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Risk, Relative Standing and Property Rights: Rural Household Decision-Making in China

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Abstract

Paper 1 examines the concern for relative standing among rural households in China. We used a survey-experimental method to measure to what extent poor Chinese farmers care about their relative income and found that the respondents cared to a high degree. Compared to previous studies in developed countries, the concern for relative standing seems to be equally strong among rural households in China. This should be seen in the light of the rapid change China has undergone, with high growth, increased inequality, and the highest urban-rural income ratio in the world. Thus, the rural population, which is lagging behind, is suffering not only from the low absolute income but also from low relative income.

Paper 2 studies risky decision-making in a high-stakes experiment with couples in rural China. In the experiment, spouses chose between risky lotteries, first separately and then jointly. We are particularly interested in the (socio-demographic) factors determining (i) the similarity of spouses' individual decisions and (ii) women's influence on couples' joint decisions. We find that spouses in richer households have more similar individual risk preferences. The couple's joint decision is largely influenced by the husband, but women with higher income, more years of education, and communist party membership have a significantly stronger influence on the joint decision.

Paper 3 investigates farmers' preferences for various property rights attributes of a forestland contract. We find that farmers are highly concerned with what types of rights a contract provides. Reducing perceived risks of contract termination and introducing a priority right in renewal of an old contract significantly increase farmers' marginal willingness to pay (MWTP) for a forest contract. An extended waiting time for rights to harvest the forest reduces a farmer's perceived value of a contract. We also investigate whether accounting for the fact that farmers ignore one or more attributes when answering

stated preference questions affects the MWTP, and find it to be systematically lower in the model where we consider that respondents ignore attributes.

Paper 4 assesses the impact of tenure types, property rights, and harvest quota regulation on farmer investment behavior in Chinese collective forests. We investigate the issue using household survey data from *Fujian* province. The results indicate that investment incentives increase due to the tenure reform. In the reform property rights are gradually established, and confirmed to the individual farmers via a contract. However, some issues remain. Farmers still perceive some tenure arrangements to be more uncertain, which discourage them to undertake plot investments. The harvest quota regulation, introduced for stock conservation purposes, acts as a disincentive in forestry management and development. These evidences imply that there could be even further improvement in investment incentives, if some of these constraints were relaxed through a policy reform.

Keywords: Choice experiment, China, Field experiment, Forestry, Household decision-making, Inequality, Ignoring attributes, Investment, Relative standing, Risk, MWTP, Property rights.

JEL Classification: C91, C92, C93, D10, D61, D63, Q15, Q23, Q50, Q51.

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Preface

Five years and three months in Göteborg, Sweden! Looking back, I just cannot believe that I have lived here for such a long time. This has been a key stretch of my life – trying to define myself intellectually while at the same time enjoying a wonderful life experience, together forming a great beginning of my future.

Göteborg – what a legendary city, as poetic as the name! Misled by the Chinese translation and before moving here, I always imagined this as a place having to do with castles. Yet, you have shown me more than I could ever imagine. You do have castles, and very old and beautiful architecture, but you also have age-old streets that give me a real sense of your history, a beautiful countryside that resonates with your culture, and breath-taking ocean scenery that is part of your natural splendor. Göteborg, you will be a most beautiful memory!

At the end of my doctoral work in Göteborg, I would like to express my gratitude to all who have taken this journey with me. Because of you, I never felt I was alone or lonely. Because of you, the journey, which was supposed to be tough, became pleasant and enjoyable.

My heartfelt appreciation to my two supervisors: Fredrik Carlsson and Håkan Eggert. Fredrik, I am deeply grateful to you for your excellent supervision, and everything you do to help me grow as a researcher. I must say I could never ask for anything more in a supervisor and co-author. Håkan, I appreciate your constructive criticism, which greatly improved my papers. You always pointed out the weaknesses of my work, its policy implications, and its language problems, all to make me a more effective researcher. To me, both of you are excellent examples of what great researchers and supervisors ought to be.

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would like to acknowledge Gunnar Köhlin for his continued engagement in and strong commitment to capacity building in developing countries. Special thanks also to Thomas Sterner. He and his family opened a different door for me, giving me an opportunity to learn more about Swedish sports, social life, traditions, and culture. I would like to especially thank Jintao Xu, the leader of the Environmental Economics Program of Beijing University, for encouraging me to apply for the PhD program. Thank you for having a strong belief in my research ability, and helping me discover my talents. Your encouragement shall serve as invaluable support through the long journey of my future.

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I am deeply grateful to everyone who enriched my life by sharing life in Sweden with me. Because of you, my stay in Sweden has felt more comfortable and more like home. I am indebted to my colleagues and friends at the department, and especially at EEU: Alpaslan Akay, Anna Widerberg, Anders Ekbom, Andreea Mitrut, Astrid Nunez, Clara Villegas, Conny Wolbrandt, Constantin Belu, Cristiana Manescu, Daniel Zerfu, Daniel Slunge, Elias Tsakas, Elina Lampi, Emelie Dahlberg, Eyerusalem Siba, Florin Maican, Haileselassie Mehdin, Haoran He, Hong Wu, Jessica Coria, Jesper Stage, Jinghai Zheng, Jianhua Zhang, Karin Jonson, Karin Backteman, Katarina Renström, Katarina Nordblom, Kofi Vondolia, Magnus Hennlock, Menale Kassie, Olof Drakenberg, Olof Johansson-Stenman, Marcela Ibanez, Martin Linde-Rahr, Miguel Quiroga, Miyase Köksal, Pham Khanh Nam, Qian Weng, Sven Tengstam, Uwera Claudine, Xiaojun Yang, Yonas Alem, and Åsa Löfgren. My thanks also go to the EEU extended family: Edwin Muchapondwa, Francisco Alipizar, Jorge Garcia, Mintewab Bezabih, Mahmud Yesuf, Martine Visser, Peter Berck, Razack Lokina, Wisdom Akpalu, and Wilfred Nyangena.

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Finally, I want to express my deepest gratitude to my family: my father, my mother, and my younger sister. This thesis is for you. Your love and faith in me is the source of my energy and drive. My grandmother and grandfather, I know you are very happy and proud of me in heaven at this moment, and that you will be with me when I defend my thesis. You gave me all your love and attention for 17 years. This thesis is for you too.

Ping Qin

Göteborg of Sweden, December 2008

Summary of Thesis

This thesis consists of four articles, all of which use empirical data from rural China. The first two deal with behavioral economics; the first investigates the concern for relative position in society, and the second household decision-making under risk. The third and fourth articles focus on forestry issues. More exactly, the third paper studies preferences for property right attributes of a forest contract, and the fourth investment behavior in relation to quality of property rights using household survey data in the *Fujian* province. The first three papers rely on survey-based experiment data from the *Guizhou* province.

Paper 1: *It is better to be the head of a chicken than the tail of a phoenix: a study of concern for relative standing in rural China.*

That relative standing is important to people in China is reflected in two, partly contradictory, Chinese sayings. The first, "It is better to be the head of a chicken than the tail of a phoenix," suggests that relative standing is important; i.e., it is better to accept a worse position in absolute terms given that you in exchange are in a better position in relative terms, compared to being in a better position in absolute terms while being among those worst off relatively. The second, "the gun always shoots the fastest bird," suggests that it is better not to deviate from others, and particularly not to be more successful than others. The two sayings highlight an interesting duality of China and the current Chinese society. Although, there is growing evidence that relative standing is important for many people, most of the empirical studies have been done either in developed countries or with students in developing countries. This paper contributes to the literature by investigating whether poor people in a poor country are equally concerned about their relative standing. To study this, we use experimental methodology (a survey-based hypothetical experiment similar to that of Johansson-Stenman et al., 2002) to measure people's preferences regarding relative standing. In the experiment, the respondents were asked to make repeated choices between two hypothetical states of the world for an imagined future relative where the income of the relative and the average income in society varied. We then calculated the

implicit marginal degree of positionality for each individual, which can be compared with other studies.

We found that Chinese farmers are highly concerned about relative standing, although the farmers in our sample are poor. If the result is interpreted in the light of the rapid change that China has undergone, with high growth, increased inequality, and the highest urban-rural income ratio in the world, we can conclude that the rural population in China, which is lagging behind, is suffering not only from low absolute income but also from low relative income. As for what influences people's preferences regarding relative position, we found that village size, ethnicity, and family income are important factors.

Paper 2: *Intra-household decision-making in rural China and the influence of income, education, and party membership*

Many important economic decisions – e.g., labor supply, residential location, buying insurance or a new car, and investing in stocks and bonds or in children's education – are often made by households rather than by individuals. Although households are still treated as single entities in standard economic textbooks, day-to-day experience reveals that household decision-making often involves conflict among spouses and family members and certainly requires compromises in many cases. In this paper, we use an experimental methodology to examine Chinese household decision-making under risk. In particular, we focus on two questions: (1) How similar are the decisions of two spouses when they make decisions separately, and what (socio-demographic) factors influence the degree of similarity? (2) How does a couple's joint decision relate to the two spouses' separate decisions on a matter, and under what conditions do wives have a stronger influence on joint decisions? This was done by conducting a field experiment (using the procedure of Holt and Laury, 2002) using 117 couples in rural China. In the experiment, the participants were required to make a risky decision between two alternatives in 10 pair-wise choices. We first conducted the experiment on the participants individually, and then looked at what decisions the couples made jointly. There were two main features of the experiment: First,

the subject pool consisted of poor farmers in a rather poor rural area of China. The experiment participants had an average of 4.8 years of schooling, and yearly income of 570 USD. Second, our experiment can be considered a high-stakes experiment since subjects on average earned three times their normal daily wage for participating in the experiment, which lasted about 1.5 hours.

We found that spouses in richer households, in households where the wife earns a higher share of the income, and in households where both spouses are members of the communist party have more similar individual risk preferences. A couple's joint decision is more often closer to the husband's preferences. However, wives with higher income, more years of education than their husbands, and communist party membership do have a significant influence on joint decisions.

