

Analysis on the Effect of Agricultural Supply Chain Finance Development on Rural Revitalization

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Abstract: Agricultural supply chain finance is an important innovative model in the field of rural finance. This paper selects provincial panel data of 30 provinces in Chinese mainland from 2011 to 2020, calculates the rural revitalization index, and studies the impact of the development of agricultural supply chain finance on rural revitalization. The research draws the following conclusions: Firstly, the development of agricultural supply chain finance significantly promotes rural revitalization. Secondly, there is a single threshold effect on the promotion effect of agricultural supply chain finance on rural revitalization: taking the Engel coefficient, urban-rural income gap and urban-rural consumption gap as threshold variables, the lower the Engel coefficient of rural residents and the smaller the income and consumption gap between urban and rural areas, the stronger the promotion effect of agricultural supply chain finance on rural revitalization. Finally, the promotion of agricultural supply chain finance development to rural revitalization is more significant in the samples with higher urbanization rates and higher agricultural supply chain finance levels.

1. Introduction

In 2022, the report of the 20th National Congress emphasized the need to comprehensively promote rural revitalization, accelerate the construction of a powerful agricultural country, and solidly promote the revitalization of rural industries, talents, culture, ecology and organization. A strong country starts with strong agriculture, and the country is only strong when the agriculture is strong. However, the effective implementation of the rural revitalization strategy is inseparable from finance, and financial support is indispensable for increasing the income of rural residents, improving the infrastructure of rural areas, improving the ecological environment of rural areas and promoting the modernization of agriculture and rural areas. The Strategic Plan for Rural Revitalization (2018-2022) issued in 2018 pointed out that at present, it is necessary to increase financial support for agriculture, improve the rural financial system, adapt it to the characteristics of agriculture and rural areas, and allocate more financial resources in the key and weak areas of rural development, so as to meet the diversified financial needs of rural areas. Then, can the development of agricultural supply chain finance effectively promote rural revitalization? Are there heterogeneity and threshold effects in its impact? This paper studies these problems.

2. Literature Review

By combing the current literature, it is found that scholars' research on agricultural supply chain finance promoting rural revitalization at this stage mostly starts from the perspective of increasing residents' income, and analyzes its impact and effect mechanism. Boheng Jiang et al (2022) [1] found that agricultural supply chain finance can significantly promote the farming income of farming households based on CRERFS2021 data. Jie Guo et al (2022) [2] found that agricultural supply chain finance can effectively alleviate the financing difficulties of agriculture-related enterprises by studying the financial data of listed agriculture-related enterprises, and the effect of alleviating the financing constraints of enterprises participating in precise poverty alleviation is more significant, which is conducive to the effective implementation of rural revitalization strategy. Yun Shen et al (2019) [3] found that the higher the probability of farmers obtaining supply chain financial credit of farmers' cooperatives, the lower the multidimensional poverty index of farmers, and the poverty reduction effect is remarkable. An in-depth study shows that the higher the proportion of farmers' non-agricultural income, the more significant the poverty reduction effect of supply chain financial credit of enterprise-led farmers' cooperatives. By constructing the pricing model of agricultural supply chain financial loan service led by core enterprises, Yonghui Chen et al (2018) [4] found that agricultural supply chain finance can encourage farmers to expand the production scale of high-value agricultural products, ease the financial constraints of farmers, adjust the profit distribution among farmers' purchasers, and then promote rural revitalization.

In view of its effect mechanism, Debao Dai et al (2022) [5] used provincial panel data to find that agricultural supply chain finance increased the income of rural residents by expanding the production scale and increasing urbanization rate, and reduced the Engel coefficient by increasing urbanization rate. Yun Shen et al (2019) [6] found that the mechanism of agricultural supply chain finance for rural poverty reduction under the autonomous model is to promote industrial development, and provide risk support and prevention and control.

By sorting out the literature, it is found that there are relatively few empirical studies on the impact of agricultural supply chain finance on rural revitalization at present. Therefore, this paper selects the data of 30 regions in China (excluding Tibet and Hong Kong, Macao and Taiwan) from 2011-2020 to construct a rural revitalization development index and analyze the promotion effect of agricultural supply chain finance on rural revitalization.

