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Market Channel Choice and Its Impact on Farm Household Income: A Case Study of 243 Apple Farmers in Shaanxi province, China

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Abstract

Although Shaanxi province is the largest in China, both in terms of apple production and cultivated areas, with local farmers' income mainly sourced from apples, the per-capita net income of farmers in Shaanxi province remains behind the national average. Since the market channel choice of farmers could be perceived as one of the available income strategies, this paper provides empirical evidence to measure the impacts of market channel choice on farmers' income using a Heckman sample selection model and an OLS model based on a farm household survey of 243 apple farmers in Baishui and Luochuan counties of Shaanxi province, China. Moreover, this paper discusses the different impacts of market channel choice on household income among farmers who are cooperative members and those who are not.

Discipline: Agricultural Economics
Additional key words: small-scale farmers, marketing channel, farmer cooperatives

Introduction

With the great revolution in supermarkets in recent years, the circulation channel of fresh fruits and vegetables has undergone rapid changes. Compared with traditional markets, the modern procurement system implies more demanding requirements faced by farmers, e.g. in terms of the quality, volume, and consistency of production, which may be hard for small farmers to meet. The picture is further complicated by the fact that small farmers might be excluded as producers for the new market segment (Michael et al. 2009). There is considerable debate and uncertainty regarding the impacts of these developments on farmers and poverty in developing countries.

Some literature emphasizes how the changes in the way the supply chain is organized increase the requirements and open up opportunities for small and poor farmers to access high-value markets. Furthermore, the emergence of vertically coordinated systems in supply chains may help farmers facing major market constraints to integrate in the modern supply chains (Maertens et al. 2007, Masakure & Henson 2005). Contract farming is an institutional solution to market failure in the market of credit, insurance and information (Key & Runsten 1999), and an arrangement commonly used to guarantee product quality and food safety standards. In this sense, some agencies consider contract farming one of the main instruments to link small-scale farmers to domestic and even foreign markets and thereby reduce poverty (World Bank 2007). Like the Samroiyod Shrimp Farmers' Cooperative in Thailand, farmer organizations often buy inputs in bulk and supply them to their members at lower prices and higher quality, which ensures farmers can access good-quality inputs at fair prices as well as boosting the financial sustainability of farmer organizations (Kassam et al. 2011). Through the collective action of the farmer organization, smallholders could be better-placed to tap into the high-value supply chain and compete with larger farmers and agribusinesses (Stockbridge et al. 2003). In addition, there is evidence that collective action can help smallholders reduce barriers to market entry by improving their bargain-

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ing power with buyers and intermediaries (Kherallah et al. 2002). In China, the modes of "leading enterprise + cooperative + farmers" and "supermarket + cooperative + farmers" have gained better performances in raising food safety and guarantee a steady supply chain for food products (Zhang Mei & Guo Xiangyu 2010).

Other literature indicates that small farmers are left behind in the supermarket-driven horticultural marketing channel (Kirsten & Sartorius 2002, Reardon et al. 2003). Contract farming has often been criticized as a tool for agri-industrial firms and food multinationals to exploit unequal farmers with power relationships and extract rents from the chain. Moreover, large agribusiness firms use contracts to exploit cheap labor and transfer the production risk to farmers. Another concern is that smallholders will be marginalized because companies will prefer to work with medium- and large-scale growers, thus exacerbating rural inequality (Little & Watts 1994, Singh 2002).

Some researchers describe the exiting circulation channels of agricultural products in China. At present, the main marketing channels for fresh agricultural products in China can be divided into three levels, namely, the wholesale market in the production area, the wholesale market in the consumer market, and the retail market. There are also five patterns of linkages with farmers in the circulation of agricultural products in China, namely, "farmer + professional wholesale market", "farmer + rural fairs", "farmer + middleman", and "farmer + farmer cooperative", and "farmer + processing company" (Huang Zu-hui et al. 2005). Liu cites the case of Hebei province in China to analyze three typical circulation chains in the fresh vegetable logistic system, and argues that the random supply chain based on the wholesale market in China ("farmer + professional wholesale market") incorporates the efficiency of transaction (Liu Dong-ying & Liang Jia 2007). Other researchers analyze factors influencing the farmers' choice to participate in the farmer cooperatives in southern China, such as Zhejiang and Jiangxi provinces (Zhang Q et al. 2004).

