

## Research Article

### Study on Reason of Chinese Food Price Fluctuation Based on Inspection Analysis

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**Abstract:** In order to analyze the Chinese food price fluctuation reason, the inspection analysis model is applied in it. Firstly, the basic characteristics of Chinese food price fluctuation are discussed. Secondly, the affecting factor index system of Chinese food price is confirmed. Thirdly, the long and short period driving force model of Chinese food price is established and the corresponding inspection analysis is carried out and results can offer effective theoretical basis for establishing the controlling policy of Chinese food fluctuation.

**Keywords:** Affecting factor index system, Chinese food price fluctuation, inspection analysis, reason

## INTRODUCTION

With sustainable development of Chinese economic integration, Chinese food price fluctuation is increasing significantly. In the past ten years, the Chinese food price increases continuously, where the Chinese food price index increases by nearly 60%, food supply relates with sustainable development of people and concerns propagation and health of people. Rapid growth and frequent fluctuation of food creates challenges for Chinese policy establishment, therefore it is necessary to study the affecting factors of food price and present the corresponding controlling measurements of food price (Serra and Gil, 2013).

In China the food occupies about one third of Chinese CPI (Consumer Price Index), which has biggest weight index among eight sub-indexes. Chinese food price is often volatile due to requirement and supply changes, then the Chinese CPI increases or decreases accordingly. The food price rising reasons can be analyzed from the aspects of macroeconomic factors, such as biological energy source, cost push, supply and demand relationship and global economy. National bureau of statistics make clear that that currency inflation should be judged by CPI during the procession of analyzing the fluctuation of China food price, the CPI structure should be concerned (Wang, 2013). People's bank of China explicitly offers the changing factors of Chinese CPI eight sub-class indexes should be considered while the whole CPI is concerned. Therefore during the procession of studying the food price, it is necessary to analyze the fluctuation of food price from the angle of food consumer price class index while the total index of Chinese food price consumer is concerned. This will help stabilize related policies of

food price and the policy effect can be played fully. This research applies the inspection analysis to analyze the main reasons of Chinese food price fluctuation.

### Basic characteristics of Chinese food price fluctuation:

**Whole characteristics of Chinese food price:** In order to analyze the whole characteristics of Chinese food price fluctuation, the statistical data from January 2003 to December 2014 is obtained from National Bureau of Statistics website, which concludes Chinese consumer price index, food consumer price index. Based on collecting data, the fluctuation range of food price index is bigger than that of consumer price index in most months from sample period and the average value in sample period is equal to 103.14, the standard deviation is equal to 3.53, while the average value of food price index is equal to 107.53 and the standard deviation is equal to 7.32. As seen from computing results, the fluctuation range of food consumer price index is bigger than CPI obviously (Hochman *et al.*, 2014).

## METHODOLOGY

### Structural property of Chinese food price fluctuation:

The total fluctuation of food consumer price index can reflect the total trends of Chinese food price, however judging the food price trend cannot be achieved from increasing range of food consumer price index, the structural property of food consumer price class index fluctuation should be concerned at the same time. The month-on-month data of six class indexes among Chinese food consumer price index is obtained from National Bureau of Statistics website, which are corn (LSHI), meat and its Product (RQZP), Egg

Table 1: Describing statistical characteristics of Chinese food consumer price six class indexes

Class index	Min. value (month)	Max. value (month)	Middle number	Avg. value	S.D.
Corn	98.5 (2008.4)	132.7 (2005.1)	115.6	117.4	8.95
Meat and its product	86.2 (2010.3)	153.8 (2008.5)	120.0	124.8	14.87
Egg	87.4 (2005.7)	129.5 (2005.9)	108.5	109.2	12.35
Aquatic product	91.6 (2006.3)	126.5 (2007.4)	109.1	111.8	7.96
Fresh vegetable	84.6 (2005.1)	153.8 (2009.8)	119.7	119.8	12.75
Fresh fruit	88.2 (2007.4)	152.4 (2008.5)	120.3	122.5	11.48

