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Effect of personality traits on smallholders' land renting behavior: Theory and evidence from the North China Plain

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ABSTRACT

This study investigates the effect of smallholders' personality traits on their land rental market decisions. We develop a conceptual framework and show that these internal factors could affect smallholders' land rental market participation beyond institutional and socio-demographic factors. Our empirical analysis is based on a survey of 2119 rural households collected in the North China Plain. We find that smallholders with a higher level of openness are more active in participating in the farmland rental market. Moreover, internal locus of control plays a significant role in explaining smallholders' land renting behavior. We further show that need for achievement mediates the link between internal locus of control and smallholder's intention to rent land, indicating that fostering a higher level of internal locus of control—and subsequently achievement desire—could play an important role in promoting smallholders' land-renting behavior. More generally, our results imply that taking rural smallholders' personality traits into account in designing land rental policies may increase the effectiveness of policies aimed at promoting land rental market participation among smallholders and incubating crop farm scale enlargement in rural China.

1. Introduction

Agricultural production in rural China has long been constrained by small-scale and fragmented land holdings (Nguyen, Cheng, & Findlay, 1996; Tan, Heerink, & Qu, 2006). More than 60 percent of farms were cultivated by smallholders with farms of < 0.5 ha by 2013 (Ji et al., 2016). The Chinese central and local governments have been promoting land consolidation and larger-scale farm operations through land rental market development (Ministry of Agriculture [MoA], 2016), but the progress has been rather uneven across regions (Ito, Bao, & Ni, 2016; Luo, 2016). For example, recent data show that about 33.8 percent of the farmland was rented out at the national level nationwide by 2017 (Ministry of Agriculture and Rural Affairs [MARA], 2018), while it was less than 30 percent in the North China Plain regions, compared to more than 30 percent–50 percent in the middle and lower reaches of the Yangtze River (Wang, Li, & Xin, 2018).[1]

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[1] The higher land rental market development in some south coastal provinces of China has been credited to the higher economic development, smaller land endowment, and more institutional innovations than in the northern provinces (Ito, Bao, & Ni, 2016).

Previous research on rural households' land rental market participation in China and elsewhere has mostly stressed the impact of external constraints. For instance, Carter and Salgado (2001) found that credit constraints were central factors that limited smallholders' access to land rental markets in Latin America. Other studies found evidence that labor market imperfections (Mullan, Grosjean, & Kontoleon, 2011; Yao, 2000), prohibitive land transaction costs (Huy, Lyne, Ratna, & Nuthall, 2016; Skoufias, 1995), and incomplete property rights and land tenure insecurities (Feng, Heerink, Ruben, & Qu, 2010; Holden, Deininger, & Ghebru, 2011; Ma, Heerink, van Ierland, Lang, & Shi, 2020) are important factors prohibiting rural households' participation in land rental markets.

Several recent studies on rural households' agricultural production decisions argued that, despite the presence of various external constraints, internal or psychological characteristics might be fundamental factors affecting rural smallholders' agricultural production and investment decisions (Bernheim, Ray, & Yeltekin, 2015; Duflo, Kremer, & Robinson, 2011; Haushofer & Fehr, 2014). Specifically, Bernard, Dercon, Orkin, and Taffesse (2014) argued that low aspirations among poor people can lead to underinvestment even when returns are high. Furthermore, Abay, Blalock, and Berhane (2017) showed that internal locus of control can play an important role in explaining smallholders' behavior towards on-farm technology adoption. Ali, Bowen, and Deininger (2019) found that noncognitive skills (polychronicity, work centrality, and optimism) significantly affected adoption decisions and technical efficiency in rice production in Ghana.

Despite the growing awareness of the role of psychological factors in smallholders' decision making, to our knowledge their potential role in farmland renting decisions has not been examined so far. We believe it is of major importance for policymakers (or other stakeholders) in developing countries to obtain more insight into the link between smallholders' personality traits and farmland renting behavior. First, well-functioning rural land rental markets facilitate the rural structural transformation in China and other developing countries, as they contribute to efficiency and equity by allowing more-able producers to gain access to additional land and permitting off-farm employment for households with less-able producers (Chamberlin & Ricker-Gilbert, 2016; Jin & Deininger, 2009; Ma, Heerink, van Ierland, Lang, & Shi, 2020). Personality traits may affect smallholders' actual and perceived profitability of land rentals, just like other production and investment decisions. Second, current public policies regarding land rental market development have mainly focused on releasing external constraints (Deininger & Feder, 2009; Deininger & Jin, 2005; Ma, Heerink, Feng, & Shi, 2015). However, certain personality traits may predispose or intrinsically drive individuals to (not) engage in land renting activities. A better understanding of smallholders' psychological characteristics and their subsequent roles in land rental market participation might contribute to more effective land market development policies.

The current rural farmland liberalization in China lays a good foundation for investigating the role of personality traits in smallholders' land rental market participation. Since 1978, farmland in China has been managed under the so-called "household responsibility system (HRS)," which divides the property rights of rural farmland into two layers: the ownership right is owned by the village collectives and the use right is held by individual households that contract farmland from the village. In the early stages of the HRS, farmland used to be distributed according to a completely egalitarian principle in which all households in a village received land use rights based on the number on persons and/or laborers in a household (Qu, Heerink, & Wang, 1995), and was only allowed to be rented by households with permission from village leaders (Lin, 1989). The Chinese government then gradually relaxed restrictions on farmland transfer among rural smallholders since the 1990s as a way to promote agricultural modernization. The "Rural Land Contract Law (RLCL)" of 2002 fixed the contract duration for the use of arable land at 30 years, and almost entirely prohibited land reallocations (Ye, 2015). In other words, smallholders' family size was no longer related to their farm (land) size after 2002, though minor reallocations still took place within some villages (Long, Li, Liu, Woods, & Zou, 2012; Ma, Heerink, Feng, & Shi, 2015). Since 2009, rural land reforms in China aimed at stimulating rural land rental markets and land investments by measures to improve tenure security (Luo, 2016; Ma, Heerink, Feng, & Shi, 2015; Wang & Zhang, 2017; Wang, Riedinger, & Jin, 2015).

This study focuses on addressing two research questions: First, what is the relationship between personality traits and smallholders' land rental market participation in China? Second, if there is a relationship, what are the underlying mechanisms through which personality traits exert their effects? We specifically develop a conceptual framework of the effect of personality traits on smallholders' land rental market participation through economic and non-economic factors, and use a cross-sectional survey of 2119 rural households collected in the North China Plain to estimate the impact of personality traits on land rental decisions. This dataset contains rich information about smallholders' land renting behavior and intention, personality traits, and preferences. The findings indicate that smallholders with a relatively high level of openness participate more in the farmland rental market. Internal locus of control is found to play a significant role in explaining smallholders' land renting-in decisions. We further show that the effect of internal locus of control is mediated through the smallholders' need for achievement, indicating that fostering higher levels of internal locus of control—and subsequently achievement desire—could play a significant role in promoting smallholders' land renting behavior. This study can shed light on the extant literature of land rental market development by showing that personality traits can influence smallholders' participation in land markets, beyond institutional and socio-demographic factors.

The remainder of the paper is organized as follows. In Section 2 we develop a conceptual framework of the impact of personality traits and preferences on land renting decisions. Section 3 provides a description of the context of our study and data collection. In Section 4 we present our empirical estimation strategy; Section 5 reports on the descriptive analysis and estimation results. Section 6 presents the conclusion.

2. Conceptual framework

Both economists and psychologists endeavor to identify determinants of heterogeneity in human behavior. In conventional economic analysis, decision problems are typically depicted in the framework of utility maximization, where an individual's utility is shaped by various types of preferences concerning risk, time and formal or informal institutions. Psychologists who study individual

personality characteristics generally predict human behavior using the framework of personality traits, which can be defined as the most fundamental psychological constructs underlying the regularities in people's thinking, feeling, and behavior (Roberts, 2009).

These psychological constructs have been integrated in behavioral economics into the economic decision-making framework (Almlund, Duckworth, Heckman, & Kautz, 2011; Becker, Deckers, Dohmen, Falk, & Kosse, 2012; Borghans, Lee Duckworth, Heckman, & ter Weel, 2008; Heckman & Kautz, 2012). A growing number of empirical studies have started focusing on the roles of personality traits in investment and technology adoption behavior (Ali, Bowen, & Deininger, 2019; Busic-Sontic, Czap, & Fuerst, 2017; He & Veronesi, 2017). However, knowledge about the effect of personality traits on land rental market participation is still lacking.

In the following sub-sections, we first describe the relevant personality variables and then develop a framework conceptualizing how personality traits may be associated with land renting decisions of smallholders in China.

2.1. Personality traits

Personality traits (or non-cognitive skills) are typically defined as patterns of thoughts, feelings and behaviors that persist from one decision situation to another (Roberts, 2006). An individual's personality traits are often formed in his/her early stages of childhood through biological maturation, i.e. gene expression and hormonal processes, and learning (Roberts, 2009; Specht, Bleidorn, Denissen, Hennecke, Hutteman, Kandler, & Zimmermann, 2014), and are rather stable over time after adulthood (Srivastava, John, Gosling, & Potter, 2003). Previous studies show that personality traits affect almost every aspect of an individual's decision making and behavior (Cobb-Clark & Schurer, 2012; Jones, Livson, & Peskin, 2006).

Although the concept of personality traits is rather broad, in practice it is generally acknowledged that individual personality traits can be derived primarily from five dimensions (Mount, Barrick, Scullen, & Rounds, 2005). The literature shows consensus in using the Five Factor Model (FFM, or *Big Five Model*) to measure an individual's personality traits (Borghans, Lee Duckworth, Heckman, & ter Weel, 2008). The five factors, specifically labeled as *openness to experience*, *conscientiousness*, *extraversion*, *agreeableness*, and *neuroticism* (OCEAN), categorize personality traits at the broadest level of abstraction (Costa & McCrae, 1992). Openness to experience [O] characterizes people who are intellectually curious, tend to seek new experiences and explore novel ideas. Conscientiousness [C] describes an individual's degree of organization, persistence, hard work and motivation to pursue long-term goals. Extraversion [E] describes the degree of being confident, dominant, energetic, active, and enthusiastic. Agreeableness [A] is an indication of an individual's trust, altruism, and cooperation within interpersonal relationships. Neuroticism [N] represents the individual's degree of emotional instability, distress, anger, and frustration (John & Srivastava, 1999).

Another personality trait, which has been frequently studied in behavioral science, is *locus of control* [LoC].[2] LoC is described as the degree to which people attribute success or failure to themselves or the external circumstances (Rotter, 1966). People with a strong internal LoC believe that their future is determined more by their own actions, whereas people with a strong external LoC believe that the external environment has more power in controlling their lives (Antonides, 1996). People who are more internally controlled are also known to seek information, take initiatives, and engage in entrepreneurial activities (Antonides, 1996; Caliendo, Fossen, & Kritikos, 2014; Hansemark, 2003).

2.2. Personality traits and land renting behavior

Previous studies regard smallholders' participation in land rental markets essentially as an economic decision (De Janvry, Sadoulet, & Wolford, 2001; Deininger & Feder, 2001). On the notion that smallholders are "poor but rational" profit-maximizing decision-makers, smallholders with favorable farm-operating skills can access land resources offered by households with less-developed skills through land rental markets. Land, in this way, is regarded as a fundamental economic factor of production, with profit maximization driving land renting decisions. Personality traits may affect farmland renting behavior, just like affecting other agricultural production and investment decisions. However, farmland is not only an essential factor in agricultural production but may also possess non-economic values like emotional attachment, status, or social security (Kuehne, 2013; Quinn & Halfacre, 2014; Zhang & Donaldson, 2010). These non-economic values may depend to a certain extent on specific personality traits. In this study we therefore assume that smallholders' land renting decisions depend on economic as well as non-economic factors, and that personality traits may affect both types of factors.

2.2.1. Economic factors

There are generally two strands of literature relating personality traits with economic decisions made by rural smallholders. First, considerable literature exists on the role of personality traits (e.g., LoC and Big Five) in agricultural technology adoption and investment. For example, Crase and Maybery (2004) found that smallholders' openness to experience was a significant explanatory factor of farm management practices in Australia. Empirical evidence from Africa shows that other personality facets, such as LoC, tenacity, and impulsiveness, play important roles in explaining heterogeneous decision making regarding adoption of improved seeds, chemical fertilizers, and irrigation practices (Abay, Blalock, & Berhane, 2017; Ali, Bowen, & Deininger, 2019). Smallholders in

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[2] The exact relationship between LoC and the Big Five in personality trait studies is rather unclear. Some studies argue that LoC can be an additional personality trait apart from the Big Five, while other studies have shown that LoC and the Big Five had additional predictive power in understanding individual behaviors (Judge, Erez, Bono, & Thoresen, 2002; Morrison, 1997). In our study, we assume that LoC is an additional personality trait, which might be related to some Big Five characteristics, but is different in nature.

