

Real Estate Price Bubble and Price Forecasts in Korea

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1. Introduction

Korea experienced rapid increases in urban land and housing prices during the late 1980s. Real estate prices reached a peak in 1990 and started declining in 1991 and plummeted in 1998 in the aftermath of the economic crisis that broke out in late 1997. The abrupt upswing and the sudden downfall of real estate prices was interpreted by mass media and some scholars as a process of the formation and bursting of a price bubble. They argue that the extremely high ratio between aggregate land value and GDP in Korea in the late 1980s was a clear sign of a price bubble. Such a common belief was confirmed by a more careful analysis of the 1974-89 data by Kim and Suh (1993). They concluded that a growing bubble existed in the nominal land price and the relative price of land.

Although the notion of price bubble appears straightforward, testing for its existence is ridden with difficulties. The most difficult part is to specify the intrinsic value determined by the market fundamentals. For example, using the notion of the “theoretical land value”, Noguchi (1994) defined that part of land price exceeding it as bubble. He then concluded that 54% of the land price in Tokyo was bubble in 1987. On the other hand, Boone and Sachs (1989) and Stone and Ziemba (1993) argue that the level of Japanese and price can be explained by market fundamentals and that the fluctuations of prices are driven mostly by economic forces. In these studies, testing for the existence of a bubble is a test of model specification at the same time. On the other hand, Edelstein and Paul (1999) report that most of the variations of Japanese land prices can be explained by a first-order autoregressive model using a couple of expectations related variables, without estimating the market fundamentals.

Some other practical problems are that the test for a bubble can be done only on an ex post base, and that different conclusions might be reached depending upon the sample period considered. Moreover, estimation of the price bubble is not useful in forecasting the future course of price, or devising policies to stabilize the prices.

The main purpose of this paper is to perform a test for the existence of real estate price bubble using time series data for the 1974-99 period, and then to provide forecast for the medium term of 2000-2005. In the next section, we describe the trends of real estate prices in Korea since 1974, and relate them to those of major macroeconomic variables. In section III, we conduct cointegration tests for the existence of real estate price bubbles. Then the cointegration relations are used to produce forecasts for real estate prices in section IV. Section V concludes the paper.

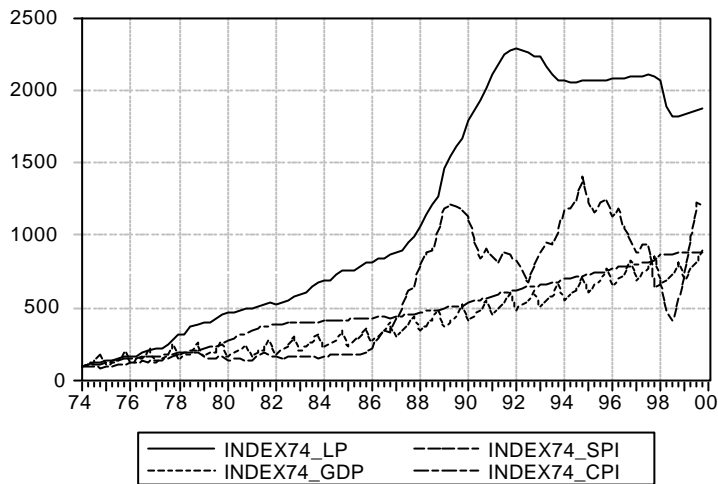
II. Trends of Real Estate Prices in Korea

1. Price Trends

Demand for urban land and housing increased rapidly since 1960s as a result of rapid economic growth and urbanization. On the other hand, supply of developable land and urban housing lagged behind demand mainly due to rigid land use regulations. As a result, real estate prices rose faster than other prices until late 1980s. Although this is a logical interpretation of the market outcome, it was not a consensus among the general public and policy makers (Kim 1993, Kim and Kim 2000). Instead, high and rising real estate prices were often attributed to speculation, and the government introduced various measures to discourage speculation. But, government finally realized the need to work on the supply side, and therefore increased the supply of developable land through drive to build two million new dwelling units over the 1989-92 period. Consequently, prices started declining in absolute terms since 1991. Then the economic crisis brought about a sudden downfall of real estate prices (Kim 2000).

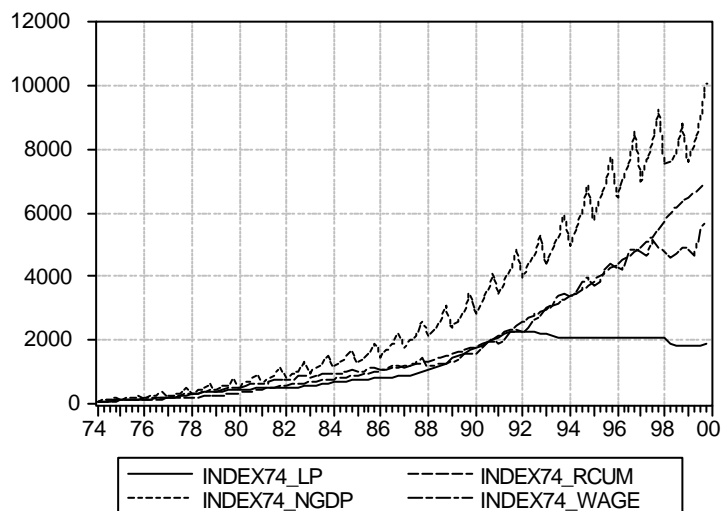
We now take a closer look at the data on land and housing prices. The trend of land price is illustrated in figure 1 and figure 2. The Ministry of Construction and Transport started publishing land price indexes in 1974. The indexes are computed from assessed values of a large number of plots in each quarter, for different regions, land-use categories and zoning status. Figure 1 compares the index of the average land price (LP) with real GDP, the consumer price index (CPI) and the stock price index (SPI) for the 1974-99 period, whereas figure 2 shows the trend of land price relative to those of nominal GDP (NGDP), wages(WAGE) and cumulated return on corporate bond (RCUM) during the same period. From these figures, one can see that land price increases outpaced the growth of real GDP, stock prices and the overall price level, but they fell behind the growth of nominal GDP, wages and cumulative return on corporate bonds. This raises a question of whether land price increases were abnormally high as many commentators argue.

