INTERNATIONAL REAL ESTATE REVIEW

2013 Vol. 16 No. 2: pp. 166 – 188

Valuation of Brokers over Real Estate Cycles: Korean Evidence*

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We examine a unique Korean data set, the Kookmin Bank apartment price index, which is based on broker appraisals, in order to shed light on how brokers determine valuation over real estate cycles. We build a repeat sales apartment price index as well as a hedonic apartment price index by using the transaction data, which have become available in the public domain since 2006, and compare them with the Kookmin Bank apartment price index. By examining the volatility in the broker appraisals as well as the partial adjustment models of broker appraisals, we find that the appraisals are smoothed. Furthermore, the smoothing is asymmetrical and greater during down markets than up markets. These findings are consistent with the hypothesis that brokers impound new transaction prices by using the quality of information as weight. The extent of smoothing and asymmetry in smoothing broker appraisals persist over two subsequent cycles contrary to the expectation that they would become more sensitive to transaction prices as transaction prices become more widely spread.

Keywords

Real estate brokers; Appraisals; Appraisal smoothing; Real estate cycles; Transaction prices; Disclosure

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* We thank Ko Wang, Brent Ambrose and Wen-Chi Liao for their helpful comments, which helped to immeasurably improve the paper.
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1. Introduction

Many countries have recently experienced significant boom and bust cycles in the property market and as a result, significant attention is now focused on the valuation of brokers in contributing to these cycles. Thus, we investigate a unique Korean data set called the Kookmin Bank apartment price index, in order to shed light on how brokers determine valuation over a cycle.

The Kookmin Bank apartment price index, which is based on appraisals of neighborhood real estate brokers, is the most widely used residential price index in Korea. Until recently, residential transaction information has been very limited so that transaction price based indices such as a repeat sales price index and a hedonic price index were not available in Korea.[1] We study the behavior of broker appraisals over the two recent cycles by building a repeat sales price index as well as a hedonic index.

Since transaction prices were not reported to the government prior to January 2006, there are few transaction prices before then to construct a real estate price index for the Korean residential market. In July 2005, the Korean government revised the Real Estate Brokerage Act, which made it mandatory to report the actual sales prices of real estate transactions from January 1, 2006 onwards in order to improve the transparency in the real estate markets. The Ministry of Land, Transport and Maritime Affairs discloses the actual sales prices of apartment condominiums every month on their website. Since 1986, the Kookmin Bank has published an apartment price index based on a survey of licensed real estate brokers. Brokers included in the survey are expected to report their opinions on the market prices of sampled housing units, which are based on private information, including recent transaction prices in the neighborhood.

In order to study the behavior of broker appraisals, we construct a repeat sales apartment price index by using data available from January 2006 to December 2010. We use a method that estimates the repeat sales price index which has been modified to deal with less than perfect provisions of transaction data. We also construct a hedonic apartment index by using a standard method that estimates the hedonic price index, which reflects the idiosyncrasies of the Korean apartment market.

By using the transaction prices collected from January 2006 to December 2010, we construct a repeat sales apartment price index as well as a hedonic index for three districts in the greater Kangnam submarket in Seoul and compare them with the price index based on broker appraisals. We find evidence that smoothing occurs in the broker quotes, but it is asymmetrical,

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[1] The Korea Appraisals Institute began publishing a repeat sales price index in December 2009.

being far greater during the down market than the up market. However, contrary to our expectation that the disclosure of transaction prices would reduce smoothing over time, the degree of smoothing does not appear to diminish in the second real estate cycle compared to the first real estate cycle since the introduction of the disclosure regulation of transaction prices.

The paper is organized as follows. In Section 2, we review the relevant literature and develop hypotheses. We present the methodology in Section 3, consider data issues in Section 4 and report the results in Section 5. Finally, we offer the concluding remarks in Section 6.

2. Literature Review and Hypotheses Development

Broker appraisals have played an essential role in the Korean residential markets where transaction prices had been unavailable until 2006. In Korea, one can readily find neighborhood brokers who can provide daily movement of house prices. These broker appraisals are considered to be an accurate reflection of the market and heavily affect the market participants. The Kookmin Bank apartment price index is the best known apartment prices index based on broker appraisals and has been available since 1986. For this reason, we use this index as a proxy for broker appraisals.

In order to study the behavior of broker appraisals, we compare the price index based on broker appraisals with two transaction price based indices, namely, the repeat sales price index and the hedonic price index. The former was first proposed by Bailey, Muth, and Nourse (1963) and a modified version of the latter was popularized by Case and Shiller (1987). Since the repeat sales index only uses data that involve houses which have been traded twice or more, there is a concern for sampling bias as well the inefficiency of data usage (Clapp and Giaccotto, 1992). In order to overcome the limitations of the repeat sales index, we build a hedonic price index as a supplementary measure of true transaction prices by estimating the hedonic price regression equation.

A number of studies report that appraisers smooth house valuation prices. Diaz and Wolverton (1998) report evidence of appraisal smoothing and attribute the reduced variability of real estate return series to appraisers that are being influenced by their own previous value estimates. Webb (1994) reports that appraisers tend to underestimate value in rising markets and overestimate value in falling markets. He holds that smoothing arises from appraisers who rationally weight previous value estimates against subsequent market information. Furthermore, Geltner (1993) has developed an approach to recovering the underlying market returns from observable appraisal-based index returns by explicitly correcting for appraisal smoothing.

Clayton, Geltner and Hamilton (2001) report an average lag of about three quarters at the individual appraisal level. They suggest that this is a rational action by the appraisers because as uncertainty about new information increases, less weight is rationally placed on the new information, and appraisers tend to rely more heavily on older data. We extend the information-based interpretation of appraisal smoothing by Clayton, Geltner and Hamilton and postulate that, when transaction volume decreases, deteriorating the quality of the market information, brokers place a lower weight on current market prices and a greater weight on past appraisal information, resulting in a smoothed valuation time series. Therefore, the quality of information hypothesis implies that broker appraisals are more smoothed in a down market than an up market. We test the notion of information based weighting in appraisal smoothing by examining whether the smoothing is asymmetrical, that is, whether the smoothing is greater during the down market than during the up market.

