

Farmer's Choices and Informal Loans in China: Risk-sharing and Personality Effects

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ABSTRACT

At times, development economists have argued informal loans serve the same role as informal insurance. Empirical research shows that the motives for using informal loans are that rural households want to share risks when external shock occurs. Instead of looking at the village level, we construct a national-wide panel dataset based on the China Family Panel Study (CFPS) and the China National Bureau of Statistics to investigate Chinese farmers' motives for using informal loans and giving gifts among the social network of friends and relatives. To control for potential endogeneity between borrowing amounts, lending amounts, and the value of the gifts given, we develop a system of simultaneous equations and apply the Three-Stage Least Squares (3SLS). Our results support the hypothesis of reciprocity motives and emphasize the impact of the rural household head's personality on the financial behaviors, but we do not support the assumption of informal loans as insurance.

BIOGRAPHICAL SKETCH

Yunran Wang grew up in Beijing, China. She started her undergraduate study at China Agricultural University in 2016 and then transferred to the University of Colorado Denver in the fall semester of 2017. In the fall semester of 2018, she transferred again to the University of Minnesota-Twin Cities to study Economics continually. After graduating with High Distinction and receiving a Bachelor of Arts in Economics in 2020, she began her graduate study in Applied Economics and Management with concentrations in Food & Agricultural Economics at Cornell University. Starting in 2021, she worked with Prof. Calum G. Turvey and Prof. Miguel I. Gomez. In March 2022, she joined the Institute for Compensation Studies (ICS) at Cornell University's ILR School. She earned her Master of Science degree in May 2022.

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TABLE OF CONTENTS

ABSTRACT.....	iii
BIOGRAPHICAL SKETCH	iv
ACKNOWLEDGMENTS	v
TABLE OF CONTENTS.....	vi
LIST OF TABLES	vii
1. Introduction.....	8
2. Review of Existing Literature	13
3. Empirical Support	17
3.1 Informal Loans and Formal Loans in China	17
3.2 Empirical Model	18
3.3 Empirical Results	25
3.3.1 3SLS Regression Results.....	26
3.3.2 Robustness Test	31
3.3.3 3SLS Regression by Years	33
3.3.4 Personality Effects	37
4. Conclusion	42
References.....	45

LIST OF TABLES

Table 1	Outstanding Loans from Bank or Friends and Relatives	18
Table 2	Variable Description	20
Table 3	Three-Stage Least Squares (3SLS) Regression	27
Table 4	Three-Stage Least Squares (3SLS) Regression with Binary Dependent and Endogenous Variables	32
Table 5	Three-Stage Least Squares (3SLS) Regression-Drop Household Head Related Variables	32
Table 6	Three-Stage Least Squares (3SLS) Regression—2014, 2016, 2018.....	34
Table 7	Three Dimension of Personality	38
Table 8	3SLS Regression for Personality 1	39
Table 9	3SLS Regression for Personality 2	40
Table 10	3SLS Regression for Personality 3	41

1. Introduction

Access to credit for farmers has always been important in China. Whether formal or informal, credit access allows farmers to afford agricultural inputs and make other productive investments (Lin et al., 2019). Because of the wide variety of economic shocks and relatively low income, avoiding income variation and smoothing consumption is often necessary for rural families. Thus, to meet the existing need of households to borrow money, the government started building formal financial institutions at the early stage of founding the People's Republic of China (The PRC)¹. Although the government has made many efforts to expand farmers' credit access, scholars find that most rural farmers in China do not borrow from formal credit sources. Instead, farmers in rural China show a strong preference for the informal loan (or informal credit) (Turvey and Kong, 2010; Turvey, Kong, and Huo, 2010; Lin et al., 2019).

Informal loans have several advantages. Since borrowers and lenders are familiar with each other, information asymmetries are less likely to happen. Thus, numerous informal loans in the rural credit market are made without witness or written contracts. Additionally, while the borrower and lender negotiate over the loan size, the interest rate is zero most of the time (Udry, 1990). In China, 60 percent of all credit outstanding is between friends and relatives at zero interest rates (Turvey, Kong, and Huo, 2010). Informal loans within social networks are typically through pure transfers with high flexibility.

¹ In the 1950s, a group of Rural Credit Cooperatives (RCCs) was constructed quickly under the Chinese government's intervention. By the late 1970s, RCCs began to serve rural households and worked like banking institutions. In the early 1980s, Rural Cooperative Foundation (RCFs) was established. While the objective of RCFs was also to serve farmers, it was never classified as formal financial institutions until shut down (Tsai, 2004). Besides RCCs, Postal Savings Banks and Agricultural Banks also aimed to increase farmers' access to credit and efficiencies in the rural economy (Turvey and Kong, 2010).

While the informal loan has advantages, it is also understandable to investigate the significant motives behind using an informal loan. One reason is the failure in the formal microcredit market. In some developing countries, people are often excluded (or rationed) from formal credit markets, partially because they lack collateral or guarantors (Yuan and Xu, 2015; Shoji et al., 2012). Chinese scholars also find a similar dilemma. Because of the risks of loan default and information asymmetry, formal financial institutions are more likely to provide credit to borrowers who can provide collateral and guarantors (He, 2005; He, 2007; Tang and Guo, 2017).

However, lacking collateral or guarantors may also cause farmers not to access informal loans provided by friends and relatives. Reputation and relationships on which informal loans are built require enough assets and acquaintances as proof of repayment. An effective social network for informal borrowing also needs long-term investment. For instance, Yuan and Xu (2015) argue that poor households in rural China have a lower probability of accessing the informal credit market. They mention that social networks constrain poor households. Since poor households have no financial means to invest in their social capital, they have difficulty expanding their social network. Moreover, Jia et al. (2015) find that farmers in less developed areas of rural China usually use formal credit in crop production and informal credit to meet consumption requirements. Therefore, concluding that farmers who are excluded from formal credits may resort to informal credits is inconclusive.

Another motive involves risk-sharing. Development economists have at times argued that the motives for using informal loans are that households want to smooth consumption when external shock occurs (Udry, 1994; Fafchamps and Lund, 2003). Risks like natural hazards, health problems, and other inevitable affairs requiring substantial expenditures can cause

unexpected income variations (Fafchamps and Lund, 2003; Fafchamps and Gubert, 2007). To study how villagers respond to idiosyncratic risks and smooth consumption, Townsend (1994) was one of the first to reveal the importance of risk-sharing arrangements (Schechter and Yuskavage, 2012). In discussing the risk-sharing mechanism, empirical studies suggest that informal loans (credits) effectively serve as insurance at the village level (Udry, 1994; Kimball, 1988). For example, Udry (1994) argues that incomplete insurance markets motivate informal credit transactions when income shocks arise. Since the villages are small and information flows freely, he states that informal credit contracts could supplant insurance to mitigate risks and allow borrowers and lenders to share risks if there are shocks on both parties.

Relatedly, some scholars argue that the willingness to lend informally is a risk management strategy based on the notion of reciprocity; when a lender gives money to a borrower, the lender gains informal insurance against future income variation. If the lender's income fluctuates in the future due to the external shocks, the borrower at this time will play the role of risk-sharing. Thus, today's borrower may become tomorrow's lender. While the evidence is clear that this is the case in many rural economies, the credit-as-insurance argument may not hold generally. In particular, a different branch of economic literature, starting with Rabin (1993), explores other motives for informal lending, including fairness, kindness, reciprocity, altruism, and inequity aversion. These 'other-regarding motives' may operate under risk conditions, but the risk may not be the only channel friends, relatives, and others lend to each other. For example, households may also adopt informal loans for not risk-related reasons, such as weddings and funerals (Turvey and Fu, 2019), and Schechter and Yuskavage (2012) find that unreciprocated loans, which only go from lenders to others, are not due to altruism but other unknown factors.

The overall purpose of this research is to understand, in rural China, why farmers whose lives depend on agricultural activities prefer to use informal loans amongst relatives and friends. Specifically, this paper focuses on two objectives:

- (1) Examine whether risk-sharing is the primary reason households use informal loans and
- (2) Identify factors determining households' choice of informal loans, such as reciprocity, altruism, and personalities.

