Grower's Selling Behavior: Transaction Cost Comparison Analysis

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Abstract

The paper develops an analytical framework of estimating the magnitude of transaction costs on the basis of previous related studies and the specific trade characteristic of apple growers in Northwestern China. The investigation results present that the cooperative growers can averagely save 884.59 yuan of transaction costs compared with conventional growers. The empirical results conducted by a Tobit model demonstrate statistically significance of grower's off-farm experience, degree of trust in cooperatives, apple farm size, and various transaction costs variables on the proportion of selling products through cooperatives. The policy considerations mainly concentrate on upgrading cooperative information service ability, establishing contractual framework, and developing support programs on road construction.

Keywords: *China; Conventional Grower; Comparison; Cooperative Grower; Tobit; Transaction Costs*

1. Introduction

The fast inclination of high-value food products demand in developing countries is triggering significant changes in traditional supply chain, especially involve in small household farmers (Reardon et al., 2009). Under the background of globalization which has provided farmers different market channels and helps the farmers to look beyond the traditional spot market (Shukla and Jharkharia, 2010), the Chinese government put much effort on realizing the free trade of agricultural market and upgrading the efficiency of agricultural supply chain in the last three decades. The fruits are not allowed to be free traded in the agricultural product market until the implementation of Ten Policies on Further Active Rural Economy issued by Chinese Communist Party (CPC) Central Committee and the State Council in 1985. Since then, the country markets, and wholesales have been developed rapidly. The circulation pattern has been

changed from the traditional and single trading channel to a multi-channel and multi-level circulate network. Several study results reported that the agrofood market is dominated by spot market exchanges of a larger number of small farmers, traders and wholesalers (Jia amd Huang, 2011), and the wholesalers are the major trading outlet for farmers, followed by small brokers in 2005 in North China (Huang et al., 2007).

Since the adoption of *Law on Agricultural Cooperatives of People's Republic of China* in 2007 (Thereafter, *the Law*), cooperatives experience a high speed development. It is reported that the number of registered agricultural cooperatives reached 689 thousand at the end of December 2012 (State Administration for Industry & Commerce of the People's Republic of China). Cooperatives have been treated as a trading outlet for small household farmers due to the integrated service functions and internalized transaction. Simultaneously, with the further growth of supermarket in China (Hu et al., 2004), the direct trading way between small scale farmers and supermarkets is widely promoted by Chinese government in order to reduce transaction costs caused by various sectors in the value chains (the Ministry of Agricultural of People's Republic of China).

In fact, there is growing pressure for farmers in developing countries to accelerate their efforts to commercialize production facing increasing market competition (Aubert, et al., 2004). For instance, in China, the average farm size is only 0.15 hectare per farmer (CNSB, 2012) and farmers are not well organized as well (Shen et al., 2005). The small scale trading amount of products and the poor organized situation also post farmers in a disadvantageous position when negotiating with their up- and downstream partners (Song and Qi, 2011). Given the disadvantages of small scale farm characteristic and multiple marketing channels, choosing a proper trade channel can help growers reduce transaction costs. Therefore, the growing gap between family farms and their up- and downstream partners dictated an increasing need for inter-sectorial coordination within the agro-food sectors and thereby enhances the potential role that can be played by cooperatives. A large number of scientific literatures have provided sound evidence of the advantages of being a member in cooperatives theoretically and empirically (Feinerman and Falkovitz, 1991; Barton, 2000; Nilsson et al., 2012). Vandeplas et al. (2012), taking the biggest dairy company in the world (Nestle) in India as an example, find that farmers supply to cooperatives and multinationals channels are more efficient than other market channels (informal and domestic private) .

According to *the Law* in 2007, the purpose of cooperatives is to provide various services involving in production and sales process, to generate greater profits by obtaining input factors and services at lower price than the price which they would pay elsewhere, and also by marketing their products at better prices than the price which they would sell through other marketing channels. More importantly, cooperatives facilitate vertical coordination to minimize the various stages of the production-processing-distribution chain, to internalize the vertical externalities between upstream producers and the downstream processors, to maximize their joint profits (Feng and Hendrikse, 2011).

Cooperatives are the appropriate vehicle to reduce transaction costs and to facilitate

access of small-scale producers faced high transaction costs as reflected primarily in their low level of education, poor road and communication infrastructure, lack of market information, as well as long distance to markets to input and product markets (Ortmann and King, 2007). A large number of studies explore producer's trading favors and distribution effect adopt transaction cost economics which adopts a contractual approach to the study of management and organization promoted by Williamson (1973) (Escobal and Cavero, 2011; Verbeke and Kano, 2013). For instance, the empirical results conducted by Hobbs (1997) indicate that the proportion of cattle sold through auctions is influenced positively by monitoring cost referring to the degree of grade uncertainty surrounding direct-to-packer sales and negatively by the negotiation cost associated with the risk of cattle not being sold at the auction and the time spent at auction. Matungul et al. (2001) also highlight that farm household income can be raised by reducing transaction cost such as investing in roads, an efficient legal system, farmer support services including input supply, marketing information, and extension, etc.

Recently, considering transaction costs have many unobservable components, a range of the precursors are growingly interested in measuring the magnitude of transaction cost and exploring the role of transaction cost played in farmer's choice of a marketing channel. The empirical results conducted by Royer (2011) indicate that bilateral contracting mechanisms minimize transaction costs incurred in the dairy sector. Hess et al., (2012) identified farmer's marketing choice between IOFs and cooperatives on the basis of transaction cost economics and found a tendency that larger and more entrepreneurial farmers prefer dealing with IOFs, whereas farmers with an inclination for security are more likely to trade with cooperatives.

Furthermore, in the fresh produce industry, the role of trust between grower and various potential buyers, e.g., agents, cooperatives, wholesalers, retailers, etc. also affect grower' s decision making in choosing the optimal transaction channel with better selling price during the sales process. Grower generally is more likely to transact with those market agents who are prepared to invest in their relationship with the grower (Batt, 2003). Whereas Fulton (1999) claim that high farmer commitment to cooperatives can results in the cooperatives having a significant market share, even if the price offered by the cooperatives is not that high. Other researchers strength that the trustworthiness reduces transaction costs and is an important source of competitive advantage in the sales process (Dyer and Chu, 2003).

