The Impact of House Price Fluctuation on Automobile Inventory Pressure -An Analysis based on the Data of 70 Cities

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Abstract. The fluctuation of real estate price may affect the balance sheet and credit constraints of residents and then change the consumption rhythm of durable goods such as automobiles and transmit to channel inventory. Based on the monthly data from November 2020 to October 2025, this paper constructs a comprehensive national housing price index composed of 70 new and second-hand housing price indexes and matches it with the inventory early warning index (supplemented by inventory coefficient). The Vector Autoregressive Model (VAR) model was established after Augmented Dickey-Fuller Test (ADF) stationarity test and difference processing, and the dynamic effects were identified by combining Granger causality test, impulse response and variance decomposition. The results show that house price fluctuation has no significant predictive effect on inventory pressure, and the response of inventory to house price shock is weak and not significant in most periods. The explanation degree of house price to inventory fluctuation is only about 3% -5.5%. The research shows that the statistical correlation between house price and inventory pressure is weak in the sample period, and inventory management should give priority to factors such as production and marketing rhythm, channel policy and market competition. House price index can be used as an auxiliary reference.

Keywords: House Price Fluctuation, Inventory Alert Index, VAR Model, Impulse Response, Variance Decomposition.

1 Introduction

As an important macroeconomic variable, real estate price fluctuation will change residents' consumption and durable goods purchase decisions by affecting household balance sheet and credit constraints [1]. Based on the CFPS micro data, Zhou Li and Yi Jian found that the rise in house prices and household debt have a threshold effect on the consumption of urban residents constrained by the loan to value ratio, and the reactions of households with and without housing are significantly different [1]. Sunhao and others pointed out that the rise of housing prices generally inhibited the upgrading of consumption structure, which was manifested by squeezing development

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expenditures such as transportation and communications by changing marginal propensity to consume [2]. Yinzhichao and others believe that housing wealth can alleviate liquidity constraints on the whole, so as to promote household consumption and improve consumption structure [3] based on the evidence of CHFS. At the level of housing finance system, when the operation of provident fund faces liquidity pressure, the increase of loan threshold will reduce the availability of loans and then inhibit the consumption of constrained families [4]. At the same time, the deposit and withdrawal system of housing provident fund can improve consumption level and optimize consumption structure by affecting disposable income and Preventive Savings motivation [5].

In addition to domestic evidence, Vestman et al. Used quasi-natural experiments to identify the impact of housing wealth and found that the change of housing wealth would significantly affect the purchase of new cars, and high loan to value ratio and low-deposit families had stronger reactions [6]. Chopra et al. Changed residents' long-term housing price expectations through on-site information intervention. They found that renters would reduce expenditure and reduce the probability of purchasing durable goods when they expected the housing price to rise faster, suggesting that the expected channel may amplify the fluctuation of durable goods demand [7].

When consumer fluctuations are transmitted to the middle reaches of the automotive industry chain, dealers bear the pressure of inventory and capital turnover. The linkage of loan to value ratio and interest rate in inventory financing contracts is an important tool for risk management [8]. After the outbreak, the imbalance between supply and demand led to an increase in dealers' price increase rate and pushed up the inflation of new car consumers, indicating that the shortage of inventory will be quickly reflected in the transaction price and the industry boom [9]. From the perspective of competitive structure, the dynamic pricing slope of dealers for inventory changes will change with market power, and the inventory price relationship has significant heterogeneity [10].

To sum up, existing studies have revealed the wealth, collateral and expected effects of house prices on the demand for consumption and durable goods, as well as the inventory financing and pricing mechanism of dealers, but few literature has directly tested whether house price fluctuations will systematically push up the inventory pressure index of automobile dealers. Based on this, this paper uses 70 housing price indexes of large and medium-sized cities to build the national housing price comprehensive index, and combines the monthly data of inventory early warning index and inventory coefficient issued by the China Automobile Dealers Association (CADA)., uses the vector autoregressive model to identify the dynamic impact of housing price fluctuations on inventory pressure, and provides empirical evidence in the Chinese context.

