Research on the Longitudinal Transmission Mechanism of Prices for Urban Vegetable Supply Chain-Based on the Empirical Research in Chongqing

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Abstract This paper mainly introduces the longitudinal transmission mechanism of urban vegetable prices in Chongqing area. On the basis of the supply chain theory, the "farm price - wholesale price - retail price" of vegetables in Chongqing has been identified as the research object. Through statistical analysis, it is found that the above three types of price show a modest annual fluctuation of 7 - 12% from 2008 to 2013. Later, the paper focuses on the empirical research on the weekly price data in 2013 applying the co-integration theory, which reveals that the farm price of vegetables is largely influenced by themselves; the wholesale price of vegetables is mainly affected by their own price, the production price and the retail price of the earlier stage without the current influence of the production price; and the retail price of vegetables is also affected by their own price, but is not affected by the their current local price and the wholesale price. Vegetable prices have shown an obvious positive transmission mechanism in the links from production to retail, but the feedback effect of retail on production is not brought into play.

Key words Vegetable prices, Longitudinal transmission, Chongqing area, Empirical research

1 Introduction

The report at the 18th Party Congress has proposed to lay more emphasis on safeguarding and improving people's livelihood. Commodity price is always a priority in people's livelihood and affects the immediate interests of the people. Vegetables are indispensable necessities of life, and the price fluctuation of vegetables is vital to the national economy and the people's livelihood. The government has also issued a series of documents to promote the production and distribution of vegetables and secure an adequate supply in vegetable market. However, it is more difficult to regulate and control the vegetable supply chain as compared with the other general agricultural products due to the large variety and strong seasonality of vegetables as well as the prominent price elasticity and rigid demand in the consumer market. In 2011, the production value of vegetables reached 126 000 000 yuan. It's the first time for vegetables to overcome grain and become the first major agricultural product. The per capita vegetable consumption has reached 370 kilograms per year, ranking first in the world. However, the price rise of vegetables is too big. According to the data of the National Bureau of Statistics, the consumer price in 2010 rose by 3.3% over the previous year, in which the food price rose by 7.2% and the price of fresh vegetables saw the biggest increase of up to 18.7%. But the farm price of vegetables has always been low with dead stock from time to time. The double contradictory state of "both high-priced and low-priced vegetables are harmful to the people" has become a significant problem for local governments in the construction of people's livelihood. According to some scholars, the main course of this phenomenon is that the distribution organizations have certain advantages of price monopoly in vegetable pricing, and these organizations are the major profit gainers of prices (Gao Yang, 2011). In that way, does this phenomenon exist in the industrial chain of vegetables? If it does exist, what kind of transmission relationship there will be? Based on this, the paper studies the longitudinal transmission mechanism of vegetable prices in Chongqing area according to the data provided by Chongqing Price Bureau and Chongqing Agriculture Committee and the survey data of the research group with a view to optimize the industrial chain of vegetables in Chongqing, establish a long-term mechanism for stable vegetable prices and achieve the mission proposed by the report at the 18th Party Congress with regard to the construction of people's livelihood.

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2 Longitudinal transmission mechanism of urban vegetable prices

The price transmission mechanism of agricultural products is the inherent law of changes in the price system, serving as an important carrier for the price mechanism to act on microeconomic units and perform the function of resource allocation. It reflects the interrelation among various components inside the agricultural system. Longitudinal transmission mechanism mainly refers to the price transmission from the upstream, midstream to the downstream of the industrial chain of agricultural products.

Scholars at home and abroad have made quite a few of research achievements in the fields of agricultural products and veg-

