The Changing Relationship between UK Home Prices and Rents*

Chung, Keunsuk · Kim, Jan R.

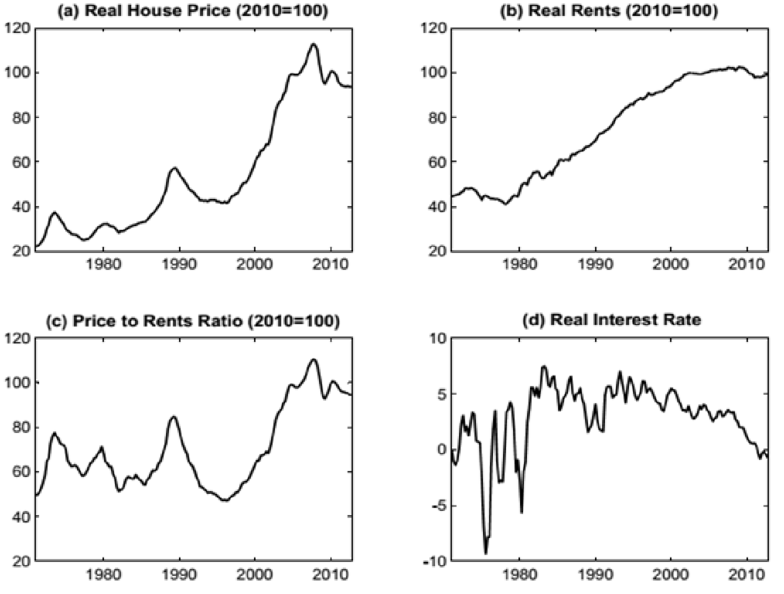
Contents

Ⅰ. Introduction

Over the past decade, the UK housing market has seen an unprecedented increase followed by a sudden collapse in housing prices. As shown in Figure 1, the real house prices rose by 31 percent between 1980 and 1995, but they increased by 164% percent between 1995 and 2007. In contrast, real rents remained relatively subdued even during the recent run-up in house prices with the index of rents increasing by less than 17 percent between 1995 and 2007, resulting in the unprecedented rise in house prices relative to rents. As a result, the house price-rent ratio peaked in 2007 at approximately 126 percent above its level in 1995, but the ratio then fell by 13 percent since then.

* This work was supported in part by the Hankuk University Foreign Studies research grant for 2014.

[Figure 1]: U.K. Housing Market Data over 19;71:Q1–2012:Q4[1)]



One popular measure used to get an indication of over or undervaluation of house price is the price–to–rent, the nominal house price index divided by the rents. Intuitively, this measure could be interpreted as the cost of owning versus renting a house: when house prices are too high relative to rents, potential buyers find it more advantageous to rent, which should in turn exert downward pressure on house prices. Alternatively, from the asset pricing perspective, the housing price–to–rent ratio measures the market value of a house compared to the cash flow it could earn, and therefore indicates potential earnings from investing in housing and whether owning or renting makes better economic sense. From either perspective, house prices and rents should not deviate from each other by

1) The details of the data series in Figure 1 are provided in section 2.1.

too much or for too long, but the long and frequent swings Figure 1 suggests that the price-rent relationship in the UK housing market may not be as stable as expected. In this vein, Girouard et al. (2006) and Kuenzel Bjørnbak interpret the actual UK actual price-rent ratio above its “fundamental” level in the early 2000s as an indication of overvaluation.

In a series of seminal papers, Campbell and Shiller (1987, 1888a, 1988b) developed a present value model of asset valuation in which the asset's fundamental value is tied to the sum of its future payoffs discounted by investors using rates that reflect their preferences. A few key implications drawn from this model for the relation between asset prices and cash flows are as follows: *(i) asset prices and dividends should be of the same order of integration* and *(ii) if the two variables are both non-stationary in levels but stationary in first differences, they should be cointegrated in such a way that their ratio (i.e., the price-to-dividend ratio) is stationary*. Adapted to the housing market, present value models postulate that the fundamental price of a house is approximately the discounted future flow of rents that will accrue if the unit is rented out, and thus, the price-rent ratio should be stationary unless house price bubbles move house prices away from their fundamental values.