2 Research Design and Methodology

The research sample range selected in this paper is from November 2020 to October 2025, a total of 60 monthly observation data, mainly covering two dimensions of real estate market price and auto dealer inventory. Among them, the real estate data comes

from the National Bureau of statistics, covering the sales price index of new commercial housing and second-hand housing in 70 large and medium-sized cities in China. The automotive industry data comes from the monthly "inventory early warning index" and "inventory coefficient" data released by CADA. All original data are at a monthly frequency, and there is no missing value after verification in the sample period, so there is no need to interpolate or eliminate.

Because the VAR model is suitable for analyzing the dynamic interaction between variables and does not need to preset the causal direction, it fits the Research scenario of "the interaction between house price fluctuation and inventory pressure". This paper selects the following core variables to build the system based on the requirements of VAR model for the same dimension and stationarity of data: the first is the index of automobile inventory pressure. Select "auto dealer inventory early warning index" as the core proxy variable to measure the industry pressure. The index takes 50% as the boom-and-bust line. The higher the value, the weaker the market demand and the greater the risk of unsalable inventory. At the same time, refer to "inventory factor" as an auxiliary verification indicator. The second is the selection of price fluctuation indicators. This paper uses the "new commercial housing sales price index" and "second-hand housing sales price index" of 70 large and medium-sized cities. In view of the fact that the automobile inventory is a national dataset. in order to achieve the matching of data dimensions, this paper uses the arithmetic mean method to synthesize the house price indexes of 70 cities into the comprehensive index of house price fluctuation at the national level. In addition, in order to eliminate seasonal factors and accurately depict the annual trend of asset prices, this paper focuses on the year-on-year (same month last year=100) data of price index for empirical analysis.

Then the enhanced Dickie Fuller (ADF) test was used to test the stationarity of each time series. If there is a unit root, it is stabilized by differential processing to avoid pseudo regression and meet the modeling premise. Then the optimal lag order is determined according to the Akaike Information Criterion (AIC) and Schwarz Criterion (SC) information criteria, and the VAR system is constructed. Then, the Granger causality test was used to verify whether house price fluctuation was the statistical leading factor causing the change of automobile inventory pressure. Finally, the impulse response function (IRF) is used to intuitively show the lag impact path and duration of the impact of house price fluctuation on automobile inventory; At the same time, the variance decomposition technique is used to quantify the contribution of house price factors to the change of automobile inventory.

3 Results and Discussion

3.1 Construction of National Housing Price Comprehensive Index and Variable Processing

In order to keep the house price index consistent with the automobile inventory index in the statistical caliber, this paper combines the sales price index of newly-built commercial housing and the sales price index of second-hand housing in 70 large and medium-sized cities (the same month of last year=100) into a national house price index

series by the arithmetic mean method. Let the housing price index for city i in period t be denoted as$P_{i,t}$, with N cities (N=70 in this study). The national housing price index is defined as:

$$H_t = \frac{1}{N} \sum_{i=1}^{N} p_{i,t} \tag{1}$$

Further, this paper constructs a comprehensive house price index to absorb the price information of new and second-hand houses at the same time

$$H_t^{comp} = \frac{H_t^{new} + H_t^{used}}{2} \tag{2}$$

Considering that there may be unit roots in the level value of the price index, this paper uses the first-order difference of the comprehensive index of house prices to describe "house price fluctuation", namely:

$$HP_t = \Delta H_t^{comp} = H_t^{comp} - H_{t-1}^{comp} \tag{3}$$

Figure 1 shows the time series of the national housing price composite index and the auto inventory early warning index. On the whole, the two curves change in the same direction in individual stages, but also have obvious deviation periods, indicating that the linkage between the two is not "synchronous correspondence". In order to avoid the intuitive judgment only based on the graph, this paper further calculates the correlation: in the sample from November 2020 to October 2025, the correlation coefficient between the national housing price composite index (level value) and the inventory early warning index is -0.076 in the same period; The correlation coefficient between house price fluctuation and inventory early warning index described by first-order difference is -0.128. After further setting the house price fluctuation as leading for 1-6 months, the absolute values of the correlation coefficients are still less than 0.15 (the maximum is about 0.145, which appears near the leading for 4 months). Therefore, from the level of descriptive statistics, it can be preliminarily judged that there is only a weak correlation between house price fluctuation and dealer inventory pressure, and whether there is a stable dynamic transmission still needs to be tested by the follow-up VAR framework.

