

AN EMPIRICAL STUDY ON THE RELATIONSHIP BETWEEN PSPI AND PBPI RPI IN CHINA-BASED ON VAR MODEL

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ABSTRACT

This article is based on the monthly indicators of China's producer price index (PSPI), industrial producer's purchase price index (PBPI) and retail price index (RPI) from January 2009 to March 2018. Regression (VAR) model, Granger causality test, pulse analysis, econometric analysis of PSPI, PBPI impact on RPI in the economic environment in China in the past ten years, and study the dynamics of these three types of price index Influence, variance decomposition analysis of its effect. The analysis results show that PBPI and PSPI have an effect on RPI, PBPI is a Granger cause of RPI, and PSPI is not a Granger cause of RPI. RPI's lag phase 1 has a strong impact on itself, indicating that its RPI's own growth has inhibitory effects, PBPI has a positive effect on RPI delay, and PSPI only has a positive effect on RPI in lag phase 2. RPI has a reverse effect. The current PBPI fluctuations will have a significant impact on RPI during the 7-period period, with the impact level being close to 14%. Relatively speaking, PSPI has little impact on RPI, and its contribution to RPI change rate remains basically at around 3%.

Keywords : RPI; PBPI; PSPI; VAR model; Granger

I. INTRODUCTION

The PPI and PBPI are mainly used to measure the average change of the manufacturer's ex-factory price, that is, to reflect the extent to which the judgment of production and supply affects the economic operation. In general, the production of goods is divided into the original phase, the middle phase and the completion phase. The goods are not yet processed, the goods still need further processing, and the goods are about to enter the sales cycle. The retail price index (RPI) mainly reflects the total size and geographical distribution of the domestic consumer goods market. It provides a basis for analyzing and judging the overall situation, regional characteristics, product categories, supply, and future market trends of the domestic consumer goods market, and also reflects physical goods. The total amount of consumer demand and its changing trend, so RPI can reflect the impact of consumer demand and economic operation.

Since retail is the final link in the circulation of goods, RPI is also an indicator that most directly reflects the sensitivity of goods. Considering that when producers sell goods, they can adjust the ex-factory price of goods according to the market environment. Therefore, producers are relative to retailers and consumers. With initiative, but also more market information, relatively easy to adjust prices. Therefore, there is a lag period for RPI relative to PBPI and PSPI.

According to the law of price transmission, PSPI and PBPI have a certain influence on RPI. PSPI reflects the price level of the production link. The RPI reflects the price level of the retail consumption link. The fluctuation of the overall price level generally occurs first in the production area, then spreads through the industrial chain to

downstream industries, and finally affects consumer goods. From the perspective of supply chain supply, PSPI changes affect PBPI first. PSPI's rise and fall are then communicated to consumers through sales prices. From a demand perspective, RPI sales performance can be fed back to PSPI and PBPI market supply and demand levels. PSPI is an index that measures the trend and degree of changes in ex-factory prices of industrial products, and reflects changes in the price of production in a given period of time. The existence of PBPI, PSPI, and RPI has an important basis for formulating relevant economic policies and national economic accounting.