etable price transmission mechanism. Farrel (1952) has opened the door to conduct empirical research on the asymmetry of price transmission process [1]. Lele (1967) has applied the correlation coefficient method to study the price mechanism of sorghum market in Western India [2]. Cushing (1990) has studied the price transmission mechanism in America through empirical analysis, which indicates that the transmission mechanism from the producer price to consumer price is more important than that from the consumer price to producer price, and price transmission is the results affected by many factors [3]. Willett (1997) has conducted empirical analysis on the transmission of prices in different links of the supply chain for edible oil, fruit and meat products, which reveals that the price transmission in the supply chain has the feature of asymmetry [4]. Aguiar (2002) has conducted empirical analysis on the weekly price data of two kinds of popular vegetables in France. The results show that it is difficult to prove the asymmetry of price transmission between farm price and retail price due to a lack of insurance for fresh vegetables. On the basis of the theories abroad, domestic scholars have also launched the researches on the longitudinal transmission mechanism of the prices of vegetables and agricultural products [5]. Bai Xuemei (2009) has conducted empirical research on the transmission mechanism of producer price and consumer price from the year 1978 to 2007 in our country applying the VAR model, and the results indicate that Granger causality does not exist between the consumer price and producer price in the long term without regard to the conduction mechanism of monetary policy [6]. Hu Huaping (2010) has conducted empirical analysis on the relationship between the vertical price transmission and longitudinal market jointing of vegetables by using the unsymmetrical error correction model. The results of the study prove that the looser the longitudinal market jointing is, the weaker the unsymmetrical vertical price transmission will be [7]. Xu Shiwei (2010) has applied the general index for the producer price of agricultural products and the retail price index of food to analyze the price transmission of agricultural products between the producing area and the sales area [8]. The research conducted by Liu Fang (2012) indicates that time lag exists in the transmission from the producer price to retail price of fruits and vegetables, but the transmission from retail price to producer price is quite smooth [9]. Zhou Zhenya (2012) holds the view that high circulation cost has hindered the longitudinal transmission of vegetable prices [10].

Existing studies have laid a solid foundation for this paper, but there is still no final conclusion on the transmission of vegetable prices at home and abroad. The major reason for this may be that the regional characteristics of the industrial chain of vegetables vary greatly. In recent years, Chongqing has strived to develop the new agricultural business entities. The proportion of cooperative and family farm dominated by vegetable production in the business entities has reached nearly 30%, representing an improvement in the organizational degree of vegetable production. In terms of circulation, market fees are regularized, circulation pattern is innovated, and circulation cost is saved; while in terms of retail, fair-price neighborhood stores and vegetable outlets are launched and the agriculture-supermarket jointing is encouraged so as to reduce the retail prices of vegetables and benefit ordinary citizens. Therefore, it is necessary to verify the internal transmission mechanism of vegetable prices in Chongqing area with empirical data so as to provide data support for establishing a long-term mechanism to stabilize vegetable prices in Chongqing area.

3 Method selection and discussion of empirical findings

3.1 Method selection At present, co-integration test is the mainstream approach for market integration research. In the co-integration test, judge the long-term equilibrium relationship between prices on the basis of the test first, and then reflect the short-term correction mechanism that deviates from the long-term equilibrium state through the vector error correct model. In the meanwhile, check and analyze the direction of price transmission according to the causal relationship.

3.2 Data source and processing According to the vegetable supply form mentioned above, this section will analyze the vegetable price fluctuation from the perspective of value chain. In this part, the weekly data of average farm prices of vegetables in 10 key districts and counties of Chongqing City in 2013 has been taken as the farm price P1; the weekly data of wholesale prices of vegetables (weighted average prices for bulk purchase of over 100 tons per day) in Chongqing City in 2013 has been taken as the wholesale price P2; and the retail prices of vegetables (for varieties published by NDRC) in Chongqing City in 2013 has been taken as the retail price P3 (the above data is provided by Chongqing Agriculture Committee and Chongqing Price Bureau).

The tendency chart of the above three types of price can be obtained according to the data, as shown below in Figure 1 (X – coordinates represent the week, and Y – coordinates represent yuan/kg).

