A Study On The Price Transmission: Experience From Chinese Market

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Abstract:

This article examines the fluctuation characteristics of price level in China, and studies the transmission mechanism of price through Granger Causality test. It shows the transmission relationship between CPI and PPI in China is not stable from 2000 to 2013: a bidirectional transmission was observed at the initial stage of the test, no transmission at the interim stage and bidirectional transmission at the last stage. The fluctuations of the food price are the main reason of the fluctuations of price level in China, and are also the main reason of backward transmission between CPI and PPI. The money supply in China had a relatively more significant impact on CPI, but a very restrict impact on the level of PPI.

Key words: Price Transmission, Granger Causality test

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1. INTRODUCTION

Some new characteristics of price transmissions were observed in China in the last 10 years. For example, the fluctuations of PPI are much more obvious than that of CPI, the fluctuations of PPI cannot transmit to CPI in time. Those phenomena not only contort the transmission function of the price signal, but also imposed difficulties on macro-control and the setting of monetary policies in China. Therefore, understanding the process of price transmission and mastering the law of price transmission are significantly meaningful for the regulation of economics and finance.

Relevant literatures provide theoretical analysis and empirical tests about the transmissions between PPI and CPI from several different aspects. The traditional price transmission theory mainly concentrates on supply shock, which claims that the fluctuations of price usually transmit from PPI-measured upstream price index to CPI-measured downstream price index. It means that PPI could be the leading indicator of CPI. Having studied the law of transmissions in United States, Silver and Wallace (1980) confirmed that PPI could lead to the changes of CPI. Kyrtsou and Labys (2006) examined the monthly data in United States from 1970 to 2002, and found out that all commodities index in PPI have a dynamic and non-linear influence on CPI, which showed that PPI could be the leading indicator of inflation. Whereas Jianqi Chen (2008) tested the causality between PPI and CPI in China from 1999 to 2008, and discovered that the relationship between PPI and CPI is of no apparent statistical significance. He thinks the reverse relationship between PPI and CPI in China is mainly due to the synthetic action of investment-driven economy and maintenance of gloomy consumption.

Demand determination theory claims that the demand of consumers for finished goods determines the demand for intermediate goods. Hence, the price changes of the finished good should have influences on the input price of intermediate goods. For example, Colclough and Lange (1982) suggested that the changes of the commodity price would influence the price of input goods in production process. Liping He et al. (2008) suggested that CPI Granger-Causes PPI by using Granger test to examine the causality between PPI and CPI in China from 2001 to 2008, which indicates that, among all sorts of factors, demand factors have a more significant influence on price level than supply factors. After examined the price level of China from 1997 to 2008, Zhiqing Dong et al (2009) discovered that, quantitatively, CPI is a leading indicator of PPI and the leading period is 3 months.

It can be seen that from above literatures, whether the transmissions between CPI and PPI are forward or backward, there are always supports from either theory analysis or empirical test.

By using error correction model, Jingqi Song and Xiaohui Shu (2008) discovered that there exists mutual causality between PPI and CPI in China in long term, but only unidirectional causality exists in short term period. Yanqun Zhang (2007) suggested a different conclusion by using CVAR model. He verified that the changes of raw materials price index can be the leading indicator for both CPI and PPI in short time period, but in long term the tendency of CPI determines PPI. However, Weikang Xu (2010) found out that the transmissions between CPI and PPI are mutual within his test period. Why do different papers give different conclusions, or even opposite? First of all, the different constituents of price index in different countries are the main reason for inconsistent conclusions of the transmissions between PPI and CPI derived from different markets. Secondly, as an accelerated developing country, it is difficult for the static test to be instructive in solving practical problems, which is due to the extreme unsteadiness of the test conclusion caused by extensions of the sample period.

Given the above, this article studies the characteristics of price changes and transmission characteristics in China from two aspects. On one hand, analyzing the constituents and the characteristics of fluctuations of Chinese PPI and CPI, and testing the main reason of fluctuations of PPI and CPI in different time periods. On the other hand, by using dynamic Ganger Causality test to exam the time-varying characteristics of the transmission between PPI and CPI. Also, on the basis of dynamic Granger Causality test, Granger - F test (Fei, 2012) is conducted to examine the factors that cause the transmissions of PPI and CPI from a quantitative perspective.

