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An empirical research on the influence of house price on the consumer market based on monthly statistics in Shanghai

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Abstract. Consumption plays a crucial role in people's daily lives. In recent years, China's consumer market has faced urgent needs for consumption transformation and heavy pressure from economic downturn. As an important component of everyday consumption and wealth savings, there is a close relationship between changes in house prices and the consumer market. There has been a heated debate in the academic community regarding the positive or negative relationship between the two. The study keeps focus on the changes of consumer market, attempting to reveal the effects of house price has. This article extracts monthly consumption and housing price data in Shanghai from 2014 to 2024, strictly arranges them in chronological order, and uses the ECM model to handle the instability of time series data. The conclusion of this study is that the rise in housing prices can stimulate consumption. Also house prices have a controlling effect on the fluctuations of the consumer market.

Keywords: House price, consumption market, fixed assert.

1. Introduction

On the macro level, the variety, abundance, and novelty of consumption not only contribute to economic growth and market vitality, but also play an important role in the development of social structure, cultural exchange, and personal happiness. As an important part of consumption, real estate plays a vital role in people's lives and wealth. Changes in house prices also affect the mortgage amount that property owners can get. For those who do not have a house, rising house prices not only increase their alternative consumption costs, but also force them to choose between daily consumption and house purchase investment. They have to store some assets for future purchase, thus reducing their consumption level. In addition, although the correlation between house prices and consumption is obvious, it does not mean that there is a direct relationship between the two. House prices and consumption may be affected by a variety of factors such as interest expenses, income expectations, credit conditions and unemployment.

When it comes to the influence of house price on consumption, scholars tend to support two kinds of theory, one supposing the effect is positive and the other standing for negative impacts. Meanwhile, plenty of studies focus on the way house price affects the consumption behaviors. Wealth effect and Crowding-out effect are the widest-known theories to explain the mechanism.

A group of researchers deem that house prices have a positive impact. Lin et al. found that for cities with different degrees of development, the impact of housing prices on consumption will be reflected in both positive and negative wealth effects [1]. Cong and Song believed that the rise of housing prices can promote the consumption demand of urban residents, and there exists a significant partial mediating effect of human capital between housing prices and urban consumption. Overall, human capital and housing prices have a positive promoting effect on urban consumption [2]. Zhang and Chong believed that the rise in housing prices has driven non-residential consumption among residents, with little impact on essential consumption. Also, it will increase unnecessary consumption through the "wealth effect" [3]. To conclude, it is believed by plenty of researchers that house price pushes the consumption.

However, the assumption that house price affects consumption positively is faced with a large number of doubts. Hong proposed that there is a negative correlation between overall fluctuations in real estate prices and consumption growth [4]. Tong proposed that the increase in household income has a promoting effect on household consumption, while changes in housing prices are negatively correlated with household consumption, and regional differentiation is severe [5]. Sun et al. found that housing prices inhibit the upgrading of residents' consumption structure, which is different in different consumption structure upgrade stages, in different levels of cities and regions [6]. Jin and Jiang believed that the rise in housing prices has a wealth effect and a substitution effect, because the rise in housing prices makes residents spend more on buying houses, which leads to a decline in daily consumption levels [7]. These scholars all define the relationship between house price and consumption as negative.

There also exist a few studies that observed the relationship in different aspects. Liu and Chen believed that the rise in housing prices has significantly increased the inequality of residents' consumption [8]. Jin and Chu believed that the fluctuations in housing prices and stock prices will precede economic fluctuations and consumption fluctuations, which shows that real estate and stocks are a kind of w in housing prices and stock prices have little impact on residents' consumption, and there is a two-way causal relationship between residents' consumption and housing price fluctuations and economic fluctuations [9]. Xu and Wu found through research that the impact of GDP on housing prices shows a nonlinear improvement effect as the population increases, and the more serious the aging of the region, the greater the possibility of housing prices falling [10].

