

AN EMPIRICAL STUDY ON THE COORDINATED DEVELOPMENT OF AGRICULTURE-RELATED CREDIT IN BZ CITY RURAL COMMERCIAL BANK THROUGH THE "BANK-INSURANCE" LINKAGE CREDIT ENHANCEMENT MODEL

GaoYan Liu, Jiao Qin*

*School of Economics and Management, Jiangxi Agricultural University, Nanchang 330045, Jiangxi, China.
Corresponding Author: Jiao Qin, Email: 284749069@qq.com*

Abstract: This paper takes the agriculture-related credit business of BZ City Rural Commercial Bank as the main research object, starting from the supply side of agriculture-related credit, relying on the "China Insurance Yearbook", "BZ City Rural Commercial Bank Financial Annual Report" and "BZ City Rural Statistical Yearbook" Based on the data support, select the relevant data representing the agricultural insurance premium income, agricultural production value, agricultural credit balance of BZ City Rural Commercial Banks from 2012 to 2021 as indicators, establish a VAR model, and perform pulse effect analysis variance decomposition analysis on this basis. This explores the synergistic relationship between agricultural insurance, agricultural credit and agricultural development. The empirical results show that: (1) agricultural insurance has a positive role in promoting agriculture-related credit of agricultural commercial banks in BZ city; (2) agriculture-related credit of agricultural commercial banks in BZ city has no obvious effect on promoting agricultural insurance, and the synergistic effect between the two remains to be seen. Strengthen; (3) Agricultural insurance and agricultural credit of BZ City Rural Commercial Bank have a strong pulling effect on agricultural development; finally, based on the results of empirical analysis, this paper starts from the construction of a perfect legal system, a perfect guarantee mechanism, and a perfect development. The three aspects of the mechanism summarize the policy suggestions for the coordinated development of agricultural insurance and agricultural credit in BZ City Rural Commercial Bank.

Keywords: Agricultural insurance; Agricultural credit; Coordinated development

1 INTRODUCTION

China is entering the "14th Five-Year Plan" development period. Under the absolute indicators of carbon peak and the long-term vision of carbon neutrality, China's agricultural industrial structure is undergoing tremendous changes. The Central No. 1 Document of 2021 proposes to comprehensively promote rural revitalization and accelerate the modernization of agriculture and rural areas[1]. It is widely known that finance is the core of modern economy, and the smooth implementation of the rural revitalization strategy is inseparable from the support of the financial industry. The development of agriculture and rural areas is even more dependent on the support of rural finance. How to make full use of rural financial tools to help solve the "three rural" issues, lay a foundation for the development of agriculture and rural areas, and promote the stable and long-term implementation of the rural revitalization strategy is a topic of common concern in the financial industry. From 2013 to 2021, the Central No. 1 Document has proposed to increase credit support for agricultural operators, strengthen the coordination and cooperation between agricultural credit and agricultural insurance, and give full play to the role of agricultural insurance in supporting agriculture and benefiting farmers[1]. The Guiding Opinions on Accelerating the High-Quality Development of Agricultural Insurance issued in 2019 pointed out that "establish and improve the rural credit system, improve the credit rating of farmers through the credit enhancement function of agricultural insurance, and alleviate the problems of difficult and expensive loans for farmers[2]." The Agricultural Insurance Regulations also explicitly propose to strengthen support for agricultural insurance and credit, and to support the development of rural areas through specific measures such as promoting the development of agricultural insurance organizations[3]. There are cooperative advantages between agricultural insurance and agricultural credit in terms of service objects, information resources, and risk control. The cooperation and development of the two has always been highly valued by the central leadership and relevant scholars. The Central No. 1 Document of 2009 was the first to officially explore the cooperation model between agricultural insurance and agricultural credit; the Central No. 1 Document of 2016 proposed to establish a silver-insurance interaction mechanism combining agricultural credit and agricultural insurance, develop "insurance finance," and provide policy support for the interaction between agricultural insurance and agricultural credit. Since then, the Central No. 1 Document for many consecutive years has proposed to support the development of silver-insurance interaction models in rural areas, emphasizing the role of agricultural insurance in reducing agricultural risks and improving the accessibility of agricultural credit to farmers. Currently, China's rural financial system, after years of improvement and development, has seen significant growth in the market size of agricultural credit and agricultural insurance in some pilot areas, and the service capacity of rural financial services has been significantly enhanced, forming its own characteristic

development model. However, there are still many problems in the cooperative development of the two, so this article takes the rural commercial bank of BZ City as a breakthrough point to deeply study the synergistic effect between agricultural credit and agricultural insurance of the bank, find the problems existing in their development, and make reference suggestions for promoting the practice of the development of agricultural insurance and agricultural credit in various places of our country.

2 LITERATURE REVIEW

2.1 Summary of Relevant Research

The research on agricultural insurance in China mostly began after the recovery and development of the insurance industry in our country. The insurance industry developed rapidly in the 19th century, and agricultural insurance also developed with the prosperity of the industry. Zhang Ping[4] believed in 1985 that agricultural insurance played an important role in promoting the development of the rural commodity economy. For crop insurance, appropriately reducing the insurance amount is conducive to business expansion and increasing the insured area. In 2012, Tuo Guo-zhu[5] proposed that agricultural insurance had become an important tool in the "Three Rural Issues" work, making great contributions to the rural financial reform. With the continuous development of agricultural insurance, the current agricultural insurance, in addition to playing the basic role of guarantee, needs to serve the comprehensive implementation of the rural revitalization strategy and the "14th Five-Year Plan". Jin Xin (2021)[6] believes that promoting the high-quality development of agricultural insurance can better serve the "14th Five-Year Plan". It is necessary to innovate agricultural insurance from four aspects: product, technology, model, and mechanism, so that it can better assist the rural revitalization strategy and serve the "14th Five-Year Plan". Long Wenjun[7] proposed that agricultural insurance should better highlight its policy-oriented function during the "14th Five-Year Plan" period, and agricultural insurance will be an important means to solve the difficulty of obtaining loans. In addition, with the continuous development of science and technology, it is imperative to use science and technology to assist agricultural insurance. Liu Xiaoming, Chen Qiankun, and Liu Xiaoling (2021)[8] proposed to introduce scientific and technological means into agricultural insurance, believing that the application of insurance technology can reduce information asymmetry and improve the efficiency of agricultural insurance, and reduce operating efficiency.

