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Résumé / Abstract

Since 2003, a grass-roots movement of New Rural Reconstruction (NRR) has emerged in China to experience alternative model of rural development. The movement adopts a particular approach for rural development on basis of rural social and cultural reconstruction. In order to understand this social approach, we investigate an original NRR experiment in a poor village of south China, where organic farming is promoted by means of basketball game. An in-depth household survey is conducted to qualitatively analyze this social approach and derive intuitive hypothesis of extended social network for empirical test. With a panel structure dataset collected by the survey, we quantitatively identify the causal effect of social network by exploiting the endogeneity of social network formation. Our identification result provides micro evidence for a large social multiplier effect in the diffusion of organic farming, whereas it is negative for organic experts. Also, our results highlight the role of women, education and labor force for the development of organic farming. On basis of these results, we conclude that organic farming is suitable but challenging for small villages in China, while social activity is a good lever to achieve farmers' collective action for its large diffusion.

Mots clés / Key words : New rural reconstruction; Social network; Organic farming; China.

Codes JEL / JEL codes : D71, O33, Q55

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1 Introduction

How to achieve sustainable development in poor rural areas? This question lies in the center of debate for governments of developing countries. In China, the knotty “Three Dimensional Agrarian Problems” (Sannong wenti) ¹ make it a critical question and call for different attempts to find adequate solution. In response to mainstream voice of industrialization and urbanisation, alternative development thinking stresses on small-holders farmers’ collective action and cooperation, which could be regarded as a form of social economy (Ostrom, 2000; Berkes et al., 2002; Wen, 2007). Guided by this thinking, a grass-roots social movement of “New Rural Reconstruction(NRR hereafter)” with peasantry-focus social economy has emerged in contemporary China since 2003(Day, 2008; Pan and Du, 2011a).

Across its wide and varied spectrum of experiments, the NRR addresses the rural sustainability from a particular perspective. Their approach relies on the social and cultural reconstruction by means of social and cultural activities(i.e., reading and dancing). Its advocates believe that it is the first necessity for rural reconstruction. Because social and cultural activities are cost-efficient means to empower poor peasants the esprit of cooperation. Only on a solid social basis for cooperation, the poor village could achieve sustainable economic development(Pan and Du, 2011b). In practice, a number of successful cases have been reported across the country²(Day, 2008).

Apart from its pragmatic aspect, the social approach of NRR also attracts academic interest for sustainable development research(Pan and Du, 2011a,b). However, few study has been done to test and understand its mechanism. In sociology, the social capital theory provides a hypothesis for this approach(Coleman, 1988, 1994; Putnam, 1993, 1995). Social capital is defined as norms, trust and social networks that improve the efficiency of society (Putnam et al., 1994). It could be generated by intensive social interaction and play an important role in social and economic development, i.e., decrease crime rates (Putnam, 2001), improve longevity (Putnam et al., 1994), increase income equality (Kawachi

¹It is a summary of peasants, rural society, and agriculture problems, i.e., exodus of rural labor, ageing rural population, shrinking of arable land and deterioration of agricultural environment etc.

²one can refer to examples such as Lishu county experiment in Jilin, Lankao county experiment in Henan and Jiangzhuang experiment in Shandong.

et al., 1999) and enhance economic achievement through increased trust and lower transaction costs (Fukuyama, 1996). In empirical economics, social capital is materialized and measured by social network. The development of modern econometric methods enable the empirical test of the social capital in economic development (Manski, 1993; Brock and Durlauf, 2000; Moffitt and Valente, 2001; Durlauf and Fafchamps, 2003; Lee, 2007; Bramoullé et al., 2009; De Giorgi et al., 2010).

In light of the social capital theory, we would like to empirically test the social approach of NRR movement. Provided the lack of macro data, we conduct a case study in a small village from south of China. In this original NRR experiment, the basketball game is put forward to unite smallholder farmers for sustainable agricultural innovation, i.e., organic farming. With an in-depth household survey in the village, we qualitatively analyze farmers' motivation for organic farming and the role of basketball game in farmers' collective action. Further more, using the panel structure data collected by the survey, we empirically test the extended social network hypothesis, as revealed by our fieldwork and the social capital theory, to explain the mechanism of the basketball approach. The aims of this case study are to fill the blank of NRR study and evoke more profound academic research on this alternative model of rural development.

In terms of methodology, we follow the discussion of Moffitt and Valente (2001) about policy intervention and identification of social network effect. Our identification strategy is based on the exogenous change of social network due to policy intervention (i.e., basketball game). In practice, we make use of Heckman correction for the endogenous formation of social network, and rely on the exclusion restriction of Inverse Mills Ratio(λ) of Heckman to construct valid instruments for endogenous social effect. This novel Heckman-instrumentation approach has been studied and found application in various domains recently (Zeitlin, 2009; Patnam, 2011).

For the result, we identify a large social multiplier effect in the diffusion of organic farming which justify the efficiency of extended social network in the village. The result is significant and robust with other estimators such as within and spatial instrumentation (Bramoullé et al., 2009; De Giorgi et al., 2010). Moreover, we perform a dif-in-dif analysis to investigate the heterogeneous effect of social network according to farmers' timing of

organic farming adoption and find a negative social network effect for organic experts. Apart from the social network effect, we also identify women, education and labor as critical factors for the sustainable development of organic farming in poor rural China. Taken together, our result validates the effectiveness and efficiency of social activity in small village. we conclude that social network is crucial for poor farmers' collective action for agricultural innovation. Basketball game promotes organic farming, because it can extend the social network through which innovation is diffused rapidly. However, this approach remains questionable for large villages. In spite of its limited scope, this case study provides reference for other NRR experimentation and sheds light on the social foundation of sustainable rural development. Just as a starting point, more specific social mechanisms such as altruism and social pressure will need more profound exploration in the future.

The remainder of the paper is organized as follows: section 2 presents the context of NRR and gives example of an original NRR experiment; section 3 talks about our fieldwork; section 4 models the social networks in our case; section 5 reviews the literature; section 6 discusses the econometric issues; section 7 gives detail of our dataset; section 8 discusses the main result and policy implications; section 9 concludes.

2 New Rural Reconstruction in contemporary China

In China, the Rural Reconstruction(RR) movement could be traced back to the 1920's-30's([Pan and Du, 2011a](#)). A new wave of RR in contemporary China grew out of a shift of debate on "Three Dimensional Agrarian Problems" from the promotion of market-led agricultural economy to the focus on peasantry. The advocates of NRR argue that given the number and atomization nature of Chinese smallholder farmers, the agrarian problems cannot be solved if they are simply treated as one agricultural economic issue in free market economy. The real solution relies on the peasantry side other than the market side ([Wen, 2007](#)). This new thinking was rapidly developed and attracted intellectuals and students to come together under the name of NRR. Since 2003, students and social workers are trained at "Liangshuming center" and "James yen institute" to implement NRR experiments (i.e.,

village cooperative, organic farming, Community Supported Agriculture) across China (Day, 2008).

Among others, we are interested by an experiment in Sancha village(109.01E/22.73N) in south of China. Sancha is a small village(i.e., 120 permanent households) under the administration of Pingma town³ in Guangxi Zhuang autonomous region⁴. With an annual revenue of about 1700yuan/habitant, the village is classified as a provincial “Poor Village” in Guangxi. Traditionally, the social life and agricultural production in the village are collectively organized on basis of four families (i.e., families Xu, Li, Huang and Lu, also labeled as production groups 1, 2, 3 and 4). Since 1980’s, the implementation of Household Responsibility System (HRS) has broken the collective production into individual unit (Lin, 1997).

Thanks to its well preserved natural environment and undeveloped nature, Sancha village was selected by an NGO, named PCD⁵, as a experimental site for NRR. In 2005, a project of organic paddy rice production was introduced to the village with support of Guangxi Maize Research Institute(GMRI). Initially, the project was implemented within family Li. During the experimentation stage, PCD provided environmental education, technical guidance and market support (Community Supported Agriculture) to encourage farmers’ conversion to organic farming. After three years’ experimentation, the organic technology was successfully adapted to local condition. The adoption rate had reached 90% within family Li in 2008.

