

Study on Influencing Factors of Egg Price Fluctuation

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Abstract: In recent years, due to the joint impact of food safety incidents, egg disease and price fluctuations of related substitutes, the market price of eggs, especially eggs, has fluctuated for many times, which not only affects residents' food consumption and income of egg farmers, but also affects the healthy development of egg industry. This paper selected the monthly panel data from 2014 to 2020 to study the influencing factors of egg price fluctuation. The results showed that chicken price and feed price had significant effect on the fluctuation of egg price, and the price of compound feed had the greatest effect on it. In addition, the increase of pork price would not necessarily lead to the rise of egg price. Meanwhile, the consumer price index had no significant impact on the price of eggs, and the increase of residents' income level would significantly promote the price of egg. Therefore, it is of great practical significance to study the external and internal laws of egg price fluctuation and explore the mechanism of stabilizing egg price for the healthy development of poultry and egg industry and national economy.

Keywords: egg price, influence factor, empirical research

1. Introduction

According to the data of China animal husbandry information network, the frequent fluctuation of egg prices has gradually attracted people's attention since 2014 to 2020. In 2014, China's egg price was mainly affected by the "H7N9 event", showing a fluctuating upward trend. In September, the egg price once rose to 12.2 yuan/kg; subsequently, the price of eggs fell sharply, falling to 9.11 yuan/kg in June 2015; in 2016, egg prices fluctuated slightly, and the breeding industry was basically in the state of profit and loss balance. However, in the first half of 2017, the price of eggs plummeted again due to the epidemic, and rebounded after hitting the bottom at an ultra-low price; in 2018, egg prices experienced a trend of first stability, then fluctuation and rise. Covid-19 and the outbreak of swine flu were the most severe impact on the egg price in the second half of 2019 to the first half of 2020 [1]. On the one hand, the sharp fluctuation of egg price has affected the daily consumption of the public; on the other hand, it has caused great damage to the layer breeding industry, resulting in a large fluctuation of egg supply, which is not conducive to the smooth operation of the egg market. Exploring the specific factors affecting the fluctuation of egg price will help to reduce the unstable fluctuation of egg market price, reduce the risk of industrial chain and supply chain, and provide reference for the production and operation of layer farmers and the decision-making of egg industrial chain.

In the summer, the national egg price was "rising". Why did the egg price rise in the summer? The main reason was the decrease of supply, the increase of demand and the increase of production and storage costs. The main reason for the decrease in supply was the decline of hen egg production. It was hot in summer. For chicken farmers, they were facing a severe test. In summer, the temperature was hot, and the hen was affected by the high temperature, and the egg rate decreased sharply. Moreover, affected by the high temperature, the feeding of hens was much more difficult than usual, and hens were more likely to get sick. Therefore, when summer comes, hen egg production would certainly decline, while chicken farmers' feeding costs and disease prevention costs had increased a lot, which was one of the main reasons for the rise in egg prices.

With the arrival of summer, the cost of egg storage and shipment was also higher than usual. The high temperature in summer required higher requirements for the storage and transportation of eggs, which means the increase of cost. Moreover, eggs were more likely to break down in high temperature and hot weather, and too high temperature may also cause eggs to break down during transportation. In this way, the breakage rate of eggs would also increase, which also increased the cost of eggs, which was also a factor driving the price rise of eggs.

Increased demand for eggs is also a factor in the rise in egg prices. Since the summer, the supply of pork has been tight, so the price of pork also begins to rise frequently. If the price of pork rises much, everyone will reduce the purchase of pork. Many people have reduced the purchase of pork and meat, and then began to increase the purchase of eggs, which means that the demand for eggs has increased. The increasing demand for eggs is also a factor affecting the price rise of eggs [2].

This paper mainly discusses the influencing factors of egg price fluctuation by selecting the monthly panel data from 2014 to 2020. It is of great practical significance to study the external and internal laws of egg price fluctuation and explore the mechanism of stabilizing egg price for the healthy development of poultry and egg industry and national economy.

