The Effect of Money Supply on the Prices of Different Agricultural Products

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Abstract

In the past 20 years, China has experienced three times of severe inflation. Although the reasons for each inflation are different, the price fluctuations of agricultural products are higher than that of industrial products. This article was based on agricultural product price fluctuation which is influenced by the money supply, namely under the condition of agricultural prices overshoot. In the current economic situation, especially since the global financial crisis in 2008, in order to alleviate employment pressure and stimulate economic growth, the governments is generally adopted a loose monetary policy which lead to the surging prices. So this paper will make a further discussion about the relationship between money supply and the prices of different agricultural goods.

Compared with industrial products, whether the increase of liquidity has a greater impact on the price of agricultural products, how much difference it has on the price of various agricultural products, and clarifying the reasons behind the price fluctuations of various agricultural products, plays an important role in the formulation of China's monetary policy. Although there are a lot of studies on such issues which compare agricultural products as a whole with industrial products, but few studies divide agricultural products into different categories such as vegetable basket products, poultry storage products, aquatic products and grain products, and separately study the impact of money supply on them. Therefore, it is of great significance to classify agricultural products and do a further study on the influence of money supply on their prices.

The measurement methods adopted in this paper include co-integration test and error correction model. Based on the co-integration test, we get the conclusion that the money supply increase lead to the sharpest increases in the prices of aquatic products, livestock products second and vegetable basket products last. Through the error correction model inspection, we found the degree of deviating from the long-term equilibrium price is different in the short term, livestock products after shock wave is the largest, second of aquatic products, grain basket product deviation is minimized because various agricultural products price elasticity of demand are different, and this paper also make reasonable explanations on the meaning of economics.

Keywords: money supply, agricultural product classification, co-integration test, error correction model

1 Literature review

1.1 Chinese research literature

China's research on agricultural price fluctuations is mainly explained from three aspects: price elasticity of agricultural products, inflation and production cost. Peng guangfeng (2005) pointed out that the rising prices of agricultural products mainly because the inelasticity of demand for agricultural products, the relatively backward productive forces which restricted the development of agricultural production and the adjustment of national industrial policies. In addition, li hui, Kong Zheli (2009) pointed out that because the demand elasticity of agricultural products is less than the industrial products, did not expect to money supply makes overshoot relative prices of agricultural products, namely agricultural relative price volatility is greater than the industrial products. Zhao liuyan (2007) studied the different effects of inflation on grain price and industrial products price according to the "overshoot" hypothesis. The paper concluded that inflation led to grain price more volatile than industrial products price, but this should not be interpreted as rising grain prices led to the industrial products prices, but grain price can do a faster adjustment according to the inflation expectations.

After the reform and opening up, China experienced three times of severe inflation in its economic development.

Around 1980, the overexpansion of aggregate demand and rising price index resulted from the expansion of investment and consumption demand; In 1985-1989, inflation was due to overheating of the economy and runaway circulation of money; In 1993-1995, the most serious inflation was caused by excessive fixed investment and extreme disorder of financial order. If you add 5% inflation in the latest year, there are four severe inflations after the reform and opening-up. Since inflation seems to coincide with the rise in agricultural prices, there are many scholars who believe that inflation leads to the rise in agricultural prices. Song guoqing (2006) found that inflation is an important reason for the rise of agricultural prices. The reason is that China's nominal interest rate adjustment lagging, in the period of economic expansion, rapid credit expansion, leading to inflation, real interest rates fell, the low real interest rates will lead to speculative industry increase, as agriculture' low profits led to reduced supply of agricultural products, the price rise. Li jinghui and Fan zhiyong (2005) put forward the view of inventory speculation. The main idea is that the occurrence of inflation will directly affect people's expectations, resulting in the production of inventory, and the destruction of the balance between supply and demand of agricultural products, so the money supply caused a drastic change in the prices of agricultural products through the inventory. Therefore, we believe that there may be a transmission channel through which the monetary supply shock leads to inflation expectations, which affects the supply and demand relationship of agricultural products through inventory, thus leading to the rise of agricultural products prices. Lu feng and Peng kaixiang (1999) analyzed the data from 1987 to 1999 by means of measurement, and summarized their opinions on the relationship between grain price and inflation. In addition, granger causality is measured. The author denies that the rising grain prices lead to inflation, and holds that inflation is the cause of the rising grain prices in both short and long term. On the contrary, grain prices do not lead to inflation in the long run or in the short run. Wang xiuqing and Qian xiaoping (2004) pointed out that the impact of agricultural product price rise on the overall price level of the country showed a significant downward trend. Experience has shown that a 1% rise in agricultural prices would lead to a 0.4% rise in the country's overall price level in 1981, while the impact fell to 0.195% in 2000. It can be predicted that with the continuous progress of industry technology and the continuous decline of agriculture proportion of national economy, the impact of agricultural price rise on the overall price level will continue to decrease.

