

Research on the Influence of Brand Certification on Farmers' Professional Cooperatives Participating in E-commerce

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Abstract. Based on the microscopic survey data of 100 vegetable cooperatives in Sichuan Province, this paper empirically analyzes the influence of brand certification on cooperatives participating in the e-commerce by binary logistic regression model. The results show that the proportion of Sichuan vegetable cooperatives participating in the e-commerce is generally lower, which needs further improvement. Brand certification has a positive role in promoting cooperatives to participate in the e-commerce, with a marginal contribution of 19.7%. In addition, government sales support has a positive impact on the cooperative e-commerce, which is an important guarantee for promoting cooperatives to participate in the e-commerce. While the difficulty of agricultural product sales has a negative impact on the cooperative e-commerce, and the more difficult the agricultural products are sold, the higher the probability that the cooperative will participate in the e-commerce. Thus, this article puts forward policy suggestions such as actively promoting cooperatives to participate in brand certification, promoting cooperatives to participate in the e-commerce according to local conditions and strengthening government sales support.

1 Introduction

Farmers' professional cooperatives (hereinafter referred to as "cooperatives") have important functions such as reducing transaction costs and resolving information asymmetry^[1,2], which can effectively resolve the problems of agricultural products' sales, and thus have developed rapidly. According to the official data from the Ministry of Agriculture and Rural Affairs, the number of legally registered cooperatives nationwide amounted to 2.203 million as of the end of October 2019, and about half of the rural households entered the cooperatives. Cooperatives have become one of the most important new type of agricultural management entities for the development of modern agriculture. However, it is undeniable that the cooperative has not fundamentally solved the problem of agricultural products' sales^[3], so the sustainable development of the cooperatives also face challenges. Higher transaction costs are an important factor that makes it difficult to sell agricultural products^[4]. The transaction costs of cooperatives mainly come from various transaction activities carried out between cooperatives and other market entities. Cooperatives participating in e-commerce can effectively reduce search costs, negotiation and decision costs, supervision costs, switching costs, etc^[5]. In addition, the development of e-commerce can enhance the market competitiveness of cooperatives, improve the level of standardized management and the quality of members^[6]. Therefore, Kong pointed out that not only e-commerce needs cooperatives, but cooperatives also need e-commerce^[7].

The government strongly supports cooperatives to develop e-commerce. In order to actively respond to the "Internet +" action, the 2017 Central Document No. 1 emphasized the promotion of comprehensive docking and integration between cooperatives and e-commerce. However, with the policies promotion in the past five years, there is a certain gap between the cooperatives' e-commerce practice and theoretical expectations. There are still some cooperatives that have not participated in e-commerce. Why do cooperatives have a different attitude towards e-commerce, that is, what factors affect the cooperatives participating in e-commerce? Answering this question has important theoretical and practical significance for resolving the sales difficulties of agricultural products and the sustainable development of cooperatives.

2 LITERATURE REVIEW

The model and advantages of cooperatives participating in e-commerce have attracted extensive attention from scholars. "Production and sales docking" and "production and consumption docking" are two basic circulation paths of cooperatives' agricultural products, from which the e-commerce is an important form of the former^[8]. The model of cooperatives participating in e-commerce mainly includes C2O model, COM model and CO2O model^[9]. Similarly, Chen et al. found that the supply and demand information release model, the self-operated outlet model and the entrusted sales model are cooperatives' common e-commerce model^[10]. Xu and Si explored feasible e-

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commerce models for several main types of agricultural products, namely, food crop agricultural products adopting the information platform model and the supply and marketing integration model driven by leading enterprises, fresh agricultural products using small community e-commerce and the online store model, the specialty agricultural products adopting the third-party platform model and the self-operated platform model, the economic forest products adopting the agricultural product auction model and the large-scale procurement model^[11]. The advantages of cooperatives in developing e-commerce are mainly in two aspects, namely, the high degree of organization and the latecomer advantage^[12]. Compared with traditional sales in the bazaar, cooperatives participating in e-commerce face a larger market and stronger premium capacity^[13], Yang and Wang pointed out that cooperatives can reduce transaction costs such as search costs, negotiation and decision-making costs, supervision costs and conversion costs^[5], thereby promoting the sales of agricultural products and the sustainable development of cooperatives.