Paper 3: *Forest land reform in China: what do the farmers want? – A choice experiment on farmers' property rights preferences*

There are various decentralization experiments going on in the Chinese forestry sector. However, so far little attention has been given to what the farmers want from a reform. In this paper, we investigate Chinese farmers' preferences for a set of property right attributes of a forest contract. Unlike other work (Kung 1994, 1995), the current study provides a novel experimental analysis (choice experiment) of farmers' preferences towards private forest contracts with different characteristics. This means that we can provide policy makers with the relative importance of these attributes, given the estimated individual marginal willingness to pay (MWTP) for different attributes of a contract. To study the problem, we conducted a choice experiment on 210 forest farmers in a rural area of China. The farmers were asked to choose their preferred forestry contract between two hypothetical alternatives; seven repeated choices were made. The experiment took place in two regions of the *Guizhou* province: *Majiang*, which still has a collective management system, and *Jinping*, which is currently shifting gradually from a centralized to a decentralized forestry management system. We chose the two regions because they represent two different forestry management systems. The results can enhance our

understanding of whether and how property rights preferences differ across regions with different forestry management systems, and hence, can aid in policy making.

Our results indicate that preferences for property right attributes are fairly similar in the two regions. An extended waiting time for rights to harvest a forest reduces a farmer's perceived value of a contract, while reducing the perceived risks of termination of a contract and/or introducing priority rights in the renewal of an old contract significantly increases a farmer's willingness to pay for a forest contract. We found preference differences between the two regions with respect to tenure length of a contract. The farmers in *Jinping* prefer a 50 year contract, while we do not observe clear preferences for any particular tenure length in *Majiang*. We also investigated whether accounting for the fact that farmers ignore one or more attributes when answering stated preference questions affects MWTP, and found it to be systematically lower in the model where we considered that respondents had ignored attributes.

Paper 4: *Forestland rights and farmers' investment incentives in China – An empirical study of Fujian province*

Understanding land rights formation and measuring its effects on production are two central issues of the political economy of development (Eggertsson, 1990). China's agricultural reform is widely regarded as a success. Seeing the agricultural reform as a positive example, and given the depletion of forests in the 1950s and in the mid 1970s (Liu, 2001), there has been a number of reforms in the forestry sector as well. As a matter of fact, when we talk about the reform, it is difficult to see it as one reform; instead, there have been a number of attempts to improve the property rights so as to avoid rapid depletion of forestry resources and improve forestry performance. Given China's size and huge regional heterogeneity in natural, economic, and social terms, the property rights structure varies significantly on the ground across regions. Therefore, it presents an excellent opportunity to study tenure rights, forestry investment, and production. The objective of this study is to investigate the impacts of the forestry tenure reform on farmers' investment incentives. The forestry tenure reform

in Fujian officially began in 2003. The objective was to clarify the property rights in the areas that have adopted the household-based production responsibility system in the 1980s, and establish the individual management system in the areas that had forests managed by village collective or by a shareholding system. To study the issue, in 2006 we carried out a large survey of 520 households, collecting detailed information regarding forestry inputs, output, and forestry tenure arrangement. Two positive effects followed from the forestry tenure reform: (1) improved property rights significantly increases farmers' investment incentives in forestry, and (2) farmers' general confidence in current forest tenure rights has increased. However, the reform is not without problems. The harvest quota policy, which is supposed to protect forestry resources, was found to discourage farmers from investing in forestland. Thus, we might conclude that the performance of the property rights reform is discounted due to the fact that rights regarding harvest and marketing are still heavily controlled by the government.

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It is Better to Be the Head of a Chicken than the Tail of a Phoenix: A Study of Concern for Relative Standing in Rural China

Fredrik Carlsson and Ping Qin[1]

Abstract:

This paper examines the concern for relative standing among rural households in China. We used a survey-experimental method to measure to what extent poor Chinese farmers care about their relative income and found that the respondents cared to a high degree. Compared to previous studies in developed countries, the concern for relative standing seems to be equally strong among rural households in China. This should be seen in the light of the rapid change China has undergone, with high growth, increased inequality, and the highest urban-rural income ratio in the world. Thus, the rural population, which is lagging behind, is suffering not only from the low absolute income but also from low relative income.

Key words: Relative standing, China, Inequality

JEL Classification: C93, D63

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1. Introduction

Relative standing is important to people in China, reflected in two, partly contradictory Chinese sayings. The first, "it is better to be the head of a chicken than the tail of a phoenix," suggests that relative standing is important for a person and that it is better to be in a relatively good position. The second, "the gun always shoots the fastest bird," intimates that it is better not to be too different from others or, at least, not better than others. Many prominent economists in the past, including Adam Smith, Karl Marx, Arthur Pigou, and Thorstein Veblen, have discussed the observation that people are concerned with their own income and consumption relative to that of others. Based on the important work by Robert Frank (1985, 1999), economists have more recently renewed an interest in concerns for relative standing. There is also growing empirical evidence that relative standing is indeed important for many people (Carlsson et al. 2007a; Johansson-Stenman et al. 2002; Kingdon and Knight 2007; Solnick and Hemenway, 1998). Most of the empirical studies have been done either in developed countries or with students in developing countries (Alpizar et al. 2005; Carlsson et al. 2008; Solnick et al. 2007). The only exception is Carlsson et al. (2007b), who did a study similar to ours on Vietnamese farmers. This means that most of the evidence regarding concern for relative standing is valid for medium- and high-income people (in a global perspective), while not much has been done in poor countries. One interesting question, therefore, is whether comparatively poor people in a poor country are equally concerned about their relative standing. If concern for relative income is present at lower income levels, then it lends much more power to the argument that relative income matters (McBride 2001). In order to investigate this, we conducted a household survey and economic experiment (these were part of a larger survey on a different topic) in a rural province of China. As far as we know, the only study of concern for relative standing among a Chinese population is Solnick et al. (2007). They used a student sample and a survey-experimental method similar to ours and found that there were very small differences between Chinese and U.S. students with respect to concern for relative standing.

The two Chinese sayings above also point to the duality of China and the current Chinese society, which makes it even more interesting as a case study of concern for relative standing. Chinese people are group-oriented (Leung 1996), but at the same time, they have a strong desire for social status and emphasize competitive and self-oriented goals, such as "social status, power, and wealth" (Yang 1996). Apart from the cultural aspect of positional concern, China has undergone drastic change, change that is in conflict with the fundamental political ideology of equality. Since the late 1970s, China has witnessed radical social change and economic development, from a period when planned economy dominated and people were equal and poor to an era with a strong market orientation, increasing incomes, and increasing income inequality. During a short period of less than 30 years, the Gini coefficient for China increased from 0.16 before reforms in the 1970s to 0.41 in 1994, and then to 0.47 in 2004.[2] In addition, according to Chang (2002), China had the highest urban-rural income ratio in the world; in 2000 the ratio was 2.8.

This development clashes with the official communist ideology and, more importantly, it may distract people's attitudes from the fundamental values and beliefs in "equality." Although the Communist Party's egalitarian notion can be seen as simple rhetoric, it does shape Chinese social structure and attitudes. As Bowles (1998) argued, markets and other economic institutions influence the evolution of people's values and tastes. Thus, people's perceptions of factors, such as equality and relative standing, are affected by the society in which they live. People who live in rural areas at the lower end of the income distribution—and who live in a society where equality has been important—might suffer even more not only from income differences between urban and rural areas but also from rising income differences within rural areas. Bramall (2001) showed that the Gini coefficient for rural China increased from 0.24 in 1980 to 0.35 in 1999. Benjamin et al. (2005) documented large inequalities between neighbors within villages in rural China, as well as income differences between rural and urban areas.

[2] These are official Chinese statistics found on the Chinese official website, http://news.xinhuanet.com/english/2007-08/08/content_6493366.htm.

The rest of the paper is organized as follows. We discuss the design of the survey and the experiment in Section 2. The results are presented in Section 3, and Section 4 concludes the paper.

2 . Design of the survey-based experiment

The survey and experiment were conducted in the Guizhou province located in southwest China. We interviewed 210 respondents (all from farmer households), in 11 rural villages, in two counties (Jin Ping and Ma Jiang). The experiment was part of a larger survey designed primarily to obtain information about respondent views on the privatization of forestland in the province. Guizhou is the poorest province in China, an ideal setting for studying the implications of status concern of poor households (Brown et al. 2008). The average per capita income of our sample is 2,882 Chinese yuan, which is above the village mean of 1,102 Chinese yuan, but below the provincial mean of 5,409 Chinese yuan. In the two sampled counties, around 20 ethnic groups are represented, including Han, Miao, Dong, and Buyi. Ethnic groups account for around 80 percent of the population.

The subjects were interviewed in their homes for about one hour. There was no compensation paid for showing up, but as explained in detail later, the subjects were paid at the end of the survey. Before the experiment, they were given verbal information and instructions, and all questions were read aloud to each respondent. All alternatives in the experiments were shown on paper as well.

We designed a survey-based hypothetical experiment, similar to that in Johansson-Stenman et al. (2002), where we asked respondents to make repeated choices between two hypothetical states of the world for an imagined future relative. Two elements were varied in the experiment: the income of a relative and the average income in society. Furthermore, in one part of the experiment, the income of the future relative was below the average income in one of the two alternatives; in another part, it was above the average in both alternatives. Our reasoning for this was to test whether concern for relative standing depended on whether a respondent was above or below the average. Dusenberry (1949), for

example, argued that this could be the case. In particular, he argued that low-income groups are affected by high-income groups' consumption, but not vice versa. Andersson (2006) also used an experiment like ours on Swedish students and found that when individuals make choices about above-average incomes then they are less concerned about relative standing than if the income is below average.

A number of papers discuss various ways to model concern for relative standing (Johansson-Stenman et al. 2002; Knell 1999; Ravallion and Lokshin 2005). In order to compare our experiment with previous empirical research, and to keep it simple, we assumed that people potentially relate to the average income in society. The comparison, for example, could be in terms of a ratio comparison utility function, $u(x, x/\bar{x})$, or an additive comparison utility function, $u(x, x-\bar{x})$, where x is the individual's income and $\bar{x}$ is the average income in society. For simplicity's sake, we assumed an ordinal additive comparison utility function, $u = (1-\gamma)x + \gamma(x-\bar{x}) = x - \gamma\bar{x}$. As suggested by Johansson-Stenman et al. (2002), γ reflects the marginal degree of positionality, i.e., the fraction of the marginal utility of income that is due to the increase in relative income. Thus, when $U = u(x,r) \equiv u(x, x-\bar{x})$, then $\gamma = \frac{\partial u}{\partial r}\frac{\partial r}{\partial x} \Big/ \left(\frac{\partial u}{\partial x} + \frac{\partial u}{\partial r}\frac{\partial r}{\partial x}\right)$, where r is a measure of relative income.