Chinloy, Cho and Megbolugbe (1997) report that appraisal values are systematically about 2% higher than purchase data and explain this difference by broker incentives to ensure that buyers get mortgage loans large enough to close the deal, thus contributing to the broker’s commission, which is based on transaction volume. Extending the notion of the transaction incentive from the work of Chinloy, Cho and Megbolugbe, we examine whether the disclosure of transaction prices decreases the smoothing of the broker appraisals over time and whether asymmetrical smoothing lessens as transaction prices become more and more widely available with time.

3. Methodology

The following is an explanation of the methodology that we have employed to construct the repeat sales apartment price index by using data available from January 2006 to December 2010. In the repeat sales index estimation proposed by Bailey et al., time dummies are created for the entire estimation period. These time dummies enter the regression equation as explanatory variables where the dependent variable is the natural logarithm of the current period price. For a given apartment transaction, we assign to the time dummies, values of 1 for the transaction months, otherwise 0. By regressing, we obtain price indices for each period.

In this paper, we have modified the traditional estimation method for repeat sales indices since the Ministry of Land, Transport and Maritime Affairs only discloses the name of the apartment complex that an apartment belongs to, as well as the floor and the size of the apartment, but not the unit number; therefore, making a perfect identification of the apartments impossible. We circumvent this problem by noting an idiosyncrasy of the Korean apartment markets where apartments which are found in the same apartment complex, on the same floor and have the same square footage can be considered essentially the same apartments from a pricing perspective. Here, we use similarity matching rather than perfect matching where repeat sales pairs are formed from similar apartments rather than the same apartments.[2] This procedure results in substantially increasing the repeat sales pairs, which enables us to construct a repeat sales index based on a limited sample period over which transaction prices are available.

By following the standard estimation method for repeat sales indices, we regress the natural logarithm of the ratio of the second to the first sales prices of each repeat sales pair i on $D_{i,t}$, a series of time indicators which equal –1 (when the first sale takes place), +1 (when the second sale takes place) or 0 (any other time).

$$\ln \frac{P_{i,t_2}}{P_{i,t_1}} = \sum_{t=1}^{T} \beta_t \cdot D_{i,t} + \ln \varepsilon \tag{1}$$

The estimated cumulative market return from time 0 to t is thus:

$$\hat{c}r_t = e^{\beta_t} - 1 \tag{2}$$

Finally, setting the index to 100 for time 0, which is January 2006 for our study, the index value for time t is:

$$P_t = 100 \times e^{\beta_t} \tag{3}$$

We explain below the methodology that we have employed to construct the hedonic apartment price index by using data available from January 2006 to June 2009. In the hedonic price index estimation proposed by Rosen (1974), time dummies are created for the entire estimation period. These time dummies enter the regression equation as explanatory variables where the dependent variable is the natural logarithm of the current period price. For a given apartment transaction, we assign to the time dummies, values of 1 for the transaction months, otherwise 0. By regressing, we obtain price indices for each period.

In this paper, we have used the traditional estimation method for the hedonic price index to reflect an idiosyncrasy of the Korean apartment markets. Following the estimation method for the hedonic price index, we regress the natural logarithm of the price on D_i, a series of time indicators which equal 1 (when the sale takes place), or 0 (any other time).

$$\ln P_i = \alpha + \sum_{i=1}^{k} \beta_i \ln X_i + \sum_{t=2}^{T} \gamma_i \cdot D_i + \ln \varepsilon \tag{4}$$

[2] The Ministry of Land, Transport and Maritime Affairs also takes this approach in constructing their residential repeat sales index. The results reported in this paper hold even when we use an identical match.

Finally, by setting the index to 100 for time 0, which is January 2006 for our study, the index value for time t is:

$$P_t = 100 \times e^{\beta_t} \tag{5}$$

The sample descriptions and summary statistics of the variables used to estimate the hedonic regression equation (4) and the estimated coefficients of the priced attributes are shown in Appendix A. However, we do not report the coefficients of the time dummies in order to keep the presentation compact.

4. Data

We use the apartment sales prices, which the Ministry of Land, Transport and Maritime Affairs began publishing on their web-site since January 2006, to construct the repeat sales price index. Therefore, the study period extends from January 2006 to December 2010, which gives 60 monthly observations. To study the broker appraisals based the apartment prices index, we use the Kookmin Bank apartment price index, which is the official price index in Korea and often used as the basis of loan collateral valuation. We analyze Kangnam, Seocho, and Songpa, which are three districts of the greater Kangnam submarket located in Seoul to the south of the Han River.[3] In most other submarkets, we have found that there are not enough sales to construct the house price index. We do not build a single Kangnam submarket repeat sales index or hedonic price index since the Kookmin Bank did not release the corresponding Kangnam submarket index.

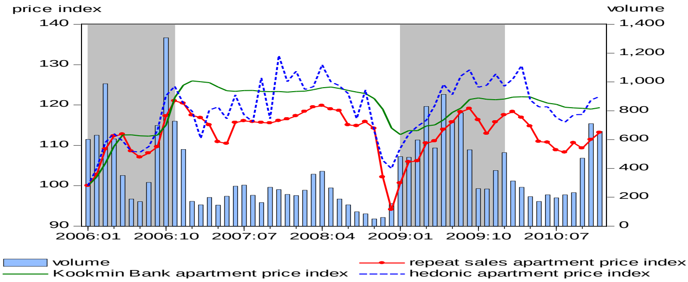
As shown in Figure 1, we have identified two real estate cycles since January 2006 by using the transaction volumes as a guide. The first cycle extends from January 2006 to December 2008 where the up market is from January 2006 to November 2006 and the down market is from December 2006 to December 2008. The second cycle is from January 2009 to December 2010 where the up market is from January 2009 to January 2010 and the down market is from February 2010 to December 2010. Note that the high transaction volume periods (shaded areas) coincide with the periods of price run-ups as measured by the transaction price indices and the low transaction volume periods coincide with the periods of a price downturn.[4] An up market followed by a down market allows us to investigate the behavior of broker appraisals within a cycle while two consecutive real estate cycles allow us to study the impact

[3] Kangnam, Seocho, and Songpa are also known as Kangnam or the three districts of Kangnam, while Kangnam literally means "to the south of the Han River."

