地域研究, 第10卷 第2號
1994年 12月 pp. 53 ~ 60

Capitalization Effects of Government Intervention on Housing Market

Ji-Chung Yang
Korea Research Institute for Human Settlements

The capitalization effects of the government financial intervention can be explained by asset-market model of housing market as well as Tiebout type model and estimated empirically. We have investigated the price change effects of capital-gains taxes and interest rates for two qualities of housing markets(high and standard). It turns out that the standard quality market is far more sensitive to interest rate and income tax changes than the high-quality market while the capital-gains tax has roughly the same effect on both markets in terms of sensitivities in the Korean housing market.

1. Introduction

Housing problems in Korea are characterized by inadequate supply and high levels and rapidly rising prices. The ability of urban families to afford decent housing, rental or owner-occupied, has deteriorated as housing prices rose faster than household income. Large capital gains from real estate may also have worsened the distribution of wealth and income.

The Korean government has exercised tight control over the sectoral distribution of loanable funds and has steered funds away from housing in favor of export sectors. Hence, the Korean housing market has been strongly influenced by a tightly regulated financial system. Even though mortgage funds have increased substantially in recent years, there is relatively little mortgage finance available compared to the situation in the U.S. A striking feature of the Korean housing finance system is its illiquidity as evidenced by low loan-to-value ratios. Bank surveys of homeowners indicate that those who take out loans have loan-to-value ratios which range from 20% to 30%.

The role that the housing finance system plays in influencing the nature of this housing market is an important one. The Korea Housing Bank(KHB) and the National Housing Fund(NHF) are the dominant institutions in providing housing loans. KHB and NHF provide twenty year mortgages although the KHB issues adjustable rate mortgages(ARMs) with the NHF issuing graduated payment mortgages (GPMs). Mortgage rates are regulated and the ARM interest rate is adjusted by the government. In Korea, rather than letting banking interest rates reflect the real cost of capital and subsidizing the cost of borrowing, planners have set interest rates by fiat(Renaud, 1989).

Both KHB and NHF provide buyers with similar loan-to-value ratios to each other in the 20%~30% range. Households face two financial markets because of illiquidity as evidenced by low loan-to-value ratio in Korea. Hence, there exist two interest rates: one is the official interest rate(i_o) decided by the government, and another is the private interest rate(i_p) which equals the rates by the informal financial market(curb market). The real interest rate that affects housing markets is the weighted interest rate (i_w) which is de-

rived from the interaction between official and informal financial markets. The loan-to-value ratio is determined by similar mechanisms. This ratio is one of the results of government intervention through money supply, housing loans, and interest difference between the two financial markets.

The changes in user-costs of housing reflect government intervention since it accounts for some tax variables and the interest rate. Because user-cost is an important factor in estimating housing demand (see Manchester 1987), it is easy to show that the change in user-cost affects the average house price. We next analyze the price change effects of goverment intervention. Briefly speaking, our question is the following:how has government intervention in housing-related markets affected average house(land) price levels and their rate of change?

Aggregate total of housing loans is directly correlated with credit availability. This credit availability affects the increase in demand of housing. And a tax on realized capital gains has the well-known lock-in effect of discouraging the supply of residential land(see also Kanemoto 1985). This results in increasing average housing prices as well as average land prices. Hence, these kinds of interventions are capitalized into average housing prices.[1)]

The capitalization effects of the government financial intervention can be explained by asset-market model of housing market as well as Tiebout type model(Oates, 1969, 1973) and estimated empirically.

There is concern that the variability(or volatility) of housing and land prices makes modeling them a challenging study. Can we only model simple phenomena whose systematic determinants are relatively obvious? Or are dynamic modeling methods sufficiently powerful to allow good explanation of rapidly changeing variables? If so, can house price changes be predicted ex ante sufficiently accurately to sustain profitable speculation? Also, can the government control the price changes? Hence, it is critical to study the effects of some policy variables(taxes, interest rate, etc.) and of expected price changes on housing prices as well as on land prices.

Because recently the government has been most concerned with moderate income groups which are thought to demand standard-quality housing, it is interesting to separate the market into two(high and standard-quality housing market). It is assumed that price and income elasticities vary by quality types in Korea. By using land price or some index as a dependent variable, we plan to examine the effects of real-estate tax variables which is dis-criminatory in Korea.

