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Economic Effectiveness of Specialized Households of Project of Cattle Feeding Based on Crop Residues

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Abstract. The small-scale specialized households are the main body of the project of cattle feeding based on crop residues (CFCR), they are accounting for more than 90%. However, the numbers is quickly declined in recent years for the poor economic effectiveness of specialized households. This paper explains why with the following research. The calculation method of the economic effectiveness of specialized households of CFCR is given based on the analysis of all the inputs and outputs, with the special indicator of profit-oriented of one cattle monthly, and the profits of the specialized households are measured by the opportunity costs of going out to work. A micro-level study is carried out in a typical county of center China to assess the above theory research.

1. Introduction

The project of cattle feeding based on crop residues (CFCR) has been implemented in China for 17 years. It is good to increase beef outputs, save in feed grain, and promote a virtuous circle of farming system with sustainable development [1]. The small-scale specialized households are the main body of CFCR according to the 2008 Chinese statistics yearbook of animal husbandry, the scale within 100 heads of the total numbers of beef cattle is accounting for 97.34%, and the scale within 100 heads of all the feeding dairy cows is accounting for 98.7% [2]. But the numbers is quickly declined in recent years for the poor economic effectiveness of specialized households [3].

According to the model of CFCR with the core of the specialized households, which suited with the national conditions, it is necessary to study the economic effectiveness of specialized households of CFCR. So the government could take the management method of "seizing the middle, and promoting the others", and seize the scattered specialized households of CFCR with the support policies, and drive the other concentrated steps in this way, such like calf production, beef cattle fattening and dairy production, in order to promote the sustainable development of the industry of CFCR [3]. The paper is helpful to give the reasonable management methods for the government.

In this paper, we began by analyzing all the inputs and outputs of specialized households of CFCR; next, the calculation methods of the economic effectiveness are set up; thirdly, the profits of the specialized households are measured by the opportunity costs of going out to work; and finally, a micro-level study is carried out in a typical county of center China.

2. The inputs and outputs

The project of CFCR is a complete production activity, and has the general nature of economic activity, which is that it has inputs and outputs. The elements of the inputs and outputs of specialized households of CFCR are showed in figure 1.

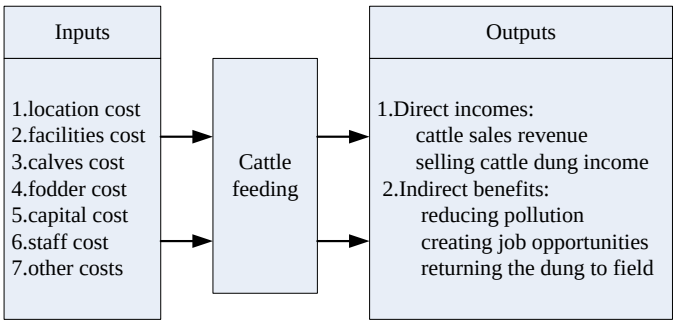

Fig1 Analysis of the relationship between input and output of CFCR by specialized households

The farmers of specialized households of CFCR would not give their labor payments by themselves. Therefore, the simple balance of the farmers is that the economic benefits of cattle feeding are equal to going out for a work. Otherwise, the farmers would prefer to work outside rather than feeding cattle in the home.

Here, we supposed the following situations of the typical specialized households of CFCR: The family has L Labors of people; the common income of a labor yearly is X RMB; the net profit of feeding one cattle is A RMB; the minimum scale for cattle feeding is Y heads; the labor conversion factor is μ ($\mu = 0.7$). So we can get the following equation if not considering the time value of the capital:

$$A \cdot Y \geq \mu \cdot L \cdot X \tag{1}$$

Then, the formula of calculating the minimum scale for cattle feeding is got by rearranging the above equation.

$$Y \geq \frac{\mu \cdot L \cdot X}{A} \tag{2}$$

Here, we emphasize that all the parameters used in the equations are converted as the single cattle consume cost, and the cycle of feeding one cattle is N months, the parameters of calculating economic benefits are shown in table 1.

Tab. 1 The economic benefits calculation parameters of CFCR of specialized households

	activities		symbol	unit
inputs	Land rental cost		I_1	RMB
	Calf cost		I_2	RMB
	Fodder cost	Crush fodder	I_3	RMB
		Concentrated fodder	I_4	RMB
	Labor cost		I_5	RMB
	Vaccine cost		I_6	RMB
	Water and fuel cost		I_7	RMB
	Transportation cost		I_8	RMB
	Depreciation cost of fixed assets		I_9	RMB
	Interest cost on the loan		I_{10}	RMB
	The total costs		I	RMB
outputs	Selling cattle revenue		O_1	RMB
	Selling cattle dung income		O_2	RMB
	The total incomes		O	RMB
economic Effectiveness	Cost-profit margins		λ	%
	The profit of one cattle monthly		H	RMB
	The profit compared with part-time work		Z	RMB

The total costs include all the costs in the period of feeding one cattle, the formula is:

$$I = I_1 + I_2 + I_3 + I_4 + I_5 + I_6 + I_7 + I_8 + I_9 + I_{10} \tag{3}$$

The gross incomes include selling cattle revenue and selling cattle dung income, the calculation equation is the following:

$$O = O_1 + O_2 \tag{4}$$

3. The model

Here, we think that it is reasonable that the personal labor costs should not be included in the equations of calculating economic effectiveness of specialized households in order to compared profit with going out for a work.

