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ABSTRACT

This paper discusses the relationship between interest rate and inflation rate on one part and the house price relative to *chonsei* price (up-front lump-sum deposit from the tenant to the owner for the use of the property with no additional requirement for periodic rent payments) on the other. The key point of the paper is that the relative price of sales to *chonsei* depends on the ratio of inflation to real interest rate, and thus even when the monetary authority maintains a pre-announced target level of inflation rate, the relative price of sales to *chonsei* rises if the real interest rate is lowered. This finding seems to help understand the recent hikes of the house prices despite the stabilizing *chonsei* prices. Recognizing this relationship, it may be sensible to lower the target inflation rate in an economy where real interest rates permanently decline, if the society wishes to reduce its adverse effect on the wealth distribution between house owners and *chonsei* tenants.

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1. Introduction

Since the IT bubble burst in 2000, interest rates have fallen and housing prices have risen in the global economy. According to Case and Shiller(2003), for example, the ratio of house prices to per capita income soared from around 6.5 in 2000 to around 8.5 in 2003 in California. Along with the soaring house prices, investment on house construction also increased at a substantial pace. For example, the residential investment in the U.S. increased by 4.9% in 2002 and 7.5% in 2003, while GDP grew at the rate of 2.2% in 2002 and 3.1% in 2003.

Korea was no exception in this global trend. During the period from 2001 to 2003, the general house price index rose by more than 30%. However, the prices of apartments --- the most preferred housing type in recent years --- rose by more than 50% nationwide, and by almost 100% in the Kangnam area (south of Han River) of Seoul. Along with the rise in house prices, construction industries enjoyed a boom. The average annual growth rate of building construction investment during the period of 2001-2003 reached at 13.3%, while the average GDP growth rate remained only at 4.6%. This boom increased the portion of building construction relative to GDP from 8.4% in 2000 to 11.3% in 2003.

In addition to all of these standard indicators, however, the Korean housing market has a unique *chonsei* system that provides a very meaningful indicator for the market value of housing service --- *chonsei* price, or an up-front lump-sum deposit from the tenant to the owner for the use of the property with no additional requirement for periodic rent payments (see Section 2 for details). While *chonsei* prices, as well as sales prices, should reflect demand and supply in the housing market, the two prices have shown sharply different trends since the second half of 2002 (see [Figure 1]). Until the first half of 2002, both prices had rapidly recovered from the collapse after the 1997 crisis. Since then, however, only the sales prices have kept rising while the *chonsei* prices have stagnated, which has sharply raised the ratio of sales to *chonsei* price or lowered the real value of *chonsei* deposit (deflated by the sales price). This phenomenon can, in a sense, be interpreted as a transfer of wealth from *chonsei* tenants to house owners.

Motivated by this observation, this paper examines the determinants of the relative housing prices --- sales and *chonsei* prices --- and shows that the relative housing prices depend on the ratio of nominal to real interest rate. It is probably easy to expect that the discrepancy between the two housing prices is widened as the (expected) inflation rate increases. At the same time, however, the discrepancy can also be widened when the real

interest rate declines, even though the monetary authority adamantly sticks to a pre-announced inflation target. In fact, this argument applies not only to the housing prices, but also to the prices of general nominal assets that are not hedged against inflation.

If the monetary authority has concerns over the potential wealth transfers due to the decline in real interest rate, it could, at least in theory, maintain the relative housing prices (or relative prices of real to nominal assets) by proportionately adjusting the target level of inflation rate to the decline of the real interest rate.[1] This result may find its relevancy to an economy like Korea, in which real interest rates are secularly declining and the credit market is not yet completely accessible to households (see Sections 2 and 5).

This paper is organized as follows. Section 2 explains the *chonsei* system of Korea and Section 3 contains a theoretical model that explains the determination of housing prices. The first part of Section 3 discusses the arbitrage condition between the sales and *chonsei* prices, and the second part presents a simple general-equilibrium growth model

[1] The recent volatility in asset prices under the stable and low inflation environment has triggered a challenge on the standard inflation targeting framework. While a majority of economists (e.g. Bernanke and Gertler (2001), and Gilchrist and Leahy (2002)) still support the standard monetary policy framework represented by Taylor rules, a group of economists (e.g. Cecchetti et. al.(2000), Borio and Lowe (2002), and Hahm and Hong (2003)) argue that the monetary authority needs to react to asset price bubbles in order to stabilize the economy. See Bean (2003) for this debate. Although from a quite different perspective, this paper's result could be interpreted to provide a rationale for the monetary policy that considers asset price fluctuations.

that includes housing sector. Section 4 presents the results of a crude empirical analysis on the ratio of sales to *chonsei* prices in Korea, and Section 5 concludes with brief remarks about monetary policy.

2. *Chonsei* System in Korea

The Korean housing market has a very unique system, called *chonsei*, whose literal meaning is 'total rent.' In this system, the tenant pays an up-front lump-sum amount of deposit (currently 30 to 70 percent of house sales prices) to the owner for the use of the property with no additional requirement for periodic rent payments. The interest earned on this lump-sum deposit, therefore, provides income to the owner during the contract period (typically two years), and the deposit is returned to the tenant when the contract expires. If the owner does not return the *chonsei* deposit at maturity, the Korean legal system grants the tenant to take a right of full control over the property until the owner returns the deposit. That is, the deposit money of tenant is legally protected as an asset that can be claimed against the collateral value of the property.

Although its historical origin is obscure, the literature has attributed the popularity of *chonsei* system to the underdevelopment of formal financial services (mortgage services in

particular) and the government interventions for interest rates.[2] During the period of 'government-led development,' in particular, the Korean government kept interest rates low for business firms. These interventions inevitably imposed higher-than-equilibrium interest rates on consumer credit and housing finance in the formal financial market. Under this environment, "For landlords, *chonsei* is an informal financial instrument that satisfies various household credit demands. …. For tenants, the *chonsei* system allows households to afford homes that would not be possible for outright cash purchase." (Ambrose and Kim (2003), p.62)

This *chonsei* system has been widely spread out with the rapid urbanization for the last few decades in Korea.[3] According to the *Population and Housing Census Report* (2000), the total number of households in Korea is 14.31 million, out of which 7.75 million (54%) are homeowners and 4.04 million (28%) are under *chonsei* contracts (the remaining households are under monthly rents). In particular, the ratio of *chonsei* tenants increases in metropolitan areas, where housing prices are high. For example, the number of *chonsei* tenants is as large as the number of homeowners in Seoul (out of 3.09 million households,

[2] See for example Renaud (1989) and Choi (2003).
[3] See Ambrose and Kim (2003) for details.

1.26 million (40%) are homeowners and 1.27 million (40%) are under *chonsei* contracts.)

Given the popularity of *chonsei* system, it is obvious that a substantial amount of assets are held in the form of *chonsei* deposit in Korea. For example, a back-of-the-envelop calculation yields 200 to 250 trillion won, approximately 40 percent of GDP or 80 percent of the total stock value, as the outstanding amount of total *chonsei* deposit.[4] Given this size of the *chonsei* deposit, it seems natural that policymakers are concerned about the fluctuation of *chonsei* prices.[5] More important than the *chonsei* prices themselves, however, may be the ratio of sales to *chonsei* prices. This ratio is often interpreted as an indicator for the affordability of potential homebuyers because relatively young and/or poor households commonly live under *chonsei* contracts until they accumulate sufficient savings

[4] According to the *1997 National Wealth Survey*, the total value of household housing (excluding land) is 485 trillion won, which is approximately 50% of the total building value of all sectors. Applying this ratio of 50% to the total land value estimate, 1,548 trillion won, yields 1,259 (=774+485) trillion won as the total value of housing (including land). Using 28% as the ratio of *chonsei* dwellings and 60% as the ratio of *chonsei* to sales prices, one can obtain 212 trillion won in 1997, which is estimated to inflate to 284 trillion won as of the end of 2003, applying the *chonsei* price index. This amount is almost 40 percent of GDP (721 trillion won) or 80 percent of total equity value (355 trillion won) in 2003.

[5] While many *chonsei* contracts are revolved upon maturity, the related parties write new contracts whose prices reflect market situations at that time. Therefore, new contracts involve cash transactions between owners and *chonsei* tenants, whenever *chonsei* prices change in the market. With general price inflation, it is common for tenants to deposit additional money that covers the increments in *chonsei* prices, but there were some exceptional cases. For example, housing prices including *chonsei* prices were collapsed by more than 20% nationwide in the swirl of economic crisis in 1998, which pushed many owners to the verge of liquidity crisis and invited the government to mobilize special rescue funds for them.

in addition to the *chonsei* deposit for the purchase of their own houses.[6] As an extreme example, if 100% of *chonsei* deposit is held for future purchase of houses, then a 1% increase of sales price over *chonsei* price simply implies a 1% decline in the purchasing power of *chonsei* deposit.