<Figure1> Land Price & Selected Macroeconomic Variables:1974-99



Note : Q1,1974=100

<Figure2> Land Price, Nominal GDP, Wages & Interest:1974-99



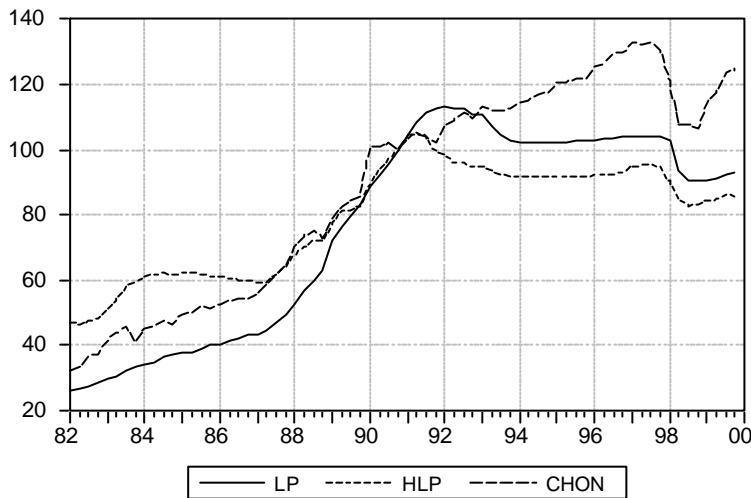
Note 1) Q1,1974=100

2) Cumulated return on corporate bond rate (RCUM) was computed assuming quarterly compounding since the first quarter of 1974.

Normally, housing and land prices tend to move together. Figure 3 presents the indexes of urban housing prices together with the average land price index explained above. The graph covers the 1982-99 period because the official housing price indexes are available only since 1982. The indexes are published by the Housing and Commercial Bank, the dominant mortgage lender,

formerly called the Korea Housing Bank until it was privatized in 1997. The figure shows two housing price indexes. The first one is the average asset price and the other is so-called chonseil deposit index. Chonseil is a unique Korean rental arrangement under which the tenant leaves a lump sum deposit to the landlord at the signing of the lease. No monthly rental payments are made during the lease period, and the full amount of the deposit is returned to the tenant at the termination of the lease. The amount of deposit is typically around 50 % of the asset price.

<Figure3> Land and Housing Prices : 1982-99



The graphs suggest that the purchase asset price of housing moves quite closely with the average land price but that the two housing prices do not necessarily do so. In fact, the chonseil deposit index kept rising even though the asset price of housing and land price took a down turn around 1991. This implies that the two separate indexes must be investigated separately.

2. Real Estate Prices and Macroeconomic Variables

The main objective of this paper is to investigate whether there was a bubble in real estate prices. Before we carry out a formal test of bubble in the next section, we look at the correlation coefficients of land price and key macroeconomic variables. Table 1 suggests that the price of land is affected by the fluctuations of the overall economic activity, although it might appear to move erratically from time to time due to speculation. Especially strong correlation is found between land price and real GDP as well as with CPI.

	LP	GDP	NGDP	CPI	SPI	M2	RCUM	WAGE
LP	1.000							
GDP	0.908	1.000						
NGDP	0.876	0.986	1.000					
CPI	0.918	0.955	0.953	1.000				
SPI	0.882	0.822	0.775	0.786	1.000			
M2	0.760	0.918	0.959	0.903	0.663	1.000		
RCUM	0.823	0.949	0.982	0.941	0.711	0.991	1.000	
WAGE	0.856	0.966	0.991	0.953	0.749	0.962	0.985	1.000

<Table 1> Correlation between land price and key macroeconomic variables

However, an analysis of coefficients of contemporaneous correlation might be misleading because of the possibility of spurious regression between variables with trends. In order to address this problem, we present in table 2 a matrix of correlation coefficients among the rate of changes of the variables considered in table 1. The correlation coefficients in table 2 are much smaller than those reported in table 1¹. But all the coefficients are statistically significant. The strongest correlation was found between land price and nominal GDP.

	PCH_LP	PCH_GDP	PCH_NGDP	PCH_CPI	PCH_M2	PCH_SPI
PCH_LP	1.000					
PCH_GDP	0.319	1.000				
PCH_NGDP	0.568	0.396	1.000			
PCH_CPI	0.267	- 0.218	0.581	1.000		
PCH_M2	0.335	- 0.068	0.280	0.174	1.000	
PCH_SPI	0.104	0.189	- 0.070	- 0.124	- 0.002	1.000

Note : The rate of change in real and nominal GDP was computed over the same quarter of the previous year.