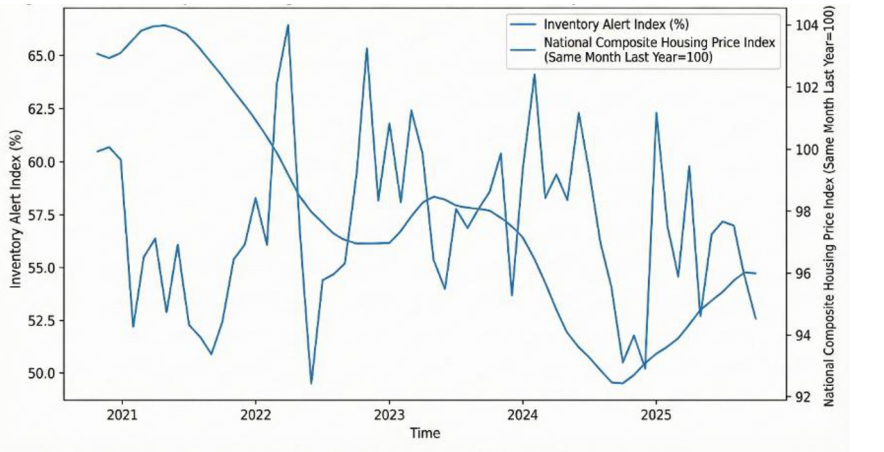


Fig. 1. National housing price composite index and auto inventory early warning index (November 2020 to October 2025)

3.2 Stability Test and Differential Processing

In order to avoid pseudo regression and meet the premise of VAR Modeling, this paper uses the enhanced Dickey Fuller (ADF) unit root test for each time series.

Table 1. ADF unit root test results

variable	ADF statistics	P value	Lag order	sample size
Inventory alert index	-4.9175	0.0	0.0	59.0
National housing price composite index	-1.6299	0.4675	11.0	48.0
House price fluctuation (Δ house price composite index)	-4.327	0.0004	10.0	48.0

The "sample size" in Table 1 is the effective number of samples for ADF regression, which is usually equal to the number of original observation periods t minus the lag order k selected by ADF and then minus 1 (t − K − 1). Therefore, different variables display different sample sizes due to different K (for example, the sample size is 48 when t=60 and k=11), which does not mean that the 12-month data is missing.

Table 1 indicates that the deposit warning index is stable at the level (P value is close to 0), the national housing price composite index is unstable at the level (p=0.4675), and its first-order difference (housing price fluctuation) is stable (p=0.0004). This difference is basically consistent with the variable attribute: the inventory early warning index belongs to the industry prosperity/pressure index, which usually fluctuates around a certain equilibrium interval and has a certain mean regression characteristics; Even if the housing price index adopts the year-on-year caliber of "the same month of last year=100", it may still show a sustained trend or structural decline during the sample period, which is easier to show as a non-stationary series. Based on this, the subsequent VAR model uses "house price fluctuation (Δ house price composite index)"

and "inventory early warning index" as endogenous variables. It should be noted that the "house price fluctuation" after the difference focuses more on depicting the change range of year-on-year change, which may weaken part of the information that the "level" of house price affects the demand for durable goods through the wealth effect. Therefore, if the subsequent estimation results are weak, it should be interpreted in combination with this variable structure.