Suppose that the marginal degree of positionality is 0.2. This means that for a small income increase, there are two effects on utility: an absolute income effect and a relative income effect. If γ is 0.2, then 80 percent of the utility increase is due to the increase in absolute income, and the remaining 20 percent is due to the increase in relative income.[3]

What we wanted was an experiment that allowed us to estimate the marginal degree of positionality for a respondent. In addition, we wished to test whether the marginal degree of positionality was a function of r—or, in our case, if the value depended on whether the own income was above or below the average income.

[3] It is therefore natural to restrict the marginal degree of positionality to be between 0 and 1.

In order to elicit people's preferences regarding relative standing, we needed to create a formal experiment. Following Johansson-Stenman et al. (2002), the subjects were instructed to make choices for an imaginary relative living two generations in the future. If the subjects had children of their own, we asked them to think of their children's grandchildren. If they did not have children, we asked them to imagine their future grandchildren. This was to help the respondents liberate themselves from their current circumstances. At the same time, we assumed that they would respond using their own preferences, since it is fair to say that they had limited conceptions of what their future relative would think and would probably expect their future relative to be like them. This assumption can no doubt be questioned. A different way to look at this would be to ask respondents what they think people in general would choose. Research in psychology has shown that people use their own preferences to predict those of others (e.g., Epley and Dunning 2002; Hsee and Weber, 1997). This is analogous to the false consensus notion in social psychology (Ross et al. 1977), which implies that people overestimate the degree to which other people share their own preferences.

Our subjects were asked to make repeated choices between two alternatives: A described average income, and B, the imaginary grandchild's income. In all other respects, the alternatives were identical. The respondents made six choices. In the first three choices, alternative A was a fixed number where the average income was 4,000 yuan/month, and the grandchild's income was 3,600 yuan/month.[4] This alternative was compared with three different B alternatives that had varying incomes for the future relative, but a fixed average income. (See an example in appendix 1.) The grandchild's income in alternative B was chosen correspond with a certain degree of positionality if the individual was indifferent to the two societies (assuming an additive comparison utility function). Table 1 shows the two alternatives for the 6 choices (This was also the order in which they were presented in the survey[5]).

[4] US$ 1 = Yuan 7.42, at the November 2007 exchange rate.

[5] The choices were always presented in the order shown in table 1. There was, of course, a risk that the order of the choices could affect the responses. At the same time, we wanted to make the experiment as simple and easy as possible for the subjects.

Let us look at the first choice. If an individual is indifferent to the two alternatives, then

$$x_A - \gamma \bar{x}A = x_B - \gamma \bar{x}B \rightarrow \gamma = \frac{x_A - x_B}{\bar{x}A - \bar{x}B} = \frac{3{,}600 - 3{,}150}{4{,}000 - 2{,}200} = 0.25 \ .$$

A respondent who chooses alternative A has a marginal degree of positionality less than 0.25, and a respondent who chooses alternative B has one larger than 0.25. In the first three choices, the grandchild's income is always lower than the average in alternative A and always higher than the average in alternative B. In order to test whether the concern for relative standing depended on whether a person is below or above the average, we constructed three additional choices. They reflected the same implicit marginal degree of positionality as the first three, except that the grandchild's income was above the average income in both alternatives. In alternative A, the average income remained 4,000 yuan, but the grandchild's income was 4,200 yuan. The average income in alternative B was also the same as before, but the grandchild's income was higher.

Table 1. Design of alternatives in relative income experiments

		Average income	Grandchild's income	Degree of positionality if indifferent (γ)
Choice 1	Alternative A	4000	3600	0.25
	Alternative B	2200	3150	
Choice 2	Alternative A	4000	3600	0.5
	Alternative B	2200	2700	
Choice 3	Alternative A	4000	3600	0.75
	Alternative B	2200	2250	
Choice 4	Alternative A	4000	4200	0.25
	Alternative B	2200	3750	
Choice 5	Alternative A	4000	4200	0.5
	Alternative B	2200	3300	
Choice 6	Alternative A	4000	4200	0.75
	Alternative B	2200	2850	

3. Results

The survey was conducted in September 2007, with a total of 210 interviews. Of the 210 responses to the choices for a future grandchild, eight were inconsistent in the sense that the subjects switched from alternative A to alternative B in a later choice, which violated the monotonicity assumption of the utility function. Potential explanations for such behavior are learning and fatigue effects, or an alternative functional form of the utility function.[6] Regardless of the cause, we excluded these responses from the analysis. The share of inconsistent responses was in line with previous similar experiments, despite the fact that most of the respondents had a low level of education. The results of the experiment are presented in table 2.

[6] For example, an individual might want to be as close to the average as possible in absolute terms. This would mean that he/she opted for society A in the first two choices, and society B in the third.

Table 2. Results of the hypothetical experiment

		Grandchild's income	Average income	Degree of positionality if indifferent (γ)	Share respondents
Choice 1	Alternative A	3600	4000	0.25	0.43
	Alternative B	3150	2200		0.57
Choice 2	Alternative A	3600	4000	0.5	0.51
	Alternative B	2700	2200		0.49
Choice 3	Alternative A	3600	4000	0.75	0.54
	Alternative B	2250	2200		0.46
Choice 4	Alternative A	4200	4000	0.25	0.52
	Alternative B	3750	2200		0.48
Choice 5	Alternative A	4200	4000	0.5	0.57
	Alternative B	3300	2200		0.43
Choice 6	Alternative A	4200	4000	0.75	0.65
	Alternative B	2850	2200		0.35

A large number of the subjects are concerned with their relative standing. The distribution of the responses was bipolar. A large fraction has a marginal degree of positionality smaller than 0.25 and a large fraction has one larger than 0.75. The estimated mean degrees is similar to those found in other studies. Carlsson et al. (2007a) estimated a mean degree of positionality for income between 0.59 and 0.71, using a random sample of the Swedish population, while Alpizar et al. (2005) estimated a mean marginal degree of positionality for income of 0.45, using a sample of Costa Rican university students. Using the same assumptions about the utility function as we did here, the implicit mean degree of positionality in Solnick and Hemenway (1998) is 0.33. If we compare the implicit mean marginal degree of positionality of 0.28 for the Vietnamese farmers (Carlsson et al. 2007b), it is clear that Chinese farmers are much more concerned with relative standing. Solnick et al. (2007) conducted a study on university students in China and found that they are concerned with their relative income: 59 percent of the respondents would choose a state

where they are better off in relative terms compared to others, instead of a state where they are better off in absolute terms of income.

In the part of the hypothetical experiment where the income in alternative A was lower than average (choices 1–3), 46 percent had a marginal degree of positionality above 0.75. If we compare the responses to the first three questions with those to the last three questions, we see a clear shift toward less concern for relative standing when the grandchild's income is above the average in both alternatives. The estimated mean marginal degrees of positionality are 0.51 in the first part and 0.42 in the second part.[7] The median is 0.5 in the first and 0.25 in the second. Using a t-test, we can reject the hypothesis of equal means (p-value = 0.066). Using a Wilcoxon signed-rank test, we can also reject the hypothesis of equal distributions (p-value=0.033).

These results are in line with what Andersson (2006) found in a similar study with Swedish students. Among our subjects, that upward-comparison is stronger than the downward comparison. Reference groups for upward comparison can be, for example, people in the city and off-farm migrants in the city. Knight and Song (2006) argued that the high growth of urban incomes and the extension of peasant horizons through media and increased temporary migration may have generated a sense of relative deprivation among rural people. Indeed, there have been newspaper and even official reports of peasant discontent and incidents of rural protest and unrest. Thus, the relatively poor farmers in our subject pool do care about relative standing. Since they are poor, they suffer not only from being poor but also possibly from being in a relatively bad position, compared with, for example, people with an off-farm job in the city. However, this depends on with whom they compare themselves. There are many possible reference groups (such as the individual's own past, aspirations, or desired future; others in the family; spouse; others with similar characteristics; and others in the same residential vicinity or workplace), since individuals have different identities in different contexts and so might have different comparator groups (Kingdon and Knight 2007). In our follow-up questions, we asked our subjects if they

[7] For non-extreme responses, we used the mid-value in each interval when calculating the mean. For the extreme responses $\gamma < 0.25$ and $\gamma > 0.75$, we set the values to 0 and 1, respectively.

agreed or disagreed with the following statement: "I always compare my income with…" We provided seven groups that we thought they most likely would compare with. The results are presented in Table 3.

There were small differences between the different groups, but the two groups that the subjects most compared themselves were people in the village and off-farm migrants in the city.[8] The group they compared themselves with the least were actually people in the city. Thus, as expected, the distance to the comparison group affected the extent to which they compared themselves with the groups. At the same time, the situation in the city mattered indirectly since an important comparison group was the off-farm migrants who move to the cities to earn a living.

Table 3. Groups with which the respondents compare themselves (fraction of respondents who agree with the statement)

	Strongly agree	Agree	Neither agree or disagree	Disagree	Strongly disagree
Relatives	0.16	0.31	0.06	0.28	0.18
Neighbors	0.19	0.35	0.06	0.25	0.14
People in the village	0.19	0.40	0.06	0.26	0.09
People in the township	0.10	0.35	0.07	0.34	0.14
People in the city	0.10	0.19	0.06	0.37	0.29
Party members	0.13	0.24	0.09	0.34	0.20
Off-farm migrants in the city (from the village)	0.15	0.40	0.06	0.25	0.13

We now turned to the question of which individual factors determined the responses in terms of concern for relative standing. In the regressions, the dependent variable was the marginal degree of positionality for the two hypothetical experiments. In order to account for the fact that we observed interval-censored values, we estimated an interval regression

[8] These are the two groups they strongly agreed or agreed that they compared with in their statement.

model. Table 4 shows the descriptive statistics of our sample for various variables that we included in the regressions. The sample size had 202 observations.

We included three dummy variables for household income to capture whether a household was relatively poor or rich. Household income was the sum of farming income and income from all other labor activities. We also included a number of household characteristics in the regressions (gender, ethnic belonging, education, Communist Party member, and house value), and two attitude variables measuring to what extent respondents agreed with the two Chinese sayings ("It is better to be the head of a chicken than the tail of a phoenix," and "the gun always shoots the fastest bird."). Finally, we included village size as an explanatory variable, in order to test whether individuals were less concerned with relative standing in a large village.

Table 5 reports the results of the two interval regressions. The first regression model is for the first part of the experiment, where the grandchild earns less than average in alternative A and more than average in alternative B. The second regression model is for the second part of the experiment where the grandchild earns more than average in both alternatives A and B.

