

Corporate Real Estate Holdings and the Value of the Firm in Korea

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Abstract. This study investigates the relationship between changes in real estate prices and the value of firms. The main hypothesis is that changes in the value of firms caused by expectations of increasing real estate prices will be smaller in magnitude than these in the value of their real estate holdings since there will be a loss in the value of the firm occasioned by the perception of future growth opportunities forgone. The secondary hypothesis is that the loss in value caused by growth opportunities forgone will be proportional to the amount of debt financing used.

The findings using a yearly cross-sectional test during 1987–91 indicate that the proportion of a firm's real estate holdings to its total assets had no significant effect upon the return-on-investment in its stocks. However, the higher the debt ratio of the firm, the lower the coefficient of the real estate holdings, implying that the value loss of the growth opportunities forgone becomes larger as the firm uses more debt. Also these results are not observed in size analysis. Accordingly, a debt effect is regarded to be clearer than a size effect in the impact upon stock returns of the real estate holdings.

Introduction

During the past few decades, Korea has experienced a continuous and sharp increase in real estate prices. Demand for real estate has sharply increased, particularly due to economic development and urbanization. On the other hand, the increase of the real estate supply has been relatively slow, due to the limited availability of land and various regulations. Lower returns on financial instruments, resulting from financial controls and the underdevelopment of the financial system, have been another cause of the rise in real estate prices. In addition, speculative demand for real estate, fed by expectations of future price rises has increased real estate prices to unprecedented levels (see Kim, 1991). In fact, the rate of land price increase in 1987–91 was on average 21.5%, while the inflation rate based upon the consumer price index was on average 6.7% for the same period.

Higher real estate prices are likely to have the following effects in Korea. First, they can cause a slowdown in the production activities of firms, because their production costs increase as the factor price of land rises. Second, the fact that gains from real estate

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investment are greater than normal labor income or normal profits of the firm can sap the work ethic and reduce managerial incentives. Third, a rise in real estate prices can distort wealth distribution among firms and individuals, due to differences in holdings of real estate. Despite these potentially serious effects, however, it is not known to what degree the rise in real estate prices affects firms' management.

This study examines how increases in real estate prices influence investment activity and the value of the firm in Korea. In Korea, it is often said that past increases in real estate prices have resulted in the decline of firms' willingness to invest, thus hindering the development of the economy. Further, a study by Nourse and Roulac (1993), who try to link real estate decisions to corporate strategy, suggests that real estate decisions may influence the firm value through corporate strategy.

To address the issue, a traditional finance framework is used for theoretical developments and the empirical tests utilize capital market data. This study consists of four sections. In section two, the effect of real estate price increases on a firm's value is derived theoretically. In section three and four, empirical tests are explained and the results are reported. The fifth section presents conclusions.

Theoretical Analysis

The Case of No Debt Financing

As in Myers (1973), which examines the determinants of corporate borrowing, we assume that the market is perfect so that there exists no market imperfections such as corporate taxes or bankruptcy costs. In addition, it is assumed that the market is complete so that an investor can construct any future income distributions desired through a portfolio of pure securities.

Under this situation, Myers (1977) considers the case in which a firm at period 0 (current period) holds an investment opportunity that can be invested at period 1 (future period). Since the firm has a new growth opportunity to invest in the future regardless of current assets, the total value of the firm consists of the following two values.

$$V = V_A + V_G, \quad (1)$$

where:

V_A = the value of current assets that the firm holds; and

V_G = the value of the new investment opportunity of the firm.

In order to analyze the firm's growth opportunities, suppose that the firm decides whether to accept a new investment opportunity after it knows the realized state at period 1, as in Myers (1977). Also suppose that the same quantity of real estate is needed for the investment opportunity, regardless of the realized state.

For the project, production factors other than real estate are also needed. Suppose that cash flows of the project, $CF(s, X)$, with the employment of production factors other than real estate in a given state, s , are determined as follows:

$$CF(s, X) = p(s)q(X) - W(s)X, \quad (2)$$

where:

- $p(s)$ = unit price of the product in a given state(s);
 X = quantity vector of production factors other than real estate;
 $W(s) = [W_1(s), W_2(s) \dots W_n(s)]$;
 = price vector of production factors other than real estate in a given state(s); and
 $q(X)$ = production function with the factor input X .

The firm determines quantities of the factor input to maximize $CF(s, X)$ in a given state s . Let $CF(s)$ be the cash flow of the state s under the optimal employment of the factor input. And as in Myers (1977), if the states are arranged along the vertical axis as $CF(s)$ increases, Exhibit 1 will be derived. Of course, $CF(s)$ do not have to be a linear function of s as in Exhibit 1.

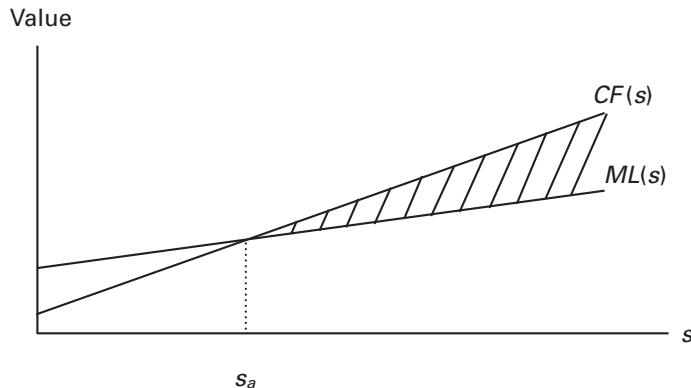
Suppose that the market value of the real estate needed for the project in state s at period 1 under the above premise is $ML(s)$. Also it is assumed that acquisition of the real estate is financed solely by equity and no debt financing is needed.

Then, the firm makes an investment only if cash flows, $CF(s)$, exceed the market value of the real estate, $ML(s)$. Otherwise it would reject the project. This case is shown in Exhibit 1. For the convenience of analysis, it is assumed that the real estate price in period 1 is a linearly increasing function of state s in Figure 1. This, of course, is not a binding requirement.¹

As shown in Exhibit 1, the investment period for the firm's growth opportunity begins with state s_a . Therefore the pure value of the investment opportunity omitting the real estate value is represented as a shaded area and the value of the investment opportunity, V_G , becomes as follows:

$$V_G = \int_{s_a}^{\infty} y(s)[CF(s) - ML(s)] ds, \quad (3)$$

Exhibit 1 Determination of a Firm's Investment for Growth Opportunity with No Debt Financing



where:

$y(s)$ = current value of the pure security which pays one dollar at state s and pays none at the other states.