The research contributes to the broader literature on agricultural and development economics by delineating different motives for informal lending beyond risk-sharing and examining more broadly the cultural and social network effects that have arisen culturally in China. From a policy perspective, it is important for lenders and other institutionalists to understand the forces of social networks and familial lending to determine drivers of credit demand in the formal sector and develop inclusive financial products to meet these formal demands.

The analysis is undertaken via a new panel dataset which involves the China Family Panel Study (CFPS), the CFPS Individual Survey², and provincial level disaster data from China National Bureau of Statistics. The CFPS baseline sample consists of 16,000 households in 25 provinces, representing 95% of the Chinese population. In addition, compared with the cross-

² The China Family Panel Studies (CFPS) survey is a nationally representative, biennial longitudinal survey of Chinese communities, families, and individuals started in 2010 by the Institute of Social Science Survey (ISSS) of Peking University, China. This multipurpose survey covers a variety of topics, such as household expenditures, income, and assets. Since the family questionnaires in 2010 and 2012 are inconsistent with 2014 to 2018, we only use the data from 2014, 2016, and 2018 to conduct this study. Additionally, family questionnaires do not record the household head's gender, schooling, and health condition. Therefore, we extract these household heads' characteristics from individual surveys and merge them based on the respondent id.

sectional data, utilizing panel data reduces problems about simultaneity and omitted variable bias.

This paper focuses on three hypotheses based on the concepts of risk-sharing, reciprocity, and altruism.

First, if rural households borrow more, lend less, and give fewer gifts after experiencing natural disaster shocks, we conclude they share risks through informal loans and gift-giving behaviors.

Second, if households increase lending or gift-giving to borrow more or vice versa, they pursue a long-term reciprocity relationship among friends and relatives.

Third, if households lend more and give more gifts, they may be motivated by altruism. According to these three hypotheses, our findings demonstrate that the reciprocity hypothesis generally holds, but not altruism. We also have difficulty supporting the assumption of risk-sharing.

The paper is organized as follows. In Section 2, we discuss the literature on the influence factors of informal loans and gift-giving behaviors in other developing countries and China. In Section 3, we first compare the situation of informal loans and formal loans in rural China to mention the importance of studying the informal loans in rural China. Then, we outline our three-stage least square (3SLS) regression model, describe our endogenous and exogenous variables, and demonstrate the instrumental variables in the second part. In the third part of Section 3, we report the 3SLS regression results for the panel dataset, cross-sectional dataset, and panel dataset with personalities as control variables. The conclusion ensues in Section 4.

2. Review of Existing Literature

A significant amount of literature relates to informal loans, informal insurance, and risk-sharing behaviors (e.g., Udry, 1990; Udry, 1994; Kimball, 1988). When focusing on the village level, development economists argue that informal loans play similar roles as informal insurance if villagers try to share the risks effectively. Udry's (1990) study of northern Nigeria discusses the relationship between credit and insurance in a rural economy. In his research, borrowing and lending in the informal credit market are common. According to his survey, 97% of informal loans occur between neighbors and relatives, and 65% of the remaining informal loans happen between individuals with a long history of gifts and credit interactions. Credit transactions play a direct role in risk-sharing between households in rural northern Nigeria. Following research in 1990, Udry (1994) created two models of informal state-contingent loans and indicated that a fully efficient risk-sharing equilibrium is not achieved. Similar to Udry (1994), several studies on village economies also demonstrate that risk-sharing is partly efficient between households in poor villages (Townsend, 1994; Morduch, 1990).

Economists also notice that there appear to be some non-pecuniary conditions of social networks on the informal loan as the risk-sharing arrangement. Grimard (1997) for Cote d'Ivoire shows that their hypothesis of complete risk-sharing within ethnic groups is rejected, yet informal loans and credit could perform as partial insurance to counter the effect of income shocks and smoothing consumption within the same ethnic groups when risk-sharing through formal financial arrangements are limited. Bramoulléa and Kranton (2007) find that the risk-sharing network is dynamic in their theoretical paper. They mention that any two people can agree to form risk-sharing links, but each agent cannot coordinate link structure across the whole network. By simulating two risk-sharing networks, efficient and equilibrium networks, they

conclude that all individuals will be connected and involve full insurance at efficient networks, and peripheral individuals are vulnerable in equilibrium networks.

Development economists also argue that family and relatives are the social networks that risk-sharing often takes place. Rosenzweig (1988), for instance, illustrates that the risk mitigation mechanism of insurance-based transfer arrangements among family and kinship is used to smooth consumption when spatially covariate income risks occur. In his study, households tend to use familial transfer arrangements rather than credit markets to reduce income risk ex-post, especially for families with accumulated wealth and the ability to self-insure. He also demonstrates that household success to mitigate risk ex-post by transfers depends not on the contemporaneous village economy but the household structure. Moreover, although Fafchamps and Gubert (2007) admit that close geographic distance could significantly determine the risk-sharing links between villagers, they also conclude this may relate to kinship. Recent research from Robson (2021) indicates that the willingness to give increases when people are closer to each other. He uses a lab-in-the-field experiment to demonstrate that social connectedness significantly affects giving.

Gift-giving might be another mechanism to smooth consumption and share risks (Ravallion and Dearden, 1988; Townsend, 1994; Fafchamps and Lund, 2003; Cochrane, 1991). Ravallion and Dearden (1988) use data from Yogyakarta Province in central Java to show that private transfer or gift-giving through money could partly serve the purpose of risk-sharing. Donors generally prefer less inequality. Private transfer arises between donors and recipients if the target household has sick, elderly, and newborn family members. Conducting empirical research in the rural Philippines, Fafchamps and Lund (2003) conclude that mutual insurance toward risks formed on gifts and no-interest loans. Following previous research, Fafchamps and

Gubert (2007) suggest that physical form and cash form gifts respond to shocks. Furthermore, less significant evidence shows that households will receive more gifts from network partners when their family member has a health problem.

Besides discussing the role of informal loans and gift-giving to the household when an idiosyncratic risk occurs, recent literature discusses the borrowing, lending, and gift-giving behaviors when the systematic shock happens in the rural area of a developing country. Janssens et al. (2020) use weekly financial household data from low-income households in rural Kenya to show the impact of the COVID-19 pandemic on informal loans and gift-giving behaviors. In their research, although income from work is reduced by one-third, no evidence indicates that households cope with the income fluctuation by borrowing. However, families do lend less and give fewer gifts. Ronkko et al. (2021) find a different result about the impact of the COVID-19 in Bangladesh. Due to the lockdown policy, borrowing and monetary gifts decreased. As a result, households suffer from negative income shock, but conventional coping mechanisms in the face of an unexpected shock, such as borrowing from friends and family, become impossible.

Compared with the formal loan, which could be considered an enforceable contract by legal institutions, the motivation of informal loan repayment is more complex and connected with reciprocity. From previous research, economists use game theory to explain informal loan repayment behaviors. For instance, Coate and Ravallion (1991) suggest that the interaction between two people of the private voluntary arrangement should be considered a repeated game. Because he assumes that everybody is a self-interested person, then nobody would like to share their wealth, and the probability of defaulting on informal loans would be high. Thus, the repeated interactions in the future may be seen as a bind of implicit contracts and explained by reciprocity. Further, borrowers and lenders who have transacted before are more likely to change

position and have transactions later (Fafchamps and Lund, 2003; Schechter and Yuskavage, 2012).

Like many developing countries, informal loans among Chinese farmers occur primarily within their social networks, few in private financing institutions. Regardless of the availability of Rural Credit Cooperatives (RCC), Postal Savings Banks, Agricultural Banks, and foreign Microfinance Institutions (MFI), farmers in the rural area of China tend to borrow informally from friends and relatives (Turvey and Kong, 2010). Based on the China Household Finance Survey database, Chai et al. (2019) show that the social network facilitates informal borrowing and informal lending. Furthermore, they find information cost, risk perception, and incentives on precautionary saving are decreased and changed when social networks are strengthened.