<Table 2> Correlation between % changes in land price and macroeconomic variables

¹ These figures are much smaller than 0.8~0.9 reported in KAB (1998). One reason for the discrepancy is that we used quarterly data whereas KAB used annual data. The matrix of correlation coefficients computed from annual data is presented in table A-1 of the appendix.

III. Cointegration Tests for Price Bubble

1. The Methodology

A fundamental problem with testing for a price bubble is that the validity of the test hinges on the correct specification of the market fundamental, which is inherently difficult. On the other hand, cointegration test is a test of whether or not a stable long-run equilibrium relationship exists between the real estate price and the variables representing the fluctuation of the overall economic activity. The existence of the equilibrium relationship allows one to exclude the possibility of a price bubble. Although this approach is not entirely free of the problem of misspecification, the procedure is much simpler because the bubble term does not have to be estimated.

In this study, we use the index of average land price to represent real estate prices and consider the index of the asset price of housing and the chonseil deposit index of chonseil deposit as supplementary price variables. Real GDP is used as the key indicator of business cycle, and also the summary measure of the determinants of the price of services from real estate.

We perform Johansen's maximum likelihood test for cointegration using a vector autoregression (VAR) model. A VAR model given by

$$Y_t = A_1 Y_{t-1} + A_2 Y_{t-2} + \dots + A_p Y_{t-p} + \varepsilon_t \quad (1)$$

can be transformed into

$$\Delta Y_t = \Pi Y_{t-1} + \Pi_1 \Delta Y_{t-1} + \dots + \Pi_{p-1} \Delta Y_{t-p+1} + \varepsilon_t \quad (2)$$

The Johansen test is based on the analysis of the matrix of coefficients of the lagged dependent variable. If the null hypothesis $H_0 : \Pi = 0$ [i.e., $\text{rank}(\Pi) = 0$] cannot be rejected, co-integration does not exist. On the other hand, co-integration exists if the canonical correlation is greater than 0, i.e. $\text{rank}(\Pi) > 0$.

2. Cointegration between land price and real GDP

We first estimated a VAR model using quarterly data for the period of Q1, 1974 – Q4, 1999. A set of seasonal dummy variables (SD2, SD3, and SD4 for Q2, Q3 and Q4) was used to control

for seasonality in real GDP data.² The result of co-integration test is presented in <table 3>, which suggests that land price index is co-integrated with real GDP, a measure of market fundamentals. In other words, land price is determined by market fundamentals in the long run, even though it can deviate from the intrinsic value in the short run, the phenomenon known as price bubble. The estimated co-integration equation

$$LP=16.23+0.00112GDP \quad (3)$$

shows that land price index rises by 0.00112 (1.12) for every one billion (trillion)Won of additional GDP in the long run³.

Our finding is seemingly different from that of Kim and Suh (1993) which reports the existence of a growing rational bubble in land price for the 1970-89 period. Since the sample period is different from ours, we applied the same test to the sample period of their study. The result is presented in panel (2) of table 3, which shows that no co-integration relationship existed between 1974 and 1989. Therefore, our finding is not inconsistent with Kim and Suh. However, the evidence against cointegration does not necessarily imply the existence of price bubble, because of possible misspecification of the model determining the market fundamentals.

² We did not make seasonal adjustment because it raises problems for co-integration test and for forecasting. See Lee and Siklos(1993) and Bell and Hillmer(1984) for details.

³ The figures for GDP and LP during the 1990s have been around 400 trillion Won (100 trillion per quarter) and 100, respectively. Therefore, equation (3) implies that a 1 % increase in GDP (per quarter) would lead to a little more than a 1% rise in LP.

(1) Sample period : 1974.Q1 1999.Q4									
- Cointegration test									
H ₀ : r = 0 LR = 17.58* Critical Values: 20.04(1%), 15.41(5%)									
H ₀ : r = 1 LR = 0.01 Critical Values: 6.65(1%), 3.76(5%)									
Normalized Cointegrating Vector: $z_t = LP_t - 0.00112GDP_t + 16.228$									
- Estimation of error-correction models									
Regressor		LP _t				GDP _t			
z _{t-1}		- 0.02 (- 2.18)				15.98 (2.34)			
Constant		- 2.54 (- 2.10)				- 3113.87 (- 2.96)			
SD2	SD3	SD4	6.41	1.94	1.11	5793.71	4999.15	4670.23	
			(3.28)	(1.09)	(0.52)	(3.42)	(3.25)	(2.54)	
LP _{t-1} to LP _{t-4}		0.52	0.09	0.05	0.18	205.72	204.93	- 347.87	- 156.98
		(4.91)	(0.77)	(0.40)	(1.64)	(2.24)	(1.96)	(- 3.28)	(- 1.68)
GDP _{t-1} to GDP _{t-4}		0.00	0.00	- 0.00	0.00	- 0.07	- 0.15	- 0.28	0.52
		(4.50)	(0.39)	(- 0.25)	(0.23)	(- 0.80)	(- 1.61)	(- 2.75)	(5.07)
R ² / Adj R ²		0.650 / 0.601				0.975 / 0.972			
(2) Sample period: 1974.Q1 1989.Q4									
- Cointegration test									
H ₀ : r = 0 LR = 12.72 Critical Values: 20.04(1%), 15.41(5%)									
H ₀ : r = 1 LR = 3.00 Critical Values: 6.65(1%), 3.76(5%)									