Tanzania and Mozambique with more external locus of control are found significantly less likely to adopt improved maize varieties (Malacarne, 2019).

The second strand of literature focuses on the role of personality traits in rural households' livelihood strategies, especially migration decisions. Caliendo, Cobb-Clark, and Uhlendorff (2015) found evidence that internal LoC is associated with a higher propensity to migrate across regions in Germany. Ayhan, Gatskova, and Lehmann (2020) explored the effect of the Big Five factors on migration in Ukraine and found that openness to new experiences was positively associated with the probability of an individual to migrate from rural to urban areas.

Personality traits may also play a role in the economic considerations that drive rural smallholders' land rental decisions in China. Given existing land and labor market imperfections, many Chinese smallholders are making decisions on land and off-farm labor market participation simultaneously rather than in isolation (Feng, Heerink, Ruben, & Qu, 2010). Decisions to rent out land are closely related to decisions to migrate to urban areas and to explore new income earning opportunities, whereas farm expansion through land rentals often requires novel managerial ideas and adoption of innovative technologies. Openness to experience, i.e. an individual's propensity to try new experiences and explore novel ideas (Costa & McCrae, 1992), is likely to play a crucial role in such land rental market participation decisions. Whether they expand farms by renting additional land or migrate to urban areas by giving up (part of) their land depends on their own land–labor endowment and their comparative advantages in agricultural production.

Hypothesis 1:. *Openness to experience has a positive effect on overall participation in land rental markets.*

Locus of control may also affect land rental market participation. Smallholders with a strong internal LoC may believe they are responsible for taking actions to change their fate, while those with a high level of external LoC may believe their life is to a large extent determined by their external environment. Though there is no direct and clear evidence about the role locus of control plays in the land rental market participation in the literature, our interest in studying locus of control is motivated by studies examining its importance in other factor markets. For example, Caliendo, Cobb-Clark, and Uhlendorff (2015) found that locus of control affected people's labor market participation decision via their job seeking behavior. Individuals having a high level of internal locus of control were more likely to take extra effort to search for a job. Caliendo, Cobb-Clark, Hennecke, and Uhlendorff (2019) further found that people with high level of internal locus of control were more oriented to search for job opportunities across larger geographic areas, and also migrated more often. Given these findings, we would expect that smallholders with strong internal LoC are more likely to participate in land rental markets, either by renting-in land or by renting-out land, as a result of exerting more efforts in searching on-farm or off-farm income earning opportunities.

Hypothesis 2:. *Internal locus of control has positive effects on overall participation in land rental markets.*

2.2.2. Non-economic factors

Non-economic values of land may also determine how smallholders view and deal with their land (Fairhead & Leach, 1996; Lokhorst, Hoon, le Rutte, & de Snoo, 2014). Personality traits are likely to affect these non-economic values, and hence to affect land rental decisions.

First, farmland holdings are considered as an important source of social security for rural smallholders in China; rural households faced with unemployment or other risks and uncertainties can still rely on the farmland assigned to them for earning a living (Ma, Heerink, Feng, & Shi, 2015; Wang, Weaver, & You, 2013; Yu, Shi, & Jin, 2010). Renting out farmland may put smallholders at a risk of losing this important source of social security until the rental contract expires (Qu, Heerink, Xia, & Guo, 2018). Neurotic persons, i.e. individuals characterized by getting stressed easily, avoiding negative factors, and being prone to interpret ordinary situations as threatening or stressful (Paunonen & Ashton, 2001), may be less inclined to rent out land because they see this as a loss of protection against unemployment, bad health and other misfortune. Alternatively, when farming is considered as stressful as compared to wage employment, neurotic smallholders may prefer to rent out their arable land and earn a wage income elsewhere. Because of the opposite directions of the two processes regarding neuroticism, we can only estimate the net impact of neuroticism on land renting out and we thus do not state a hypothesis about it.

Arable land may also be a status symbol. Empirical evidence suggests that land-renting (and labor-hiring) entrepreneurial farmers in China not only tend to expand their scale of agricultural production, but also frequently occupy superior positions in authority relations and have greater social power (Zhang & Donaldson, 2010). This suggests that conscientiousness plays a role in land rental decisions. This would be consistent with evidence that conscientiousness is related to life goals of having a high-status career and an influential and prestigious occupation (Roberts & Robins, 2000). We thus expect that smallholders who score high in conscientiousness will pursue superior within-village social status by renting more land.

Hypothesis 3:. *Conscientiousness has a positive effect on renting in land.*

Smallholders may also experience a strong emotional attachment (i.e. belonging or connection) towards their land, as was found in some African communities (Koot & Büscher, 2019; Koot, Hitchcock, & Gressier, 2019; Mujere, 2011). Personality traits may affect such emotional attachments, and thereby play a role in land rental decisions. But in the case of China, it may be assumed that emotional attachment to the land is rather weak given the system of allocation of land to households under the HRS.

2.3. Preferences and motivations

Besides personality traits, we also consider preferences and motivational factors in our analysis. Motivations and preferences are
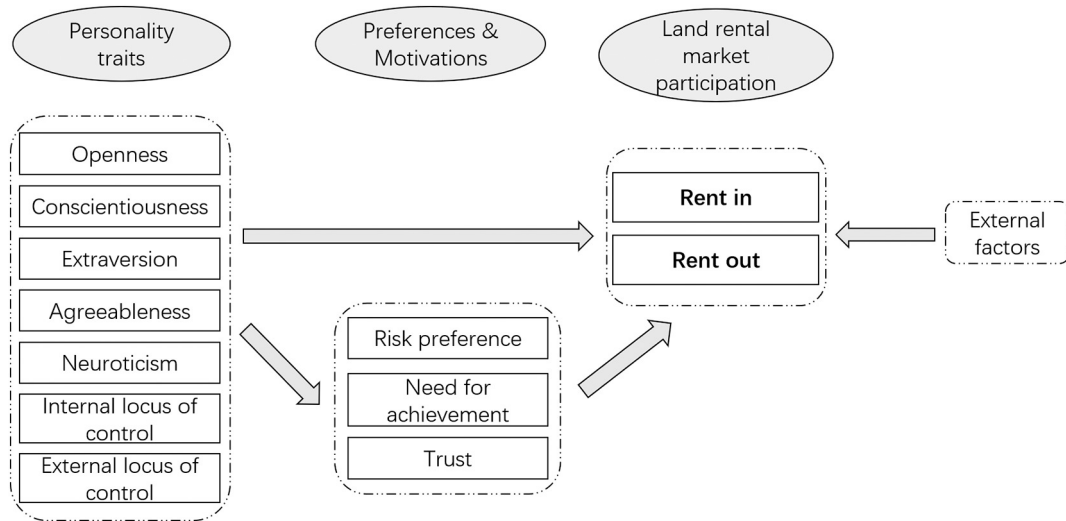
Fig. 1. Conceptual model.

less likely to be intrinsic components of personality traits (Ferguson, Heckman, & Corr, 2011; Roberts, 2009). Instead, they may mediate the effect of the fundamental psychological constructs (i.e. personality traits) on behavior (Mooradian, Renzl, & Matzler, 2006). Hence, we extend our conceptual model of land rental market participation by including the potential mediating roles of risk attitudes, social trust, and achievement motivation.

Risk-averse households are less likely to participate in the land rental market (Ma, 2013), whereas non-kinship trust can reduce transaction costs and thereby stimulate land rental transactions (Ma, Heerink, van Ierland, Lang, & Shi, 2020). A person with high *need for achievement* [nAch] generally aims at rivaling and surpassing others at tasks in which she or he engages (McClelland, 1961). Farm expansion, being able to stimulate entrepreneurship and achieve higher within-village social status, can be an important way to fulfill smallholders' achievement desire.

Hypothesis 4:. *Personality traits affect land renting behaviors through risk preference, need for achievements, and (or) interpersonal trust.*

2.4. Graphical representation

The conceptual model presented in Sections 2.1–2.3 is graphically represented in Fig. 1. It shows that decisions to rent in or rent out land depend on external as well as internal factors. The most fundamental internal factors, i.e. personality traits, affect these rental decisions directly and/or indirectly through preferences and motivations, which are considered as mediating factors. These preferences and motivations affect economic and non-economic factors in land rental decisions. Due to data limitations, we do not examine the role of these intermediate economic and non-economic factors in the empirical analysis but estimate reduced-form equations of personality traits, preferences and motivations, and land rental market participation. Economic and non-economic factors are therefore not shown in the graph.

3. Data

To study the role of personality traits in rural smallholders' farmland renting behavior, we use data from a large-scale rural household survey conducted in the North China Plain in 2018. In the following sub-sections, we first explain our sampling and data collection procedures, followed by a detailed illustration of the measurement of personality traits and preferences.

3.1. Sampling and data collection

The data of our study was collected by in-person interviews with smallholders and village cadres from Handan prefecture in Hebei province, China in February 2018. Handan prefecture locates in the center of the North China Plain (NCP)—one of China's most important agricultural production regions. The agricultural sector accounted for 12.5 percent of Handan Prefecture's total GDP in 2016, which was significantly higher than the national average of 8.6 percent (China Natiational Bureau of Statistics [CNBS], 2017).

Data collection took place as part of a larger survey on the impact of so-called science and technology backyards in Handan prefecture. Among others, the survey contained rich information about households' land rental market participation. For the purpose of our study, we added a separate module on rural smallholders' personality characteristics to it. This allows us to gain deeper insights into the effect of personality traits on smallholders' land renting behavior, which cannot be gained by using available secondary data sets collected for larger regions or China as a whole.

To collect the household data, the field survey was conducted in four counties in Handan prefecture. After one round of pretest, we first listed all townships and villages within these four sampled counties, comprising 23 townships and 649 villages. We further restricted our sample to staple food production areas. To make sure all our sampled villages included mainly maize and wheat producers, we excluded villages where maize and wheat were not the main crops produced.[3] Then we randomly sampled villages proportional to the size of the township. In total, a sample of 135 villages from 22 townships was obtained. A list of all registered households was obtained within each village, from which we randomly drew 16 households per village to conduct *face-to-face* interviews with. In each household we interviewed the main farming member within each family. In total, we have surveyed 2,119 households from 135 rural villages.[4]

3.2. Measures

We measured a series of outcome variables to describe households' land renting behavior. Specifically, we asked, at the time of survey, if: (1) the household was participating in the land rental market (renting-in or renting-out at least one piece of land); (2) the household was renting (in) at least one piece of farmland; (3) the household was renting out at least one piece of farmland; (4) the respondent was intending to rent (in) or rent out at least one piece of land; (5) the respondent was intending to rent (in) more farmland; (6) the respondent was intending to rent out more farmland.[5]

The key variables in our study were the measured smallholders' Big Five personality traits, LoC, risk preference, trust, and nAch. To measure personality traits in a reliable way, we adopted an internationally recognized Big Five personality scale (the Big Five Inventory-10, hereafter BFI-10) and applied its Chinese version (see Carciofo, Yang, Song, Du, & Zhang, 2016; Rammstedt & John, 2007). The BFI-10 scale has been widely used in economic and behavior studies (Donato, Miller, Mohanan, Truskinovsky, & Vera-Hernández, 2017; Oehler, Wendt, Wedlich, & Horn, 2018; Soliño & Farizo, 2014). In the BFI-10, each of the five personality dimensions was captured by two items, for which respondents rated their level of agreement on a 5-point Likert scale. We elicited LoC following the standard practice of Rotter (1966) but used the 10-item inventory with a 6-point Likert scale (see Table A1 in the Appendix), which has been widely used in other research (Ali, Bowen, & Deininger, 2019; Caliendo, Cobb-Clark, & Uhlendorff, 2015; Cobb-Clark, Kassenboehmer, & Schurer, 2014; Coleman & DeLeire, 2003). We constructed two separate LoC traits (i.e. internal and external) based on factor analysis.[6] Each of the internal and external LoC traits corresponded to 5 items.