II. LITERATURE REVIEW

At present, many scholars in China have devoted themselves to the study of commodity price transmission or the fluctuation of commodity price index. Yan Shuxi and Wu Jianyi used the smooth transfer autoregressive (STAR) model to verify the nonlinear fluctuation characteristics of the four categories of CPI, RPI, PSPI, and PBPI monthly prices from January 1996 to September 2014. Modeling analysis. From the perspective of the smooth transfer rate, the order of CPI, RPI, PSPI, and PBPI increases sequentially; from the transfer position, the order of RPI, CPI, PSPI, and PBPI increases sequentially. STA Lu et al. (2009) analyzed the characteristics of China's commodity price fluctuations in recent years, discussed the impact of commodity price fluctuations on China's national economy, and proposed some targeted measures and recommendations. Luo Bingxin took the commodity retail price index as an independent variable, and based on the GDP, the added value of the primary industry, the added value of the secondary industry, and the added value of the tertiary industry as the dependent variables, established four neural network time series models, model coefficients. Reflected the impact of the retail price index of goods on China's economic growth, based on this proposal. Li Yong from the Johansen cointegration test in the study of external influence factors and internal conduction relations of the price system concluded that there is a long-term stable equilibrium between the consumer price index, retail price index, and producer price index. relationship. As the most representative indicator of the price system, CPI, RPI, and PPI are interrelated and interactive in the long-term, In the long-term, there must be a mechanism for mutual transmission among the three. Although there are significant differences in the composition of these three types of indicators, no indicator has changed from other price indicators which fully demonstrates that the price system is a system that is related to each other and influence each other. Granger causality test results show that the retail price index and the producer price index are Granger causes. This result shows that the mutual conduction path between the production area represented by the producer price index and the retail market represented by the retail price index of the commodity is smooth, and price changes in the production area are gradually transmitted to the circulation area. Therefore, it is possible to PPI. As an advanced indicator of RPI, changes in PPI are used to forecast changes in RPI; similarly, fluctuations in commodity prices in the circulation area will also be transmitted to the production area after a certain period of time. RPI can also be used as a leading indicator of PPI, which will be helpful for future PPIs. prediction. Zhu Zhu and Jiang Xue through the construction of the global financial cycle index series, combined with the VAR model on the causes of the global financial cycle conducted an empirical analysis: From 2000 to 2018, the global financial cycle appeared a total of four times a relatively obvious financial contraction and three times The relatively obvious financial expansion; the operation of the global financial cycle is mainly affected by the international macroeconomic situation, expected factors, capital factors and market efficiency factors, innovation factors, and non-cyclical emergencies. The Research Group of the Institute of Fiscal Science of the Ministry of Finance (2013) found that strong policies, reforms, and management measures were taken in the country to initially realize a favorable situation in stabilizing prices, but future price trends are still facing greater uncertainty, and further summary The current price trend and its influencing factors are: first, grasping the adjustment of the total amount, controlling the fiscal deficit and debt in a moderate range, and secondly, exerting the fiscal structural adjustment policy function to ease the cost of the high-input growth mode and promoting inflationary pressure;

Further increase the support for the production and supply of agricultural products. Fourth, improve the system of subsidies and guarantees related to price. Although there have been many researches on the mechanism of the economic growth of certain commodities on China's economic growth, there are few researches on the effect of RPI fluctuations on economic growth. So, based on a monthly index of the Industrial Producer Price Index (PSPI), the Industrial Producer Purchase Price Index (PBPI), and the Retail Price Index (RPI) for a total of 111 months from January 2009 to March 2018 in China, Try to analyze the relationship between these three from the (PSPI PBPI RPI) idea, then establish the VAR model, and choose the generalized impulse response analysis.

III. DATA DESCRIPTION

Based on a monthly index of the Industrial Producer Price Ex-works (PSPI), Industrial Producer Purchase Price Index (PBPI) and Retail Price Index (RPI) for a total of 111 months from January 2009 to March 2018 in China, data sources Bureau of Statistics website.