Although a study about rural China indicates formal credit constraints significantly raise rural borrowers' dependence on reciprocal loans by using data from 2007 to 2008 (Zhao, 2021), the situation and formal credit availability may change after a decade. Given the nature of the loan market in the rural area of China, it is essential to understand the rationale behind the informal loan. Reciprocity, risk-sharing, or any noneconomic factors might account for the motivations of informal loans.

3. Empirical Support

3.1 Informal Loans and Formal Loans in China

According to the previous research, informal loans (or informal credits) play an essential role in rural China, particularly in the regions where formal loans (or formal credits) are hard to access. The common reason those formal financial institutions used to reject farmers in need is the lack of collaterals and guarantees. However, lacking collaterals and guarantees may also prevent farmers from accessing informal credit markets based on reputations and relationships. Therefore, farmers who use informal loans may be caused by several other reasons but not market failure.

Broadening the research range to the national level, we use data from China Family Panel Studies (CFPS) survey to conduct this study. The panel dataset includes data from three years 2014, 2016, and 2018. The baseline, sub-dataset 2014³ contains almost all households whose families depend on agricultural activities. However, in 2016 and 2018, some families changed their way of living and lived without agricultural activities. Based on the panel dataset, Table 1 counts the number of households with outstanding loans and lists the number separately according to bank or friends and relatives. It is easy to see that households use informal loans twice as much as formal loans at financial institutions each year, which indicates the importance of studying the motives behind using informal loans in China.

³ The panel dataset used in this study consists of three different biennially sub-dataset 2014, 2016, and 2018. In addition, we excluded households with missing data during the data cleaning and balancing process. For example, if the original CFPS dataset shows the household has an absent food expenditure, then we drop this household in our final panel dataset.

Table 1: *Outstanding Loans from Bank or Friends and Relatives*

Loan Type	2014	2016	2018
Outstanding Loans from Bank (Formal)	243	281	323
Outstanding Loans from Friends and Relatives (Informal)	571	604	556

3.2 Empirical Model

Most previous research that studies the relationships between informal loans, informal insurance, and risk-sharing behaviors concentrate on the village level (e.g., Udry, 1994; Fafchamps and Lund, 2003). However, the borrowing or lending behaviors among rural households may go beyond the village level in China. We, therefore, extend the research scope by using a nationwide dataset extracted from CFPS.

Following Udry (1994), we allow for interdependence between informal borrowing and lending behaviors. In addition to informal loans, Fafchamps and Lund (2003) also suggest including gift-giving in the research of risk-sharing networks in rural areas. To investigate the impact of gift-giving, we included another equation with gift-giving as the dependent variable. Gift-giving is also added as an independent variable in the other two equations for potential interdependence. In order to control for multidirectional relationships between informal borrowing, informal lending, and gift-giving behaviors, we estimate the system of equations using Three-Stage Least Square (3SLS).

$$Borrow_{i,t} = \alpha_0 + \alpha_1 Lend_{i,t} + \alpha_2 Gift_giving_{i,t} + \sum_m \alpha_m Y_{m,i,t} + \sum_n \alpha_n X_{n,i,t} + \sum_j \alpha_j D_{j,i,t} + \varepsilon_{i,t} \quad (1)$$

$$Lend_{i,t} = \beta_0 + \beta_1 Borrow_{i,t} + \beta_2 Gift_giving_{i,t} + \sum_m \beta_m V_{m,i,t} + \sum_n \beta_n X_{n,i,t} + \sum_j \beta_j D_{j,i,t} + \varepsilon_{i,t} \quad (2)$$

$$Gift_giving_{i,t} = \gamma_0 + \gamma_1 Borrow_{i,t} + \gamma_2 Lend_{i,t} + \sum_m \gamma_m U_{m,i,t} + \sum_n \gamma_n X_{n,i,t} + \sum_j \gamma_j D_{j,i,t} + \varepsilon_{i,t} \quad (3)$$

In our econometric framework, there are three endogenous regression equations, where $i = \{1, 2, \dots, i\}$ denotes the set of households, with $t = \{2014, 2016, 2018\}$ being the time indicator. On the right-hand side of the equations, *Lending*, *Borrowing*, and *Gift-giving* are the endogenous variables, respectively, from Eq. (1) to Eq. (3).

Among all three equations, variable D represents demographic variables, and variable X represents disaster level and personality variables we are interested in. However, there also exists one unique variable in each equation: Y, V, and U, which will be treated as instrumental variables during the 3SLS regression procedure. In the category of demographic variable, we also include five characteristics of the household head. By the design of CFPS, the household head⁴ is the family member who has the right to make financial decisions in each household. Therefore, we conclude education level⁵, gender, chronic disease, marriage, and medical insurance of household heads are important in the family's financial decisions.

Since the conventional coping mechanism of idiosyncratic risks includes informal loans and gift-giving (Udry, 1990; Udry, 1994; Fafchamps and Lund, 2003; Fafchamps and Gubert,

⁴ The information on each household head's highest education level, gender, chronic disease, and medical insurance comes from the CFPS individual survey. We merge household head's characteristic variables with household-related variables based on responder id.

⁵ We use high school education as a threshold in this study. The completion of high school education is determined by the highest education level that each household head received, which is updated biennially. We conclude household heads who finished high school education could better choose financial activities.

2007), we introduce natural disasters from the environment as an index of risk-sharing behaviors. Therefore, we expect the estimated coefficients of variable *Disaster_Level_t* and lagged variable *Disaster_Level_t-1* to be positive in equation (1) and negative in equations (2) and (3). Furthermore, a natural disaster can damage the household's agricultural activities on a great scale. Thus, including natural disasters in the dataset makes regression less susceptible to attenuation biases from measurement errors (Sawada, Nakata, and Kotera, 2017).

While the 3SLS approach identified above accounts for the endogeneity of the active variables, an important and often ignored aspect of such models is the unobserved personality traits of the household head. In other words, the individual personalities of lenders, borrowers, or gift-givers may also affect borrowing, lending, and gift-giving behaviors. Thus, we generate three personalities to explore the possible impact of subjective attitude on informal loans and gift-giving. A detailed description of the three personalities is listed in Table 2. The three dimensions, popularity, happiness, and getting along well with others, come from three questions in CFPS. We use cluster analysis to create different personalities based upon answers to the survey questions.

Table 2: *Variable Description*

	Variables	Description
Demographics Variables (D)	Agricultural	Family life depend on agricultural activities is 1, otherwise is 0.
	Aquaculture	Family life depend on aquaculture activities is 1, otherwise is 0.
	Total Assets	Sum of land asset, house asset, fixed asset, finance asset, durables asset.
	Saving Engel's Coefficient	Amount of saving in the household Ratio of food expenditure to total expenditure

Disaster and Personality (X)	Consumption of Self-produced Goods	Ratio of consumption of self-produced goods (in RMB) to total value of self- produced goods.
	Family Size	The number of family members.
	High School	Household head complete high school education is 1, otherwise is 0.
	Gender	The gender of household head.
	Married	Household head get married is 1, otherwise is 0.
	Disaster Level	Disaster level of current year multiply by survey taking month over twelve months.
Variable for Equation 1 (Y)	Disaster Level of Last Year	Disaster level of last year.
	Personality 1	People who are very popular and could get along very well with others. They are extremely happy with this state.
	Personality 2	People who are not popular and could get not along well with others. They are not happy with this state.
Variable for Equation 2 (V)	Personality 3	People who are popular and could get along well with others. They are very happy with this state.
	Bank Loan	Household has bank loan is 1, otherwise is 0.
	House Debts	The amount of house debts.
Variable for Equation 3 (U)	Chronic Disease	Household head has chronic disease.
	Small Business	Household own a small business is 1, otherwise is 0.
	Medical Insurance	Household head has medical insurance is 1, otherwise is 0.
	Gift Receiving	The amount of gift receiving during celebration events.
	Celebration Spending	Spending on celebration events, such as wedding and funeral.
	Donation	Household has spending on donation is 1, otherwise is 0
	North	Household live in North is 1, otherwise is 0.

