Price Transmission in China’s Swine Industry with an Application of MCM

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Abstract

The paper studies the relationship, adjustment ability, path, efficiency and intensity of price transmission in the swine industry chain in China, which consists of the prices of corn, compound feed for fattening pig, piglet, pig and pork. Monthly prices covering a period of 18 yr (1994-2011) are analyzed using a Market-Chain Cooperated Model (MCM). The empirical results show that there exists a stable long-term cointegration and short-term dynamic relationship in the price system. First, the adjustment speed of each price series is very slow and the transmission path is top-down and one-way significantly. Second, the price from upstream to downstream lags about 2 mon, while there is no lag in price transmission from midstream to downstream. Third, in terms of price transmission intensity, the price of pig impacted greatly on pork price, not only in the current period but also through the whole period. Besides, the price of corn has the largest lagged effects on pork price. According to the above empirical results, we suggest that government should strengthen monitoring and early warning of the swine industry chain, especially the upstream and midstream, attach great importance to the timely adjustment of feed prices and perfect the measures of price subsidy.

Key words: price transmission, Market-Chain Cooperated Model, swine industry chain

INTRODUCTION

With increasing openness of agricultural market, many factors influence the market price of agricultural products. In China, agricultural market is characterized by a high volatility in price, which has become a main obstacle for China’s agricultural development and farm income growth. As one of the most important industries in rural China, swine industry is an important source of farm income. Moreover, as the first largest animal meat consumed, pork plays an important role in food consumption. Therefore, high volatility in pork price has drawn increased public attention since 1994.

Unusual fluctuations in pork price have appeared recently. In May, 2010, average pork price dropped to a trough level of 16.04 RMB yuan kg\(^{-1}\). Since then, the pork price had begun to rise and reached a record high level of 30.35 RMB yuan kg\(^{-1}\) in September, 2011, with an increase rate of 89.21%. Afterwards, the pork price began to decrease due to governmental policy interventions. In March, 2012 average pork price was 25.97 RMB yuan kg\(^{-1}\), decreasing by 14.4% compared to price in September, 2011. Given the importance of the swine industry and adverse impacts of price volatility on farm income growth, it is crucial to understand how price changes in the swine industry chain. The goal of this paper is to address the price transmission mechanism in China’s swine industry, the knowledge of which may help China’s government stabilize mar-
ket prices in the swine industry. This study can also provide reference value used by governments to manage the whole market price of agricultural products.

Over the past a few decades, there were a large volume of empirical literature on prices in swine industry chain. First, many previous studies focused on price fluctuation rule (Parcell 2000; Wu 2000; Lv and Qi 2007; Gale et al. 2012). For example, Lin (1990) considered 3 larger fluctuations cycles existed in pig production. Sun (2006) explained price fluctuations in pig market using the Cobweb theory and recommended to establish an early warning system in China’s pig market. Zhang and Song (2012) decomposed price volatility of China’s pig market into long-term trends, cyclical fluctuations, seasonal fluctuations and stochastic volatility by applying a Modern Quantitative Decomposition Smoothing Technique. They found that the fluctuation cycle of pork price was about 40 mon. Second, previous studies discussed forming mechanism and factors that can affect pig price (Yin and Zhou 1997; Xin and Tan 1999; Rao 2003). For instance, Li and He (2007) explored possible reasons that can lead to pork price fluctuation, such as national macro-control, pork supply and demand for pork. They pointed out that the most efficient way to mitigate the pork price volatility was to provide accurate and up-to-date market information. Qi et al. (2007) analyzed pork price fluctuations through internal transmission and exterior shock mechanism, and proposed policy recommendations to mitigate the cyclical fluctuations of pork price. Ci (2008) demonstrated that market self-regulation would not suppress fluctuations, but increase volatility base on a Game analysis, and indicated that it was necessary to introduce governmental macro-control and establish a risk warning mechanism. Ning and Qiao (2010) found the influence factors of pork price by using qualitative and quantitative analysis and also put forward some suggestions. Third, in recent years, price transmission mechanism of swine industry chain has become a research focus. These studies mainly took corn price, piglet price, pig price and pork price as research objectives, and then analyzed the relationship or efficiency of price transmission in swine industry chain (Miller and Hayenga 2001; le Goulven 2001; Abdulai 2002; Sanjuan and Dawson 2003; Pfaff and Andera 2003; Bakucs and Fertő 2005; Jones 2005; Wang and Chen 2009; Karantininis et al. 2011; Nie and Lv 2011). Carraro and Stefani (2011) analyzed the price transmission mechanism in three agri-food chains (i.e., lamb, pork and pasta), establishing a structural change framework. Their results showed that structural breaks in the price transmission mechanism were an issue in the food chain of pasta and pork in terms of the price bubble of 2007-2008. Xu et al. (2011) studied the dynamic relationship between pig price and corn price, using a set of econometric methods, and found that there was a positive correlation between the two products.