2. THE FLUCTUATIONS AND CONSTITUENTS OF PPI AND CPI

1. Index Analysis of CPI Constitution

This section first calculates the weight of each sub index in CPI by using regression method, and then used the weight to calculate the contribution ratio of each sub index. The formula is following:

$$GXCPI_{i,t} = w_i * CPI_{i,t} / CPI_t \quad (1)$$

$GXCPI_{i,t}$ denotes the contribution ratio of the i type CPI (e.g. food) within time t.

$CPI_{i,t}$ denotes the year-on-year growth rate of i type CPI within time t.

CPI_t denotes the year-on-year growth of the overall level of CPI within time t

w_i denotes the weight of the i type index from January 2001 to December 2013

When using regression method to calculate the weight of each sub index in CPI, in order to ensure the indices are stationary time series, HP method is conducted to calculate the gap of indices. The smoothing parameter of HP is 14400. In order to reflect the contribution ratios more directly, we calculate average contribution ratio of every index in confidence interval in this section. The formula is following:

$$GXCPI_i = \frac{1}{T}\sum_{t=1}^{T} GXCPI_{i,t} \quad (2)$$

The current rise of CPI was mainly driven by the rise of food price, and the cost of housing also played an important role. Table 1 shows that during the period from January 2001 to December 2013, the mean value of the contribution ratio of the rise in the price of food and housing price accounted for 59.6% and25.6% respectively, followed by education and entertainment (7.2%) and health care (5.9%).

Table 1 Estimated Weight Value of the Indices in the CPI and the Contribution Ratio of the Variables to the CPI (2001.1. -2013.12.)

Variables	Weight		Mean Value of the Contribution Ratio
	Weight Coefficient	t Statistic	
Food	0.324	220.947	0.596
Alcohol & Tobacco	0.102	8.741	0.027
Clothing	0.027	3.209	0.003
Family Equipment	0.027	3.209	0.007
Medical Care	0.108	15.653	0.059
Communications	0.107	12.255	-0.010
Entertainment & Education	0.136	36.262	0.072
Housing	0.159	46.732	0.256

Note: The weights of all kinds of variables in the CPI may be slightly adjusted annually, but the estimate of weight coefficients in the table can broadly reflect the average level of all kinds of indices weights in the CPI. The same in Table 2 and Table 3.

After December 2002, a sustained rising trend of CPI showed in China, from 0.4% in January 2003 to 5.2% in September 2004. At that time, four of eight categories of consumption price indices (food, Clothing, education and housing) rose in varying degrees, of which the Food CPI showed the maximum growth rate, rising from -0.1 % to 14.6% from November2002 to July 2004. From a practical perspective, China entered the fourth consecutive year of grain reduction in 2003.and the grain price increased due to the shortage of supply. This growth leads the direction of the trend of CPI to a positive way. In. 2004, the prices rise of grain and financial subsidies lead the price of Grain to increase obviously. In the case of the ever-increasing grain supply, grain price fell gradually. As a result, the Food CPI started to fall after it reached 14.6%. The index fell down to 4% in January 2005. Influenced by the change of the Food CPI, total CPI began to fall when it reached 5.3% in July 2004. The index fell down to 1.9% in January 2005. Figure 2 confirmed the absolute influence on the total CPI caused by the Food CPI of which the contribution ratio fluctuated around 100% and even reached up to 295% in February 2003.

CPI showed the increase trend again from October 2006, which rose up to 8.7% from 1.4% in February 2008. Clothing CPI rose up to 2.4% from 0.8%, Family Equipment & Service CPI rose up to 2.1% from 1.7%, Medical Care CPI rose up to 3.2% from 1.3%, Housing CPI rose up to 6.6% from 4.6%, and Food CPI rose enormously up to 23.3% from 2.2%. From a practical perspective, this rise of Food CPI is mainly due to the increase of pork and meat prices. Compared with 2006, the pork production of China in 2007 declined by 7.8%, which caused a shortage of pork supply. As a result, the price of pork rose up and pushed Food CPI to increase. Figure 2 confirmed that, from October 2006 to February 2008, the contribution ratio of Food CPI still maintained a high level of 80%.

From February to October in 2009, the negative growth of CPI was mainly caused by the decrease in the Housing CPI. The contribution ratio of Housing CPI was about 63%(according to equation (2)). During this period, Housing price fell down to -3.8% from -2.9% and the other prices also fell down in varying degrees. The Food CPI increased slightly of which the contribution ratio tended to zero.