Apart from the policymakers' concerns, the information about *chonsei* prices is potentially very useful in identifying the factors that affect asset prices of real estate. Unlike the sales price, the *chonsei* price inherently excludes the possibility of capital gains and reflects the value of housing service assessed by the spot housing market itself. In this sense, the Korean housing market provides an important additional indicator for the real estate prices, which are not available in other countries. Next section considers various factors that explain the discrepancy between the sales price and *chonsei* price, but the emphasis will be given to the expected capital gains that are greatly influenced by macro variables such as interest and inflation rates rather than other micro or institutional factors.

3. Theoretical Discussion

3.1. Interest Rate, Inflation Rate, and Real Estate Prices

[6] For the stylized facts of housing tenures and demography, see Renaud (1989) and Choi (2003).

Chonsei vs. Purchase

A household in Korea having two choices for housing service, either purchase or *chonsei*, would consider the following factors. First, there are inherent differences between homeowners and *chonsei* tenants. For example, the homeowners are free to move whenever they want, while the *chonsei* tenants do not enjoy such a freedom. This is a factor that boosts the sales price relative to *chonsei* price. In contrast, however, the homeowners should bear the cost to maintain the quality of houses that *chonsei* tenants do not have to care about. This is a factor that discounts the sales price relative to *chonsei* price. *A priori*, therefore, it is not clear whether the sales price should be inherently higher than the *chonsei* price.

Second, the homeowners should bear the risk of price fluctuations, while the *chonsei* tenants are relatively well protected from such risks. As far as investors are risk averse, this is a factor that discounts the sales price relative to *chonsei* price. Third, the homeowners should pay taxes that *chonsei* tenants are free from.[7] This is another factor that discounts the sales price relative to *chonsei* price. In short, these factors cannot explain why sales prices are substantially higher than *chonsei* prices for the basically same

[7] Section 4 provides explanation on the Korea's real estate tax system.

housing services.

Therefore, the primary reason for the huge discrepancy of the sales price relative to *chonsei* price seems to lie in the expectation on capital gain. That is, the *chonsei* tenants are expected to recoup only the deposit in monetary unit upon maturity, but the owners will be able to enjoy capital gains if the house prices rise as they did in Korea. As any other prices in monetary economy, the rise of house price is composed of two parts, the rise in the relative price of house over general prices and the rise of general prices (or inflation) itself. However, the rise of relative price can hardly be sustained in the long run, and thus this paper focuses on the general price inflation as the underlying factor that persistently increases house price.[8] For the same reason, the general price inflation can be seen as a primary factor for the sales price that remains substantially higher than *chonsei* price all the time.

An Arbitrage Condition

[8] Theoretically, it is possible that the relative price of house keep rising at a more rapid rate than general prices if the productivity growth rate of housing sector is permanently lower than other sectors. However, this does not seem to be the case at least in Korea during the 1987-2003 period: the overall housing price increased at 4.1% per annum, slightly lower than the CPI inflation rate of 5.0%, although the average apartment price increased at 6.9%, slightly higher than the CPI inflation rate.

Focusing on the aforementioned factor of expected capital gain, the arbitrage condition between the sales and *chonsei* prices can be written as:

$$(1) \qquad P_t^H = \left\{ \; i_t P_t^C + E_t(P_{t+1}^H) \; \right\} / \; (1+i_t) \;\; ,$$

where P_t^H is sales price at time t, P_t^C is *chonsei* price, i_t is nominal interest rate, $E_t(P_{t+1}^H)$ is the sales price at time t+1 expected at time t. That is, the sales price at time t is the discounted sum of the return for housing services (or the opportunity cost of dwelling in the house rather than leasing the house on a *chonsei* contract), $i_t P_t^C$, and the expected sales price at time t+1, $E_t(P_{t+1}^H)$.

This arbitrage condition can be recursively solved forward, and the solution will be a complicated function of the expectations about future *chonsei* prices and interest rates. Assuming a steady state with no speculative bubbles (in which the interest rate is fixed at i and the *chonsei* price increases at a constant inflation rate of π), however, Equation (1) produces a simple and intuitive result:

$$(2) \qquad \frac{P_t^H}{P_t^C} = \frac{i}{i-\pi} \;\; .$$

That is, the ratio of the sales to *chonsei* price is equal to the ratio of nominal to real interest rate. Of course, this result is based on many restrictive assumptions. Nevertheless, if the sustained real interest rate is around 4 percent and *chonsei* price inflation rate is around 3 percent (a medium-term target inflation rate of the monetary authority in Korea), this ratio becomes 1.75, which is similar to the ratio of sales to *chonsei* price at the end of 2003.[9]

Financial vs. Real Asset Prices

It has long been recognized that the existence of inflation raises the value of real assets relative to financial assets that are not hedged against inflation risks. In Korea, the discrepancy between the sales and *chonsei* prices for the same housing can be referred to as a typical example for this. In fact, the above result can be applied to rather general asset prices. In a steady state economy where the nominal interest rate is fixed at i, the price of a financial asset that yields a constant return R in monetary unit at every point in time is determined by $\int_0^\infty e^{-is} R ds = R/i$, while the price of a real asset that provides service flow whose price increases at a constant inflation rate π can be expressed as $\int_0^\infty e^{-is} \mathrm{Re}^{\pi s} ds = R/(i-\pi)$. Therefore, the existence of inflation pushes up the price of a

[9] The ratio of sales to *chonsei* prices of apartments at the end of 2003 was 1.7 for the nation and 2.0 for Seoul. (Kookmin Bank (2004))

real asset relative to that of financial asset providing the same service, and their ratio becomes the same as the sales to *chonsei* prices, $\frac{P_t^H}{P_t^C} = \frac{i}{i-\pi}$.[10]

From this result, it is easily confirmed that a rise in the inflation rate would raise the price of real asset relative to that of financial asset. What has not been much discussed in the literature, however, is that the same effect can be generated by the decline of real interest rate. Defining the real interest rate as $r \equiv i - \pi$, Equation (2) can be re-expressed as $\frac{P_t^H}{P_t^C} = 1 + \frac{\pi}{r}$, implying that the relative price is determined by the ratio of inflation rate to real interest rate, rather than by the inflation rate alone. Therefore, even when the monetary authority strictly maintains a pre-announced target level of inflation rate, the ratio of sales to *chonsei* price rises if the real interest rate is lowered.

In order to relate this discussion to monetary policy, however, it seems necessary to explicitly understand the general price level. In other words, the meaning of "real estate price" or "*chonsei* price" rather than the relative price of those two needs to be clarified in the context of general price inflation. At the same time, if the discussion is extended from

[10] The sales to *chonsei* price ratio can also be considered in this context. The prices of *chonsei* and sales are $P_0^C = \int_0^t e^{-is} R_s ds \;+\; P_0^C e^{-it}$ and $P_0^H = \int_0^t e^{-is} R_s ds \;+\; P_t^H e^{-it}$, respectively. The main difference between the two prices is that, at time t, *chonsei* renters are left with the *chonsei* deposit at time 0, while the owners are left with the house price at time t ($P_t^H = P_0^H e^{\pi}$).

the housing market to the macro-economy, the real interest rate and rent need to be taken as endogenous variables. In this sense, this subsection's discussion is viewed as a partial equilibrium approach in which inflation rate, real interest rate, and rent are exogenously determined. In order to sense a general equilibrium flavor, the next subsection will examine a very simple growth model.

3.2 A Simple Growth Model

Consider a representative household who earns (nominal) income $i_t A_t$ from asset A_t and spends $P_t C_t$ and $R_t H_t$ for consumption C_t and housing service H_t, respectively. If the instantaneous utility function is given by $\ln(C_t^{\alpha} H_t^{1-\alpha})$ and the time discount rate is ρ, then the household solves the following optimization problem:

$$(3) \qquad Max. \int_0^{\infty} \ln(C_t^{\alpha} H_t^{1-\alpha}) \; e^{-\rho t} d_t \;\; , \;\; s.t. \;\; \dot{A}_t = i_t A_t - P_t C_t - R_t H_t \;\; ,$$

where $\dot{A}_t$ denotes the increase in the asset level. If the (nominal) value of the asset is the sum of (nominal) values of capital and houses,

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Comparing the two prices, one can derive $P_0^H / P_0^C = (1 - e^{-it}) / (1 - e^{-(i-\pi)t}) \approx i / (i - \pi)$.