Min.: Minimum; Max.: Maximum; Avg.: Average; S.D.: Standard deviation

Table 2: All kinds of food price indexes from 2003 to 2014

Year	x <sub>1</sub>	x <sub>2</sub>	x <sub>3</sub>	x <sub>4</sub>	x <sub>5</sub>	x <sub>6</sub>	x <sub>7</sub>	x <sub>8</sub>	x <sub>9</sub>	x <sub>10</sub>
2003	102.3	112.5	103.3	98.6	100.3	117.7	120.5	103.0	101.8	110.1
2004	126.4	118.3	117.6	120.2	112.7	95.1	93.9	104.0	102.2	104.1
2005	101.3	94.3	102.5	104.6	105.9	109.1	110.4	102.2	101.6	102.4
2006	102.6	98.6	97.1	96.0	101.2	108.2	108.2	117.9	121.5	101.6
2007	106.3	126.7	131.7	121.8	105.1	107.9	107.3	102.2	100.1	107.3
2008	107.0	125.4	121.7	104.3	114.1	111.0	110.7	110.8	109.0	111.8
2009	105.6	81.7	121.7	101.6	102.5	115.4	115.4	107.1	109.1	102.3
2010	106.7	89.4	91.5	104.3	99.6	113.6	117.3	115.3	110.3	105.3
2011	108.3	96.3	98.5	110.5	95.2	121.4	123.4	120.4	115.2	112.8
2012	110.5	102.6	103.5	115.2	104.5	115.7	118.3	116.3	119.3	117.2
2013	115.7	106.3	108.3	106.4	108.3	112.1	113.6	111.7	120.1	118.3
2014	123.9	110.4	115.6	102.2	113.4	102.5	107.1	104.6	115.7	114.8

(EGGS), aquatic Product (SHCP), fresh vegetable (XCAI), fresh fruit (XGUO) from January 2003 to December 2014. Based on collecting data, Chinese food consumer price index six item class indexes show different fluctuation characteristics, the volatility of some food price indexes is more intense and volatility of other food price indexes is gentle. In order to analyze the structural property of Chinese food price food fluctuation, the describing statistical characteristics of six indexes for Chinese food consumer price are computed and the corresponding results are shown in Table 1.

As seen from Table 1, the fluctuation Chinese food consumer price total index six item class indexes has the following characteristics:

- The maximum price fluctuation range of Chinese food is meat and its product, the average value and standard deviation are 124.8 and 14.87 respectively, which are biggest among six class indexes. Then is the fresh fruit, the average value and standard deviation are 122.5 and 11.48 respectively.
- The minimum price fluctuation range of food is aquatic product and the average value and standard deviation are 108.5 and 109.2 respectively, which are least among six class indexes, then is the corn, the average value and standard deviation are 115.6 and 117.4 respectively.
- The maximum value of six food price indexes happens from 2006 to now, in this period the CPI increases greatly and the minimum value happens on the year that the whole CPI decreases slowly. That is the changing trend of six food consumer price indexes are agree with the trend of whole CPI (Li, 2013).

**Affecting factor index system of Chinese food price:** The Chinese food price mainly is affected by many

factors, according to the real situation, the indexes are chosen from farming, forestry, animal husbandry, side-line production and fishery class, the commodity with highly correlated food are used as the basis of evaluating food price. In order to be benefit for statistics the corresponding index system is constructed in premise of confirming index content (Anderson *et al.*, 2013). Therefore according to the analysis content requirement the ten analysis indexes are confirmed, which conclude corn, oil, meat and its product, egg, aquatic product, vegetable, fresh vegetable, fresh and dried fruit, fresh fruit and diet product for external use. Food price is an important part of consumer price and data selection should fit scientific, authenticity, reliability, comparability and integrity. All kinds of related food price indexes are used as the analysis indexes of affecting food price and the variable assumption is carried out for ten indexes, which is listed as follows: corn is defined by  $x_1$ , oil is defined by  $x_2$ , meat and its product are defined by  $x_3$ , egg is defined by  $x_4$ , aquatic product is defined by  $x_5$ , vegetable is defined by  $x_6$ , fresh vegetable is defined by  $x_7$ , fresh and dried fruit are defined by  $x_8$ , fresh fruit is defined by  $x_9$  and diet product for external use is defined by  $x_{10}$ . The corresponding data from 2003 to 2014 are listed in Table 2.