Therefore, the increasing structural price leads to the rising of CPI. In addition, the rising CPI due to cost-push price increase rather than demand-driven price increase. The direct cause of

the significant growth trend of food prices was the decrease of supply caused by cost-push. Actually, the seasonal reason leads to shortage supply. Following the sharp rise in food prices, market supply will gradually increase. At the same time, the prices of the production will gradually increase to a stabilized level.

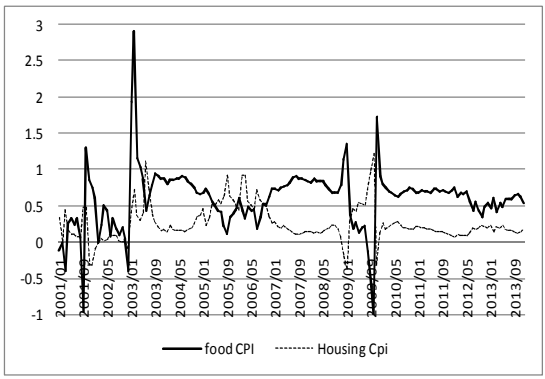

Figure 1 the contribution ratio of Food CPI and Housing CPI

2. Index Analysis of PPI Constitution

1) PPI-means of subsistence

As the same as the analysis of CPI, firstly, this section measures each sub - index weights of means of subsistence by adopting the regression method. The next step is to calculate the contribution ratio of all kinds of indices on the means of subsistence.

The price of the means of subsistence rose sharply three times in the confidence interval, which was mainly due to the rise of Food PPI: (1) The first rise was in the period from February 2002 to October 2004, Subsistence PPI rose from -2.9% to 1.7%. At that time, the price of food, clothing and daily necessities increased in varying degrees. The Food PPI showed the maximum growth rate, which increased from -0.4% to 5.6%; Clothing PPI and Daily Necessities PPI increased by 3.3% and 5.6% respectively. However, the price of consumer durables had been in a negative growth. Thus, in this period, the increase of the PPI was the result of the general rise in the prices of all kinds of means of subsistence of which the food price increased at the highest rate. (2) The second rise started from August 2006, the Subsistence PPI rose up to 3.7% from 0.3% in the period from August 2006 to November 2007. However, this growth was mainly driven by the rise of food price. Food PPI raised by 9%, reached up to 9.1% from 0.1% during July 2006 to November 2007; Daily Necessities PPI raised by 2.3%; Clothing PPI basically maintained stably at 1.2%; the increase range of

Durable PPI shrank but still maintained a negative growth. According to equation (2) from August 2006 to November 2007, the contribution ratio of Food PPI on means of Subsistence PPI reached up to 88%, which confirmed that the price of means of subsistence was mainly driven by the price of food. (3) The third price rise of means of subsistence was from January 2010 to September 2011. The contribution ratios of food, clothing, housing and durable consumption were 69.1%，23.6%，16.7% and -10.2% respectively. Therefore, food was still the main cause of the price growth of means of subsistence.

Table 2 Estimated Weight Values of the Indices in the means of Subsistence PPI (and the Contribution Ratio of the Variables to the means of Subsistence PPI)(2001.1.-2013.12.)

	Weight		Mean Value of the Contribution Ratio
Variables	Weight Coefficient	t Statistic	
Food	0.358	111.112	0.369
Clothing	0.219	19.602	0.059
Daily Necessaries	0.184	21.306	0.153
Durable Consumption	0.265	24.296	0.336

2) PPI-production section

The contribution ratios in Table 3 and the tendency of the ratios in Figure 3 shows that, in the confidence interval, the rise of Production PPI was mainly driven by the rise of the price of raw materials. Since the economic growth of China resumed the tendency of increase, the Production PPI rose three times: (1) The first rise period started from January 2002 to November 2004, the index raised gradually up to 6.7% from -5% in March 2003. After a slight decline, the index resumed to increase to 11.7% in November 2004; the trend of Mining PPI and Raw Materials PPI were similar to the trend of the Production PPI, which increased by 3.3% and 5.6% respectively; the Processing Industry maintained a rise tendency throughout the period, the Processing PPI rose up to 4.6% from -3.7%. According to equation (2), in this period, the proportion of the contribution ratio of raw materials, mining and processing on the rise of Production PPI were 55%, 19% and 30%. From a practical perspective, the investment expansion in China caused tensions on domestic resources supply since 2000. According to statistics, in 2003, the consumption of crude oil, coal, iron ore, steel, aluminum and cement in China separately accounted for 7.4 %, 31%, 30%, 27%, 25% and 40 % of the whole