We measured smallholders' general risk preferences by using an 11-point rating scale running from 0 (*I see myself as a person who always tries to avoid risks*) to 10 (*I see myself as a person who always positively takes risks*). Moreover, the Need for Achievement inventory with 5-point Likert scale consisted of three items adapted from Namayengo (2017) (see Table A1 in the Appendix). Interpersonal trust was a dichotomous measure using a standard question originating from the World Value Survey (WVS) valued 0 (*In general, I believe most people are trustworthy*) or 1 (*I believe most people need to be treated with caution*).

Control variables measured in the survey were the aforementioned external factors (see Fig. 1), including land tenure security variables, land characteristics, and household and village characteristics. Tenure security was measured by whether smallholder had obtained the land certificate after the new-round land certification program, and if smallholder's farmland was not periodically reallocated within village in the second-round land contracting period.[7] Higher tenure security was expected to increase the probability of participation in the land rental market. Contracted farmland size and number of contracted plots were introduced as indicators of a household's land endowment, which were expected to have impact on the household's renting additional land. Household demographic information was used as an indicator of labor endowment. A larger number of household labor was expected to positively affect the decision to rent in land. Households' access to credit and off-farm opportunities were also considered as participation in land rental markets is closely associated with households' exposure to off-farm labor market and credit. Village characteristics contained information about village-level land endowments, geographical location, and within-village kin relationships. We used a group of location variables indicating the degree to which (village) households were connected to the larger economy and markets (Renkow, Hallstrom, & Karanja, 2004), and we used the number of family clans to indicate the kinship structure within a village.[8] A detailed list of these covariates and their definitions can be found in Table A2 in the Appendix.

3.3. Reliability and validity considerations

Concerning the potential problems in using psychometric scales among rural populations in developing countries (Laajaj &

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[3] Some villages may specialize in cash crops, such as apple, cotton, and grapes rather than staple food production. We collected information about crop specialization before we conducted interviews in the villages to make sure most smallholders were planting local staple food (wheat and corn) rather than cash crops.

[4] 41 Observations were dropped due to missing or incomplete data. Non-response was about 2 percent.

[5] To avoid unclear definition among surveyed households, we clarified to all the respondents that farmland inherited from their predecessors should not be reported as land rental transactions.

[6] Some studies, such as Collins (1974), Gatz and Good (1978), have suggested that external and internal locus of control should be treated as two independent traits. We follow the same practice in our study.

[7] The launch of Document No. 1 in 1984 marked the beginning of the 1st round of land contracting, in which the central government stated that the land-use rights of farmers should be granted for at least 15 years in their land contracts. The central government then extended land contracts to another 30 years upon expiry (since 1999), referring to the start of the 2nd round of land contracting. (Feng, Bao, & Jiang, 2014)

[8] A Chinese clan is defined as a patrilineal and patrilocal group of related people sharing a common surname or ancestor.

Macours, 2017), we have taken a few measures to account for potential biases due to measurement error. As the acquiescence bias is likely to happen in rural low-income settings, we tried to mitigate it following common practice in the psychometrics literature by balancing the scale (e.g. locus of control) and using both positively and negatively phrased statements (Soto, John, Gosling, & Potter, 2008). Furthermore, as the relatively low educational level of respondents may affect their understanding of the questions, we undertook a few rounds of pretests for the personality scales prior to the official interview with the respondents. The pretests were carried out with smallholders residing in two out-of-sample villages in Handan prefecture. We asked them to repeat their understanding of each scale item using their own wordings, then we rephrased the items which were difficult to understand and re-tested again. In this way, we found that smallholders in this sample region could understand the scales well and only one item of the BFI-10 was reworded slightly into local dialect after the pretests.

We also addressed the reliability and validity concerns of measuring personality traits. First, the BFI-10 scale has been shown to be an appropriate measure retaining significant levels of reliability and validity both in China and in other countries (Carciofo, Yang, Song, Du, & Zhang, 2016; Rammstedt & John, 2007). Second, the reliabilities of scales measuring locus of control and need for achievement were tested using Cronbach's α, which were 0.76 (internal LoC), 0.69 (external LoC), and 0.73 (nAch), indicating these scales had reasonable internal consistency.[9] Moreover, average variance extracted (AVE) comparisons were applied to all latent personality traits to assess convergent and discriminant validity. Convergent validity was verified as all AVE values were greater than a rule-of-thumb critical value of 0.5, except for the external LoC scale.[10] Discriminant validity was used to test whether latent constructs were inter-correlated due to measurement error. The square root of AVE values for each latent construct are reported in Table A3 in the Appendix, indicating discriminant validity because the values on the diagonals were the highest in any column or row.

4. Empirical strategy

4.1. Multivariate regression analysis

We are primarily interested in households' actual land renting-in and renting-out behaviors. As long as households were renting or renting out a piece of farmland at the time of survey, they are categorized as participating in the land rental market. We further asked respondents to report their intention (or willingness) to rent in and/or rent out more land in the near future than the household currently did. We included this question because the actual land renting decision might be taken (partly) by the household, regardless of the respondent's personality, whereas intention to rent in or out (more) land is primarily determined by the respondent's personality and preferences (Ajzen, 1991). In total, we have six outcome variables.

Given the dichotomous nature of our dependent variables, to analyze the effect of personality traits on the land rental market participation, we first run a series of *probit* regressions. Specifically, we estimate three sets of equations, each time adding more variables:

$$y_{ij} = \Phi(\alpha_{0j} + \alpha_{1j}'x_i + \alpha_{2j}'w_i + \varepsilon_{ij}) \tag{1}$$

where y_{ij} is the land renting outcome variable j (running from 1 to 6, including behaviors and intentions) for smallholder i (running from 1 to I, being the number of observations). x_i is a vector of the household decision-maker's personality traits (both the Big Five factors, and LoC variables). w_i is a vector of county dummy variables, ε_{ij} is the village-clustered robust standard error term, and Φ is the standard normal distribution function. The αs are coefficients to be estimated for the first set of equations.

To control for potential confounding factors, which may bias our estimation of the impact of personality traits, we then take into account the respondent's basic demographic and family characteristics and the households' land tenure situation factors (i.e. land certificate possession, past land adjustments) (the vector z_i), as well as the household's village characteristics (the vector v_i). In the land renting intention equations, we also include the actual land renting-in and renting-out variables as explanatory variables (the vector z_i). The βs are coefficients to be estimated for the second set of equations. This gives us as a next step:

$$y_{ij} = \Phi(\beta_{0j} + \beta_{1j}'x_i + \beta_{2j}'w_i + \beta_{3j}'z_i + \beta_{4j}'v_i + \varepsilon_{ij}) \tag{2}$$

To examine whether an individual's preferences play a role in land renting behavior, we include m_i, the vector of the respondent's personal preferences. Specifically, m_i includes the respondent's measured general risk preference, need for achievement, and interpersonal trust. The γs are coefficients to be estimated in the third set of equations. Thus, we have:

$$y_{ij} = \Phi(\gamma_{0j} + \gamma_{1j}'x_i + \gamma_{2j}'w_i + \gamma_{3j}'z_i + \gamma_{4j}'v_i + \gamma_{5j}'m_i + \varepsilon_{ij}) \tag{3}$$

Personality traits are assumed to be rather stable over time and exogenous after adulthood, according to previous literature suggesting that personality traits are partially genetically inherited and fostered mostly in the early childhood of an individual (Bouchard & Loehlin, 2001; Cobb-Clark & Schurer, 2012; Costa & McCrae, 1992; Jones, Livson, & Peskin, 2006; Srivastava, John, Gosling, & Potter, 2003). Although there is mixed evidence of the stability of preferences over time (Chuang & Schechter, 2015;

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[9] According to a rule of thumb, alpha higher than 0.60 indicates an acceptable reliability.

[10] Fornell and Larcker (1981) suggest that an AVE value being no smaller than 0.4 can still be acceptable if the composite reliability (CR) is larger than 0.6. In our case, the AVE of external LoC was 0.450, and CR of external LoC was 0.796.
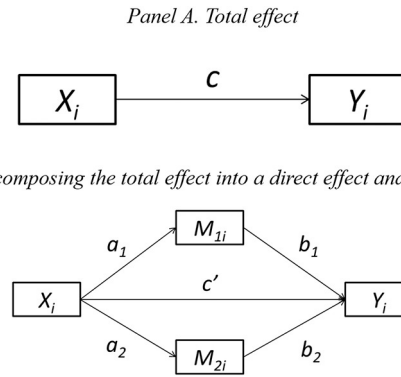
Panel A. Total effect

Panel B. Decomposing the total effect into a direct effect and indirect effects

Fig. 2. Mediation of personality traits (X_i) on land renting behaviors (Y_i).

Schildberg-Hörisch, 2018), we assume that preferences are relatively stable at least over the short periods of time. We can therefore interpret the estimation results for those variables as causal effects on land rental behavior. The same holds for respondent's social-demographic characteristics and most of the village characteristics included in Eqs. (2) and (3), because they were exogenously determined before land rental market participation decisions were taken.

4.2. Causal mediation analysis

Since a mediator mediates, or carries over, the effect of the independent variable on dependent variables (Mackinnon, 2008), the size of the direct effect of independent variables may diminish in the presence of mediating variables. Hence, we assume that the preference variables mediate the effect of personality traits on land rental participation if the coefficients of personality traits in Eq. (2) diminish compared to those in Eq. (1). To further disentangle the paths through which personality traits and preferences affect farmland renting behavior, we conduct the Causal Mediation Analysis (CMA) (Baron & Kenny, 1986; Hicks & Tingley, 2012). This analysis enables us to understand to what extent preferences, achievement desire, and trust mediated the effect of personality traits on land renting behavior.

Specifically, we employ the (multiple) mediation model proposed by Preacher and Hayes (2008) (Fig. 2). In this mediation model, M_i depicts potential mediators. Path c in Fig. 2A is the total effect of X_i on Y_i, which is decomposed into a direct effect c' and indirect effects of X_i on Y_i via mediators M_1 and M_2 in Figure B. a_1 and a_2 depict the effects of X_i on the mediators, and b_1 and b_2 depict the effects of the mediators on Y_i. The total indirect effect of X_i on Y_i is therefore the sum of $a_1 b_1$ and $a_2 b_2$. Fig. 2 also applies to the case of one mediator or more than two mediators analogously.

Complications arise when either the mediator or the outcome variable is dichotomous and when using the standard normal distribution for deriving a p-value for the indirect effect (Preacher & Hayes, 2008). In this case, the calculation of indirect effects requires a combination of OLS regression along with either *probit* or *logit* models (Mackinnon & Dwyer, 1993). We adopt the method of bootstrapping for non-parametric estimation of the indirect effect without imposing the assumption of normality of the sampling distribution, as suggested by Preacher and Hayes (2008).

5. Results

5.1. Descriptive analysis

Table 1 presents summary statistics for key variables; summary statistics of the control variables can be found in Table A2 in the Appendix. In the sample, 26.1 percent of smallholders participated in the land rental market; 12.6 percent rented farmland and 14.8 percent rented out farmland (see Table 1). However, 25.5 percent and 24.2 percent of households intended to rent and rent out more land, respectively, indicating that the land rental market has the potential for future development in our survey area.

Table 2 shows the Pearson correlation coefficients among all psychological characteristics. Most of the correlation coefficients are well below 0.3 in absolute terms but statistically significant, suggesting that the majority of the psychological constructs used in this study correlate, but substantially distinct from each other. The descriptive results in Table 2 for the Big Five personality traits show construct validity, because the correlations between neuroticism and the other four dimensions (openness, conscientiousness, extraversion, agreeableness) are negative, as expected, and are consistent with previous psychometric research (Gosling, Rentfrow, & Swann, 2003). We find that internal LoC significantly correlates with conscientiousness (0.263), extraversion (0.144), agreeableness (0.290), and particularly nAch (0.381). This suggests that if an individual's internal LoC is positively associated with his or her land renting behavior (or intention to join the land rental market), then this effect might be mediated through an individual's nAch, if nAch would also be correlated with land renting behavior. We further find that risk preference negatively correlates with openness and extraversion, and positively correlates with neuroticism, which is in line with previous observations by Dohmen, Falk, Huffman, and Sunde (2010).