While previous studies have analyzed price fluctuation rule, price formation mechanism and influence factors, little is known about price transmission mechanism in the whole swine industry chain. Such research is still in the exploration stage, starts relatively later, and has not yet come to uniform conclusions. Literatures about price transmission mechanism research are mainly from the following viewpoint: analyzing the relationship of price transmission (Miller and Hayenga 2001; Abdulai 2002; Sanjuan and Dawson 2003; Karantininis et al. 2011; Xu et al. 2011), price transmission intensity (Wang and Chen 2009), or price transmission efficiency (Pfaff and Anders 2003; Bakucs and Fertő 2005; Nie and Lv 2011), but has not yet systematically and comprehensively study on price transmission mechanism of the whole swine industry chain.

This paper aims to fill in the gap in literatures, and addresses the price system of China’s swine industry chain comprehensively using the Market-chain Cooperator Model (MCM). Specifically, we examine several aspects, including price transmission relationship, adjustment ability, path, efficiency and intensity. Also, we include the price of compound feed for fattening pig in our study which makes our research more comprehensive.

DATA AND EMPIRICAL METHODOLOGY

Data sources and analysis

Monthly data on prices in the swine industry chain (including prices of corn, compound feed for fattening pig, piglet, pig, and pork) from June 1994 to October
2011 were obtained from Animal Husbandry Department in China’s Ministry of Agriculture. These data were aggregated from weekly prices collected in 470 markets nationwide. Then we tried to analyze the price transmission’s relationship, path, intensity, efficiency, and the ability that could adjust the price system itself among the upper, middle and lower reaches in the swine industry chain: The prices of corn, compound feed for fattening pig, piglet were the representative in the upstream. The price of pig was the representative in the midstream; and pork price stood for the product price from downstream in the swine industry chain. Moreover, in order to eliminate heteroscedastic, this paper was applied to natural log transformation on condition that keeping the cointegration relationship of the original data.

Fig. 1 depicts trends in prices of corn, compound feed for fattening pig, piglet, pig, and pork. All prices in China’s swine industry chain have a similar time trend. It seems that there exist some relationships between middle and lower reaches in the whole swine industry chain.

Corn was the main feed ingredients for swine industry, accounted for 60-70% of feed ingredients in China. We made a statistical analysis and discovered that there existed obvious multicollinearity between the corn and compound feed for fattening pig, so we analyzed the impact of the two kinds of prices to pork price by putting them into different models.

### Empirical methodology

The MCM was a combination method, including Johansen Cointegration Test, Error Correction Model (ECM), Partial Adjustment Model, Granger Causality Test, the Impulse Response Function (IRF) and Finite Distributed Lag Model (FDL). The MCM was used to study five aspects of the swine industry chain, including price transmission, path, intensity, efficiency, and price adjustment (Xu et al. 2012). Fig. 2 summaries our research contents and corresponding methods (Li 2010; Xu 2010).

### PRICE TRANSMISSION RELATIONSHIP ANALYSIS

#### Correlation analysis

As the first step, we tested the correlation among prices of the five products. Table 1 presents the results of correlation tests. We found all correlation coefficients are relatively large. The correlation coefficients between pork price and others are larger than 0.8, showing that they highly and positively correlate to each other. All of the above indicates that there exists a close relationship in the price system in swine industry chain.

![Fig. 1 Prices trend of China's swine industry chain, June 1994-Oct 2011. Price1, price2, price3, price4, and price5 represented the prices of corn, compound feed for fattening pig, piglet, pig, and pork, respectively. The vertical axis on the left was for the price curves with price1 and price2, the vertical axis on the right was for the price curves with price3, price 4 and price5. Source: the Ministry of Agriculture of China.](image)
Sequence stationarity tests

Time series data must have the same integration order before a co-integration test. So we first conducted unit root tests using the Augmented Dickey-Fuller Test (ADF) at 1% significance level.