(4) $$A_t \equiv P_t^K K_t + P_t^H H_t ,$$

it is easy to show that the growth rate of consumption as well as capital becomes proportional to the real interest rate, or $i_t - \dot{P}_t^K / P_t^K$:

(5) $$\frac{\dot{C}_t}{C_t} = \frac{\dot{H}_t}{H_t} = i_t - \frac{\dot{P}_t^K}{P_t^K} - \rho \quad .$$

Production and Capital Market Efficiencies

In this economy with no frictions where real and nominal variables can be completely separated, the relative prices of real assets to consumption goods are entirely determined by the supply side, or the technology that stipulates how many units of real assets are accumulated at the expense of one unit sacrifice of consumption. In order to make this point clear, assume the following technology:

(6) $$\dot{K}_t + \dot{H}_t = D(BK_t - C_t) .$$

For simplicity, this equation takes a linear production function BK_t and treats capital and house as perfect substitutes at the supply side. A peculiar feature in this equation is the coefficient $0 < D \leq 1$ that measures the units of increase in future capital when present

consumption is reduced by one unit. While $D=1$ is the standard case in growth models, the case of $D<1$ can be interpreted in line with a *Tobin's q* model in the sense that $D<1$ implies a real adjustment cost in investment.[11] Another, perhaps more pertinent, interpretation of D may be the degree of capital market efficiency. In other words, if the capital market efficiency is low, or $D<1$, then the capital accumulation process is marred although the production efficiency B is maintained.

Once the model is set up as above, it is easy to derive the equilibrium relative prices by equating the resource constraint (Equation (6)) and the budget constraint (Equations (3) and (4)). That is, using Equations (3) and (4),

$$(7) \qquad \dot{P}_t^K K_t + P_t^K \dot{K}_t + \dot{P}_t^H H_t + P_t^H \dot{H}_t = i_t(P_t^K K_t + P_t^H H_t) - P_t C_t - R_t H_t$$

is derived, and by equating this equation to equation (6), one can obtain the following four equilibrium conditions:

$$(8\text{-}1) \qquad P_t / P_t^K = D \;\Rightarrow\; P_t^K = P_t / D$$

[11] Of course, while the adjustment cost vanishes when the economy approaches a steady state in *Tobin's q* models, Equation (6) assumes that the cost exists permanently for simplicity. See Abel and Blanchard (1983) and Lim and Weil (2003) for growth models that explicitly incorporate formal *Tobin's q* specifications.

(8-2) $P_t^H / P_t^K = 1 \Rightarrow P_t^H = P_t^K$

(8-3) $i_t - \dot{P}_t^K / \dot{P}_t^K = DB$;

(8-4) $(i_t P_t^H - R_t - \dot{P}_t^H) / P_r^K = 0 \Rightarrow i_t - \dot{P}_t^H / P_t^H = R_t / P_t^H \Rightarrow R_t = BP_t$.

These results are easily predictable from the assumptions. That is, Results (8-1) and (8-2) state that the relative price of capital (or house) to consumption good is determined by D, while Result (8-3) indicates that the real interest rate is determined by B multiplied by D, or the efficiency of the capital transformation process from present to the future. Result (8-4) is an arbitrage condition that the benefit from the purchase of house, the sum of rent R_t and capital gain $\dot{P}_t^H$, should be equal to the opportunity cost, $i_t P_t^H$.

Inflation and Chonsei Price

The introduction of money in this model economy does not affect any relative prices, hence any resource allocation processes. Therefore, if the monetary authority inflates a certain target price, say, consumption price P_t, at a rate of π, the asset prices will increase at the same rate. In contrast, however, the rate of inflation can affect the relative price of *chonsei*. As far as an arbitrage condition holds between the *chonsei* and

rent markets, the opportunity cost of *chonsei*, $i_t P_t^C$, should be equal to the rent:

(9) $$P_t^C = R_t / i_t = BP_t /(DB + \pi).$$

Price Responses to a Decline in Real Interest Rate

What would happen to this economy if the real interest rate permanently declines? First, the growth rate is unambiguously lowered (Equation (5)). The relative prices of assets to consumption goods, however, depend on the sources of the decline in interest rate. If the real interest rate is lowered due to the decline in B, then the relative price of house (or capital) does not change (Equation (8-1)), and only the relative price of *chonsei* declines (Equation (9)). If, in contrast, the real interest rate is lowered due to the decline in D, then both the house (or capital) and *chonsei* prices rise, but the price of house rises more than that of *chonsei*. [Figure 2] describes this situation.

The intuition that the decline in B does not change the relative price of house can be explained as follows. The price of house is ultimately determined by $P^H = \int_0^\infty e^{-(i-\pi)s} R ds = \frac{R}{i-\pi}$, and thus the fall in the real interest rate itself is a factor to raise the house price by lowering the discount rate for the future (or the return rate of alternative investment). In a general equilibrium set-up, however, the rent R is also lowered by the

decline in B because consumption goods supplied by the same amount of capital are decreased while the supply of houses remains at the same level. In the particular model of this subsection, the instantaneous fall in R exactly cancels off the effect from the decline in the real interest rate, leaving the house price unchanged.[12] In contrast, if the real interest rate is lowered due to the decline in D, the supply of consumption goods and R do not change, raising the house price.

Price Index and the Target Rate of Inflation

In the above, it was shown that the house price does not change if the real interest rate declines due to a fall in B. Yet it is worthwhile to note that the house price here was the relative price of house to consumption goods. In other words, this "price" becomes the price in monetary unit, only when the monetary authority uses the price of consumption goods as a target. In practice, however, it seems common to include rent as an important component of the target CPI.[13] If, for example, the monetary authority gradually increases

[12] In this case, the relative price of capital to consumption good does not change, but the shadow price of capital (as well as consumption good) jumps up. That is, an unanticipated adverse shock to productivity decreases the level of consumption, and the *ex post* marginal utility of consumption good is higher than the marginal utility that was expected before the shock was realized.

[13] In Korea, the weight of rent is approximately 15% in the headline CPI that does not include owner's equivalent rent (www.nso.go.kr). If the owner's equivalent rent was included in the CPI, the weight of rent would be increased to approximately 31%, which is similar to that in the U.S. at 31.5% (www.bls.gov).

the price index,

$$(10) \qquad q_t \equiv P_t^{\alpha} R_t^{1-\alpha}$$

(instead of P_t), then the price of housing (as well as P_t) in monetary unit will rise even when a fall in B lowers the real interest rate (see [Figure 2] for the time paths of the housing prices in this case).

Although the *chonsei* price in monetary unit is also affected by the choice of target price as well as the source of the decline in real interest rate, the ratio of sales to *chonsei* prices depends only on the inflation rate as confirmed in the previous subsection. Therefore, if the monetary authority lowers the target inflation rate proportionately in response to the decline in the real interest rate, the discrepancy of the *chonsei* price from the sales price would not be expanded. [Figure 2] also shows the time paths of housing prices when the monetary authority follows such a rule.

Quantity Responses to a Decline in Real Interest Rate

Though not a central issue in this paper, the responses of the quantity variables with respect to a decline in the real interest rate can also be traced (see Appendix for

algebra). One of the results worth noting is that a fall in the real interest rate lowers the ratio of consumption to housing at the steady state, but raises the ratio of consumption to capital.

It is natural to decrease the steady state level of capital to housing ratio as the real interest rate (or the marginal rate of return for capital) declines due to a fall in B, because the shock that lowers the marginal rate of return for capital does not directly lowers the marginal utility from the housing service.[14] Therefore, the household reduces the saving for capital accumulation (hence income), but not the saving for housing. This optimization behavior leads to a decrease in the steady state level of consumption, but not as much as the decrease in the steady state level of capital. Recalling that the measured income is a linear function of capital, this implies that the steady state saving rate in the aggregate falls when the real interest rate declines. At the same time, however, the saving rate for housing investment rises with a fall in the real interest rate or growth rate, which seems to be consistent with the recent experiences of the global economy as mentioned in the Introduction.

[14] When the real interest rate declines due to a fall in D, the results become complicated. See the Appendix.

Remarks

In order to learn intuitions in a straightforward way, this subsection introduced a very simple growth model in which all of the prices are instantaneously adjusted from one steady state to another. This model may be extended in various dimensions to generate rich dynamics of asset prices. For example, a Cobb-Douglas production function can be used instead of the linear production function of this subsection (results are available upon request). In this case, a fall in the efficiency growth rate gradually lowers the real interest rate, and thus the discrepancy between the sales and *chonsei* prices is also widened at a gradual pace. Another variant would be to explicitly introduce the *Tobin's q* model, which would produce short-run fluctuations of asset prices. Perhaps the most interesting variation of the model, however, might be the one in which housing rents adjust to fluctuations of interest rates in a gradual manner (probably due to a slow adjustment of housing market relative to consumption goods market). This feature that relaxes the tight link between the housing and other markets would be able to generate short-run deviations of rents from interest rates, hence the fluctuations of house prices.