Table 1

Definition of (key) variables and descriptive statistics.

	n (1)	M (2)	SD (3)	Min (4)	Max (5)	VIF (6)
Outcome variables						
Land rental market participation						
Household was either renting or renting out land	2119	0.261	0.439	0	1	
Household was renting land	2119	0.126	0.332	0	1	
Household was renting land out	2119	0.148	0.355	0	1	
Land rental market participation intention						
Respondent was intending to either renting or renting out land	2119	0.445	0.497	0	1	
Respondent was intending to rent farmland	2119	0.255	0.436	0	1	
Respondent was intending to rent out farmland	2119	0.242	0.428	0		
Key personality variablesRespondent's personality traits						
Openness to experience [O]	2119	2.830	0.982	1	5	1.07
Conscientiousness [C]	2119	3.894	0.896	1	5	1.16
Extraversion [E]	2119	3.278	1.005	1	5	1.09
Agreeableness [A]	2119	4.144	0.803	1	5	1.18
Neuroticism [N]	2119	2.538	0.942	1	5	1.20
Internal locus of control	2119	4.839	0.759	1	6	1.40
External locus of control	2119	2.836	0.979	1	6	1.13
Respondent's preferences and trust						
Risk preference	2119	4.342	3.203	0	10	1.06
Need for achievement	2119	4.104	0.833	1	5	1.35
Interpersonal trust	2119	0.371	0.483	0	1	1.03

Note: We calculated the Variance Inflation Factor (VIF) to account for potential multicollinearity. In our result, all covariates had VIF scores below 3 and the mean VIF was 1.38, indicating that our regression analysis was not significantly influenced by multicollinearity. VIF of other covariates are presented in Table A2 in the Appendix.

Table 2

Correlations among respondent's personality traits, preferences, and trust.

	O (1)	C (2)	E (3)	A (4)	N (5)	Internal LoC (6)	External LoC (7)	Risk preference (8)	Need for achievement (9)	Trust (10)
Openness to experiences [O]	1									
Conscientiousness [C]	0.034	1								
Extraversion [E]	0.098***	0.096***	1							
Agreeableness [A]	−0.084***	0.230***	0.025	1						
Neuroticism [N]	−0.025	−0.172***	−0.220***	−0.209***	1					
Internal LoC	0.011	0.263***	0.144***	0.290***	−0.275***	1				
External LoC	0.026	−0.131***	−0.089***	−0.187***	0.218***	−0.259***	1			
Risk preference	0.093***	0.023	0.082***	−0.037*	−0.045**	0.003	0.021	1		
Need for achievement	0.172***	0.263***	0.162***	0.141***	−0.127***	0.381***	−0.114***	0.138***	1	
Interpersonal trust	0.030	−0.016	−0.065	0.002	0.079***	−0.025	−0.009	−0.035	−0.019	1

Note: $* p < 0.1.$ $** p < 0.05.$ $*** p < 0.01.$

5.2. Farmland rental market participation

Table 3 reports the estimated effects of smallholders' personality traits and preferences on their household's overall participation in the farmland rental market (either renting or renting out land). We first include personality variables only, then add control variables to the models, and finally include motivation and preferences variables as well.

We find that openness to experience positively affects smallholders' participation in land rental markets in all three equations, providing support for Hypothesis 1. A one standard deviation increase in smallholders' openness to experiences corresponds to a 2.0 percentage points increase in the probability of land rental market participation in Eq. (3) ($p < 0.05$). It indicates that open smallholders are more likely to change their livelihoods by utilizing the land rental market, either by increasing farm size to be more specialized in agricultural production, or by renting out land and getting involved in migration or for some local off-farm employment. We further find no significant effects on land rental market participation for the other four of the Big Five personality traits.

Regarding LoC, we find that both internal LoC and external LoC of smallholders have significant effects on their households' overall land renting participation. A one standard deviation increase in internal LoC (external LoC) is associated with a 2.4 (2.1) percentage point increase in the probability of land rental market participation ($p < 0.05$) in Eq. (3). For internal LoC this finding provides support for Hypothesis 2, and suggests that smallholders with relatively high internal LoC exert more effort in searching for

Table 3

Impact of personality on overall participation in farmland rental market (*probit*).

Outcome variables	Household participated in the land rental market			Respondent intended to participate more in the land rental market		
	(1)	(2)	(3)	(4)	(5)	(6)
Respondent's personality traits						
Openness to experience [O]	0.018**	0.019**	0.020**	0.003	−0.004	−0.007
	(0.009)	(0.010)	(0.010)	(0.010)	(0.011)	(0.012)
Conscientiousness [C]	0.003	0.005	0.005	0.011	0.010	0.007
	(0.009)	(0.010)	(0.010)	(0.011)	(0.012)	(0.012)
Extraversion [E]	0.012	0.006	0.008	0.008	0.003	−0.001
	(0.010)	(0.011)	(0.011)	(0.010)	(0.010)	(0.011)
Agreeableness [A]	−0.000	0.004	0.004	0.000	0.006	0.007
	(0.010)	(0.010)	(0.010)	(0.009)	(0.010)	(0.010)
Neuroticism [N]	−0.008	−0.003	−0.004	0.012	0.016	0.017
	(0.010)	(0.011)	(0.011)	(0.011)	(0.012)	(0.012)
Internal locus of control	0.023**	0.023**	0.024**	0.034***	0.031**	0.026**
	(0.010)	(0.011)	(0.011)	(0.011)	(0.012)	(0.012)
External locus of control	0.021**	0.020*	0.021**	−0.006	−0.003	−0.005
	(0.009)	(0.011)	(0.011)	(0.010)	(0.011)	(0.011)
Respondent's personal preferences and trust						
Risk preference			−0.009			0.016
			(0.010)			(0.011)
Need for achievement			−0.003			0.018
			(0.012)			(0.014)
Interpersonal trust			0.042*			−0.044**
			(0.024)			(0.020)
Respondent's social-demographic characteristics						
Age (year)		0.001	0.001		−0.004***	−0.004**
		(0.001)	(0.001)		(0.001)	(0.001)
Gender (1 = male)		0.006	0.008		0.060	0.057
		(0.042)	(0.042)		(0.039)	(0.039)
Education (year)		0.000	0.001		0.001	−0.000
		(0.003)	(0.003)		(0.003)	(0.003)
Household head (1 = yes)		0.042	0.045		0.079*	0.076*
		(0.036)	(0.036)		(0.041)	(0.041)
Household and land characteristics						
Land reallocated before (1 = yes)		0.082**	0.088**		0.025	0.019
		(0.035)	(0.035)		(0.028)	(0.028)
Land certificate possession (1 = yes)		−0.031	−0.030		−0.004	−0.005
		(0.022)	(0.022)		(0.018)	(0.018)
Contract farmland size (mu)		−0.005	−0.005		0.001	0.001
		(0.003)	(0.003)		(0.003)	(0.003)
Number of contracted land plots		−0.021***	−0.021***		−0.010	−0.010
		(0.007)	(0.007)		(0.007)	(0.007)
Number of laborers		0.014*	0.014*		0.016*	0.015*
		(0.008)	(0.008)		(0.009)	(0.009)
Number of elders		0.011	0.010		0.007	0.007
		(0.017)	(0.017)		(0.018)	(0.018)
Number of students		−0.012	−0.011		0.018**	0.016*
		(0.009)	(0.009)		(0.009)	(0.009)
Family laborers work off-farm (%)		0.086*	0.092*		−0.035	−0.047
		(0.047)	(0.048)		(0.052)	(0.052)
Credit accessibility (1 = yes)		0.021	0.025		0.093***	0.086***
		(0.025)	(0.025)		(0.029)	(0.029)
Household rented land (1 = yes)	–	–	–		0.170***	0.170***
					(0.037)	(0.037)

(*continued on next page*)

Table 3 (*continued*)

Outcome variables	Household participated in the land rental market			Respondent intended to participate more in the land rental market		
	(1)	(2)	(3)	(4)	(5)	(6)
Household rented-out land (1 = yes)	–	–	–		0.066**	0.073**
					(0.029)	(0.029)
Village characteristics						
Distance to county center (km)		0.001	0.001		−0.001	−0.001
		(0.002)	(0.002)		(0.001)	(0.001)
Distance to township center (km)		−0.008	−0.008		0.001	0.001
		(0.007)	(0.007)		(0.004)	(0.004)
Distance to highway (km)		−0.002	−0.002		0.002	0.001
		(0.003)	(0.003)		(0.001)	(0.001)
Distance to food market (km)		0.002	0.002		0.000	0.000
		(0.003)	(0.003)		(0.002)	(0.002)
Township government (1 = yes)		0.020	0.022		−0.004	−0.005
		(0.050)	(0.049)		(0.039)	(0.040)
Village merged before (1 = yes)		−0.072	−0.071		−0.037	−0.033
		(0.062)	(0.060)		(0.072)	(0.069)
Farmland size per capita (mu)		0.067**	0.067**		−0.004	−0.004
		(0.029)	(0.028)		(0.023)	(0.023)
Number of family clans in the village		−0.003	−0.004		0.021**	0.022**
		(0.012)	(0.012)		(0.009)	(0.009)
County dummies	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2,119	1,912	1,912	2,087	2,087	2,087

Notes:
- Robust-clustered standard errors in parentheses, * p < 0.1. ** p < 0.05. *** p < 0.01.
- Number of observations varies as data on village characteristics are missing for some villages
- Average marginal effects are reported.

either on-farm or off-farm opportunities. The positive effect that we estimated for external LoC was not postulated in the conceptual framework (Section 2.2). Further research may explain this unexpected finding.

The last three columns in Table 3 report the regression results for respondents' intention to participate in the land rental markets. We find that internal LoC also has a strong positive effect on intention to participate more in the land rental market ($p < 0.05$). A one standard deviation increase in internal LoC increases the intention to participate more in the land rental market by 2.6 percentage points. Internal LoC thus has consistent effects on both actual participation and on intention to participate more. We do not find significant effect of external LoC on the respondents' intentions to participate more in land rental markets, even though it has a significant positive effect on overall land rental market participation. The same holds for openness to experience.

5.3. Farmland renting-in and renting-out behavior

This section presents and discusses the regressions results for smallholders' land renting-in and renting-out behavior separately (see Table 4). We find that internal LoC has a consistently significant positive effect on the households actual renting-in of land ($p < 0.05$) and on smallholders' intention to rent more land ($p < 0.01$), except when we control for respondents' preferences and interpersonal trust (columns (3) and (6)). One standard deviation increase in internal LoC corresponds to a 1.6 (2.4) percentage points higher probability of renting-in behavior (intention) (columns (2) and (5)). The significant positive effect on the renting-in of land and the insignificant effect on the renting-out of land implies that smallholders with a relatively strong internal LoC are more likely to seize opportunity through renting land instead of migrating to urban areas. Interestingly, when we add preferences and trust to the equations, the respondents' nAch has a significant positive effect on the households actual renting behavior ($p < 0.10$) and intention to rent more land ($p < 0.05$), while internal LoC is no longer significant. This finding suggests a possible mediation effect of nAch (and possibly also risk preference, which has a significant effect in the intention equation at $p < 0.10$) for internal LoC. In Section 5.4, we will examine these potential mediation effects of nAch and risk preference in more detail. We also find some tentative evidence ($p < 0.10$) that internal LoC affects the respondents' intention to rent-out more land. But the impact on actual land renting-out is not statistically significant.

Regarding the other personality traits, we find some tentative evidence that external LoC has positive effects on land renting out ($p < 0.10$). But the impact of external LoC on intention to rent out more land is not statistically significant. These findings imply that smallholders who believe that their lives are controlled by their external environment seem to accept that others were interested in renting (part of) their land and actually rented it out. Interpersonal trust plays an important role in such decisions, as indicated by its significantly positive effect (p < 0.05) in the renting out land equation (see column (9)).

Table 4

Impact of personality traits on household farmland renting-in and renting-out behavior and intention (*probit*).