Regarding the previous literatures, questions related to that how much is the differences related to the magnitude of transaction costs among these marketing outlets is raised. As cooperatives being a connection between farmers and markets play an important role in agrofood market, we try to keep our methodology and calculation as straightforward and simple as possible in the comparison of transaction costs on this specific market outlet between cooperatives growers (hereafter, CP) and conventional growers (CV)[1]. Thus, the aim of this article is to make comparison of the magnitude of

[1] Cooperatives grower is defined as that farm household specifically focusing on apple production

transaction costs between the two groups under consideration. Essentially, we begin by an introduction of the trade channels, the cooperatives development, and the transaction cost economics theory. In section 2, we develop an analytical framework based on transaction cost theory. Data and methodology are explained in section 3. The transaction costs measurement and empirical results are presented in section 4. The policy implications of the findings and limitations are discussed in the last section.

2. Analytical framework

Since Williamson (1979) proposed the theory of Transaction Cost Economics, a number of researchers start to apply TCE to explore a variety of economic relationships, ranging from lateral and vertical integration (Williamson, 2010; Chaddad and Rodriguez, 2010) to market channel selection (Brouthers, 2002), make-or-buy decision (Geyskens et al., 2006; Memili et al., 2011), as well as contract arrangement (Adler and Scherer, 1999). However, unlike production costs, transaction costs are difficult to assess as they represent the potential consequences of alternative decisions (Klein et al., 1990). Several studies focus on measuring the magnitude of transaction costs associated with the implementation of various public policies (Mettepenningen et al., 2009), and the comparison between different contractual relations (Royer, 2011). Given the increasingly important role in rural areas played by cooperatives, our study specifically focus on the comparison of two distinct transactional mechanisms by evaluating the magnitude of transaction costs. The two distinct transactional mechanisms are defined as:

1) the cooperative transaction mechanism which grower participates in cooperatives and trades products in large quantity through cooperatives;
2) the non-cooperative transaction mechanism which grower trades products in large quantity through other marketing outlets (i.e., retailers, wholesalers, agents, middlemen, processing firms, supermarkets, etc.) except cooperatives.

Note that a few of their products can be also sold through cooperatives only those products achieve the basic quality requirement of cooperatives.

For the purpose of comparing the magnitude of transaction costs of both transaction mechanisms under consideration, an analytical framework of the determinants and measurement of transaction costs are promoted (Figure 1). The transaction costs are categorized into information cost (IC), negotiation cost (NC), enforcement cost (EC) and transportation cost (TRC). In each category, we apply several concrete explanatory variables concluded from questionnaire to calculate the magnitude. Table 1 highlights these variables in detail.

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participates in cooperatives; apples in large quantity are traded through cooperatives. Conventional grower is defined as that farm household specifically focusing on apple production does not participate in cooperatives; apples in large quantity are traded through other marketing channels except cooperatives.

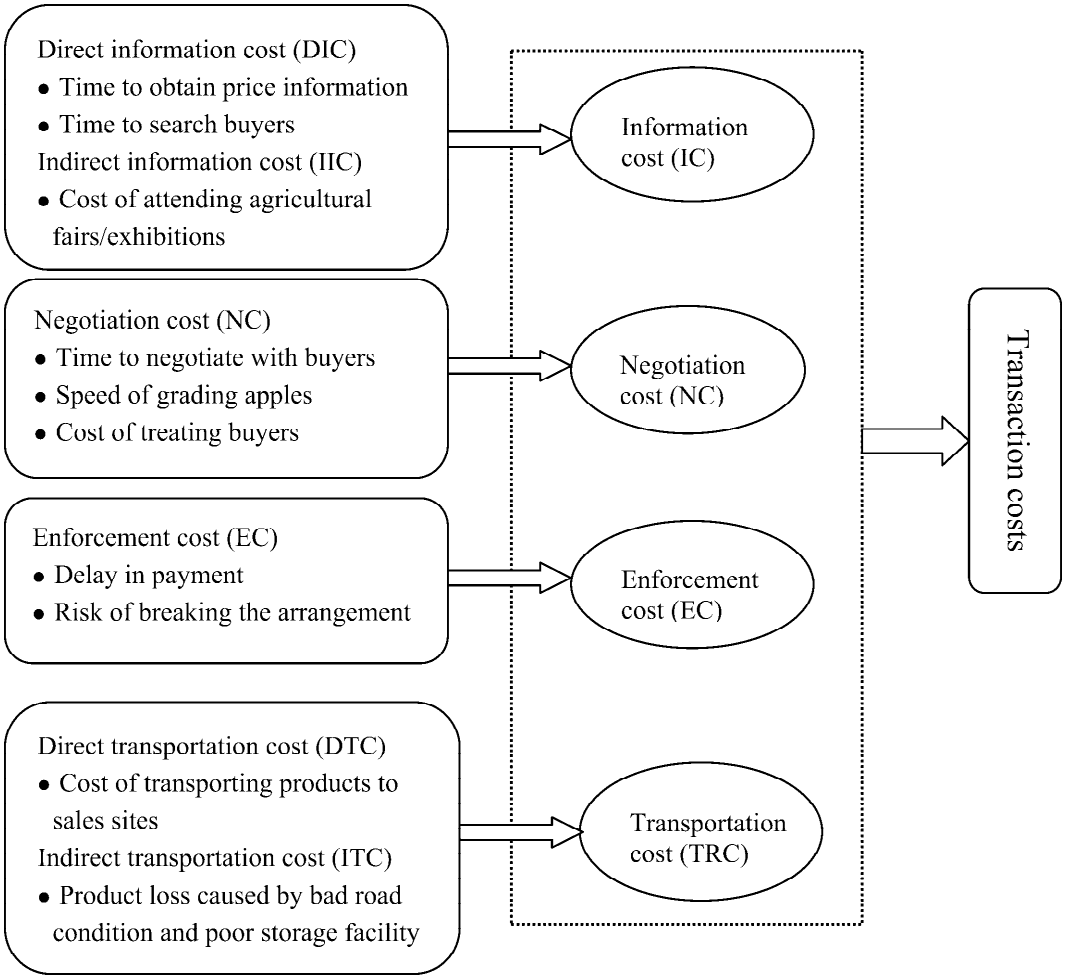


Figure 1: *Analytical framework of transaction costs*

Table 1: *Variables description*

Variable	Variable code	Variable scale and measurement	Expected sign
Dependent variable			
Percentage sell products through cooperatives	PET	$\frac{\text{Apple volume sells through cooperatives}}{\text{total apple production}} \times 100\%$	
Independent variables			
Farmer demographics			
Age of growers	AGE	Years	−
Educational attainment	EDU	Years	+/−
Off-farm experience	OFE	0 = no off-farm experience 1 = have off-farm experience	+/−
Apple farm experience	ONE	Years	+/−
Trust degree in	TRU	5 = very trust, 4 = trust, 3 = moderate,	+