In conclusion, most scholars agree that house prices play a significant role in the change of consumption, no matter how the effect is finished. However, a large number of studies work on the relationship between consumption behaviors and house price, ignoring the reaction of the consumer market. As a result, the study focuses on the changes of consumer market, attempting to define the way house price affects the market.

2. Methodology

2.1. Data source

The data in this study comes from the statistical data from the National Bureau of Statistics, Shanghai Municipal Bureau of Statistics, and Shanghai Municipal Bureau of Finance. Monthly data related to housing prices and consumer markets in Shanghai from 2014 to 2024 are collected, including the monthly average selling price of commercial housing, housing price index, total social retail goods, and rate of change. At the same time, the change index of fixed assets investment and the change rate of general public budget expenditure are taken into consideration. All the data mentioned above is calculated on a monthly basis. Average house prices are listed in the unit of Yuan, while the general public budget expenditures are presented in the billions of Yuan. All the data about growth rate are accumulated year-on-year.

2.2. Indicators selection and explanation

To measure the changes in the consumer market in Shanghai, this study selected the growth rate of total retail sales of social goods and the consumer index of residents as the dependent variables. The total retail sales of consumer goods refer to the amount of physical goods sold directly by enterprises to

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individuals or social groups through transactions for non production or non business purposes, as well as the income obtained from providing catering services. The goods included in the statistics do not include raw materials used for production investment, nor do they include expenses incurred by residents for purchasing commercial housing, and expenses incurred by farmers for purchasing agricultural production materials. The fluctuation of housing prices is displayed through the average housing price and monthly housing price index. To control dimensionality, the housing price data was logarithmically processed. The price index of second-hand and newly built houses will be used to reflect the impact of different types of housing prices on the consumer market. The influence of policy expenditure and corporate investment on the consumer market cannot be ignored. The change rate of general public budget expenditure and fixed assets investment will reflect the impact of both. After defining the names and indication of variables, a descriptive analysis is necessary to give a concise summary of the statistics. The basic qualities of the information are displayed in Table 1.

Table 1. Descriptive Analysis

Variable	Min	Max	Mean	Std. deviation
Growth Rate of Total Retails Sales of Consumer Good (GSC)	-48.300	113.500	7.408	17.954
Consumer Price Index (CPI)	-0.200	3.690	1.958	0.904
Growth Rate of House Price (GHP)	-37.530	106.970	11.588	21.088
House Price (HP)	9.593	10.806	10.266	0.325
Growth Rate of Fixed Assets Investment (GFI)	-21.200	40.500	7.329	9.408
Growth Rate of General Public Budget Expenditure (GPE)	-12.000	66.200	9.549	13.626
Growth Rate of Second-hand House Price (PR-S)	-7.500	37.400	5.658	9.965
Growth Rate of Newly-built House Price (PR-N)	-5.900	39.500	6.797	10.211

2.3. Method introduction

In order to take on further study on the influencing effect of house price changes on the consumer market, a correlation test should be finished at first to figure out whether the indicators are selected properly. So the study uses the method of Pearson correlation. The method is aimed to find out the linear correlation between these two variables. The range of the Pearson correlation coefficient is $[-1,1]$. If no linear correlation between the two variables, the value of the Pearson correlation coefficient is 0. The result of the correlation test is shown in Table 2.

Table 2. Pearson Correlation Test

	GCS	CPI
GHP	0.323**	0.052
HP	0.059	-0.487**
PR-S	0.062	0.438**
PR-N	0.017	0.376**
GFI	0.613**	-0.660**
GPE	0.082	0.327**
* p<0.05 ** p<0.01		

It can be learned from the table 2 that growth rate of house price and fixed asserts investment are correlated with the growth rate of total consumer goods' sales at the level of 0.05. Either of the two independent variables shows a positive influence. While all the independent variables except the growth rate of house price are correlated with the consumer price index at the level of 0.05. Among them, house price and the growth rate of fixed asserts investment present negative effects, and the other variables

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correlate CPI positively. As a result, GHP and GFI is used to explain the variable GCS, while PR-S, PR-N, GFI and GPE is used to explain the variable CPI.

