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Cooperative membership, social capital, and chemical input use: Evidence from China

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ABSTRACT

The proper use of chemical input is an original and key link to ensure environmental sustainability and food safety, as it not only exerts influences in the environment such as soil and water but also people's health directly. This paper targets at exploiting factors predicting the way that farmers use chemical input, based on first-hand data from 145 vegetable farmers with the membership of cooperatives in China. The role of social capital is investigated beyond traditional determinants. There are three indicators of social capital adopted in this paper, communication of technology and market information, trust, and members' awareness of common goals. We identify three ways of chemical input use in field investigation. They are using chemical input according to own experience and the instruction on the package, under the guidance of the government, and under the guidance and monitoring of cooperatives. The findings of empirical analysis highlight the role of social capital in influencing the way farmers use chemical input. The awareness of common goals incentivizes farmers to use fertilizer under the guidance of the government and cooperatives, while all the three aspects of social capital are significantly associated with the way that farmers use pesticide. To be specific, farmers in a cooperative with a higher level of communication, trust, and common goals display the tendency to using chemical input based on external guidance rather than own experience.

1. Introduction

Food safety incidents have been happening all the time and became more frequent in the past decade,[1] which triggered the public's high concern and increase consumers' awareness of safety food (Burlingame and Pineiro, 2007; Cicia et al., 2016; Grunert, 2005). Under this context, there are growing challenges faced by farmers. For one thing, the efficacy of food safety control in production has been subject to increasing importance in recent years in response to new regulations, the globalization of food trade, changing consumer demand, enhanced urbanization, and ever increasing concerns for environment sustainability (Burlingame and Pineiro, 2007; Jayasinghe-Mudalige and Henson, 2006). For another thing, Consumers began to pay attention to not only the product itself but also the production procedure such as the input used and production record (Asfaw et al., 2009).

Pesticide residues have become a focus for both environmental sustainability and food safety in recent years (Zhang et al., 2015). While chemical input contributes to increased production, it causes non-point source pollution and environmental degradation of agricultural ecology (Sanders, 2006; Shen et al., 2012). The pollution consequently exerts direct challenges on food safety in production. In addition, the proper use of chemical input such as fertilizer and pesticide is an original and key link to ensure the food safety, because it will be reflected in all the downward links of supply chain and sequentially affect consumers' health and safety (Henson et al., 2005; Koureas et al., 2012; Thongprakaisang et al., 2013). Hence force, to reduce the residue of agricultural chemicals via proper use of inputs is one of the keys to food safety problem (Carvalho, 2006).

Chemical input use in China, including fertilizer, pesticide, and agricultural film, is facing problem of overuse. The amount of fertilizer used in China in 2015 was 60.23 million tons and is 2.3 times of that in 1990. However, the sown area of crops in 2015 increased by 12.1%, compared with that in 1990. That is to say, the amount of fertilizer used per unit area in 2015 is 2.1 times of that in 1990. The overuse of chemical input use in China is due to a couple of reasons. First, the food security issue because of the large population and limited land causes farmers to use more chemical input to increase output. The arable land per capita in China is around 0.08 ha, 1/4 of that of the world on average. Second, farmers in China are mostly poorly educated and have a low awareness of environmental sustainability and food safety.

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[1] Food safety is the assurance that food will not cause harm to the consumer when it is prepared and/or eaten according to its intended use (Codex Alimentarius, FAO/WHO, 2001).

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According to population census in 2010, 40.3% of rural residents in China have primary school education or less, 48.1% of farmers have middle school education, and 11.6% have high school education. The low education level of farmers poses more challenges to the proper use of chemical input. Third, the aging problem in rural China constrains the extension and creation of new method and technology in agriculture production. The proportion of aged people (older than 60 years) is around 16.14% in 2015 and this proportion in rural China is even higher.[2] In addition, most young people in rural areas are not engaged in farming but working in urban.

Except for the socio-demographic features of producers and environmental factors such as laws, regulations, and consumer preferences, the farming behavior of producers are influenced by both formal institution and informal governance(Knowler and Bradshaw, 2007; Nkamleu and Adesina, 2000; Zhou et al.,2015). Social capital is a key dimension of informal governance and it is one of the most reliable factors (Knowler and Bradshaw, 2007; Sidibé, 2005). Adler and Kwon (2002) define social capital as a valuable asset based on inter-personal social relationship. However, little attention is given to the effect of social capital on chemical input use. This paper seeks to find out the determinants of the way farmers use chemical input by putting a special emphasis on social capital.

The subsequent section gives a literature review on the determinants of producers' input use practices and the role of social capital. This is followed by the methodological framework of our study, the sample, the model, and the variables. The empirical results and discussions are provided in section four, while conclusions and future researches are presented in the final section.