Suppose that the real estate price for state s in period 1 increases by ΔML for any reasons.^{2,3} Accordingly, the amount needed for the purchase of the same amount of real estate for state s in period 1 increases to $ML(s) + \Delta ML$. Therefore, in this case the acceptance region for the investment opportunity begins with s_b , not s_a in Exhibit 2. Thus the net value of the firm's investment opportunity omitting the real estate costs, V_G , becomes as follows:

$$V_G = \int_{s_b}^{\infty} y(s)[CF(s) - (ML(s) + \Delta ML)] ds \tag{4}$$

Thus when this value is compared with the value of the growth opportunity before the real estate price increase, the value of the growth opportunity decreases by the following value, ΔV_G , as the price of real estate rises:

$$\Delta V_G = \int_{s_a}^{s_b} y(s)[CF(s) - ML(s)] ds + \int_{s_b}^{\infty} \Delta ML y(s) ds \tag{5}$$

That is, the value of the future investment opportunity of the firm decreases by the shaded area in Exhibit 2 due to the real estate price increase and thus the value of the firm's growth opportunity decreases by that amount.

However, the above results do not apply for the assets that the firm currently holds.

Exhibit 2
Changes in Investment Decisions for the Firm's Growth Opportunity Due to the Real Estate Price Increase under No Debt Financing

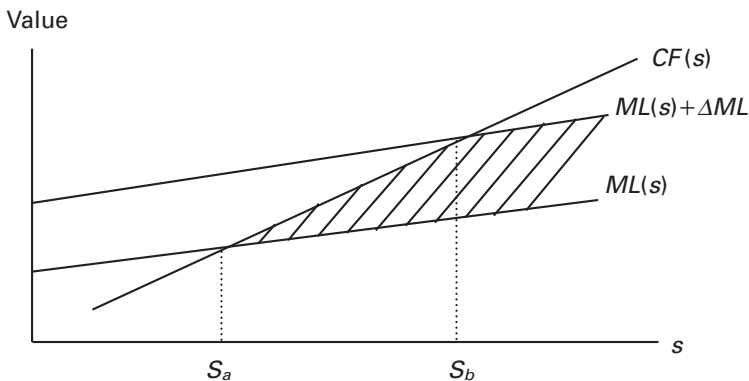
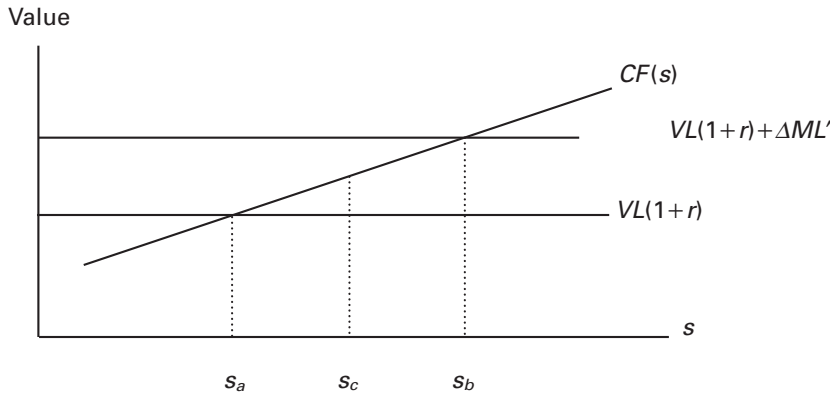


Exhibit 3
Determination of a Firm's Production with Existing Assets Held Due to A Real Estate Price Increase



That is, since the price of the assets currently held by the firm is reflected as a sunk cost, the firm's production opportunity will not be changed by even the current change in the asset price.

In order to see this, suppose that a firm has purchased real estate at a price of VL in period 0. Exhibit 3 represents the determination of a firm's production at this time. If it were not for additional expectations of an increase in price after a firm's purchase of real estate, it would be favorable for the firm to begin production in period 1 when the future value (in period 1) for VL in period 0, $VL(1+r)$ (r =riskless interest rate), is less than $CF(s)$. Otherwise, it would be favorable⁴ for the firm not to produce. Accordingly, when there are no additional expectations of increase in real estate prices, the production period for existing real estate holdings of a firm begins with s_a .

Suppose that the real estate price of a firm is expected to increase by $\Delta ML'$ in period 1 after purchase.⁵ If a firm does not hold real estate at this time, production does not begin at a point such as s_c . However, if a firm has already purchased real estate in period 0, production begins at the point s_c . The reason is that in case production begins at s_c , the profit of net investment, $CF(s_c) - VL(1+r)$, which is the production revenue minus acquisition cost, is greater than 0. Also since the real estate price of the firm after its production in period 1 is expected to increase by $\Delta ML'$, the firm gets a capital gain due to the increase in real estate value as well as the profit from production.

In the end, this kind of logic holds for all s in $s_a < s < s_b$ in Exhibit 3. Therefore the value of existing assets held by the firm due to the real estate price increase, V_A , becomes:

$$V_A = \int_{s_a}^{\infty} y(s)[CF(s) - VL(1+r)] ds + (VL + \Delta VL), \quad (6)$$

where:

$$\Delta VL = \Delta ML' \int_{-\infty}^{\infty} y(s) ds = \frac{\Delta ML'}{1+r}, \text{ and}$$

ΔVL = amount of increase in real estate value now ($t=0$) due to $\Delta ML'$ of real estate price increase in period 1.

If this logic is continued, it is expected to lead to a one-to-one relationship between increases in the present value of real estate (ΔVL) and those in the value of a firm's existing assets (V_A). That is,

$$\frac{\Delta V_A}{\Delta VL} = 1. \quad (7)$$

Therefore other things being equal, and if capital markets are efficient, the existing value of a firm's real estate assets generally increases by the amount of increase in real estate value. The reason is that even if it is expected that the price of existing real estate held by the firm will increase, this does not affect the production opportunity with the existing assets held by the firm. Since capital markets are efficient, V_A changes by the amount of change in VL if change in real estate value is rapidly and fully reflected in the value of the firm.

Meanwhile, expectations of a real estate price increase (decrease) limit (increase) the growth opportunities of the firm and then decrease (increase) the value of the firm's growth. Accordingly, the amount needed for additional investments in future real estate is inversely related to the growth value. Furthermore, it is expected that the growth value of a firm decreases (increases) in line with the increase (decrease) in the real estate holdings of a firm, as well as increase (decrease) in the additional real estate investment needed for growth opportunity. That is:

$$\frac{\Delta V_G}{\Delta VL} < 0. \quad (8)$$

The reason is that $\Delta V_G/\Delta ML$ can be expected to be less than 0 according to the logic above. If it is assumed that the additional amount of real estate holdings needed for the future growth opportunity investment is ΔL and additional expected value for a unit of real estate in period 1 is ΔP_1 , the ΔML is equal to $\Delta P_1 \cdot \Delta L$.⁶ Also if we assume that the amount of existing real estate holdings of a firm is L , VL is as follows:

$$\Delta VL = \Delta ML' \int_{-\infty}^{\infty} y(s) ds = \Delta P_1 L \int_{-\infty}^{\infty} y(s) ds. \quad (9)$$

As long as $\Delta L/L$ is positive (+), $\Delta V_G/\Delta VL$ becomes negative (-). Accordingly, the growth opportunity value of a firm is inversely related to the value of the existing real estate.

