Effect of Chinese Cotton Subsidies on Cotton Farmers Planting and Planting Willingness

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Abstract
Based on the survey of 1386 households who are growing cotton in Xinjiang, we use the model of multivariate ordinal logistics regression to analyse the influential factors of farmers' willingness to continue to grow cotton, and the reason of farmers' behaviour changing of cotton planting after the implementation of the target price policy. The results show that: the difference between northern and southern Xinjiang farmers planting behaviour tendency is obvious, the older farmers' willingness to continue growing cotton is stronger, the greater the risk of cotton growing the easier for farmers to reduce the planting area, if farmers' expectations of future income aren't high, it will lead to reduction of farmers planting behaviour. Based on the analysis of the model, this paper believes that we should continue to improve the agricultural insurance mechanism, make full use of network marketing platform, strengthen the technical guidance to farmers.
Key words: *farmers; cotton; target price; policy response; multivariate ordinal logistics regression*

1 Introduction
In 2014, China began to implement the target price policy of cotton, cotton target price subsidy policy is quite different from the previous temporary storage policy. This policy aims to protect the interests of farmers under the premise of the market in the allocation of resources to play a decisive role, through the market price signal to guide the production, circulation and consumption of cotton, promote the coordinated development of the upstream and downstream industry chain. (*Yao Mingye*[1])
On the current situation of cotton cultivation in china, the problems of cotton production has a great influence on natural conditions, high production cost and low labour productivity in cotton production, and the contradiction between the small production of cotton cultivation and the social production of industry is still exist, so the focus of cotton price regulation is to ensure a reasonable operation mechanism of cotton market, protect the basic income of farmers, and stable the yield of cotton.(*Wen Yan*[2]*, Gao Shan*[3]*, Yang Zhongna et al.*[4])
At present, the research on the target price policy of cotton in China is mainly focused on the two aspects: One is the introduction and evaluation of the cotton target price subsidy policy; the other is the quantitative empirical evaluation of the subsidy policy. In view of the farmer's opinion and feedback to judge the subsidy policy practice and the effect analysis of the article is less. Some scholars (*Lingxiao Lu, Liu Hui*[5]) puts forward the calculation formula of the target price level, gives the policy suggestions to consummate emergency underpinning market plan, and thinks that the cotton target price reform is improving the cotton price formation mechanism, protecting the interests of farmers in pilot areas, playing a stabilizing role in cotton production in Xinjiang (*Huang Jikun*[6] et al.). Some scholars put forward that the target price is not a simple policy of price (*cold Chongzong*[7]), government determine the target price of agricultural products should comprehensively consider the cost of production,

supply and demand, government financial burden, consumer affordability, and the international market price, such as the relationship between the price.

This paper makes an empirical study on the use of a large-scale research data on the cotton farmers planting willingness, planting behaviour and its influencing factors after the policy change, with emphasis on the impact of cotton target price subsidy policy on farmers. Therefore, the research of this paper can directly reflect the effect of the current policy, so as to make contribution to the existing research.

2 Experimental

2.1 Data sources

Xinjiang is the main production area of high quality cotton in china, which is also implementing the reform of the cotton target price policy pilot. This paper selects 13 typical cotton growing counties (cities) in Xinjiang province to investigate, including Luntai, Kuche, Yuli, Awati, Wensu, Shache, Bachu, Mengaiti, Hutubi, Manasi, Wusu and Shawan, Changji. The research group from December 2014 to March 2015 thorough investigation of county (city) to carry out research, first in the county (city) randomly selected 3 research towns, then in each of the villages and towns in the random selection of 3 villages, each village sent out 10-20 copies of the questionnaire. A total of 2070 questionnaires were issued, and we pick out 1386 effective questionnaires of the target price policy response of farmers, the sample data of the survey is large enough, can reflect the basic cognition of the farmer to the target price policy.