The ambition of project was not limited to one family. It aimed to expand successful organic technology to the whole village and influence nearby villages. Nevertheless, this was not a simple task. According to PCD’s investigation, most farmers remained doubtful about the yield of organic farming, because they got used to chemical inputs in the green revolution of 1980’s. With limited resource, the environmental education and technical promotion of PCD saw the limitation of convincing farmers. After one year

³There are 5 levels of administration in China from high to low: province, city, county, town and village. Governments present at each level except for the village level.

⁴Guangxi Zhuang autonomous region is a “Zhuang” minority dominated region where the economic development is low at the national level. Find the location of Sancha village on map7 in appendix.

⁵PCD (Partnerships for Community Development) is a NGO based in Hong Kong. More information about this NGO can be found on their site: <http://www.pcd.org.hk/eng/index.html>.

promotion, the adoption rate was only 29% for the whole village in 2008.

Things moved on with the policy intervention of local government. For sake of urban-rural integration and rural community building, local government decided to incorporate Sancha village into the Pingma community⁶. As a result, Sancha village received a government grant for its community building. With the grant, an ancient basketball court in the village were renovated to a floodlit basket court at the end of 2008.

For most farmers, the new court represent the modernity and has evoked a basketball enthusiasm. By recognizing this basket culture, the village committee decided to organize basketball game regularly with support from PCD. Particularly, a basketball league match was organized by inviting neighbor village teams. For pragmatic consideration, the basketball game was generally programmed in the evening. Because farmers would have more spare time in the evening so that more audience could come. Moreover, the schedule of school children was considered as well. However, the mountainous condition and lack of road light might constraint some farmers to join the game in the evening, but they could not do better. According to the committee, thanks to the basketball game, the social life in Sancha village was substantially enriched. More importantly, the barrier of communication was broken down among four families, the intensified social interactions had achieved the farmers' cohesion as advocated by NRR. In 2009, Sancha village had won the league match against seven neighbor villages. The prize of a black pig was equally shared by four families.

To end the story, PCD found the project of organic farming also advanced along with the basketball game. Farmers' knowledge about organic technology increased considerably. At the end of 2009, the adoption rate reported by farmers reached 71% for the whole village. To explore more profoundly the Sancha experience, we decide to make a more close contact with the village.

⁶the term of community is employed to conform the rural village with urban district in the rural community construction movement(Ministry of Civil Affairs).

3 The fieldwork and research intuition

The objective of our fieldwork is to investigate: 1) the motivation of smallholder farmers for organic farming; 2) the role of basketball game in the promotion of organic farming 3) the social networks of farmers. A semi-structured questionnaire was predesigned according to information gathered via internet and by telephone interview with project field coordinator. To make our questionnaire relevant to the context and gather more background information, we began with a preliminary interview with key informants (i.e., head of village and party branch secretary) as well as a sample of 15 households (i.e., 10 organic farmers and 5 non-organic farmers, which represent 10% of the population) randomly selected in the village.

All interviews took place at farmer' home at dinner so that the conversation was unrolled in a friendly atmosphere. According to these interviews, 3 main motivations for organic farming were identified: 1) health 2) money and 3) information. Firstly, the health consideration was put forward by most farmers who practice organic farming (9 of 10 respondents). 6 of them confirmed that the syndrome due to chemical pesticide spray was general and significant, which pushed them to adopt organic farming. Secondly, the price premium was attractive for poor farmers (7 of 10 respondents). Although organic food market is still in its infancy in China, the organic food price is high, i.e., the price of organic rice is 7 yuan/kg⁷ whereas the price for conventional rice is only 4 yuan/kg⁸. Thirdly, the understanding of organic farming is strongly coincident with farmers' adoption. For instance, organic farmers of family Li, who engaged in the experimentation stage, got complete information about organic farming and were familiar with all organic technologies (i.e., duck-rice system, pest control with medical plants). They were generally confident about the productivity of organic farming. For other new organic farmers, most of them stated the organic farming as farming without chemical fertilizer and pesticide, but the understandings about comprehensive organic technologies were varied. For non-organic farmers, they had heard about organic farming with little understanding. Most of them expressed great doubt on the productivity without chemical inputs.

⁷price through the CSA channel

⁸price on local market

We then investigated the source of information about organic farming by asking the question, *“where do you learn organic farming?”* For farmers of family Li, all of them had mentioned PCD as information provider. However, this was not the case for farmers from other families. 5 of them reported that they learned organic farming from their relatives, neighbors and friends. This report was confirmed by the coordinator of PCD, stating that the NGO had tried to promote organic farming to all farmers, but many of them were out of reach given the limited human resource. Finally, 3 farmers mentioned that they learned about organic farming on the basketball court. As one reported: *“I get to know organic farming for the first time after the conversation with LB⁹ in the basketball game.”*

We had gotten the hint and continued to investigate the role of basketball game. According to our filed observation, most farmers of family Li live close to the basketball court. In fact, even before the renovation of basketball court, farmers of family Li were used to play basketball game on the court given their proximity. Therefore, participation in the basketball game would induce more contact with farmers of family Li. This observation explained why farmers could get information about organic farming on the basketball court.

“So what is the biggest change with basketball game?” To this question, we got different answers. In general, 13 of 15 respondents confirmed that they have more communication with others due to the basketball game. Not surprisingly, when asked to count the names of other family, farmers who reported to frequently participate in the game could generally count more than 15 names. In contrast, those who reported to participate rarely could count less than 5 names. Intuitively, farmers’ social interaction was intensified due to the basketball game. This understanding leads to a plausible hypothesis: The basketball game has indeed extended the social network in the village and promoted the organic farming through the mechanism of farmers’ social interaction with others. To make sure, this hypothesis needs to be validated by an empirical test with more data.

To this end, we revised our questionnaire with feedback from the interviews and used it for collection of data from all households in Sancha village. In practice, the formal survey was implemented in local dialect and in form of face-to-face interview with household

⁹LB is a farmer of family Li

head at home. Generally, the formal survey lasted for about one hour. Questions such as “*On average, have you or your family participated in the basketball game as player or audience more than 3 times per month?*”¹⁰ was asked to measure farmers participation in the basketball game, “*Do you practice organic farming on at least one plot of your paddy land?*” and “*Can you tell the difference between organic farming and conventional farming?*”¹¹ were used to capture farmers’ effective organic adoption. Besides, a number of household’s socio-economic characteristics, household living condition were also noted during our home visiting. Respondents were asked to recall information for 2007, 2008 and 2009. To ensure the accuracy, we checked the answers with available records provided by the village head and dropped information from any non-reliable interview¹². After the data cleaning, information of 108 households for 2008 and 2009 were retained for our empirical study.

4 Modelling the social network in Sancha village

To test our hypothesis of extended social network, we need to firstly define and model the social network in the village. In literature, the egocentric data is usually collected to model specific social networks, i.e., family network and friendship network(Wasserman and Faust, 1994). In this case study, we aim to explore the social interactions within a broader scope, i.e., through social activity. In the case of basketball game, it is difficult to decide what kind of interactions play the most important role. One may interact with more people other than his family members and close friends, or gets influenced by conversations between others in the game. To this effect, we prefer to take account of all potential social interactions to define the extended social network. One may argue that it is unrealistic that a farmer communicate with all participants of the game. It is indeed true. However, the attempt of precise measuring could induce potential measurement

¹⁰According to village head, the game is organized weekly. So we regard households who report to participate at least 3 times per month as frequent participants that are able to make effective social connection with others.

¹¹The definition of organic farming follows that of IFOAM.

¹²The rejected cases include farmers who were too old to understand the question and farmers who refused to be interviewed. They represent less than 10% of the total interviews.

errors and information omission. Alternatively, if one can justify the effectiveness of an extensive network, it is reassuring to infer the effectiveness of a more intensive network. Between the precision and reassurance, we choose the latter.