4. A Brief Look at the Data[15]

Interest Rate, Inflation Rate, and the Ratio of Sales to Chonsei Prices

Based on the theoretical discussion of the previous section, this section takes a brief look at the actual data of the sales and *chonsei* prices of apartments from Korea.[16] While it would also be of great interest to examine the house prices in relation to general prices and macroeconomic fluctuations, the model's predictions regarding these issues are not sufficiently clear. At the same time, it is very likely that various sector-specific shocks have generated uneven effects across the housing market and other markets in actual data. This section, therefore, limits the scope of analysis to the relative housing prices that are presumably immune to the noises generated by micro sector-specific shocks. In addition, considering that most theoretical discussion was based on steady state analyses, the empirical examination is also focused on the relationships of long-run trends across variables.

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[15] See Appendix II for variable explanations and data sources.

[16] The data for house prices were collected from the Kookmin Bank. This data set is an official (or at least semi-official) one that the Korean government uses. Originally, this data set was compiled by the National Bank for Housing, which was merged into the Kookmin Bank (then another government bank) and privatized after the Korean crisis. This data set traces the prices of 16,000 sampled houses throughout the whole country every month. For apartments, the sample size is 13,020 covering Seoul, 6 metropolitan areas, 56 cities, 4 Goons (district unit in rural area), and 90 Gus (district unit in urban area). Currently, the quality of the houses is not considered in this data

[Figure 3] shows the trends of relevant variables since 1986, the first year of the available data, along with their HP filtered trends. First, the ratio of sales to *chonsei* prices ([Figure 3A]) had declined from almost 3 in the late 1980s to around 1.5 in 2000, and rebounded back to 2 since then. Second, apart from the exceptional hike during the currency crisis period in 1998, the nominal interest rate ([Figure 3B]) had also declined from over 15% in the early 1990s to around 6% in 2003. Third, however, the expected inflation rate ([Figure 3C]) had also been lowered from over 5% in the late 1980s to below 3% in 1998 and 1999, operating as a factor to lower the ratio of sales to *chonsei* prices. Fourth, in contrast, the portion of expected inflation in the nominal interest ([Figure 3D]) has been rising from below 20% in 1998 and 1999 to over 40% in 2003, mainly due to the decline in the real interest rate in spite of stable inflation expectations, which seems to operate as an important factor for the rebound of the housing price ratio.

Taxes on Real Estate

Although the inflation and interest rates seem to be capable of explaining the *direction* of long-term trend of the housing price ratio, they are not sufficient enough to

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set.

explain the *magnitude* of the changes in this ratio, particularly the ratio around 3 in the late 1980s and early 1990s. During this period, the portion of the expected inflation rate in the nominal interest rate was nearly 50%, implying that the inflation and interest rates cannot generate the housing price ratio over 2. This observation invites discussions on the other factors explained in Section 3 that can potentially affect this ratio. In order to incorporate the other factors, slightly modify the arbitrage condition, Equation (1):

$$(1') \qquad P_t^H = \left\{ \; (i_t + \alpha) P_t^C - \tau \quad P_t^H + E_t(P_{t+1}^H) \; \right\} / \; (1 + i_t) \;\; ,$$

where τ is a tax rate for holding a house and α represents all the other factors such as convenience for owning a house, maintenance cost, risk averseness, and so forth. The reason for separating out the tax rate from other factors is that the changes in tax rate can be traced to an extent, while the changes of other factors over time are neither traceable nor believed to be significant. Under the steady state assumption again, Equation (2) is modified to be:

$$(2') \qquad \frac{P_t^H}{P_t^C} = \frac{i + \alpha}{i + \tau - \pi} \quad .$$

The real estate tax system is extremely complicated in Korea: one should pay

acquisition and registration taxes when he purchases a house, property tax while he holds a house, and capital gains tax when he sells a house. However, what makes the system complicated is how to calculate the actual taxes. For example, the legal tax rates for acquisition and registration are 2% and 3%, respectively, but the effective tax rates are far lower than the legal rates because the actual taxes are based on "publicly assessed values" that are far lower than market prices. Similarly, the property tax rate ranges from 0.2% to 7% progressively with property values, but the effective tax rate is estimated to be around 0.1%. The capital gains tax rate is 40-60%, but there exist many exceptional cases for reductions and exemptions.

[Figure 3E] and [Figure 3F] show the estimated effective tax rates on real estate, or the total tax revenues divided by the estimates of total real estate value. In light of Equations (1') and (2'), these statistics have two potential shortcomings. First, since the relevant tax data for apartments are not available, these figures report the effective tax rates for the entire real estate (including land and non-apartment houses). Second, since the portion of property tax (or holding tax) in total real estate tax revenue is very low in Korea relative to those in other countries, the figures report not only the property tax rate but also the total tax rate including taxes related to transactions. However, it should be noted that

the transaction-related taxes must have theoretically different effects on real estate prices from those of holding taxes.

In spite of the shortcomings, the figures provide some basic insights. First, the effective tax rate on real estate has been rising from a very low level ([Figure 3E]).[17] In conjunction with the rapid decline of nominal interest rate, the relative size of the effective tax rate to the nominal interest rate has been sharply increasing ([Figure 3F]), implying that the tax factor appears to have contributed to the decline in the ratio of sales to *chonsei* prices. Second, however, the magnitude of the impact by tax seems to be small relative to the impacts by interest rates and inflation rates: during the sample period in [Figure 3], the effective holding tax rate fluctuates from 0.02% to 0.12% only (from 0.1% to 0.6% for the entire tax rate), while the fluctuations of interest rates and inflation rates are in the order of several percentage points. This observation seems to emphasize the importance of macro-variables in determining the real estate prices, although the macro-variables as well as taxes do not appear to sufficiently explain the high sales price relative to *chonsei* price in the late 1980s.[18]

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[17] The effective holding tax rate was merely 0.02% and even the entire tax revenue was less than 0.1% of total real estate value in the late 1980s.

[18] A strong conjecture among Koreans is that there were significant bubbles in real estate prices in the late 1980s, which has not been considered in this paper.

6. Conclusion with Some Remarks on Monetary Policy

This paper discusses the relationship between interest rates and inflation rates on one part and the house prices (typical real asset prices) relative to *chonsei* prices (typical nominal asset prices) on the other. The key point of the paper is that the relative price of sales to *chonsei* depends on the ratio of inflation to real interest rates. Therefore, even when the monetary authority maintains a pre-announced target level of inflation rate, the relative price of sales to *chonsei* rises if the real interest rate declines.

It is not clear whether the monetary authority *should* be concerned about the changes in this ratio. At least, the growth model presented in this paper is completely silent on this issue: there exists neither short-run fluctuation nor social cost from inflation. Probably the answer should be sought in the context of the debate about whether the monetary authority should be concerned with the fluctuations of asset prices in the first place.[19] In addition to its implication on short-run economic fluctuations, however, the

[19] The recent volatility in asset prices under the stable and low inflation environment has triggered a challenge on the standard inflation-targeting framework. While a majority of economists (e.g. Bernanke and Gertler (2001), and Gilchrist and Leahy (2002)) still support the standard monetary policy framework represented by Taylor rules, a group of economists (e.g. Cecchetti et. al. (2000), Borio and Lowe (2002), and Hahm and Hong (2003)) argue that the monetary authority needs to react to asset price bubbles in order to stabilize the economy. See Bean (2003) for this debate. Although from a quite different perspective, this paper's result could be interpreted to provide a rationale for the monetary policy that considers asset price fluctuations.

changes in the relative housing price between sales and *chonsei* generate significant implications about wealth distribution in Korea. As mentioned in Section 2, most of *chonsei* deposit is the savings that relatively young and/or poor people have reserved for the purchase of houses in the future. Unless the capital market is perfect, therefore, a rise in the sales price relative to *chonsei* price is very likely to worsen the wealth distribution.

If the fluctuations in interest rates and the induced fluctuations in the relative house prices are cyclical, the implication about wealth distribution is temporary. If the real interest rate (and growth rate) secularly declines, however, it may permanently deteriorate the wealth distribution. In fact, the secular decline in capital productivity and real interest rates is a likely scenario in developing economies like Korea, although it may not be common in developed economies.[20] [Figure 4], copied from Cho and Koh (1999), clearly shows the long-term declining trends of capital productivity and real interest rates in Korea for the past 30 years. In this case, the monetary authority can at least in theory prevent such an "undesirable" deterioration of wealth distribution by lowering the target inflation

[20] The convergence theory based on either the Neoclassical growth model (Barro (1991), Mankiw, Romer and Weil (1992)) or technology diffusion (Lucas (2000), Parente and Prescott (1994)) predicts a secular decline of (capital) productivity growth rate and real interest rate.

rate in proportion to the decline in real interest rate.[21]

In practice, of course, it is extremely difficult to identify the components of short-term fluctuation, as opposed to secular components, from the variations of real interest rates. Given the widespread apprehension about the zero (nominal) interest rate bound, in addition, a more serious question may be how much to lower the target inflation rate in an economy with very low interest rates. That is, as the real interest rate declines toward zero, the monetary authority may have to accept either a higher discrepancy between real and financial asset values or a higher risk of hitting the zero interest rate bound. Regarding many issues, including this thought-provoking one, the paper does not provide rigorous discussions yet, and many arguments remain at conjecture levels. No doubt that far more research is needed before drawing conclusions in this area.