Following the implications of present value models, many empirical studies have performed standard unit roots and cointegration tests. The results, however, generally indicate that the ratios are either non-stationary or the house prices and rents are not cointegrated. Girouard et al. (2006) find that the presence of a unit root in the price-rent ratios cannot be rejected in most of the 18 OECD countries. Mikhed and Zemčík (2009) examine the U.S. Metropolitan Statistical Areas data for the period 1975 to 2006 and find that the house prices and rents either have a different order of integration or are not cointegrated, rendering the price-rent ratio non-stationary. More recently, Clark and

Coggin (2011) examine the national and four regional data of the U.S. and find that, while the results for regional data are mixed, the nationwide price−rent ratio is neither stationary nor cointegrated with house prices. In contrast, Gallin (2008) explores the long run relationship between the nationwide quarterly house prices and rents of the U.S. over the period 1970 to 2005 and finds that the log price−rent ratio is stationary.[2)]

Although the literature points to the lack of a stationary price−rent relation, there are several issues calling for caution in interpreting those results straightforwardly in terms of the over− or under−valuations in house prices. First, as exhibited in Figure 1 by the protracted deviations from its historical benchmarks, the price−rent relation itself may not be invariant over time. Theoretically, as the present value models (e.g., Poterba (1984)) suggest, the price−rent ratio depends on real interest rates and expected capital gains from housing assets. Therefore, shifts in credit conditions or tax treatments are likely to cause changes in the price−rent relation. In fact, empirical evidence is available in support of the instability in the price−rent relation. Using a random walk with a regime−switching drift specification, Nneji et al. (2011) find that a structural break occurred in the US price−rents ratio series approximately 1998, which may have been caused by the presence of the bubble in the market since then. Lai and van Order (2010) identify a shift in the regime of the US housing market around a similar date that was caused by a significant increase in the momentum of the disturbances to the growth of the price−rent ratio. Second, upon allowing for the possible shifts in the fundamental price−rent relation, a methodological issue emerges as it is well documented that standard unit roots and cointegration tests may fail to detect the presence of periodically collapsing rational bubbles in asset

2) Based on this result, Gallin (2008) proceeds further to construct an error correction model to analyze the short−run dynamics between house prices, rents, and user costs of housing capital.

prices. As demonstrated in Evans (1991), tests of this type can erroneously accept the no-bubble hypothesis when prices contain an explosive stochastic bubble that collapses from time to time, unless the expansion phase of prices lasts for most of the sample period considered. Furthermore, although such tests can, in principle, answer the question whether there is a significant bubble in the asset price somewhere in the whole period under investigation, they cannot isolate those periods characterized with the presence of a bubble from those that are not.

We attempt to address the issues above in a simple yet straightforward framework. Our point of departure is to allow the relation between house price and rent to depend on the underlying conditions in the housing markets and therefore to change over time. More specifically, we construct a Markov-switching error-correction model of the UK housing market in which the long-run relationship between the real house prices and real rents (and also the short-run adjustment coefficients) switches stochastically between two regimes.[3] In one regime, labeled as the fundamental regime, the long-run relation between house prices and rents is specified following the key implication of the present value models, i.e., the stationary price-rent ratio. In the other regime, labeled as the non-fundamental regime, we do not impose any a priori restrictions on the price-rent relation, thus letting the data speak for themselves. Once the estimation results for the non-fundamental regime are obtained, we draw further insights on the nature of the UK housing in that regime. For example, if the non-fundamental regime is well characterized by a certain type of bubble, we should be able to localize the corresponding periods of the bubble by the estimated probabilities of that regime.

Estimation results show that our sample period is characterized by the

3) Schaller and van Norden (2002) construct regime switching regression models for stock market returns nesting the fads model of Summers (1986) and the stochastic bubbles model of Blanchard and Watson (1982).

presence of these two distinct regimes around the beginning of 1988. The pre-1988 era is characterized by the fundamental regime, where the long-run equilibrium relationship well corresponds to the prediction of the present value models with a stable price-to-rent ratio. In the latter half, which is characterized by the non-fundamental regime, however, the results are mixed. The post-1988 era also involves a stationary price-rent relation, which implies that the regime is not characterized by speculative bubbles. However, the long-run behavior of the price-rent ratio is not well explained by the present value models because the estimated long-run equilibrium house prices and rents are related in a nonlinear fashion; and the identified regime period exhibit a long swing in the price-rent ratio.

The remainder of the paper is organized as follows. In section 2, we discuss the features of the U.S. housing market data and present a Markov-Switching error correction model intended to address those features. Section 3 presents the estimation results, focusing on the natures of the distinctive regimes identified by the model. Section 4 summarizes the paper.