However, there has been little empirical research into the effects of farmer's market channel choice on their income, especially in the rural area of China and this paper aims to help address that gap. The case of apple farmers and their income is important for Shaanxi province because the apple industry has become a pillar of its rural economy, and plays an important role in promoting provincial economic development. Although Shaanxi province is the largest in China, in terms of both apple production and cultivated area, with local farmer's income mainly sourced from apple, the per-capita net income of farmers in Shaanxi province (RMB 4,105) remains behind the national average (RMB 5,919) in 2010. Moreover, the income gap between urban and rural residents in Shaanxi province was 3.82:1, which exceeds the national income gap (3.23:1). The task of increasing farmers' income is related to the overall situation of economic and social development in Shaanxi province. Since the market channel choice of farmers could be perceived as one of the available income strategies, the objective of this paper is to evaluate the impact of such marketing choice and other factors on farm household income, then put forward a corresponding policy to increase farmers' income.

Data and Descriptive Statistics

The apple industry is an advantageous and leading industry in the county-level economy of Shaanxi province. In 2007, the China Fruit Circulation Association awarded the honorary title of "National Top 20 county (City) for Apple production" to the top 20 counties (cities) based on their apple cultivation area, apple output, and weighted average scoring, to commend their positive contribution to

Table 1. Survey Area and Sample Distribution in Luochuan county

Township	Total Households	Sample Households	Percentage[a)]	Total Villages	Sample Villages (Households)	Percentage[b)]
Jiuxian	3328	72	2.16%	34	Luoyang (39) Jingyao (30) Awu (1) Xiyu (1) Wangjia (1)	14.71%
Yangshu	4064	22	0.54%	27	Nanyangshu (18) Hanmen (3) Xiyueshi (1)	11.11%
Jingzhao	1588	16	1.01%	15	Nananshan (16)	6.67%
Baiyi	1726	26	1.51%	10	Niutianju (26)	10.00%
Total	10706	136	1.27%	86	10	11.63%

Source: Household survey conducted by the author in 2010

[a)] Percentage of the Sample Households to the Total Households

[b)] Percentage of the Sample Villages to the Total Villages

Table 2. Survey Area and Sample Distribution in Baishui county

Township	Total Households	Sample Households	Percentage	Total Villages	Sample Villages (Households)	Percentage
Dukang	4682	32	0.68%	12	Hanji (14) Tongji (10) Shishi (8)	25.00%
Leiya	3434	41	1.19%	14	Dongfangcheng(10) Xifangcheng(12) Dawadi (12)	21.43%
Zongmu	2999	34	1.13%	12	Shisuo (8) Luoyan (14) Fuping (19)	25.00%
Total	11115	107	0.96%	38	9	23.68%

Source: Household survey conducted by the author in 2010

Table 3. Distribution of Farmers by Farmers' Income (Yuan)

County	Frequency	Total income (Mean)	Income from apple	Percentage
Luochuan	136	49,535 ($7,393)	40037.07 ($4,976)	80.83%
Baishui	107	20,971 ($3,130)	13075.27 ($1,952)	62.35%
Total	243	70,506 ($10,523)	53112.34 ($7,927)	75.33%

Source: Household survey conducted by the author in 2010
Note: The exchange rate was RMB 6.7 per U.S. dollar at the time of the survey (IMF, 2010)

the Chinese apple industry, such as promoting regional distribution, professional production, industrial management, standardization, and further enhancing the scale. Luochuan county ranked fifth with an apple cultivation area of 33,557 hectares and output of 510,000 tons. Baishui county ranked eighth with an apple cultivation area of 20,355 hectares and output of 439,600 tons. According to our survey, the main apple circulation mode in Baishui county is the same as that in Luochuan county.