Outcome variables	Household rented land			Intention to rent more land			Household rented out land			Intention to rent out more land		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Respondent's personality traits												
Openness to experience [O]	0.007 (0.006)	0.010 (0.006)	0.008 (0.006)	0.003 (0.008)	−0.004 (0.009)	−0.008 (0.009)	0.010 (0.008)	0.007 (0.008)	0.009 (0.008)	−0.001 (0.007)	−0.003 (0.007)	−0.002 (0.007)
Conscientiousness [C]	0.001 (0.007)	0.009 (0.007)	0.007 (0.007)	0.003 (0.009)	−0.000 (0.009)	−0.004 (0.009)	0.007 (0.008)	0.002 (0.008)	0.004 (0.008)	0.004 (0.008)	0.004 (0.008)	0.004 (0.008)
Extraversion [E]	0.010 (0.007)	0.004 (0.006)	0.003 (0.006)	0.008 (0.010)	−0.001 (0.009)	−0.005 (0.010)	0.006 (0.008)	0.006 (0.008)	0.009 (0.008)	0.005 (0.007)	0.008 (0.007)	0.008 (0.007)
Agreeableness [A]	−0.009 (0.008)	−0.003 (0.007)	−0.004 (0.007)	−0.001 (0.008)	0.012 (0.009)	0.011 (0.009)	0.004 (0.008)	0.003 (0.008)	0.003 (0.008)	−0.002 (0.008)	−0.006 (0.007)	−0.006 (0.007)
Neuroticism [N]	0.004 (0.007)	0.006 (0.006)	0.005 (0.006)	0.002 (0.010)	0.003 (0.010)	0.003 (0.010)	−0.011 (0.009)	−0.009 (0.009)	−0.010 (0.009)	0.008 (0.008)	0.013 (0.008)	0.014* (0.008)
Internal locus of control	0.017** (0.007)	0.016** (0.008)	0.012 (0.008)	0.027*** (0.009)	0.024*** (0.009)	0.014 (0.010)	0.010 (0.009)	0.008 (0.008)	0.011 (0.008)	0.012 (0.008)	0.014* (0.008)	0.015* (0.008)
External locus of control	0.009 (0.007)	0.008 (0.006)	0.008 (0.006)	−0.002 (0.008)	0.003 (0.008)	0.002 (0.008)	0.014* (0.008)	0.013 (0.008)	0.014* (0.008)	−0.005 (0.008)	−0.009 (0.008)	−0.010 (0.008)
Respondent's personal preferences and trust												
Risk preference			−0.001 (0.007)			0.014* (0.008)			−0.010 (0.008)			0.005 (0.008)
Need for achievement			0.013* (0.007)			0.030** (0.012)			−0.011 (0.009)			−0.005 (0.010)
Interpersonal trust			0.007 (0.015)			−0.026 (0.016)			0.038** (0.016)			−0.022 (0.015)
Respondent's social-demographic characteristics												
Age (year)		−0.002** (0.001)	−0.002** (0.001)		−0.005*** (0.001)	−0.005*** (0.001)		0.003*** (0.001)	0.003*** (0.001)		0.001 (0.001)	0.001 (0.001)
Gender (male)		0.024 (0.025)	0.024 (0.025)		0.059** (0.027)	0.058** (0.026)		−0.008 (0.035)	−0.007 (0.035)		0.017 (0.027)	0.017 (0.027)
Education (year)		−0.003 (0.002)	−0.003 (0.002)		−0.004 (0.003)	−0.005* (0.002)		0.003 (0.002)	0.003 (0.002)		0.004* (0.002)	0.004* (0.002)
Household head (1 = yes)		0.026 (0.024)	0.027 (0.023)		0.053* (0.028)	0.048* (0.028)		0.006 (0.028)	0.009 (0.028)		0.019 (0.026)	0.018 (0.026)
Household and land characteristics												
Land reallocated before (1 = yes)		−0.021 (0.017)	−0.022 (0.017)		0.032 (0.024)	0.025 (0.024)		0.084*** (0.030)	0.090*** (0.031)		0.006 (0.021)	0.003 (0.021)
Land certificate possession (1 = yes)		−0.009 (0.014)	−0.008 (0.014)		0.001 (0.016)	−0.000 (0.016)		−0.018 (0.019)	−0.018 (0.019)		−0.002 (0.014)	−0.002 (0.014)
Contract farmland size (mu)		−0.005** (0.002)	−0.005** (0.002)		−0.002 (0.003)	−0.002 (0.003)		−0.000 (0.002)	−0.000 (0.002)		0.004 (0.002)	0.004 (0.002)

(*continued on next page*)

Table 4 (*continued*)

Outcome variables	Household rented land			Intention to rent more land			Household rented out land			Intention to rent out more land		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Number of contracted land plots		0.000 (0.005)	0.000 (0.005)		−0.010* (0.005)	−0.010* (0.005)		−0.022*** (0.005)	−0.022*** (0.005)		−0.002 (0.005)	−0.002 (0.005)
Number of laborers		0.016*** (0.005)	0.015*** (0.005)		0.021*** (0.007)	0.020*** (0.007)		0.004 (0.006)	0.004 (0.006)		0.000 (0.006)	0.000 (0.006)
Number of elders		−0.022 (0.013)	−0.022* (0.013)		−0.000 (0.015)	−0.002 (0.015)		0.025** (0.012)	0.024** (0.012)		−0.004 (0.012)	−0.003 (0.012)
Number of students		−0.007 (0.005)	−0.007 (0.005)		0.019*** (0.007)	0.017** (0.007)		−0.005 (0.008)	−0.003 (0.008)		−0.002 (0.007)	−0.002 (0.007)
Family laborers work off-farm (%)		−0.006 (0.032)	−0.008 (0.033)		−0.035 (0.041)	−0.046 (0.041)		0.091*** (0.035)	0.100*** (0.034)		0.017 (0.041)	0.016 (0.041)
Credit accessibility (1 = yes)		0.012 (0.018)	0.012 (0.018)		0.058** (0.023)	0.052** (0.022)		0.008 (0.019)	0.013 (0.019)		0.029 (0.020)	0.028 (0.020)
Household rented land (1 = yes)	–	–	–		0.175*** (0.034)	0.172*** (0.034)	–	–	–		−0.012 (0.022)	−0.012 (0.022)
Household rented-out land (1 = yes)	–	–	–		−0.064*** (0.021)	−0.061*** (0.021)	–	–	–		0.114*** (0.026)	0.117*** (0.025)
Village characteristics												
Distance to county center (km)		−0.001 (0.001)	−0.001 (0.001)		0.001 (0.001)	0.001 (0.001)		0.002 (0.001)	0.002 (0.001)		−0.002** (0.001)	−0.002** (0.001)
Distance to township center (km)		−0.005 (0.003)	−0.005 (0.003)		0.002 (0.003)	0.002 (0.003)		−0.004 (0.005)	−0.004 (0.005)		−0.001 (0.003)	−0.001 (0.003)
Distance to highway (km)		−0.001 (0.001)	−0.001 (0.001)		0.003** (0.001)	0.002** (0.001)		−0.002 (0.002)	−0.001 (0.002)		−0.001 (0.001)	−0.001 (0.001)
Distance to food market (km)		0.005*** (0.002)	0.005*** (0.002)		0.002 (0.001)	0.002* (0.001)		−0.004 (0.003)	−0.004 (0.003)		−0.001 (0.002)	−0.001 (0.002)
Township government (1 = yes)		−0.028 (0.020)	−0.027 (0.020)		−0.031 (0.025)	−0.031 (0.025)		0.047 (0.040)	0.047 (0.040)		0.010 (0.029)	0.009 (0.028)
Village merged before (1 = yes)		−0.047 (0.030)	−0.045 (0.031)		−0.050 (0.061)	−0.042 (0.057)		−0.024 (0.048)	−0.024 (0.045)		−0.002 (0.026)	−0.004 (0.027)
Farmland size per capita (mu)		0.011 (0.015)	0.011 (0.015)		0.017 (0.020)	0.016 (0.020)		0.061** (0.029)	0.061** (0.028)		−0.018 (0.017)	−0.019 (0.017)
Number of family clans in the village		0.002 (0.008)	0.002 (0.008)		0.014** (0.007)	0.014* (0.007)		−0.005 (0.009)	−0.005 (0.009)		0.012* (0.006)	0.012** (0.006)
County dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2,119	1,912	1,912	2,119	1,912	1,912	2,119	1,912	1,912	2,119	1,912	1,912

Notes:
- Robust-clustered standard errors in parentheses, * p < 0.1. ** p < 0.05. *** p < 0.01.
- Number of observations varies as data on village characteristics are missing for some villages
- Average marginal effects are reported.

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Table 5
Mediation analysis results for impact of internal LoC on land renting-in.

	Y = Household rented land			
	Coefficient	Bootstrapped std. error	CI lower	CI upper
	(1)	(2)	(3)	(4)
1. **Total effect [c]**	0.091**	0.044	[0.000	0.176]
2. Effect of X on M1 [a_1]	0.374**	0.020	[0.333	0.414]
3. Effect of M_1 on Y [b_1]	0.074	0.041	[-0.007	0.155]
4. **Indirect effect with M_1[#] [$a_1 \times b_1$]**	0.020	0.015	[-0.007	0.054]
5. Effect of X on M2 [a_2]	0.003	0.022	[-0.039	0.046]
6. Effect of M_2 on Y [b_2]	−0.006	0.038	[-0.081	0.069]
7. **Indirect effect with M_2[#] [$a_2 \times b_2$]**	0.000	0.001	[-0.002	0.004]
8. **Total indirect effect[#]**	0.020	0.016	[-0.008	0.055]
9. **Direct effect [c'] [#]**	0.070	0.044	[-0.016	0.159]
10. Proportion of total effect mediated	21.978%			

	Y = Respondent intended to rent more land			
	Coefficient	Bootstrapped std. error	CI lower	CI upper
11. **Total effect [c]**	0.106**	0.042	[0.022	0.182]
12. Effect of X on M_1 [a_1]	0.374**	0.020	[0.333	0.414]
13. Effect of M_1 on Y [b_1]	0.141**	0.052	[0.040	0.242]
14. **Indirect effect with M_1 [$a_1 \times b_1$]**	0.042**	0.015	[0.013	0.072]
15. Effect of X on M_2 [a_2]	0.003	0.022	[-0.039	0.046]
16. Effect of M_2 on Y [b_2]	0.064	0.036	[0.007	0.134]
17. **Indirect effect with M_2[$a_2 \times b_2$]**	−0.001	0.002	[-0.008	0.002]
18. **Total indirect effect**	0.041**	0.016	[0.010	0.071]
19. **Direct effect [c']**	0.065	0.044	[-0.017	0.154]
20. Proportion of total effect mediated	38.679%			

Notes:
- X = Internal LoC, M_1 = nAch, M_2 = risk preference, Y = Household rented land, resp. Respondent intended to rent land.
- See Section 4.2 for definition of a_1, a_2, b_1, b_2, c and c'.
- Indirect effects (in rows 4, 7, 8, 14 17 and 18) were calculated with 1000 re-sampling bootstrapped standard errors.
- Bias-corrected 95% confidence intervals (CI) were reported.
- ** $p < 0.05$

We do not find significant effect of smallholders' conscientiousness on land renting (or renting out), thus rejecting Hypothesis 3. This finding supports the presumption that emotional attachment to the land is rather weak in China given the system of allocation of land to households under the HRS.

We also do not find significant effect of neuroticism on renting out (or renting) of land, except for a slightly significant positive effect ($p < 0.10$) on intention to rent out more land in the equation that includes personal preferences and trust. These findings may suggest that neuroticism affects smallholders' intention to rent out more via the process of perceived stress reduction than via the process of perceived loss of protection against adverse events.

The estimated coefficients for the other three personality traits—openness to experience, extraversion and agreeableness—are all not statistically significant in the land renting equations nor in the land renting out equations. For openness, this result contrasts with the significant positive effects on overall land renting participation reported in Table 3. A possible explanation is that smallholders with a high level of openness are more likely to try new experiences by either enlarging their farms or renting-out all their land and migrating (see motivation of Hypothesis 1 in subsection 2.2.1).

In the *probit* analysis that is applied for Table 4, smallholders that rented land are compared with the group that rented-out land or did not participate in the rental market; and those that rented-out land are compared with the group that rented land or did not participate. As an alternative we also apply the multinomial *probit* analysis to a categorized participation variable with three outcomes: (1) household rented land, (2) autarkic household (as a base outcome), and (3) household rented-out land. The regression results are presented in Table A4 in the Appendix. The main findings are similar to those of the *probit* model estimations. The positive coefficient estimates for openness are significant (at $p < 0.10$) in one of the three land rent-in participation regressions and one of the three land rent-out participation regressions. These additional findings provide some tentative support for the proposition that smallholders with a high level of openness are more likely to try new experiences by enlarging their farms or by migrating.

5.4. Mediation analysis

To examine the potential mediation effects, suggested by the regression results, we apply the causal mediation analysis (CMA). Table 5 reports the results of this mediation analysis for internal LoC and land renting-in behavior (top panel) and intention (bottom

panel), where nAch and risk preference are potential mediators to be investigated.

For actual land renting-in by households, the mediation effect is found to be insignificant. A possible explanation is the prevalence of informal land rentals, characterized by informal contracts and zero rent payments, which are still popular in rural China (Ma, Zhou, Heerink, Shi, & Liu, 2018; Ye, Feng, & Jiang, 2018). These usually happen when a household migrates to the city and relatives or acquaintances in the same village feel responsibility for cultivating the land that would otherwise remain idle or be reallocated by the village government. As a result, households that rent land may not be self-motivated to do so, and nAch and risk preference do not significantly affect actual land renting.