In the 1st equation of our system of equations, we use the amount of borrowing as the dependent variable, which reflects the outstanding informal loans in each household. However,

this amount of informal borrowing does not contain the historical repaid informal loans. The borrowing behavior depends on lending, gift-giving, and other exogenous control variables. Except for demographic, disaster, and personality variables, which are the same in all three equations, households with outstanding bank loans may also seek informal loans among their social networks (Jia et al., 2015). Therefore, the first exogenous variable is bank loans. The spending on house debts is used as the second explanatory variable. In China, especially in urban areas, households with housing demand tend to borrow as much as possible from relatives and friends because of the low financial cost of informal borrowing (Yang, Fan, and Wu, 2017). We follow the survey setting of CFPS and use the amount of repayment on total house debts in the past 12 months, labeled as *House Debts* in the Y variable category. To capture a potential interrelation between health shock and borrowing behavior, we include the chronic disease of the household head. The responders answer "yes" on this chronic disease-related question only if a doctor informs them that they have had a chronic disease in the past half-year. Since a newfound and long-lasting chronic disease could disturb the household's financial arrangement, the relationship between chronic disease and informal borrowing behavior should be positive.

Matthew Rabin (1993) argues that people like to help those who are helping them and hurt those who are hurting them. The incentive behind such behavior is associated with fairness equilibrium. Similarly, the literature on informal borrowing and lending has long identified reciprocity as the motive (e.g., Fafchamps, 2003; Turvey et al., 2010; Ferrara, 2003). To capture the reciprocity between borrower and lender in informal loans, we use the outstanding lending amount as a dependent variable in our 2nd equation. We expect households with a small business other than agriculture will have more flexibility and liquidity to be lenders. We also include *Medical_Insurance* since a more secured family may have a greater ability to lend.

As Turvey and Fu (2019) explain, using data from the 1930s, the predominant cause for informal loans was for weddings and funerals. These celebrations are determined by culture, and ‘saving face’ is a critical and ingrained aspect of Chinese culture. Specifically, gift-giving through the red envelope (a form of giving cash as a gift) or physical form gift during weddings and funerals is an inevitable ceremony expenditure. Households may borrow from or lend to their friends and relatives if unavoidable spending exists. More importantly, empirical evidence shows that gift-giving or private transfer payments could partially serve the target of risk-sharing and reduce the impact of idiosyncratic shocks, such as sickness and illness, in rural areas (Ravallion and Dearden, 1988). Accordingly, the dependent variable in the 3rd equation of our system is *Gift-giving*. Combining the recent social norms in China, we extend the scope of inevitable gift-giving expenditure in this paper. The dependent variable in the 3rd equation includes a number of possible channel explanations including, family members entering university, children being born, a family member passing away, or celebrating the birthday of elders. Because we also try to determine the role of reciprocity and altruism among the household's social networks, gift-receiving and spending during the celebration events, and donation in the charity events are included as explanatory variables in the 3rd equation. Moreover, households in different areas have different cultures with celebration events. The variable North (=1) is a dummy variable for households living in North or South China to control spatial differences.

The model we use in this study is a simultaneous equations model in which each dependent variable (*Borrow*, *Lend*, and *Gift-giving*) is a function of two other dependent variables rather than just independent variables. This approach is consistent with Granger causality. In other words, *Lend* is determined jointly by *Borrow* and *Gift-giving*, and the same

logic is followed by *Borrow* and *Gift-giving*. To identify causal pathways and address this endogeneity issue, we use the instrumental variable and 3SLS approach to estimate the model consisting of Eq. (1), Eq. (2), Eq. (3) in STATA.

A good and efficient instrumental variable should relate to the independent variable but not directly associate with the dependent variable. For example, in equation (1), variable *Lend* and *Gift-giving* are endogenous variables. Substituting the 2nd and 3rd equations into the 1st equation, we can generate a reduced form of the equations system. Since variable V only correlates to variable *Lend*, and variable U only correlates to variable *Gift-giving*, variable V and U are automatically treated as instrumental variables in the reduced form of the first equation.

Compared with Two-Stage Least Squares (2SLS), the 3SLS approach is a more consistent and efficient estimator. In the first stage, we obtain the model system's Two-Stage Least Squares (2SLS) estimates. The estimation from the 2SLS is helpful in the second stage, where the residuals are computed to determine cross equation correlations. Finally, the third stage uses generalized least squares (GLS) to estimate model parameters, which improves the efficiency of the estimates by considering all of the information about interrelationships in the system of equations (Madansky, 1964; Godwin, 1985).

In larger systems of equations, although the equations' error terms are tightly connected through more general multiple correlations, all cross-equation correlations can be small. Since 3SLS does not ignore these more general relations, it can have greater small-sample efficiency than 2SLS even when pairwise correlations are small (Belsley, 1988). As a result, 3SLS coefficients are consistent and relatively more efficient than 2SLS even with small samples (Godwin, 1985; Kmenta and Gilbert, 1968; Mikhail, 1972; Seaks, 1974; Swamy and Holmes,

1971). Therefore, we selected 3SLS as the primary econometric method in this research, recognizing also that if there are no cross-equation correlations the estimator will provide the same coefficients and standard errors as 2SLS.

3.3 Empirical Results

In our empirical analysis the unrestricted model includes all independent variables. We use the outstanding amounts (valued by RMB) of borrowing, lending, and gift-giving in the system of equations. Thus, dependent variables on the left-hand side and endogenous variables on the right-hand side are continuous. We then change the nature of variables or exclude categories of variables for the robustness test. The first test substituted continuous dependent variables with dummy variables. The second robustness test drops the household head-related variables.

Our system of equations includes three endogenous variables. From Eq.1 to Eq.3, variable X and variable D exist in all three equations, containing 14 exogenous variables in total. Table 2 provides a detailed description of our system of equations. To satisfy the order condition for identification, the number of right-hand-side endogenous variables in each equation should be less than the total number of exogenous variables in all three equations minus the number of exogenous variables in each equation. For example, equation (1) is overidentified because six instrumental variables are greater than two endogenous variables. Following the same logic, all equations in our system are overidentified. Otherwise, the system of equations is underidentified, and the parameters cannot be estimated. The rank condition guarantees that the system of equations can be solved and have unique values of the parameters.

3.3.1 3SLS Regression Results

Table 3 presents the results from the 3SLS regressions of the simultaneous equations framework illustrated in equations (1)-(3). In order to capture a potential interdependence between the dependent variables, we treat *Borrow*, *Lend*, and *Gift-giving* as endogenous variables. Before running a 3SLS regression, we use a Durbin and Wu-Hausman test⁶ to ensure the existence of endogeneity between *Borrow*, *Lend*, and *Gift-giving*. Applied to the first equation, the Durbin and Wu-Hausman test rejects the null hypothesis that *Lend* and *Gift-giving* can be treated as exogenous variables at the 1% level. Therefore, using 3SLS is appropriate and could avoid possible biased and inconsistent estimates in our empirical results.

Column (1) shows that *Lend* has a statistically significant positive effect on *Borrow* and *Borrow* also has a statistically significant positive effect on *Lend* in Column (2). This supports our reciprocity hypothesis that farmers like to borrow if they lend to others before. Looking at Column (1) again, *Gift-giving* also has a positive statistically significant effect on *Borrow*, indicating that farmers consider reciprocity in gift-giving and borrowing behaviors. Notably, the relationship between *Lend* and *Gift-giving* is not statistically significant in either direction. Therefore, pure altruism is not supported, and this result is consistent with the assumption proposed by Coate and Ravallion (1991) that individuals are generally self-interested people.

⁶ The Durbin and Wu-Hausman test is helpful in discerning endogeneity issues. This test contains two steps. In the first step, the dependent variable is regressed on exogenous variables and then generated predicted values of dependent variables through estimated coefficients. In the second step, the dependent variable is regressed on all exogenous variables and predicted dependent variables. The null hypothesis of the Durbin and Wu-Hausman test is that the potential endogenous variables can be treated as exogenous variables. Whether or not to reject the null hypothesis according to the significance of predicted dependent variables using a t-test or F-test.