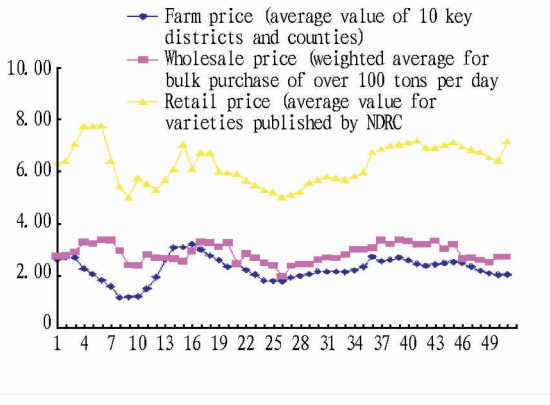

Fig. 1 Tendency chart of three types of price

It can be seen from Fig. 1 that the farm price P1 reaches a trough of 1 yuan/kg at the 8th week of 2013. The fluctuation range is 89.77% according to the calculation formula of (Peak Value-trough Value)/Average Value. The curve of the wholesale price

P2 is quite stable with the fluctuation range of 48.47%. The price is maintained at around 3 yuan/kg. The curve of the retail price P3 is irregular. The fluctuation is quite drastic with the fluctuation range of 43.88%. It reaches the peak at the 4th week of 2013 at the price of 6.29 yuan/kg, and reaches the trough at the 9th and 24th weeks respectively at the price of 4 yuan/kg.

3.3 Empirical result analysis and discussion (1) Unit root test. The co-integration test is mainly designed to test the causal relationship between non-stationary series. In order to avoid spurious regression, firstly, apply the ADF unit root test proposed by Dickey & Fuller to carry out stationary test for the explaining variables and explained variables. According to the test results shown in Table 1, the original series of the three types of price are unsteady. After the first difference, the series tend to be steady at the significance level of 1%. The three types of price constitute the integrated series of the same order, thus co-integration analysis can be conducted.

Table 1 Unit Root Test

	Test type (c,t,k)	ADF statistics	5% level	Prob. *	
P1	(c,t,1)	-1.265	-2.89	0.120 8	Unsteady
P2	(c,0,1)	-1.869	-2.89	0.110 6	Unsteady
P3	(c,0,1)	-1.029	-2.89	0.201 6	Unsteady
ΔP1	(0,0,0)	-3.472 844	-2.89	0.003 1	Steady
ΔP2	(0,0,0)	-4.093 490	-2.89	0.000 2	Steady
ΔP3	(0,0,0)	-3.197 690	-2.89	0.006 4	Steady

Note: In (c,t,k), c is the constant term, t is the trend term, k is the lag phase, and Δ is the difference symbol.

(2) Co-integration test. This paper applies Johansen multi-variable co-integration test. According to the test results, both the Trace and Maximum Eigenvalue statistics have rejected the null hypotheses of no co-integration, one co-integration relationship at most or two co-integration relationships at most, which indicates that at least three co-integration relationships exist among the three variables. Therefore, a long-term stable relationship is maintained among vegetable prices. Conduct regression analysis with P1, P2 and P3 as the explained variables and P1, P2 and P3 as well as their difference series as the explaining variables. After making multiple adjustments for the empirical model and passing the *t* test, *F* test and D-W Value Test, the final regression results are obtained as follows from Formula 1 to Formula 3:

$$P1 = 2.2363 + 1.4718AR(1) - 0.6471AR(2) \quad Formula\ 1$$

$$P2 = 0.2850P1(-1) + 0.3520P3(-1) + 0.5159AR(1) \quad Formula\ 2$$

$$P3 = 3.8670 + 0.5751P1 + 1.2360P2 + 0.7934AR(1) \quad Formula\ 3$$

From Formula 1 it can be seen that the price P1 in the vegetable production of Chongqing City is mainly affected by the vegetables themselves, but the price P2 in the circulation link and the price P3 in the retain link have no significant effect on P1. There are three possible causes: 1) The urban and rural information circulation is poor because of the urban-rural dual structure. The marketization degree is quite high in the later two links, but the first stage takes place mainly in the rural area with inadequate market development; 2) The biological nature of vegetable production determines its long cycle. Even with the information of the retail link, it is still impossible to adjust the production plan and production structure in a timely manner; 3) The production plan of vegetable producers is mainly developed according to their previous experience.