The synergistic effect of agricultural credit and agricultural insurance has been studied since the end of the last century. Wen Yuanda[7] proposed in 1988 that agricultural insurance and agricultural credit should be developed uniformly. The role of credit is to support the development of production and the expansion of circulation, while the role of insurance is to ensure that the production and circulation process is not interrupted due to some accidental losses. Both have different functions and are interrelated, jointly promoting economic development. In 2006, Li Yuxi[9] proposed that the reason why credit support for the agricultural system cannot be formed is the lack of a policy-based agricultural insurance system as a guarantee, and China should learn from Japan's agricultural insurance model to establish a policy-based insurance system. In addition, Feng Qingshui and Huang Yanning[10] found through an efficiency model in 2015 that the degree and direction of the influence of external factors on the cooperation efficiency of banks and insurance companies are different, and it should be further explored to establish formal cooperation mechanisms between the two. Pan Xiaojun (2019)[11] believes that the "agricultural insurance + rural credit" interaction model is conducive to the development of rural areas and beneficial to rural poverty alleviation and revitalization. Peng Xiaobing and Zhu Jiang (2019)[12] jointly believe that compared with the traditional model, this interaction model can form a cooperative game, increasing the common interests of farmers, insurance companies, and credit companies, and also proposed that the authority should provide preferential policies for insurance companies and credit companies. Lin Kaixuan (2020)[13] believes that the banking and insurance linkage mechanism can effectively resolve the contradictions between finance and agricultural development, and proposes that the authority can guide and promote the linkage of banking and insurance to promote the cooperative development of agricultural insurance and rural credit.

2.2 Review of Literature

Firstly, through the analysis of literature, it is found that experts and scholars mostly use real economic data for econometric calculations, draw their own conclusions, and put forward policy suggestions to promote the coordinated development of agricultural insurance and agricultural credit. Existing research mainly analyzes the relationship between agricultural insurance and agricultural credit in terms of total volume, directly applying the overall sample data of the country as a whole. However, the regional differences in the development of agriculture in our country are relatively large, which lacks practical guiding significance for the coordinated development of regional agricultural insurance and agricultural credit. Secondly, most existing literature starts from the demand side of agricultural funds, focusing on how to disperse or reduce the risks of agricultural production and operation, ensure stable and increased income for the main bodies involved in agriculture, and thus ensure that agricultural credit funds can be repaid on time. However, there is a lack of attention and exploration from the supply side of agricultural credit.

Based on the above two points, this paper selects the rural and commercial bank of BZ City as the research object through the method of empirical research, deeply studies the role and effect of the synergy between agricultural credit and agricultural insurance of the bank, analyzes the interaction mechanism between agricultural credit, agricultural insurance, and agricultural development of the rural and commercial bank of BZ City, and proposes the existing

problems and solutions in the current synergy development of agricultural credit and agricultural insurance of the bank based on the research results of the above text.

3 EMPIRICAL MODELS AND DATA SOURCES

3.1 Model Setting

Based on the existing research and corresponding theories, this paper empirically analyzes the synergistic effect between agricultural insurance and agriculture-related credit of BZ Rural Commercial Bank by selecting Eviews software to make a model.

In order to study the synergistic relationship between agricultural premium income, gross agricultural production value and agricultural credit balance, this paper uses a vector autoregressive model (VAR model) to establish a lagged VAR model of X_t and Y_t by assuming the existence of a relationship between X_t and Y_t .

$$x_t = a + \alpha X_{t-1} + \beta_{t-1} + \ell \tag{1}$$

$$Y_t = b + \gamma X_{t-1} + \delta Y_{t-1} + \ell_1 \tag{2}$$

Combine formulas 1 and 2 to obtain:

$$Y_t = C + R_t Y_{t-1} + \ell_t \tag{3}$$

On this basis, we can obtain the VAR model of N variables with a lag of K order:

$$Y_t = C + R_1 Y_{t-1} + R_2 Y_{t-2} + \dots + R_k Y_{t-k} + \ell_t \tag{4}$$

From equation 4, then:

$$Lny_t = \alpha_1 \ln y_{t-1} + \dots + \alpha_p \ln y_{t-p} + \beta_1 \ln x_{t-1} + \beta_p \ln x_{t-p} + c \tag{5}$$

Y_t represents an $N \times 1$ order time series column vector, C represents an $N \times 1$ order constant term column vector, denotes an $N \times N$ order parameter matrix, α and β are the regression coefficients of endogenous variables, and the parameters of exogenous variables are to be estimated. T denotes time, and P represents the optimal lag order.

3.2 Variable Selection and Data Sources

3.2.1 Variable selection

This article selects the agricultural credit balance index of the rural and commercial banks in BZ City from 2012 to 2021 to reflect the development level of agricultural credit in BZ City's rural and commercial banks; the agricultural insurance premium income index reflects the development degree of agricultural insurance in BZ City; the gross agricultural product index reflects the development level of rural areas in BZ City. Agricultural insurance premium income is represented by API, GAP represents the gross agricultural product, and ACB represents the agricultural credit balance.

3.2.2 Data source

This article selects the time series from 2012 to October 2021 as the analysis object, where the premium income data of agricultural insurance is from the "China Insurance Yearbook", agricultural credit data is from the annual financial statistics report of "BZ City Rural Commercial Bank Co., Ltd.", and the gross value of agricultural production data is from the "BZ City Rural Statistics Yearbook" of the BZ City Statistics Bureau.

3.2.3 Research framework diagram (Figure 1)

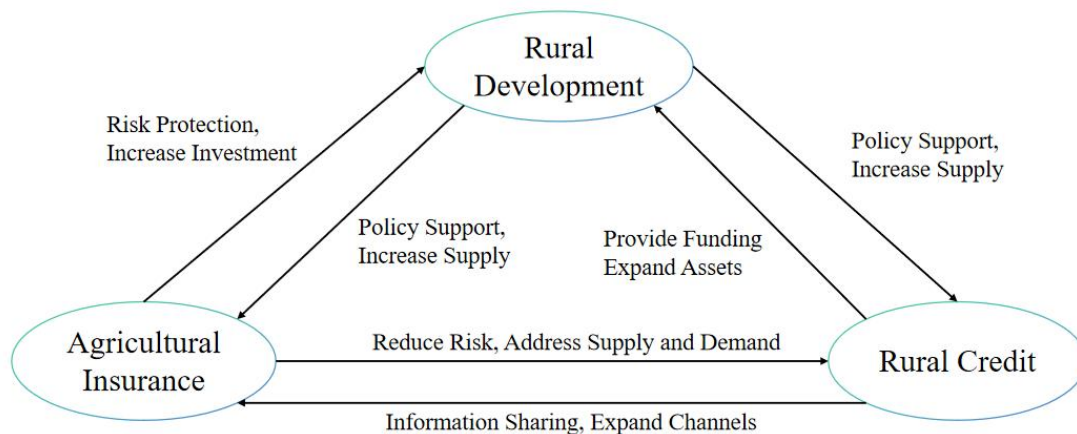


Figure 1 Diagram of the Research Framework

4 ANALYSIS AND TESTING

4.1 Descriptive Analysis

Through descriptive statistics on agricultural premium income, agricultural GDP and agricultural credit balance data from 2012 to 2021, the following results are obtained (Table 1):