Table 3. *Three-Stage Least Squares (3SLS) Regression*

	Eq. 1 Borrow	Eq. 2 Lend	Eq. 3 Gift-giving
Borrow	--	0.466*** (0.071)	0.097 (0.060)
Lend	0.642*** (0.102)	--	0.101 (0.063)
Gift-giving	0.934*** (0.294)	0.360 (0.243)	--
Agricultural	-427.827 (1086.038)	1087.549 (856.788)	-519.399* (287.112)
Aquaculture	-624.424 (689.753)	20.225 (549.676)	248.146 (178.419)
Total Assets	-0.0004 (0.0005)	0.002*** (0.0003)	0.00007 (0.0001)
Saving	-0.085*** (0.008)	0.076*** (0.006)	0.006 (0.006)
Engel's Coefficient	-2310.274 (1724.804)	415.055 (1386.309)	-240.610 (464.551)
Consumption of Self-produced Goods	-915.430 (967.363)	163.410 (769.152)	-488.672* (256.719)
Family Size	790.452*** (180.09)	-387.543** (154.647)	-99.138 (64.346)
High School	-13.133 (1053.851)	837.941 (835.099)	118.962 (270.315)
Gender	-173.939 (671.042)	861.529 (525.528)	-411.657** (173.022)
Married	-504.764 (1206.771)	342.371 (958.355)	915.394*** (302.977)
Disaster Level	861.698 (3896.745)	6572.436** (3004.099)	-5002.677*** (958.431)
Disaster Level of Last Year	-4901.423 (3457.54)	566.589 (2779.889)	4245.989*** (829.149)
Personality 1	-261.046 (764.835)	-881.966 (600.791)	596.715*** (192.607)
Personality 2	2473.971*** (853.610)	-1553.975** (699.579)	-616.933** (259.104)
Bank Loan	5459.274*** (1174.355)	--	--
House Debts	0.013*** (0.003)	--	--
Chronic Disease	136.564 (540.564)	--	--
Small Business	--	-1792.353*** (311.922)	--
Medical Insurance	--	1178.669 (726.009)	--

Gift Receiving	--	--	0.094*** (0.011)
Celebration Spending	--	--	-0.004 (0.014)
Donation	--	--	1280.42*** (202.591)
North	--	--	-512.620*** (129.895)
Note: * p<0.1, **p<0.05, ***p<0.001. Standard errors are in the parentheses.			

To simulate previous research by Fafchamps and Lund (2003), Sawada et al. (2017), Udry (1994), and Fafchamps (2011), we explore the relationship between natural disaster level and risk-sharing behaviors (*Borrow*, *Lend*, and *Gift-giving*). Specifically, we include two variables, denoted as *Disaster_Level_t* and *Disaster_Level_t-1*. Furthermore, because the responders take the survey in different months and natural disasters after the survey-taking date cannot affect the responder's financial decision, we weight the variable *Disaster_Level_t* by multiplying survey-taking months divided by 12 months. The results in Column (2) of Table 3 reveal a statistically significant positive correlation between the current disaster level and lending behavior. Farmers lend money to friends and relatives even after receiving an adverse shock. This situation may be because of the hardship of expressing rejection, which could relate to the ‘saving face’ culture. The negative effect on gift-giving of the current disaster level in Column (3) might be explained by the inability to spend nonrefundable money when households have a choice on attending celebration events. However, the disaster level of last year shows a positive relationship with gift-giving behavior. We interpret this result as evidence of ‘saving face’ culture as well. As we expect, the sign of the estimated coefficient of the current disaster level is positive in the *Borrow* equation, but the coefficient is not significantly different from zero.

Compared to previous research, which is largely based on village-level networks and relationships, these results are more national in scope, with borrowers and lenders living in different provinces and facing different levels (and types) of disasters. In the absence of village-level fixed effects and granular data, we cannot (or hesitate to) conclude that a household head who decides to be a lender may not be a consequence of the target borrower receiving an adverse shock. The only thing that we can observe from the results is that farmers choose to be a lender even if there is an adverse shock. Moreover, we do not observe that households borrow for the current year's natural disaster shock, but we do observe that they give more gifts when last year's disaster level increases. The positive effect of last year's disaster shock on the current year's gift-giving behavior may indicate that households want to compensate for the not-helping behavior in the last year. However, when they are not able to spend nonrefundable money, lending and receiving repayment from the borrower might be a good way to 'save face' rather than direct rejection.

Previous research on informal loans generally adds assets or wealth in the empirical model (e.g., Turvey and Kong, 2010; Fafchamps and Gubert, 2007). We, therefore, include *Total_Assets* in our system of equations. The coefficient on total assets in the 2nd equation is positive and statistically significant at the 1% level. A household with more total assets is more willing to be a lender. Although the coefficients of *Total_Assets* in *Borrow* and *Gift-giving* equations are as expected and consistent with Fafchamps and Gubert (2007) - farmers with more assets tend to borrow less and give more gifts - they are not statistically significant in this result. Saving as a mechanism to cope with various shocks is recognized in most Chinese families (Wei and Zhang, 2011). Households are willing to save more today in response to unexpected shocks or future uncertainties (Carroll, 1997). According to Table 3, a household with increasing

savings borrows less and lends more, which is consistent with the proposition of saving as a form of self-insurance. Similar to Chai et al. (2019), who find family size positively affects the size of borrowing through the Probit and Tobit regression models, our regression result shows that family size significantly impacts borrowing positively and lending negatively. Furthermore, we adopt the ratio of consumption value to the total value of self-produced goods to measure the agricultural activities of each household. When the ratio is closer to one, the family consumes most of the self-produced goods, and lesser volumes of products sold to the market. Since the estimated coefficient in Column (3) is negative, we conclude the household will give fewer gifts when they cannot sell self-produced goods and receive income.

Each equation has its unique variables. In equation (1), it is interesting to observe that households with loans from banks borrow 5459.274 RMB more than households without formal loans. This result suggests that a bank's formal loan may not meet the household's needs, and the household resorts to informal loans from friends and relatives to compensate for the demands. A similar conclusion appears in Jia et al. (2015) and Turvey et. al (2010) who find that farmers use formal loans on crop production and informal loans on consumption requirements. A positive estimated coefficient of *House_Debts* in the borrowing equation may support the idea that farmers use informal loans for their consumption needs. Turvey et al. (2010) find that 41.4% of the informal group borrowed for house construction, but only 31.2% of the formal group borrowed. In the second equation, *Medical_Insurance* almost displays a statistically significant at 10% level with a positive estimated coefficient. However, this non statistically significant coefficient affirms the finding in Geng et al. (2018) research. By examining the relationship between health insurance and informal insurance in China, they conclude that when households can access informal insurance (informal borrowing and lending) without constraints, health

insurance does not crowd out informal insurance. Finally, in the 3rd equation, the estimated coefficients of *Gift-receiving* and *Donation* are positive and statistically significant at 1%. Receiving more gifts and therefore giving more gifts during celebration events represent reciprocity. We find that a household that donates within the past 12 months tends to spend \$1280.42 RMB more in gift-giving than households that never donated. Therefore, we conclude that altruism also promotes gift-giving behavior. Lastly, households in north China spend less on gift-giving compared with south.

3.3.2 Robustness Test

In this section, we conduct two necessary robustness tests. In the first test, we change the nature of dependent and endogenous variables into binary variables. Second, we drop household head-related variables in the system of equations. In contrast to our earlier findings, the result of the 3SLS regression of binary dependent variables on binary endogenous variables reveals that the coefficients on *Borrow* in Eq. (2) is no longer statistically significant. The results are reported in Column (2) of Table 4. However, re-estimating our system of equations with dropping household head-related variables, including *High_School*, *Gender*, *Married*, *Chronic_Disease*, and *Medical_Insurance*, we find a positive and statistically significant coefficient on *Borrow* in Eq. (2) and Eq. (3), as shown in Columns (2) and (3) of Table 5. Moreover, the estimated coefficients of *Gift-giving* in Eq. (2) and *Lend* in Eq. (3) become positive and statistically significant in our first test. In the second test, all other coefficients are robust to our original findings of 3SLS regression in Table 3. In addition, we notice that all the coefficients, whether in our first or second test, remain as positive as our earlier findings.