2.2 Mathematical formulas and equations

Whether the farmers continue to plant the cotton depends on the size of the expected income and the risk cost of the farmers after the promulgation of the target price: when the expected income of farmers is greater than the cost of risk after the promulgation of the policy, farmers will be willing to continue to grow cotton, otherwise it is not willing to. Under normal circumstances, the risk cost of the farmers are including the loss caused by the difficulty of the cotton sales, cotton prices fell which lead to the income is less than grew other crops or the opportunity cost of wage income, and insurance compensation mechanism is not perfect. Assuming that farmers are rational "economic man", with the pursuit of the maximization of income, you can set the function of whether the farmers continue to plant the cotton as a function of:

$$I_c = \pi_c - (D_c + B_i + S_c) - C_c \quad (1)$$

In the Eq. (1), π_c is the expected income for farmers to continue planting cotton; D_c is the transaction costs of farmers in the process of selling cotton, such as searching for buyers, bargaining, etc. B_i is the income for planting other crops or wages of going out to work; S_c is the loss caused by the imperfect insurance compensation mechanism; C_c is the cost of cotton planting. Theoretically, if I_c>0, the farmers continue to plant the cotton, otherwise, farmers may switch to grow other crops, or go out to work.

Based on the above hypothesis, this paper constructs the logistics model as follows:

Among them, whether the farmers continue to plant the cotton (Y1) is binomial variable, the model form is:

$$\ln\left(\frac{p}{1-p}\right) = \beta_0 + \sum_{i=1}^{P} \beta_i x_i \quad (2)$$

In the Eq. (2), P is the probability of farmers continue to plant the cotton, that is the probability of Y=1, 1- P is the probability of farmers don't continue to grow cotton farmers that is the probability of Y =0. I is the number of variables that affect the willingness of farmers to grow cotton. In this paper, the influencing factors are set to 13 independent variables, β_0 is intercept (constant), β_i is the factor of regression coefficient.

Select the behaviour of the farmers to continue planting from the farmers who are willing to grow, because the behaviour of farmers growing cotton was defined as three levels in the sample, which could be arranged from high to low, is an ordered categorical variable, this paper selects the multivariate ordinal Logistic regression model. The model form is:

$$\ln\left(\frac{p(y\leq j)}{1-p(y\leq j)}\right) = a_j + \sum_{i=1}^{P} \beta_{ij} x_{ij} + \varepsilon_{ij}\,; \quad j = 1,\ 2,\ 3 \quad (3)$$

In the Eq. (3), y was interpreted as a variable "farmer's planting behaviour", and the explanatory variables that affect y are recorded as X_{ij}, a_j is a constant term, ε_{ij} is a random disturbance term, β_{ij} is the regression coefficient of influencing factor, $p(y \leq j)$ is cumulative probability of the j and below j

3 Econometric analysis and interpretation

3.1 Model specification

In this paper, the spss19.0 statistical analysis software is used to estimate the two logistics models and the ordered multi class Logistic model. The model I and model III both included all the explanatory variables. In model II and model IV, non-significant explanatory variables were removed. The dependent variable of model I and model II is "whether the farmer is willing to continue planting", so in the model III and model IV "future behavior of farmers to continue planting "data is from the model I and model II in the elimination of farmers who do not want to continue to grow cotton. Two dependent variables correspond to four models, estimated results are shown in table 2. Because the model II and model IV eliminated the variables that were not significant, which can more clearly reflect the impact of significant variables on farmers' willingness to grow cotton, and the situation of farmers' choice of growing cotton. Therefore, the following analysis will be based on the regression results of the model II and model IV.

3.2 Model estimation results

3.2.1 The impact of the characteristics of farmers

Age is an important factor affecting whether farmers continue to grow cotton, the age variable in the model of whether the farmers continued to grow cotton through the 5% level of significance test and its coefficient is positive, it shows that in the case of other conditions unchanged, older farmers continue to grow cotton will be greater, for each additional unit of age, the occurrence of willingness to continue planting will increase by 4.7%.This paper believes that the reasons are the following three aspects: First, the older farmers planting cotton longer, the more the farmers have enough experience in the market changes, the more

it can deal with the risks brought by the policy reform; Second, the farmers who have the longer farming time and the age is older, Changing the tools of production is more difficult, and the cost of planting crops is greater; Third, older farmers have more cotton related social relations and easier to carry out the sale of cotton contacts and exchanges, and the price of cotton is more easily guaranteed, so their willingness to continue to grow cotton is stronger.