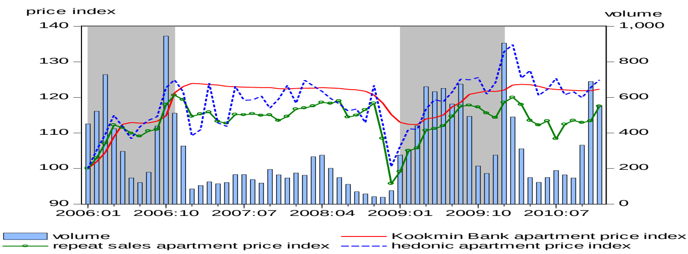
[4] While the precise identifications of two cycles and four subperiods are somewhat arbitrary, market participants would not strongly disagree with these demarcations. The main contentions of the paper are not influenced at all by the precise demarcation of two cycles and four subperiods.

of the introduction of the disclosure regulation of transaction prices on broker appraisals over time.

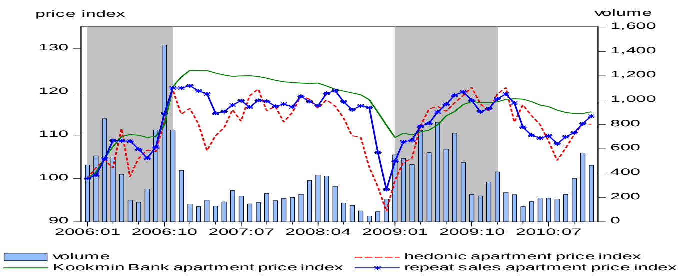
Figure 1 Identification of Down Markets and Up Markets Based on Residential Transaction Volumes



(a) Kangnam



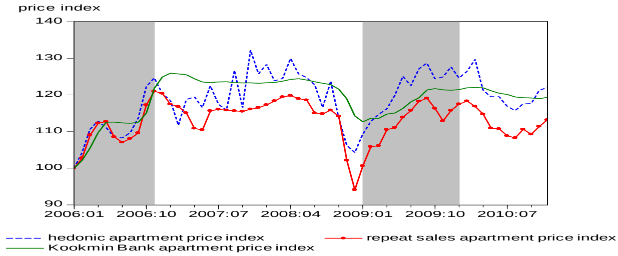
(b) Seocho



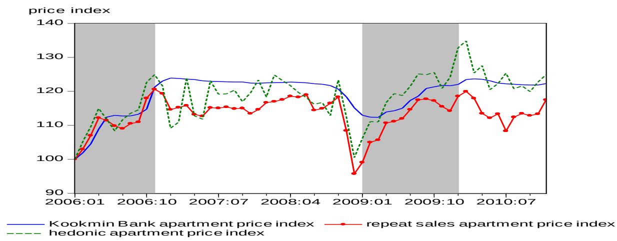
(c) Songpa

Solid line: Kookmin Bank apartment price index; dotted line: hedonic apartment price index: symbol line: repeat sales apartment price index
Up markets are shown as shaded area. The first up market is for 2006:01-2006:11 and the second up market is for 2009:01-2010:01. The first down market is for 2006:12-2008:12 and the second down market is for 2010:02-2010:12.

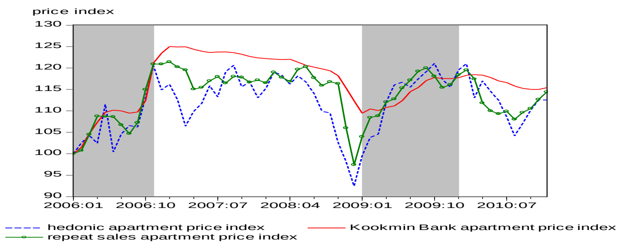
Figure 2 Apartment Price Index and Hedonic Apartment Price Index Based on Broker Appraisals



(a) Kangnam



(b) Seocho



(c) Songpa

Solid line: Kookmin Bank apartment price index; dotted line: hedonic apartment price index: symbol line: repeat sales apartment price index
Up markets are shown as shaded area. The first up market is for 2006:01-2006:11 and the second up market is for 2009:01-2010:01. The first down market is for 2006:12-2008:12 and the second down market is for 2010:02-2010:12.

5. Results

Figure 2 shows the Kookmin Bank apartment price index, which is based on broker appraisals, and the repeat sales as well as the hedonic apartment price indices for all three districts. A comparison between the two transaction price indices and the Kookmin Bank apartment price index indicates that, during house price run-up, both indices rise more or less together, showing a similar pattern. On the other hand, during the down market, the Kookmin Bank apartment price index shows very little price change.

We examine whether the broker appraisals are smoothed, and if so, the nature of the smoothing. First, we measure the extent of the smoothing in the broker appraisals by using a standard deviation. As shown in Table 1, we find that the standard deviation of the Kookmin Bank apartment price index (A) is consistently lower than that of the repeat sales apartment price index (B). The lower volatility of broker appraisals suggests that they are smoothed versions of the transaction prices.

Table 1 Difference in Volatility Between Broker Appraisals and Transaction Prices During the Up Markets and the Down Markets

Panel A. Kangnam

index	Kookmin Bank index (A)	repeat sales index (B)	A-B
first up market (C)	5.22	5.96	-0.74(1.05)
first down market (D)	2.32	5.69	-3.36(0.17)[a]
second up market (E)	3.49	5.60	-2.11(0.39)[c]
second down market (F)	1.21	3.52	-2.31(0.12)[a]
C-D	2.90(6.92)[a]	0.27(1.09)	
E-F	2.28(8.32)[a]	2.09(2.54)[c]	

Panel B. Seocho

index	Kookmin Bank index (A)	repeat sales index (B)	A-B
first up market (C)	5.15	5.86	-0.71(1.12)
first down market (D)	1.84	4.61	-2.78(0.16)[a]
second up market (E)	3.81	5.81	-2.00(0.43)[c]
second down market (F)	0.70	3.34	-2.65(0.04)[a]
C-D	3.31(11.40)[a]	1.24(1.61)	
E-F	3.12(30.08)[a]	2.47(3.02)[b]	

Panel C. Songpa

index	Kookmin Bank index (A)	repeat sales index (B)	A-B
first up market (C)	4.62	5.99	-1.37(0.89)
first down market (D)	3.03	4.94	-1.91(0.38)[a]
second up market (E)	3.30	4.88	-1.58(0.46)
second down market (F)	1.38	3.91	-2.53(0.12)[a]
C-D	1.59(3.51)[a]	1.05(1.47)	
E-F	1.92(5.73)[a]	0.97(1.56)	

Notes: Cycle 1 : 2006:01-2008:12; Cycle 2 : 2009:01-2010:12.

