply at least 100 times b $(0<b<1)$ percent of all dwellings of a plot size no larger than $\overline{q}$. Furthermore, the unit price of such dwellings is regulated at $\overline{P}$, where $\overline{P}$ denotes the price of the house including both land and the building. In order for the regulated price $\overline{P}$ to be binding, $(\overline{P}-C)$, the maximum amount that can be paid for land for housing, must be less than p^{C}, where C is the construction cost per unit land area. On the other hand, no regulation applies to the supply of houses with parcel sizes larger than $\overline{q}$. The quantities and the prices of these units are determined by market forces. We denote the price per parcel of land used for these unregulated housing as p_{h}^{R}.

First of all, we can show that no houses that are smaller than $\overline{q}$ in plot size will be supplied in the market under this regulation. It is well known that the construction cost per unit floor area increases as the size of the housing gets smaller. Since $\overline{P}$ is regulated, $\overline{P}-C$ gets smaller as q decreases, and therefore the developer will not allocate land to houses smaller than $\overline{q}$. Hence, under this regulation on size distribution of housing, $\overline{q}$ becomes the minimum parcel size, and no units supplied in the regulated housing market will be smaller than that.

We assume that there are N households in the city and each of them must be housed in a separate unit. This requires that the total number houses supplied in the market

must be N. Due to the regulation, bN houses supplied will be of an identical parcel size $\bar{q}$, and the remaining (1-b)N houses will be larger than $\bar{q}$ in parcel size. Since housing demand rises with income and $\bar{q}$ is the minimum parcel size, bN houses of parcel size $\bar{q}$ will be occupied by bN households with lowest income. If we denote the highest income among those bN households as y_1, and the lowest and highest incomes of all households as y_0 and y_2 respectively, the following relationships must hold;

$$\int_{y_0}^{y_2} f(y)dy = N \text{ and } \int_{y_0}^{y_1} f(y)dy = bN$$

where $f(y)$ represents a density function of income distribution.

Let L_l^R be the total area of land allocated to houses of parcel size $\bar{q}$ and L_h^R be that allocated to houses larger than $\bar{q}$. Those two quantities can be expressed as;

$$L_l^R = \bar{q}bN \tag{1}$$

$$L_h^R = \int_{y_1}^{y_2} q^*(p_h^R, y) f(y)dy \tag{2}$$

An equilibrium attains in the land market when the profit from residential use is equal to that from commercial use at the margin. We assume that the price of unit land in commercial use, or the opportunity cost of residential land is constant at p^c. Therefore, the following relationship must hold;

$$\bar{p}L_l^R + p_h^R L_h^R = p^c(L_l^R + L_h^R) \tag{3}$$

where $\bar{p} = \bar{P} - C$, the price of housing less construction cost per parcel when parcel size is $\bar{q}$ $\bar{p}(\bar{p} < p^c)$.

The left-hand side expression in equation (3) represents the revenue(or profit) when L_l^R and L_h^R are devoted for residential uses, while the right-hand side represents the plots of land put into commercial uses. In equilibrium, these two amounts must be equal. Landlords-developers supply houses of size $\bar{q}$ even though $\bar{p} < p^c$, because they cannot supply non-regulated houses unless they first fulfil the requirements to produce the smaller units up to the specified fraction.

We now want to find the unregulated price of residential land p_h^R. Because utility function is assumed to be of the form $U = c^a q^b$, housing demand becomes $q^* = \frac{\beta}{\alpha+\beta}\frac{y}{p}$. Therefore, equation (2) is transformed as follows;

$$L_h^R = \int_{y_1}^{y_2} q^*(p_h^R, y) f(y) dy = \int_{y_1}^{y_2} \frac{\beta}{\alpha+\beta}\frac{y}{p_h^R} f(y) dy = \frac{1}{p_h^R}\int_{y_1}^{y_2} \frac{\beta}{\alpha+\beta} y f(y) dy \quad (2')$$

if we let $\int_{y_1}^{y_2} \frac{\beta}{\alpha+\beta} y f(y) dy \equiv A$, then equation (3) can be re-written as;

$$\bar{p} L_l^R + A = p^c (L_l^R + \frac{A}{p_h^R}). \quad (3')$$

One can solve (3′) to get

$$p_h^R = \frac{A p^c}{(\bar{p} - p^c)\bar{q} t N + A}. \quad (4)$$

Because $\bar{p}$ is set below p^c, equation (4) implies that $p_h^R > p^c > \bar{p}$ holds.