Variable	Variable code	Variable scale and measurement	Expected sign
cooperatives		2 = untrust, 1 = very untrust	
Farm characteristics			
Farm area	FSZ	Mu (1 mu=0.0667 hectare)	+
Apple farm area	ASZ	Mu (1 mu=0.0667 hectare)	+
Apple income	AIN	Thousand Yuan	+
Total labor use	LAB	Days	+/−
Information cost			
Time to obtain price information	TPI	Time spent obtaining market price information prior to sale (hours)	+/−
Time to search buyers	TSB	Time spent searching trading partners prior to harvest season (hours)	+/−
Cost of attending agricultural fairs/exhibitions	IIC	Cost of attending agricultural fairs/exhibitions including transportation and accommodation (yuan)	+/−
Negotiation cost			
Time to negotiate with buyers	TNG	Time spent negotiating with available buyers and fix the trading price and transacting place (hours)[1]	+/−
Speed of grading apples	TOG	Time spent grading apples prior to sale during harvest season (hours)	+
Cost of treating buyers	COA	Cost of treating buyers including expenditure on accommodations, cigarette, etc. during marketing period (yuan)	−
Enforcement cost			
Delay in payment	TFP	Number of days being fully get paid from the buyers (days)	+
Risk of breaking the contract	COB	Loss of growers due to buyer's breaking the arrangement (yuan)	+
Transportation cost			
Direct transportation costs	DTC	Expenditure on transporting apples from grower's home to marketing site (yuan)[2]	+/−
Indirect transportation costs	ITC	Apple loss caused by bad road condition and poor storage facilities (yuan) [3]	+/−

Note: 1: In combination with our face to face interview, growers often contact with potential trading partners by telephone. Thus, time spent searching buyers and set the deal is comparatively short, usually takes several minutes;

2: Marketing site might be agent's home, cooperatives, grower's home, or apple orchard. DTC is zero if the sales site is the apple orchard;

3: $COB = AI \times LP$, where AI is apple income in 2010, LP is the average apple loss rate of

the total apple income during transporting process.

Information cost

All transactions are conducted under a certain level of imperfect information (Aubert et al., 2004). Knowing market information prior to direct sales allows farmers to make decisions on which marketing outlet to choose and when to sell products on the basis of seasonal price trends. Thus, to acquire the market information is probably a critical step before the products entering the sales process. However, our field discussions practically revealed that the most neglect aspect of transaction costs by growers is the information cost which is unavailable to assess directly.

Information cost occurs *ex ante* to a transaction in different ways. In order to evaluate the magnitude of information cost, quantitative questions are asked in the questionnaires. The information cost is categorized into two parts:

1) direct information cost measured by "time spent obtaining market information in advance of sales (TPI)" and "time spent discovering potential trading partners (TSB);"
2) indirect information cost valued by "cost of attending agricultural product fairs/exhibitions (IIC)." Agricultural product exhibition provides a bridge connecting local growers and the national wide trading partners.

It also gives the chance for growers to know the latest development trend of agricultural products, i.e., new varieties, advance planting technology, etc. Therefore, the cost of attending agricultural product exhibitions is considered to be part of information cost.

Basically, apple growers have multiple sources of obtaining market information, e.g., local government department, agricultural cooperatives, records from the previous years, friends, relatives, or neighbors, television (agricultural channels), and internet (e-commerce). Regarding discover potential buyers, a good relationship with previous trading partners enable growers not to search out alternative buyers. The survey data illustrates that 59.2% of conventional growers directly contact with the trading buyers in the previous year to make the deal; 42.1% of cooperative growers directly contact with cooperatives.

Generally, researchers hold different opinions on the impact of information costs on sales proportion of various transaction channels. Hobbs (1997) present information cost has insignificant effect on the proportion of cattle sold liveweight, whereas Shiimi et al., (2012) promote that the accessibility of market and technology information influence the proportional number of cattle sold through the formal market. Therefore, the expected impact signs of information costs are uncertain.

Negotiation costs

Negotiation costs are the costs required to come to an acceptable agreement with the other transaction parties (Commons, 1931). Time spending negotiating with potential

trading buyers (TNG) is a negotiation cost. The purpose of the negotiation is to determine acceptable price and appropriate transaction site to both growers and buyers. Growers in China have little negotiation power in the up-and downstream market chain attributed to the products homogeneity and the lower transaction volume. This leads to a comparatively higher negotiation power of buyers when fix the transaction price and control the delivery time and site. Royer (2011) posits that the negotiation costs are very low when producer trade products with cooperative purchasers since the arrangement is set by cooperative purchasers and offered to producers. The similar situation occurs in China. Cooperatives are responsible for setting terms of arrangement, and the members in cooperatives decide to "take it or leave it." Therefore, growers who sell products to agents are likely to incur quite a different negotiation cost than those who sell products through cooperatives.

Furthermore, the speed of grading apples (TOG) which is barely mentioned in previous studies, also perceived as a vital part of negotiation cost since this may affect the price received. The aim of grading is to add value to products, and also to partially improve the negotiation power prior to the transaction. The survey result reveals that grading apples obviously increase the apple prices[2]. The greater apple size and quality is, the higher price is (see Table 2). Simultaneously, apple price in each grade is higher for cooperatives growers than for conventional growers, and the average price of the three grades is also greater than the price without grading for both cooperative and conventional growers. Overall, the price distinction implies a different of transaction cost between the two groups under consideration. The field discussion also reveals that conventional growers strongly complaint about the time consuming and the cost of labor use during the grading process. For cooperative growers, conversely, apple grading is usually done by the help of cooperatives or the buyers. Thus, the speed of grading products is supposed to be faster for cooperative growers than for conventional growers, and the expected sign would be positive.