Table 1 Descriptive Analysis

	Mean	22.97685	22.88055	17.61097
Median	23.24096	22.93069	17.34187	
Maximum	23.58261	22.98177	18.99729	
Minimum	22.14577	22.6919	16.78362	
Std. Dev.	0.658096	0.123615	0.94582	
Observations	5	5	5	

4.2 Unit Root Test

To eliminate the impact of heteroscedasticity on time series, this paper takes the natural logarithm of three time series: agricultural insurance premium income, total agricultural output value, and agricultural credit balance, and represents the new sequences after taking the natural logarithm as LNAPI, LNGAP, and LNACB, respectively. To mitigate the "spurious regression" problem formed by directly regressing on non-stationary time series, the ADF test method is generally used, and the test results are shown in the table below (Table 2).

Table 2 ADF Test Analysis

Variable	C,T,L	ADF	1% Critical Value	5%Critical Value	10%Critical Value	P-value	Conclusion
lnGAP	(c,t,0)	-0.903671	-10.66657	-6.482609	-4.819859	0.8232	Unstable
LNAPI	(c,t,0)	-0.914683	-6.423670	-3.984991	-3.120686	0.6623	Unstable
LNACB	(c,0,0)	0.428956	-10.66657	-6.482609	-4.819859	0.9591	Unstable
DLNAPI	(c,0,0)	-7.58643	-8.033476	-4.541245	-3.380555	0.0121	Stable
DLNACB	(c,t,0)	-2.133763	-3.563915	-2.157408	-1.610763	0.0423	Stable
DLNGAP	(c,0,0)	-0.804808	-3.563915	-2.157408	-1.610463	0.0289	Stable

Note: In the (C, T, L) test form, C represents the intercept term, T represents the trend term, K represents the selected lag order, and D represents the first-order difference.

From the inspection results, the ADF values of the variables LNAPI, LNGAP, and LNACB are all greater than 1% of their critical values, and the P-values are all greater than 0.1, indicating that the null hypothesis is accepted, there are unit roots, and they belong to non-stationary sequences. After first-order differencing, the ADF values of the first-order difference sequences DLNAPI, DLNGAP, and DLNACB for each variable are all less than 10% of the critical values, and the P-values are all less than 0.1, rejecting the null hypothesis, indicating that there are no unit roots, i.e., each variable is a first-order difference sequence of a stationary sequence.

5 EMPIRICAL ANALYSIS AND CONCLUSION

5.1 Vector Autoregression (VAR) Model and Its Dynamic Analysis

This article studies the dynamic impact of relevant time series and random disturbances on the variable system using vector autoregression models and further explains the impact of these influences on economic variables. It also analyzes

the relationships between agricultural insurance premium income, gross agricultural production, and agricultural credit balance in the three pairs. Before establishing the VAR model, it is first necessary to select the optimal lag order. According to the information criterion, different lag orders can be selected as variables, resulting in:

5.1.1 Agricultural insurance premium income and gross agricultural production value VAR model

Table 3 Agricultural Insurance Premium Income and Gross Agricultural Production Value VAR Model

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-13.24924	NA	0.155546	3.812311	3.832171	3.678361
1	7.975263	26.53063*	0.002259*	-0.493816	-0.434235*	-0.89567
2	12.03026	3.041249	0.003181	-0.507566*	-0.40826	-1.177317*

From the table above (Table 3), it is known that the lag order of the model is 2. The results of the VAR model are as follows (Table 4):

Table 4 The Results of the VAR Model

	LNGAP	LNAPI
LNGAP(-1)	0.455848 -0.50745 [0.89832]	-2.3221 -3.01349 [-0.77057]
LNGAP(-2)	0.3233 -0.48451 [0.66727]	3.726435 -2.87731 [1.29511]
LNAPI(-1)	0.08914 -0.08413 [1.05951]	-0.88666 -0.49963 [-1.77465]
LNAPI(-2)	0.013052 -0.0812 [0.16074]	0.230346 -0.48219 [0.47770]
C	3.629811 -1.92043 [1.89010]	-2.3392 -11.4046 [-0.20511]

From the VAR model, we can obtain 2 model equations representing the relationship between them

$$\text{LNAPI} = 0.46\text{LNGAP}(-1) + 0.32\text{LNGAP}(-2) + 0.09\text{LNAPI}(-1) + 0.01\text{LNAPI}(-2) + 3.62 \quad (6)$$

From the self-impact response of the API, agricultural insurance itself has strong sustainability.

From the response of the impact of API on GAP, the agricultural insurance premium income has a negative impact on the agricultural GDP lagging in the second stage, while it has a positive impact on the agricultural insurance lagging in the first stage, indicating that the driving role of agricultural insurance in agricultural development is gradually enhancing.

$$\text{LNGAP} = -2.32\text{LNGAP}(-1) + 3.73\text{LNGAP}(-2) - 0.87\text{LNAPI}(-1) + 0.23\text{LNAPI}(-2) - 2.33 \quad (7)$$

From the impact of GAP on the API, the driving effect of agricultural development on agricultural insurance is gradually weakening. From the GAP's response to its own impact, it can be seen that agricultural development has a strong sustainability.