Table 1 –The meaning of variables, assignment and descriptive statistics analysis results

classification	Variable name and code	Variable description and assignment	mean value	standard deviation
dependent variable	whether the farmers continue to plant the cotton(y1)	Willing to=1, not willing to =0	0.98	0.15
	The farmers' planting behavior(y2)	Expand the area =1, maintain the same =2, reduced area =3	1.92	0.73
The characteristics of farmers	Age	Fill out the actual situation	45.35	11.26
	planting area	Fill out the actual situation	50.36	94.91
	The proportion of the total income of cotton	Fill out the actual situation	76.36	26.43
The cognitive situation of the target price policy	Understanding level of the target price policy	A better understanding of =1, heard of =2, do not know =3	1.93	0.77
	Farmers' expectation of future income	Very good =1, very bad =2, do not know =3	2.02	0.92
	The income from planting cotton is not as good as other crops or the income of non-farm income	Agree with =1, do not agree with =2	1.33	0.47
The risk assessment of cotton planting and coping	Farmers' awareness of the risk of cotton planting	High risk =1, general risk =2, low risk =3	1.48	0.63
	Farmers' perception of the degree of difficulty in sales of cotton	great difficulty =1, little difficulty =2, no difficulty =3	1.77	0.79
	The satisfaction degree of insurance service of agricultural insurance company	Very satisfied with =1, satisfied with =2, generally satisfied with =3, not satisfied with =4	2.57	0.92
	Farmers' understanding of cotton insurance	Very understanding =1, the general understanding =2, do not understand =3	2.00	0.58
	Whether or not to purchase cotton insurance	No =0, yes =1	0.65	0.48
Economic geography position	In the northern and southern of Xinjiang	In the northern of Xinjiang =0,in the southern of Xinjiang =1	0.72	0.45

3.2.2 The impact of the farmer's perception of the target price policy

The farmer's perception of the target price policy is an important factor to affect the farmers' behaviour. The significance test of the 5% level was adopted in the modelⅣ, and its coefficient is negative, that is, compared to farmers who do not understand the cotton target-price policy, farmers who have more understanding or heard of the target price policy, but also reluctant to continue to grow cotton. The possible reason is that: for farmers who are not familiar with the target price, farmers do not know how the changes in policy affect the market and their income, as usual, they continue to grow cotton; For farmers who have heard of the target price policy, the changes of policy make the farmers produce uncertainty psychology and for the future whether to continue to grow cotton with a wait-and-see attitude; For farmers who have a better understanding of the target-price policy, the master and understand the cotton target price policy is more adequate, therefore it can be estimated by the existing national policy subsidy information on their income, when the government subsidies cannot make up for the cost of their own expenses, farmers will choose not to continue to grow cotton, instead of working or planting other crops to make up for losses.

3.2.3 The impact of the farmer's risk assessment on cotton planting

(1) Farmers' evaluation of risk of cotton planting is an important factor to affect the farmers' planting behaviour. The risk assessment variables in model Ⅲ and model Ⅳ have passed the 1% level of significance test, and its coefficient is positive. The calculation results show that in the case of other conditions unchanged, the greater the risk of cotton growing the easier for farmers to reduce the planting area. In recent years, the government promulgated the "four grain subsidy", the minimum grain purchase prices, the abolition of agricultural tax and a series of subsidy policy to improve the farmers' enthusiasm. In the case of large fluctuations in the earnings of cotton planting, farmers with higher risk perception will reduce the planting area of cotton, and grow food crops.

(2) Farmers' perception of the difficulty degree in sales of cotton has an important influence on whether or not the farmers continue to grow the cotton and farmers' cotton planting strategy. In the model Ⅲ and model Ⅳ, the farmer who has great difficulty in selling large sales has passed the significant test of the 10% level and the coefficient is positive, however, the "little difficulty" and "no difficulty" of the farmers in the model Ⅰ and model Ⅱ have not passed the significant test. The above results show that compared with the "no difficulty" of the farmers, the greater the difficulty in selling the cotton, the greater the possibility of farmers to reduce the cotton planting area. In model Ⅳ, the significant test of the 1% and 5% level was adopted in the household who think cotton sales the "great difficulty" and "little difficulty", and the coefficient was positive. Model results show that in the case of other conditions unchanged, the more difficult the farmers to sell cotton, the lower the farmers income is, farmers will reduce the cotton planting area, increase the planting area of other crops, so as to improve the economic benefit.