Table 4. Descriptive Statistics

	Description	Mean	Standard deviation
Income group 1	= 1, if equivalence-scaled household income is less than 1,500 yuan; zero otherwise*	0.223	0.417
Income group 2	= 1, if equivalence-scaled household income is between 1,500 and 4,000 yuan; zero otherwise*	0.376	0.486
Income group 3	= 1, if equivalence-scaled household income is between 4,000 and 6,000 yuan; zero otherwise*	0.188	0.392
Income group 4	= 1, if equivalence-scaled household income is between more than 6,000 yuan; zero otherwise*	0.213	0.410
Female	=1, if respondent is female; zero otherwise	0.069	0.254
Age	Respondent age in years	49.49	12.41
Education	Respondent education in years	5.97	2.99
Party member	=1, if respondent is a Communist Party member; zero otherwise	0.203	0.403
Han	=1, if respondent is Han Chinese; zero otherwise	0.307	0.462
Dong	=1 If respondent belongs to Dong ethnic group; zero otherwise	0.134	0.341
Miao	=1, if respondent belongs to Miao ethnic group; zero otherwise	0.411	0.411
Other ethnic groups	= 1, if a respondent belongs to another ethnic group; zero otherwise	0.148	0.356
Relatives in city	=1, if respondent has relatives living the city; zero otherwise	0.049	0.217
Interaction with Guiyang	How many times respondent has visited Guiyang (1 = many times … 4 = never)	0.119	0.324
Chicken and phoenix saying	Agreement with saying about chicken and phoenix (1 = strongly disagree … 5 = strongly agree)	2.376	1.196
Bird saying	Agreement with saying about bird (1 = strongly disagree … 5 =strongly agree)	2.896	1.332
Value of the house	Value of respondent's house in 2007 (in 10,000 yuan)	1.785	2.696
Size of the village	Village population/100	15.71	9.569

* Equivalence-scale is (number of adults + 0.5 x number of kids)$^{0.75}$; members older than age 16 are adults.

Table 5. Interval regression estimates of the degree of positionality

Description	Below average income in alternative A		Above average income in both alternatives	
	Coefficient	***P-value***	***Coefficient***	***P-value***
Income group 1	0.094	0.233	0.164	0.038
Income group 2	0.118	0.096	0.128	0.065
Income group 3	0.103	0.188	0.162	0.035
Female	0.053	0.587	0.093	0.330
Age	0.001	0.925	0.0003	0.871
Education	-0.003	0.799	0.003	0.753
Communist Party member	0.032	0.624	-0.011	0.865
Miao	-0.104	0.069	-0.076	0.178
Dong	-0.046	0.584	-0.069	0.394
Other ethnic groups	0.015	0.856	0.011	0.881
Relatives in city	-0.017	0.871	-0.080	0.442
Interaction with Guiyang	0.045	0.568	-0.027	0.714
Chicken and phoenix saying	-0.009	0.676	-0.004	0.856
Bird saying	-0.032	0.070	-0.011	0.572
Value of house	0.021	0.021	0.026	0.010
Size of village	-0.005	0.076	-0.009	0.001
Constant	0.613	0.000	0.508	0.004
Sigma	0.329		0.321	
Number of observations	202		198	

As is typical with this type of data, it is difficult to explain the variation; not many of the explanatory variables are significant. We did find that respondents from the relatively poor households were more concerned with relative standing than respondents from high-income households. The major difference was actually between the high-income respondents and the remaining respondents. Thus, poor people care more about, and thus suffer even more from, their poor relative positions in society.

There are two large ethnic groups in this region, Miao and Dong.[9] Respondents from these two groups were less concerned with relative standing than the Han respondents, consistent with our intuition, although the difference between the groups was not always significant. Culturally, the Han Chinese ethnic group is more competitive and more concerned with position than the ethnic groups.[10] This result is consistent with Brown et al. (2008), who also found that households with heads belonging to the Han Chinese spent more money on positional goods.

We did not find that being a party member had a strong influence on preferences for relative standing. Carlsson (2007b) found that the Vietnamese households where at least one person was a member of the People's Committee were more status concerned. We also found that the higher the value of the house, the more the subject cared about relative standing, although this effect was not significant in the first part of the experiment. This implies that a person who lived in a nicer house was more concerned with relative standing. The house constitutes a large share of household wealth, particularly since land cannot be owned. The house is also a status-signaling good, and its visibility and other characteristics might make it more strongly related to positional concern than other goods (Carlsson et al. 2007a; Johansson-Stenman and Martinsson, 2006). Empirical evidence also shows that farmers spend a large share of their money on their houses. This could be explained with the concept of "face," or honor. Culturally, face is very important to Chinese people. In a cultural context, especially in Chinese villages, the house plays an important role for a person who is concerned with face, and the person can win more face by having a beautiful house in the village, visible to all local villagers.

We did not find that a person who agreed with the old saying, "it is better to be the head of a chicken than the tail of a phoenix," was more concerned with relative standing. But interestingly, we did find weak evidence that a person who agreed with the other saying, "the gun always shoots the fastest bird," tended to be less concerned with relative income in

[9] In this particular region, these groups are not minorities in terms of population, but are in other regions.

[10] For example, for a long time in China the imperial examination system played a very important role in people's life, and this had particular influence on the Han ethnic group. The only way to get a better life was to perform very well in the competitive examination in order to get a position in the government.

the first part of the hypothetical experiment, where the grandchild's income is below the average income in one of the alternatives.

Another interesting finding was that respondents who lived in larger villages were less concerned with relative standing. This is in line with the finding by Johansson-Stenman and Martinsson (2006) that individuals in small towns are significantly more concerned about status. There are two possible reasons for this. In a small community, it is much easier to establish the strata of society, and most people know their relative standing within the community. Runciman (1966) stressed that the choice of reference groups is very important. In our case, it could be that people are more likely to make an upward comparison when a community is small. It could also be that a respondent had a strong sense of being poor if there were only a few poor people in the village. However, if there are many poor people in the village, the respondent still knows that he/she is relatively poor, but the sense of being poor is not as strong. In the latter case, the respondent can more easily justify being poor.

4. Discussions

In this paper, we investigated people's preferences regarding relative standing, or status, in a rural region in China. A number of recent empirical studies have shown that people in developed countries do have preferences in this regard. Our results indicated that, on average, Chinese rural farmers are also highly concerned about their relative standing, although the farmers in our sample are relatively poor. The concern for relative standing, measured as the implicit marginal degree of positionality, is similar in strength to what has been found in comparable studies conducted in developed countries. What exactly affects the degree of concern for relative standing in different countries is a more complex issue. Although concern about relative standing in society seems to be a fundamental part of human nature (Solnick et al. 2007), we believe that the Chinese political system, traditional values, history, and customs may all play important roles as well. This may partly explain

why Chinese poor farmers are highly concerned about relative standing. In our case, we can speculate that strong concern for relative standing might stem from the traditional values in Chinese society, which may well have survived into present-day China, since they fit very well into its current values. The values associated with competitive and self-oriented goals, such as "social status, power, and wealth," have become important than the values associated with authorities and the family (Yang 1996).

The results point to some factors that may influence the degree of positionality. The Han ethnic group is more concerned with relative standing, compared to the Miao and Dong ethnic groups. We tend to believe this result because, culturally, Han Chinese are more competitive and value social status more.

We found that a person who agrees with the old saying, "the gun always shoots the fastest bird," tended to be less positional. This is an interesting finding that shows that some people are still influenced by the culture of *The Doctrine of the Mean*.[11] The belief that a person should not be different from others decreases the degree of positionality. Village size may, to some extent, also influence the degree of positionality. People are less positional in large communities than in small communities. In addition, we found that being a Communist Party member does not significantly influence an individual's preference for positional concern, although it is reasonable to expect a party member to have preferences for equality, since such beliefs no doubt harmonize with the political ideology of the Communist Party.

Should the current communist China still be perceived as a country of "equality"? China in the late 1970s was a poor country and people were equally poor. Then, reform and an opening-up policy began, and now China has even moved toward a market-oriented economy. During a short period of less than 30 years, China experienced rapid development. However, income inequality increased rapidly at the same time until China had the highest urban-rural income gap in the world. The highly unequal income distribution has caused widespread discontent and social protest. Knight and Song (2006)

[11] *The Doctrine of the Mean* is part of the Confucian scriptures. Here, it implies that the right action to take would be a mean between the extremes of too good and too bad.

argued that the fast growth of urban incomes and the extension of peasant horizons through media and increased temporary migration may have generated a sense of relative deprivation among rural people. Thus, people who live in rural areas at the lower end of the income distribution, and who have lived in a society where equality has been very important, might be even more frustrated than they would have been before, from the increased income differences between the rural and urban areas. This could also be the reason we did not find a low degree of positionality, as Carlsson et al. (2007b) found with Vietnamese farmers. The highly unequal development could have intensified the desire for a better relative standing in a society.

We also show that our subjects, to a larger extent, compare themselves with their neighbors and people from the village, but the differences between different groups are not that large. Furthermore, people earning off-farm incomes in the cities are an important comparison group. The strong concern for relative standing has important welfare implications. The increased inequality and, in our case, increasing incomes among the relatively rich people imply a negative externality on others.[12] People in the rural areas who do not benefit from the increased incomes are thus very disgruntled with the increased wealth of others.[13] This could in turn have important political implications. For example, there might be a strong pressure for increased interventions in the economy and for policies to equalize incomes.

[12] Our paper focused on the concern for relative position. There is not necessarily a direct link between increased inequality and changes in the relative position. What we particularly had in mind was increased income differences between different groups.

[13] There are, of course, other important welfare consequences of the increased growth in China. For one thing, many people have enjoyed drastic increases in absolute income, and the living conditions and standard have presumably risen much higher for a large share of the population. On the other hand, the pressure on the environment has also increased dramatically.

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Appendix

This is an example of the text used to describe one of the choices posed to our subjects.

We will now ask you some questions about future generations. We will ask you to make choices for a person who lives two generations into the future. So, if you have children, think of your children's grandchildren. If you do not have children, think of your future grandchildren. If you have grandchildren, think of your grandchildren's grandchildren.

The difference between the alternatives is the income of your grandchild and the average income of others in society. Prices are the same in the two alternatives, and the same amounts of goods are available. Assume that the prices are the same as today. Your grandchild has the same type of job in both alternatives. The government provides education, healthcare, and social security for all people. The distribution of income is the same in the two alternatives. This means that there are equally as many poor and rich people in the two alternatives.

We want you to focus on what is the best for your future grandchild. There is no right or wrong answer. Choose between alternative A and B for your future grandchild.

Alternative A:	Your grandchild's income is 3,600 yuan per month. The average income in society is 4,000 yuan per month.
Alternative B:	Your grandchild's income is 3,150 yuan per month. The average income in the society is 2,200 yuan per month.