consumption of the world. As a result, the price of energy, raw materials and some production prices rose rapidly. After November 2004, the rise of the price of mining and raw materials production declined sharply, the rise of the Processing price was relatively stable. The rise of means of production also continued to fall down sharply and reached down to 1.84% in September 2007. (2) In the following period, the price increased again and reached up to 10.83% in September 2008. From September 2007 to September 2008, the total contribution ratio of the rise of the price of mining and raw materials on the rise of the price of means of production is 69% and the contribution ratio of processing industry was about 30%. (3) The third rise occurred from August 2009(-10.10%) to May 2010(8.79%). This rise was also pushed by mining industry, raw materials industry and processing industry and the total contribution ratio of these three industries was 80%.

Table 2 Estimated Weight Values of the Indices in the Subsistence PPI (and the Contribution Ratio of the Variables to the Subsistence PPI)(2001.1.-2013.8.)

Variables	Weight		Mean Value of the Contribution Ratio
	Weight Coefficient	t Statistic	
Mining Industry	0.077	36.694	0.220
Raw Materials Industry	0.346	49.286	0.525
Processing Industry	0.546	68.651	0.240

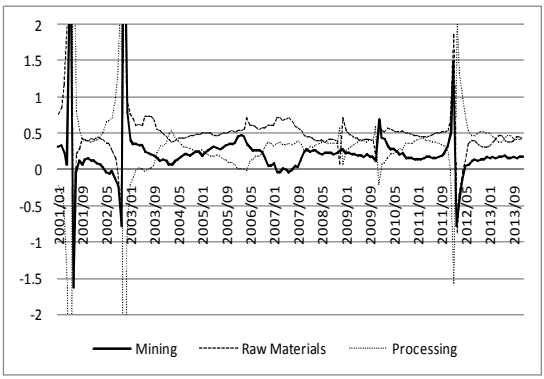

Figure 2 the contribution ratio of mining, raw materials and processing industry on means of production

3. STUDY OF THE TRANSMISSION RELATIONSHIP BETWEEN PPI AND CPI

After 2000, the price transmission relationship in China shows many new characteristics：the fluctuations of upstream product price are far greater than the fluctuations in downstream product price.; the fluctuations in upstream products cannot be transmitted to downstream promptly and the change in price of means of production cannot be transmitted to the household consumption price. Therefore, many scholars applied the Granger causality test to conduct an empirical study of the transmission relationship between PPI and CPI (Liping He, et al, 2008; Weikang Xu, et al, 2010). The Granger causality test is proposed by Granger (1969) to study the causal relationship between variables, which has been widely used in research as well as in the industry. This method gives a qualitative conclusion on a set significance level: for instance, in this thesis, the PPI Granger-causes the CPI or the PPI does not Granger-cause the CPI. However, whether the transmission relationship between the CPI and the PPI of China changes during testing or not? If there are any relationship changes, what is the incentive leading to the change F? To answer the questions above, on the basis of the dynamic Granger test, this thesis studies the transmission relationship between the PPI and the CPI by constructing a Granger-F test.

1. Stationarity Test of Data

The Granger causality test requires that the time series of PPI and CPI should be stationary, but according to the unit root test, it is found that the PPI from January2001 to December 2013 is stationary while the CPI is not (as in Table 4). For this reason, in this thesis, the HP method is used to obtain the gap value of PPI and CPI, denoted as PPI gap and CPI gap with smoothing parameter of HP being 14400; it has been verified that both PPI gap and CPI gap are stationary time series. Hereinafter, for convenience, PPI and CPI denote the gap value forms of their respective time series.

Table 4 Stationarity Test of Time Series (January2001 to December2013)

Variable	Test form (c,t,k)	ADF statistics	P value	Result
CPI	(c,0,2)	-1.816	0.372	Non-stationary
PPI	(c,0,2)	-2.834	0.005	Stationary
CPI gap	(0,0,3)	-3.337	0.001	Stationary
PPI gap	(c,0,4)	-4.881	0.000	Stationary

Description: (1) c and t in the test form denote the constant and trend term, and k denotes the lag order (2) the choice of k is based on the minimum of AIC and SC.