Following previous discussions, the social network of Sancha village is composed of 2 parts, i.e., family network and basketball network. First of all, to represent the family network in a matrix way, we construct a matrix $F = [F1_i F2_i F3_i F4_i]$ where the row i represent the household i , the columns represent four family dummies. This can be transformed to a symmetric matrix $W1$ that represent connections between household i and household j within the same family.

$$W1 = [W1_{ij}]_{i,j \in n} = F \times F' \quad (1)$$

Next, participation in the basketball game is assumed to extend the family network $W1$. Similarly, the social network created by participation in basketball game can be represented by a one column matrix $C = [C_i]$ where C_i is a participation dummy. It can also be transformed to a symmetric matrix $W2$:

$$W2 = [W2_{ij}]_{i,j \in n} = C \times C' \quad (2)$$

By combining $W1$ and $W2$, we define the extended social network by a symmetric matrix G :

$$G \equiv W1 + W2 \quad (3)$$

Under this definition, we implicitly suppose that the social interactions within network $W1$ and $W2$ are of the same effect. Instead of any particular social networks, i.e., family and friends, the social network effect that we are going to test is the mean effect within the social network G . By definition, one is *NOT* considered as peer of himself. The matrix G is then normalized for subsequent use. With this modeling, we can visualize the social network in graphic.

Fig 1. The dynamic of social network in Sancha village

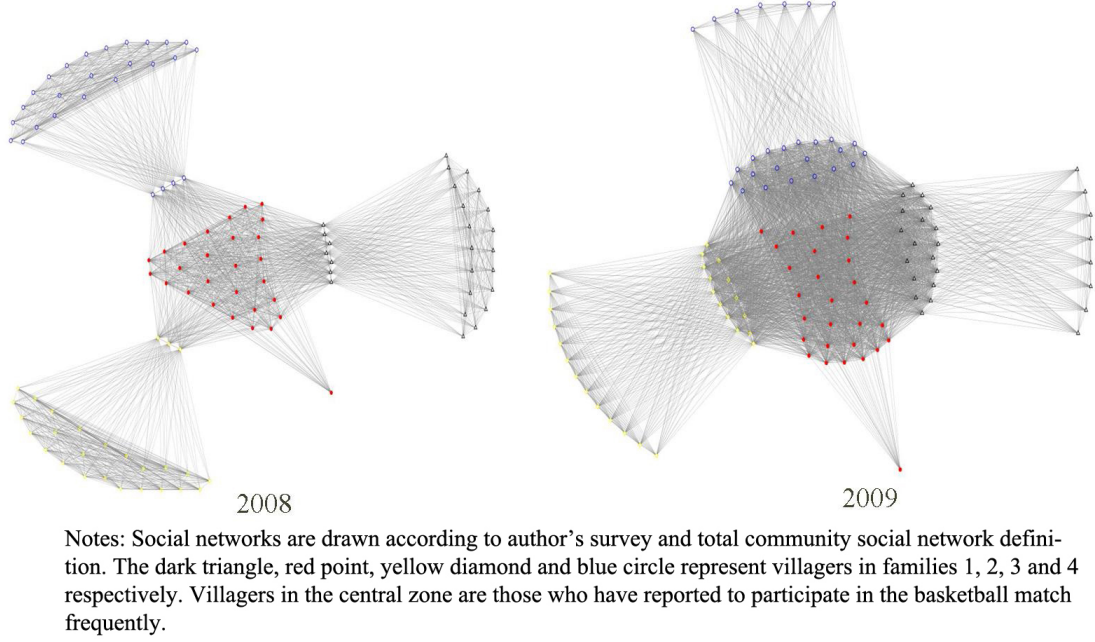


Figure1 is produced with data collected by our formal survey. The nodes of different colors represent households of four families. The edges represent the social links among households according to our definition of social network. To make it more intuitive, farmers who report to participate in the basketball game are placed in the center of the network. One can note that in 2008 (i.e., before the renovation of court), the social network are relatively sparse in the village. While in 2009 (i.e., after the renovation of court), the basketball game has attracted more farmers and intensified the social network.

5 Theoretical framework

In this section, we make a brief literature review to guide our empirical test. The social network effect (also known as peers effect) is often studied in diffusion of innovation(Young, 2000; Rogers, 1995) in economics. Specifically in the domain of agricultural economics, the social network has attracted keen interests of study to explain the diffusion of agricultural technologies in developing countries(Foster and Rosenzweig, 1996; Conley and Udry, 2001;

Bandiera and Rasul, 2006; Munshi, 2004; Miguel and Kremer, 2003). However, in spite of its solid theoretic foundation, the empirical estimation of social network effect is not simple. In summary, one needs to address three fundamental problems when estimating social network effect. The first one is discussed by Manski (1993) and commonly known as the “*reflection problem*”. Basically, it refers to the difficulty to disentangle the endogenous social network effect from the exogenous contextual effect in a “*linear-in-means*” model¹³. It could be treated as a simultaneity problem in econometrics. The second is the endogenous formation of social network. For instance, in our case, farmer’s participation in the basketball game and his adoption of organic farming could be jointly determined by his intrinsic attributes (i.e., sociability and health state) which are non-observable to econometrician. The formation of basketball network is thus endogenous and bias the estimation. Third, the estimation of social network effect could be spurious if some correlated environmental effects are omitted by econometrician. In our case, the socio-economic endowments may be family specific(i.e., culture and expertise), these endowments may probably confound with the social network effect on basis of family network.

To overcome these problems and achieve consistent estimation of social network effect, varied methods have been proposed. For instance, one could rely on the nonlinearity between individual and group response which is imposed by a discrete choice model as discussed by Brock and Durlauf (2000). One could also explore the exogenous variation in group size to achieve the identification (Lee, 2007; Boucher et al., 2012). Moreover, the overlapping structure of social networks could be explored to derive spatial instruments for the identification of social effect(Bramoullé et al., 2009). In our case, the specificity of basketball game provides another possibility. As discussed by Moffitt and Valente (2001), the change of social network by policy intervention is an exogenous source of identification. The basketball game is supposed to change the social network for all farmers in the village, whereas some are hindered by their remote location(given the evening condition of basketball game). Therefore, farmers’ remoteness from the court could serve as instrument for his social network change. On the other hand, the number of kids is

¹³n the linear-in-means model, the outcome of each individual depends linearly on his own characteristics, on the mean outcome of his reference group and on its mean characteristics.

another instrument. Because more kids means greater incentive for the basketball game. For more details, we now turn to the structural model for test and our novel approach of identification.

6 Econometric issues

6.1 Baseline study

First of all, we would conduct a baseline study to test the relation between basketball game and the adoption of organic farming using a simple model as follows:

$$ORGANIC_{i,t} = \alpha_0 + \alpha_1 BASKET_{i,t} + \alpha_2 X_{i,t} + F_s + T_t + \varepsilon_{i,t} \quad (4)$$

Where the dependent variable $ORGANIC_{i,t}$ is household i 's organic farming adoption, $BASKET_{i,t}$ is household i 's participation in basketball game at time t , $X_{i,t}$ control for a number of household socio-economic endowments such as age, gender, education level, household size, farm size and off-farm income. These endowments are expected to capture the human capital and physical capital of household. F_s are family dummies to control for unobservable family specific characteristics. T_t denotes a year dummy to capture common shocks related to the year.

With this specification, $BASKET_{i,t}$ could be endogenous due to unobservable characters of farmer (i.e., health state and sociability). To address this problem, an IV estimation is applied. As discussed earlier, 2 instruments are available in our specific setting: the remoteness from the basketball court and the number of kids of household. The baseline regression is useful to confirm our intuition of research on one hand. On the other hand, it serve to check the validity of our 2 instruments for subsequent use.