Ⅱ. The Model

Ⅱ. i Data Properties

The raw data used in this paper are the quarterly UK series of real house price, real rent, price-rent ratio, nominal interest rate, and the core CPI, all spanning 1971: Q1 to 2012: Q4. The series of real house price, and price-rent ratio are obtained from the OECD statistical warehouse as seasonally adjusted indices. Because the price-rent ratio is available as an index with 2010 as the base year, we rescale the original series to match the national account version of the rental yield (i.e., the inverse of the ratio) in Ward (2011). We then get the rent series by dividing the real house price index with the re-scaled price-rent ratio. Nominal interest rate is the 10-year government bond yield rate obtained from the FRED of St. Louis Fed. Core CPI is also obtained from the FRED and transformed into year-on-year inflation rates, which are then subtracted from the nominal interest rate to yield the real interest rate series. The three series thus constructed and the price-rent ratio are plotted in Figure 1 above.

[Table 1]: Integration Properties of Data Series

A. Unit Roots Tests			
variable [a]	specification	ADF [b]	KPSS [c]
house price	Level	−1.319 [0.620]	1.467 (0.463)
	Difference	−3.580 [0.000]	0.057
rent	Level	−1.054 [0.733]	1.557 (0.463)
	Difference	−9.181 [0.000]	0.313
price-rent ratio	Level	−1.744 [0.408]	0.683 (0.467)
	Difference	−5.789 [0.000]	0.075
B. Johansen Cointegration Test			
No. of CI relations	Trace Test [b]	Max. Eigen. Test [b]	
0	7.350 [0.537]	5.971 [0.917]	

a. All series are in logs.
b. Numbers in square brackets are the p-values of test statistics.
c. Numbers in parentheses are the 5% significance levels.

We examine the integration properties of the data, and the results are summarized in Table 1. In panel A, we first check the stationarity of the real house price, real rent, and price-to-rent series. According to the

ADF tests, the three series have unit roots in their levels, but the null of the unit roots is clearly rejected for their first differences at any significance level. This finding is further supported by the results for the KPSS test, where the test statistics for the levels of the three series are larger than the 5 % critical value, while those for their first differences are not. To allow for the house price and rent to have a more general stationary relation than the one-to-one form, we also run, in panel B, the Johansen cointegration test. Both the trace and maximum eigenvalue test fail to reject the null of no cointegration between house price and rent at any practical significance level. Overall, the results in Table 1 support the absence of the stationary price-rent relation, which is a key precondition for the class of Campbell-Shiller-type present value models for housing price.

Ⅱ. ii Markov Switching Error Correction Model[4]

We now construct an econometric model in which possible shifts in the price-rent relation is allowed, while the fundamentals still play a pivotal role in determining the house price. We start with the direct implication of the present value model that house price and rent are cointegrated, which can be represented by an error correction representation. We then follow Neftçi (1984) and Hamilton (1989) and introduce a Markov-Switching mechanism by which the long-run price-rent relation shifts between two distinctive sets of parameters.

4) Our aim here is to estimate the regime-switching long-run relations among price and rents. An alternative approach would be to test the presence of such relation, using regime-switching cointegration test of Hu and Shin (2014). We are grateful to an anonymous referee for this comment.

Let $y_t = [\log P_t, \log R_t]'$ denote the vector of real house price and real rent in logarithmic form. We consider the following model:

$$\triangle y_t = \mu(S_t) + \sum_{k=1}^{K} G_k(S_t) \triangle y_{t-k} + \alpha(S_t)\beta(S_t)' y_{t-1} + A(S_t)X_t + \varepsilon_t \quad (1)$$

where the disturbance term ε_t is specified as a sequence of i.i.d. normal random vectors with a covariance matrix Ω. Equation (1) is an error correction model in y_t with exogenous variables X_t, and the coefficients and intercepts are dependent upon the realization of a dichotomous latent state variable S_t. We assume the variable S_t follows a two-state first-order Markov chain with the transition probabilities

$$\begin{aligned} &\Pr[S_t = 0 | S_{t-1} = 0] = p^{00},\ \Pr[S_t = 1 | S_{t-1} = 0] = 1 - p^{00}, \\ &\Pr[S_t = 1 | S_{t-1} = 1] = p^{11},\ \Pr[S_t = 0 | S_{t-1} = 1] = 1 - p^{11}, \end{aligned} \quad (2)$$

where the realizations of S_t are assumed to be exogenous and independent of ε_t at all leads and lags.