2. PPI And CPI: Who Drives Who?

The definition of Granger causality is: if the lag value of a variable can help predict another variable, then the variable Granger-causes the other variable. The formula can be expressed as: $$\begin{bmatrix} CPI_t \\ PPI_t \end{bmatrix} = \begin{bmatrix} a_{10} \\ a_{20} \end{bmatrix} + \begin{bmatrix} a_{11}^1 & a_{12}^1 \\ a_{21}^1 & a_{22}^1 \end{bmatrix} \begin{bmatrix} CPI_{t-1} \\ PPI_{t-1} \end{bmatrix} + \cdots\cdots + \begin{bmatrix} a_{11}^p & a_{12}^p \\ a_{21}^p & a_{22}^p \end{bmatrix} \begin{bmatrix} CPI_{t-p} \\ PPI_{t-p} \end{bmatrix} + \begin{bmatrix} \varepsilon_{1t} \\ \varepsilon_{2t} \end{bmatrix} \quad (3)$$

If and only if the coefficients a_{12}^p in the coefficient matrices are all zero, variable PPI does not Granger-cause CPI which is equivalent to that CPI is exogenous to PPI. The null hypothesis for this test H_0 is: all a_{12}^p are 0, i.e. PPI does not Granger-cause CPI. The way to conduct a recursive Granger test is: suppose the confidence interval is from t_0 to t_T; at first, select an appropriate sub-interval from t_0 to t_n (n<T) and conduct a Granger test; and then, as the number of new values observed increases, expand the sample interval and repeat the Granger test until reaching the end of the sample interval (t_T). For the convenience of description, this thesis will give the name GF to the statistics measuring the causality between PPI and CPI, referencing Fei (2012) method, with GF statistics= $\frac{S_t}{F_{c,t}}$ in which $S_t = \frac{(RSS_{0,t} - RSS_{1,t})/p}{RSS_t/(t_T - 2p - 1)}$ follows F distribution. $RSS_{1,t}$ is the residual sum of square of the equation CPI_t in equality (3); $RSS_{0,t}$ is the residual sum of square of the lagged variable excluding PPI_t; P is the lag period; t_T is the final time value of the confidence interval. $F_{c,t}$ is the critical value of F distribution at time t (10% level of significance). Therefore, if $S_t > F_{c,t}$ (GF $\geq$ 1), PPI_t Granger-causes CPI_t; otherwise, PPI_t does not Granger-cause CPI_t. On the basis of dynamic recursive Granger test, the causes of the fluctuations of GF statistics can be studied through the construct of a Granger-F test, i.e. what are the factors causing the forward or backward transmission between PPI and CPI.

Figure 4 depicts the trend chart of GF statistics based on the recursive Granger test. The black dotted line represents the null hypothesis that PPI does not Granger-cause CPI, and when the line is above "1", it indicates that the null hypothesis is rejected, i.e. PPI Granger-cause CPI. The black solid line represents the null hypothesis that CPI does not Granger-cause PPI, and when the line is above "1", it indicates that the null hypothesis is rejected, i.e. CPI

Granger-cause PPI. Moreover, when GF statistics increases, it indicates that the stationarity of the Granger causality between CPI and PPI increases.

