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Research Article

Long-Run and Short-Run Effects Between New Commodity Home and Existing Home Prices in Guiyang, China

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Abstract: Investors and policymakers would like to know whether the new home market can predict the old home market and vice versa. This article implies a long-run equilibrium relationship between old and new home prices in Guiyang, a metropolis in Southwest China. New house prices are weakly exogenous with respect to the long-run relation, indicating that the new home market imposes long-run effects on the old one. The long-run elasticity of old home prices relative to new home prices is 0.72. A feedback effect exists between the two differential markets. The short-run elasticity of old home prices relative to new house prices is about -0.40. The short-run elasticity of new home prices relative to old house prices is 0.76. Hence, in the short run, buyers have mostly been impacted by the old home market. Notably, both the new and old housing markets may contain a bubble.
Keywords: house price, long run, short run, bubble, commodity home, existing home.

1. INTRODUCTION

To achieve excess profits, investors make efforts to collect as much information on home markets as they can. Taking Guiyang as an example, this paper examines the lead-lag and equilibrium relationships between new and old home markets.

Guiyang is the capital of Guizhou Province in China. Guiyang is a quickly growing business city in Guizhou and even in West China. In 2017, it had a land area of 8,034 square kilometers, accounting for 4.56% of Guizhou's total. It had a resident population of 4.08 million, accounting for 11.41% of Guizhou's total. The aggregate GDP reached RMB 353.80 billion (about 50.54 billion US dollars), accounting for 26.13% of Guizhou's total (Bureau of Statistics of Guiyang, 2018b; Bureau of Statistics of Guizhou Province, 2018; Nbsc, 2018b).

2. METHODS

Engle-Granger tests (Engle R. F. *et al.*, 1987) and Johansen tests (Johansen S., 1991) were conducted. Cheung-Lai (Cheung Y.-W. *et al.*, 1993) and Reinsel-Ahn (Reinsel G. C. *et al.*, 1992) finite-sample corrections were applied.

Unit root tests include ADF (Dickey D. A. *et al.*, 1979), PP (Phillips P. C. B. *et al.*, 1988), DF-ERS (Ng S. *et al.*, 2001), and the Zivot-Andrews break-point test (Zivot E. *et al.*, 1992).

ECMs were constructed and estimated (Engle R. F. *et al.*, 1987). Long-run and short-run elasticities were estimated. Weak exogeneity (Johansen S., 1992) and Granger causality tests (Granger C. W. J., 1969; Granger C. W. J., 1981) were performed.

3. Data

Monthly series cover the 2011-2015 period. House prices in Guiyang include existing home prices (*EHP*) and new commodity home prices (*NHP*). Price indices change over those in the same month of last year (Bureau of Statistics of Guiyang, 2018a; Bureau of Statistics of Guizhou Province, 2018; Nbsc, 2018a).

Data were seasonally adjusted using the X-12 multiplicative method. Logarithms were introduced. Table 1 presents data statistics. Data have an intercept and may contain a trend (Figure 1).

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Table 1. Descriptive Statistics for the Raw Data

	EHP	*NHP*
Mean	103.0950	102.0083
Median	103.2500	102.4500
Max	110.0000	107.4000
Min	96.80000	94.90000
Std. Dev.	3.944162	3.642838
Skewness	-0.007625	-0.506845
Kurtosis	1.913270	2.172746
Jarque-Bera	2.953034	4.279794
p-value	0.228432	0.117667
Period	Jan 2011-Dec 2015	
Observation	60	

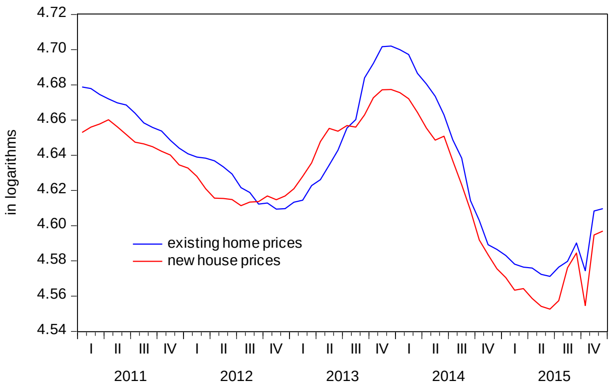

Figure 1 Monthly Change in Home Prices in Guiyang, China

4. Empirical results

4.1 Unit Root

ADF and PP tests suggested a unit root for *EHP*. DF-ERS tests suggested no. There existed a structural break in *EHP*; despite this α≈1 (0.90) implied a unit root. Hence, we took *EHP* as I(1).

ADF tests suggested no unit roots for *NHP*. PP tests suggested one. DF-ERS tests suggested more than one. There was not a structural break in *NHP*. Hence, *EHP* can be taken as being integrated of order one.