Your grandchild earns 450 yuan more in alternative A than in alternative B. This means that the grandchild can eat better food, live in a better house, and buy more things in alternative A. In alternative A, your grandchild earns 400 yuan less than the average income in society. In alternative B, your grandchild earns 950 yuan more than the average income in society.

Everything else is the same in the two alternatives. Choose the alternative that you consider the best for your future grandchild.

□ Alternative A

□ Alternative B

Intra-household Decision-Making in Rural China and the Influence of Spouses' Income, Education, and Party Membership

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Abstract:

We study risky decision-making in a high-stakes experiment with couples in rural China. In the experiment, spouses chose between risky lotteries, first separately and then jointly. We are particularly interested in the (socio-demographic) factors determining (i) the similarity of spouses' individual decisions and (ii) women's influence on couples' joint decisions. We find that spouses in richer households have more similar individual risk preferences. The couple's joint decision is largely influenced by the husband, but women with higher income, more years of education, and communist party membership have a significantly stronger influence on the joint decision.

Key words: Household decision-making, Risk, Field experiment, China

JEL classification: C91, C92, C93, D10

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1. Introduction

Many important economic decisions – e.g., labor supply, residential location, buying insurance or a new car, and investing in stocks and bonds or in children's education – are often made by households rather than by individuals. Although households are still treated as single entities in standard economic textbooks, day-to-day experience reveals that household decision-making often involves conflict among spouses and family members and certainly requires compromises in many cases. In fact, the assumption of household members having common preferences has long been revoked (see Manser and Brown, 1980, and McElroy and Horney, 1981, for seminal models of intra-household bargaining, and Lundberg and Pollak, 1993, 1996, for alternative models). Empirical studies have shown that decisions and outcomes, such as child health, nutrition, and expenditures for different goods and services (e.g., tobacco and child care), depend strongly on whether the income is controlled by the husband or the wife (see, e.g., Browning et al., 1994; Lundberg, Pollak and Wales, 1997; Chiappori, 1988; Phipps and Burton, 1998; Thomas, 1994). However, it is difficult to use field data to measure the bargaining power of family members. In particular, field data does not provide insights into the relation between two spouses' individual decisions and their joint decision on the same matter, since it does not allow a *ceteris paribus* comparison of these different decisions. Experimental economists have very recently begun exploiting the methodological advantages of controlled laboratory experiments to contribute to a better understanding of household decision-making, with a particular focus on which spouse has a stronger influence on a couple's joint decisions. Bateman and Munro (2005) pioneered experimental tests of household decision-making. To examine whether decisions made by couples conform more or less to the axioms of expected utility theory, they invited 76 couples and let the spouses make risky decisions both separately and jointly. Their results suggest that couples exhibit the same kinds of departures from expected utility theory as individuals.[1] Furthermore, they found joint decisions to be typically more risk averse than the respective spouses' individual

[1] Bone et al. (1999) examined whether group decisions of students (who were randomly assigned to groups) are different than individual students' risky decisions. Similar to Bateman and Munro (2005), they found that groups and individuals are equally prone to violations of expected utility theory. The findings of Bateman and Munro (2005) may be considered a confirmation of the insignificance of group decision-making, although it should be pointed out that the couples participating in their study had been living together for up to 46 years (instead of meeting for a very short time in the laboratory).

decisions. De Palma et al. (2006) focused on the question of which spouse has more influence on joint decisions. Based on observations from 22 couples, they concluded that husbands generally have a stronger influence on joint decisions than wives, although wives gain influence if they control the computer keyboard when entering the joint decisions in the experiment. Contrary to Bateman and Munro (2005), de Palma et al. (2006) reported that the average couple decision tends to be less risk averse than the average decision of spouses separately.

This paper examines decision-making under risk (using the procedure of Holt and Laury, 2002) in 117 couples in a poor rural area of China. Unlike Bateman and Munro (2005), we are not interested in whether couple decisions exhibit more or less so-called anomalies in decision-making than decisions made individually; instead, we focus on two questions: (1) How similar are the decisions of two spouses when they make decisions separately and what (socio-demographic) factors influence the degree of similarity? (2) How does a couple's joint decision relate to the two spouses' separate decisions on a matter, and under what conditions do wives have a stronger influence on joint decisions? Contrary to de Palma et al. (2006), who already addressed question (2), we are going to consider not only how spouses' separate decisions compare to their joint decision, but also a set of socio-demographic variables that might affect who is in charge of joint decisions. Traditionally, Chinese women, especially in rural areas, have had very little say in household decisions. To be able to offer any kind of policy advice, it seems important to know whether factors such as education and income equality affect female decision-making power in households.

Our paper distinguishes itself from Bateman and Munro (2005) and de Palma et al. (2006) with respect to the following features: First, our subject pool is completely different. Whereas the mentioned authors ran their experiments in developed countries, ours was conducted in the field in a rather poor area of China, which by many accounts is still a developing country. On average, our subjects have 4.8 years of schooling and an average yearly income of 570 USD. Second, our experiment can be considered a high-stakes experiment since the average earnings from participating in the experiment

was equivalent to the average income earned from three days of off-farm work.[2] Given this large incentive, our experiment provided a stress test of who is in charge when couples make risky decisions jointly.

In short, we find that spouses in richer households have more similar individual risk attitudes. Length of marriage, however, has no impact on similarity. This result questions the layman's view that couples become more similar in their behavior the longer they have been together. A couple's joint decision is typically closer to the husband's individual decision, which has already been documented by de Palma et al. (2006). However, we show that women with higher income, more years of education, and communist party membership have a significantly stronger influence on joint decisions.

The outline of the paper is as follows: Section 2 provides background information on our subject pool and on the province of *Guizhou* in China where the experiment was conducted. Section 3 introduces the experimental design and procedure. Section 4 presents the experimental results, and Section 5 concludes the paper.

2. Location of the experiment and background information on the sample

The experiment was conducted in rural communities of the *Guizhou* province,[3] which is the 16th largest out of 32 provinces in China and is located in the south-west part of the country. *Guizhou's* total population is 39 million, and its main industries are mining and timber and forestry. The province is one of the poorest in China, with a gross domestic product per capita of around 5,700 Chinese Yuan in 2006.[4] This figure – the lowest

[2] Kachelmeier and Shehata (1992) report a high-stakes experiment on risky decision-making that was also run in China. Their focus was on the effects of how the level of incentives affect revealed risk preferences. Contrary to our study, they were not interested in the determinants of the decision-making of couples.
[3] The University of Gothenburg (with which all authors are affiliated) supports a research program at Peking University in China, and the province of *Guizhou* is one of the regions where this program conducts research, which is the reason for choosing this province for our experiment.
[4] 1 USD corresponded to 7.42 Chinese Yuan at the time of the experiment (November 2007).

among all provinces – equals only 15% of the national average (37,000 Chinese Yuan in 2006; see NBS, 2007).

The sampled region is *Majiang*, located to the east of *Guizhou* and around 100 kilometers away from the capital *Guiyang*. The local forestry bureau provided us with a list of villages and townships, from which we randomly selected five townships, and then seven villages from these five townships. In each village, we received a household registration list – including all officially married couples – from the local village council. From this list, we randomly chose 10-24 households, depending on the size of the village. These households were first surveyed on several issues concerning farming and forestry (as part of the *Environment for Development* project at the University of Gothenburg), and could then voluntarily participate in our risk experiment. In total, 117 couples were interviewed, and all of these also participated in the experiment. In order to prevent villagers from spreading the word about the experiment within a village, we employed 20 interviewers[5] so that all experiments within a village could be finished within five hours.

[5] To avoid any interviewer effects, we randomly reshuffled pairs of two interviewers each for each day in the field.

Table 1. Descriptive statistics (*N* = 117 households)

Variable	Description	Mean	Std. Dev.	Min	Max
Income per capita	Household income in Chinese Yuan per capita	4,203	8253	200	84,117
Log Equivalence scaled income	Log of equivalence scaled household income in Chinese Yuan. Equivalence scale = (Adults + 0.5 x Kids)^0.75	8.108	1.014	5.645	11.751
Wife income contribution	Wife's share of the total household income	0.418	0.152	0	1
Length of marriage	Number of years the couple has been married	26.465	12.458	1	52
Number of children	Number of children the couple has	2.675	1.401	0	7
Wife more educated	= 1 if wife has a higher education than the husband	0.145	0.354	0	1
Education difference between spouses	Education difference between spouses in absolute value	3.235	2.513	0	10
Wife older	= 1 if wife is older than husband	0.291	0.456	0	1
Age difference between spouses	Age difference between spouses in absolute value	2.863	3.109	0	19
Wife, party member	= 1 if wife is party/cadre member	0.077	0.268	0	1
Husband, party member	=1 if husband is party/cadre member	0.179	0.385	0	1
Both spouses party members	= 1 if both spouses are party/cadre members	0.043	0.203	0	1

Table 1 reports background statistics of the sampled households. The average yearly income per capita is 4,204 Chinese Yuan, which is 22% lower than the average yearly per capita income at the provincial level (5,409 Chinese Yuan). Forty-two percent of the household income is generated from off-farm sources, and 36% from agriculture. The remaining income comes from forestry, remittances, or other sources. Women on average contribute 42% of the total household income. Among the couples in our sample, only one had been married for less than one year. The maximum length of marriage is 52 years, and the average is 27 years. It is important to note that many families in this region are not affected by the official one-child policy, and therefore the average number of children is larger than one. The reason for this is that the one-child policy is mainly for *Han* Chinese, and in our sampled region more than one-third of the inhabitants belong to other ethnic groups. The level of education is very low in our sample; the average number of years of schooling is 6.09 for husbands and 3.62 for wives. The overall average in the province of *Guizhou* is 6.75 years, which shows again that the region of *Majiang* is relatively underdeveloped.

3. Experimental design and procedure

3.1 The experimental task

We used the choice list introduced by Holt and Laury (2002) to let subjects make risky decisions. In each of 10 pair-wise choices, subjects had to choose either Option A (which can be regarded the relatively safe option) or Option B (the relatively risky option). While the two options each has the same two possible payoffs in all 10 choices, the probability for the high payoff increases in steps of 10 percentage points from 10% to 100% (consequently, the probability for the low payoff decreases by 10 percentage points from 90% to 0% in each of the ten decision rounds). Table 2 presents the lottery choices in detail. For instance, in the first decision round the respondent(s) had to choose between (A) earning either 20 Chinese Yuan with a probability of 10% or 16 Chinese Yuan with a probability of 90%, and (B) earning either 38.5 Chinese Yuan with a 10% probability or 1 Chinese Yuan with a 90% probability.