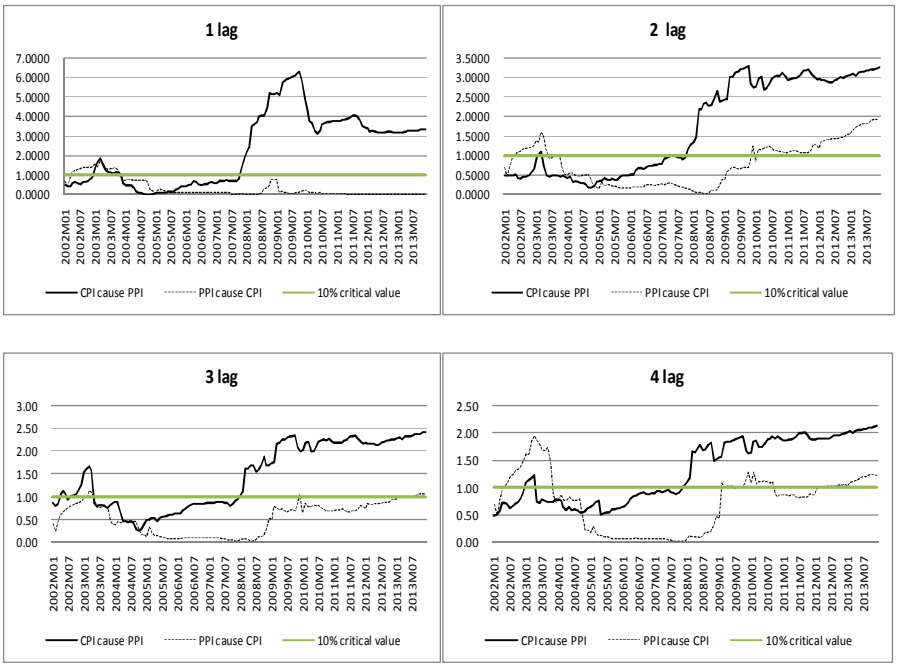

Figure 3 GF Statistics Trend Chart

As can be seen from the GF statistics in Figure 4, after 2000, the price transmission of China has been through 3 stages: bidirectional transmission between PPI and CPI during the early stage of the confidence interval; no transmission relationships over the interim of the confidence interval; bidirectional transmission again during the final stage. The trend chart shows two distinct characteristics: (1) the stationarity of the Granger causality for the backward transmission from CPI to PPI is significantly higher than that of the forward transmission (GF statistics of backward transmission is higher than that of the forward transmission); (2) the forward transmission apparently lags behind the backward transmission.

3. Empirical Analysis

From a theoretical standpoint, there are two main forms of price transmission, namely cost-push and demand-pull. Cost-push transmission is that the changes in upstream price cause price changes in midstream and downstream products. It can also be explained from the

perspective of price index as a variation in PPI, a result of the price changes in purchasing price indices of raw materials, fuels and power for industrial enterprises, which leads to a variation in CPI. Conversely, demand-pull transmission is that the changes in downstream price give rise to changes in midstream price, and then cause changes in upstream price level. It is the variations of CPI that cause the variations of PPI, and lead to relevant changes in the purchasing price of raw materials, fuels and power.

However, whether the transmissions between PPI and CPI can be achieved or not is depend on the supply-demand relationship between upstream and downstream product markets. The upstream products mainly includes the industries of excavation, production and machining of raw materials, fuels and power, while the downstream products mainly includes consumer data industry. Under the condition of shortage economy, the rising costs lead directly to the increase of commodity prices, which proved by the history of the high inflation period in China in the 1980s and 1990s. Since the late 1990s, due to the oversupply in the market of downstream products in China, a huge production and processing capacity was formed in the downstream of the industrial chain, thus resulted in a relatively insufficient final consumption demand. The increase of investment demand drives up the price level when the supply of upstream products has limited elasticity, while the production capacity of downstream products has a large number of relative surpluses at the same time, thus the rise in price of consumer terminal would lead to a loss of the corresponding market share. As a result, the price increase of upstream raw materials cannot transmit to downstream market smoothly, namely, there is a lack of necessary market environment to achieve the transmissions between PPI and CPI. By contrast, the over-demand of upstream markets leads to an intense competition among the buyers. Therefore, people will observe a price soar in upstream market as a result of a surge in demand caused by the expansion of investment. Meanwhile, the serious decline in supply of some food (e.g. grain and pork) disequilibrates the balance between supply and demand, causing a sharply jump in the price of these food. A combinations of these factors discussed above contribute to a rapid growth in CPI, and result in a sharply rising in PPI eventually. That is, compared to forward transmission, CPI can backward transmit to PPI in a relatively smoother way. Hence, the demand-supply relationship of upstream and downstream markets causes the two obvious characteristics of the trend of GF statistics.

From 2002 to 2003, PPI and CPI transmit mutually. The transmission from PPI to CPI is mainly because of the strained supply of domestic resource caused by investment expansion in China after 2000, which leads to a rapid increase in the price of upstream products, such as energy, raw materials and some of the means of production, and then causes rises in price of

household consumption and service sector. After November 2004, the price level of means of production in PPI continued to fall sharply, which is due to the continuous falling of the year-on-year growth rate of excavation and raw material industrial products, thus have lost its driving force of pulling up the level of CPI. Therefore, the GF statistics of lag 1, lag 2, lag3 and lag 4 all saw rapid declined by the end of 2004, and then fluctuated around the zero value. From the Granger causality F test in Table 5, it can be seen that the null hypothesis that the purchasing price of raw materials, from 2002 and 2003, fuels and power indices did not Granger-causes GF statistics is rejected, which proves that the rise in price of the former Granger-causes the transmission from PPI to CPI over this time period.