Overall, we conclude the regression results in Table 3 pass the robustness tests, and correlations between *Borrow*, *Lend*, and *Gift-giving* are positive. According to Table 3, Table 4, and Table 5, the positive relationship between *Lend* and *Borrow* reveals that individuals are looking for long-term interactions with their friends and relatives. In other words, self-interested farmers borrow and lend because of reciprocity. Giving gifts is another way to express kindness, which is essential in the Chinese ‘face’ culture. Friends and relatives use ‘red-envelop’ or physical gifts to maintain a close relationship during celebration events and hope to have more future interactions, which may involve informal loans and other gift-giving behaviors. Therefore, the positive relationship between *Gift-giving* and *Borrow* also uncovers the intention of reciprocity. Furthermore, as we mention in the previous findings, a positive relationship between *Lend* and *Gift-giving* should express an altruistic attitude.

Table 4. Three-Stage Least Squares (3SLS) Regression with Binary Dependent and Endogenous Variables			
	Eq. 1 Borrow	Eq. 2 Lend	Eq. 3 Gift-giving
Borrow	--	0.059 (0.097)	0.054 (0.049)
Lend	0.291*** (0.088)	--	0.202*** (0.075)
Gift-giving	0.391** (0.191)	1.525*** (0.253)	--
Note: * p<0.1, **p<0.05, ***p<0.001. Standard errors are in the parentheses.			

Table 5. Three-Stage Least Squares (3SLS) Regression-Drop Household Head Related Variables			
	Eq. 1 Borrow	Eq. 2 Lend	Eq. 3 Gift-giving
Borrow	--	0.503*** (0.071)	0.169** (0.081)
Lend	0.672*** (0.103)	--	0.017 (0.084)
Gift-giving	0.970*** (0.294)	0.218 (0.243)	--
Note: * p<0.1, **p<0.05, ***p<0.001. Standard errors are in the parentheses.			

3.3.3 3SLS Regression by Years

The previous sections discuss the endogeneity relationship between informal borrowing, informal lending, and gift-giving and the effect of natural disasters, personality, and other exogenous variables on informal loans and gifting behaviors, using pooled panel data from CFPS. Nonetheless, we are also interested in the similar relationships and differences in regression results of each year. Comparing the estimated coefficients of *Borrow* and *Lend* in Eq. 1, Eq. 2, and Eq. 3 of Table 6, we notice the reciprocity assumption held for 2014, 2016, and 2018. From Columns (1) and (2), a one RMB increase in *Lend* can generate a 2.240 RMB and 1.288 RMB increase in *Borrow*, respectively, for 2014 and 2016. Accordingly, Columns (4) and (5) indicate that a one RMB increase in borrowing amount yields an increase in the lending amount of 0.305 RMB in 2014 and 0.567 RMB in 2016, which are less than one RMB. Farmers, thus, generally can borrow more money from friends and relatives than they need to lend for reciprocity purposes. However, in 2018, one RMB growth in *Borrow* may cause a 0.441 RMB rise in *Lend*, almost the same effect (0.486 in Column 3) of *Lend* on *Borrow*. In other words, farmers in 2018 have to lend more money to receive informal loans from their private social networks than in 2014 and 2016. At the same time, a positive and significant coefficient of *Bank_Loan* (6725.171) is observed in Column 3 (The year 2018). We interpret this coefficient as farmers who take money from banks borrow 6725.171 RMB more than farmers who do not have bank loans. Knowing the coefficients of two endogenous variables (*Borrow* and *Lend*) and *Bank_Loan*, the possible explanation that we come up with is that borrowers cannot receive enough informal loans from others and may seek help from formal banks to satisfy loan demand. Again, during the economic recession period in 2018, the borrowing amounts were impacted, indicated by the parameter of *Lend* in Column 3 of Table 6. Therefore, using a panel dataset to

control the time-fixed effects in the previous section could effectively eliminate the unobserved economic variation.

Table 6. *Three-Stage Least Squares (3SLS) Regression—2014, 2016, 2018*

	Eq. 1 Borrow			Eq. 2 Lend			Eq. 3 Gift-giving		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	2014	2016	2018	2014	2016	2018	2014	2016	2018
Borrow	--	--	--	0.305*** (0.053)	0.567*** (0.125)	0.441*** (0.127)	0.009 (0.058)	-0.023 (0.071)	0.214** (0.101)
Lend	2.240*** (0.540)	1.288*** (0.230)	0.486*** (0.113)	--	--	--	0.465*** (0.104)	0.207* (0.113)	0.036 (0.077)
Gift-giving	0.122 (0.472)	2.212*** (0.615)	-0.191 (0.526)	0.098 (0.185)	-1.085* (0.615)	1.568*** (0.450)	--	--	--
Agricultural	- 13114.26** (5241.318)	597.467 (2455.197)	1141.998 (1354.527)	5200.035*** (1956.081)	-346.862 (1790.383)	1198.763 (1611.797)	- 4324.631*** (1240.298)	-822.419* (431.348)	-477.982 (497.573)
Aquaculture	-1098.034 (1295.471)	-3237.686* (1668.065)	655.043 (1127.67)	572.951 (494.991)	1814.135 (1294.179)	-1489.899 (1310.428)	-487.955* (282.598)	140.610 (361.338)	137.315 (434.088)
Total Assets	-0.006*** (0.002)	-0.002 (0.002)	-0.0003 (0.0004)	0.003*** (0.001)	0.002* (0.001)	0.001** (0.0004)	0.00005 (0.00049)	0.0002 (0.0004)	0.0001 (0.0002)
Saving	-0.235*** (0.050)	-0.124*** (0.016)	-0.061*** (0.009)	0.099*** (0.006)	0.081*** (0.014)	0.056*** (0.012)	-0.036*** (0.011)	-0.004 (0.009)	0.016* (0.009)
Engel's Coefficient	-708.062 (3354.206)	2128.895 (4062.803)	-3704.233 (2697.1)	-195.964 (1315.77)	-1731.327 (2910.171)	2386.129 (3223.541)	-313.991 (745.983)	-82.529 (715.718)	-29.653 (1054.913)
Consumption of Self-produced Goods	908.879 (1734.688)	3682.156 (2330.212)	-5510.67*** (1556.583)	-545.110 (677.800)	-2336.082 (1711.906)	2103.456 (1943.683)	-237.531 (377.638)	-320.009 (442.472)	511.349 (725.751)
Family Size	506.026 (353.475)	802.072* (434.72)	828.900*** (272.901)	-124.029 (146.195)	-539.521* (316.863)	-456.192 (342.140)	-161.477* (82.874)	111.619 (99.698)	-184.736 (130.633)
High School	1844.865 (2038.877)	-847.180 (2468.946)	-181.674 (1574.352)	-663.695 (816.157)	416.114 (1797.664)	2562.413 (1848.906)	447.579 (459.590)	414.076 (429.606)	-158.510 (585.080)
Gender	-1598.161 (1282.821)	947.202 (1635.399)	-145.667 (1002.042)	712.938 (492.493)	-141.654 (1226.894)	251.854 (1194.447)	-580.379** (279.297)	-903.714*** (281.017)	195.989 (371.936)
Married	-1485.919 (2401.803)	-632.122 (2734.509)	26.985 (1806.926)	609.073 (957.449)	433.182 (1988.041)	192.120 (2134.991)	1016.042** (518.846)	611.266 (480.315)	934.457 (656.092)
Disaster Level	234.958 (9385.087)	-10465.49 (8321.794)	-5074.817 (9322.776)	194.535 (3757.303)	8452.251 (5786.424)	24503.4*** (9022.556)	3236.085 (2048.171)	-4261.256** (1892.868)	- 12464.96*** (2149.174)
Disaster Level of Last Year	-3870.581 (7802.089)	-15931.3** (7744.196)	1758.563 (5963.827)	1024.549 (3140.403)	9561.061 (5945.589)	-4765.698 (6812.344)	3123.685* (1712.717)	3540.929*** (1381.368)	3141.167 (2068.82)
Personality 1	2731.159* (1485.638)	-681.345 (1807.125)	-300.308 (1158.037)	-1157.517** (557.387)	-82.552 (1331.254)	-851.087 (1365.089)	808.125** (328.704)	692.724** (316.479)	646.544 (421.933)
Personality 2	4236.719** * (1623.414)	4067.159* * (2063)	1899.538 (1377.013)	-1562.263** (640.291)	-2788.785* (1509.03)	451.628 (1651.679)	488.733 (406.187)	-393.587 (407.844)	- 1445.662*** (518.713)
Bank Loan	2290.713 (1605.41)	2217.418 (2123.309)	6725.171*** (1728.47)	--	--	--	--	--	--
House Debts	-0.003 (0.013)	0.005 (0.004)	0.019*** (0.005)	--	--	--	--	--	--
Chronic Disease	1382.961 (1134.16)	1029.015 (1174.137)	231.818 (703.632)	--	--	--	--	--	--
Small Business	--	--	--	894.645 (842.500)	-623.218 (406.964)	- 2900.963*** (618.520)	--	--	--
Medical Insurance	--	--	--	590.756 (502.274)	546.112 (929.036)	2229.913 (1651.063)	--	--	--
Gift Receiving	--	--	--	--	--	--	0.168*** (0.025)	0.125*** (0.028)	0.078*** (0.029)
Celebration Spending	--	--	--	--	--	--	-0.001 (0.014)	0.001 (0.013)	-0.022 (0.034)
Donation	--	--	--	--	--	--	1029.77*** (345.616)	1381.502*** (422.336)	1546.116*** (479.792)
North	--	--	--	--	--	--	-237.801 (231.460)	-718.129** (306.865)	-824.885** (333.259)