Note: 1) Figures in parentheses are *t*-values

2) * indicates statistical significance at 5% level

<Table 3> Co-integration between land price and real GDP

3. Cointegration between the relative price of land and real GDP

In the analysis above, we considered nominal land price index, but nominal land price can increase rapidly because of overall inflation. In order to rule out this possibility, we explored the relationships between the relative price of land (RLP) and real GDP. RLP was computed by dividing the nominal land price index by the GDP deflator. The result of the cointegration test is presented in table 4, which shows that RLP is cointegrated with real GDP through

$$RLP = 56.48 + 0.00020GDP \quad (4)$$

The estimated cointegration equation shows that the relative price of land rises with economic growth. In other words, the land price rises faster than the overall price level as national income grows. This observation is consistent with the cointegration relation (3) that a 1 % increase in GDP would lead to a more than 1 % increase in LP (see footnote 3). In light of the earlier result that no price bubble existed in the nominal price of land, the finding that no bubble exists in land price after the effect of inflation has been controlled for is not surprising

4. Cointegration between nominal land price and nominal GDP

A similar cointegration test was carried out between nominal land price and nominal GDP. It is logically equivalent to testing for cointegration between relative price of land and real GDP, but an additional advantage is that the result can be used directly for forecasting the land price index. The test result is presented in the lower pannel of table 4. Nominal land price index is found to be cointegrated with nominal GDP (NGDP) through

$$LP=4256+0.00041NGDP \quad (5)$$

In other words, nominal land price index rises by 0.00041 (0.41) as nominal GDP increases by one billion (trillion) Won.

(1) Realive price of land vs real GDP									
- Cointegration test									
H ₀ : r = 0		LR=16.43*		Critical Values: 20.04(1%), 15.41(5%)					
H ₀ : r = 1		LR= 0.80		Critical Values: 6.65(1%), 3.76(5%)					
Normalized Cointegrating Vector: z _t =RLP _t - 0.00020GDP _t - 56.476									
- Estimation of error-correction models									
Regressor	RLP _t				GDP _t				
z _{t-1}	- 0.03 (- 2.66)				11.12 (1.50)				
Constant	- 3.14 (- 1.70)				- 6470.90 (- 6.14)				
SD2 SD3 SD4	3.61 (1.17)	4.02 (1.42)	3.93 (1.22)	8303.97 10022.07 9800.43 (4.71) (6.23) (5.36)					
RLP _{t-1} to RLP _{t-4}	0.16 (1.88)	- 0.005 (- 0.05)	0.04 (0.40)	0.60 (6.80)	131.50 78.01 - 47.38 - 206.89 (2.70) (1.54) (- 0.93) (- 4.10)				
GDP _{t-1} to GDP _{t-4}	0.00 (1.12)	0.00 (1.31)	0.00 (0.77)	- 0.00 (- 0.31)	- 0.06 0.06 - 0.13 0.34 (- 0.70) (0.63) (- 1.36) (3.57)				
R ² / Adj R ²	0.547 / 0.484				0.975 / 0.972				
(2) Nominal land price vs nominal GDP									
- Cointegration test									
H ₀ : r = 0		LR = 19.97*		Critical Values: 20.04(1%), 15.41(5%)					
H ₀ : r = 1		LR = 0.07		Critical Values: 6.65(1%), 3.76(5%)					
Normalized Cointegrating Vector: z _t = LP _t - 0.00041NGDP _t - 42.562									
- Estimation of error-correction models									
Regressor	LP _t				NGDP _t				
z _{t-1}	0.001 (0.17)				27.99 (3.40)				
Constant	0.48 (0.89)				- 46.20 (- 0.09)				
SD2 SD3 SD4	0.01 (0.02)	0.37 (0.55)	- 0.27 (- 0.38)	1735.30 1596.50 1291.69 (2.53) (2.49) (1.89)					
LP _{t-1} to LP _{t-4}	0.54 (5.11)	0.14 (1.14)	0.12 (0.99)	0.03 (0.26)	402.62 344.72 - 422.99 - 407.56 (3.93) (2.94) (- 3.54) (- 3.87)				
NGDP _{t-1} to NGDP _{t-4}	- 0.00 (- 0.22)	- 0.00 (- 1.41)	- 0.00 (- 1.77)	- 0.00 (- 1.39)	- 0.13 - 0.22 - 0.27 0.79 (- 2.00) (- 3.42) (- 4.04) (11.57)				
R ² / Adj R ²	0.583 / 0.524				0.967 / 0.963				

Notes : Same as in table 3.

< Table 4> Cointegration between (relative) price of land and GDP

5. Land price vs stock price

Finally, we tested for cointegration between land price and stock price. The result is summarized in table 5, which suggests that the two price series are cointegrated. Since the cointegration equation (6) for the land price index has a positive coefficient of stock price index (SPI), land and stocks are found to be substitutes in the long run. An increase of stock price index by 10 points leads to a 1.18 point increase of the nominal land price index.