From July 2002 to January 2004, the main reason of observing a transmission from CPI to PPI is that the reduction in food production causes the increase of food price. Its transmission pathway is that the increase in food prices drives up the level of CPI, then transmits to the means of production in PPI, and eventually leads the means of production and the overall level of PPI to increase. From the Granger causality F test in Table 6, it can be seen that in the year of 2002 and 2003, the null hypothesis that the food CPI fluctuations did not Granger-cause GF statistics is rejected, which proves that the increase in food price Granger-causes the backward transmission from CPI to PPI over this time period.

From the GF statistics in Table 4, it can be observed that after experienced an 'unrelated' period between 2004 and 2007, PPI and CPI started to achieve a backward transmission in the second half of 2007, and then transmitted mutually by the end of 2009. The main reason of backward transmission is that the supply of pork and meat product in food CPI has experienced a severe decline between the year of 2007 and 2008, which disequilibrated the original supply-demand balance, and led to a rapid growth in the price of these food, and then caused the transmission from CPI to PPI. With the spreading and deepening of the world financial crisis in the second half of 2008, the food price dropped back and tended towards stability, which caused a decline in CPI and dragged down the level of PPI. It can be seen from the GF statistics trend diagram that different lagged values of GF statistics (backward transmissions from CPI to PPI) all reached the levels above 1 in succession from the last half of 2007 to the year of 2008, during which the food category of CPI was experiencing a high-speed growth. It can be concluded that PPI and CPI achieved backward transmission over this time period. From the Granger Causality F test in Table 6, it can be seen that the food category of CPI Granger-causes the GF statistics over this period, which proves that the short term fluctuations of food price is a significant cause of the backward transmission of PPI and CPI. In addition,

Table 5 Granger - F test proves that the transmission between PPI and CPI is caused by the continuous increase of the price of food in means of subsistence in PPI.

Table 5 Granger-causality F test: Who caused the forward transmission from PPI to CPI

Test period	Null Hypothesis	F statistics	P-value	Conclusion
2002.01-2003.12	The purchasing price of raw materials, fuels and power did not Granger-cause GF statistics	5.355	0.012	Reject
2002.01-2003.12	Food PPI did not Granger-cause GF statistics	2.187	0.143	Accept
2010.01-2013.12	The purchasing price of raw materials, fuels and power did not Granger-cause GF statistics	7.324	0.002	Reject
2010.01-2013.12	Food PPI did not Granger-cause GF statistics	5.399	0.003	Reject

Note: The best lagged value was calculated according to AIC and SC principle; GF statistics describes the dynamic causality of the transmission from PPI to CPI. The purchasing price index of raw materials, fuels and power and the food category CPI and GF are all non-stationary process over the test period discussed above. Therefore HP method is conducted to obtain the gap value of the data listed above. After examining the purchasing price index of raw materials, fuels and power ,the gap values of CPI and GF statistics are all stationary process, therefore Granger Causality F test can be conducted.

Table 6 Granger-causality F test: Who caused the backward transmission from CPI to PPI

Test period	Null Hypothesis	F statistics	P-value	Conclusion
2002.01-2003.12	Food CPI did not Granger-cause GF statistics	5.439	0.030	Reject

2007.01-2013.08	Food CPI did not Granger-cause GF statistics	2.851	0.095	Reject

Note: The best lagged value was calculated according to AIC and SC principle; GF statistics describes the dynamic causality of the transmission from PPI to CPI. The data listed above are all non-stationary process over the test period. Therefore the Granger - F test is conducted after using the same method in Table 5 to obtain the gap values of relevant data.

IV. GRANGER CAUSALITY TEST BETWEEN M2 AND SUB-INDICES OF CPI

This section studies whether the changes of the monetary policy itself (eg. The growth rate of money supply) Granger-causes the constitutions of CPI and PPI. Given that the control of the amount of money in circulation is still the main policy instrument and intermediate target of People's Bank of China, we use the growth rate of M2 to represent the changes of monetary policy. Table 7 demonstrates the outcome of the Granger Causality test. From the P-value listed below it can be seen that the money supply Granger-caused not only the overall level of CPI, but also the CPI level of food, tobacco and alcohol, family equipment, entertainment and education and housing. From the respect of PPI index, there was no enough evidence to prove that money supply Granger-caused the overall PPI index and the index of means of production; however, the money supply, under a significant level of 10%, Granger-caused the PPI index of the means of subsistence. This explained that the changes of money supply could provide relatively sufficient predictive information for the fluctuations of the overall level of CPI and its sub-indices, but was not sufficient enough to predict the fluctuations of the overall level of PPI and the level of means of productions.

