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Analysis of Pork Price Cycle and Its Relationship with CPI

Suyun CHENG*, Jin HU

School of Economics, Yangtze University, Jingzhou 434023, China

Abstract Since the second half of 2015, the price of pork has come into a new round of rising cycle, especially from January to April of 2016, pork prices continued rising. Excessive rising of pork prices sparks people's concern about CPI rising. It is of practical significance to discussing the fluctuation cycle of pork price and its relationship with CPI. In this context, we do empirical research on pork cycle and price fluctuations with CPI relationships. From January 2000 to March 2016, based on a total of 195 samples, using Eviews6.0 metrology software, we draw the following conclusions: fluctuations in the price of pork did Granger cause CPI, the impact of pork price fluctuations on the CPI was significant and the effect significantly was enhanced after certain lag; CPI did not Granger cause pork price fluctuations, CPI had no significant effect on the price of pork; pork price was affected by its own large contribution, and there was a certain time lag effect of the impact; CPI had a positive impact on itself, for its contribution is relatively large. Finally we put forward relative strategies.

Key words Pig price cycle, Pork prices, CPI

1 Introduction

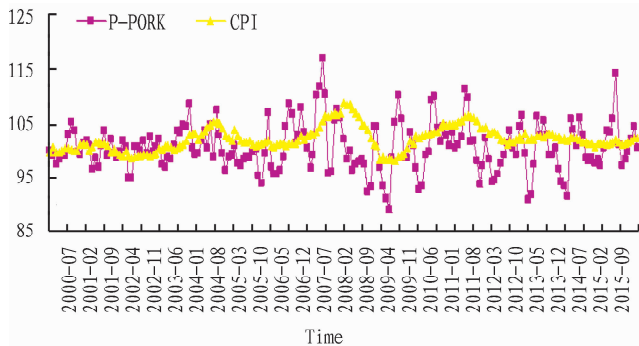
Since 2016 of January, pork prices have continued to rise, especially from April 18 to April 24, pork prices rose by 46.8%. Rising pork prices have raised concerns about rising prices. According to the experience of the past, the price of pork is likely to cause fluctuations in CPI. It is often associated with abnormal fluctuations in pork prices and changes in CPI together. Pork is one of the most important meat sources in our country, and the fluctuation of pork price affects the daily life of Chinese residents. CPI is the basic index to reflect the change of the daily life of the residents, and the change of CPI affects the basic life needs of people. Therefore, pork price and its relationship with CPI is very important, causing widespread concern. Some scholars have studied the related issues of pork price fluctuation and the relationship with CPI, Zhao Yu (2010) performs the comparison of the pork price changes from 1987 to 2009, and finds that the nominal price and the actual price of pork are rising in the fluctuation, and the change of the nominal price of pork is consistent with the change of CPI^[1]. Zhong Jiakun (2011) analyzes pork price changes in Hunan and cyclical pork price change is leveraging CPI^[2]. Li Weiyi, Wang Mingli (2010) think that pork price changes have an important impact on the CPI, and these effects are the most obvious for 2 – 3 months^[3]. Hu Yuyue (2012) proposes that the pork price fluctuation cycle and the CPI fluctuation cycle have certain relevance, this kind of correlation is also enhanced; the pork price change also has certain guiding function to the CPI^[4]. The research results of Han Yijie and Liu Xiuli (2011) show that the prices of pork rise by 20% and 50% respectively after months of rising pork prices affect the CPI with time^[5]. He Puming (2013) finds that there is a two-way causal relationship between pork price fluctuation and CPI, and the effect from pork price fluctuation is

greater than the effect from the CPI^[6]. Yu Shanna, He Puming (2015) conclude that CPI is not the reason for pig price fluctuations and there is a long-term equilibrium between the pig grain price and CPI, and pig grain price has a great impact on CPI but there is a certain lag effect^[7]. The above scholars have not only focused on the analysis of pork price fluctuations in the cycle of research, but also focused on the effect of fluctuations in CPI, and the relationship between the two in-depth discussions. But as to whether the price of pork has a certain cycle, they need specific discussion. Starting from the description of the pig price cycle, this paper gradually explores the source of the pig price cycle, as well as the relationship between pork price and CPI, and tries to re-explore the relationship between CPI and pork prices.