Table 2. The ten paired lottery-choice decisions in amounts of Chinese Yuan (¥)

Decision	Option A	Option B	Difference in expected payoff (Option A-Option B)
[1]	1/10 of ¥20, 9/10 of ¥16	1/10 of ¥38.5, 9/10 of ¥1	¥ 11.7
[2]	2/10 of ¥20, 8/10 of ¥16	2/10 of ¥38.5, 8/10 of ¥1	¥ 8.3
[3]	3/10 of ¥20, 7/10 of ¥16	3/10 of ¥38.5, 7/10 of ¥1	¥ 5.0
[4]	4/10 of ¥20, 6/10 of ¥16	4/10 of ¥38.5, 6/10 of ¥1	¥ 1.6
[5]	5/10 of ¥20, 5/10 of ¥16	5/10 of ¥38.5, 5/10 of ¥1	-¥ 1.8
[6]	6/10 of ¥20, 4/10 of ¥16	6/10 of ¥38.5, 4/10 of ¥1	-¥ 5.1
[7]	7/10 of ¥20, 3/10 of ¥16	7/10 of ¥38.5, 3/10 of ¥1	-¥ 8.5
[8]	8/10 of ¥20, 2/10 of ¥16	8/10 of ¥38.5, 2/10 of ¥1	-¥ 11.8
[9]	9/10 of ¥20, 1/10 of ¥16	9/10 of ¥38.5, 1/10 of ¥1	-¥ 15.2
[10]	10/10 of ¥20, 0/10 of ¥16	10/10 of ¥38.5, 0/10 of ¥1	-¥ 18.5

"p/10 of ¥x, q/10 of ¥y" reads that the amount x is gained with probability p/10 and the amount y with the counterprobability q/10 (= 1 – p/10).

The far right column of Table 2 indicates the difference in expected payoffs. In the first four rows (or decision rounds), Option A has a higher expected payoff; in the remaining rows Option B has a higher expected payoff. Consequently, a risk neutral subject would switch from Option A to Option B in the fifth round and then stay with Option B to the end. Subjects who switch to Option B after the fifth choice can be classified as risk averse, whereas subjects switching to Option B prior to the fifth choice are considered to be risk loving.

Note at this point that the high payoff in Option B corresponds to almost 1% of the average yearly income of our experimental participants. It therefore seems legitimate to call this a high-stakes experiment.[6]

3.2 Procedure

Two interviewers (henceforth called experimenters) visited each randomly selected couple. Hence, the experiments were conducted in the participants' homes. The participants had to go through four stages: In Stage 1 each spouse answered a detailed questionnaire on socio-demographic characteristics, health status, and social capital individually. In Stage 2 each spouse made individual decisions in the risk experiment of Holt and Laury (2002). Note that the spouses were placed in different rooms in Stages 1 and 2 in order to avoid one spouse's answers being influenced by the other.[7] This separation of spouses was done before the tasks in Stages 1 and 2 were explained to them. In Stage 3, the two spouses were reunited and had to jointly answered questions regarding the financial situation of the household and some additional household characteristics. Finally, Stage 4 was a repeat of Stage 2, but now the spouses had to make the decisions as a couple, which means that they had to agree on what options to choose. The participants were told that the amounts used in Stage 2 (given in Table 2) would be used to determine the payoffs for each of them in Stage 4. This procedure was chosen to keep the per-capita incentives constant across Stage 2 and Stage 4. All decisions were made with the experimenter present in the room. The main reason for this was that we wanted to make sure that the subjects understood the rules of the experiment and that they would be able to ask questions at any time during the experiment.[8]

[6] Recall that Holt and Laury (2002) also had one treatment with high stakes (where the high payoff was 346.50$ in Option B). Their findings show that risk aversion increases with increasing stake size (if lotteries are played out for real, as is the case in their experiment).

[7] Hence, in Stage 1, each spouse was accompanied by one experimenter. In order to avoid any kind of experimenter effect we balanced the gender of the two experimenters per household. Furthermore, we instructed experimenters to switch from interviewing the wife to interviewing the husband, and vice versa, when moving from one household to the next one.

[8] This procedure is similar as in for example Henrich et al. (2001) where experiments are conducted in small-scale societies in for example Mongolia and Tanzania.

Note that we introduced the task in a given stage only after the previous stage had been completed. Hence, when making their decisions individually in Stage 2, the participants did not yet know that they were going to make the same decisions again later with their spouses. Both when explaining the rules for Stage 2 and Stage 4, the participants were informed that 1 of the 10 decisions in each stage would be randomly played out for real, but only at the very end of the experiment.

Given the generally low educational level of our participants, we took great care to explain the rules of the risk experiment as clearly as possible. To do so, the rules of the experiment were first explained orally and then visualized as follows. The probabilities for the high and low payoffs in a given option were illustrated by using white and black chips. For example, for the first decision (see Table 2) we used two boards, one indicating Option A and the other Option B. On the left-hand side of each board we wrote down the high amount and on the right-hand side the low amount. Then we placed one white chip next to the high amount and nine black chips next to the low amount. Finally we put all chips in a bag and told the participants that at the end of the experiment they would be able to draw one chip from such a bag, where the fraction of white chips would correspond to the likelihood of winning the high payoff in the chosen option.

At the end of the experiment, each spouse had to draw one card from a deck of ten numbered cards to determine which decision would be played for real. Then he/she had to draw a chip from a bag with the corresponding distribution of white and black chips. The resulting real payoff for Stage 2 was handed over privately to each spouse. Finally, the couple repeated the procedure together in order to determine the payoff for Stage 4; i.e., they drew one card from the deck and then picked one chip from a bag that contained a corresponding distribution of chips. Recall that in Stage 4, each spouse earned the amount indicated in Table 2. In total, executing the four stages took about 1.5 hours. On average, the participants earned 37 Yuan, which equaled almost 1% of their average yearly income.

4. Results

4.1 Analysis of aggregate data

Table 3 shows the relative frequency with which husbands, wives, and couples chose the safer Option A over the more risky Option B. The number of safe choices is an indicator of a participant's risk attitude, and can be transformed into a measure of relative risk-aversion, assuming a constant relative risk aversion utility function (see Holt and Laury, 2002). In Table 3 we include only consistent choices, meaning that we exclude all observations where a decision-maker switched back at least once to Option A after having chosen Option B earlier, or where Option A was chosen in the tenth decision (i.e., preferring 20 Chinese Yuan for sure rather than 38.5 Chinese Yuan for sure). This leaves us with 105 consistent husbands, 108 consistent wives, and 105 consistent couples. Hence, 318 out of 351 choice sets (90.5%) are fully consistent. Given our sample of poor and low-educated participants, we consider this large fraction of consistent choices a success.[9]

[9] Note that the fraction of inconsistent choices ranges from 5% to 13% in Holt and Laury (2002). In Bateman and Munro (2005), 6% of the participants chose strictly dominated options. Between 9% and 23% of all choices are inconsistent in de Palma et al. (2006).

Table 3. Risk-aversion classification based on lottery choices

Number of Safe choices	Range of relative risk aversion for $U(x)=x^{1-r}/(1-r)$	Risk preferences classification	Proportion of choices		
			Husbands (N = 105)	**Wives** (N = 108)	**Couples** (N = 105)
0-1	$r < -0.95$	Highly risk loving	0.02	0.09	0.05
2	$-0.95 < r < -0.49$	Very risk loving	0.06	0.05	0.03
3	$-0.49 < r < -0.15$	Risk loving	0.10	0.09	0.04
4	$-0.15 < r < 0.15$	Risk neutral	0.16	0.10	0.12
5	$0.15 < r < 0.41$	Slightly risk averse	0.10	0.19	0.26
6	$0.41 < r < 0.68$	Risk averse	0.16	0.14	0.17
7	$0.68 < r < 0.97$	Very risk averse	0.09	0.09	0.11
8	$0.97 < r < 1.37$	Highly risk averse	0.06	0.08	0.09
9	$1.37 < r$	Extremely risk averse	0.25	0.17	0.13
Average number of safe choices			*5.79*	*5.19*	*5.59*

The bottom row of Table 3 indicates that in the aggregate we find risk-averse decisions. Recall that a risk-neutral decision-maker would choose Option A four times. However, this option is in fact chosen more than five times on average. There is no significant difference at the 5% level between the number of safe choices of husbands and wives, meaning that there are no gender differences in risk-aversion in the aggregate.[10] The large fraction of extremely risk-averse husbands (25% chose Option A nine times and only then switched to Option B) and wives (17%) might seem noteworthy at first sight. However, these fractions are fairly comparable to the portion of extremely risk averse choices in the high stakes treatments of Holt and Laury (2002), where around 15% of all subjects chose the safe option nine times when the high payoff from the safe (risky)

[10] For this test, we matched the number of safe choices of both spouses in a household and then applied a Wilcoxon signed ranks test using matched pairs (p-value = 0.14). It is a common stereotype that women are more risk averse than men, but the empirical evidence in economics is not clear-cut (see Schubert et al., 1999, for instance). Holt and Laury (2002) did not find gender differences for high stakes, and nor do we.

option was 100 USD (192.50 USD), and almost 40% were extremely risk averse when the safe (risky) option yielded 180 USD (346.50 USD).

The joint decisions are on average also risk averse, and the average number of safe choices is between the corresponding figures for husbands and wives. Although it seems as if couple decisions were less extreme than individual decisions (maybe as a consequence of a willingness to compromise), a Kolmogorov-Smirnov-test does not reveal any significant distributional differences at the 5% level between the couples' decisions and those of either the husbands or the wives. Hence, in the aggregate we find that couples' decisions and individual spouses' decisions are largely the same. However, the aggregate perspective does not answer our main research questions about what makes spouses' individual decisions similar and which spouse has more influence on a couple's decision. We therefore turn to an analysis of data at the household level. In the following analysis we rely on the 96 households in which all three sets of decisions (those of the husband, of the wife, and of the couple) were fully consistent.[11]

4.2 Analysis of data at the household level

4.2.1 Similarity of spouses in individual decisions

The husband and the wife made the same number of safe choices individually in only 6% of the 96 households considered here. In 51% of the households the husband is more risk averse, and in 43% the wife is. If we look at the wife-husband difference in the number of safe choices, the mean value is -0.5 (standard deviation 3.64), the maximum 7 and minimum -9. The average absolute difference in the number of safe choices is 2.98 (standard deviation 2.13). Hence, we observe substantial differences in the risk preferences of spouses. In order to analyze whether there is a systematic variation in how similar spouses are in terms of their risk preferences, we estimate an

[11] Twelve husbands and nine wives made inconsistent choices in the individual decision-making part of Stage 2. Out of these, there were three couples where both the husband and the wife made inconsistent choices, implying a total of 18 households where at least one spouse was inconsistent. In addition, three couples made inconsistent choices, although none of the spouses had been inconsistent individually. Hence, the total sample of 117 households is reduced by 18 households with individual inconsistencies and three households with couple inconsistency, leaving 96 households with fully consistent choices.