**Long and short period driving force model of Chinese food price:** A  $10 \times 1$  dimensional vector is defined by  $X_1$ , the components of it is the ten food price indexes, which is expressed as follows:

$$X_1 = [x_1, x_2, x_3, x_4, x_5, x_6, x_7, x_8, x_9, x_{10}] \quad (1)$$

According to Granger describing theory, the corresponding vector error amending model is expressed as follows (Wang, 2011):

$$\Delta X_t = \gamma \alpha' X_{t-1} + \Gamma_1 \Delta X_{t-1} + \Gamma_{q-1} \Delta X_{t-q+1} + \varepsilon_t \quad (2)$$

where,  $\alpha'$  is co-integration vector,  $\Delta = I-L$  is lag operator,  $\varepsilon_t \sim IN(0, \Lambda)$ . If ten class indexes has the co-integration relation, then every class index can be divided into sum of  $k$  ( $= 10 - r$ )  $I(1)$  procession common factors and ten  $I(0)$  series  $\tilde{X}_t$ , the corresponding expression is listed as follows:

$$X_t = A_1 f_t + \tilde{X}_t \quad (3)$$

where,  $f_t$  is the common factor and the dimension of it is  $k = 10 - r$ ;  $\tilde{X}_t$  is the short period component of ten class indexes.

The Gonzalo-Granger decomposing expression is listed by:

$$X_t = A_1 \gamma' X_t + A_2 \alpha' X_t \quad (4)$$

where,  $A_1 = \alpha' (\gamma' \alpha')^{-1}$ ,  $A_2 = \gamma (\alpha' \gamma)^{-1}$ ,  $\gamma' X_t$  is the common factor  $f_t$  of expression (3), short period component and  $A_2 \alpha' X_t$  is the short period component  $\tilde{X}_t$  of expression. The critical operation of achieving Gonzalo-Granger decomposing is to evaluate the common factor and coefficient matrix  $\gamma \perp$ . The least auxiliary regression is carried out for  $(\Delta X_{t-1}, \dots, \Delta X_{t-q+1})$  based on  $\Delta X_t$  and  $\Delta X_{t-1}$  respectively, the residual errors  $R_{0t}$  and  $R_{1t}$  can generate, the corresponding residual error matrix is expressed as follows:

$$S_{ij} = T^{-1} \sum_{t=1}^T R_{it} R_{jt}', \quad i, j = 0, 1 \quad (5)$$

The vector  $\alpha$  can be obtained from the following expression (Ma *et al.*, 2013):

$$|\lambda S_{11} - S_{10} S_{00}^{-1} S_{01}| = 0 \quad (6)$$

The evaluation of  $\gamma \perp$  can be obtained from the following expression:

$$|\eta S_{00} - S_{01} S_{11}^{-1} S_{10}| = 0 \quad (7)$$

In order to inspect every class index, the corresponding assumption is put forward, which is expressed as follows (Zheng *et al.*, 2015):

$$\gamma \perp = G \theta, \quad k \leq m \leq 10 \quad (8)$$

where,  $G$  is the constraint matrix of common factor  $f_t$ ,  $\theta$  is the eigenvector corresponding to the minimum eigen value, the corresponding solution equation is listed as follows:

$$|\eta G' S_{00} G - G' S_{01} S_{11}^{-1} S_{10} G| = 0 \quad (9)$$

The test statistic of likelihood ratio and its distribution are expressed as follows:

$$LR_p = -T \sum_{h=r+1}^{10} \ln \frac{(1 - \hat{\eta}_{h+m-10})}{(1 - \eta_h)} \sim \chi^2[(10-r) \times (10-m)] \quad (10)$$

## RESULTS AND DISCUSSION

The inspection of ten Chinese food consumer price class index are carried out based on MATLAB software and the corresponding inspection results are listed in Table 3 to 5.

As seen from Table 3, the horizontal value of ten food consumer price class index is  $I(1)$  procession and the first order difference value is smooth procession.

The co-integration inspection results of ten food consumer price class indexes are listed in Table 4. As seen from Table 4, ten food consumer price class indexes have a co-integration relation, which can construct a co-integration system.

The long period and short period driving force inspection of every food consumer price index are carried out based on theory model and the corresponding inspection results are shown in Table 5.

As seen from Table 5, except for oil, meat and its product and aquatic product, other food price

Table 3: Unit root inspection of Chinese food consumer price class indexes

Class index	Inspection of horizontal value			Inspection of first order difference value		
	Inspection form	ADF statistical quantity	p-value	Inspection form	ADF statistical quantity	p-value
Corn	(N, N, 6)	0.175	0.694	(N, N, 5)	-4.636	0.000
Oil	(N, N, 2)	-0.253	0.623	(N, N, 7)	-2.645	0.000
Meat and its product	(N, N, 2)	-0.152	0.448	(N, N, 9)	-6.932	0.000
Egg	(N, N, 2)	0.495	0.661	(N, N, 0)	-5.823	0.000
Aquatic product	(N, N, 2)	-0.387	0.729	(N, N, 0)	-4.385	0.000
Vegetable	(N, N, 1)	0.434	0.642	(N, N, 0)	-6.671	0.000
Fresh vegetable	(N, N, 1)	0.556	0.559	(N, N, 1)	-7.342	0.000
Fresh and dried fruit	(N, N, 1)	-0.435	0.396	(N, N, 1)	-8.194	0.000
Fresh fruit	(N, N, 0)	-0.380	0.229	(N, N, 1)	-5.536	0.000
Diet product for external use	(N, N, 0)	0.054	0.718	(N, N, 0)	-4.378	0.000