From Formula 2 it can be seen that the price P2 in the vegetable circulation link of Chongqing City is mainly affected of the products themselves as well as P1 and P3 of the earlier stage. But it is not affected by P1 of the current period. Besides, 1 unit of increase in the retail price of the earlier stage means an increase of 0.35 units in the wholesale price. The main reason lies in that in the circulation link, vegetable turnover speed is fast and the relationship between the wholesale and retail markets is quite close. In that case, it is insensitive to the farm price variation in the previous production link that is far apart in space and time.

From Formula 3 it can be seen that the price P3 in the vegetable retail link of Chongqing City is also affected by the vegetables themselves. In addition to this, it is also affected by the price P1 in the production link and price P2 in the circulation link. Besides, 1 unit of increase in the production price of vegetables means an increase of 0.57 units in the retail price, and 1 unit of increase in the wholesale price will lead to an increase of 1.23 units in the retail price. By contrast, the retail price of vegetables is much more sensitive to the wholesale price than the farm price. This is the so-called "Last mile" phenomenon in the industrial chain of vegetables. The increase in the markup percentage from the wholesale link to the retail link will lead to an excessively high vegetable price that is beyond the expectations of vegetable consumers. But in this process, the farmers haven't earned much money. In fact, the middlemen have gained most of the profits from vegetables.

4 Researching conclusion and prospect

This paper mainly researches on the longitudinal transmission mechanism of urban vegetable prices in Chongqing. First of all, statistical analysis has been conducted on the annual data including the farm price, wholesale price and retail price of vegetables in Chongqing from the year 2008 to 2013, which indicates that the vegetable price keeps increasing year by year. Except for the big increase in 2009, the price fluctuation of vegetables in the other turns out to be modest at about 7%-12%. Later, the co-integration test method has been applied to conduct empirical analysis on the weekly data including the farm price, wholesale price and retail price of vegetables from January, 2013 to December, 2013. The results show that the changes in the vegetable circulation price and retail market have little impact on the production link, and the adverse feedback effect of the vegetable price system is not apparent. In the circulation link, the price is mainly affected by the products themselves. But in the retail link, the price will be

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There is a need to actively develop cash crops, establish production bases, strictly control quality, and scientifically and rationally adjust the industrial structure; control the redundant rural small businesses, and promote the merger and cooperation of similar enterprises to form large-scale enterprises[10].

For the crops with great advantages such as day lily, apple, apricot, tobacco, etc., it is necessary to target the domestic and international markets to carry out large-scale operation, improve product quality and expand market influence and market share.

Relying on resources, it is necessary to take into account the industrial base, location advantages, market conditions and other factors, highlight the regional and local characteristics, maximize favorable factors and minimize unfavorable ones, and convert the potential comparative advantages into real product competitiveness.

3.3 Adjusting the industrial structure, increasing efforts to conduct fine and deep processing of agricultural products and extending the industrial chain Qingyang City should positively develop the characteristic economy based on the superior geographical advantages, and vigorously cultivate famous high-quality products, with storage and processing of characteristic agricultural products as the key; accelerate the pace of upgrading the overall structure of agriculture, and pay particular attention to the development of dry foods easy to be transported, such as deep-processed dried fruits; vigorously promote the modern processing of Chinese herbal medicine, and use advanced processing tools to extract the concentrated active ingredients to increase the efficacy and facilitate the medicine taking; vigorously develop agriculture, industry, commerce, transport, services, tourism and other industries according to the local circumstances; broaden employment opportunities to promote the labor force to transfer to the secondary and tertiary industries, to make overall economic structure extend backward and forward; change the previous practice of only emphasizing the primary raw materials; vigorously develop the industrial management and expand the scope of marketing to improve the overall agricultural economic efficiency.

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affected by the products themselves as well as the prices in the production and circulation links. The price of vegetables has shown an obvious positive transmission mechanism in the links from the production to retail, but the guiding effect of retail on production is not brought into play. In this paper, there are still there are still some shortcomings, as the price fluctuation of vegetables are also affected by many other factors such as seasons, emergencies, fundamentals of macro economy and the increase of urban population caused by social transformation etc. in addition to the longitudinal price transmission. In the future, the author wishes to give further consideration to these factors with a view to analyze the major factors that affects the price fluctuation of vegetables from both horizontal and vertical dimensions.

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