The data for this study comes from a farm household survey in two counties (Luochuan and Baishui counties) of Shaanxi province in 2010. This survey is based on a representative sample of apple-growing counties in Shaanxi province. 248 farm households were interviewed and 243 effective questionnaires were collected, namely, 136 in Luochuan county and 107 in Baishui county. The farmer questionnaire included a series of questions concerning household characteristics, assets, apple production and marketing, farm and off-farm income and input costs, etc. Tables 1 and 2 show the sample distribution in Luochuan and Baishui counties.

According to our survey, 51% of sample farmers are aged between 46 and 60 years, and 36% aged between 31 and 45 years. Only a small proportion is aged under 30 years (6%) or above 60 years old (7%) respectively. With regard to the education level, the majority of farmers, 55% of the overall sample farmers attain a secondary education. 82% of sample farmers have a secondary education or below, and just 16% completed the high school education. The average cultivation area per household is 10.10 mu (0.67 ha), and the average apple cultivation area per household is 7.07 mu (0.47 ha). 43% of the total sample households use all cultivated area for growing apples, 77% use half their cultivated area for growing apples.

Therefore, income from apple is the main source of farm income for local farmers, accounting for 75.33% of total gross income per household (Table 3). It should be noted that the very significant difference of income level between Luochuan and Baishui counties. In Luochuan county, the average income per household is RMB 49,535 ($7,393), where income from apples comprised 80.83% of the total gross income. In Baishui county, the average income per household is RMB 20,971 ($3,130), where income from apples comprised 62.35% of the total gross income (Table 3). The high proportion of income from apples of the total household income suggests that the main development strategy for the apple industry and farmers' income involves increasing the added value of apples instead of improving apple production and cultivation area in Shaanxi province.

Analytical Framework and Estimation procedure

To evaluate the impacts of market channel choice (MCC) on farmers' income, we can estimate the population model as

$$y_i = \beta x_i + \varepsilon_i$$

Table 4. Definition of Variables

Variable	Definition	Mean	Expected Sign
INCOME	The (natural) log of gross farm income from apple (Yuan)	9.82	
MCC	Whether or not to choose the modern channel: 1=Yes and 0=No	0.16	+
AGE	Age of household head (years)	47.72	+
EDUCATION	1=Under primary; 2=Primary; 3=Secondary; 4=High School; 5=Junior college; 6=Undergraduate	2.85	+
LABOR	The number of agricultural labor force per family (persons)	2.3	+
SIZE	Total cultivation areas of household (mu)	10.1	+
TREE	The number of apple trees per household	371.3	+
EXPERIENCE	Years of growing apples (years)	17.68	+/-
INPUT	The (natural) log of total input costs for apple production (Yuan)	8.95	+
REGION	Luochuan county or Baishui county (dummy)	0.56	+/-
COOP	Whether or not to participate in cooperatives (dummy) 1= participate; 0=do not participate	0.29	+
DISTANCE	Distance from the nearest city (km)	132.2	-

Source: Household survey conducted by the author in 2010
Note: a. Exchange rate was RMB 6.7 per U.S. dollar at time of the survey (IMF, 2010)
b. 1 ha = 15 mu

where y_i specifies the household income of each observation i (i=1,2,3,...,n), x_i represents the vector of explanatory variables that influence the household income, and ε_i is an error term. Table 4 presents descriptive statistics of the explanatory and dependent variables used in the subsequent econometric analysis (243 surveyed households). According to existing research and data collection (Ricardo 2007), the factors hypothesized to affect farmers' income are MCC (Note 1), AGE, EDUCATION, LABOR, SIZE, TREE, EXPERIENCE, INPUT, REGION, COOP, and DISTANCE. INCOME stands for an outcome variable defined as a natural logarithm of gross farm income from apple (Yuan) (Note 2).

If we could observe y_i and x_i each for all i, we would simply use OLS analysis. The problem is, we might only observe y_i for a subset of the population. For example, if the farmer is actually trading in the market at the time of the survey, then we observe the income because we assume it is observed income. However, for farmers from the trading market, we cannot observe income. This highlights the basic selection problem, whereby the sample consists only of farmers who choose the modern market channel. To test and correct for sample selection bias, the Heckman selection-correction model uses the probit model to calculate the inverse Mills ratio and includes this ratio as a regressor in the income model (Greene 2002). If we detect sample selection bias, we can use the two-step estimate for the regression and selection equations; if there is no evidence of sample selection, OLS analysis is consistent and unbiased to be applied (Jeffrey M. Wooldridge 2003).