Table 2: *Apple price of different grades and primary outlets in 2010*

Items / Grades	Cooperatives growers		Conventional growers		Price difference (yuan/kg)
	Price (yuan/kg)	Primary Outlets	Price (yuan/kg)	Primary outlets	
>75 mm	4.45	Cooperatives	3.48	Agents, wholesalers	0.62
65-75 mm	2.67	Agents, wholesalers, consumers	1.95	Agents, consumers	0.47
<65 mm	1.50	Processing firms	0.94	Processing firms	0.65

[2] In the sample areas, apples are graded into three levels, i.e., the first-class apple fruits with diameters above 75mm; the second-class apple fruits with diameters between 65-75mm; and the cull/defective apple fruits with diameters below 65mm.

Average	2.87		2.12		0.51
No grade*	2.53	Agents, wholesalers	1.67	Agents, wholesalers,	0.63

Note: * no grade means growers prefer to sell most of apple fruits (except cull/defective apple fruits) through one outlet for one time irrespective of apple size, shape, and quality, etc.

Involving in the survey, what is interesting is to note that apple growers need to cover the accommodation of buyers during the sales process. Hence, cost of treating buyers (COA) is also expressed as part of negotiation cost. The accommodation cost relies primarily on the speed of grading and packing since the slower of apple grading and packing, the buyers stay longer. This cost could be extremely higher for conventional growers than for cooperatives growers since cooperative growers barely need to offer accommodation for cooperative purchasers. Thus, it is expected to negatively affect the proportion of selling through cooperatives.

Enforcement costs

Dahlman (1979) defined the enforcement costs as the costs of making sure the other party sticks to the terms of the arrangement, and taking an appropriate action if this turns out not to be the case. The enforcement costs are expected to be very high for conventional growers in China since they hardly have negotiation power which is also the most commonly complained aspect in the field survey. In our analytical framework, two variables are applied to estimate enforcement cost.

The delay in payment (TFP), which is perceived as a negotiation cost by Hobbs (1997), is considered to be an enforcement cost in this paper since it happens after the product transaction and probably lead to a higher risk of breaking the arrangement. The survey discussion suggests that the delay in payment is shorter for conventional growers than for cooperative growers in sample areas. The explanation is that the apple agents or wholesalers are required to make instant payments on delivery when conventional growers trade products directly with them. Whereas for cooperative growers, they have to wait until the cooperatives sell most or all of the products. The survey data shows that 73.6% of cooperatives growers are trust or highly trust in their cooperatives. Thus, the cooperative growers are not worried about the risk of cooperatives breaking the arrangement due to the long time delay of payment given their highly trust degree in cooperatives. And thereafter, the delay in payment probably has positive impact on sales proportion to cooperatives.

The risk of breaking the contract (COB) is another critical enforcement cost. Contract plays a key role to coordinate the actions of independent decision makers (Bogetoft and Olesen, 2002). While the situation will be different if the individual decision makers not sign a contract but still trade products each other. The commitment or trust between the sellers and buyers can be predominantly important. The survey data in this paper indicate that only 9.9% cooperative growers and 30.8% conventional growers sign a paper contract with cooperatives and available buyers, respectively. The extremely lower rate of signing an official contract for cooperatives growers mainly

attribute to their trust in cooperatives according to our field discussion. Whereas the failure experience of commitment between conventional growers and trading partners in the previous years can be explained as a result of the higher contract rate compared to cooperative growers.

Apple growers in China experience a specific procedure trading products. They make informal trade arrangements which are not legally enforceable, and around 200-300 yuan is taken as deposit which is too low to restrain the buyers to stick to the terms of the arrangement. Consequently, the growers are those who take the high risk of buyers breaking the contract. In contrast to conventional growers, no prepayment or deposits from cooperatives before products delivered reveals a clear signal of commitment between growers and cooperatives. This can be partly confirmed by the survey data: compared with 48.0% conventional growers, only 5.5% cooperative growers said they suffered the loss caused by buyers breaking the contract in the investigate year. Thus, it is expected to be greater loss for conventional growers than for cooperatives growers, and the impact sign is expected to be positive.

Transportation cost

Transportation cost is often considered belonging to traditional analysis of marketing costs. However, they can also be a part of transaction costs if they are specific to that market channel. The distance to the sales point was used as a measurement of transportation cost (Hobbs, 1997). Therefore, in this article, transportation cost is regarded as an aspect of transaction costs.

Two parts are specified to value the magnitude of transportation costs:

1) direct transportation cost (DTC) includes the cost of labor use and vehicle use transporting products from farmgate to trading sites[3]. It is suppose to be lower for cooperatives growers than for conventional growers since some of the cooperatives provide transportation services;
2) indirect transportation cost (ITC) refers to the product loss caused by the bad road condition and poor storage condition.

The lack of adequate infrastructure for cold storage and transportation result in the waste/loss of products in developing countries (Viswanadham, 2006). It is thus expected to be higher for conventional growers than cooperatives growers because part of apple loss related to poor storage can be avoided by cooperatives growers. The storage service provided by cooperatives can be as the explanation. With the storage facilities, it can not only solve apple rotting problem, but also help growers to store apples at harvest season and sell apples at off-season with high price. Furthermore, the survey data illustrates that 66.8% conventional growers perceive transportation and storage conditions as very

[3] The transportation cost from home/orchard to sales point is calculated by the total transporting times per year multiply the transportation expenses per time. Transportation cost per time is the cost of gasoline/diesel fuel of transportation vehicles, as well as wages of hired labor employed to use these vehicles during harvest season.

bad compare to 57.3% for cooperative growers. Considering the similarity of grower's transporting vehicles and the local road condition, it is hard to expect the impact sign of the delivering cost on the proportion of apples sold through cooperatives. Thus the expected sign is uncertain.

3. Data and methodology

Data collection

China has become the largest fresh apple producer and exporter in the world attributed to the rapid expansion of apple orchards in Shandong and Shaanxi Provinces in the late 1980s (Zhang et al, 2010) and the adoption of productivity-enhancing technologies (Lagos et al., 2009). In the past decade, apple production in Shaanxi Province rose dramatically from 3.9 million tons in 2000 to 9.0 million tons in 2011. The share of fresh apple production in Shaanxi province accounts for over a quarter of the total apple production in China in 2011 (China Statistical Yearbooks). At the very least, the data set collected from Shaanxi province can appropriately represent the overall situation of apple growers in China.