3.1 Trend Chart

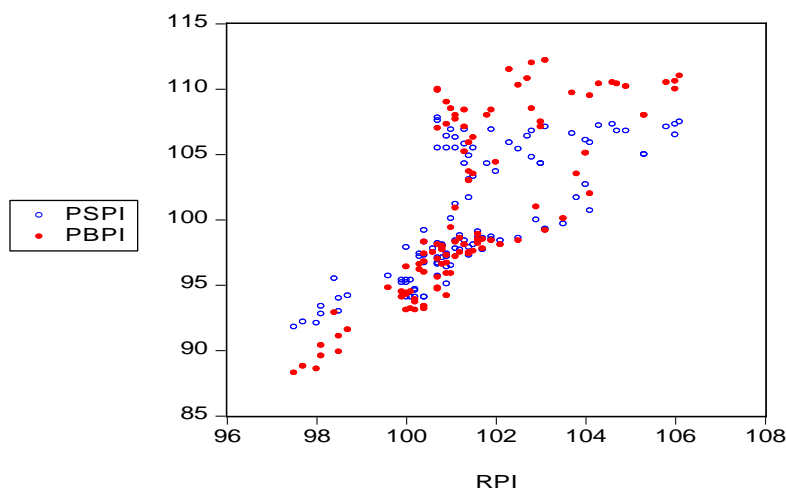
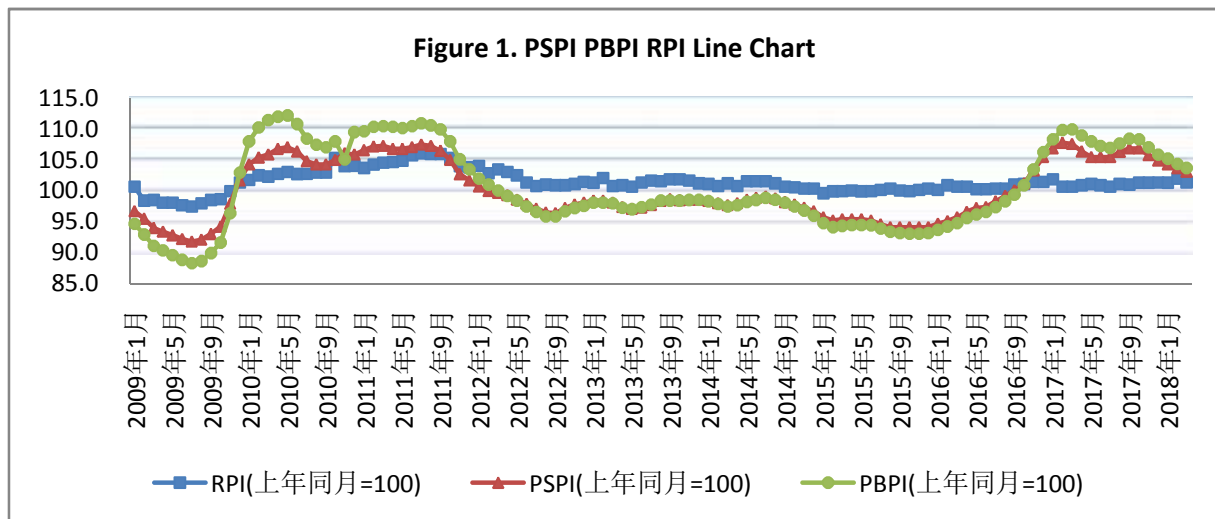


Figure 2 - PSPI PPI PPI scatter plot

According to the original data, the trends of PSPI, PBPI, and RPI for the past ten years are plotted using Eviews7.0 software.

From Figure 1 (line chart), from 2009 to 2018, the RPI index was basically stable with no significant ups and downs, but its change trend was roughly consistent with the trend of changes in PSPI and PBPI, but the change was not obvious; the trend of changes in PBPI and PSPI was The rate was almost the same, with a volatility of up to 24 points between July 2009 and July 2010. The two indices remained at about 110%, and they began to decline in July 2011. In October 2015, PSPI and PBPI fell to The lowest values were 94% and 93%. After that, PSPI continued to grow at 112%, and PBPI increased to 106%. After 12 months, PSPI and PBPI gradually fell back to the 100% to 105% range.

From the scatterplot 2, we can see that PSPI, PBPI and RPI have non-linear correlations. We observe that PSPI, PBPI and RPI are in the same trend, but the range of change is not obvious, and the trends of PSPI, PBPI and RPI are non-stationary. Therefore, the imported data was taken as the logarithm of ADF difference, and the stability analysis and correlation analysis were performed on the whole data. The results are shown in Table 2.

3.2 Descriptive Statistics

Table 1 Indexes of RPI, PBPI, and PSPI in the Last Ten Years in China

Variation	\bar{X}	S^2	Min	Max
RPI	101.1	3.5	97.5	106.1
PBPI	100.6	44.4	88.3	112.2
PSPI	100.1	22.7	91.8	107.8

From Table 1, we can see that the year-on-year index of RPI remained at 101% for almost a decade, and the PPI and PBPI index remained at 100%. From the range of the maximum and minimum values of PBPI, it can be seen that the relative range of PBPI is relatively large, which is consistent with the economic theory that the change in the price of purchased products is greater than the change in retail price.