[a] denotes significance at the 1% level.

[b] denotes significance at the 5% level.

The t-statistics are shown in round brackets.

Next, we compare the standard deviations of the Kookmin Bank apartment price index between the up market and the down market. In the first cycle, the standard deviation of the Kookmin Bank apartment price index during the up market (C) is consistently higher than that during the down market (D). We find that the same is true of the second cycle where the standard deviation of the Kookmin Bank apartment price index during the up market (E) is consistently higher than that during the down market (F). This is the first piece of evidence that smoothing in broker appraisals is asymmetrical and greater during the down market than during the up market.

We examine the smoothing phenomenon over the housing market cycle by using a partial adjustment model where appraised values are updated with contemporaneous transaction prices. We estimate the following regression model adapted from Clayton, Geltner and Hamilton (2001) to empirically test the partial adjustment model of broker appraisals:

$$\frac{Q_t}{Q_{t-1}} = \alpha + \beta\left(\frac{P_t}{Q_{t-1}}\right) \tag{6}$$

where Q_t is the Kookmin Bank apartment price index at time t, and P_t is the repeat sales apartment price index at time t. In this model, a constant term, α, measures the weight placed on the previous appraisal, while the slope coefficient, β, measures the weight placed on new market information observable since the previous appraisal. Under the null hypothesis of complete adjustment, β should equal one. Under the alternative hypothesis of partial adjustment, β is positive and less than one. The alternative hypothesis leads to the inference that brokers place only partial weight on the new information, which leads to the smoothing in the time series of the broker appraisals.

We estimate the appraisal adjustment model for the entire sample period from January 2006 to December 2010 by using the repeat sales model. We find that the coefficients of the new transaction prices are 0.26, 0.25 and 0.28 for Kangnam, Seocho and Songpa, respectively, which indicate that the broker appraisals are smoothed. In order to examine whether the smoothing weakens over time, we estimate the appraisal adjustment model for the first as well as the second real estate cycle. The coefficients of the new transaction prices drop to 0.19, 0.19 and 0.16 for Kangnam, Seocho and Songpa, respectively. In all three districts, the coefficients of the new transaction prices decrease rather than increase in the second cycle, which suggests that the smoothing does not weaken over time; rather, it persists over time. Overall, the deviation of broker appraisals from the new transaction prices is remarkable.

Table 2 Estimation of the Partial Adjustment Model of Broker Appraisals by Using the Repeat Sales Index

Panel A. Kangnam

coefficient	All periods (2006:01-2010:12)		Cycle 1 (2006:01-2008:12)		Cycle 2 (2009:01-2010:12)	
α	0.75	(48.89)[a]	0.74	(36.63)[a]	0.83	(36.26)[a]
β	0.26	(5.66)[a]	0.28	(13.32)[a]	0.19	(7.78)[a]
adjusted R-squared	0.82		0.84		0.73	
White-statistic	8.28	[0.01]	4.84	[0.08]	1.90	[0.39]
DW-statistic	1.23		1.23		1.69	

Panel B. Seocho

coefficient	All periods (2006:01-2010:12)		Cycle 1 (2006:01-2008:12)		Cycle 2 (2009:01-2010:12)	
α	0.77	(40.92)[a]	0.75	(28.39)[a]	0.82	(32.94)[a]
β	0.25	(12.51)[a]	0.26	(9.62)[a]	0.19	(7.12)[a]
adjusted R-squared	0.73		0.73		0.69	
White-statistic	12.40	[0.01]	7.54	[0.02]	10.51	[0.01]
DW-statistic	1.65		1.57		2.62	

Panel C. Songpa

coefficient	All periods (2006:01-2010:12)		Cycle 1 (2006:01-2008:12)		Cycle 2 (2009:01-2010:12)	
α	0.73	(25.56)[a]	0.65	(17.30)[a]	0.85	(47.48)[a]
β	0.28	(9.59)[a]	0.36	(9.20)[a]	0.16	(8.60)[a]
adjusted R-squared	0.61		0.71		0.77	
White-statistic	19.14	[0.01]	16.92	[0.01]	2.55	[0.28]
DW-statistic	1.23		1.47		2.01	

Notes: [a] denotes significance at the 1% level.

$$\frac{Q_t}{Q_{t-1}} = \alpha + \beta\left(\frac{P_t}{Q^*_{t-1}}\right)$$

Q_t : Kookmin Bank apartment price index
P_t : Repeat sales apartment price index

Cycle 1 : 2006:01-2008:12; Cycle 2 : 2009:01-2010:12.
T-statistics based on Newey-West heteroskedasticity and autocorrelation consistent standard errors are shown in round brackets, while p-values are in square brackets.

We estimate the appraisal adjustment model for the entire sample period by using the hedonic price index. As with the repeat sales index, we find that the broker appraisals are smoothed and the smoothing persists through two cycles. However, the coefficients of the new transaction prices are consistently smaller by using the hedonic price index rather than the repeat sales index. This is likely due to the greater price fluctuation in the hedonic price index. Furthermore, the slope coefficients decrease from the first cycle to the second cycle, which is the same as the repeat sales index. Overall, the deviation of broker appraisals from the new transaction prices is even more remarkable.