However, the practice of cooperatives participating in e-commerce is affected by many factors. Wu and Qiu pointed out that when operating fresh e-commerce platform, the cooperatives lack the management consciousness to manage the enterprise with a modern enterprise system, the concepts of Internet integrated marketing, and the logistics are imperfect, besides, a gap in the standard system of agricultural products circulation^[14]. Cooperatives participating in e-commerce face many bottlenecks such as lack of talents, little influence of agricultural products' brands, inadequate logistics system, insufficient consumer information and inadequate policy implementation^[9]. Public policy is an important driver of rural e-commerce development^[15]. Kong pointed out that the chairman of the cooperative needs to have strategic thinking and take participation in e-commerce as a long-term and strategic task^[7]. Cooperatives' e-commerce cognitive behavior is not affected by the scale of operations, but it is significantly affected by the type of industry^[15]. Zhang found that farmers joining the cooperatives will reduce the willingness of small farmers to participate in the e-commerce^[16]. Factors such as interpersonal trust, institutional trust, gender, education, family cultivated area, family annual income, proportion of labor and whether there is a village-level information service station in the village have a significant impact on cooperatives' decision-making in participating in the e-commerce operations^[17]. Among the influencing factors of farmers' e-commerce cooperative entrepreneurial behavior, farmers' age, family labor and trust with relatives or friends have the greatest impact on farmers' e-commerce cooperative entrepreneurial behavior, Social ability and other factors followed^[18]. The influence of human resources factors on the cooperatives' willingness to participate in e-commerce is more significant. Measures such as increasing capital investment in cooperative development, organizing cooperatives to operate on a moderate scale, improving the technical level of cooperative members and establishing cooperative development experience exchange platforms can all help develop cooperative e-commerce^[19]. Liu et al.

found that the chairman's education level, production base, cooperative registration capital, agricultural product sales channels, whether to sign purchase and sales contracts, etc. have a positive correlation with e-commerce behavior, while whether the cooperative has a fixed education and training place and incomplete member product transaction records have a negative correlation^[20].

The influence of brand certification on marketing has also gradually attracted the attention of scholars. Dorr found that certified mangoes and grapes increased by 58% and 28% per kilogram over uncertified prices^[21], respectively. Brands had a significant positive effect on the online sales price, sales volume and satisfaction for fruits, and the interaction effect between brand and culture had a significant positive effect on the online sales price of tea^[22], while some scholars hold the opposite view, Bacon pointed out that fair trade and organic certification did not improve the livelihoods of 228 small coffee farmers in northern Nicaragua^[23]. Jena et al. believed that due to low productivity, negligible price premiums and poor access for cooperatives to credit and information, coffee cooperatives' certification had little impact on the livelihoods of small-scale coffee producers^[24]. Owning your own brand was a necessary software condition for the cooperative e-commerce^[25]. With the rapid development of e-commerce applications in China, cooperatives developed e-commerce and took the brand path to meet the needs of market competition^[26].

In summary, scholars have conducted extensive discussions on the models and advantages of the cooperative e-commerce, the influencing factors of cooperatives participating in e-commerce, and the impact of brand certification, which have laid the foundation for in-depth research in this article. However, it is slightly inadequate. Existed researches mostly have theoretical discussions on cooperatives' e-commerce models or advantages, but lack of empirical research on the influencing factors of cooperatives participating in the e-commerce. There have been studies examining the influencing factors of cooperatives participating in e-commerce from the dimensions of the chairman's characteristic variables, cooperative characteristic variables and environmental characteristic variables. Moreover, some scholars concern about the influence of brand certification on marketing, however, lacking the attention to the influence of brand certification on cooperatives participating in the e-commerce, a new marketing method. Further speaking, how much is the impact? Which needs to be further investigated. At the same time, the industry types of cooperatives in the existed research are diverse, and the cooperatives with different types of industries have large differences in e-commerce behaviors. Thus, it is necessary to reduce the influence of industrial heterogeneity on cooperatives participating in the e-commerce. Therefore, based on the microscopic survey data of 100 vegetable cooperatives in Sichuan Province, this article uses the binary logistic regression model to empirically analyze the influence of brand certification on cooperatives participating in the e-commerce and calculates the marginal effects, which has a certain degree of innovation.