The change in the total value of a firm due to change in the value of existing real estate holdings is therefore less than unity. If the existing asset value of a firm increases by the amount of real estate value increase, the growth value of the firm will decrease.

The effect due to a change in expectations of real estate price increases in period 1 above is analyzed. However, there exists an additional reason why a price increase in the existing real estate of the firm is inversely related to its growth opportunity value.

Suppose that the price of the firm's real estate holdings has increased by ΔP_0 in period 1. At this time, the value of existing real estate of the firm in period 0, VL , increases by $\Delta P_0 \cdot L$, and then the value of existing asset holding of the firm, V_A , increases by $\Delta P_0 \cdot L$. However, price increases for a unit of real estate in period 0 gives rise to additional expectations of price increase in the future for real estate.

Here ΔML in period 1 is regarded as a stochastic value, not as a certain value. Since the investment opportunity of a firm decreases when the expected amount needed for future real estate investment increases, $\Delta V_G/E(\Delta ML)$ is clearly less than 0. However, total sign of $\Delta V_G/\Delta VL$ is influenced by the size of $E(\Delta ML)/\Delta VL$. Incidentally, $E(\Delta ML)/\Delta VL$ can be expressed as follows:

$$\frac{E(\Delta ML)}{\Delta VL} = \left(\frac{\Delta P_0 + E(\Delta P_1)}{\Delta P_0} \right) \frac{\Delta L}{L}, \quad (10)$$

where:

- ΔP_0 = amount of price increase for a unit of real estate in period 0 (now);
- $E(\Delta P_1)$ = expected amount of additional price increase for a unit of real estate in period 1 (future);
- ΔL = amount of real estate needed additionally for growth opportunity in period 1 (future); and
- L = amount of real estate that a firm holds in period 0 (now).

Here $\Delta L/L$ is positive(+) as long as L is greater than 0. Accordingly, the total sign of $\Delta V_G/\Delta VL$ depends on the sign of the parenthesized bracket. Here:

$$\begin{aligned} \text{If } E(\Delta P_1)/\Delta P_0 > -1, & \quad \text{then } \frac{\Delta V_G}{\Delta VL} < 0 \quad \text{and,} \\ \text{If } E(\Delta P_1)/\Delta P_0 \leq -1, & \quad \text{then } \frac{\Delta V_G}{\Delta VL} \geq 0. \end{aligned} \quad (11)$$

However, when the actual price formation process in the Korean real estate market is considered, the ratio $E(\Delta P_1)/\Delta P_0$ is generally expected to be greater than -1 . This is because, under the general assumption that the price formation of the real estate follows a random walk, $E(\Delta P_1)$ is on average approximately 0. In this case the above ratio, $E(\Delta P_1)/\Delta P_0$ is evidently greater than -1 .

In addition to this, Korean economists believe that price bubbles are strong in the Korean real estate market (see Kim, 1991; Kim and Cheong, 1991). The asset price bubble is dependent on several factors, such as a rational bubble, an information bubble and fads. But the reason why a price bubble, once formed, lasts for a long time, is that destabilizing speculation exists in the market.⁷ Then investors expect that the future price will also rise as the current price increases. As a result, an excess demand for an asset lasts so that the asset price increase continues for long periods.

In fact, the above phenomenon is continuously evidenced in the Korean real estate market. In the meantime, if we analyze the background to the real estate price increase in Korea, once real estate prices increase, investors on the street expect that real estate price increases will become larger since the real estate brokers or the press stir them up. Accordingly, the demand for purchase of real estate increases prior to an anticipated rise, and then prices do in fact increase. The price increase again stimulates demand for real estate, producing the vicious circle between price increases and a rise in demand.

It is not still clear how serious the phenomenon of destabilizing speculation is in the Korean real estate market. However, according to Kim's recent study (1991), it is generally estimated that price bubble effects are continuously presented in Korean real estate prices.⁸

If destabilizing speculation dominates Korean real estate prices, the relationship between ΔP_0 and $E(\Delta P_1)$ is expected to be positive. The reason is that the increase in the current price of real estate induces an expectation of an additional future price increase, and then the ratio of $E(\Delta P_1)$ to ΔP_0 is expected to change in the same direction. Therefore in view of the realities of Korean real estate markets such as the above, the sign of $\Delta V_G/\Delta V_L$ is generally expected to be negative (-).

The Case with Debt Financing

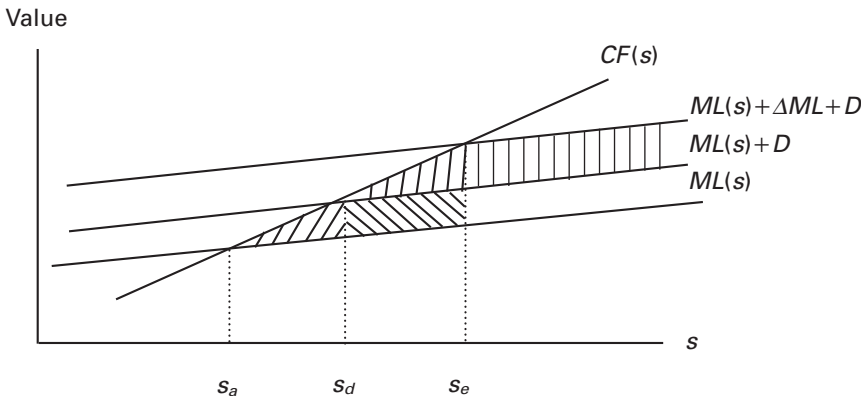
Myers (1977) analyzes a firm's growth opportunity value when debt financing occurs. His analysis shows that if the debt matures after the firm's state is known, then the value of the firm's growth opportunity decreases when the project is financed with debt.

That is, since a firm selects the growth opportunity from the point s_a at the intersection point of the amount of real estate investment, $ML(s)$, in period 1 and the line $CF(s)$ in case of no debt use, the value of a firm's growth opportunity is given as in equation (4) above.