3.3 Lag Order Determination and VAR Model Setting

Table 2. Selection results of VAR lag order (maximum lag=12)

Lag order p	AIC	SC(BIC)	HQIC
0	0.8373	0.916	0.8669
1	-0.9503	-0.7141	-0.8614
2	-1.0376	-0.644	-0.8895
3	-0.9337	-0.3825	-0.7263
4	-0.8045	-0.0959	-0.5379
5	-0.7184	0.1476	-0.3925
6	-0.6537	0.3698	-0.2686
7	-0.5067	0.6742	-0.0623
8	-0.3909	0.9475	0.1127
9	-0.3891	1.1068	0.1738
10	-0.4468	1.2065	0.1754
11	-0.5662	1.2446	0.1152
12	-0.5962	1.372	0.1444

Table 2 shows the values of AIC, SC (BIC) and hqic under different lag orders. In the empirical study, the minimum value of the information criterion and the simplicity of the model are comprehensively considered: AIC and hqic tend to be p=2, and SC (BIC) tends to be p=1. The benchmark model in this paper uses P=2, and the robustness part can further test the case of P=1.

Table 2 reports the values of AIC, SC (BIC) and hqic under different lag orders. The results showed that AIC and hqic tended to choose P=2, and SC (BIC) tended to choose P=1. Considering that the sample period of this paper is only 60 months, too high lag order will significantly consume the degree of freedom and reduce the estimation stability; At the same time, under the monthly data, dealers' stock removal/replenishment and terminal sales adjustment often have 1-2 months' inertia and lag. Based on the comprehensive statistical criteria and economic implications, this paper uses var (2) as the benchmark setting, and carries out Granger causality test, impulse response and variance decomposition analysis. In order to test whether the conclusion depends on a specific lag setting, VAR (1) can be estimated in the robustness part.

3.4 Granger Causality Test

In order to test whether housing price fluctuation is the statistical leading factor of inventory pressure change, this paper uses Granger causality test.

Table 3. Granger causality test results (house price fluctuation → inventory early warning index)

Original hypothesis H0	F statistic	P value	degree of freedom
Stock early warning index caused by non Granger fluctuations in house prices	0.380	0.6851	(2,52)

It can be seen from Table 3 that under the setting of benchmark var (2), the original assumption that "the stock early warning index caused by non-Granger fluctuations in house prices" was not rejected (p=0.6851). This means that after controlling the lag term of the inventory early warning index itself, the introduction of the lag term of house price fluctuation does not significantly improve the ability to explain and predict the change of inventory pressure. It should be emphasized that the Granger test focuses on the "predictive leader" in the sense of time series, which is not equivalent to strict structural causality. Combined with the reality of the industry, the inventory pressure is often more directly affected by the near end factors such as the supply rhythm of the main engine plant, terminal promotion and price competition, and the cost of automotive finance. The effect of housing prices transmitted to inventory through the demand side may be diluted by the above shocks, thus showing a statistically weak leading relationship.

3.5 IRF

Under the stable condition of VAR model, it can be rewritten as infinite order vector moving average representation:

$$Y_t = \mu + \sum_{h=0}^{\infty} \Psi_h \varepsilon_{t-h} \quad (4)$$

This paper uses Cholesky orthogonalization to identify the impact, and ranks "house price fluctuation" before "inventory early warning index" to describe the transmission effect of current house price impact on inventory pressure. Figure 2 shows the response path and 95% confidence interval of the housing price fluctuation shock to the inventory early warning index.

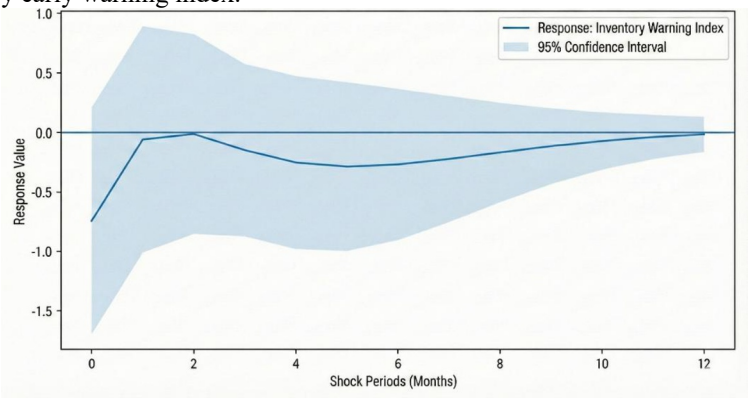


Fig. 2. Impulse response: dynamic impact of house price fluctuation shock on inventory early warning index (orthogonal IRF).