3.3 Description of fluctuation characteristics

The price theory shows that the fluctuation of the retail price of a commodity first causes a change in the production cost, which in turn affects the profit of the product. This aspect is reflected in the long-term stability of RPI, on the other hand, it is reflected in the asymmetry of information. The obvious fluctuation characteristic of China's commodity retail price index is that the change is stable. Once the RPI rises or falls, this upward or downward trend will remain unchanged for a longer period of time. Compared to the decline in the retail price index of goods, the rise in the retail price index of goods will have a greater impact on consumers, because under the condition of rising RPI, the result of inflation is obvious, and it is easy for consumers to conduct blind buying, resulting in price Abnormal fluctuations in the index. Therefore, in the process of price management, managers should reasonably and scientifically observe the fluctuation law of prices, and should appropriately control market prices. The price supervision department needs to strictly monitor the fluctuation of the retail price index of goods to prevent the occurrence of hyperinflation.

IV. EMPIRICAL ANALYSIS

This article selects all monthly indicators from January 2009 to March 2018. Before modeling the estimated parameters, the stability of the time series data must be tested. If there is heteroscedasticity, logarithmic processing is performed. Because the growth of social consumer goods has a certain degree of rigidity and lag, that is, the RPI of

the explanatory variable has a temporal inertia and may fluctuate with the cycle of the economic system. Therefore, the hysteresis effect of economic activities must be considered, and the AIC and SC information quantity must be ensured. Under the criterion of minimum value, the optimal lag period is selected to verify the stability of the model. The test results are shown in Figure 2 and Figure 3. The focus of this study is to explain the impact of fluctuations in PSPI and PBPI on RPI fluctuations. The VAR model can be expressed as:

$$RPI_t = \Psi_1 RPI_{t-1} + \dots + \Psi_p RPI_{t-p} + v_t + C$$

(Note: C represents a constant vector of n*1 dimensions, representing an n*n-dimensional autoregressive coefficient matrix, n*1-dimensional vector white noise)

4.1 PSPI, PBPI, RPI Stationary Test

Table 2 • Unit Root (ADF) Tests for PSPI, PBPI, and RPI

Original variable	Assignment variable	Inspection type (c,t,k)	ADF check value	5% threshold	1% threshold	P-value	Stability test
RPI	R1	C,R,1	-11.7302	-2.8882	-3.4913	0.0000	smooth
PBPI	R2	C,B,1	-4.8325	-2.8884	-3.4919	0.0000	smooth
PSPI	R3	C,S,1	-3.7038	-2.8884	-3.4919	0.0000	smooth

(Note:c, t, k represent constant items of time series, trend items, and lag periods, respectively.)

Given the standard deviation of R1=LNRPI as the initial impact, the response process of the assigned R2=LNPBPI, R3=LNPSPi, and R1 itself is subjected to a 10-month system simulation, and similarly the standard deviation initial impact of R2 and R3 is determined. Perform monthly simulation analysis of other variables and independent variables on the dependent variables.

The ADF stability tests of the sequences were compared one by one, and the results were collated in Table 2. From the ADF test results, it can be seen that the detection values R1, R2, and R3 after the first-order difference are all smaller than the critical value at a significant level of 1%, and the P values corresponding to the ADF are all zero, indicating that the R1 after the first-order difference of the sequence. The R2 and R3 sequences are stable.

4.2 The choice of lag order

From Table 2, we can see that PSPI, PBPI, and RPI are all first-order single integer sequences, which are consistent with the premise of establishing a VAR model. From the criterion that the minimum amount of information of the AIC and SC criteria is taken, the order with the most “*” is taken and the optimal lag order for the VAR model is determined to be 2. The results of the Eviews7.0 estimation model are shown in Figure 3.