In contrast, if the firm makes a debt contract to repay the amount D at period 1, the investment for the growth opportunity begins at the point s_d . In this case, the shareholders' value for the growth opportunity (VE_G), the debt value (VB_G), and the total value for the growth opportunity (V_G) are given as follows:

$$VE_G = \int_{s_d}^{\infty} y(s)[CF(s) - \{ML(s) + D\}] ds, \tag{12a}$$

Exhibit 4
Changes in Investment Decisions Due to Real Estate Price Increases in Case of Debt Financing



$$VB_G = \int_{S_d}^{\infty} y(s) D ds. \quad (12b)$$

$$V_G = VE_G + VB_G = \int_{S_d}^{\infty} y(s) [CF(s) - ML(s)] ds. \quad (12c)$$

Therefore when the firm uses debt, the loss of the growth opportunity is represented by the shaded area with slanted lines in Exhibit 3, and the value loss for this case is represented as follows:

$$\Delta V_G = \int_{S_d}^{S_d} y(s) [CF(s) - ML(s)] ds. \quad (13)$$

Suppose now that the amount of real estate investment needed for the firm in period 1 is expected to rise by ΔML .⁹

Then, since in this case the investment for the future growth opportunity begins at the point s_e in Exhibit 3, the net value of the opportunity for the shareholders is given as follows:

$$VE_G = \int_{S_e}^{\infty} y(s) [CF(s) - (ML(s) + \Delta ML + D)] ds. \quad (14)$$

Also, the value of the debtholder receiving D at period 1 is given as:

$$VD_G = \int_{S_e}^{\infty} y(s) D ds. \quad (15)$$

Thus, the total value of the growth opportunity represented by the sum of the value of the shareholders and that of the debtholders is as follows:

$$V_G = \int_{S_e}^{\infty} y(s) [CF(s) - \{ML(s) + \Delta ML\}] ds. \quad (16)$$

When this value is compared with the total value of the debt-use firm for which the expected amount of real estate investment needed is $ML(s)$ only, the amount of real estate investment in period 1 increases by ΔML . Thus it can be shown that the value of the firm's growth opportunity decreases in total by the following amount:

$$\begin{aligned} \Delta V_G &= \Delta VE_G + \Delta VD_G \\ &= \left\{ \int_{S_d}^{S_e} y(s) [CF(s) - (ML(s) + D)] ds + \Delta ML \int_{S_e}^{\infty} y(s) ds \right\} + D \int_{S_d}^{S_e} ds. \end{aligned} \quad (17)$$

The first term VE_G on the right-hand side of the equation corresponds to the shaded area with vertical lines in Exhibit 3. This value loss is equivalent to the value loss of the firm with no debt financing.

When the firm uses debt, however, it loses an additional value represented by the shaded area with horizontal lines in Exhibit 3. The value of the future growth

opportunity when using debt decreases additionally by ΔVD_G , in comparison with that with no debt financing. Therefore, when real estate prices increase, the value decrease for the future growth opportunity becomes larger according to how heavily the firm uses debt financing.

Then who bears this value loss in the end? Myers (1977) showed that, assuming the rational expectation of debtholders, the shareholders ultimately bear the value loss of the growth opportunity. That is, if debtholders rationally expect that this kind of value loss will occur in advance, they would reflect the loss in the financial contract in terms of interest or the price of the financial claim. Thus the loss is transferred to the shareholders in the end.

According to this argument, the additional value loss, ΔVD_G , is expected to be borne ultimately by the shareholders. Also if we assume that all profits and losses due to the real estate price change belong to the shareholders in the end, the change of the shareholders' value due to the real estate price increase will be adjusted as follows:

$$\frac{\Delta VE}{\Delta VL} = \frac{\Delta VE_A}{\Delta VL} + \frac{\Delta VE_G}{\Delta VL} < 1, \quad (18)$$

where:

- VE = total capital value of a firm;
- VE_A = equity value for assets currently held by the firm; and
- VE_G = equity value for a firm's new investment opportunity.

Since the decrease in the value of the growth opportunity is greater as the debt ratio becomes greater in case of debt-use firm, other things being equal, changes in the equity value due to change in the real estate price, $\Delta VE/\Delta VL$, are expected to become much less than unity as a firm's debt ratio becomes higher.

Real Productivity and the Value of the Growth Opportunity

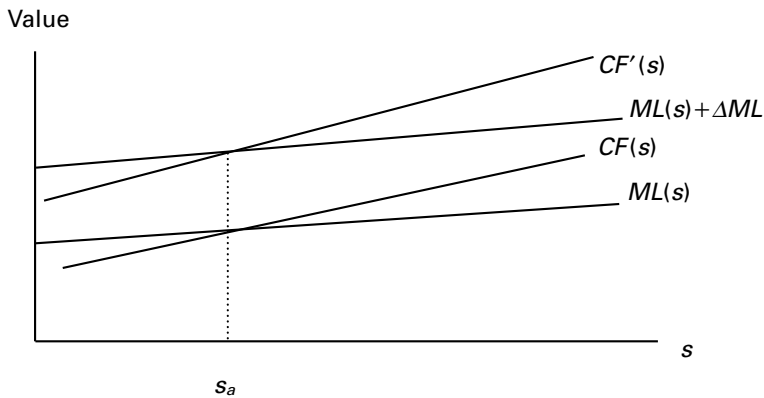
In the above discussion we did not consider the cause of the real estate price increase. However, depending upon what its causes are, the effect on the firm's growth opportunity value may be different. For example, suppose that the marginal productivity per unit of the real estate increases due to some external factors. In this case, other things being equal, the demand for the real estate will increase as the marginal productivity increases. Further, if the supply of its real estate is limited or increases too slowly to meet demand, then its price rises.

However, if the real estate prices' increases are caused by a marginal productivity increase, the value loss of the firm's growth opportunity would not occur. For example, suppose that the production function $q(x)$ changes to $q'(x)$ as in (18), as the marginal productivity of the real estate increases. For all s :

$$\frac{\partial q'(x)}{\partial x_i} > \frac{\partial q(x)}{\partial x_i} \quad (\text{for all } x_i), \quad (19)$$

where: $x_i = i^{\text{th}}$ production factor.

Exhibit 5
Determination of Investment Decisions for the Firm's Growth Opportunity
Due to Real Estate Price Increase in Case of Marginal Productivity Increase



In this case, as the firm's productivity increases, its cash flows also increases. By the way, if expected cash flows in each state along with expectations of real estate price increase both rise as much as the amount of expected increase in real estate price, the value of the firm's growth does not change. That is, suppose that the real estate price rises from $ML(s)$ to $ML(s) + \Delta ML$ and that the firm's cash flow in each state increases from the original $CF(s)$ to $CF'(s)$ as the marginal productivity of the real estate increases. Then, as shown in Figure 4, even though the real estate price rises, the beginning acceptance point of the new investment opportunity is still maintained as s_a . Therefore, the value of the growth opportunity does not change even though the real estate price rises.

The above result offers the basis for the next empirical test. If the main cause of the real estate price increase was due to the productivity increase, the firm's growth opportunity value is not influenced by the real estate price change. If other things are equal and capital markets are efficient so that the change in real estate price is properly reflected in the firm's market value (or equity value), then the firm's market value will change by the same amount as the real estate value change.

On the other hand, if the real estate price increase was due to a bubble price unaccompanied by the firm's real productivity increase or if the real estate price increase exceeds the productivity increase, the value of the firm's growth opportunity will diminish.