We do find significant mediation effects for the respondent's land renting-in intention. Specifically, we find that internal LoC strongly influences the smallholder's nAch ($p < 0.05$, Row 12), and nAch is strongly correlated with the smallholders' land renting-in intention ($p < 0.05$, Row 13). The indirect effect of internal LoC through nAch and the total indirect effect are both significant at 5% level (Rows 14 and 18), while the direct effect of internal LoC turns out to be insignificant (Row 19). For risk preference we do not find significant mediation effects, as both its correlation with internal LoC and with land renting intention are not significant. Combined with the finding that the effect of internal LoC on intention to rent more land becomes insignificant when nAch is controlled for (column 6, Table 4), these findings suggest that internal LoC does not directly affect land renting-in intention, but has an indirect effect through smallholders' need for achievement. Hence, we find partial support, namely for internal LoC, for the hypothesis that personality traits affect land renting behaviors through risk preference, need for achievements, and (or) interpersonal trust (Hypothesis 4).

6. Conclusion

Based on a rural survey of 2119 households from the North China Plain, we test our conceptual framework and find that personality traits of smallholders significantly affect their farmland renting behavior, beyond external factors such as socio-demographic and institutional factors. Specifically, first, estimates from a *probit* model show that the main personality traits affecting smallholders' overall land rental market participation are openness to experience and locus of control [LoC]. Second, our results provide evidence that smallholders with strong internal LoC generally tend to seize opportunities to rent in land rather than rent out land and focus on off-farm opportunities. We further find that need for achievement [nAch] is the plausible channel through which internal LoC affects smallholders' land renting behavior.

Given the heterogeneous personality traits among rural smallholders, these findings show that certain traits may predispose or intrinsically motivate individuals to participate in land renting activities, which may have important implications for policy makers. First, policy makers aiming to identify or screen appropriate rural households to promote the scale farming operations may take their personality traits into consideration. For example, providing more extensive rural entrepreneurial programs and corresponding subsidy policies—particularly targeting smallholders who have high-level of internal LoC—may be more efficient in fostering self-motivated family farms than the simple scaled-farm subsidies given to all rural smallholders. Moreover, as people who are more internally controlled, by nature, tend to be more resistant to external manipulation or control if they are aware of that (Rotter, 1982) and more open to information, taking initiatives, and exerting effort when tasks are thought to be skill-demanding (Antonides, 1996), policies promoting the scale farming operations that involve mandatory compliance need be developed with caution.

Taken as a whole, although our analysis is based on the premise that reducing external transaction costs has a central role for facilitating land rental participation, we show that there are also "psychological hurdles" of entering into land rental markets. This suggests that reducing external constraints alone, such as market transaction costs, may not translate into straightforward and immediate land rental market participation. Instead, adapting policy measures according to smallholders' personality traits may improve the effectiveness of rural policy and projects in China.

Despite the extensive analysis we have conducted, there are several limitations in this study we have to acknowledge. First, though changes in personality traits are seen as stable after adulthood (Cobb-Clark & Schurer, 2012; Jones, Livson, & Peskin, 2006; Srivastava, John, Gosling, & Potter, 2003), there is some evidence that traits can change across the lifespan due to age-related maturation and degeneration processes, or environmental influences (Borghans, Lee Duckworth, Heckman, & ter Weel, 2008; Specht et al., 2011, 2014). We cannot completely exclude the concern of endogeneity of personality traits. Second, the data we use in this study was collected in a specific region (the North China Plain), where the land rental incidence was relatively low, and the external conditions of the sampled smallholders (i.e. farming structure, off-farm employment situation, and climate) were relatively homogeneous across counties and villages. The rich information that we collected for this relatively small area can provide useful new insights that cannot be obtained from available secondary data sets for larger areas or China as a whole. To examine the external validity of our main findings, similar information will need to be collected in regions with different geographic and socioeconomic characteristics. Last, although we conceptualize several economic and non-economic values of land as underlying factors through which personality traits and preferences may affect smallholders' participation, we do not explicitly estimate these economic and non-economic effects due to lacking data on these variables. This is unlikely to bias our estimation results for personality traits, given that such traits are relatively constant and are unlikely to be affected by land rental decisions. It may, however, affect our findings for the mediating roles of preferences and motivations to some extent because the estimates of b_1 and b_2 in Table 5 may suffer from omitted variables bias (see also Fig. 2). It also means that we cannot disentangle the intermediate roles played by economic and non-economic motivations in shaping the relationship between personality traits and land market participation. Future research may try to shed more light on the impact of these limitations.

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Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix

See,

Table A1
Questions related to locus of control and need for achievement in the survey.

Scale	Items
Locus of control *(10-item, 6-point Likert scale)*	My life is determined by my own actions. When I get what I want, it is usually because I worked hard for it. I am usually able to protect my personal interests. I can mostly determine what will happen in my life. When I make plans. I am almost certain/guaranteed to make them work. To a great extent, my life is controlled by accidental/chance happenings. I feel that what happens in my life is determined by others. It is not always wise for me to plan too far ahead because many things turn out to be a matter of good or bad fortune. My life is chiefly controlled by other powerful people. I have little chance of protecting my personal interests.
Need for achievement *(3-item, 5-point Likert scale)*	I always look for opportunities to improve my situation. I have many aspirations. I work hard to be among the best.

Note: Items of locus of control scale are adapted from the scale developed by the German Socio-Economic Panel (SOEP) study and items of need for achievement scale are adapted from the scale developed by Namayengo (2017).

Table A2
Descriptive statistics of control variables.

Variables	n	M	SD	Min	Max	VIF
	(1)	(2)	(3)	(4)	(5)	(6)
Respondent's social-demographic characteristics						
Age (year)	2119	56.854	10.976	20	86	1.76
Gender (1 = male)	2119	0.801	0.399	0	1	2.35
Education (year)	2119	6.591	3.793	0	16	1.31
Household head (1 = yes)	2119	0.784	0.411	0	1	2.33
Household and land characteristics						
Land reallocated before (1 = yes)	2119	0.127	0.334	0	1	1.01
Land certificate possession (1 = yes)	2119	0.442	0.497	0	1	1.02
Contracted farmland size (mu)	2119	7.047	4.146	0	32	1.48
Number of contracted farmland plots	2119	3.259	1.940	0	15	1.38
Number of laborers (between 16 and 65 years old)	2119	3.042	1.605	0	8	1.91
Number of elders within the household	2119	0.509	0.772	0	3	1.68
Number of students within the household	2119	1.059	1.154	0	7	1.33
Family laborers with off-farm income (%)	2119	0.235	0.222	0	1	1.27
Credit accessibility (1 = yes)	2119	0.194	0.396	0	1	1.10
Village characteristics						
Distance to county center (km)	2119	12.683	7.371	1	45	1.26
Distance to township center (km)	2119	3.819	2.470	1	12.5	1.13
Distance to highway (km)	1944	3.762	7.103	0	60	1.09

Table A2 (*continued*)

Variables	n	M	SD	Min	Max	VIF
	(1)	(2)	(3)	(4)	(5)	(6)
Distance to food market (km)	1960	4.756	4.051	0	30	1.06
Township government (1 = yes)	2119	0.010	0.030	0	1	1.04
Village merged before (1 = yes)	2119	0.015	0.173	0	1	1.04
Farmland size per capita (mu)	2119	1.590	0.522	0.7	4	1.03
Number of family clans in the village	2119	2.065	1.159	1	6	1.03

Note: VIF of key variables are presented in Table 1. A VIF below 10 indicates no serious multicollinearity problem.

Table A3
Discriminant validity of personality traits constructs (Fornell-Larcker Criterion).

	O	C	E	A	N	In_LoC	Ex_LoC	nAch
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Openness [O]	**0.699**							
Conscientiousness [C]	0.154	**0.720**						
Extraversion [E]	0.143	0.129	**0.689**					
Agreeableness [A]	−0.024	0.174	0.133	**0.755**				
Neuroticism [N]	−0.091	−0.193	−0.197	−0.220	**0.745**			
Internal LoC [In_LoC]	0.070	0.292	0.209	0.331	−0.329	**0.722**		
External LoC [Ex_LoC]	0.063	−0.121	−0.064	−0.188	0.205	−0.303	**0.671**	
Need for achievement [nAch]	0.255	0.325	0.283	0.177	−0.191	0.434	−0.148	**0.809**

Note: The diagonal reports the square root of the average variance extracted (AVE) for each latent construct, which indicates discriminant validity because the diagonal values are the highest in any column or row.

Table A4
Impact of personality traits on household farmland renting-in and renting-out behavior and intention (*multinomial probit*).

Outcome variables	Behavior						Intention					
	(1)		(2)		(3)		(4)		(5)		(6)	
	Rent-in	Rent-out	Rent-in	Rent-out	Rent-in	Rent-out	Rent-in	Rent-out	Rent-in	Rent-out	Rent-in	Rent-out
Respondent's personality traits												
Openness to experience [O]	0.069	0.079*	0.092*	0.075	0.080	0.084	0.024	-0.002	-0.022	-0.022	-0.045	-0.024
	(0.043)	(0.047)	(0.050)	(0.054)	(0.051)	(0.055)	(0.046)	(0.048)	(0.055)	(0.052)	(0.055)	(0.053)
Conscientiousness [C]	-0.003	0.027	0.052	0.005	0.041	0.016	0.048	0.039	0.044	0.035	0.022	0.032
	(0.048)	(0.050)	(0.054)	(0.053)	(0.054)	(0.056)	(0.052)	(0.052)	(0.057)	(0.055)	(0.058)	(0.058)
Extraversion [E]	0.075	0.030	0.040	0.017	0.037	0.033	0.025	0.037	-0.025	0.053	-0.045	0.047
	(0.047)	(0.050)	(0.051)	(0.056)	(0.051)	(0.055)	(0.052)	(0.045)	(0.056)	(0.048)	(0.056)	(0.048)
Agreeableness [A]	-0.028	0.023	0.012	0.032	0.007	0.028	0.007	-0.009	0.069	-0.026	0.067	-0.023
	(0.053)	(0.049)	(0.057)	(0.053)	(0.057)	(0.054)	(0.045)	(0.049)	(0.052)	(0.049)	(0.053)	(0.049)
Neuroticism [N]	0.021	-0.076	0.048	-0.062	0.040	-0.068	0.032	0.059	0.037	0.093	0.039	0.102*
	(0.049)	(0.052)	(0.051)	(0.062)	(0.051)	(0.062)	(0.053)	(0.053)	(0.058)	(0.059)	(0.059)	(0.059)
Internal locus of control	0.122**	0.065	0.136**	0.066	0.111*	0.085	0.148***	0.110**	0.134**	0.121**	0.087	0.122**
	(0.053)	(0.053)	(0.066)	(0.058)	(0.063)	(0.058)	(0.054)	(0.052)	(0.060)	(0.058)	(0.062)	(0.058)
External locus of control	0.087*	0.081	0.092*	0.086	0.096*	0.095	-0.013	-0.037	0.026	-0.056	0.019	-0.065
	(0.045)	(0.049)	(0.052)	(0.061)	(0.052)	(0.060)	(0.046)	(0.051)	(0.051)	(0.058)	(0.051)	(0.057)
Respondent's personal preferences and trust												
Risk preference					-0.021	-0.045					0.087	0.055
					(0.053)	(0.060)					(0.053)	(0.054)
Need for achievement					0.073	-0.064					0.146**	0.000
					(0.057)	(0.067)					(0.073)	(0.067)
Interpersonal trust					0.103	0.255**					-0.176*	-0.183*
					(0.124)	(0.109)					(0.105)	(0.105)
Respondent's social-demographic characteristics												
Age (year)			-0.009	0.020***	-0.008	0.019***			-0.029***	0.002	-0.027***	0.002
			(0.006)	(0.006)	(0.006)	(0.006)			(0.006)	(0.007)	(0.006)	(0.007)
Gender (male)			0.142	-0.084	0.144	-0.078			0.321*	0.189	0.310	0.181
			(0.227)	(0.233)	(0.226)	(0.235)			(0.194)	(0.208)	(0.193)	(0.208)

(*continued on next page*)

Table A4 (*continued*)