Table 3 Estimation of the Partial Adjustment Model of Broker Appraisals by Using the Hedonic Price Index

Panel A. Kangnam

coefficient	All periods (2006:01-2010:12)		Cycle 1 (2006:01-2008:12)		Cycle 2 (2009:01-2010:12)	
α	0.82	(30.46)[a]	0.79	(21.67)[a]	0.86	(29.61)[a]
β	0.18	(6.63)[a]	0.22	(5.89)[a]	0.13	(4.63)[a]
adjusted R-squared	0.43		0.49		0.48	
White-statistic	9.06	[0.01]	9.45	[0.01]	2.70	[0.26]
DW-statistic	0.87		0.99		1.81	

Panel B. Seocho

coefficient	All periods (2006:01-2010:12)		Cycle 1 (2006:01-2008:12)		Cycle 2 (2009:01-2010:12)	
α	0.84	(35.54)[a]	0.81	(25.63)[a]	0.86	(25.89)[a]
β	0.16	(6.76)[a]	0.19	(6.11)[a]	0.14	(4.27)[a]
adjusted R-squared	0.44		0.52		0.44	
White-statistic	12.21	[0.01]	8.53	[0.01]	5.36	[0.07]
DW-statistic	1.10		1.40		1.77	

Panel C. Songpa

coefficient	All periods (2006:01-2010:12)		Cycle 1 (2006:01-2008:12)		Cycle 2 (2009:01-2010:12)	
α	0.83	(34.05)[a]	0.78	(23.69)[a]	0.89	(38.38)[a]
β	0.18	(6.82)[a]	0.23	(6.67)[a]	0.11	(4.73)[a]
adjusted R-squared	0.44		0.56		0.49	
White-statistic	12.63	[0.01]	13.62	[0.01]	0.50	[0.77]
DW-statistic	1.02		1.14		1.43	

Notes: [a] denotes significance at the 1% level.

$$\frac{Q_t}{Q_{t-1}} = \alpha + \beta\left(\frac{P_t}{Q^*_{t-1}}\right)$$

Q_t : Kookmin Bank apartment price index
P_t : Hedonic apartment price index

Cycle 1 : 2006:01-2008:12, Cycle 2 : 2009:01-2010:12.
T-statistics based on Newey-West heteroskedasticity and autocorrelation consistent standard errors are shown in round brackets, while p-values are in square brackets.

We estimate the partial adjustment models of broker appraisals for the first and second up markets and the first and second down markets by using the repeat sales index and compare the slope coefficients of the new transaction prices. As reported in Table 4, for all three districts, we find that smoothing is far greater during the down market than during the up market both in the first and the second cycles. During the first up market, the slope coefficients of Kangnam, Seocho and Songpa are 0.40, 0.43 and 0.57, respectively, which imply that half of the new transaction prices are priced in the broker appraisals. During the first down market, the slope coefficients of the new transaction prices in Kangnam, Seocho and Songpa decrease to 0.22, 0.16 and 0.18, respectively, which imply that only about 16% to 18% of the new transaction prices are priced in the broker appraisals during the first down market. Similarly, the coefficients of the new transaction prices are greater in the second up market than the second down market.

We conclude that broker appraisals are far more smoothed than transaction prices during the down market rather than the up market. We also note that given that the slope coefficient of new transaction prices reported by Clayton, Geltner and Hamilton is 0.815 for their Canadian commercial property sample, the slope coefficients of new transaction prices observed for the Kangnam, Seocho and Songpa districts are overall very low, especially during the down market. This leads to the appearance of extreme rigidity in the broker appraisals during the down market. We also note that the asymmetrical smoothing between the up market and the down market persists over time, which is present during the second real estate cycle as well as the first real estate cycle.

We estimate the partial adjustment model of broker appraisals by using the hedonic price index and report the model estimates in Table 5. In the first cycle, we find that the broker appraisals are far more smoothed during the down markets than during the up markets; the regression coefficients of the new transaction prices in the Kangnam, Seocho and Songpa districts are 0.34, 0.32 and 0.39, respectively, during the up markets, and fall to 0.11, 0.06 and 0.11 during the down markets. The smoothing dramatically increases during the down market. Only about 6% to 11% of the new transaction prices are priced in the broker appraisals during the down market while the new transaction prices account for 32% to 39% of the broker appraisals during the up market.

In the second cycle of Table 5, the regression coefficients of the new transaction prices in the Kangnam, Seocho and Songpa districts are 0.12, 0.13 and 0.09, respectively, during the up markets and fall to 0.07, 0.07 and 0.08 during the down markets. Therefore, by using the hedonic price index, we also find that smoothing is far greater during the down market than during the up market, both in the first and the second cycles. We conclude that the smoothing as well as asymmetrical smoothing between the up market and down market persist over time. In fact, the smoothing during the down market is so extreme that broker appraisals are minimally influenced by new transaction prices during both the first and the second down markets.

Table 4 Estimation of the Partial Adjustment Model of Broker Appraisals by Using the Repeat Sales Index

Panel A. Kangnam

coefficient	first up market (2006:01-2006:11)	first down market (2006:12-2008:12)	second up market (2009:01-2010:01)	second down market (2010:02-2010:12)
α	0.61 (8.47)[a]	0.79 (45.25)[a]	0.81 (16.08)[a]	0.88 (29.34)[a]
β	0.40 (5.66)[a]	0.22 (-11.45)[a]	0.21 (3.97)[a]	0.13 (3.88)[a]
adjusted R-squared	0.78	0.85	0.61	0.65
White-statistic	1.52 [0.22]	1.26 [0.53]	0.08 [0.96]	1.60 [0.45]
DW-statistic	1.65	0.91	1.75	1.95

Panel B. Seocho

coefficient	first up market (2006:01-2006:11)	first down market (2006:12-2008:12)	second up market (2009:01-2010:01)	second down market (2010:02-2010:12)
α	0.58 (5.78)[a]	0.85 (30.51)[a]	0.73 (14.27)[a]	0.93 (37.29)[a]
β	0.43 (4.33)[a]	0.16 (5.34)[a]	0.28 (5.39)[a]	0.07 (2.87)[a]
adjusted R-squared	0.66	0.54	0.74	0.51
White-statistic	2.83 [0.24]	0.19 [0.91]	8.02 [0.02]	0.69 [0.71]
DW-statistic	2.06	0.48	2.98	2.15

