Study on Deviation of CPI and PPI

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Abstract

According to the law of price transmission, the change of PPI will be transmitted downward to the production of consumer goods through the input-output relationship, causing the change of CPI in the same direction, which is the positive transmission mechanism of PPI to CPI.Changes in CPI will have a certain feedback effect on PPI, leading to changes in PPI in the same direction, which is the mechanism of CPI forcing PPI in reverse.But in recent years, CPI and PPI have diverged in the opposite direction, and the divergence has intensified.The monthly data of CPI and PPI from January 2016 to November 2021 in China are selected to establish VAR model, and granger causality test is used to find that there is Granger cause between CPI and PPI.Through the analysis of impulse response containing function, it is found that there is a certain short-term relationship between the trend of consumer price index and producer price index.

Keywords

PPI; CPI; Deviation; The Scissors.

1. Introduction

PPI is the producer price index (PPI), which measures the direction and degree of factory gate price fluctuations and is also an important basis for formulating relevant macroeconomic policies.PPI was formerly known as the wholesale Price Index, which measures the price changes of goods and services from the perspective of manufacturers. According to the GUIDELINES provided by IMF for the compilation of PPI, the statistical object of PPI is mainly the manufacturing industry, so it mainly reflects the price fluctuations of industrial products.This is basically the same as the statistical object of China's current industrial ex-factory price index.In terms of composition, PPI can be divided into means of production and means of living prices. If further subdivided, PPI can be further divided into seven subcategories: extractive goods, raw materials, processed goods, food, clothing, general daily necessities and durable goods.

CPI, short for consumer Price Index, measures the direction and degree of price fluctuations of final consumer goods and services.CPI is an important index to measure inflation, and its level can explain the severity of inflation to a certain extent.Its basic statistical method is similar to PPI, which can be divided into consumer goods and services. Consumer goods also include agricultural and sideline products and industrial products.CPI can be divided into eight subcategories: food, clothing, housing, tobacco, alcohol and supplies, transportation and communication, household equipment, supplies and services, medical care and personal goods, entertainment, education and cultural goods and services, etc.Most inflation-targeting countries take CPI or core CPI rather than PPI as the inflation target of monetary policy.But there are drawbacks.In view of the current situation in China, although China has not implemented a clear inflation targeting system, in practice, the People's Bank of China has been using inflation as the basic pursuit of monetary policy.

PPI reflects the prices of upstream industrial products and CPI reflects the prices of downstream consumer goods. As leading indicators of economic development and inflation, the two indexes have differences in their application fields, but their long-term trends should be roughly the same.

According to the law of price transmission, changes in PPI will be transmitted downward to the production of consumer goods through the input-output relationship, leading to changes in CPI in the same direction, which is the positive transmission mechanism between PPI and CPI.Changes in CPI will have a certain feedback effect on PPI, leading to changes in PPI in the same direction, which is the mechanism of CPI forcing PPI in reverse.But in recent years, CPI and PPI have diverged in the opposite direction, and the divergence has intensified.

2. Related Research

Most of the researches on the conduction relationship between CPI and PPI in China are based on VEC model or VAR model to study the linear Granger causality between them.He Liping et al. (2008) used granger causality test to study the relationship between CPI and PPI and came to the conclusion that CPI is a one-way Granger cause of PPI, that is, the lag value of CPI can help predict PPI, while PPI is not a Granger cause of CPI, that is, the lag value of PPI cannot help predict CPI.Xu Weikang applied the VEC model to investigate the transmission relationship between CPI and PPI data used by He Liping et al., and found that both CPI and PPI were the gejie reasons for each other no matter using long-term and short-term data analysis.Liu Min, Zhang Yanli and Yang Yanbin (2005) found that there was a linear correlation between PPI and CPI according to the correlation coefficients between CPI and ex-factory price index of means of production and ex-factory price index of means of living respectively, and the change of PPI would definitely affect the change of CPI.PPI has an obvious lag time in its impact on CPI.Yang Zihui et al. used non-linear Granger causality test to test the transmission relationship between CPI and PPI in several countries from the 1990s to 2011, and found that there was non-linear transmission between PPI and CPI in China and other countries.Su Yang et al. studied the asymmetric Granger causality between PPI and CPI in China and concluded that CPI and PPI are Granger causality of each other on the whole.Zhu Jianming (2009) established a regression model between CPI and PPI based on the time-delay in the transmission process between PPI and CPI, and conducted in-depth analysis on the transmission mechanism of the two. The results showed that PPI had no significant impact on CPI, indicating that the transmission of upstream industrial product price changes to CPI was basically ineffective.