2 Description of pig price cycle and its relationship with CPI

There is a strong consistency between pork price fluctuations and high degree of coordination of CPI changes. During January 2000-May 2003, the price of pork maintained the amplitude of the upper and lower 6%, with relatively small fluctuations, CPI also kept up and down the magnitude of the change in the 2% phase of the higher degree of synergy between the two. From May 2003 to November 2003, the pork price growth accelerated in November 2003, with monthly growth rate of 8.51%, a record high in 5 years, and the fluctuation of CPI also showed coordination change. In December 2003, CPI rose by 3.19% for the first time since January 2000. From January and February 2004 after the fall, CPI continued to rise, an increase of 5%. In September 2004, pork prices began to fall, and CPI began to fall from October 2004 to November 2006, and then remained stable despite relatively small fluctuations. In July 2006, pork prices began to enter a new cycle of rising, and in July 2007, pork prices hit a record high, reaching 17.08%. Abnormal rise in pork prices also led to the rise of CPI, and until February to March in 2008, monthly CPI

exceeded 8% , becoming the highest monthly peak since CPI year on year in January 2000. After that, the price of pork reached a peak but from 2007, it began to fall and in May 2009, the growth reached its lowest point of -10.91% . Pork prices also led to lower CPI decline after April 2008 when CPI gradually decreased to maintain steady, year-on-year growth in July 2009 reached the low of -1.81% . From the beginning of June 2009, pork price began to rise; in August 2009, August 2010 and June 2011, it exceeded 10% of the amplitude of this chain, CPI also entered a new round of rising cycle in July 2009, reaching 6.5% in July 2011 to become the highest point of the cycle. Pork prices peaked in June 2011 after the fall, and until March 2012, the monthly growth rate reached -5.74% , CPI also gradually fell until it reached a low in September 2012. From April 2012 to March 2015, the pork price fluctuations were relatively small, the degree of cooperation with the CPI was also high, and the CPI trend was relatively stable during this period. Pork prices rose from August 2015, to reach 14.36% , becoming second only to the growth rate in July 2007 to October 2015, fluctuations in the price of pork reached a low point, then began to rebound until April 2016; affected by fluctuations in the price of pork in April 2015, CPI had a certain growth rate, and in August 2015, CPI rose by 2% , in September 2015-April 2016, pork prices were stable as a whole, but the trend was accelerated growth. According to the above description, during 2000 to 2016, pork prices generally experienced 5 cycles from up to down, the pork cycle showed regular frequent fluctuations. Pig price cycle is about 3 years a large cycle, 1.5 years a small cycle, showing a stable state of development.



Note: Pork price fluctuations made monthly index, monthly CPI using the same data.

Fig. 1 The relationship between pork price fluctuations and CPI during January 2000-March 2016

3 The empirical analysis of the relationship between pork price fluctuations and CPI

3.1 Data acquisition and processing In order to study the relationship between pork price fluctuation and CPI as far as possible, according to the comprehensive, accurate and effective principles, this paper selects 195 samples from January 2000 to March 2016. The price of pork can be used to measure the price, taking into account the availability of data, we select the monthly price data source, and data come from China's animal husbandry information network, using sequential data. With January 2000 as the

base year, the price of pork will be compiled into index form, and the pork price index is named (P-PORK). Consumer price index (CPI) is from National Bureau of Statistics releasing monthly CPI data, CPI using the same data. Time series data may involve some seasonal adjustments, in order to ensure the empirical analysis of the effect of treatment on the monthly data of P-PORK and CPI and seasonal effect analysis of the adjusted data using Eviews 6.0 measurement software.