6.2 Identification of social network effect

Next, we would like to identify the social network effect to validate the hypothesis underlying the baseline model. To do so, we estimate a model that describe the interdependent relation between individual outcome and his peers' outcome within the predefined social network (Case, 1992; Manski, 1993; Durlauf and Young, 2001; Moffitt and Valente, 2001).

$$ORGANIC_{i,t} = \beta_0 + \beta_1 \frac{\sum_{j \in P_i} ORGANIC_{j,t}}{n_i} + \beta_2 \frac{\sum_{j \in P_i} X_{j,t}}{n_i} + \beta_2 X_{i,t} + \tau_t + \epsilon_{i,t}, \quad (5)$$

In the model, household i 's organic adoption depends on the mean adoption rate of his peers in his group P_i , which represent the social network effect and is captured by coefficient β_1 . Hereafter we follow the connotation of Manski (1993) to call it the *endogenous social effect*. Meanwhile, household i 's decision also depends on the characteristics of his peers, which represent the *contextual effect* and is captured by β_2 . Also, a number of socio-economic endowments of household are controlled for by X . Finally, τ_t is a year dummy to capture the year shock and the error term $\epsilon_{i,t}$ reflects the usual i.i.d. disturbances with zero mean and an unknown variance associated with i .

We then write the structural model in matrix notation:

$$ORGANIC_{i,t} = \beta_0 + \beta_1 GORGANIC_{i,t} + \beta_2 GX_{i,t} + \beta_3 X_{i,t} + \tau_t + \epsilon_{i,t} \quad (6)$$

where G is the social network matrix predefined earlier. $G_{ij} = 1/n_i$ if i and j share the same family or both participate in the basketball game, and 0 otherwise. The objective of our identification is to disentangle the *endogenous social effect* (i.e., Social network effect) from *contextual effect* and possible *correlated effects* in the error. We will address the problems as revealed in the literature one by one.

First of all, to rule out the *correlated effects* specific to family, we compare household's organic adoption within each family by adding family dummies ς_s $s \in 1...4$ in equation 6. The second concern is the endogenous formation of social network related to basketball game participation. As discussed earlier, it is possible that household will *self-select* into

the basketball game due to a number of unobservable characters (i.e., health state and sociability). To address this concern, we will make use of the Heckman correction for the *self-selection* problem (Heckman, 1979). For a demonstration, we model the adoption process and participation process with 2 equations:

$$ORGANIC_{i,t} = \beta_0 + \beta_1 GORGANIC_{i,t} + \beta_2 GX_{i,t} + \beta_3 X_{i,t} + \varsigma_s + \tau_t + \mu_{i,t} + \epsilon_{i,t} \quad (7)$$

$$PR(BASKET_{i,t} = 1) = \delta_0 + \delta_1 GX_{i,t} + \delta_2 X_{i,t} + \delta_3 Z_{i,t} + \varsigma_s + \tau_t + \xi_{i,t} \quad (8)$$

The presence of unobservable characters in both $\mu_{i,t}$ and $\xi_{i,t}$ is the origin of *self-selection* problem. Using two exogenous variables $Z_{i,t}$ (i.e., remoteness and number of kids) and making strict assumption (i.e., $\mu_{i,t}$ and $\xi_{i,t}$ are mean zero, jointly and normally distributed with the variance-covariance matrix), the expectation of $\mu_{i,t}$ conditional on participation can be calculated with the formula below:

$$E[\mu_{i,t} | BASKET_{i,t} = 1] = \sigma_\mu \lambda_{i,t} \quad (9)$$

Of which, $\lambda_{i,t}$ is the *Inverse Mills Ratio* calculated from the residues predicted from the participation equation 8.

$$\lambda(\xi_{i,t}) = \phi(\xi_{i,t}) / \Phi(\xi_{i,t}) \quad (10)$$

Therefore, to get rid of *self-selection* problem, one can calculate $\lambda_{i,t}$ and explicitly control for it in the adoption equation as follows:

$$ORGANIC_{i,t} = \beta_0 + \beta_1 GORGANIC_{i,t} + \beta_2 GX_{i,t} + \beta_3 X_{i,t} + \beta_4 \lambda_{i,t} + \varsigma_s + \tau_t + \epsilon_{i,t} \quad (11)$$

The third is the *reflection problem*. One of the solutions proposed in literature is to find appropriate instruments for $GORGANIC_{i,t}$ (Bramoullé et al., 2009; Moffitt and Valente,

2001). Here, the key observation we make is that $G\lambda_{i,t}$ and $G^2\lambda_{i,t}$ are two candidates under two conditions: 1) $\lambda_{i,t}$ is significant 2) $G\lambda_{i,t}$ and $G^2\lambda_{i,t}$ are *excludable* from equation11. The first condition relies on the assumption of endogenous formation of social network and will be ensured by the use of two exogenous Z in participation equation8. The second condition of *exclusion restriction* will be ensured by the assumption that farmer's participation in the basketball game should not be driven by his peers' organic adoption. This critical assumption is strong but seems hold given the timing of our sample(i.e.,one year around the court renovation). During such a short period, any strategic behaviour of farmer is unlikely which base on his complete observation of the entire social network.

To ensure this assumption, we also need control for both observable(i.e., age, gender etc.) and non-observable characters (i.e., $\lambda_{i,t}$) of household in the adoption equation11. As suggested by other studies(Arcand and Fafchamps, 2011; Fafchamps and Lund, 2003; Conley and Topa, 2002), the *assortative matching* may exist in many cases, i.e., farmers' characters are similar in their group. This means $G\lambda_{i,t}$ and $G^2\lambda_{i,t}$ may correlate with $\lambda_{i,t}$ in our case.

In summary, under the reasonable assumption of *exclusion restriction*, our identification of social network effect is achieved in three steps:

1. The participation equation8 is estimated with two $Z_{i,t}$ (i.e., remoteness from the court and number of kids)to calculate the *Inverse Mills Ratio* $\lambda_{i,t}$ (Maddala, 1983).
2. The assumption of endogenous formation of social network is checked (i.e., $\lambda_{i,t} \neq 0$) in the adoption equation11. If it holds, we use $\lambda_{i,t}$ to construct two instruments $G\lambda_{i,t}$ and $G^2\lambda_{i,t}$.
3. The adoption equation11 is estimated by applying the IV estimation using $G\lambda_{i,t}$ and $G^2\lambda_{i,t}$ as instruments.

7 Data

The dataset used for our empirical study is derived from the formal household survey as discussed in section 3. It contains information about farmers' report of participation in the basketball game and organic farming adoption as well as a number of socio-economic

characteristics for 108 households during 2008 and 2009¹⁴. Table2 presents the descriptive statistics of these variables by organic status of household, a summary for the definitions of these variables can be found in the appendix8.

Table 2: Descriptive statistics by organic adoption status

| | Total(216) | | Organic Adopter(108) | | Non-Adopter(108) | | t-test |
|------------------------------------|------------|-----------|----------------------|-----------|------------------|-----------|---------|
| | mean | Sd | mean | sd | mean | sd | p-value |
| Individual characteristics: | | | | | | | |
| BASKET(1=Participated) | 0.55 | (0.50) | 0.94 | (0.25) | 0.17 | (0.37) | 0.00 |
| AGE(in years) | 53.62 | (12.82) | 54.00 | (12.19) | 53.24 | (13.46) | 0.66 |
| SEX(1=woman) | 0.61 | (0.49) | 0.67 | (0.47) | 0.56 | (0.50) | 0.09 |
| EDUCATION(in years) | 3.63 | (3.31) | 3.8 | (3.52) | 3.46 | (3.10) | 0.46 |
| HOUSEHOLDSIZE(in no.) | 3.42 | (1.61) | 3.49 | (1.67) | 3.34 | (1.56) | 0.50 |
| FARMSIZE(in mu) | 2.13 | (0.95) | 2.22 | (0.96) | 2.05 | (0.93) | 0.18 |
| INCOME(in Yuan) | 1946.00 | (5919.65) | 2331.02 | (7067.62) | 1560.97 | (4490.14) | 0.34 |
| REMOTENESS(walk time) | 1.86 | (0.70) | 1.56 | (0.65) | 2.16 | (0.63) | 0.00 |
| KID(in no.) | 0.34 | (0.61) | 0.35 | (0.60) | 0.32 | (0.62) | 0.74 |
| Peers' characteristics: | | | | | | | |
| GORGANIC | 0.54 | (0.34) | 0.79 | (0.10) | 0.28 | (0.30) | 0.00 |
| GAGE | 53.75 | (1.13) | 54.18 | (0.59) | 53.31 | (1.34) | 0.00 |
| GSEX | 0.61 | (0.05) | 0.63 | (0.02) | 0.59 | (0.06) | 0.00 |
| GEDUCATION | 3.56 | (0.49) | 3.57 | (0.18) | 3.55 | (0.67) | 0.82 |
| GHOUSEHOLDSIZE | 3.45 | (0.25) | 3.40 | (0.14) | 3.50 | (0.31) | 0.00 |
| GFARMSIZE | 2.14 | (0.08) | 2.10 | (0.06) | 2.18 | (0.08) | 0.00 |
| GINCOME | 2035.24 | (879.85) | 2109.30 | (669.60) | 1961.17 | (1046.92) | 0.22 |

Note: For all tests of means. The null hypothesis is that the means are equal against a two-sided alternative. The confidence level is at 5%.