Note: * p<0.1, **p<0.05, ***p<0.001. Standard errors are in the parentheses.

As noted in Table 6, although farmers with one more RMB spending on gift-giving may lead to a 2.212 RMB increase in borrowing amounts in 2016, we cannot conclude that increases in borrowing amounts cause a change in gift-giving spending. Oppositely, in the recession year 2018, we find that one RMB rise in borrowing amount relates to 0.214 RMB growth in gift-giving, but no evidence to support an increase in gift-giving has an impact on borrowing amount. Therefore, farmers may pay back the favor through the gift-giving during the celebration events when they realize others may suffer from an economic shock. Overall, economic fluctuation could stimulate the borrowing demand, and households are still looking for a long-term reciprocity relationship, which can be used to explain why households borrow one RMB but give less than one RMB value in gifts. As for altruism as a motive, we compare the estimated coefficient between *Lend* and *Gift-giving* in Eq. 2 (Column 4-6) and Eq. 3 (Column 7-9). The fact that the coefficients decreased from 0.456 (in 2014) to 0.207 (in 2016) and finally became no different than zero (in 2018) may suggest that the altruistic motives vary over the years with different economic conditions. The smaller amount of gift-giving may also be caused by less gift-receiving year by year, referring to the *Gift-receiving* coefficients in Columns 7-9 of the third equation. However, it is recognized that *Donation* display a positive effect on *Gift-giving* from 2014 to 2018. It is highly possible that households with benevolence toward strangers like to give more gifts to friends and relatives. Their compassion may be expanded when they find others suffering from shocks, whether they know each other or not. Lastly, we notice a negative coefficient (in 2016) and positive coefficient (in 2018) for *Gift-giving* in the *Lend* equation, which verify the effects of unobserved economic variation.

In the discussion of informal loans and gift-giving behaviors, *Total_Assets* and *Savings* are recognized as critical exogenous variables in the system of equations. Unlike total wealth, we

use total assets in this study, the sum of land assets, house assets, fixed assets, financial assets, and durables assets. With 3SLS regression, we find several statistically significant results in Table 6. A negative estimated coefficient in Column (1) represents that farmer with more assets may borrow less in 2014. Although we have negative coefficients in 2016 and 2018, they are not statistically significant. From Column 4 to Column 6, all coefficients of *Total_Assets* are positive and statistically significant. However, they decrease with time in the *Lend* equation. Therefore, we conclude the effects of total assets on the decision on informal loans vary year by year, depending upon the economic conditions. Summarizing the coefficients of *Total_Assets* from all three years, we notice farmers are not making borrowing or lending decisions based on their assets but other factors. They are not likely to sell assets with relatively lower liquidity to compensate for the money demand. Similar to *Total_Assets*, we also catch the coefficients on *Savings*. In Eq. 1, we have negative statistically significant coefficients for all three years, demonstrating that households borrow less if they have enough savings. The positive correlation between *Saving* and *Lend* shows that households lend more if they have more money. However, we have both negative and positive relationships in the gift-giving equation. In Column (7), we find households give less during celebrations if they had more savings in 2014, and they change to more gift-giving when the time goes to 2018. According to the *Saving* coefficients, the summary is that households make their decisions on informal loans based on the cash in their hand, but not low liquidity assets like houses and durable goods. We also notice farmers have become more generous, which may be because of the overall trend in society.

Moreover, exogenous shock from disaster is the last thing we are interested in. Columns (7)-(9) of Table 6 collect the regression results for each year. The estimated coefficients of the current year's disaster level show negative effects (2016 and 2018), and last year's disaster level

demonstrates positive impacts (2014 and 2016) on gift-giving. Therefore, natural disasters lead to a reduction in the amount of gift-giving. Yet, once the farmers recover from the previous disasters, they are likely to give more gifts. Since gift-giving behavior is still an important part of rural households' lives, they are willing to express their kindness to acquaintances. Such situations may also indicate the importance of rural China's 'saving face' culture.

3.3.4 Personality Effects

The household head's behavior relies largely on non-pecuniary motives. Akerlof and Kranton (2010) mention the importance of identity in shaping an individual's behaviors. Grimard (1997) discusses the ethical and cultural impact of informal loans. Moreover, Turvey and Fu (2019) conclude the subjective attitude toward 'saving face' also influences households' financial decisions on informal loans. Therefore, we add three kinds of personalities to our study to determine the effects of subjective attitudes on informal borrowing, informal lending, and gift-giving.

We separate different personalities based on three traits: popularity, happiness, and getting along well with others. In the data collecting procedure, respondents assign different scores on each trait after considering their own situation. For example, if individuals feel extremely happy when they are very popular and can get along very well with others, they may rate themselves a high score in three traits. Then, we use cluster analysis splitting all household heads into three groups. Table 7 lists the descriptive statistics for each personality founded on these three dimensions. Similar to previous sections, we use 3SLS regression continuously in personality-related research.

Table 7: Three Dimension of Personality				
		Popularity	Happiness	Getting along well with others
Personality 1	Min	5	4	5
	Mean	8.742	9.052	8.724
	Max	10	10	10
Personality 2	Min	0	0	0
	Mean	5.815	4.285	5.5
	Max	10	10	10
Personality 3	Min	0	4	0
	Mean	6.771	7.536	6.901
	Max	10	10	10
Total	Min	0	0	0
	Mean	7.312	7.352	7.278
	Max	10	10	10

Note:

* Personality 1: People who are very popular and could get along very well with others. They are extremely happy with this state.

* Personality 2: People who are not popular and could get not along well with others. They are not happy with this state.

* Personality 3: People who are popular and could get along well with others. They are happy with this state.

Table 8 presents the 3SLS regression results with personality one as the control variable. Columns 1 and 2 represent that borrowing behavior positively affects the lending amount and vice versa. Comparing the coefficients of *Gift-giving* in Eq.1 and *Borrow* in Eq.3, the relationships between gift-giving and borrowing are also positive. However, we do not observe any evidence supporting the correlation between gift-giving and the lending amount is different from zero. Therefore, the reciprocity hypothesis still holds in 3SLS regression with personality 1 as the control variable. A negative statistically significant coefficient in Eq. 1 provides evidence that a household head with personality 1 borrows 1275.413 RMB less than personality 2 and 3. Nevertheless, they give more gifts in value according to the positive coefficient in Eq.3.