3.2 Empirical analysis of the relationship between pork price fluctuation and CPI

3.2.1 Stationarity test. Time series data are prone to spurious regression problem, and in order to avoid this kind of problem, data use stationarity test, and the results of P-PORK and CPI stationary test are shown in Table 1. The value of P-PORK is -0.074522 , larger than the 5% critical value of -1.942437 ; the probability value of this event is 0.6567, more than 5% of the CPI value; the critical value is -2.165829 , greater than 5% value of -2.876277 ; the probability of this event is greater than 5% of the value of the probability of 0.2196. The results show that the original sequence of P-PORK and CPI in the sequence is not stable. Statistical difference of sequence of delta P-PORK pork price index value is -4.292287 , less than 1% critical value of -2.577660 , and the probability of this event is 0, less than the 1% critical value; statistical difference sequence of delta CPI value is -6.085037 , less than 1% critical value of -2.577730 ; the probability of this event is less than the 1% critical value; that sequence in P-PORK and CPI in the first-order difference sequence test results is stable. The ADF test result is P-PORK and CPI original sequence is not stable and the first order difference sequence is stable, so the P-PORK and CPI can be regarded as the first order.

3.2.2 Co-integration test It is found that both P-PORK and CPI are stable, and it is necessary to know whether the two sequences are balanced in the long term, so the Johansen method is used to do the co-integration test. P-PORK and CPI co-integration test results are shown in Table 2. The original hypothesis $H = 0$ trace statistic value of 54.54523 is greater than the critical value of 15.49471 at 5% level, the largest eigen value is greater than the critical value of 14.26460 to 43.82045 at 5% level, and the probability of events is 0, less than critical value at 5% level. Co-integration test results show that the original $H = 0$ declines. Assuming $H = 1$ trace statistic value of 10.72478 is greater than the critical value of 3.841466, the largest eigen value of 10.72478 at 5% level is greater than critical value of 3.841466 at 5% level, and the probability of events is 0.0011, less than critical instruction at 5% level. Co-integration test results reject the null hypothesis $H = 1$. That is to say, there are two co-integration relationships between P-PORK and CPI. Further, there is a long-term equilibrium relationship between P-PORK and CPI.

3.2.3 Granger causality test. The two test results show a stable and balanced relationship between P-PORK and CPI, there is also a need to know whether P-PORK is CPI or CPI, and there is a need to determine the causal relationship between the two variables. To examine the relationship between P-PORK and CPI, by using Granger test method of causality, the results are shown in

Table 3. The null hypothesis probability value is 0.0002, less than the critical value at 5% level, and Granger causality tests reject the null hypothesis; the original P-PORK value is 0.6583, more than the critical value at 5% level, and Granger causality

test results accept the null hypothesis. Granger causality test results show that P-PORK is the cause of CPI, and CPI is not the reason of P-PORK, and there is an one-way causal relationship between P-PORK and CPI.

Table 1 ADF test of variables

Variables	Inspection form (C, T, K)	ADF statistics	1% critical value	5% critical value	The value of P	Conclusion
P-PORK	($C, N, 1$)	-0.074522	-2.576936	-1.942437	0.6567	Non-stationary
Δ P-PORK	($C, N, 0$)	-4.292287	-2.577660	-1.942574	0.0000	Stable
CPI	($C, T, 1$)	-2.165829	-3.464101	-2.876277	0.2196	Non-stationary
Δ CPI	($C, N, 0$)	-6.085037	-2.577730	-1.942584	0.0000	Stable

Note: C, T, K represent constant terms, trend of the number of items and lag period, respectively; the number of lags follows the AIC and SC criteria.

Table 2 Co-integration test

Co-integration sequence	Original hypothesis	Trace statistics	5% critical value	The value of P	Maximum eigen value	5% critical value	The value of P
P-PORK and CPI	$H=0$	54.54523	15.494710	0.0000	43.82045	14.264600	0.0000
	$H=1$	10.72478	3.841466	0.0011	10.72478	3.841466	0.0011

