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How Effects Arising from Sub-housing Markets Differ in Changsha, China

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Abstract: **This paper finds that housing prices are integrated of order one, denoted by I(1). Sub-housing (new goods residential) markets and residential stock markets were not cointegrated. Hence, first-differenced (FD) VARs were constructed and computed. A feedback effect was suggested between these two types of housing markets. The short-run elasticity of new home prices relative to old house prices is about -1.52. The short-run elasticity of old home prices relative to new house prices is 0.92, a near unity elasticity. Effects coming from these two markets differ notably. The old home market shows a greater impact than the new one does. We argue that housing transactions centered on the stock residential market are beneficial for a sustainable housing market.**

Keywords: **Housing, price, long run, short run, stock market, goods housing, feedback.**

I. INTRODUCTION

Changsha is the capital of Hunan Province in Central China. Changsha is a quickly growing business city in Hunan and even in Central China. In 2017, it had a land area of 11,861 square kilometers, accounting for 5.60% of Hunan's total. It had a resident population of 7.09 million, accounting for 10.33% of Hunan's total. The aggregate GDP reached RMB 1053.6 billion (about 150.5 billion US dollars), accounting for 31.08% of Hunan's total [1], [2].

With increasing residential stock, buyers may tend to be a rational consumer and investor. This paper examines the differential effects arising from the new goods home market and the stock residential market. Changsha, a metropolis in Central China, is taken as a case.

II. METHODS

This paper conducted for Engle-Granger tests [3] and Johansen tests [4]. Cheung-Lai [5] and Reinsel-Ahn [6] finite-sample corrections were considered.

Unit root tests used ADF [7], PP [8], ERS point-optimal [9], and the Zivot-Andrews break-point test [10].

First-differenced VAR were estimated [3]. Granger causality tests [11] were made.

III. DATA

House prices embrace existing home prices (variable: *EHP*) and new commodity home prices (variable: *NHP*). Monthly data are for Jan. 2011-Dec. 2015. Prices are index changes, which are compared with the same month of last year [1, 2, 12].

Data were seasonally smoothed by the X12. We used log data. Table 1 reports the data statistics. Intercepts and linear trends may occur in the data

TABLE I: DESCRIPTIVE STATISTICS FOR THE DATA

	EHP	***NHP***
Mean	100.9150	102.5550
Median	100.7000	102.3500
Max	106.8000	112.3000

Min	95.40000	91.10000
Std. Dev.	3.097283	6.516431
Skewness	0.167692	-0.288684
Kurtosis	2.463366	1.870225
Jarque-Bera	1.001147	4.024360
p-value	0.606183	0.133697
Period	Jan 2011-Dec 2015	
Observation	60	

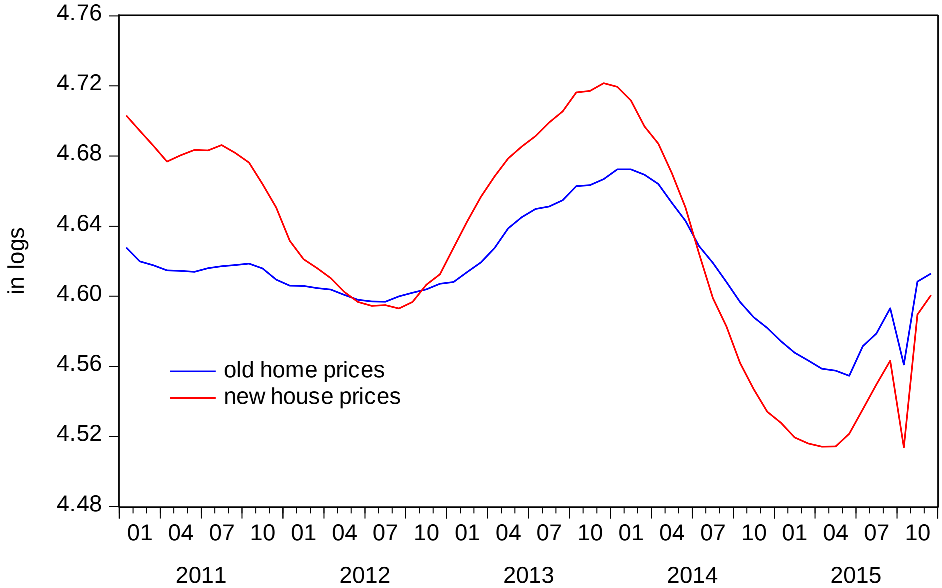

Fig. 1: MONTHLY CHANGES IN HOME PRICES IN CHANGSHA, CHINA

IV. EMPIRICAL RESULTS

4.1. Unit Root

EHP: No unit root by ADF. A unit root by PP and ERS. No unit root by the Zivot-Andrews test. *EHP* can be treated as being nearly I(1).