Table 2. the Unit Root Tests (ADF Tests)

Log variable	*k*	Level	*k*	First difference
EHP	10	-2.09	9	-3.33*
NHP	9	-5.17***	-	-

Notes: All tests encompass an intercept. The lag length *k* was decided using the *t*-test (Ng S. *et al.*, 1995). * And ***denote rejection of the null of a unit root at the levels of 10% and 1 %, respectively.

Table 3. the Unit Root Tests (PP Tests)

Log variable	***k***	**Level**	***k***	**First difference**
EHP	5	-1.76	5	-5.89***
NHP	5	-1.66	5	-7.25***

Notes: All tests encompass an intercept according to (Hamilton J. D., 1994). The lag *k* was decided using the Newey–West (NW) bandwidth technique (Newey W. K. *et al.*, 1987). ***denotes rejection of the null of a unit root at the 1% level.

Table 4 The Unit Root Tests (DF-ERS Tests)

Log Variable	***k***	**Level**	***k***	**First difference**
EHP	2	-3.24*	-	-
NHP	0	-1.21	2	-1.96

Notes: Truncation lags, *k*, were chosen using the modified Akaike information criterion (MAIC). The MAIC is suggested to dominate all other criteria (Ng S. *et al.*, 2001). Test equations contained the intercept. Critical values used are in Table 1 (Elliott G. *et al.*, 1996). *denotes rejection of the null of a unit root at the 10% level.

Table 5 The Zivot-Andrews break-date test for EHP

		Coefficient	Standard Error	*t*-Statistic	p-value	T_{za}
Parameter	θ	-0.007227	0.007385	-0.978647	0.3347	
	β	0.000365	0.000266	1.374422	0.1783	
	γ	-0.000318	0.000431	-0.739216	0.4648	
	α	0.902942	0.120742	7.478265	0.0000	June 2013
k=10	t-1	-0.155358	0.150831	-1.030011	0.3103	-
	t-2	0.548140	0.184294	2.974268	0.0054	
	t-3	0.279975	0.258441	1.083322	0.2863	
	t-4	0.208391	0.258419	0.806408	0.4256	
	t-5	-0.005305	0.271716	-0.019525	0.9845	
	t-6	-0.317189	0.272796	-1.162733	0.2530	
	t-7	0.119797	0.264339	0.453193	0.6533	
	t-8	0.618368	0.271523	2.277406	0.0292	
	t-9	0.044253	0.252576	0.175209	0.8620	
	t-10	-0.541823	0.254809	-2.126390	0.0408	
	Constant	0.443107	0.562956	0.787108	0.4367	
	R-squared	0.980787	Mean dependent var	4.628035		
	Adjusted R-squared	0.972876	S.D. dependent var	0.038974		
	S.E. of regression	0.006419	Akaike info criterion	-7.012403		
	Sum squared resid	0.001401	Schwarz criterion	-6.433275		
	Log-likelihood	186.8039	Hannan-Quinn criteria.	-6.792683		
	F-statistic	123.9767	Durbin-Watson stat	1.855062		

Notes: Variable was in logarithmic values. Test equations included both a linear trend and a constant. The lagged length *k* (between 2 and 10) was selected using a general-to-specific recursive method. Thus, given lagged terms of variable, $x_{(t-k)}$, *t*-statistic on $x_{(t-k)}$≥1.80 but the term $x_{(t-(k+1))}$ is statistically insignificant. *k* was selected backward beginning from a maximum value of 10. This method is data-dependent. The trimming fraction is 0.29. The critical values for a sample of 71 were −6.25, −5.68, and −5.38 at 1%, 5%, and 10% levels, respectively (Zivot E. *et al.*, 1992). T_{za} is the possible break date selected.

Table 6 The Zivot-Andrews break-date test for NHP

		Coefficient	**Standard Error**	***t*-Statistic**	**p-value**	T_{za}
Parameter	θ	0.011476	0.006726	1.706200	0.0966	
	β	1.54E-05	0.000239	0.064369	0.9490	
	γ	-0.001803	0.000545	-3.310434	0.0021	
	α	0.239496	0.127346	1.880662	0.0681	-
k=9	t-1	-0.017599	0.116662	-0.150850	0.8809	
	t-2	-0.004851	0.151024	-0.032119	0.9746	
	t-3	0.543107	0.238634	2.275894	0.0289	
	t-4	0.312342	0.255443	1.222744	0.2294	
	t-5	0.669377	0.290257	2.306155	0.0270	
	t-6	0.647625	0.285040	2.272049	0.0292	
	t-7	0.240975	0.274404	0.878175	0.3857	
	t-8	0.909006	0.276462	3.287998	0.0023	
	t-9	0.810598	0.312027	2.597847	0.0135	
	Constant	3.525485	0.591087	5.964415	0.0000	
	R-squared	0.976151	Mean dependent var	4.618982		
	Adjusted R-squared	0.967539	S.D. dependent var	0.037154		
	S.E. of regression	0.006694	Akaike info criterion	-6.943705		
	Sum squared resid	0.001613	Schwarz criterion	-6.408338		
	Log-likelihood	187.5926	Hannan-Quinn criteria.	-6.739834		
	F-statistic	113.3453	Durbin-Watson stat	2.125031		

Notes: The same as those in Table 5.