3. The Theoretical Analysis

3.1 Differences in Composition Lead to Divergence

CPI is divided into food and non-food categories, which are divided into consumer goods and services. In terms of weight, the weight of food in CPI is about 28%, the weight of non-food is about 72%, of which the weight of consumer goods is about 30%, and the weight of service goods is 40%.The trend in recent years has been that the weight of food has been falling, while the weight of services has been rising. Therefore, the impact of service prices on CPI is becoming more and more obvious. PPI is divided into means of production and means of living, of which the weight of means of production accounts for about 73%, while the weight of means of living is about 27%.Therefore, PPI short-term fluctuations are mainly affected by means of production prices. The above differences will lead to the inconsistency between PPI and CPI in at least two aspects. First, the price of services in CPI is basically not affected by PPI. If the CPI rises in a certain period of time mainly due to the price of services, CPI may not fall even if PPI declines. This was the case from 2012 to 2015;Second, PPI's upstream means of production prices can only indirectly affect CPI by affecting means of living prices. Therefore, if any problem occurs in the transmission between means of production price rise and means of living price to CPI, it may affect the transmission between PPI and CPI, leading to the deviation of the trend of the two.

3.2 The Impact of Changes in Total Supply and Demand on the Divergence between CPI and PPI

From the perspective of factors influencing short-term price fluctuations, CPI fluctuations are mainly influenced by weather factors and consumer demand for goods and services in the short term, while

supply has little influence on CPI in the short term. Both the means of production and the means of living in the composition of PPI, the short-term price fluctuations are more influenced by the upstream cost of means of production and the changes in the supply side, while the short-term impact of demand on PPI is not great. Is that PPI is mainly affected by supply in the short term while CPI is mainly affected by demand fluctuations. Therefore, only when aggregate supply and demand fluctuate in the same direction, the trend of PPI and CPI will converge: in the period of simultaneous expansion of aggregate supply and demand, PPI and CPI will rise synchronously. For example, during the period when China implemented the "four trillion yuan" stimulus policy from 2009 to 2011, PPI and CPI rose substantially in step with each other.In the continuous expansion of aggregate supply driven by aggregate demand, CPI rises first and then PPI rises. During the period of rapid economic growth in China from 2006 to 2008, with the continuous expansion of aggregate demand, CPI first rose sharply, and then PPI also entered a rising cycle. However, when the change direction of aggregate supply and demand is inconsistent, the trend of PPI and CPI will deviate: When aggregate demand falls obviously while aggregate supply remains unchanged, both PPI and CPI may fall, but the decline range of PPI will be significantly greater than that of CPI.For example, from 2012 to 2015, with the slowdown of China's economic growth, the total demand obviously declined, but due to the existence of a large amount of overcapacity in the industrial field, the supply of industrial products exceeded the demand, resulting in continuous negative PPI growth. However, during this period, CPI was mainly driven by the rising demand for service products in the economic transition period. Although the increase fell, the range was not large, and core CPI, which mainly reflects the changes in the price of service products, also showed a staged rise. When aggregate supply contracts significantly and aggregate demand does not, PPI may rebound sharply, but CPI may not change much. For example, since 2016, China has carried out supply-side structural reform and vigorously cut overcapacity in coal, steel, energy and other sectors. The supply of the means of production in these upstream sectors contracted significantly, leading to a rapid rise in prices and directly leading to a rapid increase in the overall PPI. However, since the total economic demand did not pick up significantly, CPI did not rise significantly at this time, and the two trends deviated again.

3.3 The Impact of Structural Changes of Supply and Demand on the Divergence between CPI and PPI

If the market structure is in a buyer's market and there are many product providers and sufficient competition, it means that a single enterprise has no dominant power over the market price. In this case, it is difficult for the enterprise to raise the price, and its production cost is difficult to be transmitted to the downstream products. However, if the market structure is in a seller's market, the product manufacturers are monopolized or several large enterprises are oligopolistic, which means that these enterprises have dominant power in product pricing and are easier to transmit production costs to downstream products. However, in China's current situation, the food and most consumer goods and service providers in the CPI are in a fully competitive market environment, so it is difficult for these enterprises to raise prices and pass on costs. Among industrial enterprises, the upstream means of production enterprises are still dominated by large enterprises, and the competition is not sufficient. It is relatively easy for large enterprises to raise prices. And the market structure of the middle and lower production enterprises is relatively diversified, and their pricing power is relatively limited. This difference in market structure determines that the rise in domestic PPI is more easily transmitted from means of production to means of living, but more difficult to transmit to CPI. This is one of the reasons why PPI diverges from CPI.