NHP: No unit root by ADF. A unit root by PP and ERS. A unit root by the Zivot-Andrews test. *NHP* can be treated as I(1).

TABLE II: THE UNIT ROOT TESTS (ADF TESTS)

Log variable	*k*	Level	*k*	First difference
EHP	8	-4.37***	-	-
NHP	4	-3.90**	-	-

Notes: All tests encompass an intercept and a trend. The lag length *k* was decided using the *t*-test [13]. ** and ***denote rejection of the null of a unit root at the levels of 5% and 1 %, respectively.

TABLE III: THE UNIT ROOT TESTS (PP TESTS)

Log variable	*k*	Level	*k*	First difference
EHP	4	-1.58	4	-7.88***
NHP	5	-1.69	5	-6.92***

Notes: All tests encompass an intercept and a trend according to [14]. The lag *k* was decided using the Newey–West (NW) bandwidth technique [15]. ***denotes rejection of the null of a unit root at the 1% level.

TABLE IV: THE UNIT ROOT TESTS ERS POINT-OPTIMAL TESTS)

Log Variable	***k***	**Level**	***k***	**First difference**
EHP	2	-3.45	3	63.57***
NHP	2	2.84	2	25.99***

Notes: Lag based on modified Akaike information criterion (MAIC). The MAIC is suggested to dominate all other criteria [16]. Test equations contained the intercept and trend. Critical values used are in Table 1 [9]. ***denotes rejection of the null of a unit root at the 1% level.

TABLE V: THE ZIVOT-ANDREWS BREAK-DATE TEST FOR *EHP*

		Coefficient	**Standard Error**	***t*-Statistic**	***p*-value**	T_{za}
Parameter	θ	0.004558	0.006553	0.695520	0.4910	
	β	0.000309	0.000213	1.453899	0.1542	
	γ	-0.000806	0.000576	-1.399503	0.1698	
	α	0.610811	0.103561	5.898094	0.0000	Nov 2013
k=8	t-1	0.121448	0.147836	0.821500	0.4165	
	t-2	0.289109	0.174312	1.658565	0.1054	
	t-3	-0.647011	0.324742	-1.992385	0.0535	
	t-4	1.692890	0.345147	4.904841	0.0000	
	t-5	0.188362	0.436632	0.431398	0.6686	
	t-6	0.147122	0.439804	0.334518	0.7398	
	t-7	-0.073396	0.454388	-0.161527	0.8725	
	t-8	0.705005	0.385322	1.829654	0.0752	
	Constant	1.789845	0.476609	3.755372	0.0006	
	R-squared	0.969253	Mean dependent var	4.613128		
	Adjusted R-squared	0.959544	S.D. dependent var	0.033173		
	S.E. of regression	0.006672	Akaike info criterion	-6.966115		
	Sum squared resid	0.001692	Schwarz criterion	-6.473689		
	Log likelihood	190.6359	Hannan-Quinn criter.	-6.777945		
	F-statistic	99.82583	Durbin-Watson stat	2.058121		

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 $x_{(t-k)} \geq 1.80$ 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 [10]. T_{za} is the possible break date selected.