$$LP = 8.55 + 0.1180SPI \quad (6)$$

(1) Sample period: 1974.Q1 1999.Q4									
- Cointegration test									
$H_0 : r = 0$		LR = 36.09**		Critical Values: 20.04(1%), 15.41(5%)					
$H_0 : r = 1$		LR = 0.83		Critical Values: 6.65(1%), 3.76(5%)					
Normalized Cointegrating Vector: $z_t = LP_t - 0.1180SPI_t - 8.549$									
- Estimation of error-correction models									
Regressor	LP_t				SPI_t				
z_{t-1}	- 0.04 (- 3.39)				1.09 (2.32)				
Constant	0.26 (1.58)				9.92 (1.46)				
LP_{t-1} to LP_{t-4}	0.32 (2.88)	0.02 (0.17)	0.07 (0.63)	0.29 (2.73)	8.70 (1.92)	- 5.47 (- 1.19)	- 0.60 (- 0.13)	- 9.00 (- 2.05)	
SPI_{t-1} to SPI_{t-4}	0.002 (0.74)	0.003 (1.21)	- 0.004 (- 1.40)	- 0.005 (- 1.47)	0.19 (1.68)	0.09 (0.78)	0.30 (2.62)	0.09 (0.67)	
$R^2 / \text{Adj } R^2$	0.583 / 0.540				0.279 / 0.206				
(2) Sample period 1974.Q1 1989.Q4									
- Cointegration test									
$H_0 : r = 0$		LR = 8.40		Critical Values: 20.04(1%), 15.41(5%)					
$H_0 : r = 1$		LR = 1.78		Critical Values: 6.65(1%), 3.76(5%)					

Notes 1) Same as in table 3.

2)** indicates statistical significance at 1% level.

<Table 5> Cointegration between land price and stock price

The estimated cointegration equation and the error correction model will be used later in forecasting the land price index.

. Real Estate Price Forecasting

1. The Methodology

We employ a VAR model with error correction to forecast real estate prices. The major advantage of using a VAR model over a conventional macroeconomic model consisting of a system of simultaneous equations is that the values of all endogenous variables are derived from their past values and therefore forecasting is possible without assumptions about the future values of exogenous variables. The accuracy of forecast made using a VAR model can be impaired if a structural change takes place, but this problem applies also to conditional forecasting based on a conventional econometric model.

In order to forecast land price index (LP), we used a VAR model consisting of LP and real GDP, and a separate VAR model comprising LP and the stock price index (SPI). This was done because it was found in section III that LP was cointegrated with both real GDP and SPI. On the other hand, the index of the purchase price of housing (HPL) was forecast from a VAR model considering the cointegration relationship between HPL and SPI. This decision was made based on the finding, to be explained below, that stock prices are more effective than real GDP in explaining the fluctuations of housing prices in the short run. The index of chonseil deposit was forecast in a similar manner.

2. Forecasting Results

Two sets of forecast for the land price index for the 2000-2005 period are presented in table 6A and table 6B, and illustrated in figure 4. LPF1_GDP and LPF2_SPI are respectively based on the error correction model reported in table 3 (cointegration between land price index and real GDP) and table 4 (cointegration between land price index and stock price index). The two forecasts paint a similar picture for the future course of land price. The difference is that LPF2 exceeds LPF1 until 2003 and falls short of LPF2 from 2003 till 2005.

LPF1 predicts that land price will increase at an annual rate of 4.3-6.4 % in 2000, and 6.8-7.2 % in 2001. Then the pace of increase will slow down gradually starting in 2002. On the other hand, LPF2 predicts a smaller rate of increase in 2000 compared with LPF1, but overtakes LPF1 until the situation is reversed in 2003. The predicted rate of land price increase is larger than that of the stock price index. The forecast for the relative price of land is presented in table 7 and illustrated in figure 5. The forecast suggests that land price will increase faster than GDP deflator. Since land price is cointegrated with both real GDP and the stock price index, one cannot tell a priori which of the two forecasts will prove more accurate. However, in the medium term, land price movements are more likely to be affected by stock prices since land and stocks are substitutes. This conjecture is confirmed by ex-post within-sample forecasting results to be explained later.

Finally, we made forecasts for the purchase price of housing and the chonseil deposit on housing. The results are presented in table 7 and illustrated in figure 6 and figure 7 respectively. The purchase price of housing is predicted to start rising in late 2000 and the pace will accelerate in 2001. Increase in housing price will peak at the end of 2001 and will decelerate in 2002, before it starts falling a bit in 2003. On the other hand, chonseil deposit will start rising in 2001 and then the pace of increase will slow down in 2002. But unlike the purchase price of housing, chonseil deposit will

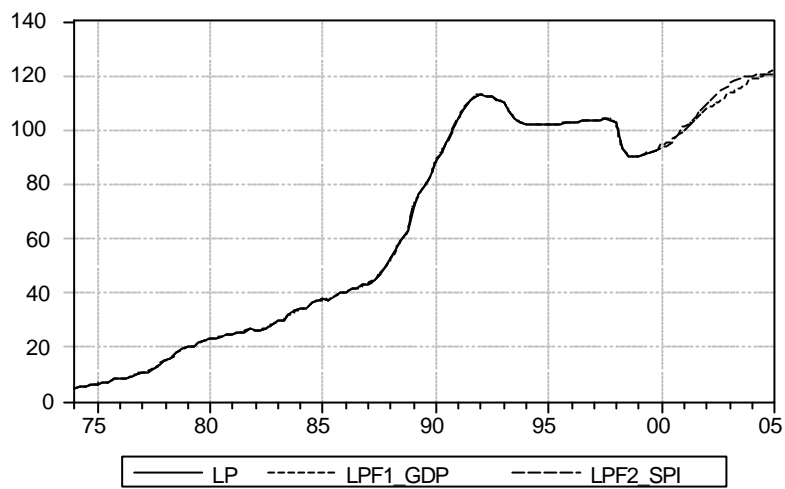
continue to rise at a moderate rate in 2003 and onward.