(3) Farmers' understanding of cotton insurance is an important factor for farmers' cotton planting strategy. In the model Ⅲ and model Ⅳ, the farmer who was "Very understanding" cotton insurance has passed the significant test of the 1% level, and its coefficient was negative, however, the farmers whose understanding degree of cotton insurance is in general

or do not understand, are not through the significant test in the two models, it shows that the farmers' understanding of cotton insurance is different which will lead to different farmers behaviour. The main reason is that, with the increase of farmers' acceptance of cotton insurance, the purchase of insurance will increase. Insurance will increase farmers' ability to withstand market risks, to ensure the income of farmers, so, farmers with higher acceptance of cotton insurance will not reduce the cotton growing area.

(4) Whether the farmers buy the cotton insurance has an important influence on the behaviour of the farmers to continue to grow cotton. In model II "Whether to buy Cotton insurance" is a variable through the 1% level of significance test and its coefficient is negative. The results of the model show that in the case of other conditions unchanged, the willingness of farmers which have bought insurance to maintain or expand the acreage of cotton is stronger, and reduced area will be weaker. The reason is: for a family, the purchase of cotton insurance can reduce the risk of cotton planting, and protect the family income. Farmers who did not buy Cotton insurance tended to cut or keep the cotton acreage.

3.2.4 The effect of economic geography position on the cotton planting behaviour of farmers

The farmer's location has important influence on the cotton planting behaviour. The position variables in model III model and IV have passed the 1% level of significance test and its coefficient is positive. The model results show that under the same condition, compared with cotton farmers in the southern of xinjiang, cotton farmers who are live in the northern region of xinjiang tend to reduce or maintain the planting area. The reason lies in: the economic development of northern Xinjiang is faster, and its changes in prices caused by policy changes is more obvious, the risk of planting for farmers is greater, therefore, farmers in northern Xinjiang tend to maintain or reduce the planting area, because of the southern region of cotton farmers can get more subsidies, the Southern farmers tend to expand or maintain the planting area.

4 Conclusion and Enlightenment

Based on the above empirical analysis, we can get the following revelation:

First, because China's agricultural market development is still not perfect, the difference between the north and the south of Xinjiang is obvious, and cotton insurance mechanism is not perfect, many types of insurance and advisory body in the agricultural insurance companies have not yet been fully built. Therefore, the government should further strengthen the implementation and innovation of agricultural insurance system.

Second, farmer's marketing channel is not smooth, in the process of selling cotton, farmers need to face the situation of the low-cost acquisition, farmers bear a larger market risk. In the cotton sales, the local government needs further liberalization of agricultural products business channel, make full use of the Internet, Taobao and other network sales platform, allows different business entities to enter the field of circulation to participate in market competition, establish and improve the market system of agricultural products.

Third, the government needs to improve the target price subsidy policy to protect the income of farmers, at the same time increase policy advocacy efforts, and promote key technologies. Local governments can give appropriate subsidies to farmers who adopt new production technology, give farmers technical guidance and support more machinery subsidy etc.

Table2 – Model regression results

Dependent variable / Independent variable	Option	Whether farmers continue to grow cotton		Farmers planting behavior	
		model I	model II	Model III	model IV
Age	age	.046**	.030*	0.005	—
planting area	area	0.003	—	0	—
The proportion of the total income of cotton	proportion	-0.001	—	0.002	—
Understanding level of the target price policy	A better understanding	-18.116	-1.828**	0.006	—
	heard of	-17.91	-1.801**	0.034	—
Farmers' expectation of future income	Very good	.999*	.717*	-0.193	.389***
	very bad	1.056	0.823	-0.211	.397
The income from planting cotton is not as good as other crops or the income of non-farm income	Agree with	0.093	—	-.360**	—
Farmers' awareness of the risk of cotton planting	High risk	1.104	—	.699***	.686***
	general risk	1.003	—	.493*	.431**
Farmers' perception of the difficulty degree in sales of cotton	great difficulty	-0.161	—	.618***	.634***
	little difficulty	0.517	—	0.243	.294**
The satisfaction degree of insurance service of agricultural insurance company	Very satisfied	0.25	—	-0.028	—
	satisfied	-17.513	—	-0.173	—
	generally satisfied	-17.038	—	-0.024	—
Farmers' understanding of cotton insurance	Very understanding	-0.792	—	-.591**	-.649***
	general understanding	1.035	—	0.192	0.162
Whether or not to purchase cotton insurance	No	0.959	—	-0.051	-.350***
In the northern or southern of Xinjiang	In the northern of Xinjiang	0.755	—	.609***	.443***

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