Outcome variables	Behavior						Intention					
	(1)		(2)		(3)		(4)		(5)		(6)	
	Rent-in	Rent-out	Rent-in	Rent-out	Rent-in	Rent-out	Rent-in	Rent-out	Rent-in	Rent-out	Rent-in	Rent-out
Education (year)			-0.016	0.015	-0.015	0.018			-0.019	0.024	-0.023	0.022
			(0.017)	(0.016)	(0.017)	(0.016)			(0.016)	(0.016)	(0.016)	(0.016)
Household head (1 = yes)			0.249	0.118	0.254	0.138			0.402*	0.220	0.377*	0.214
			(0.214)	(0.196)	(0.211)	(0.196)			(0.208)	(0.207)	(0.206)	(0.206)
Household and land characteristics												
Land reallocated before (1 = yes)			0.011	0.533***	0.012	0.566***			0.102	0.072	0.065	0.051
			(0.157)	(0.160)	(0.155)	(0.161)			(0.140)	(0.138)	(0.141)	(0.138)
Land certificate possession (1 = yes)			-0.145	-0.103	-0.138	-0.102			-0.007	-0.020	-0.012	-0.027
			(0.112)	(0.123)	(0.113)	(0.122)			(0.095)	(0.093)	(0.096)	(0.094)
Contract farmland size (mu)			-0.040**	-0.008	-0.040**	-0.009			-0.014	0.020	-0.014	0.021
			(0.019)	(0.017)	(0.019)	(0.016)			(0.016)	(0.016)	(0.017)	(0.017)
Number of contracted land plots			-0.023	-0.158***	-0.022	-0.157***			-0.043	-0.024	-0.042	-0.026
			(0.041)	(0.037)	(0.041)	(0.037)			(0.030)	(0.033)	(0.031)	(0.033)
Number of laborers			0.127***	0.021	0.125***	0.022			0.110***	0.027	0.107**	0.027
			(0.044)	(0.041)	(0.043)	(0.041)			(0.041)	(0.043)	(0.042)	(0.043)
Number of elders			-0.133	0.131*	-0.136	0.128			0.023	-0.003	0.016	0.003
			(0.108)	(0.077)	(0.107)	(0.079)			(0.096)	(0.083)	(0.096)	(0.083)
Number of students			-0.061	-0.057	-0.060	-0.045			0.107***	0.021	0.098**	0.016
			(0.044)	(0.054)	(0.045)	(0.054)			(0.041)	(0.047)	(0.042)	(0.047)
Family laborers work off-farm (%)			0.109	0.629**	0.104	0.682***			-0.247	0.042	-0.313	0.018
			(0.268)	(0.246)	(0.271)	(0.248)			(0.253)	(0.276)	(0.254)	(0.280)
Credit accessibility (1 = yes)			0.110	0.068	0.113	0.096			0.399***	0.293**	0.371***	0.275**
			(0.141)	(0.129)	(0.141)	(0.129)			(0.129)	(0.128)	(0.127)	(0.128)
Household rented land (1 = yes)	-	-	-	-	-	-			0.866***	0.277	0.866***	0.283
									(0.139)	(0.175)	(0.140)	(0.174)
Household rented-out land (1 = yes)	-	-	-	-	-	-			-0.061	0.587***	-0.038	0.605***
									(0.161)	(0.133)	(0.161)	(0.132)
Village characteristics												
Distance to county center (km)			-0.004	0.011	-0.004	0.011			0.004	-0.014**	0.004	-0.014**
			(0.009)	(0.010)	(0.009)	(0.010)			(0.006)	(0.006)	(0.006)	(0.007)
Distance to township center (km)			-0.042	-0.026	-0.042	-0.027			0.011	-0.002	0.009	-0.002
			(0.029)	(0.037)	(0.029)	(0.036)			(0.020)	(0.021)	(0.020)	(0.021)
Distance to highway (km)			-0.010	-0.009	-0.011	-0.009			0.013	-0.004	0.012	-0.003
			(0.012)	(0.015)	(0.012)	(0.014)			(0.008)	(0.005)	(0.008)	(0.006)
Distance to food market (km)			0.034**	-0.019	0.035**	-0.019			0.004	-0.005	0.005	-0.006
			(0.015)	(0.020)	(0.015)	(0.020)			(0.009)	(0.013)	(0.009)	(0.013)
Township government (1 = yes)			-0.133	0.222	-0.125	0.223			-0.115	0.057	-0.118	0.049
			(0.214)	(0.234)	(0.212)	(0.233)			(0.169)	(0.196)	(0.169)	(0.196)
Village merged before (1 = yes)			-0.417	-0.207	-0.401	-0.208			-0.228	-0.062	-0.192	-0.068
			(0.265)	(0.340)	(0.268)	(0.323)			(0.382)	(0.221)	(0.366)	(0.220)
Farmland size per capita (mu)			0.150	0.418**	0.151	0.420**			0.081	-0.091	0.076	-0.097
			(0.130)	(0.178)	(0.129)	(0.175)			(0.116)	(0.118)	(0.117)	(0.119)

Table A4 (*continued*)

Outcome variables	Behavior						Intention					
	(1)		(2)		(3)		(4)		(5)		(6)	
	Rent-in	Rent-out	Rent-in	Rent-out	Rent-in	Rent-out	Rent-in	Rent-out	Rent-in	Rent-out	Rent-in	Rent-out
Number of family clans in the village			0.017	-0.043	0.014	-0.045			0.080*	0.098**	0.080*	0.100**
			(0.064)	(0.062)	(0.064)	(0.061)			(0.043)	(0.045)	(0.044)	(0.045)
County dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2,119	1,912	1,912	2,119	1,912	1,912	2,119	1,912	1,912	2,119	1,912	1,912

Notes:

- Robust-clustered standard errors in parentheses, $* p < 0.1$. $** p < 0.05$. $*** p < 0.01$.
- Number of observations varies as data on village characteristics are missing for some villages
- Autarkic households are set as the base outcome.

References

Abay, K. A., Blalock, G., & Berhane, G. (2017). Locus of control and technology adoption in sub-Saharan Africa: Evidence from Ethiopia. *Journal of Economic Behavior & Organization, 143*, 98–115.

Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes, 50*, 179–211.

Ali, D. A., Bowen, D., & Deininger, K. (2019). Personality traits, technology adoption, and technical efficiency: Evidence from smallholder rice farms in Ghana. *The Journal of Development Studies*, 1–19.

Almlund, M., Duckworth, A. L., Heckman, J., & Kautz, T. (2011). Personality psychology and economics. *Handbook of the economics of education* (pp. 1–181). London: 2011 Elsevier Science B.V.

Antonides, G. (1996). *Psychology in economics and business: An introduction to economic psychology.* Amsterdam: Springer.

Ayhan, S. H., Gatskova, K., & Lehmann, H. (2020). The impact of non-cognitive skills and risk preferences on rural-to-urban migration in Ukraine. *Journal of Comparative Economics, 48*(1), 144–162.

Baron, R. M., & Kenny, D. A. (1986). The moderator–mediator variable distinction in social psychological research: Conceptual, strategic, and statistical considerations. *Journal of Personality and Social Psychology, 51*(6), 1173.

Becker, A., Deckers, T., Dohmen, T., Falk, A., & Kosse, F. (2012). The Relationship between economic preferences and psychological personality measures. *Annual Review of Economics, 4*(1), 453–478.

Bernard, T., Dercon, S., Orkin, K., & Taffesse, A. (2014). *The future in mind: Aspirations and forward-looking behavior in rural Ethiopia.* Social Science Electronic Publishing (2014-16).

Bernheim, B. D., Ray, D., & Yeltekin, Ş. (2015). Poverty and self-control. *Econometrica, 83*(5), 1877–1911.

Borghans, L., Lee Duckworth, A., Heckman, J. J., & ter Weel, B. (2008). The economics and psychology of personality traits. *The Journal of Human Resources, 43*(4), 972–1059.

Bouchard, T. J., & Loehlin, J. C. (2001). Genes, evolution, and personality. *Behavior Genetics, 31*(3), 243–273.

Busic-Sontic, A., Czap, N. V., & Fuerst, F. (2017). The role of personality traits in green decision-making. *Journal of Economic Psychology, 62*, 313–328.

Caliendo, M., Cobb-Clark, D. A., Hennecke, J., & Uhlendorff, A. (2019). Locus of control and internal migration. *Regional Science and Urban Economics, 79*, Article 103468.

Caliendo, M., Cobb-Clark, D. A., & Uhlendorff, A. (2015). Locus of control and job search strategies. *Review of Economics and Statistics, 97*(1), 88–103.

Caliendo, M., Fossen, F., & Kritikos, A. S. (2014). Personality characteristics and the decisions to become and stay self-employed. *Small Business Economics, 42*(4), 787–814.

Carciofo, R., Yang, J., Song, N., Du, F., & Zhang, K. (2016). Psychometric evaluation of Chinese-language 44-item and 10-item big five personality inventories, including correlations with chronotype, mindfulness and mind wandering. *PLoS ONE, 11*(2).

Carter, M., & Salgado, R. (2001). Land market liberalization and the agrarian question in Latin America. *Access to land, rural poverty, and public action* (pp. 246–278). .

Chamberlin, J., & Ricker-Gilbert, J. (2016). Participation in rural land rental markets in Sub-Saharan Africa: Who benefits and by how much? Evidence from Malawi and Zambia. *American Journal of Agricultural Economics*, 1507–1528.

China Natiational Bureau of Statistics [CNBS] (2017). *China Statistics Year Book.* Beijing: China Statistics Press.

Chuang, Y., & Schechter, L. (2015). Stability of experimental and survey measures of risk, time, and social preferences: A review and some new results. *Journal of Development Economics, 117*, 151–170.

Cobb-Clark, D. A., Kassenboehmer, S. C., & Schurer, S. (2014). Healthy habits: The connection between diet, exercise, and locus of control. *Journal of Economic Behavior & Organization, 98*, 1–28.

Cobb-Clark, D. A., & Schurer, S. (2012). The stability of big-five personality traits. *Economics Letters, 115*(1), 11–15.

Coleman, M., & DeLeire, T. (2003). An economic model of locus of control and the human capital investment decision. *Journal of Human Resources, 38*(3), 701–721.

Collins, B. E. (1974). Four components of the Rotter internal-external scale: Belief in a difficult world, a just world, a predictable world, and a politically responsive world. *Journal of Personality and Social Psychology, 29*(3), 381.

Costa, P. T., & McCrae, R. R. (1992). Four ways five factors are basic. *Personality and Individual Differences, 13*(6), 653–665.

Crase, L., & Maybery, D. (2004). Personality and landholders' management of remnant bush and revegetation in the Murray Catchment. *Australasian Journal of Environmental Management, 11*(1), 21–33.

De Janvry, A., Sadoulet, E., & Wolford, W. (2001). *Access to land and land policy reforms.* Helsinki: UNU World Institute for Development Economics Research.

Deininger, K., & Feder, G. (2001). Land institutions and land markets. *Handbook of agricultural economics* (pp. 287–331). London: Elsevier Science B.V.

Deininger, K., & Feder, G. (2009). Land registration, governance, and development: Evidence and implications for policy. *World Bank Research Observer, 24*(2), 233–266.

Deininger, K., & Jin, S. (2005). The potential of land rental markets in the process of economic development: Evidence from China. *Journal of Development Economics, 78*(1), 241–270.

Dohmen, T., Falk, A., Huffman, D., & Sunde, U. (2010). Are risk aversion and impatience related to cognitive ability? *American Economic Review, 100*(3), 1238–1260.

Donato, K., Miller, G., Mohanan, M., Truskinovsky, Y., & Vera-Hernández, M. (2017). Personality traits and performance contracts: Evidence from a field experiment among maternity care providers in India. *American Economic Review, 107*(5), 506–510.

Duflo, E., Kremer, M., & Robinson, J. (2011). Nudging farmers to use fertilizer: Theory and experimental evidence from Kenya. *American Economic Review, 101*(6), 2350–2390.

Fairhead, J., & Leach, M. (1996). *Misreading the African landscape: society and ecology in a forest-savanna mosaic, Vol*, 90)..

Feng, L., Bao, H. X., & Jiang, Y. (2014). Land reallocation reform in rural China: A behavioral economics perspective. *Land Use Policy, 41*, 246–259.

Feng, S., Heerink, N., Ruben, R., & Qu, F. (2010). Land rental market, off-farm employment and agricultural production in Southeast China: A plot-level case study. *China Economic Review, 21*(4), 598–606.

Ferguson, E., Heckman, J. J., & Corr, P. (2011). Personality and economics: Overview and proposed framework. *Personality and Individual Differences, 51*(3), 201–209.