Table2 provides a brief picture of Sancha village. As one can note, the arable land resource is scarce in the village, the average area of paddy field is only 2.13 mu (0.14 ha) per household. The labor seems abundant(3.4 persons per household), but most of which are aged people(54 years old) and female(61%). Their average education level is

¹⁴All interviewed households have actively participated in paddy rice production, using conventional or organic methods. Some in a hybrid way, which means both conventional and organic farming.

three years of primary school. This is not surprising in rural China. Along with the development of manufacturing sector, more and more rural household rely their livelihood on off-farm activities. Since there are few off-farm employment in the countryside(i.e., in Sancha village, the average off-farm income is only 1946 yuan(311 US dollar)), rural households intend to migrate and work in the city to improve their life. However, under the Hukou system and rigid land tenure regime, rural household with Rural Hukou can not sell their land and easily get integrated in the city¹⁵. Consequently, man work in the city and woman work at home is the best strategy for most poor rural household. As reported by [Cai and Wang \(2008\)](#), more than 150 million Chinese farmers worked out in the city in 2011. As such, Sancha village is a representative of thousands of millions small villages in rural China.

When we compare the organic adopters with non-adopters in Sancha village, some preliminary evidences should be noted. Firstly, there is significant difference in terms of basketball game participation. 94% organic adopter have reported to frequently participate in the basketball game in comparison to 17% non-adopter. Secondly, the difference in peers' adoption rate is also significant. For adopters, 83% of their peers also adopt. While for non-adopters, only 28% of their peers adopt. Thirdly, most peers' characters are also significantly different, i.e., adopters have more aged and female peers with large household size and big farm land. To sort out all these correlations and determine the role of each, we now turn to a more rigorous econometric regression analysis.

8 Result and discussions

8.1 Basketball game and organic farming

As a starting point, we firstly regress our baseline model to test the relation between farmers' basketball game participation and their organic farming adoption. The result is

¹⁵In China, the population is divided by Urban Hukou and Rural Hukou according to the permanent residence. In accordance, the schemes of social security and medical care are distinct for two types of Hukou. People with Rural Hukou are thus not covered by the urban social safety nets even they work in the city. For compensation, they have the use right of arable land for agricultural exploitation but without property right, i.e., they can not sell the land under their exploitation.

reported in table3, which serves as a benchmark and a check of our two instruments(i.e., remoteness and number of kids).

Table 3: Results of baseline regression

| Estimator | Dependant Variable: ORGANIC(1/0) | | | | | |
|--------------------------|----------------------------------|--------|----------|--------|-----------|--------|
| | PROBIT | | XTPROBIT | | IV-PROBIT | |
| BASKET | 0.28*** | (0.00) | 0.28*** | (0.00) | 0.26*** | (0.00) |
| AGE | 1.98e-03 | (0.13) | 1.96e-03 | (0.14) | 2.15e-03 | (0.15) |
| SEX | 0.12*** | (0.00) | 0.12*** | (0.00) | 0.13*** | (0.00) |
| EDUCATION | 0.01** | (0.02) | 0.01** | (0.02) | 0.01** | (0.03) |
| HOUSEHOLDSIZE | 0.01 | (0.26) | 0.01 | (0.26) | 0.01 | (0.29) |
| FARMSIZE | 0.09*** | (0.00) | 0.09*** | (0.00) | 0.09*** | (0.00) |
| INCOME | 1.42e-07 | (0.95) | 1.96e-07 | (0.93) | 1.76e-07 | (0.95) |
| FAMILY2 | 0.30*** | (0.00) | 0.30*** | (0.00) | 0.34*** | (0.00) |
| FAMILY3 | -0.04 | (0.43) | -0.04 | (0.46) | -0.04 | (0.44) |
| FAMILY4 | 0.07 | (0.12) | 0.07 | (0.15) | 0.07 | (0.12) |
| YEAR | 0.19*** | (0.00) | 0.19*** | (0.00) | 0.21*** | (0.00) |
| Observations | 216 | | 216 | | 216 | |
| Log pseudolikelihood | -39.79 | | | | -124.46 | |
| P-value Wald chi2 | 0.00 | | 0.00 | | 0.00 | |
| Over-identification test | | | | | 0.98 | |

Notes: Average Marginal Effects are calculated for the coefficient and Robust p-value reported in parentheses, with ***, ** and * denoting significance at the 1, 5 and 10 percent level respectively. P-value of Wald chi2 is presented. P-value of over-identification test is presented for the IV-probit estimator. First stage result is presented in Appendix 3.

For the baseline regression, we employ different estimators(i.e., probit and xtprobit) and yield consistent results. The result indicates, all else equal, household's participation in the basketball game will increase its probability to adopt organic farming by 28%. The influence of basketball game is significant and confirms the effectiveness of social approach in farmers' collective action for organic farming. To address the concern of endogeneity problem of participation, we employ an IV estimation using household's remoteness from

the court and the numbers of kids as instruments. One can note that the statistics of over-identification doesn't reject the validity of these instruments, and the effect of basketball game remains significant with a magnitude of 0.26.

Regarding other determinants of organic farming, the results highlight the role of women and education. It is conceivable that female and more educated farmers are more sensible to the health issue. Since the health concerns is the first motivation for organic farming as revealed by our fieldwork, the result just confirms this motivation. This result is in line with other studies which also find education indispensable in promotion of new technology (Foster and Rosenzweig, 1996; Huffman, 2001). Farm size is found a positive effect for organic adoption. A plausible explanation is that, as a new technology, organic farming is associated with high risk (i.e., yield lost). Household with big farm could alleviate the risk by allocating a small portion of its farm for experimentation. Finally, family Li (FAMILY2) is significantly related to organic farming. The result confirms the finding of our fieldwork that due to the early stage of experimentation, household of family Li has accumulated rich experience of organic farming, their expertise has sustained their choice of organic farming.

8.2 Diffusion of organic farming though social network

Our fieldwork has provided a hypothesis to explain the relation between basketball game and organic farming: the extended social network effect. We thus define the social network on basis of this hypothesis and attempt to identify the social network effect using econometric methods. Our identification result is presented in table4, we will follow the three-steps identification for a discussion.