3. Research design

3.1 Variable selection

This paper studies the provincial panel data of 30 provinces in Chinese mainland (except Tibet) from 2011 to 2020. The data come from the China Statistical Yearbook, People's Bank of China, Provincial Statistical Yearbooks, China Labor Statistical Yearbook and the National Bureau of Statistics.

a. Core explanatory variables: The level of agricultural supply chain finance (Fin). This paper draws on Debao Dai et al (2022) [5] to measure the level of agricultural supply chain finance using the logarithmic value of domestic and foreign currency agricultural-related loan balances of financial institutions.

b. Explained variable: The level of rural revitalization (Rur). Based on the principles of comprehensiveness and availability, this paper draws on Ting Zhang et al (2018) [7] to construct the rural revitalization index evaluation system in five aspects: prosperous industry, ecological livability, civilized rural customs, effective governance, and affluent living. Firstly, the original data are standardized, and then the entropy method is used to weigh, and the rural revitalization index of each

province is obtained. Table 1 shows the evaluation system of rural revitalization index constructed in this paper and the weights obtained by entropy method:

Table 1: Evaluation system of rural revitalization index.

first-class index	second-class index	weight	attribute
Prosperous industry	Gross output value of agriculture, forestry, animal husbandry and fishery	0.0714	+
	Total power of agricultural machinery	0.0787	+
	Per capita grain output	0.0636	+
Ecological livability	Forest coverage	0.0606	+
	Rural electricity consumption	0.1218	+
	Number of village clinics per 10,000 people in villages	0.0541	+
	Number of doctors and health workers per 10,000 people in villages	0.0310	+
	Proportion of the number of people participating in endowment insurance to the total population	0.0372	+
civilized rural customs	Population coverage rate of rural TV programs	0.0116	+
	Local financial expenditure on culture, sports and media	0.0482	+
	Telephone penetration rate	0.0419	+
	Per capita possession of public library collections	0.0694	+
effective governance	Number of autonomous organizations per 10,000 people in villages	0.0567	+
	Number of village committees per 10,000 people in villages	0.0650	+
affluent living	Per capita consumption expenditure of rural residents	0.0458	+
	Per capita disposable income of rural residents	0.0459	+
	Engel coefficient	0.0202	-
	Proportion of rural residents' expenditure on education, culture and entertainment to total expenditure	0.0379	+
	The proportion of wage income of rural residents to total income	0.0388	+

c. Threshold variables: Engel coefficient (Engel), urban-rural income gap (Gap) and urban-rural consumption gap (Gapc). Engel coefficient is the proportion of per capita food, tobacco and alcohol expenditure to per capita total consumption expenditure of rural residents; Urban-rural income gap is the ratio of per capita disposable income of rural residents to per capita disposable income of urban residents; Urban-rural consumption gap is the ratio of per capita consumption expenditure of rural residents to per capita consumption expenditure of urban residents.

d. Control variables: Education popularity (Edu), population status (Pop), basic transportation level (Tra), sex ratio (Gen), financial support for agriculture (Gov). The popularity of education is measured by the proportion of illiteracy in the population over 15 years old; Population status is measured by total dependency ratio; The basic traffic level is measured by the ratio of highway mileage to the local area in each region; The sex ratio is measured by the ratio of male population to female population; Financial support for agriculture is measured by the logarithmic value of local financial expenditure on agriculture, forestry and water affairs. Table 2 is the descriptive statistics of each variable:

Table 2: Descriptive statistics.

Variable	Mean	SD	Min	Max
Rur	0.323	0.081	0.137	0.523
Fin	4.136	0.861	2.034	6.151
Edu	4.908	2.757	0.89	16.63
Pop	0.374	0.071	0.193	0.578
Tra	0.947	0.504	0.089	2.194
Gen	1.05	0.043	0.958	1.232
Gov	6.16	0.573	4.519	7.2
Engel	0.338	0.057	0.238	0.513
Gap	0.394	0.056	0.272	0.542
Gapc	0.47	0.062	0.331	0.662

3.2 Model design

In order to test the impact of agricultural supply chain finance development on rural revitalization, the following model is constructed in this paper:

$$Rur_{it} = \alpha_1 Fin_{it} + \alpha_2 C_{it} + \alpha_0 + \mu_i + \sigma_t + \varepsilon_{it} \quad (1)$$

In the above formula, Rur_{it} is the rural revitalization level of i province in t year, and Fin_{it} is the digital financial level of i province in t year. C_{it} is the control variable of i province in t year, μ_i is the fixed effect of province, σ_t is the fixed effect of year, ε_{it} is the random disturbance term, and α_1 is the coefficient of the influence of agricultural supply chain finance on rural revitalization.