Lag	LogL	LR	FPE	AIC	SC	HQ
0	1101.688	NA	8.84e-14	-21.54290	-21.46570	-21.51164
1	1182.800	155.3614	2.15e-14	-22.9568E	-22.54804*	-22.83180
2	1198.322	28.91397*	1.39e-14*	-23.03474*	-22.54431	-22.86590*
3	1200.192	3.372894	2.18e-14	-22.94493	-22.17288	-22.83230
4	1202.349	3.754954	2.50e-14	-22.81077	-21.80710	-22.40435
5	1211.595	15.59051	2.50e-14	-22.81558	-21.58030	-22.31537
6	1214.695	5.044919	2.82e-14	-22.69989	-21.23300	-22.10590
7	1216.950	3.537581	3.24e-14	-22.50704	-20.80913	-21.87980
8	1224.515	11.42772	3.37e-14	-22.53952	-20.60939	-21.75794

Figure 3 determines the lag order

4.3 Model Establishment and Inspection

Through the data stability test, the model order is finally determined, and the VAR(2) model is established by using the difference data R1 and the data R2 and R3:

$$D(LNR_t) = \sum_i^2 C_i D(LNR_{2(t-i)}) + \sum_j^2 C_j D(LNR_{3(t-j)}) + \sim_t$$

4.4 VAR Model Stability Test

The stability foundation of the VAR model requires that all unit roots in the model fall in a unit circle with a radius of 1, so that the established model is considered to be stable. Therefore, whether the root in the previously established VAR(2) model falls into the unit circle is checked. The result of the test is shown in FIG. 4 . The results show that the six unit roots in the established VAR(2) model all fall within the unit circle, indicating that the model is valid and passed the stability test.

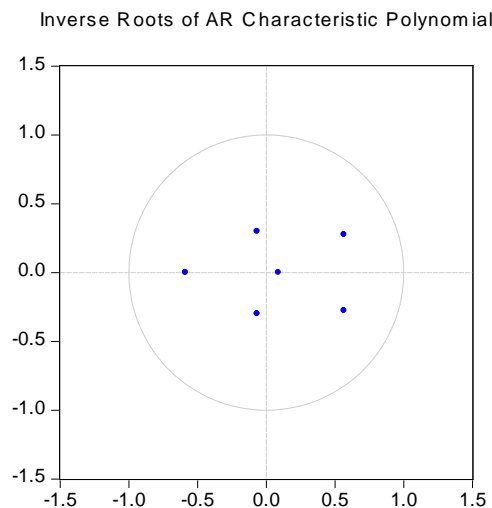


Figure 4 Unit root test of VAR model

4.5 Granger causality test

In order to study whether there is a temporal and antecedent consequence relationship between RPI, PBPI, and PSP, the Granger test was performed at a significance level of 5% for the three, and the test results shown in Table 3 were obtained. From Table 3, we can see that the retail price index RPI and the producer price index PBPI are mutually exclusive Granger reasons, but the producer price index PSPI is not the Granger cause of the retail price index RPI. Explain the PSPI fluctuation that PBPI can affect to some extent. Similarly, it can be found that the PBPI of industrial producer purchase price and the PPI of industrial producer price index are mutually exclusive Granger causes.

Table 3 Granger causality test results

Null hypothesis	P-value	test result
LNRPI is not a Granger cause of LNPBPI	0.0015	Pass inspection
LNRPI is not a Granger cause of LNPSPI	0.2725	Failed inspection
LNPBPI is not a Granger cause of LNRPI	0.0565	Pass inspection
LNPBPI is not a Granger cause of LNPSPI	0.0039	Pass inspection
LNPSPI is not a Granger cause of LNRPI	0.1572	Failed inspection
LNPSPI is not a Granger cause of LNPBPI	0.0000	Pass inspection

4.6 Analysis of Impulse Response Function Based on VAR Model

According to the (PBPI PSPI RPI) downstream price index affecting the upstream price index and the (RPI PSPI PBPI) upstream price index guiding the downstream price index, PBPI and PSPI are analyzed in terms of response speed, response strength, and impact duration, respectively. Relationship between RPI and the three. Because R3 is not the Granger cause of R1, the author responds to the impact of R3 and R2, the impact of R2 on R1, and the impact of R1 on itself. The results are shown in Figure 5 to Figure 8.