3 Data sources

This article takes vegetable Cooperatives in Sichuan province as an example to deeply analyze the influence of brand certification on cooperatives participating in the e-commerce. Sichuan is divided into five economic zones according to economic and geographic features, that is, Chengdu Plain Economic Zone, Southern Sichuan Economic Zone, Northeastern Sichuan Economic Zone, Panxi Economic Zone and Northwest Sichuan Ecological Economic Zone. Because the development level of cooperatives in Panxi Economic Zone and Northwest Sichuan Ecological Economic Zone is generally lower, and at the same time limited by the time and energy, this article focus on Chengdu Plain Economic Zone, Southern Sichuan Economic Zone and Northeast Sichuan Economic Zone, which can basically represent the development profile of most cooperatives in Sichuan Province. Therefore, this research conducted a questionnaire survey from July 15 to 26, 2019. The survey mainly used stratified random sampling: Firstly, randomly select 2 or 3 cities in each economic zone; Secondly, randomly select 2 or 3 counties (cities or districts) with large output of vegetables in each sample city; Thirdly, randomly select 4-8 vegetable cooperatives in each sample counties (cities or districts), and then conduct surveys on their directors or board members; Finally, a total of 110 questionnaires were distributed in the survey, and 105 questionnaires were recovered, with a recovery rate of 95.45%. 100 valid questionnaires were collected after invalid questionnaires with incomplete information and wrong logic were excluded, and the effective rate is 95.24%. The regional distribution of valid samples of cooperatives is shown in table 1.

Table1. Regional distribution of valid samples

Economic Zone	Sample City	Sample counties (cities or districts)	Valid Samples	Proportion(%)
Southern Sichuan Economic Zone	Neijiang	Zizhong County	5	5.00
		Dongxing District	4	4.00
	Luzhou	Lu County	6	6.00
		Hejiang County	6	6.00
Northeast Sichuan Economic Zone	Nanchong	Shunqing District	5	5.00
		Gaoping District	6	6.00
	Guang'an	Yuechi County	6	6.00
		Wusheng County	6	6.00
	Guangyuan	Lizhou District	5	5.00
		Zhaohua District	5	5.00
		Cangxi County	5	5.00
Chengdu Plain Economic Zone	Chengdu	Pidu District	6	6.00
		Pengzhou city	6	6.00
		Jintang County	7	7.00
	Deyang	Jingyang District	4	4.00
		Zhongjiang county	5	5.00
	Meishan	Dongpo District	7	7.00
		Renshou County	6	6.00
Total	8	18	100	100.00

4 Model setting and variable selection

4.1 Model setting

The dependent variable in this article is the cooperative e-commerce, whose value includes participating in the e-commerce and non-participating in the e-commerce. Cooperative e-commerce is a typical binary discrete variable. The binary logistic regression model is an effective method to estimate the binary discrete variable. Therefore, this article analyze the influence of brand certification on the cooperative e-commerce by binary logistic regression model. The basic form of the binary logistic regression model is:

$$P_i = F(\alpha + \sum_{j=1}^n \beta_j x_j) = \frac{1}{1 + e^{-(\alpha + \sum_{j=1}^n \beta_j x_j)}} \quad (1)$$

In the above formula, P_i ($i=1,2,\dots,100$) represents the probability of the cooperative to participate in e-commerce; α is a constant term; $n(n=7)$ is the number of independent variables, including core independent variables and control variables; β_j is the regression coefficient of x_j , and x_j is the independent variable. Logarithmically transform the above formula to obtain a linear expression of the logistic regression model:

$$\ln\left(\frac{P_i}{1-P_i}\right) = \alpha + \sum_{j=1}^n \beta_j x_j \quad (2)$$

4.2 Variable selection

The dependent variable in this article is the cooperative e-commerce, which specifically refers to whether the cooperatives participate in the e-commerce. The value of the cooperative e-commerce has two states, namely, participating in the e-commerce and non-participating in the e-commerce. The survey data shows that there are 46 sample cooperatives participating in the e-commerce, accounting for 46%, while 54 sample cooperatives not participating in the e-commerce, accounting for 54%. Therefore, the level of e-commerce development in cooperatives is generally lower, which needs further development.

The core independent variable of this article is brand certification, which specifically refers to whether the cooperative has a brand, for example, "Three products and one standard", own brand, etc. The value of brand certification also has two states, namely, having brand certification and no brand certification. According to the survey data, there are 76 sample cooperatives with brand certification, accounting for 76%. While 24 sample cooperatives without brand certification, accounting for 24%.