The farm household level data were obtained from six counties selected from 30 apple-growing counties in Shaanxi province in China employing systematic sampling method depending on apple production in 2009 (Source: Shaanxi Statistical Yearbook 2010). Systematic sampling is a method primarily involving the selection of elements from an ordered sampling frame, and the sampling interval k is calculated as:

$$k = \frac{N}{n} \tag{1}$$

Where N is the population size which is 30 in our research, n is the sample size which is six. Therefore, the sampling starts by selecting a county from the list at random and every 5th county is selected. Apple production in apple-growing regions represents averagely about 85.9 percent of the total apple production in Shaanxi province. The proportion of apple production in sample regions to that of thirty apple-growing counties is averagely 13.6 percent. Thus, we consider the sample areas being approximately representative samples.

The data collection for this research is conducted by two rounds. The first round was conducted in October 2010. Questionnaires from 130 cooperative growers and 290 conventional growers were collected. Given the small number of cooperative grower samples, we supplemented the primary data set with a follow-up survey involving in 84 cooperative growers in the same areas during November 3rd -20th 2012. 70 questionnaires were removed from the final statistical analysis in consideration of the questionnaire efficiency, the limitation of grower's memory, and the inception of apple orchards (Wang and Huo, 2013). Finally, 434 apple farm household level questionnaires are used in our study. Note that apple growers in each sample area share the same agricultural subsidy policy, which imply an assumption that households in each region would demonstrate similar marketing behavior with comparatively small variability

during apple planting process.

A standard questionnaire was designed to collect a range of information divided into three modules:

Table 3: *Statistics description between cooperative growers (n=183) and conventional growers (n=250)*

	Unit	Mean (St. Dev)		P-value
		Cooperative growers	Conventional growers	
Grower demographics				
Age	Years	50.9* (8.6)	54.2* (8.4)	0.0001
Educational attainment	Years	9.1* (2.8)	8.3* (2.7)	0.0029
Off-farm experience		0.1 (0.4)	0.2 (0.8)	0.2781
Apple farm experience	Years	18.3 (10.9)	18.2 (7.2)	0.8676
Trust degree in cooperatives		4.0* (0.8)	3.4* (0.8)	0
Farm characteristics				
Farm area	Mu [a]	7.9* (4.1)	5.0* (2.7)	0
Apple farm area	Mu [a]	5.2* (3.2)	3.0* (1.6)	0
Apple income	Thou. Yuan	22.8* (20.0)	16.5* (16.0)	0.0003
Total family income	Thou. Yuan	26.2* (20.6)	19.0 * (16.8)	0.0001
Total labor use [b]	Days	451.2 (158.6)	477.0 (175.0)	0.1168
Information cost				
Time to obtain price information	Hours	3.2 (25.1)	0.3 (1.0)	0.0724
Time to search buyers	Hours	0.03* (0.1)	0.42* (0.8)	0
Cost of attending agricultural fairs/exhibitions	Yuan	6.8* (17.5)	12.6* (32.5)	0.0284
Negotiation cost				
Time to negotiate with buyers	Hours	0.05 (0.4)	0.17 (1.9)	0.4092
Speed of grading apples	Hours	2.4* (2.9)	3.9* (3.4)	0
Cost of treating buyers	Yuan	5.1* (27.0)	187.3* (162.5)	0
Enforcement cost				
Delay in payment	Days	14.5* (10.8)	4.1* (6.8)	0
Risk of breaking the contract	Yuan	44.3* (258.0)	521.6* (783.1)	0
Transportation cost				
Direct transportation costs	Yuan	92.5* (251.4)	152.0* (281.5)	0.0236
Indirect transportation costs	Yuan	155.3 (267.2)	290.0 (1124.4)	0.1131

Note:* Differences between members and non-members statistically significant at p=0.05.

[a] 1 mu = 0.0667 hectare

[b] The calculation of total labor use is $LAB = NFL \times DFL + NHL \times DHL$, where LAB is the total labor use, NFL and NHL are the number of full-time farm household family labors and the number of hired labors, respectively, DFL and DHL are the on-farm working days of full-time farm household family labors and the on-farm working days of hired labors, separately.

1) grower demographics and farm characteristics including age, academic educational attainment, off-farm experience, on-farm experience, labor use, farm acreage, farm income, family incomes, etc.;
2) transaction costs particularly referring information cost, negotiation cost, enforcement cost, and transportation cost;
3) attitude towards various trading channels, cooperatives in particular.

The descriptive statistical analysis of general characteristics and transaction costs between cooperatives and conventional growers is summarized in Table 3. Six major blocks of data, i.e., grower demographics, farm characteristics, information cost, negotiation cost, enforcement cost, and transportation cost, are illustrated. With regard to grower demographics, differences in age and academic educational attainment between cooperative and conventional growers are statistically significant. Growers with younger age, more educational years, and higher degree of trust in cooperatives are more likely to choose cooperatives as their main product trading channel. In reference with farm characteristics, differences in farm acreage, apple orchard size, apple income and family income between the cooperative and conventional growers are also statistically significant. The statistical results present that cooperative growers have larger farm and apple orchard area, and higher apple income and family income than conventional growers.

In terms of the four blocks of transaction costs, the differences in time to look for potential buyers, expenditure on attending agricultural fairs or exhibitions (information cost); time to grade products prior to sell and expenditures on buyer's accommodation (negotiation cost); delay in payment, loss of growers caused by buyers breaking the contract (enforcement cost); the expenditure on transporting products from orchards to trading sites (transportation cost), are statistically significant at $p = 0.05$ between cooperative and conventional growers. The mean value of various transaction cost items show that conventional growers have much more negotiation cost, enforcement cost and transportation cost than cooperative growers (see Table 3).

Tobit model

Similar to the methodology used by Hobbs (1997), our study also employ a Tobit regression model followed by marginal effects to investigate the factors affect grower's sales proportion of products through cooperatives.