Table 2 presents the results of the ADF tests for prices in the swine industry chain. ADF statistics of all the original sequences are significant and the unit root hypothesis is not refused at 1% significance level, meaning that they are non-stationary. But for the first difference of prices, our results provide strong evidence of rejecting the null hypothesis of a unit root in all five price time series, indicating that the five price time series display significant I(1) patterns. Therefore, price series of corn, compound feed for fattening pig, piglet, pig and pork are significant I(1) sequence, which meets the conditions required for co-integration analysis on price series in the swine industry.

Long-term equilibrium relationship

We discuss whether or not prices in the swine industry chain exists a long-term equilibrium relationship, using Johansen Cointegration tests. Based on the AIC criteria, three lags were chosen as the optimal lagging number of VAR model. The lagging number of cointegration test in STATA12.0 was two, the option “intercept” and “no trend” should be included.

Table 3 shows our results of Johansen Cointegration tests. In the upper half of Table 3, the results of trace statistics show that the null hypothesis of $r \leq 3$ should not be rejected as the value of trace statistic was 10.2553, less than 15.41 at 5% critical level. That is, there exist three cointegration relationships of all the five product prices. In addition, the maximum eigenvalue statistic test results are consistent with the trace statistic test results. Therefore, our results show that there does exist a long-term stable equilibrium relationship in the inner price system of swine industry chain. Our findings are consistent with previous studies.

The cointegration equations of prices in the swine industry chain are expressed as follows (with $t$ statistics in parenthesis):
lnprice5 = 0.732 + 0.002lnprice1 + 0.021lnprice3 + 0.867lnprice4  \[ R^2 = 0.9925 \]  
(35.32***) \quad (0.11) \quad (1.22) \quad (30.01***)  
(1)

lnprice5 = 0.817 + 0.138lnprice2 + 0.052lnprice3 + 0.7491lnprice4  \[ R^2 = 0.9944 \]  
(54.39***) \quad (8.45***) \quad (3.81***) \quad (32.35***)  
(2)

Eq. (1) is the cointegration equation of corn price, piglet price, pig price, and pork price, and eq. (2) was about compound feed for fattening pig price, piglet price, pig price, and pork price. The overall goodness-of-fit of eqs. (1) and (2) are good with $R^2$ 0.9925 and 0.9944, respectively. Eq. (1) reveals that 1% increase in corn price, piglet price and pig price respectively could cause an increase in pork price by 0.002, 0.021 and 0.867%, respectively. Similarly, eq. (2) showed that compound feed for fattening pig price, piglet price, and pig price respectively changed by 1%, which could cause pork price to change by 0.138, 0.052 and 0.749%. We conclude that in the long term, pig price has the greatest impact on the pork price, and influence of compound feed for fattening pig price was the second strongest, the third was piglet price, while the influence of corn price was the weakest.

Short-term dynamic relationship

We used the Error Correction Model (ECM) to investigate the short term price fluctuations in the swine industry. The ECM for price system in the swine industry chain is expressed as follows (with $t$ statistic in parentheses):

\[
d\ln\text{price}_5 = 0.0012 + 0.0176d\ln\text{price}_1 + 0.0155d\ln\text{price}_3 + 0.7786d\ln\text{price}_4 - 0.2142EC_{t-1}  
\]

\( (1.23) \quad (0.47) \quad (0.71) \quad (24.98***) \quad (-5.53***) \)  
(3)

\[
d\ln\text{price}_5 = 0.0010 + 0.0239d\ln\text{price}_2 + 0.0387d\ln\text{price}_3 + 0.7579d\ln\text{price}_4 - 0.2229EC_{t-1}  
\]

\( (1.03) \quad (0.54) \quad (1.76) \quad (23.9***) \quad (-5.03***) \)  
(4)

Eq. (3) is the ECM model of corn price, piglet price, pig price and pork price. Eq. (4) is the ECM model of compound feed for fattening pig price, piglet price, pig price and pork price. EC in the equation denotes an error correction term. Our results show a positive correlation between $d\ln\text{price}_1$, $d\ln\text{price}_2$, $d\ln\text{price}_3$, $d\ln\text{price}_4$, and $d\ln\text{price}_5$, indicating that price of corn, compound feed for fattening pig, piglet and pig in swine industry chain can reduce short-term pork price fluctuations given the condition of the long-term equilibrium relationship. In short run, pig price has the greatest impact on the pork price, influence of corn price was the second strongest, the third was piglet price, while influence of compound feed for fattening pig price was the weakest, which quite different from the impact in long-term but consistent with the conclusions of the studies had.