Because the impact of the development of agricultural supply chain finance on rural revitalization may have a nonlinear relationship, it is necessary to analyze the threshold effect. This paper builds a panel threshold regression model by drawing on Hansen (1999) [8], and the single threshold model is as follows:

$$Rur_{it} = \beta_1 Fin_{it} I(q_{it} \leq \gamma_1) + \beta_2 Fin_{it} I(q_{it} > \gamma_1) + \beta_3 C_{it} + \beta_0 + \mu_i + \sigma_t + \varepsilon_{it} \quad (2)$$

In the above formula, q_{it} represents the threshold variable, γ represents the threshold value, $I(\cdot)$ represents the indicative function, and other variables have the same meaning as above.

4. Analysis of empirical results

4.1 Benchmark regression result analysis

Table 3: Benchmark regression results

	(1)	(2)	(3)
	Rur	Rur	Rur
Fin	0.113*** (0.003)	0.021*** (0.005)	0.017*** (0.005)
Edu			-0.000 (0.001)
Pop			-0.075** (0.035)
Tra			-0.003 (0.009)
Gen			-0.014 (0.021)
Gov			0.022*** (0.006)
_cons	0.028** (0.012)	0.253*** (0.013)	0.183*** (0.051)
year	No	Yes	Yes
province	Yes	Yes	Yes
R ²	0.960	0.987	0.988

Note: ***, **, * represent the significance at 1%, 5% and 10% levels respectively, and clustering robust standard errors are in brackets, the same below.

Table 3 shows the benchmark regression results of the impact of agricultural supply chain financial development on rural revitalization. Columns (1), (2) and (3) in the table show the regression results with the inclusion of time-fixed effects and control variables in turn. It can be seen from the results that the development of agricultural supply chain finance has significantly promoted rural revitalization, and its significance has always remained at a 1% level, regardless of whether time-fixed effects and control variables are added.

Further analysis of the regression results of control variables shows that the population situation significantly inhibits rural revitalization, which is significant at the level of 5%. The reason may be that the greater the proportion of children and the elderly in the working population, the more likely it is to bring economic burden to rural households, leading to the occurrence of poverty, and then inhibit rural revitalization. However, financial support for agriculture significantly promotes rural revitalization, which is significant at the level of 1%. The reason may be that the government's increased financial allocation to agriculture, forestry, animal husbandry and fishery accelerates the development of rural industries, and then promotes the revitalization of rural industries.

4.2 Robustness tests

4.2.1 Replace the explained variable

In order to test whether the benchmark regression results are robust, this paper draws lessons from the weighting method of Jun Liu et al (2020) [9] to empower the rural revitalization index evaluation system and obtains a new rural revitalization level index (Rur2) to replace the explained variable in the benchmark regression above. Column (1) in Table 3 is the result replaced by explained variable, from which it can be seen that the development of agricultural supply chain finance still significantly promotes rural revitalization, which is significant at the level of 1%, which is consistent with the benchmark regression result.

4.2.2 Winsorization

From the descriptive statistics of variables in Table 2 above, it can be seen that there are great differences in rural revitalization level and agricultural supply chain financial level among different regions. In this study, we apply tailoring treatment to both to avoid outliers from interfering with the regression results. In this paper, the rural revitalization level and the financial level of the agricultural supply chain are reduced by 5% on both sides and then regression analysis is carried out. Table 4, column (2) shows the regression results after the tailoring treatment. The results show that the development of agricultural supply chain finance still significantly promotes rural revitalization and is significant at the 1% level, which passes the robustness test.

4.2.3 Instrumental variable method

Table 4: Robustness tests

	(1)	(2)	(3)
	Replace the explained variable	Winsorization	Instrumental variable method
	Rur2	Rur	Rur
Fin	0.030*** (0.007)	0.025*** (0.006)	0.017*** (0.005)
Control	Yes	Yes	Yes
year	Yes	Yes	Yes
province	Yes	Yes	Yes
R ²	0.983	0.981	0.988
Kleibergen-Paap rk LM			63.302[0.000]
Kleibergen-Paap rk Wald F			435.707{16.38}
Note: ***, * *, * represent the significance at 1%, 5% and 10% levels respectively, and clustering robust standard errors are in brackets, [] is the P value and {} is the critical value at the 10% level of the Stock-Yogo test.			

Because there are some problems such as missing variables, two-way causality and measurement errors, this paper uses the instrumental variable method to alleviate endogeneity. In this paper, a one-

period lag of the level of agricultural supply chain finance is chosen as the instrumental variable, followed by a 2SLS regression. Column (3) in Table 4 is the regression result after considering endogeneity. It can be seen that the positive impact of the development of agricultural supply chain finance on rural revitalization is still significant, at the level of 1%. In addition, the P value of Kleibergen-Paap rk LM is significant at 1% level, which significantly rejects the hypothesis of "insufficient identification of instrumental variables"; The Wald F value of Kleibergen-Paap rk is larger than the 10% level critical value in Stock-Yogo test, which indicates that the instrumental variable has passed the weak identification test and shows the rationality of the instrumental variable.