Except for directly evaluating the size of transaction costs between cooperative and conventional growers, the investigation of the factors affecting the proportion of products trading through cooperatives from transaction cost perspective is also conducted. Given the dependent variable (proportion of selling apples through

cooperatives) lies between 0 and 1 or equal 0 (not trade apples through cooperatives) and 1 (trade the total apple production through cooperatives), a Tobit regression model which was first promoted by Tobin (1958) is used in the paper. The Tobit model is to deal with circumstances where the dependent variable y is observed for values greater than zero, but is unobserved or censored for values less than or equal to zero (Brown and Dunn, 2011). The observable variable y_i is defined as follows:

$$y_i = \begin{cases} y_i^* \ if \ y_i^* > 0 \\ 0 \ \ if \ y_i^* \le 0 \end{cases} \tag{2}$$

$$y_i^* = \alpha x_i + \mu_i, \mu_i \square (0, \sigma^2) \tag{3}$$

Where y_i^* is an unobserved variable, x_i is the vector of independent variables, α is the relationship between the independent variable x_i and the unobserved variable y_i^*, μ_i is a normally distributed error term to capture random influence on this relationship, $i = 1, 2, ..., n$.

Considering the complication of the Tobit regression coefficients interpretation (Hobbs, 1997), the marginal effects are also estimated to interpret the changes in the explanatory grower demographics, farm characteristic and transaction cost variables on the proportion of apple sold through cooperatives. Marginal effect is reported as the effect of the *i*th explanatory variable is a function of all explanatory variables as well as of all Tobit regression parameters (Hoff, 2007). In other words, it is the effects of a change in the mean value of y_i / x_i with respect to a change in x_i. The detail information of variables is summarized in Table 1.

4. Transaction cost calculations

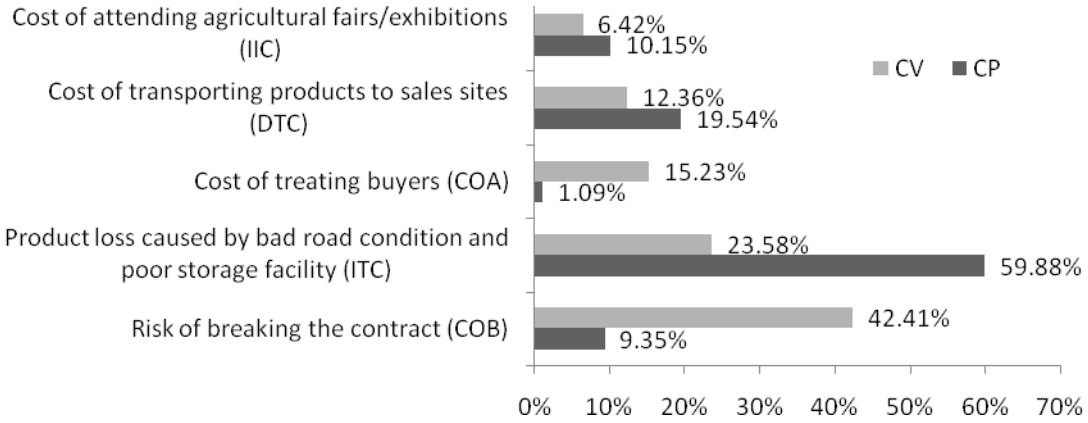
The comparison of the size of transaction cost between cooperatives and conventional apple growers is illustrated in Table 4. Given the distraction by the distinction of apple orchard management scale, an extensive estimation of the magnitude of transaction costs by apple orchard scale between the two groups under consideration is also presented in Table 5. Based on the previous literatures, three management scales are grouped:

1) small-scale grower (S) ranging from 0.1 to 3.0;
2) medium-scale grower (M) being between 3.1 and 6.0;
3) large-scale grower (L) belonging to above 6.0 (Wang and Huo, 2013).

Note that considering the difficulty of monetizing the time spent searching for market information and the trading partners, as well as the time on negotiating with buyers and grading products, the monetary expenditure on each subtype as a percentage of apple growers total transaction costs is depicted in Figure 2. Totally, the expenditure on transaction costs for cooperative and conventional growers are 345.28 yuan and 1229.88 yuan, respectively.

Information costs

Result from our survey shows that both cooperative and conventional growers spent



CP = Cooperative growers, CV = Conventional growers

Figure 2: *Each subtype as a percentage of apple growers' total transaction costs*

Table 4: *Transaction costs differences between cooperative growers (CP) and conventional growers (CV)*

	Variable code	unit	CP	CV	DF
Information cost					
Time to obtain price information	TPI	hours	3.21	0.35	2.86
Time to search buyers	TSB	hours	0.03	0.42	-0.39
Cost of attending agricultural fairs/exhibitions	IIC	yuan	48.07	79.00	-30.93
Negotiation cost					
Time to negotiate with buyers	TNG	hours	0.05	0.17	-0.12
Speed of grading apples	TOG	hours	2.44	3.90	-1.46
Cost of treating buyers	COA	yuan	5.14	187.28	-182.14
Enforcement cost					
Delay in payment	TFP	days	14.48	4.12	10.36
Risk of breaking the contract	COB	yuan	44.26	521.60	-477.34
Transportation cost					
Direct transportation costs	DTC	yuan	92.51	152.00	-59.49
Indirect transportation costs	ITC	yuan	155.30	290.00	-134.70
Sum of the cash costs		yuan	345.28	1229.88	-884.59

Note: DF is the difference value between members and non-members in cooperatives.

little time obtaining the market price information and searching out purchasers before

selling products. For cooperative grower, it averagely takes 3.21hours to acquire market information compared with only 0.35 hours for conventional grower (Table 4). The result implies that cooperatives might not provide sufficiently useful or latest market information for their members. Thus, cooperative growers have to turn to other information sources. Besides, the evaluation of the size of transaction costs between the two groups by orchard management scale in Table 5 shows an inclination that the larger apple orchard management scale of cooperative grower, the longer time they spent acquiring the price information and finding a buyer. That is the increase of the orchard

Table 5: *Transaction costs comparison by growing scale between cooperative growers (CP) and conventional growers (CV)*