5.1.2 Agricultural insurance premium income and agricultural credit balance VAR model

Table 5 Agricultural Insurance Premium Income and Agricultural Credit Balance VAR Model

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-8.94071	NA	0.052974	2.735177	2.755038	2.601227
1	14.58645	29.40895*	0.000433	-2.146613	-2.087032	-2.54846
2	20.44087	4.390818	0.000388*	-2.610219*	-2.510917*	-3.279970*

The lag order of the model is 2 as shown in the table above (Table 5).
 VAR model results are shown as follows (Table 6):

Table 6 VAR Model Results

	LNAPI	LNACB
LNAPI(-1)	-0.383711 -0.44015 [-0.87178]	-0.02219 -0.03127 [-0.70958]
LNAPI(-2)	0.323901 -0.42445 [0.76311]	-0.016138 -0.03016 [-0.53513]
LNACB(-1)	-15.17672 -6.74616 [-2.24968]	1.622883 -0.47932 [3.38583]
LNACB(-2)	14.16415 -5.69201 [2.48843]	-0.637105 -0.40442 [-1.57536]
C	43.66467 -31.0994 [1.40404]	0.986806 -2.20962 [0.44660]

From the VAR model, the following model equation for the relationship between agricultural credit and agricultural insurance can be obtained:

$$LNAPI = -0.38LNAPI(-1) + 0.32LNAPI(-2) - 15.17LNACB(-1) + 14.16LNACB(-2) + 43.66 \tag{8}$$

The response to the impact of API on ACB shows that agricultural insurance premium income has a positive effect on the agricultural insurance premium income of the two lagging periods, indicating that agricultural insurance has a certain sustainability. The response to the shock of API on ACB shows that agricultural insurance premium income has a positive effect on the agricultural credit balance of a certain period of time, indicating that agricultural insurance has a certain driving effect on agricultural credit.

$$LNACB = -0.02LNAPI(-1) - 0.01LNAPI(-2) + 1.62LNACB(-1) - 0.64LNACB(-2) + 0.99 \tag{9}$$

The impact response from ACB to API shows that the agricultural credit balance has a negative effect on agricultural insurance premium income with a lag, indicating that the driving force of agricultural credit for agricultural insurance is gradually weakening. The impact response from ACB to itself shows that the persistence of the agricultural credit balance is strong.

5.1.3 VAR model of agricultural gross domestic product and agricultural credit balance

Table 7 VAR Model of Agricultural Gross Domestic Product and Agricultural Credit Balance

Lag	LogL	LR	FPE	AIC	SC	HQ
0	5.260953	NA	0.001521	-0.815238	-0.795378	-0.94919
1	36.06595	38.50625*	2.01e-06*	-7.516488*	-7.456907*	-7.91834
2	39.80759	2.806225	3.07E-06	-7.451897	-7.352595	-8.121648*

From the table above, it can be seen that the hysteresis order of the model is 1 (Table 7).
 The results of the VAR model are as follows (Table 8):

Table 8 VAR Model Results

	LNGAP	LNACB
LNGAP(-1)	-0.05085	-0.243582

	-0.3381	-0.16617
	[-0.15040]	[-1.46585]
LNACB(-1)	-1.111409	0.978162
	-1.12273	-0.55181
	[-0.98991]	[1.77265]
C	-3.893179	1.80354
	-3.26128	-1.60288
	[-1.19376]	[1.12519]

From the VAR model, we can obtain two model equations that describe their relationship:

$$\text{LNGAP} = -0.05\text{LNGAP}(-1) - 1.11\text{LNACB}(-1) - 3.89 \quad (10)$$

From the impact response of GAP on ACB, it can be deduced that the agricultural production total value has a negative impact on the agricultural credit balance of the previous period, indicating that the stimulating effect of agricultural development on agricultural credit is gradually weakening. From the self-impact response of GAP, it can be concluded that the sustainability of agricultural development is relatively strong.

$$\text{LNACB} = -0.24\text{LNGAP}(-1) + 0.98\text{LNACB}(-1) + 1.80 \quad (11)$$

From the impact response of ACB to its own shock, it can be seen that agricultural credit has strong sustainability. From the impact response of ACB to GAP, it can be deduced that the effect of agricultural credit balance on the total value of agricultural production in the previous period is negative. Through the results of model indicators, it can be concluded that the stimulating effect of agricultural credit on agricultural development is gradually increasing.

5.2 Pulse Effect Analysis

On the basis of the VAR model, the pulse response function method can be further adopted for a deeper level of research, analyzing the degree of relationship and interaction between different endogenous variables. The pulse response function refers to the degree of response of one endogenous variable to a unit change in another endogenous variable. The analysis of pulse effects is based on the assumption that the VAR model has a certain stability. Therefore, it is first necessary to test the stability of the VAR model, and the test results and pulse effects are as follows:

5.2.1 Analysis of the pulse effect of agricultural premium income and gross agricultural production

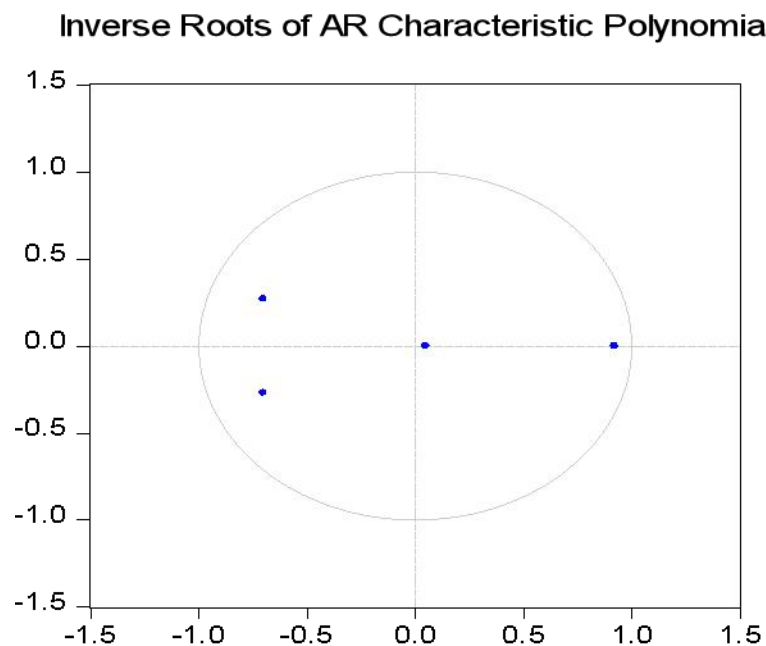


Figure 2 Stability Test

After a series of previous tests (Figure 2), it is still necessary to test the stability of the model. This can be judged by whether the eigenvalues fall within the unit circle. If all the eigenvalues are within the unit circle, the model is stable; otherwise, the model is unstable. As can be seen from the figure, all the eigenvalues fall within the unit circle, indicating that the VAR model is stable.