Panel C. Songpa

coefficient	first up market (2006:01-2006:11)	first down market (2006:12-2008:12)	second up market (2009:01-2010:01)	second down market (2010:02-2010:12)
α	0.45 (4.64)[a]	0.83 (23.94)[a]	0.77 (15.02)[a]	0.88 (50.96)[a]
β	0.57 (5.91)[a]	0.18 (4.86)[a]	0.23 (4.61)[a]	0.12 (6.69)[a]
adjusted R-squared	0.79	0.49	0.68	0.85
White-statistic	9.26 [0.00]	2.22 [0.33]	0.11 [0.94]	0.82 [0.66]
DW-statistic	2.29	0.61	2.15	2.23

Notes: [a] denotes significance at the 1% level.

$$\frac{Q_t}{Q_{t-1}} = \alpha + \beta\left(\frac{P_t}{Q^*_{t-1}}\right)$$

Q_t : Kookmin Bank apartment price index
P_t : the repeat sales apartment price index

T-statistics based on Newey-West heteroskedasticity and autocorrelation consistent standard errors are shown in round brackets, while p-values are in square brackets.

Table 5 Estimation of the Partial Adjustment Model of Broker Appraisals by Using the Hedonic Price Index

Panel A. Kangnam

coefficient	first up market (2006:01-2006:11)		first down market (2006:12-2008:12)		second up market (2009:01-2010:01)		second down market (2010:02-2010:12)	
α	0.67	(8.50)[a]	0.89	(30.48)[a]	0.88	(12.95)[a]	0.93	(34.26)[a]
β	0.34	(4.42)[a]	0.11	(-3.51)[a]	0.12	(1.90)[c]	0.07	(2.53)[a]
adjusted R-squared	0.67		0.33		0.17		0.44	
White-statistic	3.27	[0.19]	9.61	[0.00]	0.60	[0.74]	0.65	[0.72]
DW-statistic	1.66		0.78		1.82		2.13	

Panel B. Seocho

coefficient	first up market (2006:01-2006:11)		first down market (2006:12-2008:12)		second up market (2009:01-2010:01)		second down market (2010:02-2010:12)	
α	0.69	(6.83)[a]	0.94	(32.12)[a]	0.87	(13.07)[a]	0.93	(24.91)[a]
β	0.32	(3.25)[a]	0.06	(2.02)[c]	0.13	(2.09)[c]	0.07	(1.81)
adjusted R-squared	0.52		0.12		0.30		0.29	
White-statistic	1.36	[0.51]	15.33	[0.00]	4.81	[0.09]	0.71	[0.70]
DW-statistic	1.67		0.43		1.85		1.06	

Panel C. Songpa

coefficient	first up market (2006:01-2006:11)		first down market (2006:12-2008:12)		second up market (2009:01-2010:01)		second down market (2010:02-2010:12)	
α	0.63	(5.66)[a]	0.89	(37.69)[a]	0.91	(17.17)[a]	0.93	(30.19)[a]
β	0.39	(3.51)[a]	0.11	(4.16)[a]	0.09	(1.71)[a]	0.08	(2.34)[b]
adjusted R-squared	0.56		0.42		0.23		0.41	
White-statistic	7.30	[0.03]	4.53	[0.10]	0.24	[0.89]	1.90	[0.38]
DW-statistic	1.98		0.72		1.52		1.19	

Notes: [a] denotes significance at the 1% level.

$$\frac{Q_t}{Q_{t-1}} = \alpha + \beta\left(\frac{P_t}{Q^*_{t-1}}\right)$$

Q_t : Kookmin Bank apartment price index
P_t : Hedonic apartment price index

T-statistics based on Newey-West heteroskedasticity and autocorrelation consistent standard errors are shown in round brackets, while p-values are in square brackets.

Stein (1995), Leung, Lau and Leong (2002) and Clayton, Miller and Peng (2010) among others, have examined the influence of transaction volumes on house prices. As transaction volumes rise, the quality of information on asset prices is likely to improve, so we examine the influence of the transaction volume on the gap between the broker appraisals and the transaction prices where we use the transaction volume as a measure of the quality of information in transaction prices. If brokers put considerably less weights on the current market prices when the quality of information is poor, the adjustment in the broker appraisals would tend to be less when transaction volumes are low than when transaction volumes are high, which leads to a wider gap between the broker appraisals and transaction prices.

To examine whether the transaction volume influences the gap between the broker appraisals and the transaction prices, we regress the gap between them on the residential transaction volume (Model 1). As shown in Table 6, we find that the transaction volume reduces the gap between the broker appraisals and the transaction prices. This result is consistent with the notion that the smoothing of broker appraisals is based on the quality of information, which predicts that brokers put considerably lower weights on current market information when transaction volumes, a proxy of the quality of formation in new transaction data, are low.

In Model, 2, we examine whether the down market effect persists even when we control for the volume effect. In the first cycle, the down market effect persists, but disappears in the second cycle. We find that the volume effect accounts for part of the down market effect in the first cycle and most of the down market effect in the second cycle, which suggest an increasing role of the information effect.

We also examine the persistence of past appraisals as well as the persistence of volatility in the broker appraisals. The model that we have reported in Table 6 is the ARMA(0,2)-GARCH(1,1) model, where we model the mean persistence with ARMA(0,2) and the volatility persistence with GARCH(1,1). The model is as follows.

$$\frac{Q_t}{Q_{t-1}} = \beta X_t + \varepsilon_t + \phi_1 \varepsilon_{t-1} + \phi_2 \varepsilon_{t-2} \tag{7}$$
$$v_t^2 = \sigma_0 + \sigma_1 \varepsilon_{t-1}^2 + \sigma_2 v_{t-1}^2$$

where
Q_t = broker appraisals or transaction prices at t
X_t = vector of explanatory variables at t,
ε_{t-1} = house price residual at t-1,
ε_{t-2} = house price residual at t-2.