	Variable Code	Unit	Scale[a]	CP	CV	DF [b]
Information cost						
Direct information costs	DIC [c]	hours	S M L	0.47 0.58 11.28	0.68 1.00 0.24	-0.20 -0.41 11.05
Cost of attending agricultural fairs/exhibitions	IIC	yuan	S M L	3.21 3.91 10.99	6.50 20.37 56.25	-3.29 -16.46 -45.26
Negotiation cost						
Speed of grading apples and time to negotiate with buyers	NC	hours	S M L	2.21 3.26 2.05	4.31 3.60 11.02	-2.11 -0.34 -8.97
Cost of treating buyers	COA	yuan	S M L	4.29 6.17 4.35	171.31 203.78 337.50	-167.03 -197.61 -333.15
Enforcement cost						
Delay in payment	TFP	days	S M L	16.80 13.26 13.80	5.23 3.75 2.00	11.58 9.51 11.80
Risk of breaking the contract	COB	yuan	S M L	73.21 37.04 21.74	530.00 518.29 387.50	-456.79 -481.26 -365.76
Transportation cost						
Direct transportation costs	DTC	yuan	S M L	72.35 106.61 110.87	106.44 232.20 241.25	34.09 -125.59 -130.38
Indirect transportation costs	ITC	yuan	S M	255.64 220.79	157.94 534.89	97.70 -314.10

			L	428.06	420.88	7.18

Note: [a] : S = small-scale grower, M = medium-scale grower, L = large-scale grower;

[b] :DF is the difference value between members and non-members in cooperatives;

[c] : $DIC = TPI + TSB$

management scale, cooperatives growers are not satisfied with the information provided by cooperatives, they would turn to other ways to get more market information to enlarge trading channels and thus to get better deals.

Not surprisingly, cost of attending agricultural fairs/exhibitions (IIC) for cooperative growers is 30.93 yuan lower than conventional growers. The possible explanation based on the field discussion is that cooperatives sometimes organize their members to attend the agricultural fairs and cover the transportation and the entrance fee. From the scale perspective, conventional growers with large apple farm size are likely to spend more on attending agricultural fairs (Table 5).

Negotiation costs

Time spent negotiating with purchasers (TNG) has little differences between cooperative and conventional growers (0.05 hours and 0.17 hours, respectively). Indeed, many cooperative growers have mentioned during survey discussions that they barely negotiate with cooperatives as they trust in cooperatives. For conventional growers, the explanation of spending little time on negotiation is that they hardly have negotiation power on price and have to accept the price trading partner offered due to their small transaction volume.

Still, cooperative growers spent less time grading apples, 2.44 hours compared to 3.90 hours for conventional growers. This can be attributed to the service related to products grading and packing cooperative provided. For conventional growers, they need to grade products by themselves or hiring local labors which would be not only time consuming, but also incur the extra labor cost. Therefore, cost of treating buyers (COA) is obviously higher for conventional growers (187.28 yuan) than cooperative growers (5.14 yuan). Furthermore, the calculation results of transaction costs by planting scale shown in Table 5 illustrates a trend that the large-scale conventional growers (337.50 yuan) pay more for COA than small- and medium-scale conventional growers (171.31 yuan and 203.78 yuan).

Enforcement costs

For cooperative growers, the delay of fully get paid (TFP) is around 14.45 days which is much longer than conventional growers (4.12 days). The result is consistent with our expectation in Table 2. The long time delay of payment can be attributed to the transaction mode between members and their cooperatives. That is cooperatives always pay for members after they sell large amount of the products, and members agree to this trading mode given their highly trust in cooperatives. On the other side, for conventional growers, the short delay of payment, to a certain extent, reflects a lower

trust in their trading partners. The result in Table 5 demonstrates that growers with smaller planting area tend to wait longer time to be fully paid than those with larger planting scale.

Regarding the risk of purchaser breaking the contract (COB), the exceptionally advantages of cooperative growers were verified. The cost of COB for cooperatives growers is only 44.26 yuan compared with 521.60 yuan for conventional growers (see Table 4). The data in Table 5 reveals that growers with less planting areas have greater probability to suffer the loss caused by buyer's breaking the arrangement for both groups under consideration in the research. The small-scale cooperative and conventional growers lost 73.21 yuan and 530.00 yuan separately due to buyers breaking the arrangement. Incorporated with field discussions, the unofficial contact (handshake agreement) brought huge uncertainty of the final transaction largely due to the fluctuation of apple market price. In other word, buyers often pay less than the agreement price if the market price drops, or pay the same price as that in the agreement if the market price rises. In both situations, grower is always the one who suffers the loss. Hence, being a member in cooperatives can largely lower the risk and simultaneously reduce or avoid the loss of arrangement termination.

Transportation costs

Despite of the little distinctions of local transportation condition, the data clearly states that cooperative grower can save averagely 59.49 yuan of the direct transportation costs (DTC) compared with conventional growers. The indirect transportation cost mainly caused by the poor storage facilities and the bad road conditions accounts for 59.88% of the total transaction cost for cooperative growers. The situation of ITC is complicated when refers to growers for both groups with various planting scales. The data shows that ITC is higher for small and large scale cooperative growers than for conventional growers in the same scales (Table 5). The reason can be expressed as the same road conditions faced by both cooperative and conventional growers. It also implies a poor cooperative service associating with cold storage.

5. Empirical results

A Tobit regression model is applied to figure the factors affect the proportion of apples sold through cooperatives. As a matter of fact, cooperative growers in the survey areas can choose to sell apples through any marketing channels. For conventional growers, cooperatives also purchase part of their apples achieving the quality requirement. The data in Table 6 reports that only 57.9% of cooperative members trade apples through cooperatives. Regarding to the reasons not trade through cooperatives, the most greatly mentioned one is the high quality requirement of the trading products (29.2%), e.g., apple size, color, taste, and the limitation of chemical pesticides, etc., followed with the lower purchase price offered by cooperatives (26.4%) and the higher

transportation cost caused by the longer distance between orchards and cooperatives (25.5%). On the other side, the primary reasons of trading apples through cooperatives are cooperative services (e.g., apple grading, packing, and storage) and the better commitment of cooperatives (31.2% and 26.0%, respectively).

Table 6: *Reasons for member trading products through cooperatives*

Reasons	Not trading products through cooperatives	Reasons	Trading products through cooperatives
Longer distance between orchards and cooperatives	25.5%	Better commitment of cooperatives	26.0%
Lower purchase price than other outlets	26.4%	Easier to transport products to cooperatives	20.8%
Higher quality requirement of products	29.2%	Higher purchase price than other outlets	22.1%
More convenient to sell through other channels	18.9%	Beneficiary services provided by cooperatives [a]	31.2%
Total	100%	Total	100%

Note: [a] Cooperative services primarily include provision of market information, apple grading, packing, and cold storage.