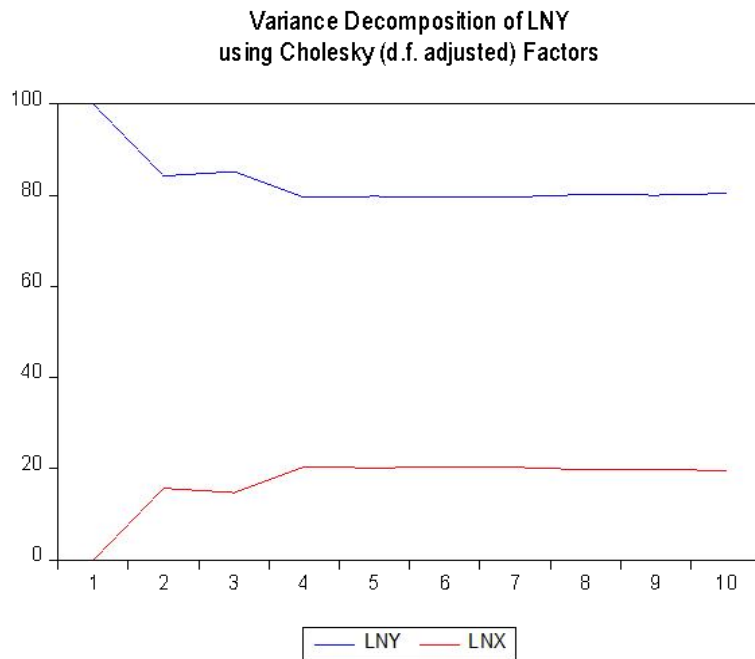


Figure 3 Pulse Effect of Agricultural Insurance Premium Income on the Total Value of Agricultural Output

Overall, the impact of agricultural insurance premium income on the total agricultural output value is relatively weak (Figure 3), and it is a positive response, reaching the maximum positive impact from the first period, and then the response gradually weakens, basically approaching 0.

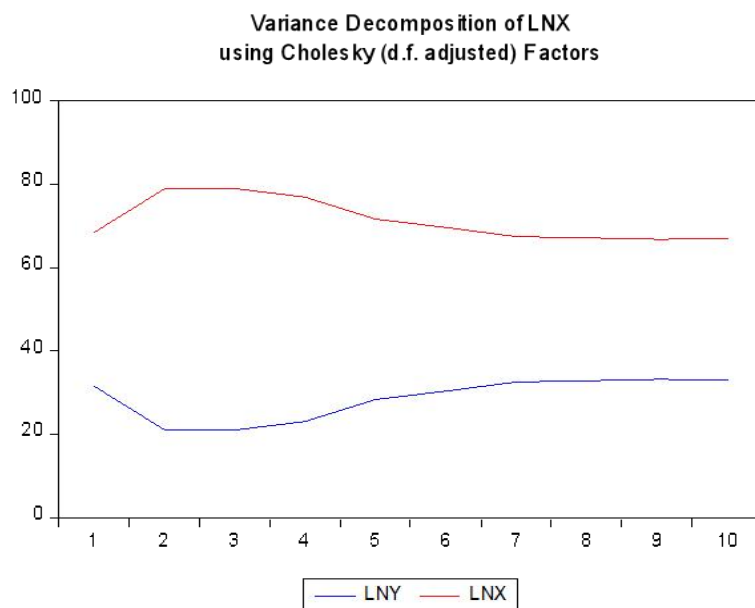
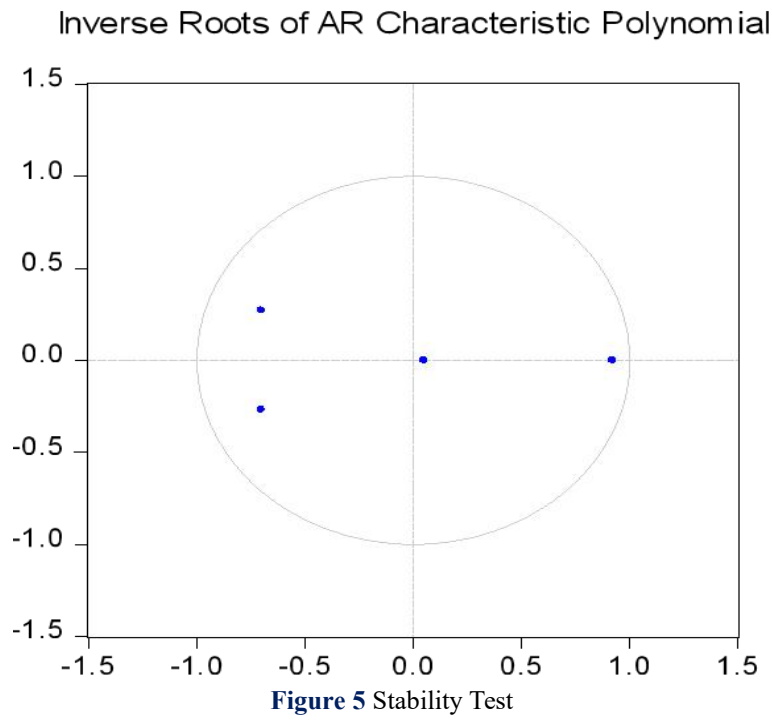


Figure 4 Pulse Effect of Agricultural GDP on Agricultural Insurance Premium Income

As shown in the Figure 4: The impact of the total value of agricultural production on agricultural insurance premium income is a positive impact, and it gradually strengthens from the first period, starts to weaken slowly from the fifth period, and gradually tends to stabilize after five periods.

5.2.2 Analysis of the pulse effect of agricultural insurance premium income and agricultural credit balance



As can be seen from the Figure 5, all the eigenvalues are within the unit circle, indicating that the VAR model is stable.