Research Design

Hypotheses and Model Building

The following hypotheses drawing on the results in section two are proposed:

$$\begin{aligned} H_0 &: \Delta VE_t / \Delta VL_t = 1 \\ H_1 &: \Delta VE_t / \Delta VL_t < 1, \end{aligned} \quad (20)$$

where:

ΔVE_t = incremental value of the firm's equity at t ; and
 ΔVL_t = incremental value of the firm's real estate at t .

The null hypothesis is consistent with the hypothesis that expectations of a real estate price increase are caused by the improvement in the real marginal productivity of the real estate.

It was analyzed in section two that the equity value of a firm would increase by the amount of increase in real estate value, since the value loss of a firm's growth opportunity is not caused even by a real estate price increase in case the marginal productivity of real estate increases. However, the rejection of the null hypothesis can be accepted as evidence supporting the hypothesis that expectations of a real estate price increase are formed by a bubble. If expectations of a real estate price increase are formed by the price bubble with only an accompanying increase in marginal productivity, the expectations constrain the firm's growth opportunity and then it is expected that the amount of equity value rise due to real estate price increase will be less than that of real estate value increase.

However, the above interpretation needs some preconditions. First of all, it presupposes informational efficiency of capital markets so that all the information about increases and decreases in real estate value are fully and promptly reflected in stock values in capital markets. If capital markets are efficiently responsive to information related to real estate, it is very difficult to judge whether rejection of the null hypothesis is caused by informational inefficiency of markets or a real estate price bubble. Thus the above hypothesis is a joint hypothesis along with informational efficiency of markets.

Second, in reality, changes in equity value of a firm are influenced by several factors such as financial risks as well as changes in real estate value. Thus incremental value of equity in the hypothesis (20), ΔVE , should be apprehended as an incremental effect rather than this effect. So proper control for factors other than real estate is required.

Third, it is supposed in making the above hypothesis (20) that changes in real estate value do not affect debt value. That is, it is regarded that all the effects due to changes in real estate value are reflected in equity value. If the incremental effect on a firm's value due to changes in real estate value is partly reflected in the debt value, the effect on equity value can differ from this effect, even though there is a one-to-one linkage running between changes in real estate value and a firm's market value.

In fact, in a situation where loans against real estate collateral are general practice in the case of financial institutions' loans, as in Korea, the possibility that changes in real estate value affect debt value is great. However, since the clear effects of this are not known as of now, let us leave this effect out of consideration in this paper.

In order to test the hypothesis (20), both the numerator and the denominator of (20) are divided by VE_{jt-1} . Then we obtain the following null hypothesis for the j^{th} firm.

$$\frac{\Delta VE_{jt}}{VE_{jt-1}} / \frac{\Delta VL_{jt}}{VL_{jt-1}} \cdot \frac{VL_{jt-1}}{VE_{jt-1}} = 1, \quad (21)$$

where:

VE_{jt-1} = equity value of the firm at $t-1$; and
 VL_{jt-1} = value of the firm's real estate at $t-1$.

Thus the above equation can be rearranged as follows:

$$R_{jt} = R_{Lt}^j \cdot \frac{VL_{jt-1}}{VE_{jt-1}}, \quad (22)$$

where:

$R_{jt} = \Delta VE_{jt} / VE_{jt-1}$ = return on j^{th} stock at t ; and
 $R_{Lt} = \Delta VL_{jt} / VL_{jt-1}$ = rate of increase for the j^{th} firm's real estate value at t .

Suppose that rates of the real estate value increase, R_{Lt}^j , are equal for all firms denoted as R_{Lt} . Further, in order to control the effects other than that of the real estate price change, suppose that the stock return, R_j is basically determined by the following market model:

$$\tilde{R}_{jt} = \alpha_j + \beta_j \tilde{R}_{mt} + \tilde{\varepsilon}_{jt}, \quad (23)$$

where:

α_j = an intercept;
 $\tilde{\beta}_j$ = a regression coefficient of the market portfolio;
 \tilde{R}_{mt} = the market portfolio return; and
 $\tilde{\varepsilon}_{jt}$ = an error term satisfying the Ordinary Least Square estimation conditions.

Then if the two equations (22) and (23) are joined, the following equation is derived:

$$\tilde{R}_{jt} = \alpha_j + \beta_j \tilde{R}_{mt} + R_{Lt} \frac{\tilde{VL}_{jt-1}}{VE_{jt-1}} + \tilde{\varepsilon}_{jt}. \quad (24)$$

However, it is impossible to estimate the coefficients using the equation (24) itself. The reason is that time-series data about the real estate ratio needed to estimate the equation are not available. In order to avoid these problems, the method that Black, Jensen and Scholes (1972) and Fama and MacBeth (1973) used in testing the validity of CAPM can be used.¹⁰

That is, in the first step, the coefficient, β_j , is estimated through the equation (23), using time-series data about rates of stock return of each sample firm. And then the coefficients, γ_0 , γ_1 and γ_2 of the following equation are estimated using cross-sectional data at time t , with β_j estimated in the previous step and the real estate ratio as an independent variable and rates of stock return at time t as a dependent variable.

$$\tilde{R}_{jt} = \gamma_0 + \gamma_1 \hat{\beta}_j + \gamma_2 \frac{\tilde{VL}_{jt-1}}{VE_{jt-1}} + \tilde{\varepsilon}_{jt}, \quad (25)$$

where: $\hat{\beta}_j$ = beta of firm j estimated through a market model.

The coefficient with which we are concerned especially in equation (25) is γ_2 . If the argument mentioned above is right, the coefficient, γ_2 , should be equal to R_{L_t} under the null hypothesis of equation (20).

A Single-Factor Model and A Multi-Factor Model

Equations (24) and (25) in the previous section again raise the question of whether the basic return generating structure in capital markets is a single-factor model or a multi-factor model and the traditional question about the validity of CAPM. As well known, the conclusion supporting CAPM generally was made¹¹ according to the results of a test on the validity of CAPM by Black et al. (1972) and Fama and MacBeth (1973) through a model similar to equation (25).

However, Banz (1981), Reinganum (1981), Keim (1983), and Basu (1983), etc. discovered that the variables such as P/E ratio and firm size other than *beta* would be important factors explaining asset returns. Also Brennan (1970) and Litzenberger and Ramaswamy (1979) established that dividend returns would be an important factor affecting expected returns on asset if personal income tax existed.

Those studies selected different methods to improve the efficiency of estimation. But the method is basically the same for most studies. That is, first of all, *beta* is estimated using a market model such as the previous equation (23). And after the portfolio construction based upon the estimated *beta*, a cross-sectional regression for each portfolio in the next period which involves estimated *beta* and other variables is performed using a model constructed similarly to equation (25).¹² But the variables other than *beta* involved in a cross-sectional analysis are different according to the object of study.