[21] A similar discussion can be found in Friedman (1969) where he argues that the optimal rate of inflation is minus real interest rate.

References

Abel, Andrew, and Olrivier J. Blanchard, "An Intertemporal Model of Saving and Investment," *Econometrica* 51, pp. 675-692, 1983.

Ambrose, Brent W., and Sunwoong Kim, "Modeling the Korean Chonsei Lease Contract," *Real Estate Economics*, vol.31, pp.53-74, 2003.

Bank of Korea, *Monthly Bulletin*. (in Korean)

Barro, Robert J., "Economic Growth in a Cross-Section of Countries," *Quarterly Journal of Economics* 106, pp. 407-443, 1991.

Bean, Charles, "Asset Prices, Financial Imbalances and Monetary Policy: Are Inflation Targets Enough?" *Reserve Bank of Australia 2003 Conference on Asset Prices and Monetary Policy*, pp.48-76, August 2003.

Bernanke, B S and M Gertler, "Should central banks respond to movements in asset prices?" *American Economic Review*, 91(2), pp.253-257, 2001.

Borio, Claudio, and Philip Lowe, "Asset prices, financial and monetary stability: exploring the nexus," *BIS Working Papers* 114, July 2002.

Case, Karl E., and Robert Shiller, "Is There a Bubble in the Housing Market?" *Brookings Panel on Economic Activity*, September 2003.

Cecchetti, S G, H Genberg, J Lipsky and S Wadhwani, "Asset prices and central bank policy," *Geneva Reports on the World Economy, 2, International Centre for Monetary and Banking Studies, and Centre for Economic Policy Research*, 2000.

Cho, Dongchul, "Post-Crisis Structural Changes and Monetary Policy Scheme in Korea," *KDI Working Paper* 2003-02, 2003.

Cho, Dongchul, and Young-Sun Koh, "Liberalization of Capital Flows in Korea: Big-Bang or Gradualism?" in *Changes in Exchange Rates in Rapidly Developing Countries: Theory, Practice, and Policy Issues*, Edited by Takatoshi Ito and Anne Krueger, Chicago Press, 1999.

Choi, Soon Young, "Housing Tenure Choice and Financial Market Constraints: The Chonsei Housing System of Korea," *manuscript*, University of Chicago, December 2003.

Clarida, Richard, Jordi Gali, and Mark Gertler, "Monetary Policy Rules in Practice: Some International Evidence," *CEPR Discussion Paper*, No. 1750, November 1997.

Friedman, Milton, "The Optimum Quantity of Money," in *The Optimum Quantity of Money and Other Essays*, Chicago: Aldine Publishing Company, 1969.

Gilchrist, Simon, and John V. Leahy, "Monetary Policy and Asset Prices", *Journal of Monetary Economics* 49, pp. 75-97 2002.

Greenspan, A., "Economic Volatility," *Speech at a symposium sponsored by the Federal Reserve Bank of Kansas City*, Jackson Hall, Wyoming, 2002.

Hahm, Jung-Ho, and Seung-Jae Hong, "Asset Price Fluctuations and Monetary Policy", *The Bank of Korea Working Paper* No.139, Institute for Monetary and Economic Research, 2002. (in Korean)

Hayashi, Fumio, and Edward C. Prescott, "The 1990s in Japan: A Lost Decade," *Review of Economic Dynamics* 5, pp.206-235, 2002.

Kim, Jun-Il, "Business Cycle and GDP Gap," *KDI Policy Studies*, pp.217-257, Spring, 1996.

King, Mervin, "Challenges for Monetary Policy: New and Old," Federal Reserve of Kansas City, August 1999.

Kookmin Bank, *Monthly House Prices*. (in Korean)

Leigh, Daniel, "Monetary Policy and the Dangers of Deflation: Lessons from Japan," *manuscript*, Jonhs Hopkins University, October 2003.

Lim, Kyung-Mook, and David N. Weil, "The Baby Boom and Stock Market Boom," *The Scandinavian Journal of Economics*, Vol. 105, No. 3, pp. 359-377, 2003.

Lucas, Robert, "Some Macroeconomics for the 21st Century," *Journal of Economic Perspectives*, pp.159-168, Winter 2000.

Mankiw, N. Gregory, David Romer, and David N. Weil, "A Contribution to the Empirics of Economic Growth," *Quarterly Journal of Economics* 107, pp. 407-437, 1992.

Ministry of Government Administration and Home Affairs, *Annual Local Tax Statistics Report*. (in Korean)

National Statistics Office, *1997 National Wealth Survey*, 1999. (in Korean)

National Statistics Office, *Population and Housing Census Report*, 2000. (in Korean)

National Tax Service, *Statistical Yearbook of National Tax*. (in Korean)

Parente, Stephen L., and Edward C. Prescott, "Barriers to Technology Adoption and Development," *Journal of Political Economy*, 102, pp.298-321, 1994.

Renaud, Bertrand, "Understanding the Collateral Qualities of Housing for Financial Development: The Korean "chonse" as Effective Response to Financial Sector Shortcomings," Discussion Paper INU 49, The World Bank, June 1989.

Appendix I: Dynamics of the Model in the Text

The dynamics of the model in the text can be traced by solving the following three equations for C_t, H_t and K_t:

$$(5) \qquad \frac{\dot{C}_t}{C_t} = \frac{\dot{H}_t}{H_t} = i_t - \frac{\dot{P}_t^K}{P_t^K} - \rho = r_t - \rho = DB - \rho \ ;$$

$$(6) \qquad \dot{K}_t + \dot{H}_t = D(BK_t - C_t) \ ;$$

$$C_t = \frac{\alpha}{1-\alpha}\frac{R_t}{P_t}H_t = \frac{\alpha}{1-\alpha}r_t H_t = \frac{\alpha}{1-\alpha}DBH_t \ .$$

from the optimization of instantaneous allocation between consumption and housing expenditure. While C_t and H_t always move along the steady state paths (although the steady state level of C_t can jump at the moment when a shock arrives), K_t has a transitional dynamics governed by:

$$\frac{\dot{K}_t}{K_t} = DB - \left[(DB-\rho) + \frac{\alpha}{1-\alpha}D^2B\right]\frac{H_t}{K_t} \ .$$

In a steady state, therefore, these three equations yield:

$$\frac{C}{H} = \frac{\alpha}{1-\alpha}DB \ ;$$

$$\frac{K}{H} = \frac{1}{\rho}\left[(DB-\rho)+\frac{\alpha}{1-\alpha}D^2B\right] \text{ ; hence}$$
$$\frac{K}{C} = \frac{1-\alpha}{\alpha}\frac{1}{\rho DB}\left[(DB-\rho)+\frac{\alpha}{1-\alpha}D^2B\right] .$$

Using these results, it can be shown that a fall in either B or D decreases the steady state values of C/H, K/H, and K/C. Finally, the aggregate saving rate at the steady state,

$$1-\frac{C}{BK} = 1-\frac{\alpha}{1-\alpha}\frac{\rho D}{[(DB-\rho)+\{\alpha/(1-\alpha)\}D^2B]} ,$$

declines with a fall in B and increases with a fall in D, but the housing investment ratio to output,

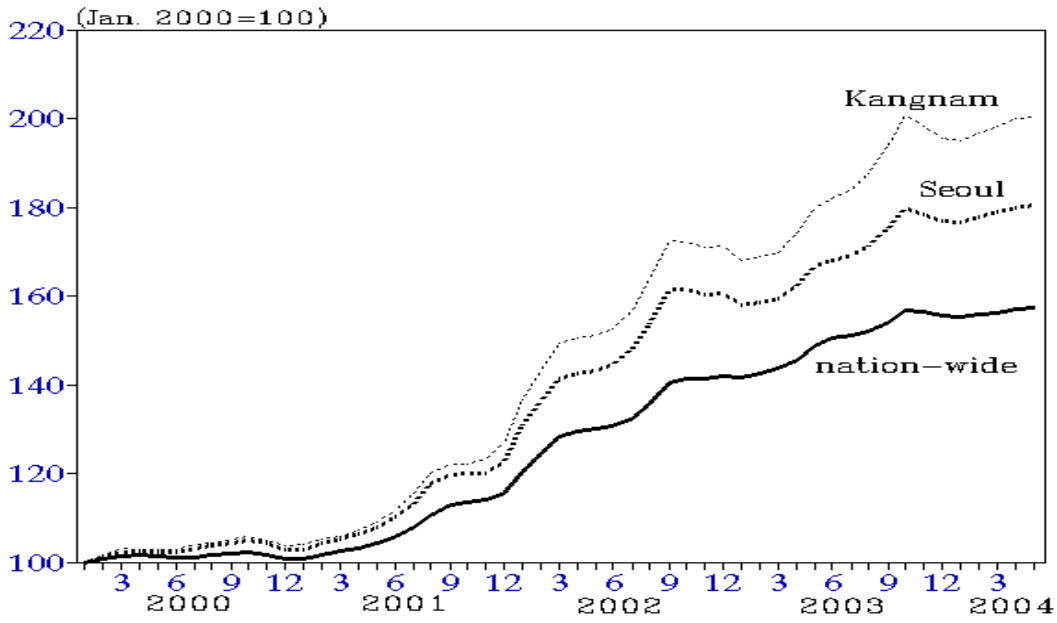
$$\frac{\dot{H}/D}{BK} = \frac{\rho}{DB}\frac{1}{[1-\{\alpha/(1-\alpha)\}D/\{1-\rho/DB\}]} ,$$

increases with a fall in B (its direction with a fall in D becomes ambiguous).