Fornell, C., & Larcker, D. F. (1981). Evaluating structural equation models with unobservable variables and measurement error. *Journal of Marketing Research, 18*(1), 39–50.

Gatz, M., & Good, P. R. (1978). An analysis of the effects of the forced-choice format of rotter's internal-external scale. *Journal of Clinical Psychology, 34*(2), 381–385.

Gosling, S. D., Rentfrow, P. J., & Swann, W. B., Jr (2003). A very brief measure of the Big-Five personality domains. *Journal of Research in Personality, 37*(6), 504–528.

Hansemark, O. C. (2003). Need for achievement, locus of control and the prediction of business start-ups: A longitudinal study. *Journal of Economic Psychology, 24*(3), 301–319.

Haushofer, J., & Fehr, E. (2014). On the psychology of poverty. *Science, 344*(6186), 862–867.

He, P., & Veronesi, M. (2017). Personality traits and renewable energy technology adoption: A policy case study from China. *Energy Policy, 107*, 472–479.

Heckman, J. J., & Kautz, T. (2012). Hard evidence on soft skills. *Labor Economics, 19*(4), 451–464.

Hicks, R., & Tingley, D. (2012). Causal mediation analysis. *The Stata Journal: Promoting Communications on Statistics and Stata, 11*(4), 605–619.

Holden, S. T., Deininger, K., & Ghebru, H. (2011). Tenure insecurity, gender, low-cost land certification and land rental market participation in Ethiopia. *Journal of Development Studies, 47*(1), 31–47.

Huy, H. T., Lyne, M., Ratna, N., & Nuthall, P. (2016). Drivers of transaction costs affecting participation in the rental market for cropland in Vietnam. *Australian Journal of Agricultural and Resource Economics, 60*(3), 476–492.

Ito, J., Bao, Z., & Ni, J. (2016). Land rental development via institutional innovation in rural Jiangsu, China. *Food Policy, 59*, 1–11.

Ji, X., Rozelle, S., Huang, J., Zhang, L., & Zhang, T. (2016). Are China's farms growing? *China & World Economy, 24*(1), 41–62.

Jin, S., & Deininger, K. (2009). Land rental markets in the process of rural structural transformation: Productivity and equity impacts from China. *Journal of Comparative Economics, 37*(4), 629–646.

John, O. P., & Srivastava, S. (1999). The big five trait taxonomy: History, measurement, and theoretical perspectives. *Handbook of Personality: Theory, and Research* (pp. 102–138). (2nd ed.). .

Jones, C. J., Livson, N., & Peskin, H. (2006). Paths of psychological health: Examination of 40-year trajectories from the Intergenerational Studies. *Journal of Research in Personality, 40*(1), 56–72.

Judge, T. A., Erez, A., Bono, J. E., & Thoresen, C. J. (2002). Are measures of self-esteem, neuroticism, locus of control, and generalized self-efficacy indicators of a common core construct? *Journal of Personality and Social Psychology, 83*(3), 693–710.

Koot, S., & Büscher, B. (2019). Giving land (Back)? The meaning of land in the indigenous politics of the South Kalahari Bushmen Land Claim, South Africa. *Journal of Southern African Studies,* 1–18.

Koot, S., Hitchcock, R., & Gressier, C. (2019). Belonging, indigeneity, land and nature in Southern Africa under neoliberal capitalism: An overview. *Journal of Southern African Studies, 45*(2), 341–355.

Kuehne, G. (2013). My decision to sell the family farm. *Agriculture and Human Values, 30*(2), 203–213.

Laajaj, R., & Macours, K. (2017). *Measuring skills in developing countries.* The: World Bank.

Lin, Y. F. (1989). Rural factor markets in China: After the household responsibility system reform. In B. Reynolds (Ed.). *Chinese economic policy* (pp. 169–203). New York: Yale University Press.

Lokhorst, A. M., Hoon, C., le Rutte, R., & de Snoo, G. (2014). There is an I in nature: The crucial role of the self in nature conservation. *Land Use Policy, 39*, 121–126.

Long, H., Li, Y., Liu, Y., Woods, M., & Zou, J. (2012). Accelerated restructuring in rural China fueled by 'increasing vs. decreasing balance' land-use policy for dealing with hollowed villages. *Land Use Policy, 29*(1), 11–22.

Luo, B. (2016). 40-year reform of farmland institution in China: Target, effort and the future. *China Agricultural Economic Review, 10*(1), 16–35.

Ma, X. (2013). *Does tenure security matter? Rural household responses to land tenure reforms in northwest China*Ph. D. thesis. Wageningen, The Netherlands: Wageningen University.

Ma, X., Zhou, Y., Heerink, N., Shi, X., & Liu, H. (2018). Tenure security, social relations and contract choice: Endogenous matching in the Chinese land rental market.

Ma, X., Heerink, N., Feng, S., & Shi, X. (2015). Farmland tenure in China: Comparing legal, actual and perceived security. *Land Use Policy, 42*, 293–306.

Ma, X., Heerink, N., van Ierland, E., Lang, H., & Shi, X. (2020). Decisions by Chinese households regarding renting in arable land—The impact of tenure security perceptions and trust. *China Economic Review, 60*, 101328.

Mackinnon, D. P. (2008). *Introduction to statistical mediation analysis.* New York: Erlbaum.

Mackinnon, D. P., & Dwyer, J. H. (1993). Estimating mediated effects in prevention studies. *Evaluation Review, 17*(2), 144–158.

Malacarne, J. G. (2019). *The farmer and the fates: A theoretical and empirical study of locus of control and investment in risky environments.* Doctoral dissertationDavis, the United States: University of California.

McClelland, D. C. (1961). *Achieving society (No. 15).* Simon and Schuster.

Ministry of Agriculture and Rural Affairs [MARA] (2018). *Annual statistical bulletin of china rural operation and management.* Beijing: China Agriculture Press (In Chinese).

Ministry of Agriculture [MoA] (2016). Agriculture Statistics Yearbook. Beijing. (In Chinese).

Mooradian, T., Renzl, B., & Matzler, K. (2006). Who trusts? Personality, trust and knowledge sharing. *Management Learning, 37*, 523–540.

Morrison, K. A. (1997). Personality correlates of the Five-Factor Model for a sample of business owners/managers: Associations with scores on self-monitoring, type a behavior, locus of control, and subjective well-being. *Psychological Reports, 80*(1), 255–272.

Mount, M. K., Barrick, M. R., Scullen, S. M., & Rounds, J. (2005). Higher-order dimensions of the big five personality traits and the big six vocational interest types. *Personnel Psychology, 58*(2), 447–478.

Mujere, J. (2011). Land, graves and belonging: Land reform and the politics of belonging in newly resettled farms in Gutu, 2000–2009. *Journal of Peasant Studies, 38*(5), 1123–1144.

Mullan, K., Grosjean, P., & Kontoleon, A. (2011). Land tenure arrangements and rural-urban migration in China. *World Development, 39*(1), 123–133.

Namayengo, M. M. F. (2017). *Microcredit to women and its contribution to production and household food security.* Doctoral dissertationWageningen University.

Nguyen, T., Cheng, E., & Findlay, C. (1996). Land fragmentation and farm productivity in China in the 1990s. *China Economic Review, 7*(2), 169–180.

Oehler, A., Wendt, S., Wedlich, F., & Horn, M. (2018). Investors' personality influences investment decisions: Experimental evidence on extraversion and neuroticism. *Journal of Behavioral Finance, 19*(1), 30–48.

Paunonen, S. V., & Ashton, M. C. (2001). Big five factors and facets and the prediction of behavior. *Journal of Personality and Social Psychology, 81*(3), 524.

Preacher, K. J., & Hayes, A. F. (2008). Asymptotic and resampling strategies for assessing and comparing indirect effects in multiple mediator models. *Behavior Research Methods, 40*(3), 879–891.

Qu, F., Heerink, N., & Wang, W. (1995). Land administration reform in China: Its impact on land allocation and economic development. *Land Use Policy, 12*(3), 193–203.

Qu, S., Heerink, N., Xia, Y., & Guo, J. (2018). Farmers' satisfaction with compensations for farmland expropriation in China: Evidence from micro-level data. *China Agricultural Economic Review, 10*(4), 572–588.

Quinn, C. E., & Halfacre, A. C. (2014). Place matters: An investigation of farmers' attachment to their land. *Human Ecology Review,* 117–132.

Rammstedt, B., & John, O. P. (2007). Measuring personality in one minute or less: A 10-item short version of the Big Five Inventory in English and German. *Journal of Research in Personality, 41*(1), 203–212.

Renkow, M., Hallstrom, D. G., & Karanja, D. D. (2004). Rural infrastructure, transactions costs and market participation in Kenya. *Journal of Development Economics, 73*(1), 349–367.

Roberts, B. W. (2006). Personality development and organizational behavior. *Research in Organizational Behavior, 27*, 1–40.

Roberts, B. W. (2009). Back to the future: Personality and assessment and personality development. *Journal of Research in Personality, 43*(2), 137–145.

Roberts, B. W., & Robins, R. W. (2000). Broad dispositions, broad aspirations: The intersection of personality traits and major life goals. *Personality and Social Psychology Bulletin, 26*(10), 1284–1296.

Rotter, J. B. (1966). Generalized expectancies for internal versus external control of reinforcement. *Psychological Monographs: General and Applied, 80*(1), 1.

Rotter, J. B. (1982). *The development and applications of social learning theory: Selected papers.* Westport: Praeger Publishers.

Schildberg-Hörisch, H. (2018). Are risk preferences stable? *Journal of Economic Perspectives, 32*(2), 135–154.

Skoufias, E. (1995). Household resources, transaction costs, and adjustment through land tenancy. *Land Economics,* 42–56.

Soliño, M., & Farizo, B. A. (2014). Personal traits underlying environmental preferences: A discrete choice experiment. *PLoS ONE, 9*(2).

Soto, C. J., John, O. P., Gosling, S. D., & Potter, J. (2008). The developmental psychometrics of big five self-reports: Acquiescence, factor structure, coherence, and differentiation from ages 10 to 20. *Journal of Personality and Social Psychology, 94*(4), 718.

Specht, J., Bleidorn, W., Denissen, J. J., Hennecke, M., Hutteman, R., Kandler, C., ... Zimmermann, J. (2014). What drives adult personality development? A comparison of theoretical perspectives and empirical evidence. *European Journal of Personality, 28*(3), 216–230.

Specht, J., Egloff, B., & Schmukle, S. C. (2011). Stability and change of personality across the life course: The impact of age and major life events on mean-level and rank-order stability of the Big Five. *Journal of Personality and Social Psychology, 101*(4), 862.

Srivastava, S., John, O. P., Gosling, S. D., & Potter, J. (2003). Development of personality in early and middle adulthood: Set like plaster or persistent change? *Journal of Personality and Social Psychology, 84*(5), 1041–1053.

Tan, S., Heerink, N., & Qu, F. (2006). Land fragmentation and its driving forces in China. *Land Use Policy, 23*(3), 272–285.

Wang, J., Li, X., & Xin, L. (2018). Spatial-temporal variations and influential factors of land transfer in China. *Journal of Natural Resources, 33*(12), 2067–2083 (In Chinese).

Wang, H., Riedinger, J., & Jin, S. (2015). Land documents, tenure security and land rental development: Panel evidence from China. *China Economic Review, 36*, 220–235.

Wang, X., Weaver, N., & You, J. (2013). The social security function of agriculture in China. *Journal of International Development, 25*(1), 1–10.

Wang, Q., & Zhang, X. (2017). Three rights separation: China's proposed rural land rights reform and four types of local trials. *Land Use Policy, 63*, 111–121.

Yao, Y. (2000). The development of the land lease market in rural China. *Land Economics, 76*(2), 252.

Ye, J. (2015). Land transfer and the pursuit of agricultural modernization in China. *Journal of Agrarian Change, 15*(3), 314–337.

Ye, J., Feng, L., & Jiang, Y. (2018). The survey on land use rights in rural china in 2016: The findings and policy implications based on 17 provinces. *Management World, 3*, 98–108 (In Chinese).

Yu, N., Shi, Q., & Jin, H. (2010). Permanent land-use rights and endowment insurance: Chinese evidence of the substitution effect. *China Economic Review, 21*(2), 272–281.

Zhang, Q., & Donaldson, J. A. (2010). From peasants to farmers: Peasant differentiation, labor regimes, and land-rights institutions in China's agrarian transition. *Politics & Society, 38*(4), 458–489.