From its point of view, equation (25) can be regarded as a model testing a multi-factor characteristic of stock returns. Of course, equation (25) is not a model derived by the equilibrium condition. However, if the coefficient, γ_2 , is discovered to be significant through cross-sectional analysis using equation (25), it provides evidence that CAPM is a misspecified model that does not involve real estate ratio as an important variable of stock return determination. However, if the coefficient, γ_2 , is not different from 0 in a statistical sense, CAPM is judged to be a well-specified model for the real estate ratio.

As is well known, firm-specific factors are not priced by a diversification effect from the viewpoint of portfolio theory. The real estate ratio of a firm corresponds to an unsystematic factor that is not related to a market factor. Accordingly, if CAPM is right, the responsive coefficient, γ_2 , for the real estate ratio in equation (25) will show a value near 0 in a statistical sense. But since many studies suggest the possibility that CAPM is a misspecified model, it is an empirical subject of interest as to whether the real estate holdings ratio of a firm can explain such factors or not.

The Sample and Test Procedures

The effect of the real estate price change is analyzed with equations (23) and (25). For this analysis, a sample was selected according to the following:

- listed manufacturing firms except wholesale and retailing firms for the period 1987–91;
- firms for which sixty monthly rates of returns for the past five years including the current year were available for the period 1987–91.

The total number of the sample selected according to the above two considerations was 1,319. Then for those firms, book-value of land holdings, paid-in capital, total assets, and debt amounts were examined. And using such data, the ratio of the real estate value to equity value of each firm was calculated based upon book-value year by year.

The ratio of the real estate value to equity value in (25), (VL_{jt-1} / VE_{jt-1}) should be based upon the market value. But as the market values of the real estate of each firm are not observable, the ratios were calculated based upon the book-value.¹³

Also, the firm's real estate includes buildings and equipment as well as land. But since the effect of the land price change was the most serious in Korea, only land was included in the analysis.

Using the above data, we take the following procedures:

- Time-series regression analyses are made for equation (23), using monthly stock returns of each firm as a dependent variable and stock market returns as an independent variable for the period 1987–91. As a result, market parameters α_j and β_j for each firm are estimated. In the regression, monthly return data for sixty months of the past five years including the current year are used and returns based upon the Korean composite stock price index (KOSPI) are used as the market return.
- Applying equation (25), a cross-sectional OLS regression analysis is made using all the samples of the firm.¹⁴ In the regression, β_j of each firm estimated in the previous step and the ratio of equity value to book value of real estate holdings are used as independent variables. At this time the value of the previous year from the period of a cross-sectional analysis is used for the ratio of real estate holdings. And yearly returns calculated based upon each firm's monthly returns are used as a dependent variable.
- If we follow the above logic, yearly γ_2 estimated in equation (25) needs to be compared with the yearly rate of price change for the land realized for the corresponding year. If there is no large difference between γ_2 and the realized

Exhibit 6
Rate of Price Increase by Land Use and by Classification of Land Category
during the Period 1987–1991 in Korea*

(Unit: %)

	1978	1988	1989	1990	1991	Avg.
National average	14.67	27.33	31.97	20.58	12.78	21.52
1 Commerce area	14.46	24.77	29.89	20.96	12.22	20.46
Industry area	27.81	27.45	32.36	22.10	15.96	25.14
2 For commercial use	15.10	26.47	24.35	19.50	13.97	19.88
For industrial use	29.68	30.34	26.62	21.64	15.08	24.13
3 Inflation rate**	3.0	7.1	5.7	8.6	9.3	6.74

*Rates of price increase in 1987–89 are actual values on the basis of the end of the 4/4 quarter, and those in 1990–91 are actual values on the basis of the end of the value of January for the corresponding year.

**based upon the consumer price index

yearly land return, then the null hypothesis is accepted. Otherwise the null hypothesis is rejected.

The rates of price increase for land realized during the period 1987–91 based upon land price index by use and by the classification of land categories released by the Ministry of Construction are listed in Exhibit 6. As shown in the exhibit, total land prices during the period 1987–91 in Korea recorded a 21.52% increase on average. Especially during the period 1988–89, the rate of land price increase was the largest. Average national land prices increased by 31.97% in 1989, showing the largest rate of increase out of the five years analyzed. In the case of land for industrial use, the price increased by 30.34% in 1988, and from the viewpoint of the classification of land category, the price increase of land for industry use was larger than that of land for commercial use. For example, price of land for commercial use during the period 1987–91 increased by 19.88% on average, while price of land for industrial use increased by 24.13%.

Results

Cross-Sectional Results by Year

Exhibit 7 shows the cross-sectional results by year. The coefficients of the real estate holdings ratio, γ_2 , are close to zero for the period 1988–90 except for 1987, for which the figure is 1.24%.

On the other hand, the coefficient of γ_2 for 1991 is significantly negative at 1.93% at a 95% significance level. Notably the response coefficient to *beta*, γ_1 , is also significantly negative, implying that the specific situation in the 1991 stock market is reflected in the coefficients γ_1 and γ_2 . Actually in 1991, the Korean stock market was generally bearish. Considering these results, the degree of the effect of stock returns on firms' real estate holdings is generally estimated to be almost zero in the Korean stock market.

When compared with the fact that the rate of national land price increase is on average

Exhibit 7
Cross-Sectional Results by Year

(Unit: %)

Year (# of sample)	γ_0 (t)	γ_1 (t)	γ_2 (t)
87 (208)	3.5213*** (4.36)	3.7975*** (5.38)	1.2368 (1.06)
88 (248)	0.5131 (0.97)	4.0133*** (9.34)	-0.7760 (-0.78)
89 (286)	1.6046*** (4.65)	0.3394 (1.09)	-0.2343 (-0.37)
90 (288)	-0.6752** (-2.23)	-0.9807*** (-3.31)	-0.3461 (0.74)
91 (289)	2.6172*** (4.57)	-4.6392*** (-7.97)	-1.9304** (-2.25)

, * are significant at the 5% and 1% significance levels, respectively; t represents student t-value.