Equations (1) and (2) allow qualitatively different dynamics in the relation between the house price and rent, both in the long run and the short run. The long-run dynamics is represented by the state-dependent cointegrating vector $\beta(S_t) = \beta^0(1 - S_t) + \beta^1 S_t$, where the superscripts (0,1) denote the realizations of states. As a result, the cointegration error vector given by $\beta(S_t)' y_{t-1}$ reflects the state-dependent long-run equilibrium relation between house price and rent. The short-run adjustments toward the long-run equilibrium are represented by the state-dependent error correction vector $\alpha(S_t)=\alpha^0(1-S_t)+\alpha^1 S_t$, which allows corrections in equilibrium errors to take place at different rates across the two regimes. Finally, the intercept term $\mu(S_t)$, the short-run parameters $G_k(S_t)$, and the coefficients $A(S_t)$ for exogenous variables are also allowed to be state-dependent in a similar way.

We distinguish between the two regimes in the UK housing market via identifying restrictionson the long-run dynamics of the model in equation (1). For regime 0 (with $S_t=0$), we set $\beta^0=[\beta^0_1, \beta^0_2]$ = [1, −1]'. Thus, house price and rent in this regime have a stable long-run ratio. We label this the *fundamental regime* because the long-run price-rent relation in this regime is constant as predicted by the present value models. Identification of regime 1 (with $S_t=1$), labeled as the *non-fundamental regime*, is more complicated, and therefore, we opt to use two alternative identifying restrictions. First, we characterize this regime with the presence of a speculative bubble. Intuitively, a rational speculative bubble is gestated by extraneous factors and driven by self-fulfilling expectations, both of which have nothing to do with the fundamentals, and therefore, house price and rent drift away from each other in the presence of a speculative bubble. That being the case, there will be neither a long-run equilibrium relation nor short-run correctionsto restore the equilibrium, which leads us to set $\beta^1=0_{2\times 1}$ as an identifying restriction for the non-fundamental regime. Second, we set $\beta^1=[\beta^1_1, \beta^1_2]'=[1, \beta^1_2]'$ but leave β^1_2 to be freely estimated. A negative yet non-zero estimate of β^1_2 implies a stable long-run relationship between house price and rent in this regime, which is not the case in the presence of a speculative bubble. Meanwhile, if the estimate of β_2^1 turns out to be different from minus one, the non-fundamental regime is not compatible with the present value models because there is no stationary price-rent ratio in such a case. The nature of the non-fundamental regime for the UK housing market is discussed in detail in Section 3.

Ⅲ. Estimation Results

When estimating equation (1), we consider the real interest rate as the exogenous variable as the real interest rate is frequently used as a proxy for the user costs of housing or the returns from the housing capital and is related to the levels of price and rent in many present value models (e.g., Poterba (1984) and Ayuso et al. (2006)). At the risk of possible misspecification of equation (1), we follow Gallin (2008) and include the real rate both in its level and difference with a one-period lag. For the lag order K for the endogenous variable, we settle with K = 2 mainly for the tractability of the model in actual estimation.

With reference to the identification schemes discussed in the previous section, three different versions of the model are estimated. In the first version, VER[1], the long-run relation between house price and rent in the fundamental regime is $\beta^0=[1,-1]'$, while that in the non-fundamental regime is specified as $\beta^1=[1, \beta_2^1]'$ leaving β_2^1 freely estimated. We also consider VER[1]-A, a variant of VER[1] that is identical to VER[1] except that the long-run relation in the fundamental regime is $\beta^0=[1, \beta_2^0]'$ with β_2^0 another free parameter to estimate.[5)]

Finally, with respect to VER[2], we maintain β^0=[1,−1]' for the fundamental regime but set $\beta^1 = 0_{2\times1}$ so that the evolution of the system in the non−fundamental regime involves neither long−run dynamics nor short−run adjustments toward the long−run equilibrium. The Gaussian maximum likelihood estimates and the associated asymptotic standard errors are reported in Table 2.