<Table 6A> Forecasts for GDP and Land Price Index

	GDP_F	LPF1_GDP	GDP_A(%)	LPF1_A(%)
2000:1	74182.89	94.99923	12.3869	4.9639
2000:2	78949.22	95.20341	8.1158	4.3133
2000:3	82111.51	96.72853	6.0480	5.1223
2000:4	90089.72	98.80632	4.3497	6.4226
2001:1	78251.61	101.4922	5.4847	6.8347
2001:2	82522.94	102.0729	4.5266	7.2156
2001:3	84956.15	103.7729	3.4644	7.2826
2001:4	92282.35	105.7670	2.4338	7.0448
2002:1	80783.21	108.1536	3.2352	6.5635
2002:2	84939.67	108.7147	2.9285	6.5069
2002:3	87129.01	110.2982	2.5576	6.2880
2002:4	94207.73	111.9862	2.0864	5.8801
2003:1	83005.79	113.9685	2.7513	5.3765
2003:2	87138.85	114.3540	2.5891	5.1872
2003:3	89282.22	115.7218	2.4713	4.9173
2003:4	96310.99	117.1188	2.2326	4.5832
2004:1	85347.03	118.7862	2.8206	4.2272
2004:2	89484.96	119.0091	2.6924	4.0708
2004:3	91650.77	120.1892	2.6529	3.8605
2004:4	98696.41	121.3778	2.4768	3.6365
2005:1	87901.24	122.8438	2.9927	3.4159

Note: _A represents annualized rate of change over the same period of previous year.

<Figure4> Land Price Forecast using an Error Correction Model

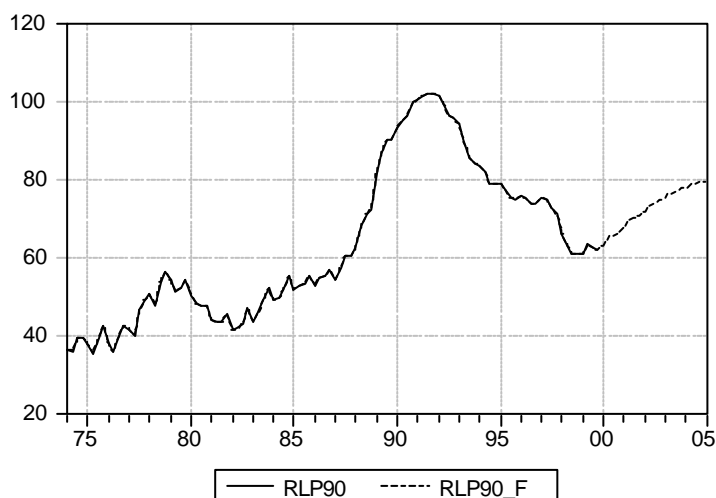


Note : 1) Actual values up to Q4,1999, Predicted values thereafter
2) LPF1 and LPF2 are based on cointegration with GDP and SPI

<Table 6B> Forecasts for Stock Price Index and Land Price Index

	SPI_F	LPF2_SPI	SPI_A(%)	LPF2_A(%)
2000:1	985.9660	93.62823	72.2813	3.4491
2000:2	1036.149	94.11189	34.6873	3.1173
2000:3	1022.174	95.85267	8.3041	4.1705
2000:4	1019.628	98.26437	10.7008	5.8389
2001:1	1019.181	100.2341	3.3688	7.0555
2001:2	996.3305	102.3593	-3.8429	8.7634
2001:3	964.6524	104.9678	-5.6274	9.5095
2001:4	935.4402	107.4976	-8.2568	9.3964
2002:1	906.4528	109.7135	-11.0607	9.4573
2002:2	875.3020	111.8354	-12.1474	9.2576
2002:3	846.6522	113.8597	-12.2324	8.4710
2002:4	825.0071	115.5811	-11.8055	7.5197
2003:1	809.7056	116.9692	-10.6732	6.6133
2003:2	799.9154	118.1235	-8.6126	5.6227
2003:3	797.3942	119.0507	-5.8180	4.5592
2003:4	802.7885	119.7173	-2.6931	3.5786
2004:1	814.6529	120.1707	0.6110	2.7370
2004:2	831.8627	120.4894	3.9938	2.0029
2004:3	853.9705	120.7108	7.0951	1.3944
2004:4	879.8521	120.8659	9.5995	0.9595
2005:1	907.8303	121.0122	11.4377	0.7003