The equation of calculating cost-profit margins is:

$$\lambda = \frac{O - I}{O} \tag{5}$$

The profit of one cattle monthly can be got with the following formula:

$$H = \frac{O - I}{N} \tag{6}$$

Thus, the net income of specialized households by one cattle would be as A , that can be calculated by the following formula:

$$A = 12H = \frac{12(O - I)}{N} \tag{7}$$

If Y_1 is heads of cattle by the specialized households yearly, then we got the net income of specialized households yearly, which as E ,

$$E = AY_1 \tag{8}$$

The opportunity profit of going out for a work can be D , according to equation 1 and equation 2, the formula is:

$$D = \mu \cdot L \cdot X = AY \tag{9}$$

We supposed that Z is the difference profits between cattle feeding and going out for a work, which can be got in the following formula:

$$Z = E - D = A(Y_1 - Y) \tag{10}$$

It is easy to get the following condition:

If $Y_1 < Y$, then $Z < 0$.

It tells us that the economic effectiveness is bad when the scale of specialized households of CFCR is too small, the situation of going out for a work would be in action.

4. A micro-level study

Early 2009, we conducted the survey of the project of CFCR in Yanshi County with the help of Animal husbandry bureau of Henan Province and Center for Control and Prevention of Animal Infectious Disease of the local government. The questionnaires about feeding beef cattle by specialized households are finished by the local people, which are chosen with stratified random sampling. The data sample is 60, about 4.3% of the whole specialized households with different scale and different breeding methods.

4.1 The regression model

We use SPSS17.0 software to process the data. The statistical descriptions are shown in table 2.

As shown in Tab.2, the profit of one cattle monthly of specialized households in Yanshi County is 159 RMB on average, and the maximum is 284 RMB, the minimum is 20RMB.

Table 2. Descriptive statistics

activities	unit	N	Min	Max	Mean	Std. Deviation
Land rental cost (X1)	RMB	60	.00	7.50	.5913	1.51144
Calf cost (X2)	100 RMB	60	.33	10.00	1.9548	2.04575
Crush fodder (X3)	100 RMB	60	.00	1.08	.0411	.16802
Concentrated fodder (X4)	100 RMB	60	.00	3.60	.9968	.59670
Labor cost (X5)	10RMB	60	.00	2.67	.1078	.43901
Vaccine cost (X6)	10RMB	60	.00	2.22	.1215	.36804
Water and fuel cost (X7)	RMB	60	.00	7.20	2.2835	1.60574
Transportation cost (X8)	RMB	60	.00	5.83	.5247	1.28490
Depreciation cost of fixed assets(X9)	10RMB	60	.08	4.89	1.2493	1.18093
Interest cost on the loan (X10)	10RMB	60	.00	3.13	.1253	.53688
Selling cattle revenue(X11)	100 RMB	60	1.21	15.75	4.7741	2.63141
Selling cattle dung income (X12)	RMB	60	.00	5.00	.3274	.94807
The profit of one cattle monthly (H)	100 RMB	60	.20	2.84	1.5902	.65696

Through analyzing the scatter and the correlations of descriptive statistics, we find the following costs that have strongly linear dependence relation with the profit of one cattle monthly (H): calf cost (X2), concentrated fodder (X4), water and fuel cost (X7), depreciation cost of fixed assets(X9), and selling cattle revenue(X11), so we let them to enter the predictive equation by presenting the enforced regression methods.

Then, the regression model of H can be also got from the software in the following:

$$\hat{H} = 0.299 - 0.871X_2 - 0.948X_4 - 0.038X_7 - 0.03X_9 + 0.866X_{11} \tag{11}$$

Table 3.Model Summaryb

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.961[a]	.923	.916	.19000	.923	130.278	5	54	.000
a. Predictors: (Constant), X11, X9, X7, X4, X2									
b. Dependent Variable: H									

Table 3 is the model summary made by the software. It tells us that the following information:

$R = 0.961$, the correlation coefficient is 0.961, and is very close to 1, that indicates a strong linear relationship between the independent variables and the dependent variable;

$R^2 = 0.923$, the coefficient of determination is 0.923, and

$R^2 = 0.916$, the adjusted determination coefficient is 0.916, those means the regression model fits the data in a high level. The percentage is more than 91.6%; the model has the strongly explanatory power.

Table 4. Descriptive statistics of ANOVAb

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	23.515	5	4.703	130.278	.000[a]
	Residual	1.949	54	.036		
	Total	25.464	59			
a. Predictors: (Constant), X11, X9, X7, X4, X2						
b. Dependent Variable: H						

Table4 is the descriptive statistics of ANOVA made by the software. We can get the following information:

$F = 130.278$, the F-statistic is 130.278, and at the same time, $p = 0.000$, the signal statistic is much smaller than 0.0001. All those indicate that the linear relationship between the independent variables and the dependent variable is clear, and the regression equation is statistically significant.