Figure 2 shows that the response range of the inventory early warning index to the impact of house price fluctuation is generally small, and the 95% confidence interval of most periods is over 0, indicating that it is difficult to identify the significant deviation of the response from 0 under the common significance level; After a short period of fluctuation, the response gradually decays and returns to near 0. The confidence interval crosses 0, which is consistent with the Granger test "Granger reasons for non inventory pressure of house price fluctuation", further confirming that the conduction effect is not significant. In the economic sense, this shows that even if there is transmission, its intensity and sustainability are relatively limited. At the same time, it should be noted that this paper uses Cholesky orthogonalization and ranks "house price fluctuation" before "inventory early warning index", implying the identification assumption that "the current house price shock can affect the current inventory, but the current inventory does not affect the current house price in reverse"; House price fluctuation belongs to macro asset price shock, which precedes the industrial inventory adjustment and conforms to the "macro micro" transmission logic. This setting is reasonable in macro intuition, but it also suggests that the robustness test can be carried out later by adjusting the sorting or using other identification methods.

3.6 Variance Decomposition

In order to further quantify the contribution of house price factors to the fluctuation of inventory early warning index, this paper decomposes the variance of prediction errors. If the forecast period is h, the forecast error variance of the inventory early warning index in h period can be decomposed into the sum of the contributions of each structural shock.

Table 4. Variance decomposition results (contribution rate of house price fluctuation)

Forecast period (month)	Contribution rate of house price fluctuation (%)
1	4.03
2	3.52
3	3.48
4	3.61
5	4.0
6	4.49
7	4.92
8	5.21
9	5.38
10	5.46
11	5.49
12	5.5

It can be seen from table 4 that the contribution rate of house price fluctuation to the prediction error variance of the inventory early warning index is generally at a low level (about 3% -6%), and the 12-month period is about 5.50%. This means that in this sample period, the main source of inventory pressure fluctuation is still its own shock and other variables not included, and house price shock is in a secondary position in

explaining inventory fluctuation. Combined with the above Granger test "not significant" and the results that the impulse response amplitude is small and not significant in multiple periods, the evidence in this paper supports the judgment of "weak correlation/weak conduction": the change of house price may affect the demand for automobiles through consumption expectation, but its marginal effect should be easily covered by the impact of industry supply and demand, policy and competition in a short sample period.

4 Conclusion

This paper selects the monthly data of housing price comprehensive index and auto dealer inventory early warning index of 70 large and medium-sized cities in China from November 2020 to October 2025 and constructs a VAR model to test the dynamic impact of housing price fluctuation on inventory pressure. The Granger test cannot reject the "inventory early warning index caused by non-Granger fluctuations in house prices" (P=0.6851) under the conventional significance level, and the house price signal is lack of prediction pilot; Impulse response showed that the response range of inventory to housing price shock was very small, the confidence interval covered 0 in multiple periods, and the conduction effect was weak and unsustainable, or was covered up by factors such as epidemic shock and price war in the auto market; Variance decomposition also shows that the contribution rate of house prices is only about 3% - 5.5%, and more than 94% of the fluctuation is explained by the impact of inventory itself. The inventory pressure is mainly from endogenous factors such as the pace of supply and demand of the industry, competition patterns and channel strategy.

To sum up, there is no strong and robust statistical link between housing price fluctuation and inventory pressure during the sample period, and the overall "correlation degree" is weak. On the one hand, Granger test was not significant (P=0.6851); On the other hand, the impulse response amplitude is small and the confidence interval covers 0, the effect is not significant and the duration is limited; At the same time, variance decomposition shows that the explanation degree of house prices is low (about 3% -5.5%). Note: the epidemic situation and policy adjustment or interference mechanism, the national average may cover up urban differences, and the bivariate var does not include variables such as interest rate and income. Therefore, dealers' inventory management should give priority to the pace of production and marketing, channel policies and changes in competition, and take the housing price index as an auxiliary rather than a core basis.

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