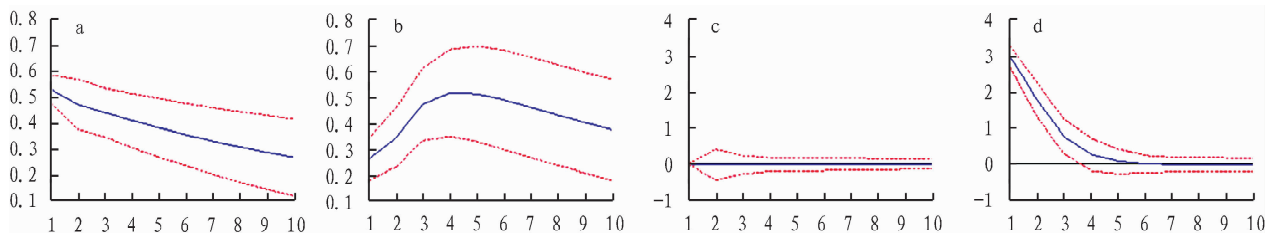
Note: $H=0$ indicates that there is no co-integration relationship; $H=1$ indicates that there is a co-integration relationship.

Table 3 Granger causality test

Original hypothesis	Lag order	F statistics	The value of P	Conclusions
1. P-PORK does not Granger cause CPI	1	14.738600	0.0002	Reject original hypothesis
2. CPI does not Granger cause P-PORK	1	0.019623	0.6583	Accept the original hypothesis

3.2.4 Impulse response function. The so-called impulse response function is mainly to describe the endogenous variables to reflect the error function. The use of the method is to add standard deviation of the magnitude of the impact of innovation, and then understand the impact of endogenous variables. The longitudinal axis of the impulse response function shows that the response degree of the explanatory variable is dependent on the variation of the dependent variable, and the response time is expressed by the horizontal axis. The response period is 10. The dash line represents the confidence interval represented by the standard deviation of the response function. The results of the specific impulse response are shown in Fig. 2. From the impulse response results (Fig. 2a), CPI clearly reflects its changes, first to about 0.53, then decreasing gradually to about 0.3; from response of CPI to P-PORK

change (Fig. 2b), there are certain delayed changes, first to 0.25, gradually increasing to nearly 0.5, but declining after the fifth phase to about 0.37 in the tenth period; in Fig. 2c, the change of CPI has little effect on the P-PORK, close to 0, from the first period to the end of the period of 0, and then gradually increasing; in Fig. 2d, P-PORK reflects relatively strong changes, close to 0.3 in the first phase, followed by a gradual decline in the fifth period to 0. The results of impulse response show that the effect of P-PORK on the CPI is greater than the effect of CPI on P-PORK, CPI impact on the P-PORK is minimum, close to 0; the influence of CPI, influence from their own decreases gradually and begins to rise from the third period, the effect of P-PORK is greater than the effect of CPI; the effect from P-PORK is greater than the effect from CPI.



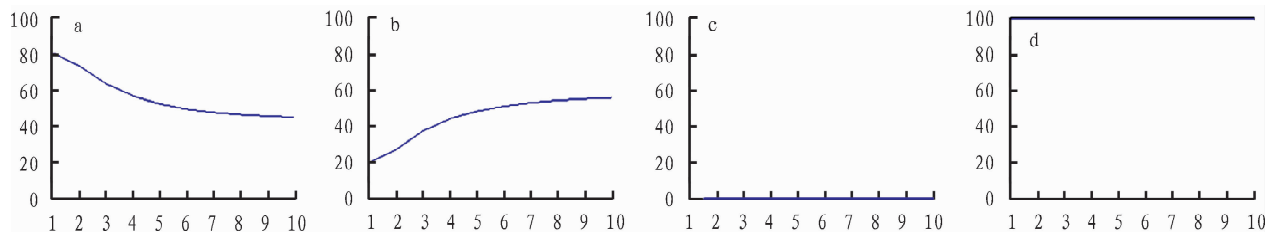
Note: a. response of CPI to itself; b. response of CPI to P-PORK change; c. response of P-PORK to CPI changes; d. response of P-PORK to itself.