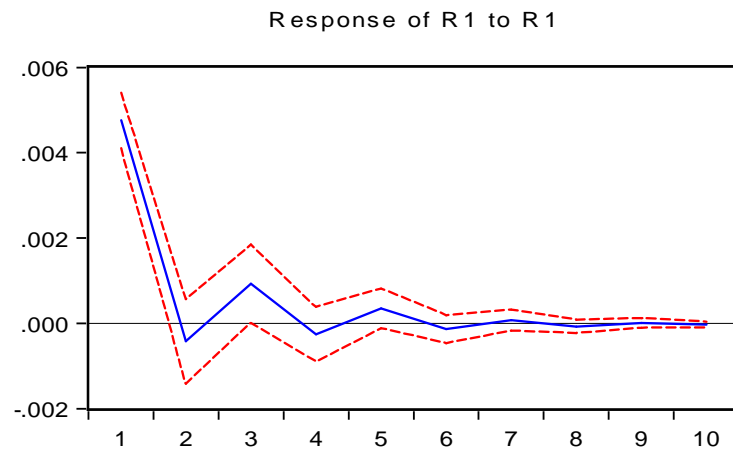


Figure 5

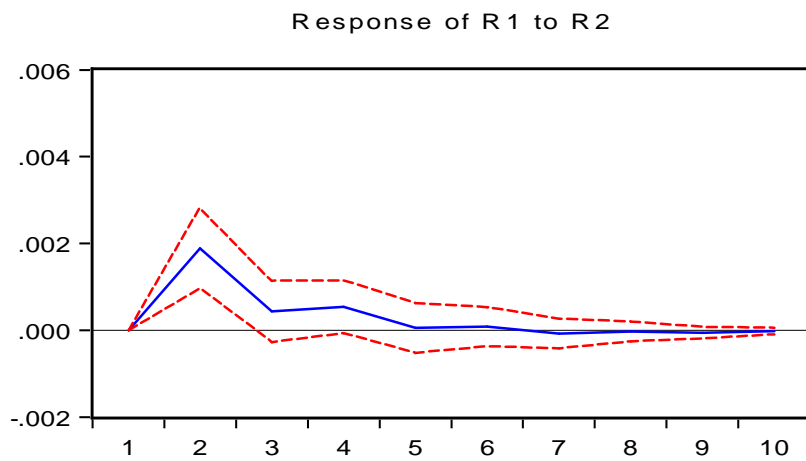


Figure 6

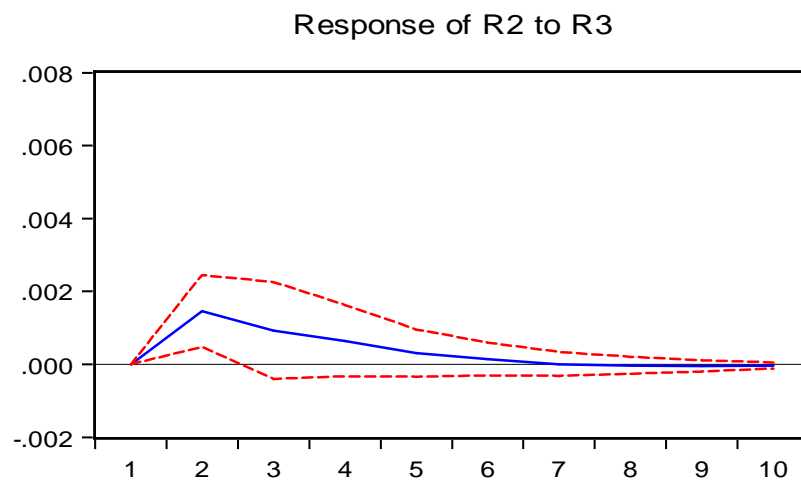


Figure 7

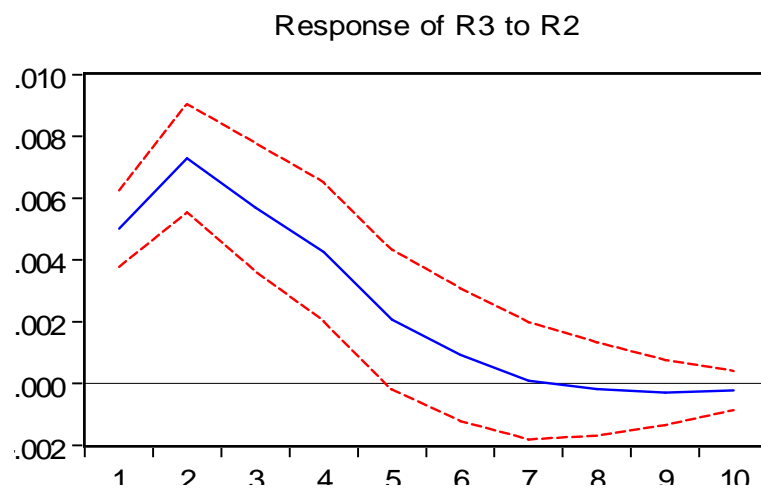


Figure 8

LNRPI lags for one month and has a significant inhibitory effect on itself. As can be seen from Figure 5, RPI experienced the greatest positive trend of downward trend in the first month due to its own impact, followed by a brief

growth trend after the second month, followed by a downward trend after 1 month, and the impact continued to The seventh month tends to zero. It shows that RPI has certain self-regulation ability and the adjustment interval is short.

The curve reflected in Figure 6 is a “hump” state. When the standard deviation of LNPBPI’s conditional standard deviation has a 1 unit impact, LNRPI has a short-term positive growth effect in the time interval of the previous month, and then continues. The positive trend of the downward trend, impact until the 9th month tends to 0.

In Figure 7, the impact of LNPSPI on LNPBPI showed an increasing trend during the first month, and decreased after the first 6 months. LNPBPI has a positive effect of increasing trend within 1 month after receiving 1 unit percentage of LNRPI impact. As the time interval increases, there is a positive effect of a downward trend and continues to the 7th month, indicating that PBPI feedback RPI has a positive effect of time lag.

It can be seen from the impact reflection curve in Fig. 8 that the response duration of LNPSPI to LNPBPI shock is close to 10 months. At the second month, LNPBPI showed the largest positive response, and after the second month, LNPSPI showed a decrease. The positive reaction of the trend until it approaches zero. Similarly, the PSPI feedback PBPI also has a time-lag positive effect.

4.7 Variance decomposition analysis