The residual analysis of the regression equation is as shown in figure 2, figure 3 and figure 4.

We can think that the residual distribution is approximate to the normal distribution, and basically meet the assumption of homogeneity variance from these figures.

So we can essentially accept the model based the above tables and figures, and we also can get the useful information from the regression equation. The main factors that affecting the profit of one cattle monthly by specialized households (H) are calf cost (X2), concentrated fodder (X4), water and fuel cost (X7), depreciation cost of fixed assets(X9), and selling cattle revenue(X11), the most important factor is concentrated fodder (X4), and the minimal factors are water and fuel cost (X7), depreciation cost of fixed assets(X9). The conclusion is useful to the government for the management of CFCR.

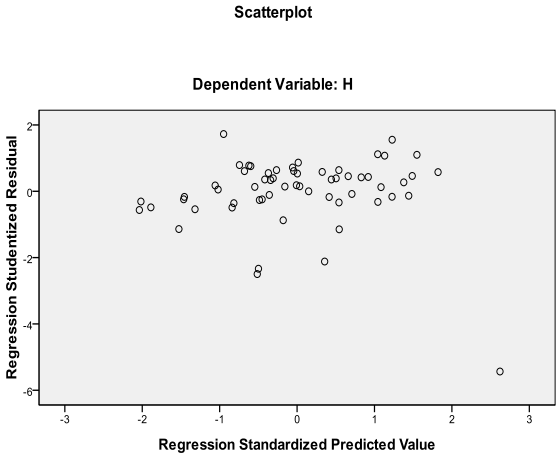

Fig.2 Scatter of ZPRED and SRESID

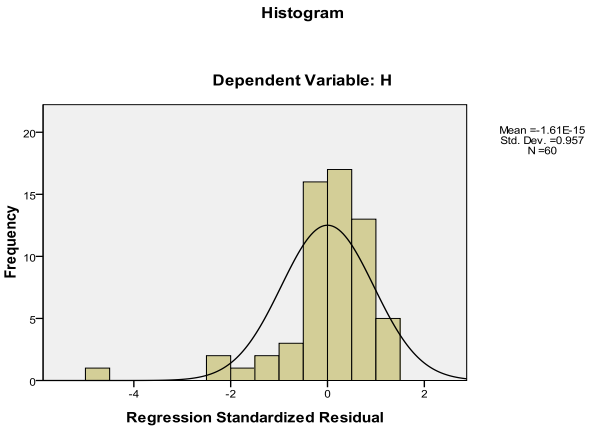

Fig.3 Bar of residual

4.2 The Minimum Scale

The net income of specialized households by one cattle can be got from equation 7 when we learn that the profit of one cattle monthly is 159 on average. The calculating formula is,

$$A = 12H = 12 \times 159 = 1908$$

At the same time, we also get the other data from the survey, $X = 8683$, $L = 2$, then, according to the equation 1 and equation 2, the minimum scale for cattle feeding would be 7 heads that can be got from the following formula,

$$Y \geq \frac{\mu \cdot L \cdot X}{A} = \frac{0.7 \times 2 \times 8683}{1908} = 6.371 \approx 7$$

4.3 The Net Loss of the Specialied Households

The scale of feeding cattle by the local people is 3.2 heads on the average based the survey, so we can get the net loss of the specialized households from the equation 10.

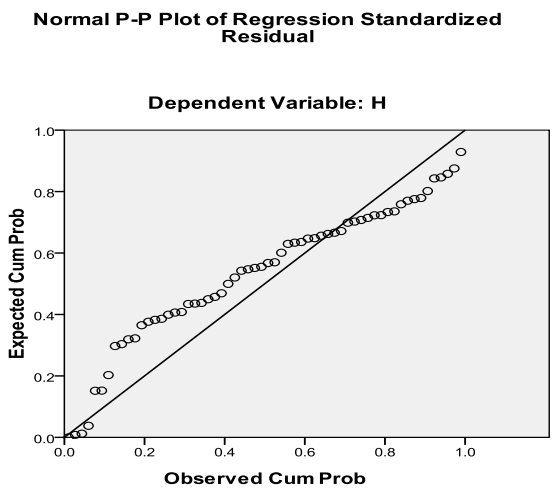

Fig.4 Normal P-P plot of residual

Here, we have the following data:

$Y_1 = 3.2$, $Y = 6.371$, $A = 1908$,

Then, we get the net loss through the following formula,

$$Z = A(Y_1 - Y) = 1908 \times (3.2 - 6.371) = -6050$$

That means the net loss of the specialized households in Yanshi County is 6050 RMB.

5. Conclusion

We can get the conclusion that the economic effectiveness of specialized households of CFCR in Yanshi County is bad, and the net loss compared with part-time job is about 6050 RMB. This is the reason why the local young people would go out for a work rather than feeding cattle at home. It is not good for the project of CFCR. The government should take some management methods to improve the project.

Acknowledgments

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