In a nutshell, the main purpose of this paper is to investigate the effect of government market intervention concerning interest rate, real estate related taxes on two quality housing market(high vs standard quality market).

2. Empirical Model Specifications

We consider time-series models to analyze the capitalization effects of the government financial market intervention in Korea. Our theoretical framework suggests that housing price is determined by financial variables such as housing loans, (M_H^S), total money supply (M^S), spreads(n, i.e. interest rate difference between private and official rate), inflation(π), a house's net service value (S(t)), and tax rates.

A house's net service value for time t, s(t) is denoted by following :

$$S(t) = R(H(t)) - [\mu + d + m]Q(t)$$

where R(H(t)) is the rental value of housing

μ is the property tax

d is the depreciation

m is the maintenance cost

Q(t) is the price of housing.

By using $R(H(t)) = Q(t)\ w$ and $w = [d + m + \mu + (1-\theta)i - \pi_H]$, we can derive the following equation :

$$S(t) = Q(t)w(t) - [\mu + d + m]Q(t)$$
$$= Q[(1-\theta)i - \pi_H] \text{ or } Q[w - d - m - \mu].$$

We just replaced $R(H(t))$ with $Q(t)w$ for deriving $S(t) = Q[(1-\theta)i - \pi_H]$. Hence we can replace the house's net service value with the function of user-cost of housing. Because the house's net service value is not easily measurable, some proxy variables are required in order to conduct an empirical analysis.

The model may be used to analyze a reduction in user costs induced by an increase in the rate of expected inflation in 1970s in Korea, and to describe its ultimate consequences for the housing market. We build the model to find the price-change effects of property taxes, capital gains taxes, and interest rates in the Korean housing market for two qualities of housing, because we want to draw sensitivities of policies by quality market type.[2] For interest rates, we use both a weighted rate(i_W) and an official interest rate(i_o). In addition, we may compare the home-ownership costs with other user costs(eg., Dougherty and Van Order, 1982 ; Poterba, 1984). Also, we find price-change effects for housing loans, etc. — the capitalization effects of government financial intervention on land price. For the expected price increase rates, we derive predicted rates with raw data using the auto-regressive intergrated moving average (ARIMA) model.[3] Hence, the empirical analysis is based on two-stage(2SLS) reduced form. When time series data are used for fitting regression models, often the error term is not independent across time. When autocorrelation is present, the ordinary least-squares(OLS) parameter estimates are not efficient and the standard error estimates are biased. Yule-Walker(YW) estimation, called two-step full transform method, is used(see Gallant and Goebel 1976, Harvey 1981). From the above discussion and theory, we can specify the following land(or housing) price equation over time:

$$Q(t) = Q\{i_W(t), ctax(t), w(t), E[\hat{R}(t)], HL(t)\} \quad \cdots\cdots\cdots (1)$$

where $Q(t)$ is the price[4]
$i_W(t)$ is the weighted interest rate[5]
$ctax(t)$ is the capital gains tax rate
$itax(t)$ is the income tax rate
$w(t)$ is the housing user-costs[6]
$E[\hat{R}(t)]$ is the expected price increase rate
$HL(t)$ is the housing loans distributed by Korea Housing Bank

We expect that capital-gains taxes and income taxes have negative effects on price changes and interest rates have positive effects.

We expect that the housing user-costs is significant and show negative effect on housing prices. The negative user-costs are related to the desirability of home-ownership and result in increasing housing shortage. Increasing housing shortage in Korean can be partly explained by this. The capital gains taxes and income taxes have negative effects on price changes regardless of market types while interest rates have positive effects. Also, we expect that housing loans is significant and show negative effects.

We can test whether the price changes can be controlled through the government financial market interventions. And if we separate housing market into high and standard quality markets, we may find the effective(sensitive) policy variables by type of market through empirical analysis.