In addition, based on the previous theoretical analysis, the chairman's characteristic variables, other cooperative characteristic variables and environmental characteristic variables may have a certain influence on the cooperative e-commerce. Therefore, in order to further investigate the influence of brand certification on the cooperative e-commerce, variables such as the special experience of the chairman of the board, the time length of the cooperative's establishment, the voting methods of the three associations, the profitability of the cooperative compared

with the previous two years, the difficulty of agricultural product sales, the government sales support are set as control variables. The descriptive statistics of each variable is shown in table 2.

Table2. Definition and description of variables

Variable name	Variable Definition	Mean	SE
Dependent variable			
Cooperative e-commerce (y)	0=participating in; 1=non-participating in	0.46	0.50
Core independent variable			
Brand certification (x_1)	0=no; 1=yes	0.76	0.43
control variables			
the special experience of the chairman (x_2)	0=no; 1=Village cadres or party members	0.62	0.49
the time length of the cooperative's establishment (x_3)	Actual value (year)	7.50	3.14
the voting methods of the three associations (x_4)	0=other; 1="One person, one vote"	0.74	0.44
the profitability of the cooperatives compared with the previous two years (x_5)	1 = a lot worse; 2 = a little worse; 3 = no difference; 4 = a little better; 5 = a lot better	3.75	0.94
the difficulty of agricultural product sales (x_6)	1 = very difficult; 2 = difficult; 3 = normal; 4 = easy; 5 = very easy	4.12	0.83
the government sales support (x_7)	0=no; 1=yes	0.77	0.42

5 Empirical analysis results

5.1 Regression and marginal analysis results

This article tests the multicollinearity among independent variables before binary logistic regression analysis. The results show that the variance expansion factor of each variable is less than 10, indicating that there is no significant multicollinearity. Thus, this article uses stata14.0 statistical and analysis software to estimate the model. The regression results are shown in table 3, from which the model I is the regression results based on the control variables, and model II based on all variables. The log-likelihood values of the two models are -63.131 and -61.696, while Pseudo R2 are 0.085 and 0.106, and the probability values are 0.068 and 0.042, respectively. Two models all pass the significance test at the 10% or 5% levels, indicating that the overall fit of the model is good. It should be particularly emphasized that the sign of the regression coefficient can reflect the influence direction of each variable, but its size has no direct significance. In order to further analyze the influence degree of each variable on the cooperative e-commerce, this article calculates the marginal effect of each variable, which is also shown in table3.

Table3. Regression and marginal results

Variables	Module I		Module II	
	Regression coefficient	Marginal coefficient	Regression coefficient	Marginal coefficient
x_1	—	—	0.922*	0.197*
x_2	0.164	0.036	0.222	0.047
x_3	0.076	0.017	0.056	0.012
x_4	-0.102	-0.023	-0.027	-0.005
x_5	0.16	0.035	0.106	0.022
x_6	-0.622**	-0.138**	-0.547*	-0.117**

x_7	1.250**	0.276**	1.116*	0.239**
cons	0.214	—	-0.445	—
Related inspection	Prob > chi2 = 0.068		Prob > chi2 = 0.042	
	Log likelihood = -63.131		Log likelihood = -61.696	
	Pseudo R2 = 0.085		Pseudo R2 = 0.106	

From model I, it can be seen that the difficulty of agricultural product sales passes the significance test at the 5% level, and the influence direction is negative, showing that the more difficult it is to sell agricultural products, the higher the probability of cooperatives participating in the e-commerce. The marginal coefficient is -0.138, which further indicates that the probability of cooperatives participating in the e-commerce increases by an average of 13.8% with the difficulty of agricultural product sales down one level. Therefore, cooperatives can innovate marketing by e-commerce where agricultural products are difficult to sell. Cooperatives open sales channels for agricultural products through the sales combination between online and offline, which also promotes their own sustainable development. Government sales support passes the 5% level of significance test, and the influence direction is positive, indicating that the cooperatives that receive government sales support have a higher probability participating in the e-commerce. The marginal coefficient is 0.276, which shows that the probability of participating in the e-commerce for cooperatives with government sales support has increased by an average of 27.6% compared with those not. Thus, government's sales support has a positive role in promoting the cooperative e-commerce. In addition, other variables such as the special experience of the chairman, the time length of the cooperative's establishment, the voting methods of the three associations, the profitability of the cooperatives compared with the previous two years fail the significance test at the 10% level, showing that whether the chairman has special experience, how long the cooperative was established, the standardization level and the profitability of the cooperative have no significant influence on the cooperative e-commerce.