PRICE ADJUSTMENT AND TRANSFER PATH ANALYSIS

Dynamic price adjustment analysis

Negative coefficients on $EC_{t-1}$ in the error correction term eqs. (3) and (4) imply that a short term price change in the swine industry would reduce deviation in...
prices themselves given the condition of the long-term equilibrium and drive prices towards equilibrium. The adjustment intensity in eqs. (3) and (4) are 21.42 and 22.29%, respectively. These indicate that short term price adjustment in the whole swine industry chain is significant. In other words, the market force itself can drive prices in the swine industry into equilibrium in short run.

We further examine the speed of dynamic adjustment for each price series in the swine industry chain using a Partial Adjustment Model. Table 4 shows our results of the partial adjustment model for price series in the swine industry chain. As shown in Table 4, adjustment coefficients for all five prices are less than 0.02, indicating that the speed of price adjustment towards equilibrium in each price series is slow. In other words, it may take a long time to achieve market price equilibrium.

**Price transmission path analysis**

To better understand the interaction and price transmission path among prices in the swine industry chain, we apply the Granger causality tests. Granger causality tests examine the linkage between current price and past price. Granger causality occurs if lags of one variable have effects on other variables (Yi 2006). The Granger causality test serves as a foundation for analysis on efficiency and intensity of price transmission.

> Although Granger tests are conducted for all price series, we report part of Granger tests results in Table 5. As shown in Table 5, optimal number of lags in VAR is 3. In Table 5 only the null hypothesis “Inprice1 doesn’t Granger cause of Inprice5” is not rejected, while others are rejected when testing whether pork price could be the Granger cause of other prices. These results indicate that there exists a one-way price transmission relationship in China’s swine industry chain. More specifically, compound feed for fattening pig price, piglet price and pig price are the Granger causes of pork price, but the pork price is not the Granger cause of other prices.

**EFFICIENCY AND INTENSITY OF PRICE TRANSMISSION**

In this section, we further explore efficiency and intensity of price transmission, including accurate lag time and degree of effect. Due to limited space, only price transmission efficiency and intensity from upstream, midstream to downstream are discussed.

**Price transmission efficiency analysis**

Fig. 3 presented the impulse response function that products of upstream, including corn price, compound feed for fattening pig price and piglet price on pork price in downstream. Fig. 3 showed the transmission efficiency of corn price, compound feed for fattening pig price and piglet price on pork price, respectively. It could be seen from the Fig. 3-A that the response of corn price impacting on pork price lagged nearly 2 mon, completely disappeared after 4 mon. This was consistent with the results of Granger causality test, namely corn price was not the Granger cause of pork price. Fig. 3-

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**Table 4** Results of partial adjustment model for price series in the swine industry chain

<table>
<thead>
<tr>
<th>Series</th>
<th>Adjustment coefficient</th>
<th>t-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>lnprice1</td>
<td>0.005</td>
<td>0.43</td>
</tr>
<tr>
<td>lnprice2</td>
<td>0.014</td>
<td>1.23</td>
</tr>
<tr>
<td>lnprice3</td>
<td>0.015</td>
<td>1.00</td>
</tr>
<tr>
<td>lnprice4</td>
<td>0.014</td>
<td>0.94</td>
</tr>
<tr>
<td>lnprice5</td>
<td>0.013</td>
<td>0.85</td>
</tr>
</tbody>
</table>

**Table 5** Granger causality test of other price and pork price in swine industry chain

<table>
<thead>
<tr>
<th>Null hypothesis</th>
<th>Time lags</th>
<th>F-statistic</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>lnprice1 doesn’t Granger cause of lnprice5</td>
<td>3</td>
<td>5.040</td>
<td>0.172</td>
</tr>
<tr>
<td>lnprice2 doesn’t Granger cause of lnprice5</td>
<td>3</td>
<td>9.429</td>
<td>0.024</td>
</tr>
<tr>
<td>lnprice3 doesn’t Granger cause of lnprice5</td>
<td>3</td>
<td>21.620</td>
<td>0.000</td>
</tr>
<tr>
<td>lnprice4 doesn’t Granger cause of lnprice5</td>
<td>3</td>
<td>39.367</td>
<td>0.000</td>
</tr>
<tr>
<td>lnprice5 doesn’t Granger cause of lnprice1</td>
<td>3</td>
<td>3.5092</td>
<td>0.320</td>
</tr>
<tr>
<td>lnprice5 doesn’t Granger cause of lnprice2</td>
<td>3</td>
<td>1.1340</td>
<td>0.769</td>
</tr>
<tr>
<td>lnprice5 doesn’t Granger cause of lnprice3</td>
<td>3</td>
<td>6.5154</td>
<td>0.089</td>
</tr>
<tr>
<td>lnprice5 doesn’t Granger cause of lnprice4</td>
<td>3</td>
<td>0.5519</td>
<td>0.907</td>
</tr>
</tbody>
</table>

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B presents the response compound feed for fattening pig price impacting on pork price lagged 2 mon, the influence approached to maximum in the third month and almost disappeared in the fourth mon. Fig. 3-C indicates the lag time of the response piglet price impacting on pork price was 2 mon as well; the impact reached to peaks in the third mon and vanished after 4 mon.