3. Empirical Analysis and Results

In this section, we present the results of empirical estimates of the models described in the previous section. We specified the following land(or housing) price equation over time:

$$Q(t) = Q\{i_W(t), ctax(t), itax(t), w(t), E[\hat{R}(t)], HL(t)\}$$

where, for a given time t, Q(t) is the price $i_W(t)$ is the weighted interest rate (INTER), ctax(t) is the capital-gains tax rate(CTAX), itax(t) is the income tax rate(ITAX), w(t) is the housing user-cost, $E[\hat{R}(t)]$ is the expected price increases rate(FORE), and HL(t) is the housing loans. This is the basic equation which we will modify for empirical analyses. For these estimations, we used Housing Finance Monthly(KHB), Monthly Statistics Bulletin(Bank of Korea), Direct tax survey data from Ministry of Finance, Urban family annual data from Economic Planning Board, land data from Korea Land Development Corporation. And we estimated expected inflation using ARIMA model. Our analysis is based on quarterly data(975−1989), so for data generation Lisman-Sandee(L−S) method are used(Boot, Feibes, and Lisman 1966, Litterman and Weiss 1985).

Now, let us briefly discuss the hypothesized variable signs. The captial-gains taxes and income taxes are expected to have negative effects on price changes regardless of market type, while interest rates have positive effects. An increase in the interest rate results in an increase in user cost of housing. And the increase in the user-cost of capital in housing sectors causes under-investment in housing sectors. And, naturally, the anticipation of future price changes has a positive effect on price changes. To estimate the anticipation of future price changes for both high-quality and standard-quality markets, we used the autoregressive integrated moving average(ARIMA) model. We followed ARIMA(1, 0, 1) procedures. This is the univariate ARMA model. Let the univariate ARMA model be

$$\phi(B)W_t = \theta(B)a_t$$

where a_t is an independent sequence of normally distributed innovations with mean zero and variance σ^2. The log-likelihood function can be written as

$$-x'\Phi^{-1}x/2\sigma^2 - \ln(|\Phi|)/2 - n\ln(\sigma^2)/2$$

where $x = W - m$, W is the time series written as a column vector, m is the mean parameter, $\sigma^2\Phi$ is the variance of x as a function of the ϕ, θ parameters, and $|\cdot|$ denotes the determinant. The maximum-likelihood estimate(MLE) of σ^2 is

$$S^2 = x'\Phi^{-1}x/n$$

where n is the number of points in the time series. We used both the land price index and the average housing price as dependent variables in the estimation. The correlation matrix tells us that the Pearson correlation value between the land price index and average housing price was around 0.97

We tried various alternatives to find the best fitting model. All models produced high R^2 value. R^2 is defined as $R^2 - 1 - (ESS/TSS)$ where ESS is the error sum of squares and TSS is the total sum of squares. In Table 1, we present the elasticities and their t-statistics for the high-quality market. For these estimates, we use an autoregressive model using Yule-Walker estimation instead of OLS. We also use LPIHNC[the land price index for the high-qualtiy market divided by the CPI(consumer price index)] as a dependent variable. As expected, the variables for capital-gains and income taxes show negative effects on the land price index, both are significant at the .05 level. One important thing is that the elasticity for capital gains taxes is bigger than that of income taxes. Results for housing investment and loans are also presented. However, only the housing-loans variable is statistically significant at the .05 level for this market. Under-investment in housing in Korea may be the explanation.

Table 1. Elasticities for High Quality Market

	DEPENDENT VAR LLPIHN	LLPIHNC	LLPIHNC
INTERCEPT	22.33 (8.97)	9.534 (5.768)	5.33 (2.89)
LFOREH	.074(.625)	.116 (1.415)	0.24 (3.05)
LCTAXH	−3.39 (−3.47)	−1.569 (−2.78)	−1.15 (−2.33)
LITAX	−2.369(−4.07)	−1.23 (−3.26)	−1.15 (−3.57)
LINTER	.621(1.77)	.5 (2.201)	.49 (3.26)
LHI			.071 (.84)
LHL			.16 (3.69)
LAG1	−.725(−4.46)	−.735 (−4.17)	−.213 (−1.14)
LAG2	.149(.921)	.199 (1.132)	−.003 (− .02)
Total R^2	.946	.9108	.9285
D.W.			1.51