Table 4: Co-integration inspection of Chinese food consumer price class indexes

Assumption	Trace statistical			Statistical quantity of		
	quantity	Critical value 5%	p-value	max. eigen value	Critical value 5%	p-value
$r = 0$	127.40	102.40	0.003	50.20	38.7	0.001
$r \leq 1$	74.70	74.80	0.051	29.80	33.5	0.107
$r \leq 2$	43.90	55.90	0.185	23.60	25.6	0.338
$r \leq 3$	22.60	32.80	0.362	30.40	21.8	0.441
$r \leq 4$	10.40	21.50	0.449	12.70	16.3	0.572
$r \leq 5$	4.76	8.93	0.313	7.94	10.3	0.385

Max.: Maximum

Table 5: Long and short period driving force inspection results of Chinese food consumer price class indexes

Class index	H <sub>0</sub> : this class index is not the long period driving force of total index			H <sub>0</sub> : this class index is not the short period driving force of total index		
	LR <sub>p</sub> statistical quantity	p-value	Conclusion	LR <sub>p</sub> statistical quantity	p-value	Conclusion
Corn	16.4	0.003	Reject H <sub>0</sub>	53.8	0.006	Reject H <sub>0</sub>
Oil	8.4	0.006	Reject H <sub>0</sub>	4.9	0.337	Accept H <sub>0</sub>
Meat and its product	49.6	0.000	Reject H <sub>0</sub>	3.7	0.261	Accept H <sub>0</sub>
Egg	8.2	0.034	Reject H <sub>0</sub>	2.5	0.000	Reject H <sub>0</sub>
Aquatic product	5.5	0.062	Reject H <sub>0</sub>	1.6	0.453	Accept H <sub>0</sub>
Vegetable	9.4	0.336	Accept H <sub>0</sub>	48.5	0.001	Reject H <sub>0</sub>
Fresh vegetable	6.6	0.417	Accept H <sub>0</sub>	38.1	0.005	Reject H <sub>0</sub>
Fresh and dried fruit	12.3	0.484	Accept H <sub>0</sub>	26.9	0.000	Reject H <sub>0</sub>
Fresh fruit	22.7	0.264	Accept H <sub>0</sub>	22.5	0.000	Reject H <sub>0</sub>
Diet product for external use	65.8	0.452	Accept H <sub>0</sub>	20.7	0.000	Reject H <sub>0</sub>

fluctuations are all the short period driving force of food price consumer index, which has the obvious effect on the short fluctuation of food price. Vegetable, fresh vegetable, fresh and dried fruit, fresh fruit and diet product for external use are not the long period driving force of food consumer price total index fluctuation, while corn, oil, meat and its product, egg and aquatic product are the long period driving force of food price fluctuation.

According to the analysis results, the following reasons of food price fluctuation are obtained. Food is the agricultural product through processing and the corresponding productivity is low, therefore the improving speed is slow. The mechanized degree of Chinese agriculture is low. The labor quality is poor and the science and technological strength of agricultural department is weak and the professionals are few. The business operation mode of agricultural production is poor. Production and circulation costs of food increase quickly in recent years. Food supply instability and stable expansion of food demand decide contradiction of demand and supply of food. In addition, the absolute limitation of land and water resources makes the food price increase continuously. With development of social productive forces, the income of people increases accordingly, the consumer demand and habit change accordingly. These changes make food handling deepen, primary food proportion of direct consumption decreases and new processing food exists, then the value-added of food increases accordingly, then the food price increases accordingly.

## CONCLUSION

In recent years, Chinese food price shows a scale fluctuation and the increasing characteristics of different food price are different. The affecting factors of food price should be found out. Unit root inspection, co-integration inspection and long and short period driving force inspection of Chinese food price are carried out and the corresponding rules are obtained and the results can offer effective theoretical basis for making over controlling measurement of food price fluctuation.

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