We discuss the results for VER[1] first. Regarding the short−run dynamics, the error correction coefficients α^0 for the fundamental regime are sharply estimated with correct signs such that if the price−rent ratio is temporarily higher than the long−run equilibrium level in this regime, a downward adjustments in price (via α^0_1=−0.157) and upward adjustments of comparable size in rent (via α^0_2=0.123) follow in the subsequent period, thus pushing the price−rent ratio toward the equilibrium level. In particular, if there is a 1% deviation in the price−rent ratio from the equilibrium in the current quarter, 0.157%+0.123%=0.28% of the deviation is corrected in the next quarter provided that the same regime continues. In the non−fundamental regime of VER[1], however, the estimated error correction coefficient for price is of the wrong sign and insignificant. The error correction coefficient for rent is significantly estimated with the correct sign, but its magnitude is much smaller than that in the other regime. In the non−fundamental regime, therefore, only rent is subsequently adjusted following disequilibrium deviations from the long−run price−rent relation. This, in turn, implies that in the non−fundamental regime, sudden surges in house prices relative to rents do not result in subsequent adjustments in price. Comparison along the long−run dimension exhibits another key difference across the two

5) As VER[1] is nested in VER[1]−A, we can check the validity of the restriction via $\beta^0_2 = 1$ in the former version using the likelihood ratio test.

regimes of VER[1]. While the pre-specified cointegration vector $\beta^0 = [1,-1]'$ corresponds to a stable long-run price-rent ratio, the estimated $\beta^1 = [1, \beta^1_2]' = [1, -0.623]'$ for the non-fundamental regime shows that house price and rent are related in a non-linear way by $P = \kappa R^{0.623}$, where κ is a regime specific constant. Although

it implies a long-run equilibrium relation, the estimated β^1 is contradictory to the prediction of the present value models.[6)]

6) When we re-estimate VER[1] with the restriction $\beta^1_2 = -1$, the likelihood test rejects the restriction with the p-value of 0.014. This result implies that the long-run dynamics in the non-fundamental regime is different from that in the other regime, and therefore the difference between the two regimes cannot be relegated to short-run dynamics only.

[Table 2]: Maximum Likelihood Estimates

Parameter		Version [1]		Version [2]		Version [1]-A	
		Estimate	Std. Err	Estimate	Std. Err	Estimate	Std. Err
$S_t = 0$	p_{00}	0.745*	0.090	0.724*	0.110	0.775	0.043
	μ_1^0	0.168*	0.020	0.165*	0.015	0.150*	0.005
	μ_2^0	-0.081*	0.030	-0.083*	0.027	-0.039	0.012
	α_1^0	-0.157*	0.026	-0.170*	0.019	-0.194*	0.007
	α_2^0	0.123*	0.039	0.124*	0.034	0.088*	0.018
	β_2^0	-1 (fixed)	n.a.	-1 (fixed)	n.a.	-0.724*	0.021
	G_{11}^0(k=1)	-0.311*	0.104	-0.275*	0.080	-0.352*	0.090
	G_{12}^0(k=1)	-0.059	0167	-0.106	0.170	-0.013	0.117
	G_{21}^0(k=1)	-0.199*	0.076	-0.177*	0.081	-0.185*	0.065
	G_{22}^0(k=1)	0.421*	0.062	0.418*	0.078	0.420*	0.101
	G_{11}^0(k=2)	0.039	0.049	0.067	0.047	-0.022	0.021
	G_{12}^0(k=2)	-0.054	0.154	-0.034	0.142	-0.040	0.106
	G_{21}^0(k=2)	-0.062	0.092	-0.091	0.100	-0.075	0.581
	G_{22}^0(k=2)	0.427*	0.057	0.431*	0.068	0.369*	0.091
	A_{11}^0	-0.000	0.001	-0.001	0.001	0.001	0.001
	A_{12}^0	-0.004*	0.002	-0.004*	0.002	-0.004*	0.001
	A_{21}^0	0.011*	0.001	0.010*	0.002	0.010*	0.002
	A_{22}^0	0.001	0.002	0.001	0.000	-0.001	0.001
$S_t = 1$	p_{11}	0.954*	0.021	0.949*	0.021	0.945*	0.010
	μ_1^1	-0.003	0.003	-0.002	0.001	-0.003	0.004
	μ_2^1	-0.023*	0.005	-0.000	0.002	-0.022*	0.008
	α_1^1	0.002	0.005	n.a.	n.a.	0.003	0.006
	α_2^1	0.039*	0.007	n.a.	n.a.	0.037*	0.012
	β_2^1	-0.623*	0064	n.a.	n.a.	-0.608*	0.055
	G_{11}^1(k=1)	0.551*	0.067	0.556*	0.063	0.552*	0.068
	G_{12}^1(k=1)	-0.198*	0.104	-0.204	0.117	-0.211	0.099
	G_{21}^1(k=1)	-0.036	0.046	-0.036	0.055	-0.039	0.048
	G_{22}^1(k=1)	0.608*	0.062	0.640*	0.072	0.592*	0.073
	G_{11}^1(k=2)	-0.048	0.034	-0.058*	0.028	-0.055	0.031
	G_{12}^1(k=2)	-0.084	0.113	0.042	0.116	-0.082	0.111
	G_{21}^1(k=2)	0.055	0.046	0.055	0.056	0.055	0.047
	G_{22}^1(k=2)	0.203*	0.057	0.158*	0.061	0.163*	0.060
	A_{11}^1	0.001*	0.000	0.001*	0.000	0.001*	0.000
	A_{12}^1	-0.001	0.001	0.000	0.001	-0.001	0.001
	A_{21}^1	0.001	0.001	0.001	0.001	0.001	0.001
	A_{22}^1	-0.001	0.001	-0.001*	0.001	-0.000	0.001
	Ω_{11}	$7.9\text{x}10^{-5}$*	$1.0\text{x}10^{-5}$	$8.0\text{x}10^{-5}$*	$7.7\text{x}10^{-7}$	$7.9\text{x}10^{-5}$*	$6.0\text{x}10^{-6}$
	Ω_{12}	$4.4\text{x}10^{-5}$*	$1.3\text{x}10^{-5}$	$4.3\text{x}10^{-5}$*	$32.4\text{x}10^{-6}$	$4.5\text{x}10^{-5}$*	$1.2\text{x}10^{-5}$
	Ω_{22}	$3.0\text{x}10^{-4}$*	$3.4\text{x}10^{-5}$	$3.1\text{x}10^{-4}$*	$6.5\text{x}10^{-6}$	$2.8\text{x}10^{-4}$*	$3.1\text{x}10^{-5}$
Log-LKHD		955.576		950.382		957.220	