LLPIHN : logarithm value of LPIHN(land price index for high quality market [HQM])
LLPIHNC : log(LPIHN/CPI)
LFOREH : logarithm value of future price change for high quality market
LCTAXH : logarithm value of capital gains tax rate for high quality market
LITAX : logarithm value of income tax rate for high quality market
LINTER : logarithm value of interest rate
LHI : logarithm value of housing investment
LHL : logarithm value of housing loan

Table 2. Elasticities for Standard Quality Market

	DEPENDENT VAR LLPISN	LLPISNC	LLPISNC
INTERCEPT	16.3 (7.79)	7.254(4.66)	1.13 (.6)
LFORES	−.07 (−.51)	−.009(−.09)	.017(.167)
LCTAXS	−1.066(−2.07)	−.551(−1.53)	−.24 (−.67)
LITAX	−2.625(−3.503)	−1.464(−2.745)	−1.41 (−2.67)
LINTER	.501(1.05)	.347(.99)	.76 (2.99)
LHI			.13 (1.09)
LHL		−.704(−5.61)	.27 (4.18)
LAG1	−.68 (−5.73)		−.17 (.96)
LAG2			−.23 (−1.3)
Total R^2	.944	.926	.924
D.W.			2.31 (ML)

LLPISN : logarithm value of LPISN(land price index for standard quality market [SQM])
LLPISNC : log(LPISN/CPI)
LFORES : logarithm value of future price change for standard quality market
LCTAXS : logarithm value of capital gains tax rate for standard quality market
LITAX : logarithm value of income tax rate for standard quality market
LINTER : logarithm value of interest rate

Table 3. Sensitivities

	H.Q.M(High Quality Market)	S.Q.M(Standard Quality Market)
Forecast	27.52	7.74
CTAX	− 38.23	− 31.68
ITAX	−125.05	−257.87
INTEREST	15.05	61.13

Forecast is the expectation of future price change at t+1 predicted at time t. This value is derived by ARIMA model for each quality market.

Table 4. DEPENDENT VAR

	LHP	LHPCP
INTERRCEPT	12.26 (8.9)	7.13 (8.239)
LFORES	−.05 (−.685)	.009(.194)
LCTAXS	−.32 (−1.16)	−.039(−.227)
LITAX	−1.76 (−4.65)	−.802(−.33)
LINTER	.233(1.44)	−.138(−1.27)
LHI	.216(2.7)	.18 (3.62)
LHL	.13 (2.83)	−.03 (−1.07)
LAG1	−.266(−1.65)	−.374(−2.42)
LAG2		
Total R^2	.956	.859
SSE	.743	.29
AIC	−38.58	−79.94
D.W.	1.896(by ML)	1.886(by ML)

LHP : logarithm value of HP(housing price)
LHPCP : log(HP/CPI)
LFORES : logarithm value of future price change for the stadard quality market
LCTAXS : logarithm value of capital gains tax rate for the standard quality market
LITAX : logarithm value of income tax rate for standard quality market
LINTER : logarithm value of interest rate

In Table 2, we present the elasticities for the standard-quality market. The elasticity of the capital-gains tax for the standard-quality market is −0.551, compared to −1.569 for the high-quality market. This means that capital gains taxes are a more effective policy tool for reducing price increases in the high-quality market than they are in the standard-quality market in Korea. As expectd, capital-gains taxes and income taxes show negative effects on the land price index for the standard-quality market. However, the anticipation of price changes in the standard-quality market has a negative sign but is not significant at 10% level. The Korea Housing Public Corporation has made extensive great effort to supply the standard quality markets for serveral years. Hence the housing in the standard-quality market is sometimes oversupplied. Also, since most households prefer good public schools for their children, there have been housing shortages in the high-quality markets. Hence, some standard-quality market areas are simply "waiting rooms" for residents desiring better-quality housing. Also, because of goverment efforts to stabilize the standard-quality market, the anticipation of price changes in the standard market has had little or no role in increasing housing prices. This reflects the circumstances that investment in the high-quality market is more profitable than the investment in the standard-quality market. Hence, this verifies that "the rich become richers", and it is not easy for moderate-income groups to accumulate their wealth quickly. Also, it means that moderate-income groups can not afford to move into the high-quality market without a substantial subsidy.