Table 7 Whether M2 caused the changes of price indices

Growth Rate of M2 did not Granger-cause the variables listed below	F statistics	P-value	Conclusion
CPI	9.975	0.000	Reject
Food	8.083	0.001	Reject
Tobacco & Alcohol	3.545	0.032	Reject
Clothing	0.059	0.943	Accept
Family Equipment	8.258	0.000	Reject

Medical Care	5.818	0.004	Reject
Communication	0.570	0.567	Accept
Entertainment & Education	2.631	0.076	Reject
Housing	2.654	0.075	Reject
PPI	1.253	0.289	Accept
Means of Production	1.221	0.298	Accept
Mining Industry	0.986	0.376	Accept
Raw Material Industry	0.771	0.464	Accept
Processing Industry	1.488	0.229	Accept
Means of Subsistence	2.453	0.090	Reject
Food	2.146	0.121	Accept
Clothing	2.623	0.076	Reject
Daily Necessaries	5.120	0.007	Reject
Durable Consumption	2.081	0.129	Accept

Note: The best lagged value was calculated according to AIC and SC principle; The growth rate of M2 and every price index listed above are all non-stationary process over the test period. Therefore HP method is conducted to obtain the gap value of the data listed above. The gap values are all stationary process after examination. Therefore Granger Causality F test can be conducted.

V. CONCLUSIONS

This thesis conducts empirical studies on the fluctuation characteristics, the influential factors and the transmission relationship CPI and PPI, The main methods and conclusions are as follows:

1. By the time-varying analysis of contribution ratio of the components within CPI, it is found that within the confidence interval (January2001-August2013), rise in CPI was mainly structural price rise caused by the change in food prices rather than overall price rise. In addition, the rise in CPI is the growth of cost-push price rise rather than demand-pull price. The former leads to reduction of supply, then food prices increase dramatically. This shortage

supply is seasonal rather than regular. As the food prices drastically increase, market supply gradually increases, and the corresponding prices will gradually stable.

2. By the time-varying analysis of contribution ratio of the components within PPI, it is found that within the confidence interval, the price of means of subsistence of PPI shows several sharp increases, mainly because it is pulled by the rise of food price index; while the increase in price of means of production of PPI is mainly because of the pull by the rise in prices of raw material industrial products.

3. This thesis applies a recursive Granger causality test to study the dynamic transmission relationship between PPI and CPI. The dynamic research method not only differentiates if PPI and CPI achieve forward, backward or bidirectional transmission at different times, but also estimate the stationarity of both when transmitting at different times. According to the fluctuations of GF statistics: (1) After 2000, PPI and CPI are observed to have three stages: a bidirectional transmission at the initial stage of the test; no transmission at the interim stage and bidirectional transmission at the last stage. (2) GF statistics show two distinct characteristics: one is that the stationarity of the Granger causality for the backward transmission from CPI to PPI is significantly higher than that of the forward transmission (GF statistics of backward transmission is higher than that of the forward transmission); the other is that the forward transmission apparently lags behind the backward transmission.

4. This thesis studies the causes of the change of transmission relationship between PPI and CPI by conducting a Granger-F test. The study confirms that: (1) the two backward transmissions of CPI and PPI in the confidence interval are both caused by the fluctuations of food price; (2) the forward transmission between PPI and CPI from 2002 to 2003 is caused by the fluctuations of the purchasing price of raw materials, fuels and power; while the forward transmission between PPI and CPI after 2007 is caused by the fluctuations in food prices of means subsistence of PPI.

5. After the study of Granger Causality test, we found that the fluctuations of the money supply (year-on-year growth rate of M2) can induce changes of the overall level of CPI and majority of the sub-indices of CPI, but does not have significant impact on the level of PPI and the index of means of production. Therefore, it is inappropriate to use monetary policy to manage the fluctuations of the PPI level of means of production.

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