Catalyzing Innovation
ANNUAL WORLD BANK CONFERENCE ON LAND AND POVERTY
WASHINGTON DC, MARCH 25-29, 2019

RESEARCH On The MODERATE-SCALE Of APPLE FARMERS In DIFFERENT TARGETS

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INTRODUCTION

Firstly, under the background of market deepening, population transformation and urban-rural integration, the agricultural production target has changed from the traditional goal of "developing production and ensuring supply" to the dual goal of "increasing grain output and farmers' income", and the small-scale business model has been increasingly challenged.

Secondly, it has become an inevitable choice for agricultural development to innovate agricultural management system and expand agricultural management scale.

Thirdly, since 1987, the China's government has proposed a number of ways to implement moderate scale operations, and the problem has been a constant concern

Fourthly, in the critical period of dietary structure transformation of Chinese residents, the development of apple moderate scale operation is of great significance to improve apple production, reduce production costs and increase income of fruit farmers.

Questions:
How much farmland does the apple farmer need to manage? Considering output maximization?
Or net-income maximization? Or cost minimization?

MATERIALS | METHODS

Methodology

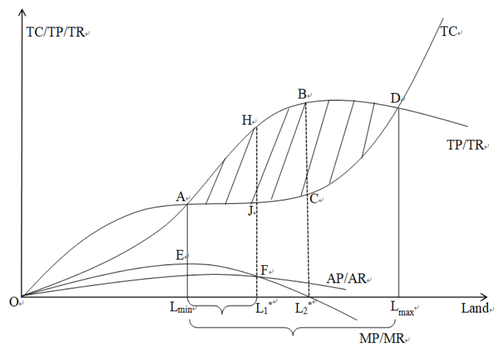

Figure 1 Economic analysis on moderate scale in different targets

The moderate-scale of apples in terms of output maximization （0， L_1^*] ;
The moderate-scale of apples in terms of net-income maximization [L_{min}， L_2^*]
The moderate-scale of apples in terms of cost minimization （0， L_2^*]
Considering three targets [L_{min}， L_1^*]

Materials

The data in this paper is derived from the questionnaire survey of 663 apple growers in shaanxi province conducted by the national apple industry system research group in 2015

Table 1 Sample Distribution

Region	Xianyang City			Yanan City				Weinan City
Country	Changwu	Binxian	Xunyi	Baota	Yichuan	Fuxian	Luanchuan	Baishui
Samples	80	82	83	78	85	87	82	84
Proportion	12.10	12.41	12.56	11.80	12.86	13.16	12.41	12.71

Methods

Input-Output Model

$$\ln Q_i = \alpha_0 + \sum_{j=1}^{3}\alpha_j \ln X_{ij} + \frac{1}{2}\sum_{j=1}^{3}\sum_{j=1}^{3}\gamma_{jj} \ln X_{ij} \ln X_{ij} + \delta_1 Age_i + \delta_2 Age_i^2 + \delta_3 Edu_i + \delta_4 Land_i$$
$$+\delta_5 Plant - y_i + \sum_{n=1}^{4}\eta_n Scalabeldummy_{in} + \sum_{m=1}^{2}\lambda_m Regionaldummy_{im} + \mu_i$$

Net-income Model

$$\ln R_i = \alpha_0 + \beta_0 \ln Plot_i + \sum_{j=1}^{3}\left(\alpha_j + \beta_j \ln Plot_i\right)\ln X_{ij} + \frac{1}{2}\sum_{j=1}^{3}\sum_{j=1}^{3}\gamma_{jj} \ln X_{ij} \ln X_{ij} + \delta_1 Age_i$$
$$+\delta_2 Age_i^2 + \delta_3 Edu_i + \delta_4 Land_i + \delta_5 Plant - y_i + \sum_{n=1}^{4}\eta_n Scalabeldummy_{in} + \sum_{m=1}^{2}\lambda_m Regionaldummy_{im} + \mu_i$$

Cost Model

$$LnC_i = \lambda_{oi} + \lambda_{1i} HS_i + \lambda_{2i} X_{2i} + \lambda_{3i} Plot_i + \delta_1 Age_i + \delta_2 Age_i^2 + \delta_3 Edu_i + \delta_4 Land_i$$
$$+\delta_5 Plant - y_i + \sum_{n=1}^{4}\eta_n Scalabeldummy_{in} + \sum_{m=1}^{2}\lambda_m Regionaldummy_{im} + \mu_i$$

ACKNOWLEDGEMENTS

I would like to thank professor Xuexi HUO for his valuable Suggestions on the paper modification and improvement, and thanks to the members of the national apple industry system research group for their help in the data collection.

RESULTS

Table 2 Descriptive analysis of major variables

Variables	Mean	SD	Minimum	Maximum
Output（jin）	23490.92	17552.97	200.00	140000.00
Net-income of apples（yuan）	37154.84	50732.12	-70360.00	665786.00
Input of labors（work day）	226.74	244.19	26.50	5442.00
Land（mu）	7.14	4.77	0.50	35.00
Input of capital（yuan）	27532.74	20500.95	1230.00	191360.00
The sex of the household's heads	0.98	0.13	0	1
The age of the household's heads（year）	50.86	8.80	24	75
Years of schooling for the head of household（year）	7.92	3.04	0	15
Land fragmentation（patch）	2.75	1.63	1	16
Number of family farmers（people）	2.13	0.68	1	7