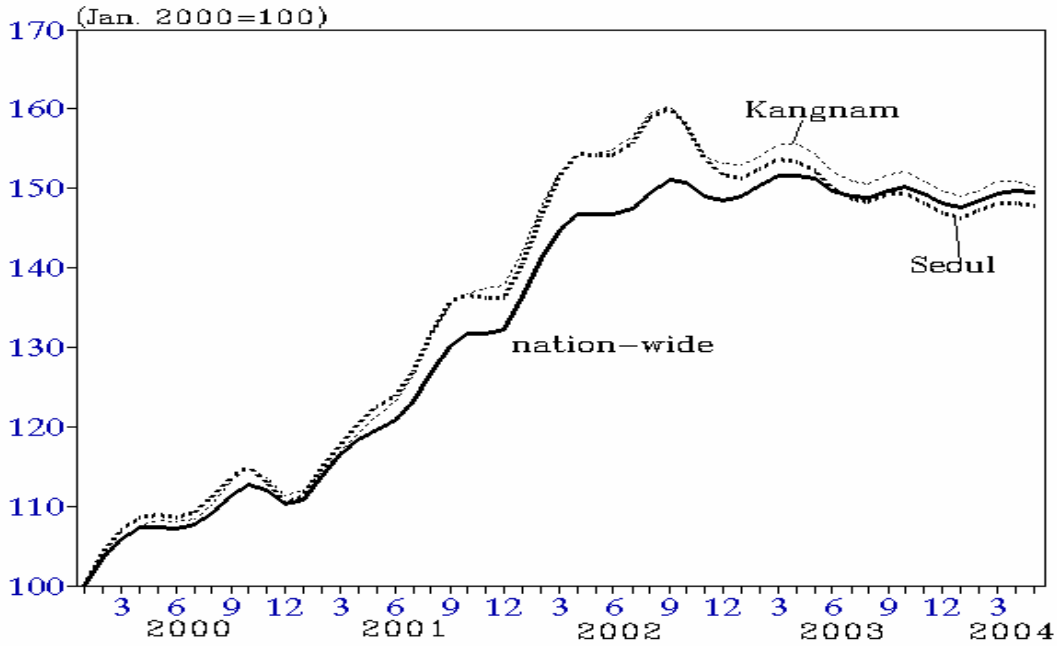
Appendix II: Variables and Data Sources

Variables		Notes	Data Sources
House Prices		Since the ratio of the sales to *chonsei* prices is not available prior to December 1998, this variable was extended backward using their inflation rates of the sales and *chonsei* prices.	*Monthly House Prices*, Kookmin Bank
Nominal Interest Rate		Yield rate on 3-year corporate bonds	*Monthly Bulletin*, Bank of Korea
Expected Inflation Rate		Obtained by annualizing forecast values for the next three years (12 quarters) of inflation at every quarter using the structural vector auto-regression estimation composed of two variables, GDP and core CPI.	Kim (1996), Cho (2003)
Real Estate Taxes	On Holding	1. Land: aggregate land tax, local education tax, and city planning tax 2. Building: property tax, local education tax, city planning tax, and common facilities tax	*Annual Local Tax Statistics Report*, Ministry of Government Administration and Home Affairs
	On Purchase	Acquisition tax and registration tax	
	On Capital Gains	Capital gains tax, excessively holding land tax (existed during the 1991—1993 period only), and asset revaluation tax	*Statistical Yearbook of National Tax*, National Tax Service
Total Value of Real Estate		This variable was extended backward using their inflation rates of house and land prices, based on the total value of real estate estimated at the end of 1997 (2,500 trillion won: 1,548 trillion won for land and 952 trillion won for buildings).	*National Wealth Survey*, National Statistics Office
Effective Tax Rates on Real Estate		Ratio of the real estate tax revenues to the total value of real estate	

[Figure 1A] Trends of House Prices

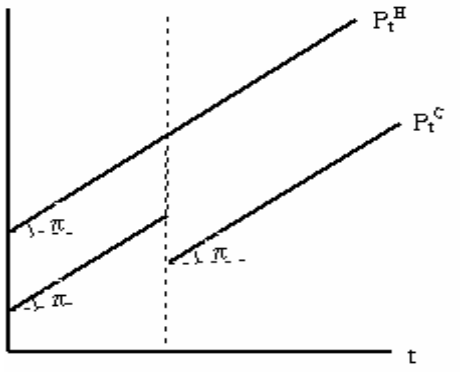


[Figure 1B] Trends of *Chonsei* Prices

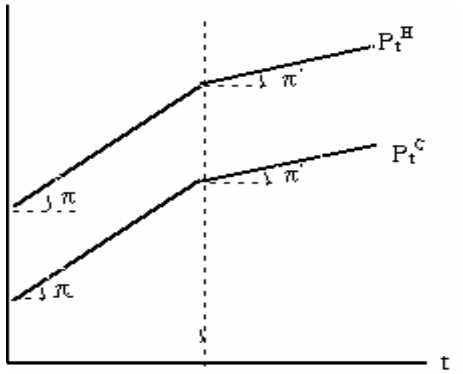


[Figure 2] Time Paths of House Price (P_t^H) and *Chonsei* Price (P_t^C)

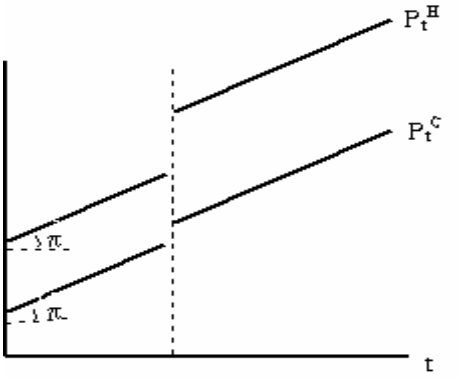
$B\downarrow$, $\bar{D}$, $\bar{\pi}$ and targeting P_t



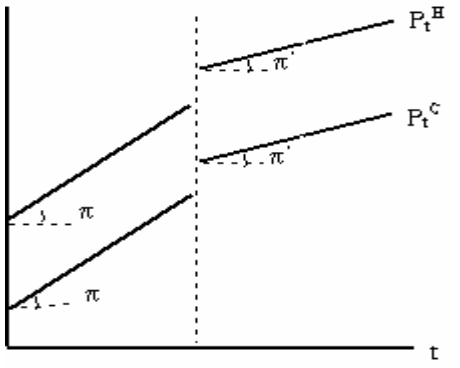
$B\downarrow$, $\bar{D}$, $\pi\downarrow$ and targeting P_t



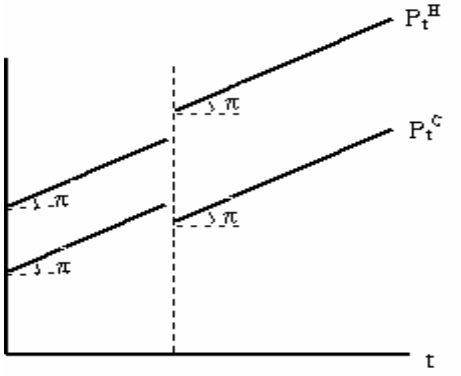
$\bar{B}$, $D\downarrow$, $\bar{\pi}$ and targeting P_t



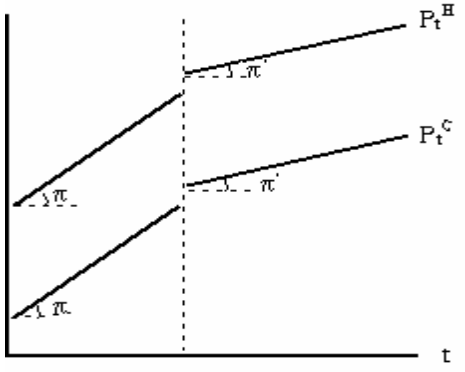
$\bar{B}$, $D\downarrow$, $\pi\downarrow$ and targeting P_t