The Tobit regression results indicate that the proportion of apple sold through cooperatives is statistically and positively affected by grower's off-farm experience (OFE), the degree of trust in cooperatives (TRU), apple farm size (ASZ), time spent obtaining market information (TPI), speed of grading apples (TOG), and the delay in payment (TFP). Whereas time to discover trading partners (TSB), cost of attending agricultural fairs (IIC), and the expenditure on buyer's accommodation (COA) statistically and negatively influence the proportion of apples sold through cooperatives (see Table 7).

The marginal effects are also presented in the last row in Table 7. With reference to grower demographics and farm characteristics, the marginal effects reveal that a one-unit increase in grower's off-farm experience, the degree of trust in cooperatives, and the size of apple orchard will lead to a 2.48%, 9.72% and 0.88% increase in the proportion of apple sold through cooperatives, respectively. The findings can be partly confirmed by the data in Table 3: cooperative growers have more off-farm experience, larger apple farm size, and higher degree of trust in cooperatives compared with conventional growers.

Information costs which are always ignored by growers indeed statistically affect the sales percentage through cooperatives. Results in Table 7 show that the longer time spent searching out buyers and the more cost on attending agricultural fairs will result in

a decrease proportion of selling apples through cooperatives. It makes sense that the purpose of growers putting much effort on discovering available purchasers and attending various agricultural exhibitions is to find a better exchange price. Thus, if the price provided by other marketing outlets is greater than cooperatives, cooperative growers will for sure to choose those trading channels.

Table 7: *Regression results*

Variable	Variable codes	Coefficient	Std. Error	t-Statistic	Marginal effects
	Grower demographics				
Age	AGE	−0.0035	0.0033	−1.05	−0.0011
Educational attainment	EDU	0.0039	0.0093	−0.42	−0.0012
Off-farm experience	OFE	0.0794	0.0410	1.94*	0.0248
Apple farm experience	ONE	0.0029	0.0026	1.14	0.0009
Trust degree in cooperatives	TRU	0.3114	0.0356	8.47***	0.0972
	Farm characteristics				
Farm area	FSZ	0.0100	0.0087	1.15	0.0031
Apple farm area	ASZ	0.0281	0.0126	2.23**	0.0088
Apple income	AIN	−1.11E−06	1.45E−06	−0.76	−3.45E−07
Total labor use	LAB	−0.0001	0.0002	0.47	2E-05
	Information cost				
Time to obtain price information	TPI	0.0022	0.0012	1.82*	0.0007
Time to search buyers	TSB	−0.1076	0.0509	−2.12**	−0.0336
Cost of attending agricultural fairs/exhibitions	IIC	−0.0023	0.0012	−1.86*	−0.0007
	Negotiation cost				
Time to negotiate with buyers	TNG	−4.09E−05	0.0364	−0.00	−1.27E−05
Speed of grading apples	TOG	0.0179	0.0108	1.66*	0.0059
Cost of treating buyers	COA	−0.0009	0.0003	−2.90***	−0.0003
	Enforcement cost				
Delay in payment	TFP	0.0073	0.0025	2.87***	0.0023
Risk of breaking the contract	COB	−2.03E−05	5.38E−05	−0.38	−6.34E−06
	Transportation cost				
Indirect transportation costs	ITC	−3.29E−05	7.55E−05	−0.44	−1.02E−05
Direct transportation costs	DTC	0.0001	9.08E−05	1.30	−3.68E−05
Constant	C	−1.3407	0.2728	−4.91	

Note: * significant at $p = 0.10$; ** significant at $p = 0.05$ level; ** * significant at $p = 0.01$ level.

Part of negotiation costs arising from grading apples positively influences the sales proportion to cooperatives. A one-unit increase of the days spending on grading is expected to lead to a 0.59% inclination of the proportion of selling through cooperative.

It can be verified by the measurement of magnitude of transaction costs in Table 4 that the grading time is averagely 1.46 days less for cooperative growers than for conventional growers due to the services provided by cooperatives.

Note that the cost of treating buyers almost exclusively occurred for conventional growers (only 7 conventional growers in 183 said they covered buyer's accommodation in the survey year). A decrease of expenditure on treating buyers is corresponding to a decline in trading volume through cooperatives. In combination with the field discussion, the reason can be the simple trading process and the fast payment of apple agents and wholesalers who are the major trading outlets for conventional growers are (see Table 2).

The result presented in Table 7 suggest that a one-unit increase in the variable "delay in payment" would lead to a 0.23% increase in cooperatives use. This can be confirmed by the results in Table 5 and Table 6 that cooperative growers have to wait for longer time than conventional growers to be fully paid.

6. Conclusions

Knowing the detail information of transaction costs, their magnitude, and the percentage of each size of subtype to the total transaction costs might be helpful for growers to choose an efficient transaction mechanism facing multiple marketing channels. The article develops an analytical framework of calculating the size of the transaction costs on the basis of previous related studies and the specific trade characteristic of apple growers in Northwestern China.

Our investigation indicates that on average the cooperative transaction mechanism lead to a reduction of growers transaction costs compared with non-cooperative transaction mechanism. The main distinctions of transaction costs between growers under the two transaction mechanisms are the negotiation cost related to expenditure on accommodation of buyers, the enforcement cost associating with loss of buyers breaking the arrangement/contract, and the transportation cost occurred during the delivering process.

The results in the study imply several policy recommendations. Cooperatives should upgrade their service ability to provide latest market information to reduce the information cost. Policies and regulations considerations of local government department should foster an environment conducive to support the development of cooperatives. Policy makers should establish a contractual framework to help growers signing a legal contract with purchasers to restrain the opportunism behavior, and thus to minimize the enforcement cost. Also, developing and supporting programs referring to road construction can lower grower's transportation costs.

On the whole, our transaction cost framework appears to provide a useful explanation of the advantages of cooperative transaction mechanism; however it is by no means a complete explanation. Many of external variables are also associated, such

as the effect caused by unpredictable environmental conditions, geographical and socio-economic factors. Moreover, given the limitation of budget and questionnaire design, the data of only one year were collected. This probably affects the accuracy of the empirical results. Consequently, we will consider the effect of several external factors on grower's market choice, enlarge the data set and the time serial in the future studies.

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