Because R2 (LNPBPI) and R1 (LNRPI) are each other's Granger causes, R3 (LNPSPI) is not Granger's cause of R1 (LNRPI). The author's research direction is the influence of PBPI and PSPI on RPI, so When the model is analyzed by variance decomposition, only the regression result of R1 is analyzed by variance decomposition. The author conducted a variance decomposition analysis of the regression of R1 and found that the results of the analysis of variance tend to be stable after the fifth period, and the variance value is about 0.005366. The result is shown in Figure 9.

Variance Decomposition of R1:				
Period	S.E.	R1	R2	R3
1	0.004758	100.0000	0.000000	0.000000
2	0.005181	84.96695	13.28139	1.751663
3	0.005315	83.79811	13.28170	2.920194
4	0.005352	82.88986	14.11187	2.998272
5	0.005366	82.87248	14.04523	3.082290
6	0.005369	82.85898	14.05351	3.087517
7	0.005370	82.84221	14.06807	3.089714
8	0.005371	82.83892	14.06786	3.093221
9	0.005371	82.83002	14.07707	3.092912
10	0.005371	82.82861	14.07783	3.093555

Figure 9 Variance decomposition analysis results for R1

The analysis of variance shows that the change in the rate of change of RPI is mainly influenced by itself. In the first period, the impact of the RPI's own rate of change reached 100%. With the gradual delay of time, the degree of contribution of the RPI has shown a downward trend. The rate of decline has reached the maximum between the 1st and 2nd periods, and its contribution margin is close to 16%. %, but in the later period, the rate of decline was not significant. After the 5th period, it was basically stable at about 82.8%; in addition, the rate of change of RPI was also affected by the rate of change of PBPI to a certain extent. This effect can be mainly expressed as: : In the second phase, the rate of change of PBPI contributed the most to the impact of the RPI change rate to 13.28139%. Compared with the contribution of the first phase, the PBPI has a significant impact on the RPI, and the PSPI influence on the RPI. Slightly, it is basically maintained at about 3%. This conclusion is also consistent with the previous Granger test of

causality. With the passage of time, the impact of RPI began to increase gradually. By the fourth period, the contribution of PBPI has risen directly to about 14.11%, which is close to 1% of the difference in the second period, and then basically stabilized.