Since the concerning variables are collected in Shanghai from 2014 to 2024 every month in the order of time, it is suitable to define the variables as time-series statistics. Before the further study is started, an ADF test is in need to test whether the statistics is stationary. And the result of the ADF test will decide if the variables should be differential processed before being substituted into the model and calculated. The results of the ADF test are listed in Table 3.

Table 3. Results of the ADF Test

Variable	T(Unpossessed)	P	Stationary	T(First Difference)	P	Stationary
GCS	-5.908	0.000	Yes			
CPI	-0.780	0.825	No	-5.601	0.000	Yes
GHP	-2.857	0.051	Yes			
HP	-1.813	0.374	No	-9.284	0.000	Yes
GFI	-4.052	0.001	Yes			
GPE	-1.829	0.366	No	-2.933	0.042	Yes
PR-S	-1.879	0.342	No	-4.528	0.000	Yes
PR-N	-1.648	0.458	No	-3.917	0.002	Yes

It is presented in Table 3 that the variables except GCS, GHP and GFI are not stationary. To deal with the situation, the ECM model can be taken into use, which is a model often used to cope with time-series statistics without stationarity. For non-stationary time series, it is proper to be transformed into stable sequences through differential methods. The ECM model is the EG two-step method (EG-ADF method). Firstly, OLS linear regression is established for X and Y, and residual ECM is obtained. Then, Y and X are taken as first-order differences to obtain det(Y) and det(X), and ECM is taken as first-order lag, i.e., ECM (-1). Finally, the model will establish OLS linear regression for det(Y), det(X) and ECM (-1). The constant ECM model form is performed as:

$$Y_t = \beta_0 + \beta_1 X_t + \beta_2 X_{t-1} + \delta Y_{t-1} + \varepsilon \quad (1)$$

3. Result and Discussion

3.1. The ECM model of GCS

As mentioned in the former part, the variable GCS can be explained by the variables GHP and GFI. Before the statistics is adapted into the ECM model, taking a co-integration test is in schedule to find out whether the statistics should be processed. The co-integration between three variables can be learned from Table 4.

Table 4. Johansen Co-integration Test (Based on the Trace Statistics)

H0	Eigenvalue	Trace	Critical value of 10%	Critical value of 5%	Critical value of 1%
None	0.624	135.216	27.067	29.796	35.463
At most one	0.136	27.626	13.429	15.494	19.935
At most two	0.099	11.500	2.705	3.841	6.635

According to the table, the hypothesis' None ', 'At most 1 co-integration' and 'At most 2 co-integrations' are rejected at the 1% level as their trace statistics all go beyond the critical values. Consequently, the concerning indexes have a co-integration relationship between each other, which means there exists a balanced connection between the variables. As a result, the statistics is allowed to be used in the ECM model.

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On the basis of the co-integration test, the next step to take is the co-integration regression model, which works on the long-term equilibrium relationships. The results of the model are presented in Table 5.

Table 5. Co-integration Regression

	Coefficient	Std. Error	t	p
c	-3.433	1.736	-1.977	0.051
GHP	0.227	0.061	3.701	0.000
GFI	1.121	0.137	8.164	0.000
F	F (2, 108)=43.521, p =0.000		Durbin-Watson	1.034
nobs	111		AIC	895.490
R2	0.446		BIC	903.618
Adjusted R2	0.436		RMSE	13.300

According to the table, the formula of the co-integration equation model is performed as:

$$GCS = -3.433 + 0.227 * GHP + 1.121 * GFI \quad (2)$$

The R value of the cointegration equation model is 0.446. From the perspective of the co-integration equation test, the co-integration equation model passed the F-test (F=43.521, p=0.000<0.1). For the long-term equilibrium equation parameter test, the coefficient of housing price growth rate was 0.227, showing a significant 0.01 level (t=3.701, p=0.000<0.01), indicating that housing price growth rate will have a positive long-term equilibrium relationship with the growth rate of total retail sales. Meanwhile, the coefficient value of fixed assets investment growth rate is 1.121, showing a significant 0.01 level (t=8.164, p=0.000<0.01), which means that the growth rate of fixed assets investment will have a positive long-term equilibrium impact on the growth rate of total retail sales.