Fig. 2 Specific impulse response

3.2.5 Variance decomposition analysis. The impulse response to other variables or their pulse response is significant, but this kind of influence degree of contribution is further divided, the variance decomposition can be relatively accurate description of the degree of influence. Fig. 3 shows the variance decomposition results of the two variables. In Fig. 3a, the CPI contribution is 80.82 in the first period, then begins to decline, and reaches the lowest value of 44.61373 in the tenth period; in Fig. 3b, P-PORK contribution to

CPI increases gradually, from 19.18 in the first period to 55.39 in the tenth period, greater than the contribution degree of CPI to itself; in Fig. 3c, the CPI contribution to P-PORK is 0 in the first period, and the contribution less than 0.1 from the second period to the tenth period, close to 0; in Fig. 3d, the P-PORK contribution is 100 in the first period, and maintains more than 99.98 contribution from the second period to the tenth period. This shows that the impact of P-PORK on CPI is long-term and significant,

but the impact of CPI on the P-PORK is small, close to 0;



Note: a. contribution of CPI to itself; b. contribution of P-PORK to CPI; c. contribution of CPI to P-PORK; d. contribution of P-PORK to itself.

Fig. 3 Variance decomposition results

4 Conclusions and recommendations

4.1 Conclusions Based on the comprehensive use of stationarity test, co-integration test, Granger causality test, impulse response analysis and variance decomposition analysis, this paper studies the relationship between pork price change and CPI. First, fluctuation in the price of pork is Granger cause of CPI, pork price fluctuation in the CPI has continued to affect, and the contribution of CPI to fluctuations in the price of pork gradually increases, exceeding 50%, which shows that the effect of fluctuations in the price of pork on CPI is significant, and there is a certain lag in the impact. Second, CPI is not the Granger cause of pork price fluctuations, CPI changes in pork price fluctuations have minimal impact, and CPI contribution to pork price volatility is very small, close to 0, indicating that CPI has little effect on pork prices. Third, the price of pork is greatly influenced by itself and its contribution is very high; CPI has a positive impact on its own contribution to its own relatively high degree of change.

4.2 Recommendations

4.2.1 Encouraging large-scale pig farming. Pork price fluctuations are associated with the current pattern of farming. China's current pig breeding scale is still small, leading pig farming enterprises are insufficient, the ability to drive the enterprise is limited, and advanced breeding technology is difficult to promote. These problems lead to a certain degree of instability in China's pig supply, and the pig cycle is scheduled to come. To jump out of the strange phenomenon of the pig cycle, there is a need to carry out large-scale pig farming. Large scale farming helps protect the pig production stability, and it is also conducive to promoting the use of new technologies; it can also play a role in stabilizing the market demand, easing the market price downturn and reducing market pressure. It is necessary to speed up the appropriate pig slaughter as far as possible to ensure market supply; large-scale farming is also conducive to disease prevention and control, market risk sharing and market competitiveness improvement. To encourage large-scale pig farming should be an important job to protect the stability of hog prices.

4.2.2 Regulating the pork market to ensure the stability of pork prices. Pork production situation is more severe than grain production situation, pork belongs to fresh product, subject to market risk, and other diseases affect the supply, so the pork market needs government regulation. There is a need to give pork production subsidies for pork production or retail enterprises and acquire or sell pork reserves when pork prices change. Apart from natural

P-PORK and CPI contribution to their own is more obvious.

causes, it is often associated with human speculation, hoarding and profiteering problem of abnormal fluctuations in the price of pork. In order to maintain market stability in the pig, the regulatory authorities should strengthen supervision; the statistics department should release timely and effective authoritative market information, to ensure the dissemination of news channels, which can inhibit these problems to a certain extent. It is necessary to establish a long-term mechanism for the early warning and prevention and control of the pig market, to ensure the stability of pork prices.

4.2.3 Adjusting the price of pork in the proportion of CPI. Each round of rising pork price is associated with people's expectations for price increases, the expected rise will lead to irrational consumer behavior, thereby exacerbating the rise in CPI. The rise in pork prices leads to a general price increase, and as long as the price of pork rises, the inertia of excessive reaction increases market tension. In fact, the impact of pork price changes on people's life is not large. Even if the price of pork rises 5 yuan per kg, people consume 3 k of pork every month, a month spending increases only 15 yuan, and 15 yuan a day is not enough for residents' spending. Therefore, it is necessary to make the price of pork slowly eliminated from the CPI altar. In the long term, the price of pork will gradually reduce the proportion of CPI, the proportion of the price of pork in CPI according to the Engel coefficient adjustment, and constructing reasonable CPI has important significance for ensuring the pork price stability.

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