4.2 Cointegration

Engle-Granger tests suggested that variables may be cointegrated. Allowing for Cheung-Lai finite-sample corrections, the Johansen test suggested a cointegrating vector. However, allowing for Reinsel-Ahn finite-sample corrections, the Johansen test suggested no cointegrating vector. Taking all these tests into account, we could conclude that *NHP* and *EHP* are cointegrated. The normalized cointegration vector is

$$EHP = \underset{(0.09)}{0.72}\,NHP - \underset{(0.00)}{0.0003}$$

The adjustment coefficient for *EHP* is -0.32. The adjustment coefficient for *NHP* is -0.27. Hence, both variables need to be adjusted downwards, which implied a price bubble.

Table 7. Engle-Granger Tests

Dependent variable	Z_{α}-statistic	p-value
NHP	−20.29	0.04
EHP	−15.52	0.13

Notes: Variables were in logarithms and first differences. Tests contained an intercept. Lags were chosen based on a t-statistic. p-values are provided in (Mackinnon J. G., 1996).

Table 8. Johansen cointegration trace tests

r	*k*	Eigenvalue	Trace	O-L*	C&L**	Reinsel-Ahn***
0	3	0.36	30.14	25.87	28.45	25.62
≤1		0.09	5.55	12.52	13.76	4.71

Notes: *r* is the null hypothesis of the cointegration rank of at most *r*. Models I, II, III, IV, and V are proposed for the trace statistic (Johansen S., 1991, 1995). We chose Model IV (Hendry D. F. *et al.*, 2001). *5% Osterwald-Lenum asymptotical critical values (Osterwald-Lenum M., 1992). **5% Cheung-Lai finite-sample critical values (Cheung Y.-W. *et al.*, 1993). ***Reinsel-Ahn finite-sample trace corrections (Reinsel G. C. *et al.*, 1992). The lag length *k:* AIC.

4.3 Weak exogeneity

For α_{11}=0, LR=18.67 with a p-value of 0.00, which rejected the weak exogeneity of *EHP* at the 1% level. For α_{21}=0, LR=7.52 with a p-value of 0.01, which implies we can accept the weak exogeneity of variable *NHP* at the 1% level.

4.4 Estimation of ECMs

Having the cointegrating vector detected built into the first-differenced VAR, we estimated ECM (Table 9). ECM estimates would be used to test for subsequent Granger causality. Regarding the short-run effect of *NHP* on *EHP*, the estimates on the first and second terms are significant (*t* statistics = -2.43, -3.29). Regarding the short-run effect of *EHP* on *NHP*, the estimate on the second term is significant (*t* statistic =

3.35). Since *EHP* and *NHP* Granger caused each other, the short-run elasticity of old home prices relative to new house prices is about -0.40. The short-run elasticity of new home prices relative to old house prices is 0.76.

Table 9. ECM Estimates

		Estimate	***t*-statistic**	**Estimate**	***t*-statistic**
Error-correction term$_{t-1}$		**-0.32**	**-5.08**	**-0.27**	**-2.97**
	Lagged term	*EHP*		*NHP*	
EHP	t − 1	0.09	0.47	0.04	0.18
	t − 2	0.97	5.96	0.76	3.35
	t − 3	0.46	2.06	0.30	0.94
NHP	t − 1	-0.34	-2.43	-0.32	-1.61
	t − 2	-0.53	-3.29	-0.60	-2.62
	t − 3	0.10	0.58	0.34	1.41
Constant	-3.68	0.00	0.34	-0.00	-0.21
R-squared	0.67				
Adj. *R*-squared	0.62				
F-statistic	13.80				
Akaike AIC	-7.41				

4.5 Granger Causality

By excluding lagged *NHP* variables, χ^2 is 16.21 with a p-value of 0.001, which suggests Granger causality from new home prices to old home prices. By excluding lagged *EHP* variables, χ^2 is 13.92 with a p-value of 0.003, which suggests Granger causality from old home prices to new home prices.

5. Concluding Remarks

This study proposes a cointegrating relationship between new commodity home prices and existing home prices in Guiyang, Guizhou Province, Southwest China. In the long run, they tend to move together. New house prices are weakly exogenous and so impacted old home prices in the long run. The long-run elasticity of old home prices relative to new home prices is 0.72.

Both of the adjustment coefficients for the cointegrating vector are negative. Hence, new commodity home prices as well as existing home prices in Guiyang may contain a bubble.

In the short run, this study suggests a feedback relationship; new home and old home prices lead each other. The short-run elasticity of old home prices relative to new house prices is about -0.40. The short-run elasticity of new home prices relative to old house prices is 0.76.

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