When finishing the co-integration regression, an ECM model follows, studying the short-term volatility relationship, which includes the first-order difference component of the sequence and the previous period error value, i.e. ECM (-1). Table 6 explains the adaption of the ECM model.

Table 6. ECM Model (Error Corrected) of GCS

	Coefficient	Std. Error	t	p
c	-0.205	0.898	-0.229	0.820
det(GHP)	0.189	0.060	3.161	0.002
det(GFI)	3.101	0.247	12.576	0.000
ECM(-1)	-0.777	0.074	-10.465	0.000
F	F (3, 105) =75.827, p =0.000		Durbin-Watson	1.542
nobs	109		AIC	801.055
R2	0.684		BIC	811.821
Adjusted R2	0.675		RMSE	9.197

From the table 6, it can be learned that the ECM model formula is presented as:

$$GSC = -0.205 + 0.189 * \det(GHP) + 3.101 * \det(GFI) - 0.777 * ECM\ (-1) \quad (3)$$

The R value of the ECM model is 0.684. From the perspective of model testing, the ECM model passed the F-test (F=75.827, p=0.000<0.1). Regarding the impact of short-term fluctuations, the coefficient of the difference in housing price growth rate was 0.189, showing a significant 0.01 level (t=3.161, p=0.002<0.01), indicating that the current fluctuation of housing price growth rate will have a positive adjustment on the current fluctuation of the total retail sales growth rate of goods.

The coefficient value of the growth difference sub item of fixed assets investment is 3.101, showing a significant 0.01 level (t=12.576, p=0.000<0.01), which means that the current fluctuation of the growth rate of fixed assets investment will have a positive adjustment to the current fluctuation of the total retail sales growth rate.

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Besides, the value of the error correction coefficient is -0.777, showing a significant level of 0.01 (t=-10.465, p=0.000<0.01), indicating that when short-term fluctuations deviate from long-term equilibrium, the non-equilibrium state will be pulled back to equilibrium with an adjustment force of -0.777.

3.2. *The ECM model of CPI*

Similarly, the variables to be used in the ECM model, including CPI, HP-S, HP-N, GFI and GPE are supposed to take a co-integration test in the beginning. According to the statistical results, the hypothesis that there exist at most 3 co-integration relationship cannot be refused. Consequently, the concerning statistics has to be differenced at first order. The descriptive analysis of the processed data can be seen in Table 7.

Table 7. Descriptive Analysis of Variables at First Difference

Variable	Min	Max	Mean	Std.Deviation
Diff1(CPI)	-1.600	1.240	-0.025	0.271
Diff1(HP-S)	-10.300	8.600	-0.142	2.017
Diff1(HP-N)	-6.700	6.900	-0.085	1.938
Diff1(GFI)	-14.600	17.900	0.046	4.138
Diff1(GPE)	-34.200	50.100	-0.120	9.771

After differencing the variables lack of co-integration, the processed data is supposed to pass the next co-integration test. The results are shown in Table 8. The further analysis is aimed to base on the co-integration relationship between the concerning variables.