2. Net Welfare Gain Associated with the Regulation

The main objective of our analysis is to evaluate the welfare consequences of the regulation. The first step towards this is to calculate the compensating variation of the consumer-renters who occupy houses of size $\bar{q}$.

The utility level enjoyed by the household who occupies a house of size $\bar{q}$ at regulated price is given by;

$$\bar{U} = (y - \bar{p}\bar{q})^{\alpha} \bar{q}^{\beta} \quad (5)$$

Since the demand for the numeraire good and that for housing are given as

$$c^* = \frac{\alpha}{\alpha+\beta} y, \quad q^* = \frac{\beta}{\alpha+\beta}\frac{y}{p^c},$$

the compensating variation (denoted as B) can be found from the following condition.

$$\{\frac{\alpha}{\alpha+\beta}(y+B)\}^{\alpha}\{\frac{\beta}{\alpha+\beta}\frac{y+B}{p^c}\}^{\beta}=(y-\overline{pq})^{\alpha}\,\overline{q}^{\beta}(=\overline{U}) \qquad (6)$$

B is the amount of money that must be given to the consumer to enable him to enjoy the same level of utility that she would attain when she occupies the regulated unit of size $\overline{q}$ at price $\overline{p}$. If we further assume that $\alpha+\beta=1$, then B can be expressed as

$$B=\alpha^{-\alpha}\beta^{-\beta}(p^c)^{\beta}(y-\overline{pq})^{\alpha}\,\overline{q}^{\beta}-y \qquad (7)$$

Integration of B over the income range between y_0 and y_1 yields the aggregate welfare gain associated with the regulation.

It would be interesting to analyze the relationship between B and y. Although it is tempting to conjecture that the measure of welfare gain B will each a maximum at such y that $q^*(y,p^c)=\overline{q}$, this proves to be untrue. To see this, note that the first and the second derivatives of B with respect to y are respectively as follows;

$$\frac{dB}{dy}=\alpha^{1-\alpha}\beta^{-\beta}(p^c)^{\beta}(y-\overline{pq})^{\alpha-1}\,\overline{q}^{\beta}-1$$

$$\frac{d^2B}{dy^2}=(\alpha-1)\alpha^{1-\alpha}\beta^{-\beta}(p^c)^{\beta}(y-\overline{pq})^{\alpha-2}\,\overline{q}^{\beta}$$

Since it is unreasonable to expect the expenditure on housing to exceed household income ($y-\overline{pq}>0$) and since $1-\alpha<0$, the sign of the second derivative is negative. This implies that there exists some y^* that maximizes B.

In order to find it, set $\frac{dB}{dy}=0$ to get

$$y^*=\overline{pq}+\alpha\beta p^c\overline{q}. \qquad (8)$$

We are interested in finding the location of y^* relative to $\overline{y}$ for which $q^*(\overline{y},p^c)=\overline{q}$. Since $q^*(\overline{y},p^c)=\frac{\beta}{(\alpha+\beta)}\frac{\overline{y}}{p^c}$, $\overline{y}$ can be derived as follows;

$$\overline{y}=\frac{p^c\overline{q}}{\beta} \qquad (9)$$

In order to determine the relative location of y^*, we divide (8) by (9) to get

$$\frac{y^*}{\bar{y}} = \beta\{\frac{\bar{p}}{p^c} + (1-\beta)\beta\} \qquad (10)$$

It can be shown that the maximum value of the right-hand side expression of equation (10) is 1 when $\bar{p} = p^c$ and $\beta = 1$. For all other $\bar{p}(< p^c)$ and $\beta(0<\beta<1)$, $\frac{y^*}{\bar{y}}$ is less than 1, which implies that y^* lies to the left of $\bar{y}$.