When we add an explicit selection equation to the income population model, we get

$$y_i = \beta x_i + \varepsilon_i$$

$$M_i = 1(w_i \gamma + u_i > 0)$$

and

$$Prob\,(M_i = 1) = \Phi\,(w_i \gamma)$$

Where y_i is observed when M_i=1, and zero otherwise. M_i is a dummy variable indict the farmers' market choice, Φ is the cumulative distribution function of the standard normal distribution, w_i denotes the vector of independent variables that influence farmers' market choice, γ stands for the vector of coefficients to be estimated and u_i is the error term of the selection equation.

Heckman's (1979) two-step estimation procedure can be described as follows:

(1) Using all observations - those for which M_i is observed (selected observations) and those for which it is not - and estimating a probit model in which M_i is the dependent variable and w_i are the explanatory variables. Based on the parameter estimates $\hat{\delta}_i$, calculate the inverse Mills ratio ($\lambda_i(\alpha_u)$) for each observation:

$$\hat{\lambda}_i(\alpha_u) = \varphi(w_i \hat{\gamma}) \,/\, \Phi(w_i \hat{\gamma})$$

(2) Estimate β and $\beta_\lambda = \rho\sigma_\varepsilon$ by the least square regression of y_i on x_i and $\hat{\gamma}$, which will reveal consistent estimates for the parameter vecto β. Namely, by including the inverse Mills ratio as an additional explanatory variable, we have corrected for sample selectivity.

$$y_i \text{ on } x_i, \hat{\gamma}$$

Table 5. Results Estimated from the Heckman Model (Non-Coop members, 171 households)

	(1) probit Model MCC (dependent variable)				(2) OLS Model INCOME (dependent variable)			
	Coef.	(Std. Err.)	Z	(P>z)	Coef.	(Std. Err.)	Z	(P>z)
Age	-0.011	0.013	-0.840	0.403	-0.001	0.007	-0.140	0.891
Education	-0.2810**	0.127	-2.210	0.027	0.026	0.091	0.290	0.775
Labor	0.3340*	0.182	1.830	0.067	0.012	0.109	0.110	0.909
Size	0.042	0.028	1.510	0.131	0.0310**	0.015	2.010	0.044
Tree	0.000	0.000	0.130	0.898	0.000	0.000	-0.970	0.330
Experience	-0.028	0.019	-1.530	0.126	-0.004	0.012	-0.350	0.728
Loginput	0.116	0.163	0.710	0.476	0.6830***	0.108	6.310	0.000
Region	0.186	0.331	0.560	0.573	1.1015***	0.180	6.130	0.000
Distance	0.0059*	0.003	1.760	0.078	-0.0022*	0.001	-1.840	0.065
_cons	-0.718	1.510	-0.480	0.635	2.853	1.104	2.580	0.010
mills	-	-	-	-	0.970	-	0.334	-

* Significant at the 10% level; ** Significant at the 5% level; *** Significant at the 1% level.

Table 6. Results Estimated from the Heckman Model (Coop members, 72 households)

	(1) probit Model MCC (dependent variable)				(2) OLS Model INCOME (dependent variable)			
	Coef.	(Std. Err.)	Z	(P>z)	Coef.	(Std. Err.)	Z	(P>z)
Age	-0.003	0.022	-0.140	0.887	0.010	0.010	0.960	0.339
Education	-0.7591**	0.338	-2.240	0.025	0.166	0.164	1.010	0.310
Labor	-0.363	0.319	-1.140	0.255	0.080	0.150	0.530	0.595
Size	0.1601**	0.079	2.040	0.042	0.007	0.041	0.160	0.876
Tree	-0.002	0.001	-1.550	0.121	0.0011*	0.001	1.810	0.071
Experience	-0.046	0.040	-1.160	0.248	-0.014	0.019	-0.750	0.454
Loginput	0.666	0.413	1.610	0.107	0.3544***	0.136	2.600	0.009
Region	1.3315**	0.577	2.310	0.021	0.232	0.390	0.590	0.552
Distance	-0.002	0.006	-0.290	0.769	0.001	0.002	0.420	0.671
_cons	-2.581	3.272	-0.790	0.430	5.547	1.261	4.400	0.000
mills	-	-	-	-	-0.550	-	0.584	-

* Significant at the 10% level; ** Significant at the 5% level; *** Significant at the 1% level.