4.3 Threshold effect analysis

Table 5: Threshold effect analysis.

		Threshold value	F	P	Critical value		
					10%	5%	1%
Engel Coefficient	Single	0.3732	21.05	0.02	14.139	17.223	25.3
	Double	—	8.86	0.243	11.724	15.483	23.103
Urban-rural income gap	Single	0.4428	26.63	0.087	25.239	34.441	48.917
	Double	—	13.17	0.367	41.748	52.832	81.725
Urban-rural consumption gap	Single	0.5390	21.89	0.083	19.755	24.669	32.244
	Double	—	13.13	0.183	16.457	19.497	25.531

Firstly, the significance and quantity of the threshold effect are tested, and the P value and F statistic of the threshold effect test are calculated 300 times according to the Bootstrap method. Table 5 shows the test results of the threshold effect. It can be seen from the table that when the Engel coefficient is used as a threshold variable, there is a single threshold, which is significant at 5% level. At the same time, when the urban-rural income gap and the urban-rural consumption gap are the threshold variables, there is also a single threshold, which is significant at the 10% level.

Table 6: Threshold effect regression results

	Threshold variable		
	(1)	(2)	(3)
	Engel	income gap	consumption gap
Low threshold interval	0.013*	0.015***	0.013*
	(0.006)	(0.005)	(0.007)
High threshold interval	0.010	0.019***	0.015**
	(0.007)	(0.005)	(0.007)
Threshold value	0.3732	0.4428	0.5390
Control	Yes	Yes	Yes
year	Yes	Yes	Yes
province	Yes	Yes	Yes
R ²	0.954	0.955	0.954

Table 6 shows the threshold regression results. It can be seen from column (1) that when the Engel coefficient of rural residents is lower than the threshold value (0.3732), agricultural supply chain finance significantly promotes rural revitalization, which is significant at the level of 10%. When the Engel coefficient is higher than the threshold, the promotion of agricultural supply chain finance to rural revitalization is no longer significant. It indicates that the richer the residents live, the greater the promotion effect of agricultural supply chain finance on rural revitalization. From column (2), it can be seen that agricultural supply chain finance significantly promotes rural revitalization regardless of the level of the urban-rural income gap, which is all significant at the 1% level. However, with the narrowing of the income gap between urban and rural areas, the promotion of agricultural supply chain finance to rural revitalization has increased, and the coefficient has increased from 0.015 to 0.019. It can be seen from column (3) that with the narrowing of the consumption gap between

urban and rural areas, the promotion of agricultural supply chain finance to rural revitalization increases, the significance level changes from 10% to 5%, and the coefficient increases from 0.013 to 0.015. From the above analysis, it is clear that the economic growth of rural areas and the improvement of rural residents' affluence can enable agricultural supply chain finance to better promote rural revitalization.

4.4 Heterogeneity analysis

In order to further explore the internal relationship between agricultural supply chain finance and rural revitalization, this paper analyzes the heterogeneity of agricultural supply chain finance in promoting rural revitalization by means of group regression.

Firstly, the urbanization rate is taken as the grouping basis, and (1) and (2) of Table 7 are listed as regression results. The results show that the promotion of agricultural supply chain finance to rural revitalization is more significant and the coefficient is larger in the samples with high urbanization rate; It is not significant in the sample with low urbanization rate. It shows that agricultural supply chain finance plays a greater role in promoting rural revitalization in areas with high levels of urban-rural integration.

Meanwhile, the level of agricultural supply chain finance is used as the basis for grouping, and (3) and (4) of Table 7 are listed as regression results. The results show that when the level of agricultural supply chain finance is higher, its contribution to rural revitalization is more significant and the coefficient is larger. When the level of agricultural supply chain finance is low, its contribution to rural revitalization is not significant. Therefore, when the financial level of agricultural supply chain is high, its development can better promote rural revitalization.