2. Literature Review

The academic literature on egg price fluctuation mainly focuses on the causes of egg price fluctuation, transmission mechanism and short-term prediction: (1) research on the causes of egg price fluctuation. Through Arima seasonal adjustment model and HP filtering method, Yan Zhenyu et al. Concluded that egg price fluctuation has periodic cycle characteristics and seasonal trend [3]. (2) Research on the transmission mechanism of egg price. Xie Sina and others selected the monthly egg price data of 11 years in all provinces (cities) since 2000 and used VAR model to study the relationship between egg prices in China's main production and sales areas conduction mechanism. Based on the asymmetric error correction model, Dong Xiaoxia and others studied the existence of asymmetric transmission effect between egg purchase price and retail price in China from January 2001 to December 2013. The research shows that there is a long-term equilibrium relationship between them, and this relationship is asymmetric. (3) Research on short-term prediction of egg price. Wu Yuhuan et al. Established ARIMA time series analysis model to reasonably predict the future short-term price of China's egg market. Tang Jiangqiao uses Holter winter seasonal product model to predict egg price, and obtains the prediction results after 12 months. The academic research on egg price fluctuation has made a great breakthrough, which provides a good foundation for this paper. Existing studies focus on the short-term prediction and cycle characteristics of egg price, but there are few relevant studies on the influencing factors of egg price fluctuation, which still need to be supplemented. Under the background of comprehensively promoting the strategy of rural revitalization, analyzing the influencing factors of egg price fluctuation is conducive to improving the guarantee ability of egg supply. Therefore, this paper uses the monthly data from January 2014 to September 2020 to study the influencing factors of egg price changes, and puts forward relevant

strategic suggestions on how to stabilize egg price and promote the sustainable and healthy development of the industry based on the empirical research results [4].

3. Methodology

3.1. Variable Selection

① Consumer price index. The consumer price index (CPI) is the main measure of prices, and rising prices will increase the production cost of eggs, and then increase the price of eggs. Yang Yuying and others found that in the long run, CPI fluctuations have the greatest impact on egg price changes and the impact time is the longest. Based on this, the variable can be introduced into the model [5].

② Pork prices. Meat products have a strong impact on egg substitution. When the price of eggs rises, it will reduce the consumption demand of downstream demand manufacturers and consumers in the egg industry, and increase the consumption of egg substitution products. Zhang Yingxian found that pork price is the key factor affecting egg price fluctuation. Therefore, pork prices can be incorporated into the econometric model [5].

③ Income level of residents. The rise of residents' income level will increase residents' expenditure on diet. As a necessity of daily diet, the demand for eggs will naturally increase, and the price of eggs will also be affected. Therefore, the income level of residents is also the influencing factor of egg price fluctuation [5].

④ Chicken prices. Egg chicks are the source of egg supply. The price fluctuation of egg chicks will affect the price of eggs. Cai Shaojie et al. concluded that the change of chicken cost is the decisive factor of egg price fluctuation. Therefore, chicken price can be used as a variable in the model [5].

⑤ Feed prices. In the process of layer breeding, the cost investment of layer breeding feed accounts for more than 70% of the variable cost of the egg industry. There is a great correlation between layer breeding feed price and egg price. Zhao Yifu and others pointed out in their research that feed prices affect eggs [5].

Main factors of price change. Therefore, the feed price is used as the model explanatory variables.

3.2. Sample Selection and Data Sources

This paper uses the monthly data of China's provincial level from January 2014 to September 2020. Due to the lack of data in some provinces and cities, the data of 29 provinces and cities are finally selected as samples. The main data of egg price, chicken price, feed price and pork price in this paper come from China animal husbandry information network. Among them, the chicken price is based on the price of egg chicken, the feed price selects the price data of layer compound feed, and the pork price selects the price of boneless pork as the data source; the data of consumer price index and residents' income level are from the national statistics.

On the website of the Statistics Bureau, the consumer price index selects the CPI data over the years, and carries out price adjustment to eliminate inflation factors. The existing literature practice is to convert quarterly data into monthly data by arithmetic average method. The above data are logarithmically processed to eliminate the influence of different dimensions on the bias effect [6].

3.3. Model Construction

Before regression analysis, the monthly data of 29 provinces and cities in China from January 2014 to September 2020 are processed by logarithm to eliminate heteroscedasticity, and the panel data model is established as follows:

$$\ln \text{PRICE} = \beta_0 + \beta_1 \ln \text{CHICK}_{ij} + \beta_2 \ln \text{FEED}_{ij} + \beta_3 \ln \text{POG}_{ij} + \beta_4 \ln \text{CPI}_{ij} + \beta_5 \ln \text{INP}_{ij} + \delta \text{Ln price} \quad (1)$$

LN chip, LN feed, LN POG, LN CPI and LN InP represent the logarithm of egg price, chicken price, feed price, pork price, consumer price index and residents' income level, respectively δ represents the perturbation term [7].

3.4. Results

Before selecting panel data regression, it is necessary to compare the applicability of fixed effect model and random effect model. As shown in Table 1, first choice is conducted between fixed effect and mixed regression. The model test p value is 0.0000, which shows that fixed effect is better than mixed regression. In addition, for the original assumption that "all individual dummy variables are 0", the results of least squares dummy variable method (lsv) show that most individual dummy variables are significant. It can be considered that there is an individual fixed effect. In the choice between random effect model and mixed regression, for the original hypothesis that "there is no individual random effect", the p value of the model is 0.000, which can reject the original hypothesis at the significant level of 1%, and it is considered that the random effect model is better than mixed regression. After Hausman test, since the p value is 0.0000, the model strongly rejects the original hypothesis that "H0: UI is not related to explanatory variables", so the fixed effect model should be selected instead of the random effect model [8].