As shown in Fig. 4, we found that there was no lag time in the response that pig price of midstream impacted on pork price, which was different from products in upstream. More specifically, pig price has effects on pork price in the first mon, and then the impacts slowly diminish and disappear 4 mon later.

**Price transmission intensity analysis**

In this section, we analyze the intensity of price transmission in the swine industry chain using a Finite Distributed Lag model (FDL). According to the model elementary principle, each influence coefficient of the model embodying the influence degree which was the lagging value of independent variable on the dependent variable, namely multiplier effect. Influence coefficient of the current period was also known as Immediate Multiplier, showing independent variable changed in a unit impacted on the value of dependent variable, indicating the immediate transmission intensity between the price series. Influence coefficient of the hysteretic period was called Dynamic Multiplier, which referred to the degree of independent variable in the past period impacting on the value of dependent variable, showed the lag transmission intensity between the price series. Total impact coefficient as Long-term Multiplier contained all the impact of dependent variable changed when independent variable changed, indicating the accumulative total transmission intensity, i.e., the immediate transmission intensity and the lag transmission intensity.

Table 6 presents the results of Finite Distributed Lag model. A 1% increase in corn price would cause 0.1819% increase in pork price in short-term and 0.1604% increase in pork price in long-term and
0.3432% increase (decline) on pork price in the whole period. Table 6 also reports that 1% price increase in compound feed for fattening pig price would generate 0.5778% increase in current pork price, -0.0795% increase in one period lagged pork price and 0.4938% increase on pork price in the whole period. 1% increase in piglet price would cause 0.3932% increase in pork price in the immediate period, 0.1242% increase (decline) on pork price in the extended period. Finally, 1% increase in pig price would cause 0.7492% increase in current pork price, and 0.8346% increase in pork price sustained, and 0.8326% increase in the whole time. These results suggest that pig price has significant impacts on pork price in the current and the whole period, and that the corn price plays an important role on pork price in China’s swine industry chain.

CONCLUSION

This paper empirically examines price transmission in China’s swine industry. The study covers prices of corn, compound feed for fattening pig, piglet, pig, and pork from 1994-2011. Using MCM, we find these results and put forwards some suggestions as follows. There existed a stable long-term equilibrium and short-term dynamic relationship in price system of swine industry chain. The results of Johansen cointegration test and ECM indicated that there really existed a clear price transmission relationship from the upstream to downstream in swine industry chain, both in long-term equilibrium and short-term dynamic relationship. In the long term, pork price was affected mostly by pig price. Then came compound feed for fattening pig price, piglet price and corn price in that order. In the short term, the effect order for pork price was pig price > corn price > piglet price > compound feed for fattening pig price. Short-term price fluctuation would be subjected to long-term equilibrium relationship and the industry chain had nearly 20% of correction intensity to prompt itself to reduce the deviation of the price, and ultimately toward to a balanced state. We found from the previous research that China’s swine industry chain had a strong ability to resist the internal impact of price fluctuations (Wang and Chen 2009; Nie and Lv 2011). This showed that the government’s policy regulation and macro-management on the whole swine industry chain have had an effect.

The speed of self-adjusting was slow and had an obvious top-down price transmission path in price system of swine industry chain. The Partial Adjustment Model suggested that the speed which product prices from fluctuations to balance under the influence of long-term equilibrium relationship was very slow.