First of all, the supply structure remains unchanged, and the change of domestic demand structure will change the relative price, which will eventually lead to the deviation of China's price index. If the relative supply remains unchanged, the relative demand increases (decreases), so that the relative demand curve moves up (down), the relative price rises (falls) accordingly, CPI and PPI deviate. If relative demand remains constant, the relative demand curve does not move, relative prices remain constant, and CPI and PPI do not diverge. Secondly, the change of supply structure will change the

relative price, which will eventually lead to the deviation of China's price index. If the relative demand remains unchanged and the relative supply increases (decreases), the relative supply curve moves to the right (left), and the relative price declines (rises) accordingly, and CPI deviates from PPI. If the relative supply remains constant, the relative supply curve does not move, the relative price remains constant, and CPI and PPI do not diverge. Finally, the supply structure changes with the demand structure at the same time, but the inconsistent changes will inevitably lead to price changes. Therefore, the inconsistent changes of CPI and PPI will eventually lead to the deviation of CPI and PPI. If the relative demand increases (decreases) and the relative supply decreases (increases), the relative demand curve will move up right (left and down) and the relative supply curve will move left (right). The new equilibrium will make the relative price rise (down), and CPI and PPI will deviate. If the relative demand and supply change in the same direction with the same amplitude, the change in relative price will not be affected. CPI and PPI do not deviate. If they change in the same direction but with different amplitude, the change in relative price will eventually lead to the deviation of CPI and PPI.

4. Methodology

4.1 VAR Model

Vector autoregression model (VAR) is an effective prediction model for interrelated time series variable systems. VAR model takes all the endogenous variables in the system as the explained variables and the lag values of all the endogenous variables as the explanatory variables to construct the model. The model was introduced into economics in 1980. In each equation of the model, every endogenous variable was regression to the post-value of all the endogenous variables of the model, so as to estimate the dynamic relationship of all the endogenous variables. This model can be used to predict the system composed of CPI and PPI time economic series and analyze how the random disturbance item dynamically impacts the CPI and PPI variable system. Its general form is:

$$Y_t = A_1 Y_{t-1} + \ldots + A_N Y_{t-N} + B X_t + \varepsilon_t.$$

Where Y_t is an endogenous variable column vector, X_t is an exogenous variable vector, $A_1\ldots$, A_N and B are the coefficient matrices to be estimated, and ε_t is the error vector.

This paper selects monthly CPI and PPI data of China from January 2016 to November 2021 and establishes VAR model to analyze the relationship between CPI and PPI.

4.2 CPI and PPI Robustness Tests

The so-called stationarity of time series means that the statistical law of time series will not change with the passage of time, that is, the characteristics of the random process that generates variable time series data will not change with the change of time. In the economic field, most of the time series observations obtained are not generated by stationary processes. Although there is a strong correlation between these time series, in fact there is no relationship between these series, that is, there is a "false regression". Due to the time series data in the practice is likely to be a smooth sequence, and stability in econometric modeling has very important position, in order to avoid "false return", therefore, it is necessary for implementing stationarity test variables time series data, i.e. whether has the stationarity test variables, if the variable is smooth, It means that the sequence contains single product components, and difference is needed before estimating the process. Direct ADF test on CPI and PPI as well as their logarithmic LCPI and LPPI fails, so DLCPI and DLPPI are tested after first-order difference of LCPI and LPPI zone is obtained. The test results are as follows:

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Dickey-Fuller test for unit root                    Number of obs   =      69

                                    ———— Interpolated Dickey-Fuller ————
                Test      1% Critical     5% Critical    10% Critical
             Statistic      Value           Value          Value

Z(t)          -7.041        -4.108          -3.481         -3.169

MacKinnon approximate p-value for Z(t) = 0.0000

Dickey-Fuller test for unit root                    Number of obs   =      69

                                    ———— Interpolated Dickey-Fuller ————
                Test      1% Critical     5% Critical    10% Critical
             Statistic      Value           Value          Value

Z(t)          -3.524        -4.108          -3.481         -3.169

MacKinnon approximate p-value for Z(t) = 0.0369
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Figure 1. Chart of ADF Test

It can be seen from the ADF test results in the above table that the variables at the significance levels of 5% and 10% are both smaller than the corresponding critical value, thus rejecting the null hypothesis, indicating that there is no unit root in the variable and it is a stationary sequence.That is, the unit root test results of DLCPI and DLPPI show stable.Therefore, both LCPI and LPPI are first-order single time series.The results of stationarity test are determined to be stationary series. Therefore, vector autoregression (VAR) model can be used to explore the dynamic relationship between CPI and PPI.

4.3 Determine the Optimal Lag Order of the Model

According to the results, the lag order of VAR model is determined to be 2.

