Does cooperative membership improve household welfare? Evidence from apple farmers in China

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A B S T R A C T

This paper examines the impact of cooperative membership on farm performance indicators such as apple yields, net returns and household income, using cross-sectional data from a survey of farmers in China. An endogenous switching regression model that accounts for selection bias is employed in the analysis. The empirical results reveal that cooperative membership exerts a positive and statistically significant impact on apple yields, farm net returns and household income. A disaggregated analysis also reveals that small-scale farms tend to benefit more from cooperatives than medium and large farms.

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Introduction

The emergence of agricultural cooperatives is widely viewed as an important institutional arrangement that can help overcome the constraints that impede smallholders in developing countries from taking advantages of agricultural production and marketing opportunities (World Bank, 2006). For instance, they can strengthen farmers' negotiation abilities in the markets to gain more competitive prices for both inputs and outputs, reduce transaction costs and information asymmetry, and improve agro-food safety and quality standards (Hellin et al., 2009; Holloway et al., 2000; Jia et al., 2012; Markelova et al., 2009; Moustier et al., 2010; Trebbin, 2014; Valentinov, 2007). Given its significance in enhancing agricultural growth, the promotion of agricultural cooperatives has increasingly attracted attention of donors, governments and researchers in developing countries (Abebaw and Haile, 2013; Deng et al., 2010).

The Chinese government has made efforts to accelerate the systematic promotion of agricultural cooperatives through financial and policy support. One of such efforts is the promulgation of the Law of Farmers' Professional Cooperatives in 2007, with the aim of developing sustainable cooperatives. Despite the efforts made by the government, the Ministry of Agriculture in China reported that only 25.2% of farm households were involved in agricultural cooperatives in the country in 2013. This is partly because of the high transaction costs involved in contracting with small-scale farmers in the villages, resulting in the absence of agricultural cooperatives in many villages (Deng et al., 2010; Francesconi and Wouterse, 2015; Ito et al., 2012).

Several studies have shown that agricultural cooperatives influence the adoption of improved agricultural technology by farmers and household welfare (see e.g., Abebaw and Haile, 2013; Fischer and Qaim, 2012; Francesconi and Heerink, 2011; Ito et al., 2012; Verhofstadt and Maertens, 2014a, 2014b). In their study on Ethiopia, Abebaw and Haile (2013) find that cooperative membership exerts a positive and significant impact on fertilizer adoption, while a recent study by Verhofstadt and Maertens (2014a) on Rwanda finds a positive and significant effect of cooperative membership on the likelihood of using improved seeds, mineral fertilizer and pesticide. The study by Ito et al. (2012) shows that cooperative membership exerts a positive and significant effect on farm income of watermelon farmers in China. In examining the impact of cooperative membership, most of the studies have employed propensity score matching (hereinafter, PSM) technique to account for selection bias (Abebaw and Haile, 2013; Bernard et al., 2008; Fischer and Qaim, 2012; Ito et al., 2012; Verhofstadt and Maertens, 2014b). For example, in the recent study on Rwanda, Verhofstadt and Maertens (2014b) employ the PSM approach to examine the impact of cooperative membership on farmers' welfare, measured by farm income and poverty incidence, and find that agricultural cooperatives are effective in improving rural incomes and reducing rural poverty. However, a well-known shortcoming of PSM method is its inability to account for unobservable factors such as innate skills and risk perception, which may result in biased estimates.

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This paper aims to contribute to the growing literature on the role of agricultural cooperatives by identifying the factors that influence farmers' decisions to join cooperatives, as well as estimating the impact of cooperative membership on crop yields, net returns and household income. The study employs recent survey data of 481 apple farmers in Gansu, Shaanxi and Shandong provinces of China for empirical analysis.

We model farmers' choice of cooperative membership as a selection process, where the expected higher net returns to the cooperatives drive farmers' decisions of choosing to belong to agricultural cooperatives. This study employs an endogenous switching regression approach to account for selection bias (Lokshin and Sajaia, 2004). This approach allows us to analyze both the determinants of cooperative membership and the impact of membership on farm performance indicators such as apple yields, net returns, as well as household income, separately for members and nonmembers.

The remainder of the study is structured as follows: The next section gives an overview of the apple sector and agricultural cooperatives in China. Section 'Data and descriptive statistics' presents the data and corresponding descriptive statistics. Section 'Empirical specifications' outlines the empirical specifications employed in the analysis. The empirical results and discussions are presented in Section 'Results and discussion'. The final section provides conclusion and policy implications.