Table 3 Parameter Estimates of Input-Output Model

Variables	Input-Output Model Ⅰ		Input-Output Model Ⅱ	
	coefficient	robust standard errors	coefficient	robust standard errors
Labor	4.761***	1.313	4.791***	1.302
Land	-3.022**	1.455	-2.931**	1.433
Capital	1.420	1.666	1.400	1.655
Labor^2	-0.141***	0.043	-0.142***	0.043
Land^2	-0.191*	0.103	-0.202**	0.093
Capital^2	0.019	0.116	0.021	0.116
Labor*Capital	-0.336**	0.149	-0.338**	0.148
Labor*Land	0.378**	0.161	0.377**	0.157
Land*Capital	0.187	0.180	0.186	0.178
3-8mu	0.065	0.098	-	-
8-13mu	0.085	0.148	-	-
13-23mu	0.119	0.194	-	-
More than 23mu	0.015	0.339	-	-
Xianyang	-0.202***	0.055	-0.203***	0.055
Yanan	-0.112**	0.056	-0.114**	0.056
Constant	-10.094	6.582	-10.086	6.536
Adjust R^2	0.6932		0.6927	
White Heteroskedasticity Test	286.66*		233.63***	
Samples	661		661	

Table 4 Test results of input-output elasticity of factors and constant return to scale

Model	Output Elasticity of Factors			Scale Return	H_0: Constant Returns to Scale	
	Labor	Land	Capital	Coefficient	F-value	Significant Level
Input-Output ModelⅠ	1.223	0.414	0.232	1.869	2.48*	0.0845
Input-Output ModelⅢ	1.231	0.478	0.220	1.929	3.10**	0.0457

Table 5 Parameter Estimates of Net-income Model

Variables	Net-income Model Ⅰ		Net-income Model Ⅱ	
	coefficient	standard errors	coefficient	standard errors
Labor	1.172	10.327	-0.385	10.309
Land	-45.198***	11.020	-48.336***	10.848
Capital	58.071***	14.038	59.806***	13.986
Labor^2	-0.685	0.517	-0.659	0.514
Land^2	-4.651***	0.999	-3.700***	0.820
Capital^2	-3.673***	1.026	-3.804***	1.023
Labor*Capital	0.732	1.383	0.865	1.381
Labor*Land	2.233	1.430	2.361*	1.423
Land*Capital	4.820***	1.504	4.856***	1.503
3-8mu	-0.386	1.017	-	-
8-13mu	0.825	1.657	-	-
13-23mu	1.022	2.416	-	-
More than 23mu	6.411	4.130	-	-
Xianyang	-1.213	0.782	-1.209	0.780
Yanan	-0.839	0.759	-0.888	0.759
Constant	-233.551***	52.159	-236.586***	51.994
Adjust R^2	0.1335		0.1321	
White Heteroskedasticity Test	270.68		200.04	
Samples	661		661	

Table 6 Parameter Estimates of Cost Model

Variables	Total cost	Fertilizer cost	Org-Fertilizer cost	Pesticides cost	Bag cost	Tapetum-lucidum cost	Labor cost
Number of farmers	0.087**	0.134	0.025	-0.001	-0.080	-0.342	0.121***
Land	-0.012	-0.140**	0.206**	-0.045**	0.009	0.185*	-0.022
Land fragmentation	-0.013	0.105**	0.007	-0.063***	0.018	0.051	0.001
Age of household's heads	0.013	0.009	0.072	0.007	0.033	-0.024	0.008
Age of household's heads ^2	-0.000	-0.000	-0.001	-0.000	-0.000	-0.000	-0.000
Years of schooling of household's head	0.010	0.023	0.142**	0.012	0.004	-0.005	0.009
Planting years	-0.017***	-0.020*	0.009	-0.021***	0.004	0.071***	-0.014***
Land transfer	-0.003	0.178	0.681**	0.006	-0.161	-0.232	-0.085
3-8mu	-0.095	0.262	-0.565	-0.122	-0.071	-0.595	-0.135*
8-13mu	-0.091	0.757	-0.981	0.008	0.058	-0.970	-0.129
13-23mu	-0.050	1.757**	-2.353*	0.217	-0.004	-1.653	-0.061
More than 23mu	0.044	-2.418	-3.267	0.533	-0.172	-4.848*	0.170
Xianyang	0.144***	0.381	0.291	0.071	0.060	-1.575***	0.107*
Yanan	0.224***	-0.206	-0.033	0.214***	-0.044	-0.231	0.253***
Constant	1.278**	-0.564	-5.936*	-0.986	-1.976**	-3.970	0.497
Adjust R^2	0.0912	0.1411	0.0466	0.1427	0.0038	0.0916	0.1066
White Heteroskedasticity Test	152.58***	88.87	143.63***	134.67**	96.58	172.54***	136.16**
Samples	661	661	661	661	661	661	661

CONCLUSIONS

Firstly, whether under the goal of the output level of farmers, net income of farmers or under the goal of scale economy, there exists a moderate scale in theory while there are significant differences among the moderate scales under different goals in reality. As far as the perspective of guaranteeing apple supply, namely oriented by the maximization of farmers' output level, the optimal moderate scale of shaanxi apple farmers should be within 13-23 mu.

Secondly, considering the impact of land fragmentation, Shaanxi's apple production is increasing returns to scale, but is no significant economies of scale, that is, the increase in labor, land and capital doubled is one time, the increase in apple output is more than one time; the output elasticity of labor, land and capital is positive in the setting range of this paper, but with the continuous expansion of apple planting scale, the total output is not necessarily increased.

Thirdly, the effect of aging population on apple production has not been reflected in the main apple producing areas of shaanxi. Therefore, at the present stage, it is not necessary to worry too much about the aging of fruit farmers hindering the development of apple industry. But the phenomenon of farmers' part-time job has gradually eliminated the rural demographic dividend, and continuously strengthening technical training and policy support to train a batch of new professional fruit farmers to focus on the production and operation is an urgent task for the development of apple industry.

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