OLS model with the absolute difference in the number of safe choices made by the husband and the wife as the dependent variable.[12] Table 4 reports the results.

Table 4. OLS regression on the similarity of risk attitude (*p*-values in parentheses)

Variable	Coefficient
Log equivalence scaled income	-0.728
	(0.000)
Wife's relative contribution to household income	-3.387
	(0.024)
Length of marriage in years	0.005
	(0.828)
Number of children	-0.003
	(0.989)
Age difference between husband and wife	-0.023
	(0.775)
Difference in years of education	-0.013
	(0.871)
Both spouses party members (= 1)	-1.038
	(0.099)
Constant	6.958
	(0.000)
R-square	0.14
Number of observations	96

Dependent variable: Absolute difference in the number of safe choices of husband and wife.
Robust standard errors are estimated.

[12] The dependent variable is between zero and nine, since the maximum difference in the number of safe choices is nine. We also estimated a negative binomial model, which could be more suitable for non-negative integer data. However, in terms of the signs and significance levels of marginal effects, there were very small differences compared to the OLS model.

Household income has a significantly negative effect, i.e., the higher the household income the more similar the spouses' individual choices. Furthermore, the share of household income contributed by the wife has a strong and significant effect; an increase in this share by 10 percentage points reduces the absolute difference in the number of safe choices by 0.34. Both variables together imply that spouses in relatively richer households have more similar risk preferences, and that the spouses' risk preferences are also more similar when they contribute more equally to the household income. The third variable with an important effect is whether both spouses are party members, which is significant at the 10% level. In households where both spouses are members of the communist party, the absolute difference in the number of safe choices is reduced by approximately one unit. None of the other variables we considered to be potentially important has any significant effect on the similarity of risk preferences. It seems noteworthy that length of marriage does not affect the similarity between spouses with respect to risky decision-making, and nor does number of children, difference in age, or difference in education.

4.2.2 The relative influence of spouses on a couple's decision

We start the analysis of which spouse's risk preferences are better reflected in a couple's decisions by relating the spouses' individual decisions to their joint decisions in the following way. There are three possible cases: (i) The number of safe choices made by the couple is in the range of safe choices made by the husband and the wife (including identity of one of the couple's decisions with one of the spouses' decisions). (ii) The couple makes more safe choices, i.e., is more risk averse, than the husband and the wife individually. (iii) The couple makes fewer safe choices, i.e., is more risk loving, than both the husband and the wife. If the couple's decision is closer to the husband's (wife's) individual decisions, we interpret this as the husband's (wife's) risk preferences being more strongly represented in the couple's decision than the wife's (husband's) risk preferences. In other words, the closer the couple's decision to either of the spouses' choices, the more influence we attribute to this spouse. Table 5 summarizes the three cases introduced above and indicates how couples decisions compare to the individual decisions made by the respective husbands and wives.

Table 5. Relation of couple's decision to choices of husbands and wives

Relation of couples' decisions to those of husbands' and wives'	**[A]** Total	**[B]** Difference in number of safe choices of spouses ≤ 2	**[C]** Difference in number of safe choices of spouses > 2
(i) Safe choices of couple in the range of the husband and the wife			
Couple same as husband	24 (34%)	13 (52%)	11 (24%)
Couple closer to husband	16 (23%)		16 (35%)
Couple equal distance to husband and wife	7 (10%)	4 (16%)	3 (7%)
Couple closer to wife	11 (15%)		11 (24%)
Couple same as wife	13 (18%)	8 (32%)	5 (11%)
Total	*71 (100%)*	*25 (100%)*	*46 (100%)*
(ii) Couple makes more safe choices than either spouse			
Couple closer to husband	6 (86%)	4 (80%)	2 (100%)
Couple equal distance to husband and wife	0 (0%)	0 (0%)	0 (0%)
Couple closer to wife	1 (14%)	1 (20%)	0 (0%)
Total	*7 (100%)*	*5 (100%)*	*2 (100%)*
(iii) Couple makes fewer safe choices than either spouse			
Couple closer to husband	7 (47%)	6 (55%)	1 (25%)
Couple equal distance to husband and wife	3 (20%)	3 (27%)	0 (0%)
Couple closer to wife	5 (33%)	2 (18%)	3 (75%)
Total	*15 (100%)*	*11 (100%)*	*4 (100%)*
Risk preference of couple is identical to husband's and wife's			
Couple equal to both	3	-	-

First note in Column [A] that 78% of the couples (71/96) agree on a number of safe choices in the range spanned by the husband's and the wife's individual decisions. For the remaining 22% we observe more extreme decisions (in either direction) than made by the spouses individually.[13] In general, the data in Table 5 suggests that couples' decisions are more often closer to the decisions made by the husband, irrespective of whether case (i), (ii), or (iii) applies.[14] For case (i), we conduct a χ^2-test to test the null hypothesis that the distribution of joint choices is not related to individual choices. In order to do so we have to consider that there are five possible outcomes of how a couple's decision relates to the spouses' individual decisions. (a) The couple's decision can be identical to the husband's, but different from the wife's; (b) it can be identical to the wife's, but different from the husband's; (c) it can be of equal distance to both spouses (including the case where both spouses made identical decisions individually; (d) it can be closer to the wife's decision; or (e) it can be closer to the husband's decision. Given the discrete choice set, it is clear that with an odd difference between the number of safe choices of the husband and the wife, the option of equal distance is not feasible. When applying a χ^2-test we therefore correct for the possibility of different probabilities of the five possible outcomes listed above. The test shows that we can reject the null hypothesis that the distribution of outcomes is equal among the five possible outcomes (p-value = 0.007). Table 5 makes it obvious that the couple's decision is more often closer to the husband's decision. This raises the question of under which conditions a couple's decision is closer to the wife's preferences.

For an econometric analysis of the conditions under which the wife has a stronger influence on a couple's joint decision, we classify three categories of how the number of safe choices made by a couple relates to the number of safe choices made by the

[13] It seems noteworthy that a model by Mazzocco (2004) can explain how differences in spouses' individual risk attitudes can lead to more extreme choices of the household. Hence, couples that make more extreme decisions than either spouse individually can not simply be considered as having made a mistake. A recent model of Eliaz et al. (2006) also shows that decisions in groups (like in families) can lead to choice shifts that yield outcomes that are more extreme than the outcomes of each single group member.

[14] In order to check whether the relationship between the couple's decisions and those of each spouse depends on how differently both spouses have decided individually, we split the total sample in Column [A] into two subsamples. Column [B] considers all cases where the number of safe choices made by the husband and the wife differs by one or two units, and Column [C] presents the cases where the husband and the wife differ by three or more safe choices in the individual task.

husband and the wife individually: (i) Couple is closer to husband. (ii) Couple is equally distant from husband and wife. (iii) Couple is closer to wife. We estimate the probability that the decision of the couple is in one of these three categories with an ordered probit model. The dependent variable is equal to 1 for the first category, equal to 2 for the second and equal to 3 for the third category. The marginal effects of the ordered probit model are presented in Table 6. For dummy variables we report the discrete change of the variable from 0 to 1. The independent variables are now intended to capture factors that influence both the absolute and the relative bargaining strength of the husband and the wife. We therefore include, for example, a dummy variable indicating whether the wife is more educated than the husband, instead of including the levels of education of the husband and the wife.

Both household income and relative contribution to the household income by the wife have a significant effect on the outcome of the couple's decision. If the wife contributes relatively more to the household income, or if the household is relatively rich, then the couple's decision is more similar to the wife's risk preferences. Note that these same two variables have been found to make husbands and wives more similar with respect to their individual choices. The estimations in Table 6 show that household income and relative income of the wife have, in fact, two effects: on individual similarity and on the influence of the wife on a couple's joint decision.

Education and party membership are the other two factors that give more power to women. If the wife has more years of schooling than the husband, the couple's decision becomes less likely to be closer to the husband's preferences, although the effect is only weakly significant. Nevertheless, it shows that education is an important factor for household decision-making. Interestingly, if the wife is a member of the communist party, she has a significantly stronger influence on the couple's decision. Hence, it seems that party membership contributes to the empowerment of women. The same is not found for men, as their party membership does not shift the couple's decision in their favored direction. The ordered probit has also controlled for other factors of possible importance. However, none of them has any influence on how wives' preferences are reflected in couples' decisions.

Table 6. Marginal effects from an ordered probit model (*p*-values in parentheses)

Dependent variable	(i) Couple closer to husband	(ii) Equal distance	(iii) Couple closer to wife
Variable	Marginal	Marginal	Marginal
Log equivalence scaled income	-0.143	0.019	0.124
	(0.009)	(0.107)	(0.009)
Wife's relative income contribution	-0.812	0.108	0.704
	(0.031)	(0.144)	(0.029)
Length of marriage in years	0.006	-0.002	-0.005
	(0.307)	(0.374)	(0.304)
Number of children	-0.013	0.002	0.011
	(0.787)	(0.788)	(0.787)
Wife more educated (= 1)	-0.189	0.013	0.175
	(0.093)	(0.192)	(0.112)
Wife older (= 1)	0.075	-0.011	-0.064
	(0.518)	(0.563)	(0.512)
Wife is party member (= 1)	-0.420	-0.023	0.443
	(0.004)	(0.637)	(0.019)
Husband is party member (= 1)	0.093	-0.015	-0.078
	(0.543)	(0.624)	(0.527)
Difference in safe choices (wife – husband)	-0.014	0.002	0.012
	(0.378)	(0.417)	(0.378)
Threshold parameter 1 (standard error)	2.005		
	(0.708)		
Threshold parameter 1 (standard error)	2.417		
	(0.719)		
Pseudo R2	0.103		
Number of observations	96		

Robust standard errors are estimated.