Now let us turn to the households who have income greater than y_1, and occupy houses in the unregulated submarket. The compensating variation of those households, D, satisfies the following relationship;

$$\{\frac{\alpha}{\alpha+\beta}(y-D)\}^{\alpha}\{\frac{\beta}{\alpha+\beta}\frac{y-D}{p^c}\}^{\beta} = \{\frac{\alpha}{\alpha+\beta}y\}^{\alpha}\{\frac{\beta}{\alpha+\beta}\frac{y}{p_h^R}\}^{\beta} \qquad (11)$$

D is the monetary value of the loss in utility due to the rise in the price of unregulated unit following the regulation. Since we have assumed that $\alpha+\beta=1$, D can be solved as follows;

$$D = \{1-(\frac{p^c}{p_h^R})^{\beta}\}y. \qquad (12)$$

Integration of D over the income range between y_1 and y_2 yields the aggregate welfare loss to the this income group associated with the regulation.

Since we have derived a measure of welfare gain for the households living in the regulated sector and that for those living in the unregulated submarket, we now combine them to evaluate the overall welfare gain for the entire population. In order to do this, we need to compare the integration of B over $y \in [y_0, y_1]$ i.e., $\int_{y_0}^{y_1} Ef(y)ay \equiv \mathrm{SumB}$ and that of D over $y \in (y_1, y_2]$, i.e., $\int_{y_1}^{y_2} Lf(y)ay \equiv \mathrm{SumD}$.

Although we conjecture that the latter always outweighs the former, since no externality is assumed to exist in land consumption, we were not able to establish it analytically. Therefore, we turn to the method of simulation.

Numerical values for exogenous variables are given as follows:

$\alpha = 0.7$ (It is reasonable to assume that housing expenditure accounts for 30 % of household income.)

$y_0 = 1,000$, $y_2 = 10,000$, $p^c = 10$, N = 1,000

$f(y)$ = uniform distribution (We start with the simplest possible case.)

In the simulation exercises, we allowed the following three parameters to take several values.

$\bar{p}$ = 4, 5, 6, $\bar{q}$ = 50, 100, 150, b = 0.45, 0.55, 0.65

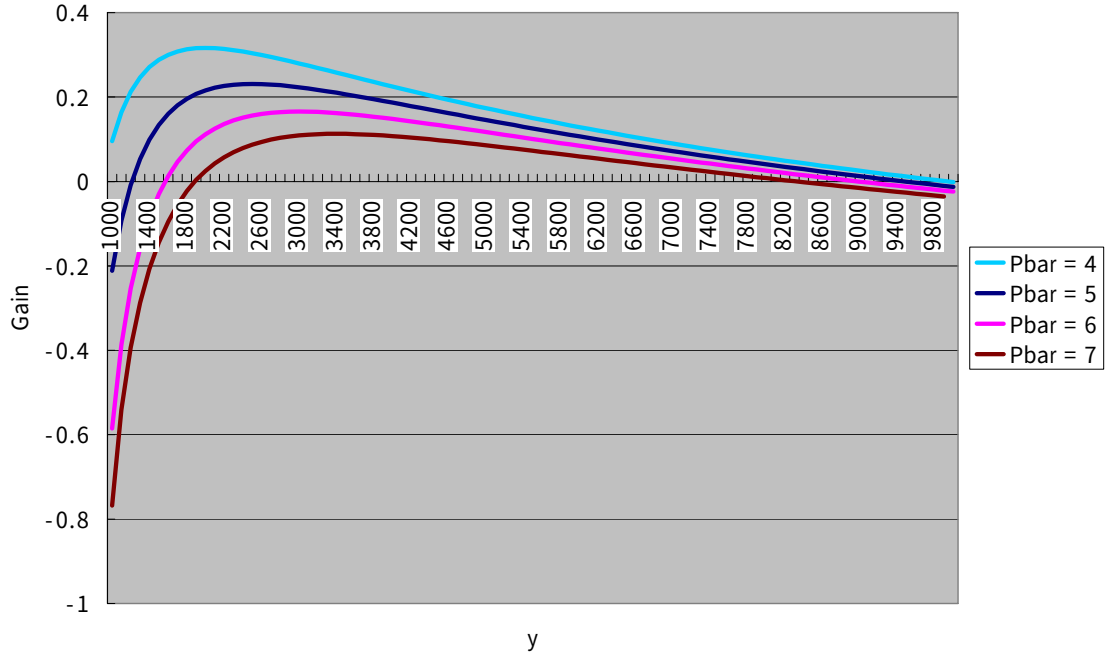
<Table 2>: Aggregate Welfare Gain Associated with Size Regulation