V. CONCLUSIONS

- (1) The ADF test shows that the RPI, PBPI, and PSPI original sequences are all non-stationary sequences, and their first-order differential sequences are all stationary sequences, that is, they are all first-order single integer sequences.
- (2) The stability test of VAR model shows that PBPI and PSPI have effect on RPI, among which PBPI has more significant impact on RPI than PSPI on RPI, indicating that the consumer's expected retail psychology is affected by the expected industrial product purchase yield, which is in line with Economic theory assumptions.
- (3) Granger causality test shows that RPI and PBPI are double causal relationships, and PBPI and PSPI are double causal relationships.
- (4) The results of the impulse response show that there is a strong self-impact impact on RPI's lag phase 1, indicating its own growth inhibition, PBPI has a positive effect on the RPI delay, and PSPI only has a positive RPI on lag phase 2. The effect has a reverse effect on RPI.
- (5) The interaction effects among PBPI, PSPI, and RPI all have time-lag effect. The fluctuation of PBPI in the current period will affect RPI in the 7th period. The lag period with different internal structure can reflect the industrial chain phenomenon. The law of value can be highlighted in price changes.
- (6) Variance decomposition results show that although the rate of change of the rate of change of PBPI has a high contribution rate to the change of RPI, the rate of change of PBPI has a significant impact on the rate of change of RPI to a large extent. The degree is close to 14%.

SUGGESTIONS

In today's increasingly mature environment of reform and opening up, in light of the technological revolution that China is experiencing and the backdrop of the Silk Road economic belt, the government still needs to strictly supervise the reduction of regional and regional imbalances in urban and rural areas, such as establishing a model city and driving three. The economic development in the fourth-tier cities encourages and supports representative private retailers, effectively uses existing resources to develop a shared economy, and avoids lags in RPI lagging behind in seriously lagging consumption levels; the company's product manufacturers should reasonably control production costs and make appropriate adjustments. The ex-factory price encourages innovative technologies to apply for patents. Scale production will help reduce costs. It will use the trend of PSPI and combine the supply and demand of the market for production. Enterprise product buyers should use big data statistics to unearth potential consumer markets as an initiative. Only in this way can we lead the consumption trends of the residents and use the trend of PBPI and combine the saturation of the market to invest. The government and enterprises should make good use of Internet finance big data and cloud computing technologies to reduce the degree of asymmetry of information. This not only can reduce transaction costs caused by transaction behavior, but also can ease resource allocation efficiency while sharing information and integrating information puzzles.

REFERENCES

- [1]Yang Yu, Lu Qi'an. Empirical research on the relationship among CPI, RPI and PPI-Econometric analysis based on VAR model[J].Price Theory & Practice,2009(05):57-58.
- [2]Xie Juan, Ye Feng, Ma Jinggui. Correlation Analysis of Corn Price Fluctuation and Soybean Price Fluctuation Based on VAR Model[J]. Price Monthly, 2018(01): 26-33.

- [3]Zhu Zhu, Jiang Xue. Global financial cycle and its causes analysis: empirical test based on VAR model [J]. Journal of Harbin University of Commerce (Social Sciences), 2018(01):29-39.
- [4] Li Y. Research on external influence factors of price system and their internal conduction relations [D]. Ocean University of China, 2014
- [5] Analysis of China's Price Situation and Macro-fiscal Policy [J]. Research Group, Ministry of Finance, Institute of Fiscal Science, Su Ming, Zhao Fuchang, Li Chengwei, Feng Beilin. Economic Research Reference. 2013 (19)
- [6] Luo Bingxin. On the Impact of Fluctuations in the Retail Price Index of Commodities on China's Economic Growth [J]. Research on Business Economy, 2017(11):29-31.
- [7] Liu Guirong, Huang Qi. Financial development and economic growth under the background of internet finance: Based on VAR model [J]. Finance and Accounting Monthly. 2018(06):167-176