Overview of apple sector and agricultural cooperatives in China

China is the world's largest apple producing country, recording a total of 38.49 million MT (49.67% of the world's total) in 2012, followed by the United States and Turkey, who produced 4.11 and 2.89 million MT, respectively (FAOSTAT). Apple production in China is mainly in its Bohai Gulf region (Shandong, Liaoning and Hebei provinces) and Northwest Loess Plateau region (Shaanxi, Shanxi, Henan and Gansu provinces). In particular, Gansu, Shaanxi and Shandong provinces cover more than half of the country's total apple orchards, accounting for 54.17% of total production in 2012. These three provinces are characterized by hilly and mountainous lands, and endowed with suitable soil and weather conditions for top quality apple production.

Gansu, Shaanxi and Shandong have obvious differences in terms of agro-climates and agro-food market environments, although they have better conditions for apple production over other areas in China. Shandong is a coastal province with favorable annual rainfall and well developed infrastructure for exports. Farmers in this province also produce other crops like pears, peaches, cherries, peanuts, corn, and apricot as cash sources, which they sell to international markets. In contrast, Gansu and Shaanxi are inland provinces that are characterized by low rainfall and poor infrastructure (e.g., road and telecommunication). As a result, the farmers there only grow corn and potatoes as extra income sources, or for household consumption, and apple output is mostly for domestic sales.

Despite being the highest apple producing country, China faces constraints on the world markets, with only about 3% of apples produced finding their way into international markets (FAOSTAT). The primary reason is the difficulty in meeting food safety and quality standards, since farmers use large quantities of agrochemicals in the production process. Moreover, farmers engaged in apple production and marketing are severely constrained by high transaction costs and information asymmetry, particularly those living in remote areas.

Given the constraints facing apple production and marketing in China, the government has strived to facilitate the development of agricultural cooperatives in the apple sector. As a new institutional

innovation, agricultural cooperatives are expected to enhance its members' access to modern supply chains, promote the adoption of new technologies, help lower production and marketing costs, as well as raise farmers' incomes (Zheng et al., 2012). The cooperative organizations take on responsibilities for providing production technologies and/or marketing information to its members. In exchange for their role in enhancing agricultural performance, these agricultural cooperatives receive support and subsidies from the government. The production technologies promoted by cooperatives include orchard management approaches (e.g., pruning, branch drawing), efficient use of inputs (e.g., fertilizer and pesticide), quality control, and pest management. In addition, cooperatives provide some services by collectively purchasing inputs for its members at reasonable prices. The typical marketing services include provision of information with respect to prices and access to marketing channels, aimed at enhancing smallholders' output market participation. The service provision of agricultural cooperatives differs across regions. For instance, in Gansu and Shaanxi provinces, apple cooperatives are mainly providing production services to its members, with limited services on farm produce distribution. In contrast, cooperatives in Shandong province provide both technical guidance and distribution services.

Data and descriptive statistics

The data used in the study come from a farm household survey that was conducted from September to December 2013 in China. A multistage sampling procedure was used for the selection of observation units. First, Gansu, Shaanxi and Shandong provinces were purposively selected based on the national intensity of apple production. In a second stage, four county-level districts where apples are intensively produced at the provincial level were chosen. These include Jingning county in Gansu, Luochuan county in Shaanxi, and Qixia and Laiyang cities in Shanong.[1] Third, six agricultural cooperatives were randomly selected from those districts, using information provided by the local agricultural bureau. Fourth, three villages affiliated to each cooperative in the selected district were randomly selected.[2] Finally, around 25–30 households including both cooperative members and nonmembers in each village were randomly selected, resulting in a total of 481 households. The data collected include information on apple production and marketing (e.g., input use, costs, yields, and output price), household income, as well as household and farm-level characteristics (e.g., age, education, farm size, and asset ownership).

Table 1 presents the definition and summary statistics of the variables used in the analysis. The dependent variable used in the study is a dummy variable that takes the value of one, if the household belonged to an agricultural cooperative, and the value zero, if no cooperative membership was recorded. The outcome variables used in the study are apple yields, net returns, and household income. Net returns are measured as the difference between the value of apple yields and variable input costs per mu.[3] The inputs included fertilizer, pesticide, hired labor, bags, irrigation and films for land moisture conservation and apple coloring. It can be observed from the Table 1 that about 43% of households in the sample belong to agricultural cooperatives. The average age of farmers is almost 49 years. The average farm size is 5.07 mu, showing that the majority of households are small-scale apple producers. The average household includes 4–5 household members.

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[1] Qixia and Laiyang are county-level cities that belong to Yantai city, according to administrative division in China.

[2] In China, village is the basic administrative unit, and there are cooperatives who organize farmers in more than one village, especially those with certain scale and who are well operated.

[3] 1 mu = 1/15 hectare.