Note: Numbers in parentheses are standard errors, and estimates with * are significant at 5%.

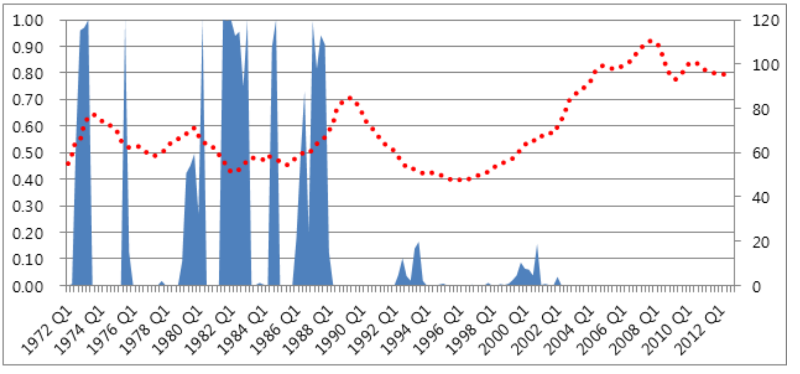
Albeit justified by the present value models, the long-run dynamics of VER[1] in the fundamental regime are imposed as an a priori restrictionand therefore should be tested. To that aim, we compare the estimation results for VER[1] and VER[1]−A. What is worthy of primary note is that the fits of VER[1] and VER[1]−A are practically identical as the estimate of β_2^0 in VER[2] is 0.724, and the maximized likelihood values yield the p−value of 0.07 for the null of $\beta_2^0=-1$. Therefore, the identifying restriction $\beta^0 = [1,-1]'$ imposed in VER[1] to isolate the fundamental regime is well supported by the data, and we conclude that the present value models fairly well describe the dynamics of the house price and rent, at least in the identified fundamental regime. Another piece of evidence suggesting that the fundamental regime identified by VER[1] is consistent with the predictions of present value models is found inthe estimated coefficients of lagged house price growth in the price equation. In the presence of a speculative bubble, the lagged house price growth yields higher house price growth in the subsequent periods to the extent that the lagged house price growth is a good proxy for the self−fulfilling expectations on future house prices. According to the estimates of G_{11}^0's, however, a house price increase in the previous period causes a significant decrease in the increase momentum during the current period, which contradicts the presence of a speculative bubble in the fundamental regime.