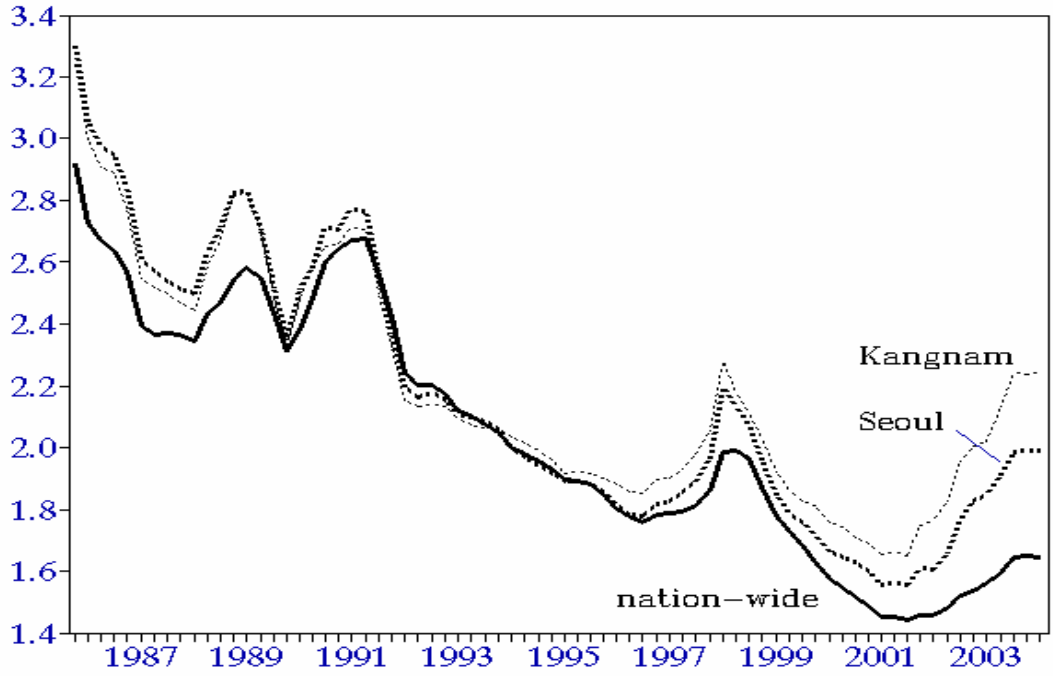
$B\downarrow$, $\bar{D}$, $\bar{\pi}$ and targeting q_t



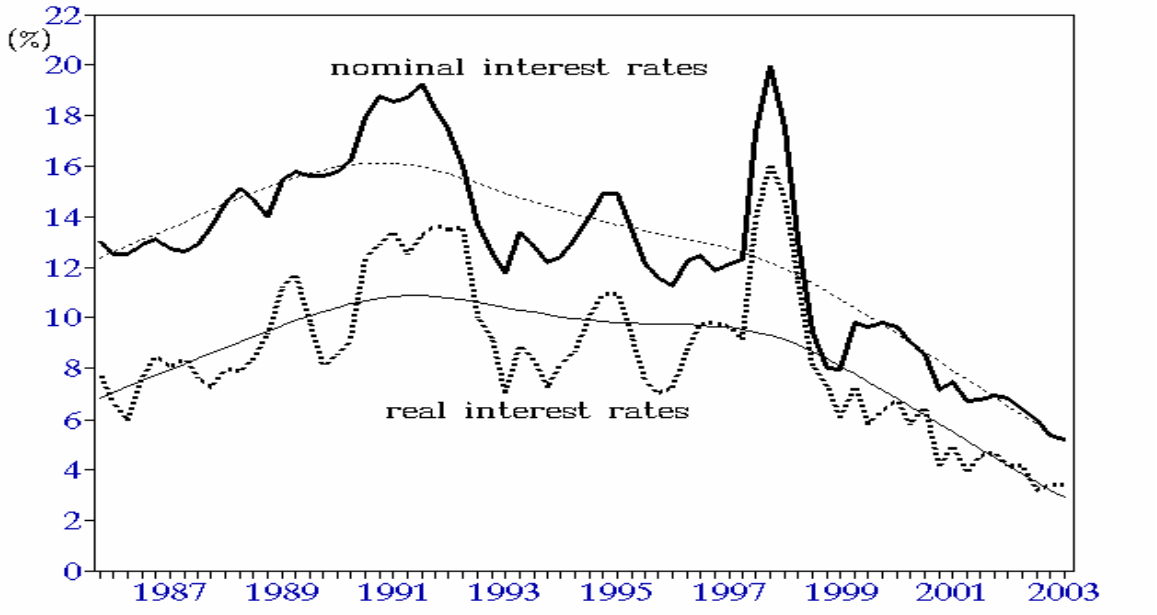
$B\downarrow$, $\bar{D}$, $\pi\downarrow$ and targeting q_t



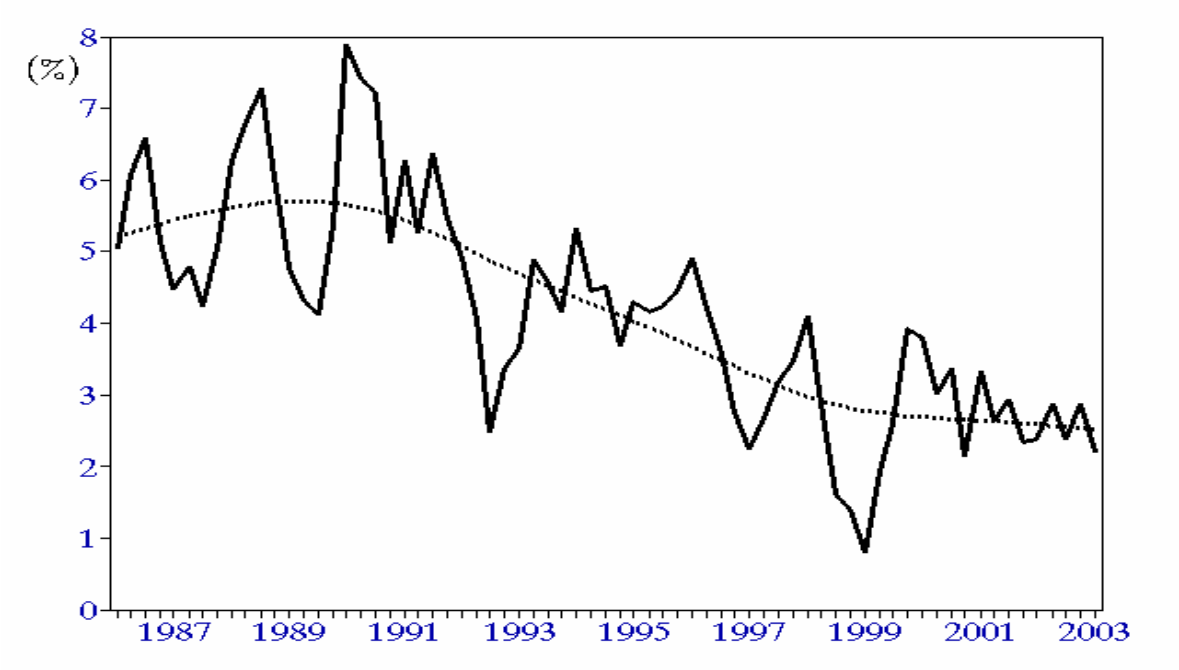
[Figure 3A] Ratio of Sales to *Chonsei* Prices



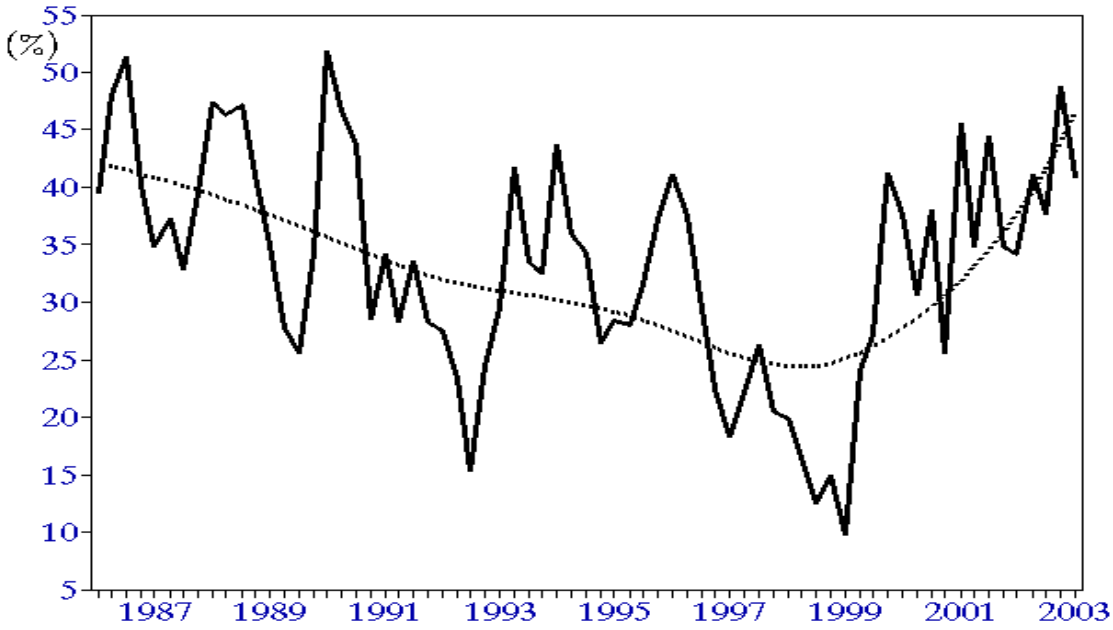
[Figure 3B] Nominal vs. Real Interest Rates