2. Literature review

2.1. Predictors of producers' food safety control and input use practices

Based on an overview of literature, a range of potential factors influencing farmers' food safety control practices in production are identified. First, socio-demographic and farm characteristics of producers including age, education, farm scale, and tenure status of the land are identified as the key predictors of producers' food safety control decisions (Zhang et al., 2016). Human capital of producers in terms of working experiences/off-farm activity and risk attitude also influence the adoption of food safety control (Cary et al., 2002). The location of farm, which is used as a proxy of resource access and sometimes is measured by the distance of farm to the markets, is also an important predictor of farmers' behaviors with regard to food safety (Baumgart-Getz et al., 2012).

Second, environmental drivers broadly recognized in empirical studies are regulations, governmental support, economic levels, and demand particularities (Codron et al., 2014; Zhou et al.,2015). Regulations include public laws and bylaws, and private standards of food safety which is exerted by downstream buyers, processors, and retailers. Both regulations and governmental support can reinforce producers' food safety control incentive (Unnevehr and Hoffmann, 2015). A higher level of constraints on food safety is associated with higher levels of adoption (Codron et al., 2014). Strong government intervention enhances the adoption of food safety practices (Codron et al., 2014). The market features of demand side provide as incentives for food safety management or sustainable practices in production (Codron et al., 2014; Unnevehr and Hoffmann, 2015).

Third, property characteristics, i.e. the transaction and contracting models between farmers and downward buyers, exerts influences on farmers' adoption of food safety control. A few studies report the membership of farmer groups or producer organizations positively influence the adoption of global GAP (Asfaw et al., 2009; Souza Monteiro and Caswell, 2009).[3] On contrary, Zhou et al. (2015) demonstrate that family farm and farmers delivering to investor-owned-firms adopt higher levels of food safety control over those who join farmer cooperatives. Similarly, Zhou and Jin (2009) find that cooperatives adopt a lower level of food quality standards compared to that adopted by investor-owned-firms. This may due to the governance of cooperatives characterized by collective ownership and benefit rights.

There is considerable evidence indicating that the informal aspects of institutions are no less important than the formal institutional settings (Nilsson and Hendrikse, 2011). Control and coordination of farmers' behavior cannot be fully accomplished by formal governance. Monitoring and transaction costs can be saved by informal governance such as social capital (Ole Borgen, 2001). A few studies touch the idea that social capital, as the main content of informal institution, influences product quality and safety control practices, yet without further investigating the effect. Chloupkova et al. (2003) report, based on a case study in dairy industry, that higher levels of quality provided by farmers are observed due to the presence of social control mechanism. zhang et al. (2016) emphasize that collaboration between parties along supply chains and information-sharing among supply chain members are but a few of the factors that motivate food firms to control food safety.

Factors that influence farmers' input use in production has received little attention. Ogutu et al. (2014) find a significant association between market information technology and farm input use including seeds and fertilizer. The use of chemical input is influenced by farmers' socio-economic factors such as education, land ownership, and location (Nkamleu and Adesina, 2000) and crop prices as well (Bayramoglu and Chakir, 2016). Asfaw et al. (2009) investigate the exporting vegetable sector in Kenya and finds that food safety standards in target countries in EU exert influences on farmers' pesticide use. According to the report by SAIN (2010), systematic and intensive instruction for farmers in production can reduce the use of fertilizer and pesticide by 30%. In addition, limited access to market as well as financial capital may impede farmers' incentives to use better inputs (Okello et al., 2009).

2.2. Social capital and food safety control

2.2.1. Defining and measuring social capital

Social capital has been broadly applied in studies of sociology, economics, and politics in the past two decades (Beugelsdijk and van Schaik, 2005; Fukuyama, 2001; Knack and Keefer, 1997; Malecki, 2012; Putnam, 1993). Coleman (1988) is the first to bring the term social capital into wide use. Coleman defines social capital by its function which is the relations between actors, either persons or corporates, that facilitate certain actions of actors within the social structure. It is the resource that actors derive from specific social structures and then use to pursue their interests (Baker, 1990). Burt (1992) defines social capital as "friends, colleagues, and more general contacts through whom you receive opportunities to use your financial and human capital." Similarly, Brehm and Rahn (1997) propose that social capital at personal level is demonstrated by "the reciprocal relationship between community involvement and trust in others." Organizational social capital is a resource within an organization and can be specified by two indicators: members' levels of collective goal orientation and shared trust (Leana and Van Buren, 1999). In comparison, Pennings et al. (1998) define organizational social capital as external resources, to be more specific, firm members' connectedness with potential clients. Social capital affects behaviors in virtue of rule enforcement and social control (Portes, 2000). Consequences of social capital are access to

[2] Data source: < China Population & Employment Statistics Yearbook 2016 > .

[3] GAP (Good Agricultural Practice) is a collection of principles to apply for on-farm production and post-production processes, resulting in safe and healthy food and non-food agricultural products, while taking into account economic, social and environmental sustainability (FAO).