Household head with personality one is popular and good at social interactions with others. Because they are happy with this state, it is sensible for them to reduce the borrowing behaviors that may hurt others' feelings and increase the behaviors that could help them win a favorable impression, such as gift-giving.

Table. 8 3SLS Regression for Personality 1

	Eq. 1 Borrow	Eq. 2 Lend	Eq. 3 Gift-giving
Borrow	--	0.463*** (0.072)	0.155*** (0.059)
Lend	0.656*** (0.100)	--	0.034 (0.060)
Gift-giving	0.946*** (0.293)	0.295 (0.244)	--
Personality 1	-1275.413* (698.078)	-222.260 (567.812)	875.292*** (179.935)
Note: * p<0.1, **p<0.05, ***p<0.001. Standard errors are in the parentheses.			

We provide 3SLS regression results with personality 2 as the control variable in Table 9. Similar to Table 8, we have positive correlations between borrowing and lending amounts in Columns 1 and 2. In addition, Columns 1 and 3 provide further positive coefficients of *Borrow* and *Gift-giving*. Still, we do not observe any evidence supporting that the correlation between *Gift-giving* and *Lend* is different from zero. In summary, the results in Table 9 provide evidence in favor of the notion that people lend for borrowing and borrow for lending. Therefore, the reciprocity hypothesis holds with personality 2. A positive statistically significant coefficient in Columns 1 and 2 of Table 9 shows that a household head with personality 2 borrows 2664.214 RMB more and lends 1177.229 RMB less than the other two personalities. They also give fewer gifts during the celebration events. Since they feel they are unpopular and may meet difficulties when they try to get along well with others, it is reasonable for them to spend less on giving gifts

and making less effort to lend money. Household heads with personality 2 may be more self-interested than the other two kinds of personalities due to a high amount of borrowing.

Table. 9 3SLS Regression for Personality 2

	Eq. 1 Borrow	Eq. 2 Lend	Eq. 3 Gift-giving
Borrow	--	0.468*** (0.072)	0.161*** (0.060)
Lend	0.665*** (0.100)	--	0.025 (0.061)
Gift-giving	0.954*** (0.294)	0.270 (0.245)	--
Personality 2	2664.214*** (780.577)	-1177.229* (659.532)	-1075.725*** (239.349)
Note: * p<0.1, **p<0.05, ***p<0.001. Standard errors are in the parentheses.			

Lastly, we control personality 3 with the same regression strategy and describe the result in Table 10. Similar to Tables 8 and 9, we find positive correlations between borrowing and lending amounts in Columns 1 and 2. Additionally, the coefficients appear in Columns 1 and 3 illustrate positive connections between *Borrow* and *Gift-giving*. Again, we do not uncover any evidence rejecting the relationship between gift-giving and the lending amount is zero. Overall, the results in Table 10 support the reciprocity assumption. Unlike people with personality 1, who are extremely happy with their state, people with personality 3 are just happy that they are popular and do not face many barriers during the social interaction activities. Thus, we are not surprised that the only statistically significant coefficient appears in the *Lend* equation (Eq.2). From Column 2 of Table 10, a household head may lend 1141.91 RMB more than people with other two personalities. Their personality may attract others to ask for informal loans. However, it is hard for them to request an informal loan from their private social network and make an additional effort to be more popular through gift-giving.

Table. 10 3SLS Regression for Personality 3

	Eq. 1 Borrow	Eq. 2 Lend	Eq. 3 Gift-giving
Borrow	--	0.451*** (0.073)	0.151*** (0.059)
Lend	0.644*** (0.101)	--	0.039 (0.060)
Gift-giving	0.973*** (0.295)	0.324 (0.245)	--
Personality 3	-790.288 (673.639)	1141.91** (528.059)	-57.983 (193.082)
Note: * p<0.1, **p<0.05, ***p<0.001. Standard errors are in the parentheses.			

4. Conclusion

In this paper, we use balanced household data from CFPS collected by resurveying respondents in 2014, 2016, and 2018 to construct a unique panel data set. Comparing the users of formal and informal loans, we discuss the importance of studying informal loans in rural China. The data allow us to statistically test the influence factors of informal loans and gift-giving behavior in detail. First, we augmented the endogeneity relationships between informal borrowing, informal lending, and gift-giving through a literature review and Durbin and Wu-Hausman test. Second, we use Three-Stage Least Square (3SLS) regression on the panel and cross-sectional datasets to test if the risk-sharing, reciprocity, and altruism hypotheses hold. Third, we examined the effects of three personalities on informal loans and gift-giving behaviors.

By running a 3SLS regression on the panel dataset, we first test whether risk-sharing is the primary reason households use informal loans and whether informal loans serve as informal insurances. While most previous studies find that rural households in developing countries use informal loans as informal insurance when they experience exogenous shocks, such as natural disasters, our evidence does not support the risk-sharing hypothesis as a strong causal pathway to informal loans. In the earlier risk-sharing assumption, we assert that if farmers intend to share risks through informal loans, they will increase the borrowing amounts, decrease the lending amount, and reduce the value of gift-giving. However, we do not have evidence to support that farmer increase their borrowing amounts when external shocks occur, and we also notice rural households increase lending amounts if the disaster level in the current year rises. The exciting result is that we confirm that farmers would decrease the value of the gifts they give during the celebration events, and the disaster level one year before is positively associated with the gift-giving behaviors. With the estimated coefficient of borrowing, lending, and gift-giving, we find

that the reciprocity hypothesis holds. According to Matthew Rabin (1993), people like to help those who are helping them and hurt those who are hurting them. We conclude that households lend in order to borrow, or they borrow and lend in the future as a way to keep a reciprocity relationship. Yet, the altruism assumption is not supported by our findings.

Our findings in the 3SLS regression of cross-sectional datasets of 2014, 2016, and 2018 suggest that farmers generally can borrow more money from friends and relatives than they need to lend for reciprocity purposes. Looking at the coefficients of three years, we find farmers' behaviors on informal loans and gift-giving may be affected by economic fluctuations. For example, farmers in 2018 have to lend more money to receive informal loans from their private social networks. Furthermore, an economic recession could stimulate the borrowing demand. Nevertheless, households borrow 1 RMB but give less than 1 RMB value in gifts in the recession year of 2018 which may indicate that households are still looking for a long-term reciprocity relationship. We also notice that altruistic motives have varied in different year, but again this may be due to broader unobserved economic conditions.

Our results also emphasize the importance of personalities in rural households' informal loans and gift-giving choices. Among all three personalities, the reciprocity hypothesis holds. Outgoing and optimistic household heads tend to reduce the borrowing behaviors that may hurt others' feelings and increase the behaviors that could help them win a favorable impression, such as gift-giving. Household heads, who are unpopular and may meet difficulties when they try to get along well with others, spend less on giving gifts and making less effort to lend money, and maybe more self-interested than the other two kinds of personalities due to a high amount of borrowing. Lastly, normal household heads attract others to ask for informal loans, but it is hard

for them to request an informal loan from their private social network and make an additional effort to be more popular through gift-giving.

Our study also has an important policy implication. It is widely agreed that informal loans could be considered a substitute for informal loans. Although previous studies support that, under specific conditions, households efficiently use informal loans to share the risks from external shocks in the village, informal loans as a general method of risk-sharing are not supported at the national level in China. Therefore, the policymaker should be careful about the substitution relationships between informal loans and informal insurances. Furthermore, since our research only focuses on rural households whose lives depend on agricultural activities in China, future studies may include more kinds of populations in the research of informal loans. Understanding why families decide to lend or borrow and whom they choose to lend or borrow may also be crucial in future studies. Additionally, our study uses idiosyncratic risks as the source of exogenous shocks. However, the systemic shocks may cause different results and implications in the topics of informal loans and credits.

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