Table 8. Johansen Co-integration Test (Based on the Trace Statistics)

H0	eigenvalue	Trace	10%	5%	1%
None	0.619	229.162	65.820	69.819	77.820
At most 1	0.343	124.907	44.493	47.855	54.681
At most 2	0.311	79.565	27.067	29.796	35.463
At most 3	0.230	39.332	13.429	15.494	19.935
At most 4	0.098	11.145	2.705	3.841	6.635

Regarding the hypothesis of ‘up to 4 co-integrations’, its trace statistic value is 11.145, and the 1% critical value is 6.635, which means that the hypothesis is rejected at the 1% level. The result indicates that the co-integration exists among the variables, which allows the adaption to the ECM model to continue.

Similar to the progress finished in the former part, the data of the five variables is substituted into the co-integration regression model to find out the long-term relationship. The first step--the co-integration regression is presented in Table 9, whose result reveals the influencing effect of the independent variables and attempts to predict further changes.

Table 9. Co-integration Regression of CPI

	Coefficient	Std. Error	t	p
c	-0.017	0.019	-0.940	0.349
Diff1(HP-S)	0.045	0.019	2.340	0.021
Diff1(HP-N)	-0.015	0.020	-0.739	0.462
Diff1(GPE)	0.000	0.002	0.123	0.902
Diff1(GFI)	-0.045	0.005	-10.047	0.000
F	F (4,105)=27.200,p =0.000		Durbin-Watson	1.820

Table 9. (continued).

nobs	110	AIC	-44.265
R2	0.509	BIC	-30.763
Adjusted R2	0.490	RMSE	0.189

The table 9 above shows the adaption to the co-integration regression model, which is also called the long-term equilibrium equation. The formula of the co-integration equation model is:

$$Diff1(CPI) = -0.017 + 0.045\ Diff1(HPS) - 0.015\ Diff1(HSN) - 0.045\ Diff1(GFI) \quad (4)$$

The R square value of the co-integration equation model is 0.509. From the perspective of the co-integration equation test, the co-integration equation model passed the F-test (F=27.200, p=0.000<0.1). For the parameter test of the long-term equilibrium equation, the coefficient value of the Diff1(HP-S) was 0.045, showing a significant 0.01 level (t=2.340, p=0.021<0.05), indicating that the Diff1 second-hand housing price index will have a positive long-term equilibrium relationship with the Diff1(CPI).On the contrary, the coefficient of the growth rate of Diff1(GFI) is -0.045, showing a significant 0.01 level (t=-10.047, p=0.000<0.01), which means that the growth rate of Diff1(GFI) will have a negative long-term equilibrium impact on Diff1(CPI).

While another two variables fail to influence CPI in the long term. The coefficient value of the Diff1(PR-N) is -0.015. There is no significant difference (t=-0.739, p=0.462>0.05).The coefficient value of Diff1(GPE) is 0.000, which does not show significant (t=0.123, p=0.902>0.05). Consequently, the effects of the variables PR-S and GFI on CPI are much stronger than that of PR-N and GPE.

On the basis of the co-integration regression step, the study focuses on the short-term changes which are predicted to take place among the several variables. The error corrected formula and the influencing effects are worked out with the first-differenced data. The result is shown in Table 10.

Table 10. ECM Model (Error Corrected) of CPI

	Coefficient	Std. Error	t	p
c	-0.000	0.018	-0.027	0.979
Diff2(HP-S)	0.036	0.017	2.148	0.034
Diff2(HS-N)	-0.021	0.022	-0.961	0.339
Diff2(GPE)	0.000	0.001	0.243	0.809
Diff2(GFI)	-0.051	0.004	-11.908	0.000
ECM(-1)	-0.924	0.098	-9.402	0.000
F	F (5,102)=44.725,p =0.000		Durbin-Watson	1.926
nobs	108		AIC	-44.29
R2	0.687		BIC	-28.20
Adjusted R2	0.671		RMSE	0.186

It can be learned from Table-10 that the model is able to explain 67.1% part of the CPI changes, and the ECM model has passed the F-test (F=44.725, p=0.000<0.1). The formula is presented as: $Diff1(CPI) = 0.036Diff2(PRS) - 0.021Diff2(PRN) - 0.051\ Diff2(GFI) - 0.924\ ECM\ (-1)$.