<Figure 5> Relative Price of Land (RPL) Forecast using ECM

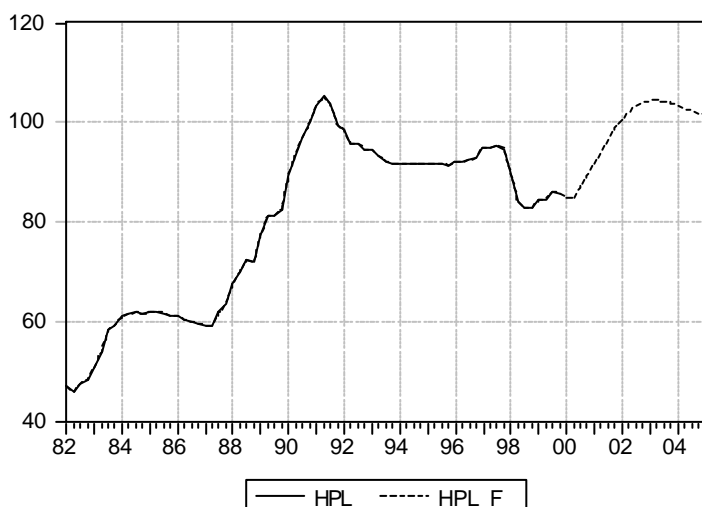


Note : Actual values up to Q4,1999, Predicted values thereafter

<Table 7> Forecasts for Purchase Price of Housing and Chonse i Deposit

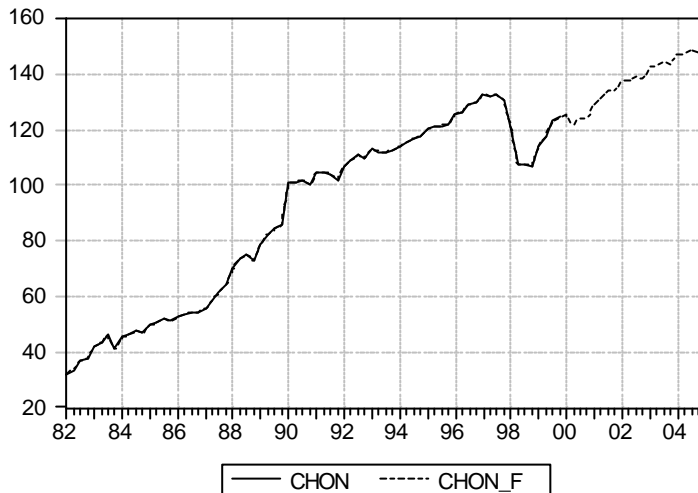
	RLP_F	HPL_F	CHON_F	RLP_A (%)	HPL_A (%)	CHON_A (%)
2000:1	63.34236	84.97636	125.1111	3.4695	0.6934	9.7215
2000:2	65.58051	84.69791	121.9239	3.2379	0.0633	3.7109
2000:3	65.81334	86.76002	123.8082	5.1128	0.7861	0.2991
2000:4	66.20769	89.21151	124.0325	6.6450	4.0501	-0.4157
2001:1	67.58512	91.64421	128.8876	6.6981	7.8467	3.0185
2001:2	69.54675	94.23286	131.2871	6.0479	11.2576	7.6796
2001:3	70.13957	96.79623	134.1853	6.5735	11.5678	8.3816
2001:4	70.84115	98.91080	133.8385	6.9984	10.8722	7.9059
2002:1	71.93750	100.6754	137.3506	6.4398	9.8546	6.5662
2002:2	73.49335	102.1469	137.4958	5.6747	8.3984	4.7291
2002:3	74.10803	103.2798	139.1055	5.6579	6.6982	3.6667
2002:4	74.84779	104.0198	138.5576	5.6558	5.1653	3.5260
2003:1	75.53961	104.4071	142.3825	5.0073	3.7067	3.6636
2003:2	76.65670	104.4810	142.8539	4.3043	2.2850	3.8969
2003:3	77.15423	104.2832	144.4977	4.1105	0.9715	3.8763
2003:4	77.81968	103.8809	143.7406	3.9706	-0.1335	3.7407
2004:1	78.10893	103.3663	147.1607	3.4013	-0.9969	3.3559
2004:2	78.82103	102.8248	147.2754	2.8234	-1.5852	3.0951
2004:3	79.16586	102.3335	148.7970	2.6073	-1.8696	2.9753
2004:4	79.72886	101.9619	148.0999	2.4533	-1.8474	3.0328
2005:1	79.67568	101.7666	151.6948	2.0058	-1.5476	3.0811

<Figure 6> Housing Price Forecast



Note : Actual values up to Q4,1999, Predicted values thereafter

<Figure 7> Chonseil deposit Forecast



Note : Actual values up to Q4,1999, Predicted values thereafter

3. Limitations of the Forecasts

The accuracy of our forecasts will be conditioned by the assumption that real GDP and stock prices will behave according to the predictions made from their past values. In fact, apart from the forecasting model used, forecasting performance is also affected by such factors as reference points and forecasting horizons. In order to examine the accuracy of our forecasts, the forecasting equations in (3) and (5) were re-estimated using the data until Q4 1995 and Q4 1997, to generate ex-post forecasts for land price at two reference points, Q1 1996 and Q4, 1998, respectively. The forecasts are plotted in figure A1 in the appendix together with the actual land price data until Q1 2000.

For the forecasting period 1996-99, both forecasts diverge from the actual price path, while LPF2 based on cointegration between LP and SPI did better than LPF1 based on that between LP and GDP. In other words, the model would not have predicted the sudden fall in land price caused by the economic crisis that broke out in 1997. As for the forecasts made at Q1 1998, LPF2 does a decent job of forecasting the decline in LP series, whereas LPF1 predicts a flat path. Although one cannot draw too strong a conclusion from this limited forecasting exercise, the findings suggest that SPI is more useful than GDP in forecasting land price. We conducted a similar exercise to find that the same is true of forecasting for housing prices.

A more serious concern is the fact that real estate prices are affected by changes in government policies as well as on macroeconomic variables. For example, launching of a secondary mortgage facility, relaxation of green belt regulations and other policies will have an impact on housing and land prices. These are structural changes imposed on an econometric model, and hence affect the accuracy of forecasting. Since we did not take these possible changes into consideration in our forecasting exercises, the accuracy of our forecasts might be impaired if and when the changes actually take place.