Another aspect of the impact of money supply on the prices of agricultural products is that inflation leads to the rise of raw materials price. Wang shouyang (2007) pointed out that in recent years, due to the consumption of some scarce raw materials, such as oil and precious metals, the price keeps rising, and the price of some agricultural production data, such as fertilizer, also rises accordingly, leading to the increase of the cost of agricultural products, which drives up the price of agricultural products. An increase in the money supply will lead to an increase in nominal demand, resulting in a rise in the price of production data, which will eventually be reflected in agricultural prices. Hu zhuohong, shenshijun (2009) also pointed out that since 2006, China's agricultural product prices have experienced a rising cycle, in which the rising costs have formed a significant impetus. Zhao Jinhou (2010) points out, from the perspective of supply and demand, although grain production is affected by the natural disasters in 2010, production declined slightly, in view of adequate inventory of government, grain prices rose sharply probability is not big, but the grain price will rise at least 9% -12% in 2011.

In addition, there are some literatures to explain the cause of agricultural price rise in a comprehensive view. The research group of the people's bank of China (2011) sorted out the reasons for the rise in agricultural prices from the perspectives of supply and demand, and made two supplements. This paper finds that aggregate demand is still the most important factor to determine the price change of agricultural products in China. Li guoxiang (2003) put forward several economic factors influencing the price of agricultural products. Among them, the imbalance between supply and demand of agricultural products leads to the rise in prices of agricultural products. The rising production cost of domestic agricultural products leads to the reallocation of agricultural input factors, which in turn leads to the rise in prices of agricultural products. The paper also pointed out some other reasons for the rise of agricultural prices, such as agricultural price support, international agricultural price fluctuation and domestic agricultural price transmission.

1.2 Foreign research literature

The foreign research on agricultural price is mainly based on the theory of agricultural price overshoot. The theoretical aspect mainly concludes deducing the agricultural product price overshoot model. Dornbush (1976) deduced the exchange rate overshoot model.

According to the model in the presence of sticky prices level, the increase in nominal money supply can lead to real money supply increased, due to the commodity market price is sticky, imbalance of money market can cause the interest rate and exchange rate overshoot, in the national capital cases, a complete liquidity and alternative fall in interest rates will cause capital flight, the arbitrage activities, thus lead to foreign exchange rates rise, its currency down. When prices begin to adjust, money market equilibrium gradually recovers, demand for local currency increases, and interest rate and exchange rate overshoot can be corrected. Jeffrey A. Frankel (1984) explained that the reduction of nominal money supply reduces the short-term real money supply, thus increasing the real interest rate and lowering the price of real goods. Due to the expectation of future appreciation, in order to make up for more interest rates, the price overshoot will occur. In this paper, Jeffrey makes a theoretical hypothesis and deduces the price determination of agricultural products and industrial products, and finally explains theoretically the lag of industrial products' price changes and agricultural products' price changes flexible.

Sayed. H.S aghaian (2002) using the time series analysis and graphics analysis, verified the South Korea, the Philippines, Thailand, the price of agricultural products under the monetary impact deviation from the equilibrium price for a long time, and greater than industrial products price range, This paper adopts the impact response model and the method of variable degradation analysis, emphasizes the interaction of variables in the model, and reaches the conclusion that money supply shock affects the relative price of different variables through currency non-neutral or overshoot.

In the empirical aspect, S. Devadoss William H. Meyer. (1986) explained the impact of money supply on farmers' welfare through VAR model. The price difference between the sale price of agricultural products and the cost price needed to produce agricultural products is used to represent the welfare of farmers. It is concluded that the increase of money supply leads to inflation, and the expected inflation has no effect on the welfare level of farmers, only the unanticipated inflation will change the welfare level of farmers. Michael Read (2000) using the unsteady time series analysis method to verify theoretical model assumption - currency neutral assumption and the open economy of existence of agricultural prices overshoot, analysis were used in the Johansen co-integration test and vector error correction model, and proves that in the event of a technological innovation or the money supply shocks, agricultural prices adjust faster than industrial products prices. At the same time, the money supply affect the short-term relative prices and strict currency neutral in the long term is not set up. Jeffrey H. Dorfman (2007) adopted Bayesian analysis and made three innovations in hypothesis: 1. The response of variables is determined under neutral rather than orderly monetary conditions. 2. Due to the uncertainty of the model, the hysteresis of the impact of money supply on agricultural products can be detected by using the Bayesian method, which weakens the uncertainty of the model itself and enhances its activity. 3. Agricultural product prices are divided into grain and livestock products. In this way, differences in the impact of money supply on the two sectors can be found, and further studies are made on the interaction between the two highly relevant sectors. Based on the above assumptions, a statistical model of money supply and agricultural products price is established to measure the relationship in the long-term. Based on the analysis, it is concluded that since the price of agricultural products increases rapidly compared with that of general products, the positive monetary policy will make the agricultural sector profit.