Regarding the impact of short-term fluctuations, the coefficient value of the difference component of the Diff1(PR-S) is 0.036, showing a significant level of 0.05 (t=2.148, p=0.034<0.05), indicating that the current fluctuation of the Diff1 (PR-S) will have a positive adjustment to the current fluctuation of the Diff1(CPI). Also, the coefficient value of Diff1(GFI) is -0.051, showing a significant 0.01 level (t=-11.908, p=0.000<0.01), which means that the current fluctuation of Diff1(GFI) will negatively adjust

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the current fluctuation of Diff1(CPI). It is worthy of consideration that the impact of the variable PR-N shows no significance in the changes of CPI.

The error correction coefficient value is -0.924, showing a significant level of 0.01 ($t=-9.402$, $p=0.000<0.01$). The result shows that when short-term fluctuations deviate from long-term equilibrium, the non-equilibrium state will be pulled back to equilibrium with an adjustment force of -0.924.

3.3. Discussion

According to the results of the GCS model, the growth rate of housing prices has a positive equilibrium effect on the growth rate of total retail sales of social goods. This result supports the theory that rising housing prices drive consumption. The calculation scope of the total retail sales of social goods does not include the purchase of housing, but mainly reflects the purchasing power of the consumer market. The research results support the close correlation between changes in housing prices in Shanghai and the level of activity in the consumer market. At the same time, the growth rate of house prices and the growth rate of social fixed assets investment can jointly pull the volatile GCS back to equilibrium. Based on this, it can be seen that changes in housing prices have a certain controlling effect on social purchasing power, and this result has certain reference value in formulating policies for consumption. When there is abnormal or weak growth in social consumption levels, investment and regulation in the real estate market may help improve the situation.

From the research results, it can be seen that in the long-term and short-term fluctuations of CPI, changes in second-hand housing prices have a stronger impact compared to the new housing price index. This phenomenon largely reflects the housing market situation and residents' housing consumption concepts in Shanghai. The housing prices in Shanghai are at a relatively high level, and the cost of purchasing a house is relatively high. The purchase of expensive new houses often requires a long-term storage and preparation process, so the impact on monthly price indices is not significant. The transaction of second-hand houses relies on high cost-effectiveness and investment value, which has a long-term impact on the monthly price index changes. Its price fluctuations can effectively pull the price index back to the original benchmark model.

4. Conclusion

According to the research results, there is a positive equilibrium relationship between the growth rate of housing prices in Shanghai and the growth rate of social fixed assets investment and the growth rate of total retail sales of social goods. When the growth rate of total retail sales of social goods deviates from long-term equilibrium, the two independent variables are adjusted with a force of -0.777 to pull it back to equilibrium. Second hand housing price growth rate and social fixed assets investment rate have positive and negative impacts on social consumer price index respectively. The current fluctuations of both will pull the unbalanced CPI back to the original model with a force of -0.924.

The results of this study suggest a positive relationship between housing prices and changes in the consumer market. The rise in housing prices has driven up the purchase amount and purchasing power of residents. The research results also indicate that the price of second-hand houses in Shanghai has a significant positive impact on the consumer price index, while the impact of changes in the price of newly built houses is relatively weak.

This study observes the volatility of the consumer market through the growth rate of total retail sales of social goods and the consumer price index of residents. There are still certain shortcomings in the research, such as vague explanations of the impact of housing prices and insufficient grasp of macro data. In recent years, academic research on housing prices and consumption has often focused on consumers, with less attention paid to changes in the consumer market. In the future, further research on the relationship between the consumer market and housing prices can deepen the understanding of the regulatory power of real estate, and provide guidance for formulating policies to stimulate consumption in the context of downward pressure in the consumer market.

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Authors contribution

All the authors contributed equally and their names were listed in alphabetical order.

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