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Sample:  2016m6 - 2021m11                 Number of obs    =      66

 lag     LL       LR      df    p     FPE       AIC       HQIC       SBIC

  0   468.946                        2.5e-09  -14.1499  -14.1237  -14.0835
  1   490.232   42.572    4   0.000  1.5e-09  -14.6737  -14.595*  -14.4746*
  2   495.287   10.11*    4   0.039  1.4e-09* -14.7057* -14.5746  -14.3739
  3    497.55   4.5263    4   0.339  1.5e-09  -14.653   -14.4695  -14.1886
  4   500.539   5.9773    4   0.201  1.5e-09  -14.6224  -14.3864  -14.0252
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Figure 2. Determining the Optimal Lag Order of the Model

4.4 Building VAR Model

According to Granger causality test theory, if the change of A variable is caused by another variable B, the change of A should occur after B.It can be further understood that if the lag value of one variable can predict the other variable, then this variable is the cause of the two changes on the other side.If a change in PPI causes a change in CPI, the change in PPI should precede the change in CPI.Granger causality test is needed to determine whether the two variables in the model really exist in the order of time of action. PPI is a one-way Granger cause of CPI in the short run.

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Granger causality Wald tests

   Equation      Excluded    chi2    df  Prob > chi2

   DLCPI          DLPPI     8.0199    2     0.018
   DLCPI            ALL     8.0199    2     0.018

   DLPPI          DLCPI     2.2885    2     0.318
   DLPPI            ALL     2.2885    2     0.318
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Figure 3. Granger Causality Test

4.5 Unit Circle Test

The premise of using impulse response function is that the VAR model passes the stability test and determines that it is a stable system, so that the impulse response analysis has reference significance.The stability test of the model is shown in the figure. The reciprocal values of all roots are within the unit circle. Therefore, the VAR model is stable, which can be used for impulse response function analysis.
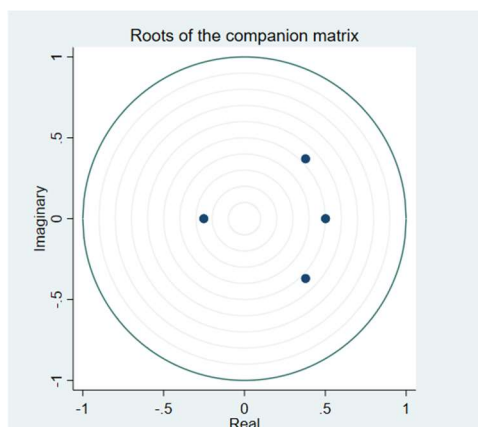

Figure 4. Model stability test

4.6 Impulse Response Analysis

In the VAR model, an impact on an endogenous variable will not only directly affect the variable, but also be transmitted to other endogenous variables through the dynamic structure of the model.Impulse response function can analyze the dynamic characteristics of VAR model, that is, how each endogenous variable changes to its own impact and how other endogenous variables respond to the impact.Then, the model is analyzed by pulse influence function, which imposes a standard deviation new interest impact on the random disturbance term of CPI and PPI respectively, and then analyzes how the two affect each other.

The abscissa represents the number of periods of the response function, and the abscissa represents the response of the dependent variable CPI to the shock of giving PPI a standard deviation interest.

5. Conclusion

CPI and PPI are two important macroeconomic indicators, which play an important role in the formulation of macroeconomic policies. In the realistic complex economic system, there are many uncertain shocks that may occur at any time, affecting the changes of the two price indexes. The price transmission mechanism is very complex, and there are many factors affecting the price transmission process, especially in the context of the new normal of the economy, the factors affecting the transmission relationship between PPI and CPI are more complex.

A more overlooked reality is that the divergence between the two price indices may be an outward reflection of structural contradictions in the economy. Exploring the internal causes of price index deviation not only has guiding significance for the current counter-cyclical macro-control, but also can help the mid - and long-term structural reform, especially the supply-side structural reform, find the starting point and avoid policy mistakes.

The empirical results lack an explanation for the long-term divergence between CPI and PPI, but theoretical analysis can provide a reasonable explanation: the weakening of transmission between CPI and PPI is the premise of divergence, otherwise the trend of both should be close to the same rise and fall. The continued negative CPI is explained by the pass-through of food prices such as agricultural products and service prices. The rise of international commodity prices to the industrial price pass-through resulted in continuous positive PPI; Together, they explain the positive and

negative divergence between CPI and PPI. In summary, the influence of the above factors resulted in the positive and negative divergence between CPI and PPI, which lasted for the longest time and had the largest deviation gap.

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