Table 6 Panel Regression of the Gap Between Broker Appraisals and Transaction Prices on Transaction Volume

Panel A. Kangnam

	Cycle 1				Cycle 2			
	Model 1		Model 2		Model 1		Model 2	
constant	0.32	(5.80)[a]	0.24	(4.16)[a]	0.25	(4.19)[a]	0.23	(3.64)[a]
log of volume	-0.05	(-5.09)[a]	-0.04	(-3.99)[a]	-0.03	(-3.14)[a]	-0.03	(-2.90)[a]
down market dummy			0.03	(2.47)[b]			0.01	(0.35)
R-squared	0.51		0.53		0.31		0.32	
DW-statistic	0.70		0.69		0.50		0.51	

Panel B. Seocho

	Cycle 1				Cycle 2			
	Model 1		Model 2		Model 1		Model 2	
constant	0.24	(4.70)[a]	0.16	(2.63)[a]	0.27	(6.24)[a]	0.25	(4.45)[a]
log of volume	-0.04	(-4.08)[a]	-0.03	(-2.54)[b]	-0.04	(-4.97)[a]	-0.03	(-4.08)[a]
down market dummy			0.03	(3.72)[a]			0.01	(0.74)
R-squared	0.46		0.52		0.44		0.46	
DW-statistic	0.93		1.04		1.09		1.12	

Panel C. Songpa

	Cycle 1				Cycle 2			
	Model 1		Model 2		Model 1		Model 2	
constant	0.16	(3.93)[a]	0.10	(2.24)[b]	0.27	(4.22)[a]	0.21	(3.82)[a]
log of volume	-0.02	(-3.29)[a]	-0.02	(-1.99)[c]	-0.04	(-4.08)[a]	-0.03	(-3.90)[a]
down market dummy			0.02	(1.98)[c]			0.02	(0.99)
R-squared	0.26		0.28		0.49		0.52	
DW-statistic	0.84		0.83		0.42		0.46	

Notes: [a] denotes significance at the 1% level
[b] denotes significance at the 5% level
The dependent variable is the difference between the Kookmin Bank apartment price index and the repeat sales apartment price index divided by the repeat sales apartment price index. The explanatory variables are the down market dummy and the log of transaction volume. The down market dummy takes the value of 1 for 2006:12-2008:12 as well as 2010:01-2010:12 and zero, otherwise.

The explanatory variables are expected inflation changes, unanticipated inflation, and house transaction volume. We measure the expected inflation change by using the CPI ARIMA forecast; the unanticipated inflation as CPI minus the CPI ARIMA forecast; and finally, the house transaction volume as a logarithm of the transaction volume.

We find that the coefficients of the transaction volumes are positive and statistically significant in all three markets, which indicate that an increase in transaction volume leads to an increase in the broker appraisals. We find that the coefficients of the first order moving average terms tend to be positive and significant, which show that broker quotes are smoothed. However, the interaction term between the second cycle and the first order moving average term is not statistically significant, which indicates that the smoothing persists over time. Both the first order ARCH and GARCH terms tend to be significant for all three districts.

We also control for the outliers, which are defined as the transaction prices that significantly deviate from the market price trend. We detect few outliers in the sample. This is likely to be a result of the data screening that the Ministry of Land, Transport and Maritime Affairs performs, where outliers, which are likely to be the result of data entry error and/or non-arm's length transactions, are removed from the database.[5] Even when we winsorize at 5%, removing observations of the top and bottom 5% of the sample, we essentially find the same overall results.

Table 7 Estimation of the ARMA(0,2)- GARCH(1,1) Model of Broker Appraisals

Panel A. Kangnam

	Model 1		Model 2	
constant	0.93	(150.01)[a]	0.93	(184.57)[a]
expected inflation change	-0.01	(-1.83)[c]	-0.01	(-1.33)
unanticipated inflation	0.01	(0.84)	0.01	(0.42)
house transaction volume	0.01	(9.29)[a]	0.01	(13.35)[a]
house price residual t-1	0.47	(7.30)[a]	0.63	(4.20)[a]
house price residual t-1 x cycle 2 down dummy			-0.28	(-1.52)
ARCH(1)	2.24	(2.06)[b]	2.04	(3.63)[a]
GARCH(1)	0.02	(1.06)	0.04	(0.41)
R-squared	0.55		0.56	
Adjusted R-squared	0.51		0.52	

(Continued…)

[5] Non-arm's length transactions include the transfer of title as gifts to family members or a third party or sale of properties to family members or a third party at a substantially discounted price before or after the death of the property owner.

(Table 7 continued)

Panel B. Seocho

	Model 1		Model 2	
constant	0.94	(161.68) [a]	0.95	(363.83) [a]
expected inflation change	-0.01	(-0.12)	-0.01	(-0.13)
unanticipated inflation	0.01	(0.63)	0.01	(0.60)
house transaction volume	0.01	(10.95) [a]	0.01	(42.27) [a]
house price residual t-1	0.47	(5.76)[a]	0.50	(1.31)
house price residual t-1 x cycle 2 dummy			-0.08	(-0.21)
ARCH(1)	-0.10	(-1.71) [c]	-0.09	(-3.61) [a]
GARCH(1)	1.06	(16.30) [a]	1.05	(25.67) [a]
R-squared	0.46		0.43	
Adjusted R-squared	0.42		0.38	

Panel C. Songpa

	Model 1		Model 2	
constant	0.96	(165.77) [a]	0.95	(431.48) [a]
expected inflation change	0.01	(0.95)	0.01	(0.50)
unanticipated inflation	-0.01	(-3.19) [a]	-0.01	(-0.93)
house transaction volume	0.01	(6.33) [a]	0.02	(20.35) [a]
house price residual t-1	-0.07	(-0.92)	0.22	(2.66) [a]
house price residual t-1 x cycle 2 dummy			0.15	(1.12)
ARCH(1)	2.19	(2.56) [b]	2.42	(4.99) [a]
GARCH(1)	0.13	(2.74) [a]	-0.01	(-0.31)
R-squared	0.20		0.41	
Adjusted R-squared	0.14		0.35	