2 Empirical analyses

This paper argues that different types of agricultural products have different degrees of price fluctuation due to different price stickiness when they are impacted by money supply. This paper will test the fluctuation degree of different agricultural product prices when they are impacted by money supply through empirical analysis.

2.1 Data selection

First, M1 represents the money supply in circulation in China because it has strong liquidity and is more sensitive to economic changes. The data of M1 are got from National bureau of statistics Second, The wholesale price index of vegetable products, livestock products and aquatic products are got from the Ministry of agriculture. Last, monthly data of the wholesale price index of grain are got from China grain network, information center and the ministry of agriculture.

2.2 Empirical test analysis

2.2.1 Stationarity test

Since all the variables used in this paper are time series data, in order to prevent false regression in the regression, the unit root test (ADF test) is needed to determine the single integral order of these variables, that is, to test the stationarity of these time series data. The test method is to take the logarithm of each variable first, and then conduct the unit root test. The results are as follows:

Table 1 ADF unit root test results

Variable	test type (C,T,K)	ADF test value/first order difference ADF test value	5% critical value /first order difference 5% critical value	result
M1	(C,T,1)	-0.042185/ -3.899677	-3.4779/ -3.4790	First order difference is stable
Vegetable basket product price index	(C,T,1)	-2.570603/ -6.199965	-3.4779/ -3.4790	First order difference is stable
Aquatic product price index	(C,T,1)	-3.374197/ -4.473806	-3.4779/ -3.4790	First order difference is stable
Livestock product price index	(C,T,1)	-1.656557/ -3.818806	-3.4779/ -3.4790	First order difference is stable
grain	(C,T,1)	-1.532913/ -5.081978	-3.4779/ -3.4790	First order difference is stable

The test results showed that the level values of all variables were non-stationary at the significance level of 5%, but the first-order difference sequences were stationary, which indicated that they were all I(1) sequences, and the lagged order was determined by the AIC criterion.

2.2.2 Co-integration test

The main purpose of co-integration test is to reveal whether there is a long-term stable equilibrium relationship between variables. The economic variables which are co-integration cannot be separated too far from each other. A shock can only cause them to deviate from the equilibrium position for a short time, and they will be restored to the equilibrium position automatically in the long run. Since all variables are stationary processes of I(1), Johnson co-integration method is adopted in this paper to test whether there is a co-integration relationship between variables.

Table 2 Co-integration test results

Variable	ADF test value	5% critical value	Result
M1 and vegetable basket product price index	-2.782463	-1.9453	Co-integration
M1 and aquatic product price index	-3.712454	-2.9055	Co-integration
M1 and Livestock product price index	-4.352413	-1.9456	Co-integration
M1 and Grain price index	-1.923371	-1.9453	No cointegration

In order to study the degree of impact of M1 on the prices of various agricultural products, this paper listed the corresponding standardized linear equation through the least square method, where M1 represents the money supply, SHUI represents the price of aquatic products, CHU represents the price of livestock products, and CAI represents the price of vegetable basket products:

$$SHUI=0.64M1+1.14$$
$$CHU=0.31M1+1.22$$
$$CAI=0.12M1+0.71$$

First of all, we find that the test results of grain and other agricultural products are different. There is no co-integration relationship between grain price index and money supply. Non co-integration relationship between grain and money supply is because that the grain is affected by the subsidy policy and other factors. Before 2004, grain products had been on the rise. In order to curb the price rise, the government has exempted agricultural tax since 2004, determined the policy of direct subsidy to grain farmers, and continuously increased the policy of strengthening agriculture and benefiting farmers.

According to the regression equation, the monetary supply quantity M1 changes by 1 unit, the price of aquatic products by 0.64 units, the monetary supply by 1 unit, the price of livestock products by 0.31 units, the monetary supply by 1 unit, and the price of vegetable basket by 0.12 units.