Econometric Results and Discussion

As described above, the Heckman model involves two equations: the selection equation estimates the probability of participating in modern market channels, while the outcome equation estimates household income as a function of various household characteristics, the market channel dummy variable, and the inverse Mills ratio (IMR). The IMR, calculated from the selection equation, adjusts the outcome equation for selection bias associated with the fact that participation and non-participation farmers may differ in terms of unobservable characteristics. We implement this analysis with two groups, namely, 171 households who are not cooperative members and 72 households who are, respectively.

The results estimated from the Heckman model for both groups are shown in Tables 5 and 6. The fact that the inverse Mills ratio for whichever group is not statistically significant implies no selection bias, eliminating the need to estimate income using the two-step Heckman procedure. Therefore, we use an ordinary least squares (OLS) model to estimate household income as a function of household and farm characteristics and a dummy variable representing participation in the market channel.

Finally, an OLS model is applied to determine the significance of selected social economic characteristics that affect the farm household income. The gross income from apple per household represents the dependent variable (Y). Y is a set of variables hypothesized to be affected by ten explanatory variables described in Table 7. The final specification of the model was represented as below:

$$INCOME = \beta_0 + \beta_1 AGE + \beta_2 EDUCATION + \beta_3 LABOR + \beta_4 SIZE + \beta_5 TREE + \beta_6 YEAR + \beta_7 INPUT + \beta_8 REGION + \beta_9 DISTANCE + \beta_{10} MCC + \mu$$

To test the difference in the impact of market channel choice on household income among farmers who are not cooperative members and those who are, this study divided all sample farmers into two groups. The comparison results are shown in Table 7. For 171 households who are not co-

Table 7. Comparative Analysis of Results Estimated from OLS regression

N0. of obs.	171 households (Non-Coop members)			72 households (Coop members)		
Income	Coef.	Std. Err.	P>t	Coef.	Std. Err.	P>t
Age	0.0008	0.0053	0.875	0.0029	0.0072	0.690
Education	0.0654	0.0512	0.203	0.068	0.0863	0.433
Labor	-0.046	0.0659	0.486	-0.0282	0.0861	0.744
Size	0.0240**	0.0102	0.020	0.0218	0.0218	0.321
Tree	-0.0001	0.0001	0.163	0.0008**	0.0003	0.047
Experience	-0.0032	0.0062	0.608	-0.0051	0.0125	0.688
Input	0.8109***	0.0711	0.000	0.4489***	0.0969	0.000
Region	0.8251***	0.1311	0.000	0.4925**	0.1899	0.012
Distance	-0.0030***	0.0009	0.001	0.0001	0.0018	0.962
MCC	0.2104**	0.1066	0.050	-0.1048	0.1459	0.475
_cons	2.0274	0.6403	0.002	5.2157	0.9291	0.000
Number of obs	171			72		
F(10,160)/F(10, 61)	46.74			9.22		
Prob > F	0.0000			0.0000		
R-squared	0.7450			0.6018		
Adj R-squared	0.7291			0.5365		
Root MSE	0.5876			0.4823		

* Significant at the 10% level; ** Significant at the 5% level; *** Significant at the 1% level.

operative members, it is clearly indicated by the statistically significant coefficients of variables SIZE, INPUT, REGION, DISTANCE and MCC. For 72 households who are cooperative members, a statistically significant relationship exists between household income from apples and the following three variables, namely, TREE, INPUT and REGION. A more detailed and complete analysis is given below.