Table 4: Results of identification

| | Naive | | Step1 | | Step2 | | Step3 | |
|---------------|---------|--------|--------|--|---------|--------|---------|--------|
| Dependant Var | ORGANIC | | BASKET | | ORGANIC | | ORGANIC | |
| Estimator | OLS | | PROBIT | | OLS | | IV | |
| GORGANIC | 1.31*** | (0.00) | | | 0.35 | (0.17) | 0.67** | (0.01) |

| | | | | | | | | |
|-------------------|-----------|--------|----------|--------|--------------|--------|-------------|--------|
| AGE | 3.20e-03 | (0.41) | 0.01*** | (0.00) | 3.36e-03 | (0.31) | 3.66e-03 | (0.34) |
| SEX | 0.15 | (0.11) | 0.06 | (0.29) | 0.19*** | (0.01) | 0.15** | (0.01) |
| EDUCATION | 0.02** | (0.03) | 0.02*** | (0.00) | 0.03*** | (0.00) | 0.02*** | (0.00) |
| FARMSIZE | 0.09*** | (0.00) | -0.04* | (0.08) | 0.03 | (0.26) | 0.05* | (0.08) |
| INCOME | -3.65e-06 | (0.49) | 1.98e-06 | (0.81) | -8.99e-06* | (0.07) | -8.53e-06 | (0.17) |
| HOUSEHOLD SIZE | 0.03 | (0.15) | 0.05** | (0.03) | 0.08*** | (0.00) | 0.07*** | (0.00) |
| GAGE | 0.07 | (0.54) | 0.43*** | (0.00) | 0.10 | (0.35) | 0.11 | (0.33) |
| GSEX | 1.03 | (0.68) | 3.42* | (0.05) | 4.59** | (0.02) | 2.97 | (0.14) |
| GEDUCATION | 0.23** | (0.03) | 0.82*** | (0.00) | 0.86*** | (0.00) | 0.71*** | (0.00) |
| GFARMSIZE | 0.17 | (0.84) | -1.87*** | (0.00) | -1.79** | (0.04) | -0.99 | (0.28) |
| GINCOME | -2.28e-04 | (0.32) | 1.20e-05 | (0.97) | -5.38e-04*** | (0.00) | -5.17e-04** | (0.02) |
| GHOUSEHOLD SIZE | 0.93 | (0.18) | 1.61** | (0.04) | 2.76*** | (0.00) | 2.43*** | (0.00) |
| REMOTENESS | | | -0.14*** | (0.00) | | | | |
| KID | | | 0.05* | (0.09) | | | | |
| IMR | | | | | 0.28*** | (0.00) | 0.26*** | (0.00) |
| Observations | 216 | | 216 | | 216 | | 216 | |
| R2/Log likelihood | 0.64 | | -51.07 | | 0.73 | | 0.73 | |
| F-test | 0.00 | | | | 0.00 | | 0.00 | |
| Over-Id test | | | | | | | 0.71 | |

Notes: Average Marginal Effects are calculated for probit estimation in col2; Robust p-value is represented in parentheses. With ***, ** and * denoting significance at the 1, 5 and 10 percent level respectively. R2 value is reported for OLS and IV estimation, log pseudolikelihood value is reported for probit estimation. The p-value of over-identification test is reported for IV estimation. The family and year dummies are controlled except for na?ve estimation in col1.

8.2.1 Social activity and its constrains

In the first column of table4, we present the result of a “naive” estimation of social network effect. One can note that the coefficient of social network effect(GORGANIC) is significant and quite large (1.31), which seems too good to be true. On the other hand, most contextual effect(GX) are non-significant. It raises doubts about the spurious identification as discussed by [Manski \(1993\)](#). We will compare this result with our 3-steps identification result and find that the “naive” result is indeed not robust.

In first step, column two reports the estimation result of the participation equation

(8) using a probit estimator. It is instructive to understand the social activity in rural areas and guide other fieldwork. Firstly, we find that education and household size are positively correlated with household's participation. Besides, senior people are also more interested by the basketball game. It is not surprising since senior people have generally more spare time and less life pressure. This result is in line with Putnam (2001)'s finding of cohort effect where senior people belong to more organizations than younger people. In rural China, the role of senior people is recognized to guide other NRR project. For instance, Wang and Hale (2009) report that a number of successful NRR cooperatives are founded on basis of senior association.

On the other hand, farm size is found to impede household's participation. In our analysis, the farm size may capture the effect of agricultural production activity. Big farm probably implicates more agricultural work and less spare time. This result suggests a potential constrain of social activity in big villages, which is supported by Wang and Hale (2009)'s report that NRR has encountered many difficulties in big villages. The efficiency of social activity remains thus questionable in big villages where agricultural burden is heavy. Moreover, we find the remoteness from the court significantly hinders household's participation in the basketball game. It also questions the efficiency of social activity in big villages where households are sparsely located.

For peers' influence, the signs and significance are similar with one's own characters. For instance, more senior, educated, female and big household peers will encourage one's participation, while peers' farm size play the opposite effect. The result suggests an *assortative matching* in the formation of social network in our case (Arcand and Fafchamps, 2011; Fafchamps and Lund, 2003; Conley and Topa, 2002). As a result, the problem of endogenous formation of social network should be taken into account in our following analysis.

8.2.2 Effect of social network

We continue our identification of social network effect. In column three, the *Inverse Mills Ratio* (λ) of Heckman is calculated and controlled in the model. One can note that the coefficient of IMR is significant, which suggests the presence of *self-selection* problem. A

likelihood ratio test is thus performed. The rejection of null hypothesis has confirmed this assumption and supports the necessity of Heckman correction. Further more, the significance of IMR enables us to construct instruments $G\lambda_{i,t}$ and $G^2\lambda_{i,t}$ for subsequent identification use.

In column four, we address the *reflection problem* by applying the IV estimation. The model we estimate is a Linear Probit Model(LPM), which is simple and intuitive for estimation and interpretation. Another advantage of the LPM model is the rich statistical tests that enable us to check assumption such as *exclusion restriction* of our instruments. Finally, given the survey nature of our data, it is possible that the errors of respondents are correlated. To eliminate this concern, a bootstrap approach is applied to the estimation. For the result, we firstly note that the magnitude of social network effect is reduced by 50% comparing to the naive estimation. However, it remains positive and statistically significant at the 5% level. The result indicates that, all else equal, 10% growth in the fraction of peers who adopt organic farming will increase 6.7% of the probability that a household also adopt organic farming. This is a large “social multiplier” effect in comparison with other studies which also find positive social network effect(Conley and Udry, 2001; Bandiera and Rasul, 2006). With this result, we can now explain the mechanism of basketball game in promotion of organic farming by a strong social network effect.

For the contextual effects, we identify more significant coefficients comparing to the naive estimation. These contextual effects provide a more complete understanding of the social network. For instance, peers’ education level and household size significantly influence household’s adoption decision. Whereas, peers’ off-farm income plays the opposite role. Given the knowledge and labor intensity of organic farming, one plausible explanation is that farmers share knowledge and labor within their social network. If this is the case, peers’ off-farm income may capture off-farm employment opportunity in the social network. These opportunity will certainly raise a competition for labor force.

Finally, apart from the social network effects, the effects of household’s characters are meaningful and useful to understand the advantages and constrains for organic farming development in rural China. We note here women, education and labor as three key words, which represent the human capital for sustainable development of organic farming. As

explained earlier, the rural society is characterized by a massive exodus of male rural labor in contemporary China, this phenomenon represent both constrains and opportunity for organic farming development in China. On one hand, government should recognize the critical role of women in rural society and rely on them for a change to sustainable agriculture. On the other hand, more education(i.e., environmental education and technical formation) is needed to reinforce farmers' capacity for sustainable development.

8.3 Robustness check

For the robustness check, we firstly explore the panel structure of our data to estimate a within model which relies on the variation of social network due to policy intervention (i.e., renovation of basket court and organization of basketball league match). The advantage of within model is able to get rid of any time-invariant correlated effects. To address the concerns of time-variant factors, we will make use of the IMR of Heckman under the assumption of *exclusion restriction*. Also, we can combine the advantages of within model and the IV approach to run an Within-2SLS estimation. These exercises are useful to serve as a comparison with previous Heckman-IV approach.

Secondly, as discussed by [Bramoullé et al. \(2009\)](#), we can take advantage of the overlapping structure of social network for the identification of social network effect. In practice, one could construct spatial instruments G^2X which consist of characters of peer's peers to identify the social network effect. In our case, the basketball game turns the social network overlap among four families (see figure 1 in section 4). This network structure makes it possible to apply the estimator of [Bramoullé et al. \(2009\)](#)(BDF for short). For concerns of endogenous formation of social network (i.e., farmers' *self-selection* into the basketball game) and correlated effects, we will control for IMR in the model and estimate a within model.