Through the analysis of the measurement results, this paper tries to find out the reasons why three different types of agricultural products are affected differently by the money supply shock. It can be seen from the analysis results that sequence of money supply influence on the prices of various agricultural products is aquatic products, livestock products, vegetable basket products, and the measurement result can be explained from economics.

First, from the perspective of supply, different types of agricultural products have different price stickiness, just as the differences in the process of price formation between industrial products and agricultural products when they are impacted by money supply. Even if they are all agricultural products, different types of agricultural products have different properties. Generally speaking, the price of agricultural products with a long production cycle has a strong stickiness, so that when the money supply changes, the production of this kind of agricultural products cannot react immediately, so the cost change is not as fast as the agricultural products with a short production cycle, so the price is less affected by the monetary shock. In comparison, the production cycle of vegetable basket products is the longest, while that of livestock products and aquatic products is longer relatively. So the impact of money supply brings more effect on them.

Second, from the perspective of demand, vegetable basket products have rigid demand nature. Livestock products and aquatic products demand will change with the improvement of people's living standard. Their demand elasticity are bigger. When money supply increases, people tend to increase the demand for livestock products and aquatic products, so the price of vegetable basket products remains stable, and the price of livestock products and aquatic products will increase, that is why the money supply shock has greater impact on the prices of the latter two agricultural products.

Finally, the production characteristics of the three types of agricultural products also determine the degree of impact of the money supply shock. Compared with the other two types of agricultural products, the vegetable basket products are also affected by natural disasters to a large extent, so the output is more difficult to control. The impact of monetary supply shock on vegetable price is also less.

2.2.3 Error correction model

The error correction model (ECM) was proposed by Davidson, Hendry, Srba and Yeo in 1987. It can be studied how the variable deviates from its long-term equilibrium state volatility when subjected to external shocks. Once the variable deviates from its long-term equilibrium state, the error correction term will be adjusted through a series of short-term adjustments, so that each variable finally tends to be balanced. For two non-stationary time series of linear regression analysis, if directly using ordinary least squares estimation model, we will get a so-called pseudo regression model, in pseudo regression model analysis, although the parameter T test and F test can pass, but from the point of long-term trends, model is meaningless. So we need to make the necessary corrections to the model.In this paper, the co-integration analysis of variables is carried out first, and then the short-term model is established. The error correction term is regarded as an explanatory variable, and the error correction model is established together with other explanatory variables reflecting short-term fluctuations.

Table 3 Error correction model test results

Variable	The extent to which the price index deviates from the long-run equilibrium when the variable is impacted by the money supply	Variable to the extent of short-term fluctuations in money supply shocks
Vegetable basket product	-0.006173	-0.028385
Aquatic product	-0.701924	-0.544571
Livestock product	-0.053536	-0.434582

As can be seen from the above analysis results, when the money supply shocks, the short-term fluctuations range from small to large in order of vegetable basket products, aquatic products and livestock products. It indicates that the price of livestock products is more likely to change with the change of money supply, and it can be inferred that the increase of money supply will stimulate people to increase consumption, especially for livestock products which are not affected by seasons. People will increase the demand of aquatic products with the increase of income level, but aquatic products diet is affected by seasons and habits, so the impact of the change of monetary supply is only part of reason for the change of aquatic products price, and the deviation from the equilibrium level is smaller than that of livestock products.

And the basket products are an indispensable part of people's life, no matter whether the increase of money supply is expected or not, people's demand for the basket products changes little.

3 Conclusions

In this paper, based on the quantitative study of agricultural prices we get the following results: besides grain, other category of agricultural products are affected by the money supply shock, the reason is that grain price is influence by policy, such as some subsidy policy, etc., so that even in the money supply increases lead to inflation, grain can still sell at a lower price. Because the demand for vegetable basket products in other agricultural products is rigid and necessary and foundational, the change of money supply has little impact on the demand. Secondly, livestock products are also necessary to daily life, but there is still a certain price elasticity of demand which is affected by money supply shock. Aquatic products are the most affected. The supply and demand of aquatic products are greatly affected by the season and people's consumption habits, so they are most affected by the money supply shock. In addition, through the error correction model, this paper proves that, due to the rigid demand price, the short-term fluctuation range of the price of basket products caused by money supply shock is the smallest and the deviation from the long-term equilibrium level is also the smallest, aquatic products secondly and the price fluctuation and deviation degree of livestock products are the largest.

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