V. Summary and Conclusions

The main objective of this paper was to analyze the trends and fluctuations of real estate prices in Korea and offer price forecasts for the short- and medium run. Our main interest was in examining whether real estate price movements can be interpreted as the formation and collapse of price bubbles, since earlier studies have confirmed their existence in the late 1980s.

We found no evidence of a price bubble over an extended period of 1974-99. Cointegration test results of quarterly data suggest that long-run relationships exist between land price and GDP and between land price and stock prices. Purchase price of housing and chonsei deposit index are also cointegrated with stock price index. These cointegration relationships were used together with error correction models to derive forecasts for the price of land and housing for the 2000-2005 period.

Quite a few studies of the U.S. housing markets (Shiller 1990 and Cho 1996) suggest that they are not efficient and that housing prices can fluctuate substantially due to irrational and speculative transactions. However, attempts to attribute real estate price fluctuations to bubbles are not desirable because they might discourage serious efforts to analyze the underlying causes and to find solutions.

In case of Korea, many commentators tend to believe that a series of measures introduced in the name of the so-called “public concept of land” made a great contribution to stabilizing real estate prices in the early 1990s. However, a careful look at the data suggests that they must have had a very limited effect on the housing market. The tax on unrealized capital gain on undeveloped land did increase the supply of row houses for rental and owner-occupation. Nevertheless, the number of those units built between 1988 and 1997 was about 750,000 and it was only 13 % of

the total supply of new houses during the same period. The main reason for the decline in housing prices was the massive supply of housing. The number of dwelling units supplied during the 1988-97 period was 5,840,000, which was equal to 55 % of the total housing stock at the 1997 year-end, 10, 630,000 units. After all, what happened was a clear example of market forces in action, rather than the result of suppressing speculation. One relevant lesson, though, is that inadequate supply of developable land and housing can instigate speculation because it validates the expectation for price increases.

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[Appendix]

	PCH_LP	PCH_GDP	PCH_NGDP	PCH_CPI	PCH_M2	PCH_SPI
PCH_LP	1.000					
PCH_GDP	0.456	1.000				
PCH_NGDP	0.773	0.379	1.000			
PCH_CPI	0.493	- 0.286	0.709	1.000		
PCH_M2	0.400	- 0.072	0.492	0.458	1.000	
PCH_SPI	0.065	0.367	- 0.057	- 0.250	0.113	1.000

Note: Based on annual data for the 1974-1999 period. PCH means percentage change.

<Table A-1> Correlation between % changes in land price and macroeconomic variables

- Cointegration test									
H ₀ : r = 0 LR = 26.25** Critical Values: 20.04(1%), 15.41(5%)									
H ₀ : r = 1 LR = 3.36 Critical Values: 6.65(1%), 3.76(5%)									
Normalized Cointegrating Vector: z _t = HPL _t - 0.0525SPI _t - 50.611									
- Estimation of error-correction models									
Regressor	HPL _t				SPI _t				
z _{t-1}	- 0.12 (- 4.10)				1.49 (1.12)				
Constant	0.32 (1.54)				10.41 (1.08)				
HPL _{t-1} to HPL _{t-4}	0.41 (3.42)	0.05 (0.39)	- 0.08 (- 0.62)	0.18 (1.60)	5.43 (0.96)	- 2.79 (- 0.46)	0.49 (0.08)	- 11.04 (- 2.10)	
SPI _{t-1} to SPI _{t-4}	0.00 (0.11)	- 0.004 (- 1.32)	- 0.009 (- 2.72)	- 0.003 (- 0.89)	0.26 (1.96)	0.05 (0.37)	0.31 (2.13)	- 0.03 (- 0.16)	
R ² / Adj R ²	0.560 / 0.490				0.253 / 0.135				

Note:1) Sample period: 1982. Q1 1999. Q4

2) Figures in parentheses are t-values.

<Table A-2> Cointegration between housing price and stock price

- Cointegration test									
H ₀ : r = 0 LR=16.16* Critical Values: 20.04(1%), 15.41(5%)									
H ₀ : r = 1 LR= 2.63 Critical Values: 6.65(1%), 3.76(5%)									
Normalized Cointegrating Vector: z _t =CHON _t - 0.1123SPI _t - 26.226									
- Estimation of error-correction models									
Regressor	CHON _t				SPI _t				
z _{t-1}	- 0.08 (- 3.17)				0.54 (0.76)				
Constant	4.51 (5.48)				46.77 (2.03)				
SD2 SD3 SD4	- 5.46 (- 4.37)	- 2.18 (- 2.21)	- 5.38 (- 4.16)		- 59.95 (- 1.71)	- 15.90 (- 0.58)	- 54.07 (- 1.50)		
CHON _{t-1} to CHON _{t-4}	0.33 (2.57)	- 0.15 (- 1.12)	- 0.04 (- 0.33)	- 0.15 (- 1.20)	3.56 (0.99)	- 6.06 (- 1.64)	1.89 (0.51)	- 6.26 (- 1.76)	
SPI _{t-1} to SPI _{t-4}	0.007 (1.47)	0.00 (0.19)	- 0.01 (- 2.39)	- 0.00 (- 0.07)	0.27 (1.99)	0.01 (0.05)	0.34 (2.27)	- 0.02 (- 0.11)	
R ² / Adj R ²	0.576 / 0.482				0.271 / 0.110				

Note: 1) Same as in <Table A-2>.

2) Seasonal dummy was included in the VAR model.

<Table A-3> Cointegration between housing rent and stock price

< Figure A1> Ex-post Forecasts for Land Price