Finally, the social network effect may be heterogeneous. The intuition is that if the social network effect is due to information spillover, farmers who have precise information about organic farming should be less sensible to the social network effect. In presence of heterogeneous expertise, social network effect is expected to be non significant for

organic experts of family Li. It could even be negative if the social network becomes too large (see explanation of [Bandiera and Rasul \(2006\)](#)). To check this hypothesis, we conduct a dif-in-dif analysis based on the exogenous policy intervention before and after 2009. We note here organic experts are similar to new adopters in terms of incentive for organic farming. They are thus comparable to determine the social network effect due to policy intervention. Practically, we construct a dummy C which indicates “0” for organic experts(i.e.,who participated in early experimentation of PCD) and “1” for new adopters(i.e., who adopt organic farming since 2009). The dummy is then crossed with the variable $GORGANIC$ to construct a new variable $C * GORGANIC$ and included in the model. Finally the estimation is made by within and within-2SLS estimators for comparison. Intuitively, we expect significant and positive sign for $C * GORGANIC$, whereas the $GORGANIC$ could be nonsignificant or negative.

Table 5: Robustness check(I)

| Estimator | Dependant variable: ORGANIC(1/0) | | | | | | | |
|--------------------------|----------------------------------|--------|--------------|--------|--------------|--------|--------------|--------|
| | WITHIN | | WITHIN-2SLS | | BDF | | BDF-WITHIN | |
| GORGANIC | 0.60** | (0.04) | 0.76*** | (0.01) | 0.60*** | (0.01) | 0.79*** | (0.00) |
| AGE | 0.65** | (0.01) | 0.56** | (0.01) | 3.60e-03 | (0.26) | 0.54** | (0.02) |
| SEX | | | | | 0.16** | (0.01) | | |
| EDUCATION | | | | | 0.02*** | (0.00) | | |
| FARMSIZE | -0.03 | (0.53) | -0.02 | (0.73) | 0.05* | (0.06) | -0.01 | (0.76) |
| INCOME | 6.67e-06 | (0.44) | 6.78e-06 | (0.42) | -8.62e-06* | (0.07) | 6.81e-06 | (0.42) |
| HOUSEHOLDSIZE | 0.09 | (0.17) | 0.10 | (0.13) | 0.07*** | (0.00) | 0.10 | (0.13) |
| GAGE | -0.09 | (0.51) | -0.07 | (0.56) | 0.11 | (0.28) | -0.07 | (0.58) |
| GSEX | 6.58*** | (0.00) | 5.96*** | (0.00) | 3.31* | (0.06) | 5.83*** | (0.01) |
| GEDUCATION | 0.61*** | (0.00) | 0.56*** | (0.00) | 0.74*** | (0.00) | 0.55*** | (0.00) |
| GFARMSIZE | -0.87 | (0.32) | -0.44 | (0.63) | -1.16 | (0.15) | -0.36 | (0.67) |
| GINCOME | -5.36e-04*** | (0.00) | -5.31e-04*** | (0.00) | -5.22e-04*** | (0.00) | -5.30e-04*** | (0.00) |
| GHOUSEHOLDSIZE | 2.31*** | (0.00) | 2.19*** | (0.00) | 2.50*** | (0.00) | 2.17*** | (0.00) |
| IMR | 0.24*** | (0.01) | 0.22** | (0.01) | 0.27*** | (0.00) | 0.22** | (0.02) |
| Observations | 216 | | 216 | | 216 | | 216 | |
| R-squared | 0.74 | | 0.74 | | 0.73 | | 0.74 | |
| F-test | 0.00 | | 0.00 | | 0.00 | | 0.00 | |
| Over-identification test | | | 0.13 | | 0.45 | | 0.15 | |

Notes: Robust p-value in parentheses; With ***, ** and * denoting significance at the 1, 5 and 10 percent level respectively. The P-value of over-identification test is presented for IV estimations in col 2, 3 and 4; The family and year dummies are controlled in all estimations; BDF refers to the estimator of spatial instrumentation as discussed by [Bramoullé et al. \(2009\)](#).

Let's first check out the results of within and BDF estimations in table5. In all these estimations, the social network effect is significant and positive. The magnitude of coefficient varies from 0.60 to 0.79. Our conclusion of large social multiplier effect is thus not rejected by the check. Besides, the role of women, education and labor force (captured by household size) are consistent with all these checks. On the other hand, off-farm activity as captured by off-farm income is the major competitor for organic farming. All these results are in accordance with our previous results.

Table 6: Robustness check(II)

| Dependant variable: ORGANIC(1/0) | | | | |
|----------------------------------|--------------|--------|-------------|--------|
| Estimator | WITHIN | | WITHIN-2SLS | |
| GORGANIC | -1.55*** | (0.00) | -2.44*** | (0.00) |
| C*GORGANIC | 1.57*** | (0.00) | 2.43*** | (0.00) |
| AGE | 0.96*** | (0.00) | 0.99*** | (0.00) |
| FARMSIZE | 0.01 | (0.12) | -1.25e-03 | (0.90) |
| INCOME | 1.26e-07 | (0.42) | 3.63e-07 | (0.20) |
| HOUSEHOLDSIZE | -0.01* | (0.07) | -0.02 | (0.20) |
| GAGE | -0.16*** | (0.00) | -0.10** | (0.02) |
| GSEX | -0.23 | (0.80) | 1.11 | (0.52) |
| GEDUCATION | 0.13 | (0.32) | 0.58** | (0.02) |
| GFARMSIZE | 1.14*** | (0.00) | 0.64 | (1.18) |
| GINCOME | -4.33e-04*** | (0.00) | -2.60e-04* | (0.08) |
| GHOUSEHOLDSIZE | -1.31*** | (0.00) | -2.06*** | (0.00) |
| C*GAGE | 0.17*** | (0.00) | 0.10** | (0.02) |
| C*GSEX | 0.04 | (0.96) | -1.11 | (0.51) |
| C*GEDUCATION | -0.15 | (0.23) | -0.58** | (0.02) |
| C*GFARMSIZE | -1.10*** | (0.00) | -0.70 | (0.13) |
| C*GINCOME | 4.59e-04*** | (0.00) | 2.78e-04* | (0.05) |
| C*GHOUSEHOLDSIZE | 1.21*** | (0.00) | 2.03*** | (0.00) |
| IMR | 4.06e-04 | (0.87) | 2.18e-03 | (0.41) |
| Observations | 154 | | 154 | |
| R-squared | 0.99 | | 0.99 | |

| | | |
|--------------------------|------|------|
| F-test | 0.00 | 0.00 |
| Over-identification test | | 0.93 |

Notes: Robust p-value in parentheses; With ***, ** and * denoting significance at the 1, 5 and 10 percent level respectively. The family and year dummies are controlled for in both estimations. The P-value of over-identification test is presented for IV estimation.

Next, let's check out the heterogeneous effect of social network with the dif-in-dif analysis in table6. Not surprisingly, *GORGANIC* becomes negative whereas the cross term $C * GORGANIC$ is significantly positive. The result implies the probability of organic experts' adoption is indeed decreasing along with the increasing number of participants in the social network. This could be due to their strategic behaviour given their complete information about the limited market for organic produce. In contrast, the social network effect is much stronger for new adopters, who have no complete information about organic farming. Taken together, these results suggest information spillover as an important explanation to the large social multiplier effect identified in our case. However, other social mechanism such as altruism and social pressure may also exist to explain the social network effect. To have a more detailed understanding about the components of social network effect, we need more specific data setting and leave it for the future study.

9 Conclusion

In order to answer the question at the beginning of this paper, we investigate a special NRR experiment in Sancha village where basketball game is employed to promote organic farming. Our fieldwork and empirical analysis reveal a large social multiplier effect within the extended social network of the village, which has provided a more thorough understanding about the social approach of NRR.