Exhibit 8
Yearly Cross-Sectional Results and Firm Size

(Unit: %)

Year	Size (n)	γ_0 (t)	γ_1 (t)	γ_2 (t)
1987	Small (69)	5.3545*** (3.99)	0.5012*** (0.41)	3.9147*** (1.55)
	Middle (69)	0.5276 (0.24)	6.9208*** (3.63)	1.6935 (0.56)
	Large (68)	3.0665** (2.23)	4.6410*** (4.40)	0.4736 (0.30)
1988	Small (82)	0.9590 (1.42)	1.7438*** (2.68)	2.6932 (1.58)
	Middle (82)	0.2584 (0.29)	3.9284*** (5.68)	0.1011 (0.06)
	Large (84)	1.1963 (0.98)	4.9925*** (5.74)	-4.2621** (-2.32)
1989	Small (95)	1.5944*** (2.66)	0.6749 (1.33)	-2.8808* (-1.72)
	Middle (95)	1.7275*** (2.70)	0.4617 (0.65)	-0.0075 (-0.01)
	Large (96)	1.8457*** (3.03)	-0.1257 (-0.25)	0.1980 (0.24)
1990	Small (95)	-0.2246 (-0.46)	-1.4138*** (-2.96)	0.9235 (0.89)
	Middle (96)	-0.3452 (-0.61)	-1.3351** (-2.16)	-0.1220 (-0.14)
	Large (97)	-1.7974*** (-3.17)	-0.1135 (-0.23)	1.2189 (1.66)
1991	Small (96)	1.9025 (1.82)	-4.6593*** (-3.93)	1.8625 (0.85)
	Middle (96)	2.3862** (2.21)	-4.0179*** (-3.48)	-2.2283 (-1.65)
	Large (97)	3.2228 (3.07)	-5.0846 (-5.72)	-3.2643 (-2.36)

*, **, *** are significant at the 10%, 5% and 1% significance levels, respectively; student *t*-values are in parentheses.

over 20% for the period 1987–91, the coefficient, γ_2 , is overwhelmingly lower. This result can be interpreted as evidence to support the null hypothesis that increases in real estate prices are mainly due to price bubbles rather than to marginal productivity increase in real estate in Korea. That is, the real estate price increase is a factor that increases the stock price by increase in the value of the firm's assets, while also a factor that serves to depress the stock price by reducing the firm's growth opportunity value. These two effects largely offset each other, leaving precise interpretation of the coefficient, γ_2 , unclear.

However, the above interpretation seems unreasonable on the following grounds. First of all, it is reasonable that the information about the firm's real estate holdings is interpreted to have a weak effect on the stock returns. In other words, the variable for a firm's real estate holdings in the CAPM framework implies a nonsystematic factor that is

not reflected in stock returns. Second, a firm's actual holdings of real estate are not public information. The actual value differs from that represented by book value. Accordingly, it can be interpreted that stock returns are not responsive to the information about the real estate holdings on financial statements.

On the other hand, as can be seen from Exhibit 7, the coefficients γ_0 and γ_1 are statistically significant. If CAPM holds true, γ_0 should be identical with the riskless rate-of-return or the rate-of-return on a zero-*beta* portfolio. And γ_1 should be identical with the risk premium of the market portfolio.¹⁵ Here this kind of test is omitted. However, the cross-sectional results generally prove that these two variables are important explanatory variables in explaining stock returns in the Korean stock market.

Yearly Cross-Sectional Results by Debt Ratio

Theoretically, the expectation is that the higher the debt ratio, the lower will be the coefficient γ_2 . Exhibit 8 shows the empirical results in respect of this effect. Exhibit 8 is a summary of the cross-sectional regression results obtained when the samples are classified by the debt ratio every year for the period 1987–91.

The debt ratio used is the ratio of book-value debt to asset value for the previous year of the cross-sectional analysis period. Theoretically, the degree of the loss of the growth opportunity value depends not on the amount of the existing debt of the firm, but on the amount of the debt taken on for the new investment opportunity. However, since it is difficult to get hold of details of the financing planned for the growth opportunity, it is assumed here that the financing for the opportunity is identical to that represented by the existing capital structure of the firm.¹⁶

In Exhibit 8, γ_2 for the high-debt firm is generally lower than that for the low-debt firm. The size of γ_2 for the high-debt firm in 1987 is lower by 3.44% than that for the low-debt firm. In 1988, the former is 2.69%, while the latter is -4.26% at a 95% significance level, representing a gap of 6.95%.

Also in 1991, the former is 1.86%, while the latter is -3.26% at a 95% significance level, representing a 5.13% gap. Accordingly, for three years out of the five years analyzed, the former is lower than the latter. For the same three years, the size of γ_2 systematically decreases as the debt ratio increases. This result is consistent with the theory that the higher the firm's debt ratio, the larger the loss of the growth opportunity value will be.

Most notably, γ_2 for the high-debt firms is significantly negative in two years out of the five, suggesting that for a high-debt firm, the higher the real estate holding, the more the rate of stock returns tends to decrease. Accordingly the empirical result for the analysis by debt ratio supports the theory generally, unlike in the result for the analysis by year.

Only in 1989 is γ_2 for a low-debt firm insignificantly negative. On the other hand, γ_2 for a high-debt firm is almost zero and the difference of γ_2 value between a low-debt and a high-debt firm is not significant. So empirical evidence support of the theory is not consistent over all the years.

Yearly Cross-Sectional Result by Size

The above cross-sectional results by debt-ratio suggest that the theory is generally consistent with the empirical evidence. Here the same sample is analyzed by cross-sectional size. Exhibit 9 represents the results by size. The asset value given by the book

Exhibit 9
Cross-Sectional Results by Debt Ratio

(Unit: %)

Year	Size (n)	γ_0 (t)	γ_1 (t)	γ_2 (t)
1987	Low (69)	5.7786*** (4.30)	1.7009 (1.54)	0.0682 (0.04)
	Middle (69)	3.5699** (0.56)	3.6831*** (2.70)	2.0610 (0.92)
	High (68)	-2.651 (-0.71)	7.2528*** (5.49)	2.1950 (0.83)
1988	Low (82)	0.7728 (0.91)	3.2985*** (5.12)	0.7544 (0.52)
	Middle (82)	1.1200 (1.44)	2.2007*** (3.31)	0.9358 (0.56)
	High (84)	-1.5621 (-1.60)	7.6135*** (9.23)	-3.7545** (-2.1332)
1989	Low (95)	1.5791*** (2.69)	0.6348 (1.38)	-0.7520 (-0.64)
	Middle (95)	0.9088 (1.41)	1.0534 (1.56)	-0.3062 (-0.29)
	High (96)	3.1534*** (4.63)	-1.4197** (-2.27)	-0.5218 (-0.46)
1990	Low (95)	-0.7251 (-1.39)	-1.0016** (-2.04)	0.8621 (0.98)
	Middle (96)	-0.5099 (-0.92)	-0.9101 (-1.52)	-0.4881 (-0.56)
	High (97)	-0.9926* (-1.90)	-0.8387* (-1.74)	0.8521 (1.18)
1991	Low (96)	0.3618 (0.34)	-3.4894*** (-3.16)	0.1720 (0.09)
	Middle (96)	3.2040*** (3.80)	-4.1020*** (-4.17)	-3.6769*** (-3.54)
	High (97)	4.2162*** (4.03)	-6.0065 (-6.05)	-2.0704 (-1.21)

*, **, *** are significant at the 10%, 5% and 1% significance levels, respectively; student *t*-values are in parentheses.

value in the previous year for the cross-sectional analysis period is used as the base for a firm's size. The coefficient γ_2 does not represent a consistent difference by firm size. There is little difference in γ_2 among large, medium and small firms in 1989 and 1990. And γ_2 for large firms is higher than that for small firms in 1987. On the other hand, γ_2 for small firms is higher rather than that for large firms in 1988 and 1991.