**Response of LNZ to LNX Innovation
using Cholesky (d.f. adjusted) Factors**

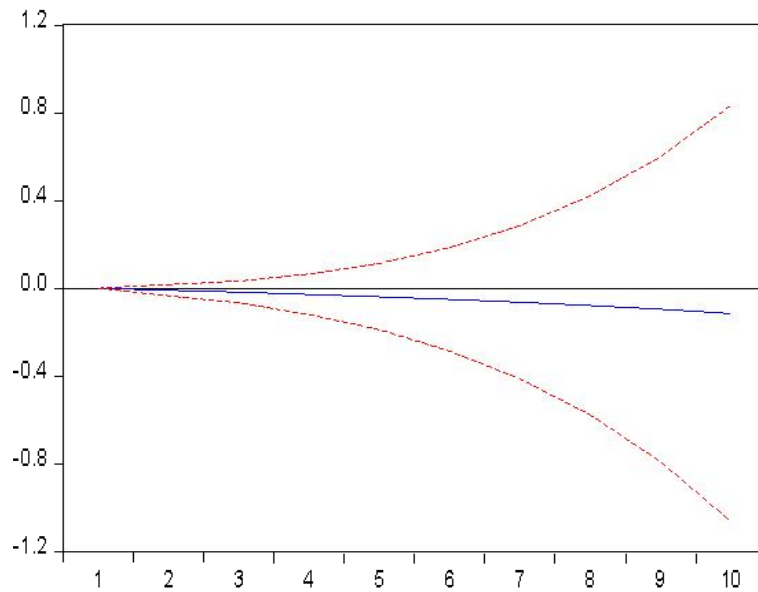


Figure 6 Pulse Effect of Agricultural Insurance Premium Income on Agricultural Credit Balance

Overall, the agricultural insurance premium income has a negative impact on the agricultural credit balance (Figure 6), with the impact increasing from the first period and gradually diverging by the third period.

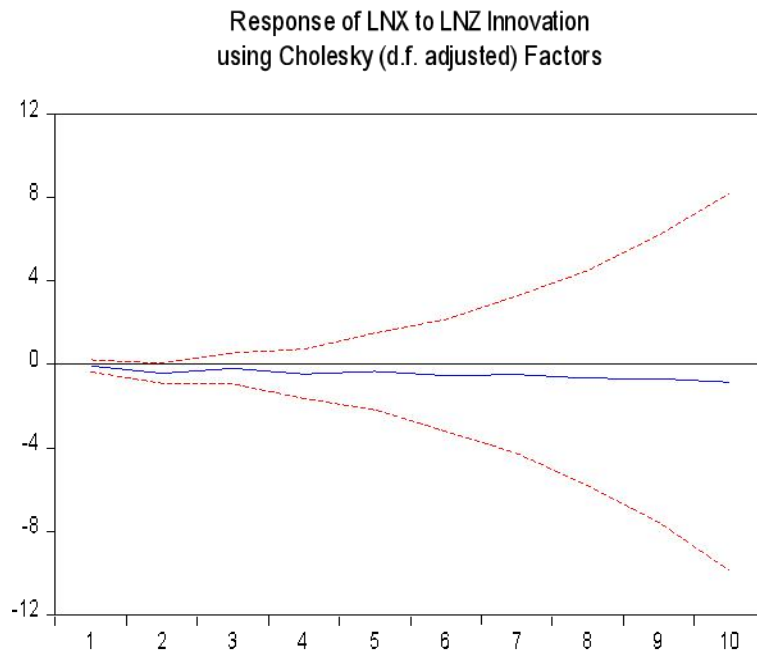


Figure 7 Pulmonary Effect of Agricultural Loan Balance on Agricultural Premium Income

According to the diagram shown (Figure 7): Overall, agricultural credit balances have a positive impact on agricultural premium income. The influence starts to increase from the first period, and the response gradually tends to diverge thereafter.

5.2.3 Analysis of the pulse effect of the total value of agricultural production and the balance of agricultural credit

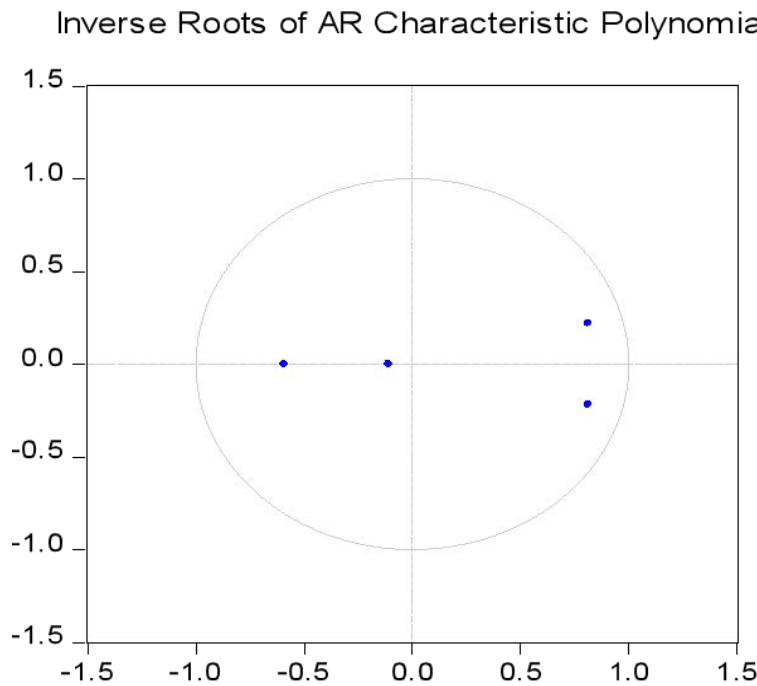


Figure 8 Stability Test

From the Figure 8, it is known that all characteristic roots lie within the unit circle, indicating that the VAR model has stability.

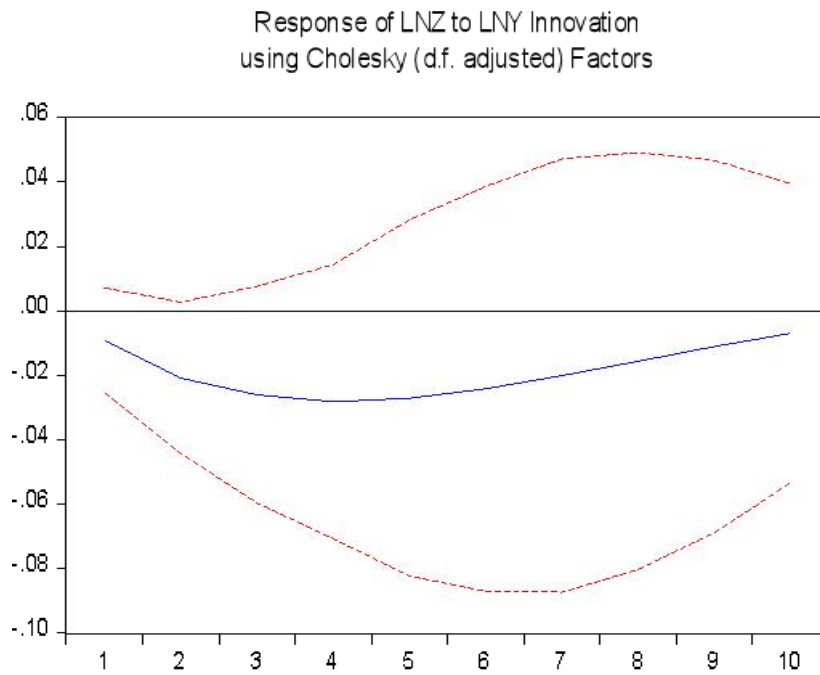


Figure 9 The Pulse Effect of Agricultural Gross Output on Agricultural Loan Balance

According to the Figure 9 shown: overall, the agricultural production total value generates a positive response to the agricultural loan balance. Starting from the 2nd period, the response gradually increases, reaching its maximum positive impact in the 7th period. After the 7th period, the response begins to gradually weaken, essentially stabilizing.