1. Results Estimated from OLS regression for 171 households (COOP=0)

The OLS regression results for 171 households who are not cooperative members are given in Table 7. The R^2 value of about 0.75 means that 75 percent of the variation in the log value of gross income from apple is explained by AGE, EDUCATION, LABOR, SIZE, TREE, YEAR, INPUT, REGION, DISTANCE and MCC. The F value is obviously highly significant at the 1 percent level, as the computed P value is 0.0000, hence the overall significance of the estimated regression is high. In the final model, five variables have a significant and positive impact on gross income from apples, namely, SIZE, INPUT, REGION, DISTANCE and MCC.

SIZE is a significant determinant of household income from apples at the 5% significance level, which means that the larger the farm, the higher the farm income from apples. This can be explained by the fact that farmers with larger plots achieve economies of scale in apple production, which allows them to minimize costs and maximize profits.

INPUT correlates positively to household income from apples at the 1% significance level, which indicates that the greater the input in apple production, the higher the farm income from apple. Because boosting inputs in apple production can enhance the apple quality and yield, they have a greater impact on the price of apples at the farm gates, which has important implications for policies designed to increase farmers' income.

REGION significantly affects household income from apples at the 1% significance level, which means that the income received by apple farmers varies significantly between these two counties. According to our survey, there are two main reasons explaining these differences. One is the difference in cultivation area of apples per household between Baishui county (0.40 ha) and Luochuan county (0.53 ha), another reason is the difference in the apple price at the farm gates between Baishui county ($0.36/kg) and Luochuan county ($0.50/kg).

DISTANCE includes a statistically significant negative effect on household income from apples at a 1% significance level, since for farmers located in remote villages, far from urban areas, it is hard to obtain market information and they have to contend with ever-increasing costs of transaction and circulation. Thus the DISTANCE from the nearest city is negatively correlated with the household income from apples.

MCC is another important factor impacting on household income for apple farmers whose are not cooperative members, with positive coefficients at the 5% significance level, which implies that farmers can earn more if they choose the modern market channel. This implies that the modern market channel may benefit small-scale farmers if they can access them. This result fully matches theoretical predictions as well as other studies examining agrifood sup-

ply chain restructuring.

The other five variables may not be significant, but still show very interesting results. Many researchers argue that human capital investment is an important factor affecting farmers' income increase, due to the theoretical growth in labor productivity. However, this study shows that human capital, as represented by variables of AGE, EDUCATION and EXPERIENCE, do not contribute significantly to household income from apples. One possible explanation is that human capital mainly affects off-farm, rather than farm income, while regression results show that TREE and EXPERIENCE have a negative relationship with household income from apples. The negative coefficient of TREE shows how enlarging the production scale can limit the output of apples due to dense growth and farmers' extensive management. Consequently, the over-density of apple trees can reduce the fruits' color and size, further reducing the number of high-quality fruits. With regard to EXPERIENCE, a possible explanation is that farmers with more experience of planting apples may be unwilling to accept new technologies and model of planting.

2. Comparative analysis and discussion between two groups

The OLS regression results for 72 households who are cooperative members are given in Table 7. The R^2 value of about 0.60 means that about 60 percent of the variation in the log of gross income from apple is explained by AGE, EDUCATION, LABOR, SIZE, TREE, YEAR, INPUT, REGION, DISTANCE and MCC. The F value is obviously highly significant at the 1 percent level, as the computed P value is 0.0000, meaning a high overall significance of the estimated regression. In the final model, three variables have a significant and positive impact on gross income from apples, namely, TREE, INPUT and REGION.

In both groups, household income from apples is found to be positively correlated with INPUT and REGION. For farmers who are not cooperative members, TREE has a negative and insignificant relationship with household income from apples, due to dense growth and farmers' extensive management, as explained in the previous paragraph. However, for farmers who are cooperative members, TREE has a positive and statistically significant impact on household income from apples at a 5% significance level. One possible explanation is that agricultural cooperatives can supply their members with technical support and help apple farmers manage their orchards. Some researchers have shown that dwarfing rootstocks and high-density orchards consistently produce higher quality fruit and greater profits (Dengtao GAO et al. 2012), but require far more management skill. Since cooperatives can teach producers better management practices and introduce new technology, TREE correlates positively with household income from apples for farmers who are cooperative members. DISTANCE from the nearest city does not significantly affect contributions to household income from apples for farmers who are cooperative members. This result indicates that, it is not difficult to get market information, even for farmers living in remote villages away from urban areas, because the cooperatives can help such farmers access market information.