Table 1: Panel data model selection [1].

Selection of fixed effects and mixed regressions		Selection of random effects and mixed regressions		Hausman Test results	
F	Prob.	chibar2	Prob.	chi2	Prob.
63.67	0.000 0	12 127.10	0.000 0	37.81	0.000 0

3.4.1. Regression Analysis.

After determining that the model is a fixed effect model, because the selected data is long panel data, the least squares dummy variable method is used for regression.

Through the empirical test of the model, it is found that the rise of egg production cost price will promote the rise of egg price. From the regression results (Table 2), the price of chicks and the price of chicken feed for eggs have a positive impact on the price of eggs at a significant level of 1%. For every 1% increase in the price of chickens, the price of eggs will rise by 0.457%; every 1% increase in the price of egg chick feed will cause the price of eggs to rise by 1.109%. It can be seen that chicks and feed are the production cost of laying hens. The rise of cost will inevitably lead to the rise of the price of laying hens.

Table 2: Regression results [1]

	The coefficient	Document standard error	Z	P> z
InCHICK	0.457***	0.075 643 3	6.04	0.000
InDEED	1.109***	0.120 277 7	9.22	0.000
InPOG	-0.102***	0.027 551	-3.691	0.000
InCPI	-0.501	0.296 267 9	-1.69	0.091
InINP	0.136*	0.058 024 2	2.34	0.019
cons	2.177*	1.036 387	2.10	0.036

② The empirical results show that every 1% increase in pork price will reduce the price of eggs by 0.102%. Under the significant level of 1%, the impact of pork price on egg price is significantly negative. The reason why there is a negative correlation between pork price and egg price can be explained from the perspective of supply and demand. The swine flu epidemic leads to a significant reduction in pork supply in the short term. In addition, the pig cycle is long, and it is difficult to increase pork supply in the short term. Under the background of little change in pork demand, pork prices will inevitably rise again and again. Due to the impact of swine flu on pork, the risk of raising pigs increases, leading pig farmers to turn to raising chickens, and the number of layer farms increases, which will eventually lead to the increase of egg supply and the decline of egg price.

③ The impact of consumer price index on egg price is not significant. It can be seen from the results in Table 2 that the coefficient between consumer price index and egg price is -0.501, and this coefficient fails to pass the test at the level of 10%. This is mainly due to the relatively small proportion of egg prices in food prices. Therefore, although the change of consumer price index changes food prices, it will not have a great impact on egg prices.

④ The income level of urban residents has a significant impact on egg prices. For every 1% increase in the income of urban residents, the price of eggs will rise by 0.136%. The increase of residents' income improves the consumption ability of urban residents, leads to an increase in their demand for eggs, and then promotes the rise of egg prices.

4. Conclusion

In conclusion, based on the monthly panel data from January 2014 to September 2020, this paper draws the following conclusions: ① chicken price and feed price are the main factors affecting the fluctuation of egg price, and there is a significant positive relationship between them and egg price. Among them, the price of compound feed for laying hens has the greatest impact on it, which means that the rise of egg production cost price will promote the rise of egg price; ② Although eggs can be used as a substitute for pork, due to the great difference between pork production cycle and egg production cycle, the increase of pork price will not necessarily lead to the rise of egg price; ③ The impact of consumer price index on egg price is not significant, and the increase of residents' income level will significantly promote the rise of egg price.

In terms of Policy, here are some recommendations: ① Strengthen the coordinated development of egg industry chain. Chicken price and feed price are important factors affecting egg price. Controlling the cost factor of egg breeding and stabilizing the market fluctuation of chicken price and feed price will help to control the fluctuation of egg price from the source. As the upstream and midstream industries of egg production, enterprises should improve the construction of industrial chain. According to the changes in the price system of the egg industry chain, stabilize the egg price

through macro-control to avoid the price wave caused by the output imbalance between upstream, middle and downstream industries move.

② Establish an early warning mechanism for egg market prices. Governments at all levels should make full use of the cyclical law of egg price fluctuation, establish a market price prediction mechanism, guide farmers to correctly view the market price fluctuation and make correct response plans in time, so as to avoid blindly expanding the breeding scale due to information asymmetry, resulting in oversupply. By analyzing the factors such as chicken price, pork price, feed price and residents' income level, the change of egg price is predicted, so as to timely resist the losses caused to farmers by epidemic and other irresistible factors, so as to achieve the effect of stabilizing egg price.

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