TABLE VI: THE ZIVOT-ANDREWS BREAK-DATE TEST FOR *NHP*

		Coefficient	**Standard Error**	***t*-Statistic**	***p*-value**	T_{za}
Parameter	θ	0.032914	0.011955	2.753125	0.0094	
	β	0.000337	0.000464	0.727055	0.4722	
	γ	-0.004276	0.001024	-4.177870	0.0002	
	α	0.185682	0.142060	1.307064	0.2000	-
k=10	t-1	-0.096658	0.146232	-0.660994	0.5131	
	t-2	-0.167678	0.222354	-0.754102	0.4560	
	t-3	0.322351	0.464339	0.694214	0.4923	
	t-4	1.019430	0.477728	2.133915	0.0401	
	t-5	0.987507	0.498649	1.980366	0.0558	
	t-6	0.436220	0.501804	0.869303	0.3908	
	t-7	0.359772	0.495644	0.725868	0.4729	
	t-8	0.366675	0.448017	0.818439	0.4188	
	t-9	-0.144681	0.445079	-0.325069	0.7471	
	t-10	0.767394	0.414430	1.851687	0.0728	
	Constant	3.773498	0.659882	5.718447	0.0000	
	R-squared	0.979468	Mean dependent var	4.616073		

	Adjusted R-squared	0.971013	S.D. dependent var	0.065080		
	S.E. of regression	0.011080	Akaike info criterion	-5.920533		
	Sum squared resid	0.004174	Schwarz criterion	-5.341405		
	Log likelihood	160.0531	Hannan-Quinn criter.	-5.700813		
	F-statistic	115.8524	Durbin-Watson stat	2.259281		

Notes: The same as those in Table 5.

4.2. Cointegration

Engle-Granger tests suggested no cointegration. Johansen tests: Reinsel-Ahn finite-sample corrections suggested no cointegration. Hence, *EHP* and *NHP* are not cointegrated.

TABLE VI1: ENGLE-GRANGER TESTS

Log Dependent variable	**Z_α-statistic**	***p*-value**
EHP	-11.92	0.28
NHP	−5.84	0.74

Notes: Variablesin first differences. Tests contained an intercept and a trend. Lags based on a t-statistic. p-values are provided in [17].

TABLE VIII: JOHANSEN COINTEGRATION TRACE TESTS

r	***k***	**Eigenvalue**	**Trace**	**O-L***	**C&L****	**Reinsel-Ahn*****
0	4	0.32	29.97	25.87	29.43	23.98
≤1		0.14	8.48	12.52	14.24	6.78

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 [4, 18]. Model IV applied [19]. *5% Osterwald-Lenum asymptotical critical values [20]. **5% Cheung-Lai finite-sample critical values [5]. ***Reinsel-Ahn finite-sample trace corrections [6]. The lag length *k* was selected by reducing the Akaike information criterion (AIC) to the extent possible.

4.3. Estimation of VARs

First-differenced VARs were estimated (Table 9).

Regarding the short-run effect of *EHP* on *NHP*, the estimates on the first term is significant (*t* statistics = -2.70).

Regarding the short-run effect of *NHP* on *EHP*, the estimate on the third term is significant (*t* statistic = 3.58).

Since *EHP* and *NHP* Granger caused each other, the short-run elasticity of new home prices relative to old house prices is about -1.52. The short-run elasticity of old home prices relative to new house prices is 0.92.

TABLE IX: VAR ESTIMATES

		Estimate	***t*-statistic**	**Estimate**	***t*-statistic**
	Lagged term	*EHP*		*NHP*	
EHP	t − 1	-0.76	-2.26	-1.52*	-2.70
	t − 2	0.26	0.73	-0.10	-0.17
	t − 3	-0.65	-1.82	-0.88	-1.49
NHP	t − 1	0.30	1.44	0.69	1.99
	t − 2	-0.19	-0.88	0.01	0.02
	t − 3	0.92*	3.58	1.36	3.16
Constant		0.00	1.68	0.00	1.21
R-squared	0.43				
Adj. *R*-squared	0.36				
F-statistic	6.17				
Akaike AIC	-6.71				

Notes: Lags=3: based on 3 by sequential modified LR test statistic at 5% level, 4 by AIC, 0 by SIC, and 4 by HQ. *Significant effects.

4.4. Granger causality

By excluding lagged *NHP* variables, χ^2 is 20.44 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 13.64 with a *p*-value of 0.0034, which suggests Granger causality from old home prices to new home prices.

V. CONCLUDING REMARKS

No cointegration is suggested between new commodity home prices and existing home prices in Changsha, Hunan Province, China. Hence, VARs in first difference were estimated.

There is a feedback between these two sub-housing markets. Effects dramatically differ between the old and new home markets; compared with the effect of new home market on the old home market, the old home market has a greater effect on the new one. Their effects have opposite signs.

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