	$\bar{p}$	$\bar{q}$	b	$\Pr^h$	$-S/y$
	4	50	0.45	11.22	-0.030
	4	50	0.55	11.81	-0.053
	4	50	0.65	12.83	-0.085
	4	100	0.45	12.78	-0.014
	4	100	0.55	14.42	-0.026
	4	100	0.65	17.88	-0.047
	4	150	0.45	14.84	-0.029
	4	150	0.55	18.51	-0.043
	4	150	0.65	29.52	-0.074
	5	50	0.45	11.00	-0.029
	5	50	0.55	11.46	-0.051
	5	50	0.65	12.25	-0.082
	5	100	0.45	12.21	-0.013
	5	100	0.55	13.43	-0.023
	5	100	0.65	15.81	-0.040
	5	150	0.45	13.73	-0.028
	5	150	0.55	16.21	-0.037
	5	150	0.65	22.28	-0.056
	6	50	0.45	10.78	-0.028
	6	50	0.55	11.14	-0.049
	6	50	0.65	11.72	-0.079
	6	100	0.45	11.70	-0.012
	6	100	0.55	12.57	-0.020
	6	100	0.65	14.16	-0.034
	6	150	0.45	12.78	-0.029
	6	150	0.55	14.42	-0.034
	6	150	0.65	17.88	-0.046
	7	50	0.45	10.57	-0.026
	7	50	0.55	10.83	-0.048
	7	50	0.65	11.24	-0.076
	7	100	0.45	11.22	-0.011
	7	100	0.55	11.81	-0.019
	7	100	0.65	12.83	-0.031
	7	150	0.45	11.95	
	7	150	0.55	12.99	
	7	150	0.65	14.94	

Table 2 summarizes the net welfare gain [(SumB - SumD)/income] for various combinations of $\bar{p}$, $\bar{q}$, and b. One can see that the net welfare gain is negative for every combination. This suggests that the welfare loss to the higher income group outweighs the welfare gain to the lower income group.

Figure 3 shows the relationship between income level (y) and the welfare gain for the low income group, the target beneficiary of the regulation. The four graphs correspond to different values of $\bar{p}$. $\bar{q}$ was set at 150 and b was set at 0.6. One can see that amount of welfare gain at each income level decreases as the regulated price rises, which is trivial. More interestingly, the figure suggests that the lowest income group is not necessarily the largest beneficiary of the regulation. This finding is consistent with the Director's Law of Income Redistribution (Stigler 1970). Furthermore, the welfare gain can become negative for certain range of income at the lowest end depending on $\bar{p}$, the regulated price, and such range tends to expand as $\bar{p}$ increases.

<Figure 3> Income and Welfare Gain to Households Occupying the Regulated Units



It is not clear how robust these results are because they have been derived from a very simple model with arbitrary calibration of parameters. A more general and analytic solution needs to be found.

IV. Concluding Remarks

This paper tried to present a welfare analysis of the regulation on the size distribution of new apartments in Korea. We first described the key features of the regulation and the evolution of government policy towards it. Next, we provided empirical evidence pointing to a positive correlation between the unit price of an apartment and its size, as well as demonstrating the fact that the pattern had changed over the past 6 years probably as a result of the lifting of the regulation in January 1998. We then presented a model of housing market a segment of which is subjected to the regulation on the size distribution. Finally, a preliminary set of calculations was presented based on a simulation using a simplified version of the model. The result suggests that the regulation must have resulted in a net welfare loss and that some households among the intended target group might have made worse off. The results needs to be refined by additional work, but they raise a concern that reinstitution of the regulation on size distribution could be costly to the society as a whole.

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