Notes: [a] denotes significance at the 1% level.
[b] denotes significance at the 5% level.
The model is ARMA(0,2)- GARCH(1,1) model:

$$\frac{Q_t}{Q_{t-1}} = \beta X_t + \varepsilon_t + \phi_1 \varepsilon_{t-1} + \phi_2 \varepsilon_{t-2}$$
$$\nu_t^2 = \sigma_0 + \sigma_1 \varepsilon_{t-1}^2 + \sigma_2 \nu_{t-1}^2$$

where Q_t=brokers' appraisals or transaction prices at t
X_t=vector of explanatory variables at t,
ε_{t-1}=house price residual at t-1
ε_{t-2}=house price residual at t-2

The explanatory variables are measured as follows:
expected inflation change=CPI ARIMA forecast,
unanticipated inflation=CPI - CPI ARIMA forecast,
house transaction volume = ln(volume).

6. Conclusion

In order to help shed light on how brokers determine valuation over the real estate cycles, we study broker appraisals by using the Kookmin Bank apartment price index, the most widely used index based on broker appraisals. We have built a repeat sales price index as well as a hedonic index by using the transaction data available in the public domain and compare it with the Kookmin Bank apartment price index.

We find that smoothing occurs in the broker quotes. However, smoothing is asymmetrical between the up market and down market, which is greater during the down market than the up market. Furthermore, the remarkable degree of smoothing during the down market as well as the asymmetrical nature of smoothing persists through time despite the disclosure of transaction prices.

Broker appraisals are far more smoothed during the down markets than the up markets. The volatility in transaction prices is far greater than the volatility in the broker appraisals during the down market, but not necessarily during the up market. Based on the repeat sales index, about 18%-22% of the new transaction prices are reflected in the broker appraisals during the first down market while up to half of the new prices are reflected in the broker appraisals during the first up market. For example, based on the hedonic price index, only about 6% to 11% of new transaction prices are priced in the broker appraisals during the first down market while the new transaction prices account for one quarter of the broker appraisals during the first up market. Furthermore, the asymmetry is found even in the second real estate cycle. Therefore, the severe smoothing of the broker appraisals during the down market does not appear to be lessened over time since smoothing in the down market does not appear to diminish during the second real estate cycle compared to the first real estate cycle.

We find that the transaction volume, which is a measure of information in transaction prices, reduces the gap between the broker appraisals and the transaction prices. Finally, when we control for the volume effect, the down market effect is still present during the first cycle. However, the down market effect disappears during the second cycle when we control for the volume effect. We conclude that the volume effect accounts for most of the down market effect during the second cycle, which suggests an increasing role of the information effect and a diminishing role of transaction incentives over time. These findings are generally consistent with the information-based smoothing of broker appraisals in which the smoothing is asymmetrical since new transaction data during down markets reveal limited information. In summary, we have shown that smoothing is asymmetrical, which is far greater during the down market than the up market. The asymmetry of smoothing is consistent with the hypothesis on information weighting. Finally, the asymmetrical rigidity of broker appraisals is caused in part by the asymmetrical smoothing of broker appraisals and the asymmetrical smoothing is persistent over time.

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Appendix

Sample description and the coefficient estimates of hedonic regression models

Panel A. Kangnam

Variables	N	mean	max	min	SD
Price(KRW10,000)	20,243	76,231	570,000	7,200	49,558
Surface area(m^2)	20,243	73.82	425	17	35.43
Number of units in the apartment complex	20,243	1,183.7	5,040	4	1,367
Distance to subway(m)	20,243	470.5	1,580	73	209.25
Number of rooms	20,243	2.63	8	1	0.96

Panel B. Seocho

Variables	N	mean	max	min	SD
Price(KRW10,000)	11,339	80,345	400,000	9,800	43,104
Surface area(m^2)	11,339	89.18	258	24	37.62
Number of units in the apartment complex	11,339	790.2	3,410	50	861.63
Distance to subway(m)	11,339	467.3	1,689	14	302.20
Number of rooms	11,339	2.96	7	1	0.99

Panel C. Songpa

Variables	N	mean	max	min	SD
Price(KRW10,000)	10,359	63,173	300,000	9,000	32,463
Surface area(m^2)	10,359	77.38	210	25	28.77
Number of units in the apartment complex	10,359	1,856	6,864	50	1,994
Distance to subway(m)	10,359	465.5	1,250	33	195.4
Number of rooms	10,359	2.91	6	1	0.84

Panel D. Hedonic regression model estimates

Variables	Kangnam		Seocho		Songpa	
Constant	4.61	(131.88) [a]	5.69	(155.99) [a]	5.84	(125.24) [a]
Surface area	1.15	(211.37) [a]	1.03	(124.18) [a]	0.94	(111.30) [a]
First floor dummy	-0.05	(-8.04) [a]	-0.05	(-7.98) [a]	-0.07	(-9.32) [a]
Number of units in the apartment complex	0.19	(137.12) [a]	0.13	(76.95) [a]	0.18	(110.11) [a]
Apartment type	0.23	(61.87) [a]	0.22	(53.15) [a]	-0.10	(-23.49) [a]
Distance to subway	-0.01	(-0.27)	-0.06	(-25.99) [a]	-0.04	(-10.22) [a]
Number of rooms	0.02	(6.73) [a]	0.05	(14.12) [a]	0.02	(6.43) [a]
1980 dummy	0.20	(52.58) [a]	0.13	(29.27) [a]	0.03	(6.66) [a]
Number of samples	20,243		11,339		10,359	
Adjusted R-squared	0.88		0.89		0.86	

Notes: [a] denotes significance at the 1% level.

First floor dummy is a dummy variable that takes the value of 1 if it is on the first floor, 0 otherwise.

Apartment type is a dummy variable that takes the value of 1 if the apartment building is a non-corridor type and 0 if it is a corridor type. It is expected to have a positive coefficient. We use a 1980 dummy, which takes on the value of 1 if the apartment complex is built prior to 1980; otherwise, 0. The t-statistics are shown in round brackets.