With respect to the results for VER[2], in which the non−fundamental regime is specified to capture the presence of speculative bubbles, we note that the estimates for the fundamental regime for VER[2] are virtually identical to those of the two previous versions. This finding implies that the identified fundamental regime is robust to the specifications for the non−fundamental regime in VER[1] and VER[2]. That being the case, we concentrate on the non−fundamental dynamics to compare the fits of VER[1] and VER[2]. The maximized likelihood values for VER[1] and VER[2] reveal the poorer performance of the speculative bubble model as the description of the non-fundamental dynamics. As neither of the two versions is nested in the other, we cannot directly apply the likelihood ratio test.[7] Nevertheless, resorting to the likelihood-based model selection criteria, such as Akaike and Bayesian information criteria, we can reject VER[2] without much resistance.

Even if we decide to settle with VER[1], the nature of the non-fundamental regime still remains esoteric. As previously mentioned, the estimation results for this regime provide mixed interpretations. On the one hand, characterized with a stationary equilibrium relation between house price and rent, the non-fundamental regime does not fit the feature of a speculative bubble, which will float house price and rent adrift from each other. On the other hand, because the estimated equilibrium relation in this regime does not support a stationary price-rent ratio, this regime does not fit the present value models either. Therefore, to obtain more knowledge of this regime from the data, we isolate the two regimes in the sample period. Figure 2 plots the filtered probability of the fundamental regime in each period (solid line) along with the price-rent ratio (dotted line). Clearly, while the fundamental regime prevailed sporadically in the UK house market until 1987:Q4, since then the UK housing market has remained entirely in the non-fundamental regime.

7) Another issue here is that the error correction parameters $\alpha^1 = (\alpha^1_1, \alpha^1_2)$ of VER[2] are not identified if we set , which causes the well-known problem in Davies (1977).

[Figure 2]: Filtered Probabilities of the Fundamental Regime



Another conspicuous feature in Figure 2 is that there was a protracted cycle-like swing in the price-rent ratio in the latter half of the sample period. Our view is that such a long swing may be sustained in the absence of a fundamental relation between price and rent, which is why our model relegates the post-1987 era to the non-fundamental regime.

Ⅳ. Conclusion

According to the present value models of house prices, rents are considered a fundamental determinant of house prices. In the absence of self-fulfilling bubbles, house prices are related to rents via a stable price-rent ratio. The prolonged deviation of the UK house price from rent since the 1990s, however, has put into question the stability of the price-rent ratio.

To account for such long deviations between house prices and rents, we construct and estimate a Markov-switching error correction model of the UK housing market, in which the log-run relationship between the real house price and real rent (and also the short-run coefficients) switches stochastically between two distinctive regimes. The two regimes considered here are the one labeled as the fundamental regime in which the long-run house price-rent relation is characterized by the prediction of the present value models; and the other labeled as the nonfundamental regime for which no restrictions on the price-rent relation are imposed. Our estimation results show that, prior to the year 1988, the fundamental regime prevailed. It is then followed by the non-fundamental regime since the first quarter of 1988.

Our results warrant a re-consideration of the price-ret ratio as a credible measure of housing market conditions. Although house prices and rents are still characterized by stationary long-run relations, the dual relationship between them that the present value model approach per se may not be adequate to explain the UK housing market. More specifically, a rise or fall in the ratio may not reflect over- or under- valuation in house price but a switching to a different regime. Furthermore, the nonfundamental regime cannot interpreted as the period with speculative bubbles, since the house price in that regime is still related with its fundamental determinant-rents. Deeper studies on the nature of the nonfundamental regime are in order[8].

8) One direct extension of the current paper is to examine whether the ratio of *Chonsei* to purchase prices in Korea is subject to a similar regime shifts, since the ratio is often viewed as an indicator of over- or under valuaion in housing market.

Works Cited

Ayuso, Juan and Fernando Restoy. "House Prices and Rents: An Equilibrium Asset Pricing Approach" *Journal of Empirical Finance* 13 (2006): 371—88.

Blanchard, Olivier and Mark Watson. "Bubbles, Rational Expectations, and Financial Markets." *Crisis in Economic and Financial Structure: Bubbles, Bursts, and Shocks*. Ed. Paul Wachtel. Lexington: Lexington Books, 1982.

Campbell, John Y. and Robert J. Shiller. "Cointegration and Tests of Present Value Models." *Journal of Political Economy* 95 (1987): 1062-88.

Campbell, John Y. and Robert J. Shiller. "The Dividend-Price Ratio and Expectations of Future Dividends and Discount Factors." *Review of Financial Studies* 1 (1988a): 195—228.