<table>
<thead>
<tr>
<th>Transmitted price</th>
<th>dlnprice5</th>
<th>dlnprice5</th>
<th>dlnprice5</th>
<th>dlnprice5</th>
</tr>
</thead>
<tbody>
<tr>
<td>constant</td>
<td>0.0031(0.98)</td>
<td>0.0022(0.70)</td>
<td>1.0838(32.15***)</td>
<td>0.0005(0.5)</td>
</tr>
<tr>
<td>dlnprice1(0)</td>
<td>0.1819(1.57)</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>dlnprice1(-1)</td>
<td>0.0152(-0.13)</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>dlnprice1(-2)</td>
<td>0.0018(0.12)</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>dlnprice1(-3)</td>
<td>-0.0968(-0.82)</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>dlnprice1(-4)</td>
<td>0.2282(2.00**)</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>dlnprice2(0)</td>
<td>-</td>
<td>0.5778(4.24**)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>dlnprice2(-1)</td>
<td>-</td>
<td>0.0513(0.38)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>dlnprice2(-2)</td>
<td>-</td>
<td>0.0359(0.27)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>dlnprice2(-3)</td>
<td>-</td>
<td>-0.0911(-0.68)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>dlnprice2(-4)</td>
<td>-</td>
<td>-0.0756(-0.56)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>dlnprice3(0)</td>
<td>-</td>
<td>-</td>
<td>0.3932(17.93***)</td>
<td>-</td>
</tr>
<tr>
<td>dlnprice3(-1)</td>
<td>-</td>
<td>-</td>
<td>0.1842(0.51)</td>
<td>-</td>
</tr>
<tr>
<td>dlnprice3(-2)</td>
<td>-</td>
<td>-</td>
<td>-0.1142(-0.55)</td>
<td>-</td>
</tr>
<tr>
<td>dlnprice3(-3)</td>
<td>-</td>
<td>-</td>
<td>-0.2644(-0.67)</td>
<td>-</td>
</tr>
<tr>
<td>dlnprice4(0)</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>0.7492(33.85***)</td>
</tr>
<tr>
<td>dlnprice4(-1)</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>0.1109(4.16***)</td>
</tr>
<tr>
<td>dlnprice4(-2)</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>0.0096(0.35)</td>
</tr>
<tr>
<td>dlnprice4(-3)</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-0.0071(-0.27)</td>
</tr>
<tr>
<td>dlnprice4(-4)</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-0.0300(-1.36)</td>
</tr>
</tbody>
</table>

The numbers in brackets after variable names meant the corresponding lags. The values in brackets following the coefficient meant the corresponding t-test value. *** and * denote significance at 1 and 10% level, respectively.
Each price series of adjustment coefficients was less than 0.02, the adjustment speed of corn price was the slowest and pig price relatively fast but its adjustment coefficient was only 0.0146. Although the capacity for self-regulation in price system of swine industry chain had improved markedly, adjustment speed that prices back to a normal level was rather slow. So it was necessary to strengthen government’s macro adjustments and controls function, such as announcing effective market information timely, setting up risk early warning and monitoring system of pork price, regulation and controlling of market supply and demand early and scientific planning to guide farmers to choose the appropriate farm scale of swine. Through the adoption of the above initiatives, we may reduce frequency and amplitude of fluctuations in pork price. And Granger causality test showed that there was a clear one-way price transmission path in China’s swine industry chain, which implied that China’s swine industry chain was typical of “cost-driven” price transmission. Therefore, the paper recommended that the government should strengthen the upstream and midstream of the swine industry chains product prices monitoring and early warning, timely regulate the price in advance.

There existed lags in price transmission and compound feed for fattening pig price in upstream had the greatest impact on pork price. Fig. 5 was based on the Granger causality test and the impulse response function result that showed the price transmission mechanism of China’s swine industry chain. From the chart, the conduction product prices from upstream to downstream existed nearly 2-mon lag and the conduction from midstream to downstream existed no lag. In addition, because external factors that affected the changing prices for swine industry chain in recent years became more complex as well as the involvement of the national policy, price transmission paths within the led industry chain was blocked, making it difficult to stabilize the product prices within the swine industry chain.

The result of Finite Distributed Lag model showed that pig price had the greatest impact on pork price, not only in the current period, but also in the whole period. While the corn price had the maximum of lagged effects on pork price. From the above conclusions, the point of stabilizing pork price was taking reason-

![Fig. 5 Price transmission mechanism of swine industry chain.](image)

able measures to control and stabilize the price of pigs and corn markets. So we came to the following suggestions: First, establishing appropriate price subsidy to stabilize the price of grain and pig market, avoiding pork price falling sharply which may lead to sharp decline in the size of pig-breeding and then making the pork price fluctuations fiercely; second, attempting to establish a price monitoring and early-warning mechanism for swine industry chain, regulating and controlling the potential events in advance that may cause pork price rising and falling, which would reduce the probability of policy ineffectiveness resulted by delay of price transmission.

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