And the size of γ_2 does not change systematically according to the expansion in the size of the firm for all the sample periods in Exhibit 9. γ_2 for large firms is significantly negative at the 95% significance level in 1988, but insignificantly negative in 1991. However, in 1991, γ_2 for medium firms is significantly negative at the 99% significance level, but that for large firms is not. Hence, for this period, γ_2 does not change systematically according to changes in firm size.

These results provide a striking contrast to those by debt ratio. They also imply that the effect by debt ratio is unrelated to firm size.

Conclusions

A sharp and continuous increase in real estate prices during the past few decades has enormously changed the economic behaviour of most economic units in Korea. Most of all, it is believed to have greatly influenced firm investment behavior and firm value.

In this study the theoretical relationship between real estate prices and the firm's value was analyzed. As a result of these analyses, it was found that expectations of real estate price increase raise the value of assets currently held by the firm on the one hand. But on the other hand, expectations for increases in real estate prices will cause a value loss to the firm by increasing potential investment costs for its future growth opportunities. Therefore, when expectations of a real estate price increases are caused by a price bubble, the total increase in a firm's value is expected to be lower than the increase in real estate value. However, if expectations of real estate price increase are caused by an increase in marginal productivity, the value loss for growth opportunities of the firm will not occur. Also it is expected that the loss of the growth opportunity value due to expectations of a real estate price increase will be larger for debt-use firms than for zero-debt firms, and for those higher-debt firms where debt is used.

In this study, these hypotheses are tested empirically, using the rates of return for common stocks. First, in yearly cross-sectional analysis using yearly rates of common stock returns as a dependent variable, and the systematic risk (β) of stock returns and the ratio of equity to real estate holding as independent variables, the coefficients for explanatory variables were almost zero. This suggests that the ratio of real estate holdings does not affect rates of common stock returns.

However, in case of cross-sectional tests stratified by the firm's debt ratio, the size of the coefficient for the real estate holding variable is generally lower for high-debt firms than for low-debt firms. This result is consistent with the theoretical hypothesis of this study that the higher the debt ratio, the larger the loss of growth opportunity value. On the other hand, in the case of cross-sectional tests by firm size, there are no systematic changes in the coefficient, unlike in the case of results by debt ratio. Accordingly, it is estimated that the effect of debt ratio is rather clearer than that of firm size and that firm size has no large effect on the effect by debt ratio.

These results are subject to the following limitations. First of all, the ratio of equity to real estate holdings as an independent variable should be based upon market value, not book value in empirical tests. But real estate data based upon market value are not available. Second, in regression analyses, the simple ordinary least square (OLS) method is used, so the coefficient is not likely to be efficient. Third, the theoretical effect of changes in real estate value on debt value are not considered.

Notes

¹If the real estate price in period 1 does not change according to state, s , $ML(s)$ in Exhibit 1 will be horizontal.

²A more detailed analysis will be provided in section two of the background to real estate price increases.

³If the size of real estate price increase in period 1 changes according to state, it can be assumed that the size of increase is $ML(s)$. Also under this assumption, the logic of this study does not change. This study assumes (for convenience of analysis) that the real estate price in period 1 increases by ΔML regardless of state.

⁴If present (period 0) real estate investment, VL , is converted into the future (period 1) value of certainty, the value is $VL(1+r)$. The determination of production in period 1 is appraised based upon the value in period 1.

⁵It is assumed that the expected value on real estate price increases in period 1 is $\Delta ML'$ regardless of state for convenience. Even if it is assumed that an increase in real estate prices is a function of state s , that is, $\Delta ML'(s)$, it does not affect the logic of this study.

⁶If the amount of price increase in a unit of real estate in period 1 is dependent upon state, the amount of price increase becomes $\Delta P(s)$.

⁷Refer to Kim (1991) concerning factors of price bubble formation and the phenomenon of a destabilizing speculation.

⁸According to Kim's study (1991), it is estimated that price bubbles such as the growing rational bubble are long-run features that are continuously included in land prices (whether price nominal or real). It was estimated in Kim's study that a rational bubble existed continuously during 1982–90 in nominal land prices and during 1985–90 in real land prices. On the other hand, it was estimated in the study that a price bubble did *not* exist for real housing prices, but one *continuously existed* for nominal housing prices during 1987–90.

⁹Here also, even if it is assumed that the amount of real estate investment in period 1 increases by $\Delta ML(s)$, the logic of this study does not change.

¹⁰Of course, the method used here is not completely the same as that of Black et al. (1972) and Fama and MacBeth (1973). In particular, they use a method that estimates the coefficients through portfolio construction in order to improve the efficiency of estimation.

¹¹Their results generally support a zero-beta CAPM rather than the traditional CAPM of Sharpe–Lintner–Mossin.

¹²In most studies, *beta* reestimated in the next period, not *beta* estimated in the portfolio construction period, is used for cross-sectional regression analysis. Also there are several methods for cross-sectional analysis, such as the OLS method based upon the assumption of homoscedastic error terms (i.e., Fama and MacBeth) and the GLS method based upon the assumption of heteroscedastic error terms (i.e., Black and Scholes, 1974). Notably, for efficient estimation, Litzenberger and Ramaswamy used GLS and Maximum Likelihood Estimation (MLE) methods, considering errors of a market model and estimation errors of *beta*.

¹³A limitation of this study is that the real estate holdings ratio here is based upon book value, not market value. However, if the degree of alienation for market-to-book value is almost the same for real estate and equity, the ratio calculated based upon book value can be used as a proxy for the ratio based upon market value. Also, if the degree of alienation for book-to-market value for real estate and equity is the same for all firms, the effect of alienation will be involved in the coefficient, r in equation (25).

¹⁴In case of a cross-sectional analysis for equation (25), the estimation method based upon the portfolio construction method is used, in general, to improve the efficiency of estimation. Also, in order to solve the problems, such as measurement errors of *beta* or heteroscedasticity of errors, GLS or MLE methods rather than OLS are used. In this study, the GLS and MLE methods suggested by Litzenberger and Ramaswamy (1979), as well as the OLS method, were used in the estimation process. However, according to the estimation results of GLS and MLE, the efficiency was not improved much when compared with OLS estimation results, and since, in some cases, estimation coefficients were shown to be insignificant, estimation results by the OLS method only are reported in this study.

¹⁵Refers to the studies cited in the research design for further details about this.

¹⁶If the existing capital structure of the firm reflects the optimal capital structure and the financing

for the new investment opportunity is raised according to the optimal target value, the capital structure for the growth opportunity will be identical to the existing one.

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