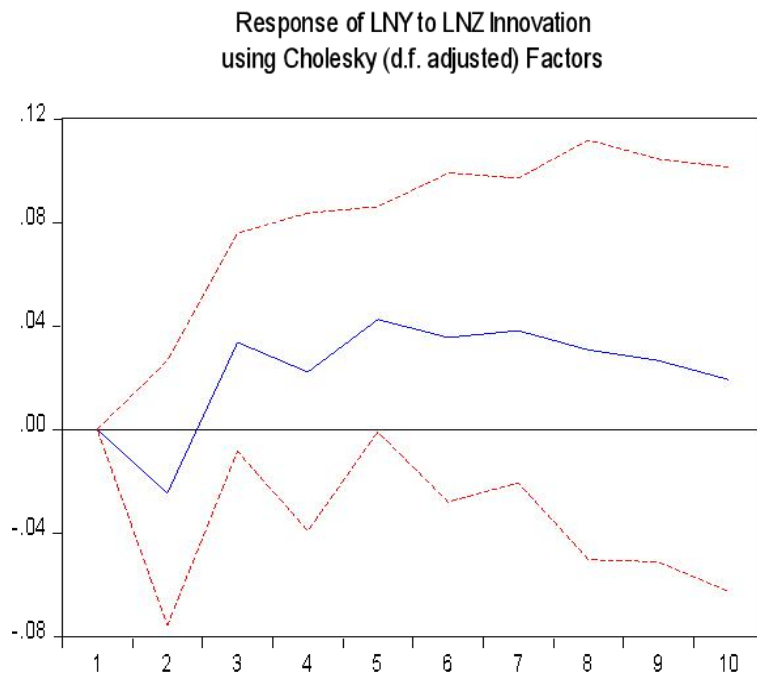


Figure 10 The Pulse Effect of Agricultural Credit Balance on the Total Value of Agricultural Production

According to the diagram shown (Figure 10): Overall, the impact of agricultural credit balances on the total value of agricultural production is mainly positive. The first two periods have a strong negative effect, but from the second period onwards, the impact gradually increases to become positive. By the eighth period, it reaches the maximum positive impact. After that, the response gradually weakens, essentially stabilizing.

5.3 Variance Decomposition Analysis

The variance decomposition refers to the degree of interaction between vectors, which is reflected in the form of the variance percentage of the prediction error of the variable when one variable in a system is affected by a set of other variables. The basic idea of variance decomposition analysis in the VAR model is to test the contribution of each variable update to the degree of influence of variables in the VAR system.

5.3.1 Decomposition analysis of variance in agricultural premium income and total value of agricultural production

Table 9 Decomposition Analysis of Variance in Agricultural Premium Income and Total Value of Agricultural Production

Variance Decomposition of LNGAP:				Variance Decomposition of LNAPI:			
Period	S.E.	LNAPI	LNGAP	Period	S.E.	LNAPI	LNGAP
1	0.499304	100	0	1	0.499304	31.653	68.347
2	0.621417	93.2534	6.746603	2	0.621417	32.14173	67.85827
3	0.72576	74.55913	25.44087	3	0.72576	35.86717	64.13283
4	0.776666	66.34072	33.65928	4	0.776666	29.39913	70.60087
5	0.826224	58.62117	41.37883	5	0.826224	29.91362	70.08638
6	0.841352	56.6729	43.3271	6	0.841352	26.35513	73.64487
7	0.855606	55.30533	44.69467	7	0.855606	26.13468	73.86532
8	0.857895	55.37253	44.62747	8	0.857895	24.92122	75.07878
9	0.860446	55.41828	44.58172	9	0.860446	24.50804	75.49196
10	0.861509	55.41279	44.58721	10	0.861509	24.11178	75.88822

From the variance decomposition results (Table 9), it is known that in the variance decomposition of agricultural premium income LNAPI, 55.412% of the contribution rate is self-carried, with the total value of agricultural production LNGAP accounting for 44.59%. In the variance decomposition of the total value of agricultural production LNGAP, 75.89% of the contribution rate is self-carried, with agricultural premium income LNAPI accounting for 24.11%, playing a significant role.

5.3.2 Decomposition analysis of variance in agricultural premium income and agricultural loan balance

Table 10 Decomposition Analysis of Variance in Agricultural Premium Income and Agricultural Loan Balance

Variance Decomposition of LNAPI				Variance Decomposition of LNACB			
Period	S.E.	LNACB	LNAPI	Period	S.E.	LNACB	LNAPI
1	0.029557	2.698327	97.30167	1	0.029557	100	0
2	0.058355	48.65445	51.34555	2	0.058355	97.56502	2.434978
3	0.094355	42.06688	57.93312	3	0.094355	95.46726	4.532738
4	0.137732	58.34217	41.65783	4	0.137732	93.71812	6.28188
5	0.189112	57.8441	42.1559	5	0.189112	92.47653	7.523468
6	0.249136	67.48529	32.51471	6	0.249136	91.49336	8.506638
7	0.3188	68.74318	31.25682	7	0.3188	90.76061	9.239388
8	0.399235	74.68452	25.31548	8	0.399235	90.17249	9.827513
9	0.491884	76.13497	23.86503	9	0.491884	89.71644	10.28356
10	0.598411	79.7046	20.2954	10	0.598411	89.34552	10.65448

From the variance decomposition results (Table 10), it is known that in the variance decomposition of agricultural premium income LNAPI, 20.30% of the contribution rate is borne by itself, with agricultural credit balance LNACB accounting for 79.70%. In the variance decomposition of agricultural credit balance LNACB, 89.35% of the contribution rate is borne by itself, with agricultural premium income LNAPI accounting for 10.65%, which plays a relatively weak role.