In reality, rural development is often constrained by the scarcity and inefficiency of formal institution in rural areas. The achievement of rural sustainable development seems to depend on the government's colossal investment. Alternatively, NRR proposes a cost-efficient solution which relies on informal institutions. Regarded as a major form of social capital, social networks are indeed widespread in rural areas. Smallholder farmers form

social networks on basis of relatives, friends as well as social and cultural activity. These social networks are essential for farmers' social learning, risk sharing, labor and finance cooperation, thus constitute the solid social foundation for farmers' collective action to achieve the sustainable development.

For conclusion, the emerging NRR movement in China has provided a new perspective to rethink the principle of rural development. Its sustainable development strategy and original social approach deserve more thorough studies to generate comprehensive understanding of the rural society.

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10 Appendices

10.1 Location of Sancha village



Source: www.map-of-china.org

10.2 Definition and description of variables

Table 8: Definition and description of variables

| | |
|---------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| ORGANIC | Farmer's self report of organic farming adoption. It's a binary variable code "1" if at least one plot of paddy field is under organic management. Code "0" otherwise. |
| BASKET | Farmer's report of basketball game participation. It's a binary variable code "1" if household participates in the basketball game more than 3 times per month during the year. Code "0" otherwise. |
| AGE | Age of household head |
| SEX | Gender of household head. Code "1" for woman, "0" for man |
| EDUCATION | Education level of household head. Code "0" for illiteracy, "1" for primary school first grade, "2" for primary school second grade, "3" for primary school third grade, "4" for primary school fourth grade, "5" for primary school fifth grade, "6" for primary school sixth grade, "7" for middle school first grade, "8" for middle school second grade, "9" for middle school third grade, "10" for high school first grade, "11" for high school second grade, "12" for high school third grade |
| HOUSEHOLDSIZE | Number of permanent residents of the household |
| FARMSIZE | Area of cultivated paddy field during the reference year, the unit is "Mu"(0.067 ha) |
| INCOME | Off-farm income of off-farm activities, the unit is "Yuan" |
| REMOTENESS | The distance to the basketball court measured by walk time. Code "1" for less than 5 minutes, "2" for 5 to 15 minutes, "3" for more than 15 minutes |
| KID | The number of kids under 5 years old and taken care by the household head |

10.3 First stage regressions

| Dependant variable | Baseline study COMMUNITY | Heckman-IV GORGANIC | Heckman-IV(WITHIN) GORGANIC | BDF GORGANIC | BDF(WITHIN) GORGANIC | DIF-DIF C*GORGANIC | DIF-DIF GORGANIC |
|-------------------------|-----------------------------|------------------------|--------------------------------|------------------------|-------------------------|------------------------|------------------------|
| REMOTENESS | -0.29*** (0.00) | | | | | | |
| KID | 0.06 (0.10) | | | | | | |
| G1MR | | -0.21 (0.39) | -0.32 (0.12) | | | | |
| G2MR | | 1.65*** (0.00) | 1.78*** (0.00) | | | | |
| G2AGE | | | | -1.17*** (0.00) | -1.17*** (0.00) | | |
| G2SEX | | | | 19.41*** (0.00) | 19.59*** (0.00) | | |
| G2EDUCATION | | | | -0.14*** (0.01) | -0.12* (0.07) | | |
| G2FARMSIZE | | | | -0.75*** (0.00) | -0.76*** (0.00) | | |
| G2INCOME | | | | -3.86e-04*** (0.00) | -4.40e-04*** (0.00) | | |
| G2HOUSEHOLD SIZE | | | | -0.38** (0.01) | -0.26 (0.16) | | |
| AGE | 1.26e-03 (0.50) | 1.81e-03*** (0.00) | 0.34*** (0.00) | -2.43e-04 (0.14) | -0.26 (0.16) | 2.46e-03 (0.73) | 0.40*** (0.00) |
| SEX | 3.63e-03 (0.95) | 0.09*** (0.00) | | 0.01** (0.03) | | | |
| EDUCATION | 1.37e-03 (0.88) | 0.01*** (0.00) | | 3.82e-04 (0.59) | | | |
| FARMSIZE | 0.01 (0.78) | -0.07*** (0.00) | -0.07*** (0.00) | -2.07e-03 (0.24) | -4.85e-03 (0.25) | 1.12e-03 (0.26) | -4.87e-04 (0.93) |
| INCOME | -1.09e-06 (0.77) | -1.45e-06 (0.39) | -4.87e-06** (0.01) | -5.06e-08 (0.86) | 6.77e-07 (0.13) | 1.45e-07 (0.57) | 3.16e-07 (0.33) |
| HOUSEHOLD SIZE | 0.01 (0.52) | 0.03*** (0.00) | 0.02 (0.20) | -0.01*** (0.00) | -2.02e-03 (0.64) | 6.06e-04 (0.66) | -5.42e-03 (0.38) |
| GAGE | | 0.06*** (0.00) | 0.06 (0.10) | -0.05*** (0.00) | -0.05*** (0.00) | -6.94e-03** (0.02) | -0.04 (0.14) |
| GSEX | | 3.72*** (0.00) | 3.04*** (0.00) | 1.19*** (0.00) | 1.04*** (0.00) | -0.04 (0.48) | 0.45 (0.49) |
| GEDUCATION | | 0.40*** (0.00) | 0.29*** (0.00) | 0.03 (0.24) | 0.01 (0.65) | -0.01 (0.26) | 0.24*** (0.00) |
| GFARMSIZE | | -2.56*** (0.00) | -2.51*** (0.00) | -0.08 (0.16) | -0.06 (0.53) | 0.04 (0.20) | 0.25 (0.39) |
| GINCOME | | -3.84e-05 (0.34) | -1.32e-05 (0.71) | -2.28e-05 (0.13) | -1.76e-05 (0.35) | -7.73e-07 (0.91) | -9.95e-05 (0.31) |
| GHOUSEHOLD SIZE | | 1.07*** (0.00) | 0.88*** (0.00) | -0.23*** (0.00) | -0.27*** (0.00) | -0.01 (0.46) | -0.84*** (0.00) |
| IMR | | 0.03 (0.29) | 0.04 (0.19) | 0.03*** (0.00) | 0.03*** (0.00) | -0.01*** (0.00) | -3.30e-03 (0.40) |
| C*GAGE | | | | | | 0.02*** (0.00) | 0.04 (0.10) |
| C*GSEX | | | | | | 2.32*** (0.00) | 1.65** (0.01) |
| C*GEDUCATION | | | | | | 0.12*** (0.00) | -0.15** (0.01) |
| C*GFARMSIZE | | | | | | 0.21*** (0.00) | -0.08 (0.77) |
| C*GINCOME | | | | | | -6.10e-05*** (0.00) | 4.97e-05 (0.62) |
| C*GHOUSEHOLD SIZE | | | | | | 0.43*** (0.00) | 1.16*** (0.00) |
| C*G2AGE | | | | | | 0.53*** (0.00) | 0.24*** (0.01) |
| C*G2SEX | | | | | | 44.99*** (0.00) | 41.26*** (0.00) |
| C*G2EDUCATION | | | | | | 2.55*** (0.00) | 2.14*** (0.00) |
| C*G2FARMSIZE | | | | | | 5.14*** (0.00) | 4.25*** (0.00) |
| C*G2INCOME | | | | | | -1.16e-03*** (0.00) | -1.11e-03*** (0.00) |
| C*G2HOUSEHOLD SIZE | | | | | | 9.98*** (0.00) | 8.42*** (0.00) |
| Observations | 216 | 216 | 216 | 216 | 216 | 154 | 154 |
| R2/Log pseudolikelihood | -80.03 | 0.98 | 0.98 | 0.99 | 0.99 | 0.99 | 0.99 |

Notes: Average Marginal Effects are calculated for probit estimation in coll; Robust p-value in parentheses; With ***, ** and * denoting significance at the 1, 5 and 10 percent level respectively; BDF refers to the estimator of spatial instrumentation as discussed by Bramoullé et al(2009); The family and year dummies are controlled for in all equations.