Table 7: Grouping regression results

	(1)	(2)	(3)	(4)
	Urbanization rate		The level of agricultural supply chain finance	
	Low	High	Low	High
	Rur	Rur	Rur	Rur
Fin	0.009 (0.009)	0.022*** (0.007)	0.005 (0.007)	0.037*** (0.014)
Control	Yes	Yes	Yes	Yes
year	Yes	Yes	Yes	Yes
province	Yes	Yes	Yes	Yes
R ²	0.993	0.986	0.986	0.987

5. Conclusions and suggestions

Based on the provincial panel data of 30 provinces in Chinese mainland (except Tibet) from 2011 to 2020, this paper constructs an index evaluation system of rural revitalization level, and studies the effect and mechanism of agricultural supply chain financial development affecting rural revitalization. The research draws the following conclusions: First, the development of agricultural supply chain finance can significantly promote rural revitalization. Secondly, taking the Engel coefficient, urban-rural income gap and urban-rural consumption gap as threshold variables, there is a single threshold effect in the promotion of agricultural supply chain finance to rural revitalization: the lower the Engel coefficient of rural residents and the smaller the income and consumption gap between urban and rural areas, the stronger the promotion effect of agricultural supply chain finance on rural revitalization. Finally, the promotion effect of agricultural supply chain finance development on rural revitalization is more significant in the sample with a higher urbanization rate and a higher level of agricultural supply chain finance.

Based on the above conclusions, the following suggestions are put forward:

First, we should actively develop agricultural supply chain finance and improve the rural financial service system. First of all, we should innovate rural financial products and encourage rural financial institutions to launch diversified financial products according to regional characteristics to meet the financial needs of rural residents. At the same time, it is necessary to intensify financial publicity, so that rural residents can better understand financial knowledge and improve their financial awareness. Finally, the government should provide policy support to agricultural supply chain finance, actively promote the development of agricultural supply chain finance, accelerate the agricultural supply chain finance into the fast lane, and maximize the promotion of agricultural supply chain finance to rural revitalization.

Second, we should actively promote the rural revitalization strategy. First of all, we should broaden the income channels of rural residents and improve their income, so that agricultural supply chain finance can better promote the effective implementation of rural revitalization strategy. At the same time, we should vigorously develop the rural economy, narrow the income and consumption gap between urban and rural areas, adhere to the integration of urban and rural development, promote the flow of production factors between urban and rural areas, and make agricultural supply chain finance better promote rural revitalization.

References

- [1] Boheng Jiang, Tao Wen. *Agricultural supply chain financing and smallholder farmers' income increase: effects and mechanisms [J]. Journal of Southwestern University (Social Science Edition)*, 2022, 48(05):86-95. DOI: 10.13718/j.cnki.xdsk.2022.05.008.
- [2] Jie Guo, Liyue Gu. *Can agricultural supply chain finance effectively alleviate the financing constraints of enterprises? --An empirical study on the participation of agriculture-related enterprises in precise poverty alleviation [J]. Operations Research and Management*, 2022, 31(03):112-118.
- [3] Yun Shen, Qinghai Li, Jing Yang. *Research on the poverty reduction effect of agricultural supply chain financial credit--an empirical comparison based on different subjects leading cooperatives [J]. Economic Review*, 2019, No. 218(04): 94-107. DOI: 10.19361/j.er.2019.04.07.
- [4] Yonghui Chen, Hongyu Tu, Yan Zeng. *Loan pricing and production regulation mechanism of agricultural supply chain finance [J]. Systems Engineering Theory and Practice*, 2018, 38(07):1706-1716.
- [5] Debao Dai, Dan Zhou, Tijun Fan. *Research on the poverty reduction effect and transmission mechanism of agricultural supply chain finance [J]. Statistics and Decision Making*, 2022, 38(14):60-64. DOI: 10.13546/j.cnki.tjyc.2022.14.012.
- [6] Yun Shen, Jingrong Li, Jing Yang. *Research on credit poverty reduction mechanism of agricultural supply chain finance in the context of rural revitalization--a perspective based on the ability of social member farmers to escape poverty [J]. Journal of Southwestern University (Social Science Edition)*, 2019, 45(02):50-60+ 196. DOI: 10.13718/j.cnki.xdsk.2019.02.006.
- [7] Ting Zhang, Minrong Li, Yanmei Xu. *Construction and empirical study of rural revitalization evaluation index system [J]. Management World*, 2018, 34(08):99-105. DOI:10.19744/j.cnki.11-1235/f.2018.08.009.
- [8] Hansen B E. *Threshold effects in non-dynamic panels: estimation, testing, and inference [J]. Journal of econometrics*, 1999, 93(2): 345-368.
- [9] Jun Liu, Yuanyun Yang, Sanfeng Zhang. *A study on the measurement and drivers of China's digital economy [J]. Shanghai Economic Research*, 2020, No. 381(06):81-96. doi:10.19626/j.cnki.cn31-1163/f.2020.06.008.