5.3.3 Analysis of variance decomposition of total income from agricultural production and agricultural loan balance

Table 11 Analysis of Variance Decomposition of Total Income from Agricultural Production and Agricultural Loan Balance

Variance Decomposition of LNGAP				Variance Decomposition of LNACB			
Period	S.E.	LNGAP	LNACB	Period	S.E.	LNGAP	LNACB
1	0.048717	100	0	1	0.048717	14.65568	85.34432
2	0.055111	80.10064	19.89936	2	0.055111	35.10952	64.89048
3	0.065244	59.27031	40.72969	3	0.065244	37.46885	62.53115
4	0.073344	58.64086	41.35914	4	0.073344	41.16763	58.83237
5	0.090631	50.90399	49.09601	5	0.090631	42.37678	57.62322
6	0.103608	50.71629	49.28371	6	0.103608	43.5709	56.4291
7	0.115657	49.53555	50.46445	7	0.115657	44.16671	55.83329
8	0.123651	49.68599	50.31401	8	0.123651	44.6135	55.3865
9	0.129129	49.62864	50.37136	9	0.129129	44.84397	55.15603

From the variance decomposition results (Table 11), it is known that 55.03% of the contribution rate in the variance decomposition of agricultural credit balance LNACB is self-carried, with the total value of agricultural production LNGAP accounting for 44.97%, with a significant contribution. In the variance decomposition of the total value of agricultural production LNGAP, 49.78% of the contribution rate is self-carried, with the agricultural credit balance LNACB accounting for 50.22%, playing a significant role.

5.4 Empirical Results and Analysis

Through the empirical analysis of the synergistic effect relationship between agricultural credit and agricultural insurance from 2012 to 2021, the following conclusions can be drawn:

First, the pulling effect of agricultural insurance on agricultural development is gradually strengthened while the pulling effect of agricultural development on agricultural insurance is gradually weakened. The impact of agricultural premium income on agricultural GDP is weak and positive, reaching the maximum positive impact from the first period. The impact of agricultural development on agricultural insurance is positive. Agricultural premium income plays a weak role in agricultural GDP.

Second, agricultural insurance has a certain pulling effect on agricultural credit, while the pulling effect of agricultural credit on agricultural insurance is gradually weakening. Agricultural credit has a negative impact on agricultural insurance, while agricultural insurance has a positive impact on agricultural credit. Agricultural credit has a weak contribution to agricultural insurance, while agricultural premium has a strong effect on agricultural credit balance.

Third, the pulling effect of agricultural credit on agricultural development is gradually strengthened, while the pulling effect of agricultural development on agricultural credit is gradually weakened. Agricultural GDP has a positive response to agricultural credit balance, and the impact of agricultural credit balance on agricultural GDP is mainly positive. Agricultural development contributes greatly to agricultural credit. Agricultural credit plays a greater role in agricultural development.

To sum up, agricultural credit and agricultural insurance of agricultural commercial banks in BZ City have a promoting effect on loan assistance. Agricultural insurance has promoted the development of agricultural credit to some extent, but the effect of agricultural credit on agricultural insurance is not obvious, and the synergy between them is weak.

6 CONCLUSION AND RECOMMENDATIONS

Currently, the agricultural insurance and agricultural credit in BZ City have developed to a certain extent, and agricultural insurance and agricultural credit have a certain promotional effect on the agricultural development of BZ City. However, due to the fact that China's agricultural insurance is still in the development stage, there are still many deficiencies. Empirical results show that the synergistic effect between the two is not significant, and there are still many deficiencies in the banking and insurance linkage model. Therefore, this chapter puts forward policy recommendations for the coordinated development of agricultural insurance and agricultural credit in BZ City based on empirical analysis.

6.1 Establish a Comprehensive Legal Guarantee Foundation

Due to the fact that China's rural financial tools are still in the initial stage and the situations among different provinces vary, there has been no unified model mechanism for the coordinated development of banking and insurance. Since the "Agricultural Insurance Regulations" were issued in 2012, China's agricultural insurance has gradually moved towards legalization. It can be seen that in order to establish and improve the legal foundation for agricultural insurance and agricultural credit, and to achieve sound development under the supervision of the authority and relevant financial departments, it is necessary to better coordinate the development mechanism between the two under standardized conditions.

Improve the legal foundation by first defining the rights and obligations among credit institutions, insurance companies, and farmers. Clarify their respective rights and responsibilities to ensure that all parties can have returns that match the risks, thereby ensuring the sustainable and healthy development of rural finance.

6.2 Establish a Sound Guarantee Mechanism

Due to the high risk of commercial agricultural insurance, the compensation probability is much higher than that of general property insurance, therefore, it is urgent to establish and improve the reinsurance system of agricultural insurance. By establishing a reinsurance system, the risks of agricultural insurance underwriting institutions can be reduced and dispersed, improving their profits and stimulating their innovative vitality. BZ City can establish a professional agricultural reinsurance company, obtain funding through authority finance, and insurance institutions can obtain reinsurance services by paying premiums to the reinsurance company, thereby providing dual protection for agricultural insurance.

From the perspective of agricultural insurance supply, insurance companies should adapt to local conditions and design different types of insurance products according to the actual situation of each place, providing diversified products and high-quality services to farmers. From the perspective of agricultural insurance demand, it should be led by the authority, gradually achieving comprehensive coverage of agricultural insurance, moving from cost insurance to income insurance.

6.3 Establish a Sound and Comprehensive Development Mechanism

Encourage rural and commercial banks and other commercial banks to actively develop agricultural credit-related

businesses, encourage non-bank financial institutions to conduct agricultural credit businesses in an orderly manner under supervision, gradually promote the market-oriented development of agricultural credit, gradually reduce the interest rates of agricultural credit under policy encouragement, broaden the scope of agricultural credit issuance, and form a top-down radiation-type agricultural credit system.

Credit guarantee mechanism is a powerful way to address the concerns of agricultural credit. By establishing a credit guarantee company for agricultural development in BZ City to provide guarantee for agricultural credit, it can encourage a large number of commercial banks and small and medium-sized financial institutions to engage in agricultural credit business, increasing their own profits while also responding to the national call to promote the establishment and completion of the national agricultural credit system. Agricultural insurance policies can be used as collateral for agricultural credit, solving the problem that individual farmers cannot obtain loans due to a lack of sufficient high-quality assets and collateral.

COMPETING INTERESTS

The authors have no relevant financial or non-financial interests to disclose.

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