From model II, it can be seen that brand certification, the core independent variable, passes the 10% level of significance test, and the influence direction is positive, indicating that the cooperative with brand certification has a higher probability of participating in the e-commerce. The marginal coefficient is 0.197, indicating that the cooperative with brand certification have an average increase of 19.7% in the probability of participating in the e-commerce. Thus, brand certification is an effective means to promote the cooperative e-commerce. In order to guide cooperative e-commerce, it should actively promote cooperatives to carry out brand certification. After adding the core independent variables, the difficulty of agricultural product sales and government sales support are still significant, both of which pass the 10% level of significance test, and the remaining control variables fail the 10% level of significance test.

5.2 Robustness analysis

Generally speaking, the cooperative e-commerce has certain requirements for the chairman's human capital, and receiving education is an important way to improve the chairman's human capital. The lower the education level,

the chairman's human capital may not be enough to support the cooperative to participate in the e-commerce, and the cooperative has a lower probability of developing the e-commerce sales. The higher the education level, the more the chairman can realize the value of the cooperative e-commerce and have a certain amount of human capital to participate in the e-commerce. Therefore, in order to test the robustness of the results, this article eliminates the samples with the education less than 6 years and more than 16 years, and then re-regresses the core variables and control variables. The results are shown in table 4, which is basically consistent with the results in table 3. Brand certification has promoted the cooperative e-commerce, that is, the previous regression analysis results are more stable. Although the marginal impact of brand certification has changed, this change is not obvious.

Table4. Robustness analysis results

Variables	Regression coefficient	Marginal coefficient
x_1	1.136*	0.240**
x_2	0.154	0.033
x_3	0.065	0.014
x_4	0.173	0.037
x_5	0.044	0.009
x_6	-0.463	-0.098*
x_7	1.044*	0.220*
_cons	-0.87	
Related inspection	Prob > chi2 = 0.037	
	Log likelihood = -57.976	
	Pseudo R2 = 0.114	

Note: * $p \leq 0.1$; ** $p \leq 0.05$; *** $p \leq 0.01$.

6 Conclusions and policy recommendations

6.1 Conclusion

This article empirically analyzes the influence of brand certification on the cooperative e-commerce by binary logistic regression model based on the microscopic survey data of 100 vegetable cooperatives in Sichuan Province, and conducts a robust test on the results. The results show that the proportion of Sichuan vegetable cooperatives participating in the e-commerce is generally lower, which needs further improvement. Brand certification has a positive role in promoting cooperatives to participate in the e-commerce, with a marginal contribution of 19.7%. In addition, government sales support has a positive impact on the cooperative e-commerce, which is an important guarantee for promoting cooperatives to participate in the e-commerce. While the difficulty of agricultural product sales has a negative impact on the cooperative e-commerce. The more difficult the agricultural products are sold, the higher the probability that the cooperative will participate in the e-commerce.

6.2 Policy recommendations

Based on the above research conclusions, this article makes the following policy recommendations:

(a) Promoting cooperatives to carry out brand certification. Guide the cooperatives' chairman to fully understand the role of brand certification in the promotion of the cooperative e-commerce, and then take brand certification as an important means to promote the cooperative e-commerce. On the one hand, cooperatives can register their own brands or use regional public brands, on the other hand, cooperatives should enhance the brand value of agricultural products in many ways, further in-depth promoting the cooperative e-commerce.

(b) Promoting the cooperative e-commerce according to local conditions. Cooperatives are supposed to coordinate both offline and online marketing channels, and innovate the cooperative e-commerce model according to local conditions. Especially, focus on areas where agricultural product sales are difficult, cooperatives should use e-commerce to open agricultural product sales channels, which can also promote the sustainable development of themselves at the same time.

(c) Strengthening government sales support. Cooperative e-commerce is inseparable from the strong support of the government. The government should provide strong support in road transportation, cold chain logistics and marketing promotion, etc, which consolidates the external guarantee of the cooperative e-commerce.

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