If we include both housing loans and housing investment in the specifications, we obtain relatively small elasticities for both capital-gains and income tax rates. However, of the two, only the housing loans variable yield a significant effect, with other variables remaining significant at the 0.05% level. Let us define the sensitivity of independent variables as $\partial LPI/\partial X$ where X is vector of independent variables. In Table 3, we present the sensitivities of each policy variables. In Table 3,

we present the sensitivities of each policy variable by type of market. The standard-quality market is four times more pirce sensitive to changes in the interest rate than is the high-quality market. One reason for this may be the following: income groups which demand standard-quality housing are more interested in borrowing money from a bank than the groups which are thought to demand high-quality market. Housing prices in the standard-quality market are also more sensitive to the income tax rate than they are in the high quality market.

In Tabel 4, we present the results of an estimation using housing price as a dependent variable. The first equation in Table 4 yields a higher R^2 value, when compared to the second equation. HP is a nominal value and HPCP is a real value. The housing price change data from the Ministry of Construction show a decrease(-7.3) in 1985. Also, the average rate of change for housing prices in the 1980s declined greatly compared to the rates of the 1970s. For these reasons, we see a negative sign for the anticipated price change variable in the first equation. Although there is a housing shortage in Korea, household affordability was not enhanced by the government's restrictive financial policies. This can be explained by a greatly rationed supply of mortgage finance since 1967 via the creation of the Korea Housing Bank. The interpretation of variables coefficients is straightforward. The elasticities of HL is relatively smaller(0.13) than those of using land price index as a dependent variable. For LHPCP(log value of real housing price), the elasticity of HL even becomes negative, however, it is not significant at the .10 level. All D.W. statistics are reasonable(1.896 and 1.886) which indicate no autocorrelation problem.

4. Concluding Remarks

We have investigated the price change effects of capital-gains taxes and interest rates in the Korean housing market for two qualities of housing(high and standard). It turns out that the standard-quality market is far more sensitive to interest rate and income tax changes than the high-quality market while the capital-gains tax has roughly the same effect on both markets in terms of sensitivities. As an ex-post evaluation of policies, capital-gains tax are more effective policy tools in reducing the magnitude of price increases in high quality market than in the standard market in Korea.

Our results reflect the circumstances that investment in the high-quality market is more profitable than the investment in the standard quality market. Hence, the results verify that "the rich become richer", and it is not easy for moderate income groups to accumulate their wealth as quickly. Also, they also imply that moderate-income groups can not afford to move into the high-quality market without a substantial subsidy. Finally, we found that parameters for the two markets are quite different, e.g., the effects of interest rates on the high-quality market do not equal the effects of interest rate on standard-quality market. Therefore, estimates without market separation will be biased. Results from equations using a weighted interest rate[$i_W(t) = vi_O(t) + (1-v)i_P(t)$] imply that a dual market yields complicated results. Using a weighted interest rate instead of the official interest rate(i_O) increases the significance level of the anticipated price-change variables and more than doubles its elasticities for the high-quality market. The same elasticity for the standard-quality market did not quite double.

Endnotes

1) During the past 25 years, the land price increased thirteen-fold, whereas the wholsale price and the national income rose only three-

fold, and five-fold, repectively.

〈Comparison between Land Price and other Economic Indices〉

	1975	1980	1985	1990
Land Price	100	328	533	1,335
Housing Price	100	355	397	649
National Income	100	142	204	526
Wholesale Price	100	225	289	311

Source:Korea Statistical Yearbook, NSO

2) Income elasticities by market types are different and tax rates such as income, capital gains, etc. are different.
3) Price increase rates at time t are $[P_{t+1}-P_t]/P_t$. And expected price increase rate at time t are calculated using the predicted value of p at time t from ARIMA model.
4) We will use both housing and land prices for this estimation.
5) It can be calculated by equation. $iw(t) = i_o(t)\,v(t)+(1-v(t))ip(t)$
6) Fot the user-costs of housing we can use Poterba's and also derive our version of user-costs. In order to calculate user-costs of housing, we can estimate depreciation rates in Korea.

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