For farmers who are cooperative members, MCC (market channel choice) also does not contribute significantly to household income from apples, which implies that the modern market channel may not benefit small-scale farmers who are cooperative members, because the farmer cooperatives can help farmers gain skills and inputs, build enterprises and process and market their products more effectively to generate higher incomes just like modern market channel. The farmer cooperatives can also achieve economies of scale, thereby lowering costs and facilitating the processing and marketing of agricultural commodities for individual farmers. Marketing-oriented farmers' cooperatives can assist their members to purchase inputs and equipment, to meet quality standards and manage the drying, storage, grading, cleaning, processing, packing, branding, collection and transportation of products. Accordingly, farmers' cooperatives provide a more reliable supply to buyers and sell larger quantities at higher prices. Organized farmers have greater bargaining power than individuals and are better able to negotiate with other more powerful market players to ultimately increase the profits that accrue to farmers rather than intermediaries and buyers.

Conclusion

The study makes conclusions from the results of econometric models and focuses on the impact of market channel choice on household income. Considering the fact that the cooperatives can affect farmers' decision-making regarding production and marketing, this study divided all sample farmers into two groups according to whether or not they participated in the farmer cooperatives.

For farmers who are not cooperatives members, SIZE is a significant determinant of household income, which indicates that the larger the farm, the higher the farm income from apples. INPUT correlates positively with household income, which means that the greater the apple production inputs, the higher the farm income from apples. REGION significantly determines household income from apples, which means that the income received by apple farmers varies significantly between these two sample counties due to the difference in cultivation areas and apple price at the farm gate. DISTANCE has a statistically significant negative effect on household income from apples. For farmers who are cooperatives members, three variables have a significant and positive impact on gross income from apples, namely,

TREE, INPUT and REGION. SIZE and DISTANCE from the nearest city does not contribute significantly to household income from apples for farmers who are cooperative members. Moreover, in both groups, human capital represented by the variables of AGE, EDUCATION and EXPERIENCE does not contribute significantly to household income from apples.

This study shows that the impact of market channel choice on household income differs between the two groups. For farmers who are not cooperatives members, market channel choice (MCC) contributes significantly to household income from apples, which implies that the modern market channel may benefit small-scale farmers if they can access them. However, for farmers who are cooperative members, MCC (market channel choice) does not contribute significantly to household income from apples, because the farmers' cooperatives can lower costs and facilitate the processing and marketing of agricultural commodities for individual farmers like a modern market channel.

Notes

1) MCC (market channel choice) is a dummy variable, equivalent to one for farmer households belonging to the modern market channel and zero for farmer households belonging to the traditional market channel. Our survey questionnaire investigated the market channel choice of apple farmers and identified five types of channels, namely, middleman, broker, processing enterprises, cooperatives, and supermarket. Finally, this study divided the market channel choice into two kinds for empirical analysis, namely the modern market channel (processing enterprises, cooperatives, and supermarket) and traditional market channel (middleman and broker).

2) This paper does not consider the impact of apple prices on farmers' income and MCC (market channel choice) for several reasons. Firstly, the purpose of this paper is mainly to measure the impacts of market channel choice on farmers' income, and the price of apples is nearly the same between the different channels according to our survey. Secondly, the average apple cultivation area per household is 7.07 mu (0.47 ha) in two sample counties and the per-mu yield of apples for an average year is 2500 kg in Shaanxi province. The total apple output per household reaches 17,675 kg. However, the price of apples at the farm gate in Baishui county is $0.36/kg, as compared to $0.50/kg in Luochuan county. Therefore, this paper chooses SIZE and TREE as the factors influencing the farmers' income. Lastly, the price of apples is nearly the same for local famers in Baishui and Luochuan counties respectively, and this paper choose the REGION representing the differences in price between the two counties.

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