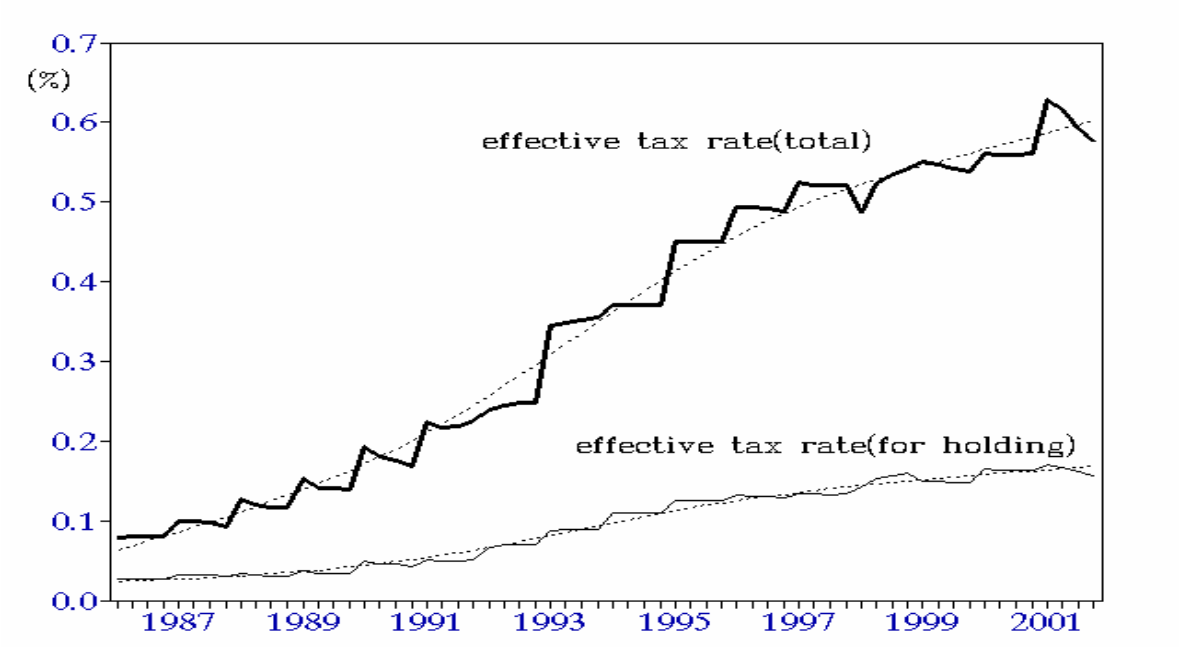
[Figure 3C] Expected Inflation Rate



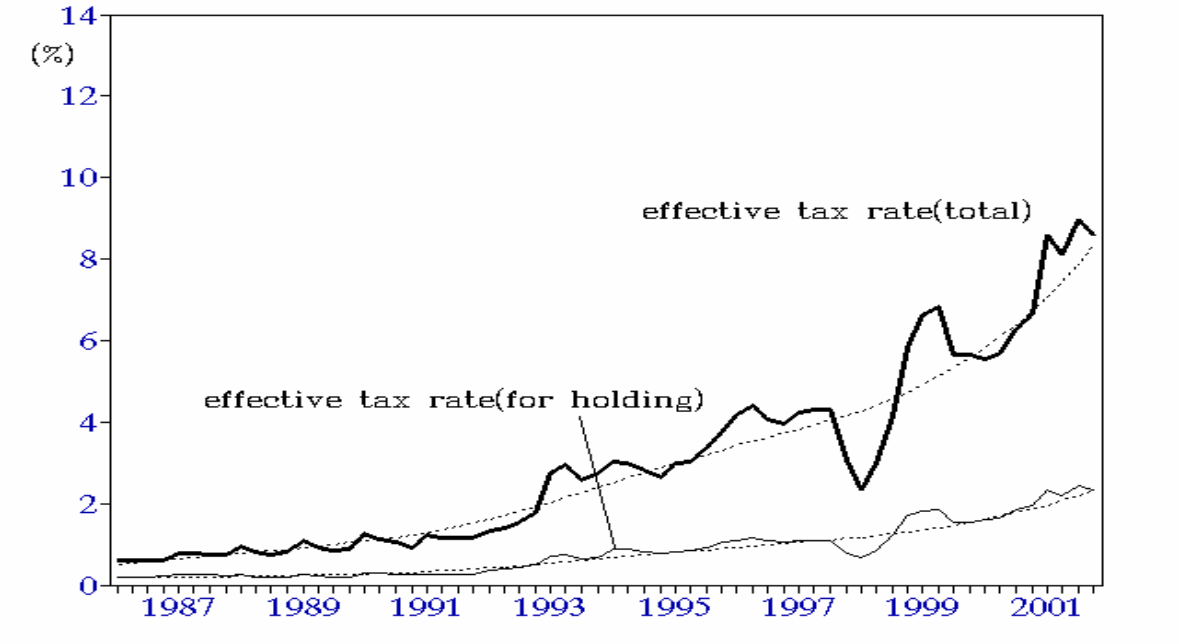
[Figure 3D] Expected Inflation Rate as a Portion of Nominal Interest Rate



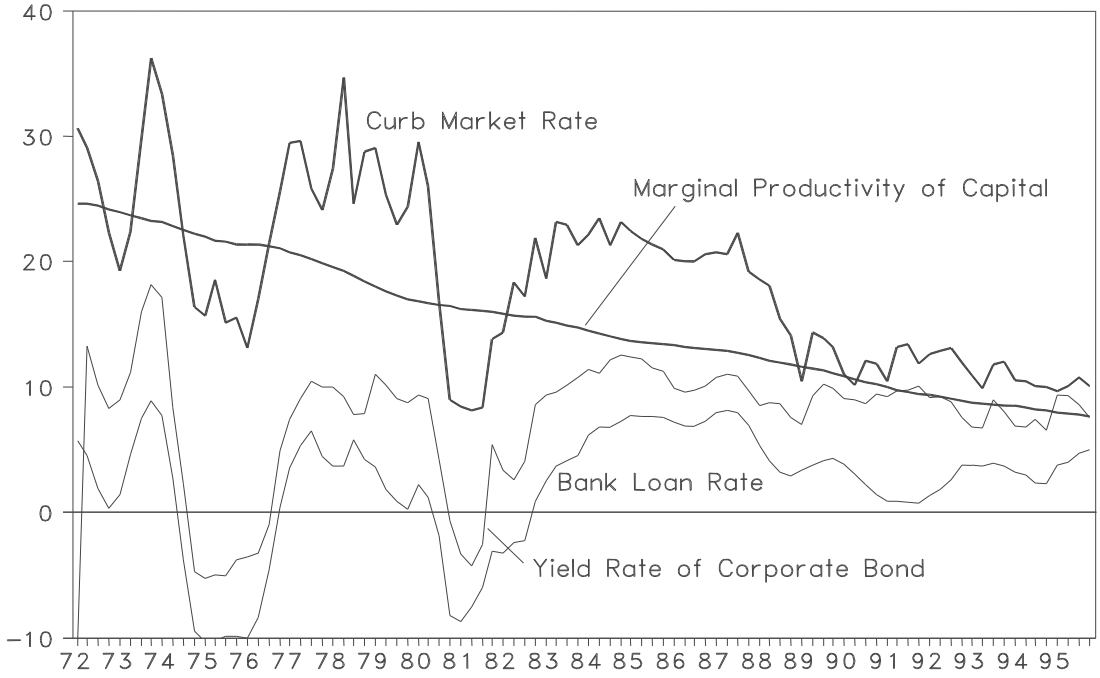
[Figure 3E] Effective Tax Rate on Real Estate



[Figure 3F] Effective Tax Rate relative to Nominal Interest Rate



[Figure 4] Trends of Real Interest Rates of Korea



Source: Cho and Koh(1999).