Campbell, John Y., and Robert J. Shiller. "Stock Prices, Earnings, and Expected Dividends." *Journal of Finance* 43 (1988b): 661—76.

Clark, S. P. and T. Daniel Coggin. "Was There a U.S. House Price Bubble? An Econometric Analysis Using National and Regional Panel Data." *The Quarterly Review of Economics and Finance* 51 (2011): 189—200.

Davies, R. B. "Hypothesis Testing when a Nuisance Parameter is Present Only Under the Alternative." *Biometrika* 64 (1977): 247-54.

Evans, G. W. "Pitfalls in Testing for Explosive Bubbles in Asset Prices." *American Economic Review* 81 (1991): 922-30.

Gallin, Joshua. "The Long-run Relationship between House Prices and Rents." *Real Estate Economics* 36 (2008): 635—58.

Girouard, N., M. Kennedy, P. van den Noorden, and C. Andre. "Recent House Price Deveopments: The Role of Fundamentals." *OECD*

Economic Department Working Paper 475 (2006).

Hamilton, James D. "A New Approach to the Economic Analysis of Nonstationary Time Series and the Business Cycle." *Econometrica* 57 (1989): 357—84.

Hu, Liang and Yongcheol Shin. "Testing for Cointegration in Markov Switching Error Correction Models." *Advances in Econometrics* (33). Ed. Yoosoon Chang , Thomas B. Fomby , Joon Y. Park. Emerald Group Publishing, 2014. 123-50.

Kuenzel, Robert and Birgitte Bjørnbak. "The UK Housing Market: Anatomy of a House Price Boom." Directorate General for Economic and Financial Affairs Country Focus (2008). 5-11.

Lai, Rose N. and Robert A. van Order. "Momentum and House Price Growth in the United States: Anatomy of a Bubble." *Real Estate Economics* 38 (2010): 753—73.

Mikhed, Vyacheslav and Peter Zemčík. "Testing for Bubbles in Housing Markets: A Panel Data Approach." *Journal of Real Estate Finance and Economics* 38 (2009): 366—86.

Neftçi, S. N. "Are Economic Time Series Asymmetric over the Business Cycle?" *Journal of Political Economy* 92 (1984): 307—28.

Nneji, Ogonna, Chris Brooks, and Charles W. R. Ward. "Intrinsic and Rational Speculative Bubbles in the U.S. Housing Market 1960-2009." *ICMA Centre Discussion Papers in Finance* 1 (2011), University of Reading.

Schaller, H. and Simon van Norden. "Fads or Bubbles?" *Empirical Economics* 27 (2002): 335-62.

Summers, Lawrence H. "Does the Stock Market Rationally Reflect Fundamental Values?" *Journal of Finance* 41 (1986): 591—601.

Abstract

The Changing Relationship between U.K. Housing Price and Rents

Chung, Keusuk* · Kim, Jan R.**

The present value models of house prices predict that house prices and rents are related via a stable price-to-rents ratio, as house prices are equal to the present discounted values of future rents. The prolonged divergence of the UK house prices from rents since the mid-1990s has put into question the stability of the price-rents relation. In this paper, we reexamine the changing relationship between house price and rents using a Markov-switching error correction model, and we find two distinct regimes in the price-rents relation. In one regime, which is identified mainly in the pre-1988 era, the long-run equilibrium relationship corresponds to the prediction of the present value models, i.e., the stable price-to-rents ratio. The other regime, prevailing since 1988 forward, also involves a stationary price-rents relation. As such, this regime is not characterized with speculative bubbles. However, the long-run relation in this regime is difficult to explain by the present value models, and the identified regime period exhibits a long swing in the price-rents ratio.

Key Words: house price, rents, price-rent ratio, error correction model, regime switching

주택가격, 월세, 주택가격-월세비율, 오차수정모형, 국면 전환

* UNIST

** HUFS

논문접수일: 2014.11.11
심사완료일: 2014.12.19
게재확정일: 2014.12.23

이름: 정근석 (제1저자)
소속: 울산과학기술대학교 (UNIST) 테크노 경영학과
주소: 울산광역시 울주군 언양읍 유니스트길 50, 689-798
이메일: chungk@unist.ac.kr

이름: 김장열 (교신저자)
소속: 한국 외국어대학교 국제통상학과
주소: 서울 동대문구 이문로 107, 130-791
이메일: kjryoul@hufs.ac.kr