5. Conclusions

We have studied risky decision-making of couples in an experiment carried out in rural China. In particular, we were interested in the similarity of spouses' individual risk preferences, in how a couple's joint decision-making relates to the respective spouses' risk preferences, and what factors shift a couple's joint decision in the direction of the wife's risk preferences. The latter question addresses the conditions under which women have more influence on household decision-making. We found that spouses in richer households, in households where the wife earns a higher share of the income, and in households where both spouses are members of the communist party have more similar individual risk preferences. A couple's joint decision is in a majority of cases closer to the husband's preferences, which is in line with de Palma et al. (2006). However, wives with higher income, more years of education (than their husbands), and communist party membership do have a significant influence on the joint decision. At the aggregate level we do not find any statistically significant differences between individual and couple decisions, and the number of safe choices made by a couple tends to fall between the numbers of safe choices made by the husband and the wife individually.

Traditionally, Chinese women have had very little say in household decisions, in particular in rural areas. They have also been discriminated against when it comes to access to education. For example, educating sons has been seen as an investment in old age support; it has been seen as more likely that sons will get paid to work, leaving the women to work on the farmland (Hannum, 2005). Our results suggest that policy measures to improve the education, and to increase the labor force participation, of women – thus giving them a chance to contribute more to the household income – are key factors in increasing the power of women in households[15] and putting them ultimately on equal footing with men. China has experienced rapid economic development with rising incomes for many households, although mainly in the cities. The effect of the economic growth on female education levels and on gender wage

[15] Empirical research shows that redistributing income from husbands to wives affects the spending patterns of households, shifting them in favor of women (Lundberg et al., 1997; see also Hotchkiss, 2005, for some further, but less clear-cut, evidence).

discrimination is not clear-cut. While female school enrollment has increased (Hannum, 2005), the gender-wage gap has actually increased, although from a low initial level (Gustafsson and Li, 2000).

A skeptical reader might argue that our experiment may not be indicative of every day life decision-making within a household, thus questioning the external validity of our results. Our rebuttal against such an argument would be twofold. First, using field data from naturally occurring household decisions suffers from the limitation that it is hard, if not impossible, to compare the decisions of a couple with the respective spouses' individual decisions, since keeping the conditions constant in both instances seems very demanding. We are at least not aware of any study that succeeds in this attempt. If it is only possible to observe either a couple's or a spouse's decision in the field, it cannot be identified how individual preferences relate to the decisions made jointly by a couple. Using the method of experimental economics, we have been able to overcome this limitation of field data. Second, our stakes were very high. The average payoff from the experiment was around 1% of the average participant yearly income. Such high stakes make decisions salient, as many important every day life decisions tend to be, and they provide enough of an incentive to act according to one's own risk preferences – *if* one's spouse is willing to accept that. We have been able to identify crucial conditions that satisfy this condition to make joint decisions more similar to women's preferences: a better education and higher personal income. In addition, party membership was found to empower women. Whether this is an artifact of our data or an intended – and successful – aim of the communist party is beyond the scope of this paper.

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Appendix: *Oral presentation of the risk experiment to participants (script for experimenters)*

We will now ask you to make 10 choices between alternatives. In each alternative there is a chance that you will earn a certain amount of money. How much you earn depends on things you cannot affect. In the end, you will draw a card randomly to decide which question will be used. This means that you will answer 10 questions, but only one question will determine your income. Right now, we do not know which one will be used.

Now let me explain to you how it works. Let us look at the chips and price tag on the table, and at the first choice situation. On the table, on this side, we have 1 white chip and 9 black chips with 2 price tags reading 20 and 16. On that side, we have 1 white chip and 9 black chips as well, but with 2 price tags reading 38.5 and 1. White chips stand for higher income on both sides and black chips stand for lower income on both sides. Therefore, on this side, if you draw a white chip you will get 20 (Yuan), and if you draw a black chip, you will get 16 (Yuan). On the other side, if you draw a white chip you will get 38.5 (Yuan) and if you draw a black chip you will get 1 (Yuan). Now let us look at numbers – we have 1 white chip and 9 black chips. This means that on this side there is a 90% chance you will get 16 (Yuan) and a 10% chance you will get 20 (Yuan). On the other side, you will have a 90% chance to get 1 (Yuan) and a 10% chance to get 38.5 (Yuan). Which side do you prefer?

Let us now look at the second choice situation. On the table, on this side, there are 2 white chips and 8 black chips with 2 price tags reading 20 and 16. On that side, there are 2 white chips and 8 black chips as well, with 2 price tags reading 38.5 and 1. As you know, white chips stand for higher income on both sides and black chips stand for lower income on both sides. Therefore, on this side, if you drawn a white chip you will get 20 (Yuan), and if you draw a black chip you will get 16 (Yuan). On the other side, if you draw a white chip you will get 38.5 (Yuan), and if you draw a black chip you will get 1 (Yuan). Now let us look at numbers, there are 2 white chips and 8 black chips. This

means that on this side there is an 80% chance that you will get 16 (Yuan) and a 20% chance that you will get 20 (Yuan). On the other side, you will have an 80% chance of getting 1 (Yuan) and a 20% chance of getting 38.5 (Yuan). Which side do you prefer?

At the end of the survey, when you have answered all the questions, you will draw a card to decide which question will be used, and then draw a chip to decide how much you will earn. Let me remind you again, you will make ten decisions, but at the end, only one of these will end up affecting your earnings. You will not know in advance which decision will be used. Each decision has an equal chance of being chosen.

Let us practice before we start. Suppose a random draw of one card from ten cards determine the first decision to be played for real. Hence, we use the first decision as an example. Assume that you have chosen this side (with high payoff of 38.5 Yuan), in order to determine how much you will then be paid, you need to draw a chip (let the subject draw a chip). How much money do you make? Assume that you have chosen that side (with high payoff of 20 Yuan), in order to determine how much you will then be paid, you need to draw a chip (let the subject draw a chip). How much money do you make?

Do you have any questions or should we proceed with the ten decisions?

Forestland Reform in China: What do the Farmers Want?
A Choice Experiment on Farmers' Property Rights Preferences

Ping Qin[1]

Abstract:

Various decentralization experiments are currently underway in the Chinese forestry sector. However, a key question often ignored by researchers and policy makers is what farmers really want from reform. This paper addresses this question using a survey-based choice experiment. We investigated farmers' preferences for various property-rights attributes of a forestland contract. We found that farmers are highly concerned with what types of rights a contract provides. Reducing perceived risks of contract termination and introducing a priority right in the renewal of an old contract significantly increase farmers' marginal willingness to pay (MWTP) for a forest contract. An extended waiting time for rights to harvest the forest reduces a farmer's perceived value of a contract. We also investigated whether accounting for the fact that farmers ignore one or more attributes when answering stated preference questions affects the MWTP, and found it to be systematically lower in the model where we considered that respondents ignore attributes.

Key words: China, Choice experiment, Forestry, MWTP, Ignoring attributes, Property rights.

JEL classification: D61, Q15, Q23, Q50, Q51

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1. Introduction

Property rights theory is of fundamental interest to economists due to the importance of understanding investment decisions (Demsetz 1967). Furthermore, property rights are preconditions for economic growth (North 2005). Property rights are often defined and modeled as a bundle of rights, e.g., tenure security, transfer right, collateral right, etc.[2] One central issue regarding property rights in recent economic research focuses on the link between property rights and investment incentives (e.g., Jacoby et al. 2002; Besley 1995: Feder 1987; Li et al. 2000). The main evidence from this strand of literature is that improved property rights are important for rural development, since investment can only flourish when there is a reasonable chance of reaping rewards from it.

Theoretically, it is often assumed that private ownership creates incentives for owners to utilize resources more efficiently, compared to common ownership (Demsetz 1967). For example, privatization is perceived as a preferred solution to environmental problems, e.g., environmental pollution and resource depletion (Cole 2000). However, according to Kung (1994, 1995), but contrary to this Western economic theory, Chinese farmers do not necessarily hold a preference for private ownership when it comes to agriculture; in fact, farmers' preferences about the period of a specific contract vary across regions. In the exploration of institutional preferences in a Chinese context, other studies emphasized what factors shape property rights preferences. For example, Liu et al. (1998) suggested that privatization is more likely to appear in areas where the state has the least to lose, or the least to fear, while where the individual option value of future land access is the highest, land rights have been privatized the least. Rozelle and Li (1998) offered an innovative explanation of land-rights formation in China: land rights may be set by village leaders in pursuit of their objectives, subject to local policy and endowment constraints.

This paper investigates Chinese farmers' preferences regarding a set of property rights attributes of a forest contract. Unlike Kung (1994, 1995), this study provides a novel experimental analysis (choice experiment) of farmers' preferences about private forest contracts with different attributes. This means that we can provide policy makers with the

[2] Dasgupta (1982) refers to property as "a set of rights to control assets."

relative importance of these attributes, given the estimated individual marginal willingness to pay (MWTP) for them. This information can be particularly relevant and useful in cases where policy makers decide to carry out the reform in a gradual and experimental manner.[3] Since this is typical of how reform is implemented in China, identification of the most important policy attributes can help policy makers determine what to prioritize and avoid fast and comprehensive implementation of all major policy changes, which could be very costly.

There are good reasons why we chose to use a survey-based choice experiment to investigate farmer preferences. First, it is difficult to use a revealed preference method. Since most of the policy attributes do not exist today, we did not have revealed preference data to rely on. Second, it was not likely that we would observe enough variability in some of the contract attributes. Even if there are dramatic policy changes following forestry policy reforms, a few key policies are expected to have little or no variability, e.g., the harvest quota policy in the forest sector. Finally, the policy attributes might be endogenous. Therefore, even if revealed preference data did exist, we suspect it is of limited use for developing a reliable and valid model of how behavior changes in response to a change in the policy variable.

Unlike other studies, we focused on the forestry sector to study farmers' preferences for property rights. The forestry sector is an interesting case since it is undergoing reform, and some forestry policies are quite controversial. Researchers and policy makers typically describe the Chinese collective forestry sector as weathering a number of policy changes and even policy reversals (Liu 2001). However, the views of the farmers are unclear. Specifically, do farmers perceive forestry sector policies as uncertain, or is this exaggerated by researchers? If given a choice, what value would farmers put on various policy attributes of a contract? Furthermore, how do farmers view the controversial harvest-quota policy, and what is the relative importance placed on this policy? To answer these questions, we designed a choice experiment and conducted a household survey in *Guizhou,* a province in

[3] China's transition has often been portrayed as a gradual and experimental process, or expressed as—using Deng Xiaoping's widely quoted phrase—"groping for stones to cross the river" (Lin et al. 2003).

southwest China. In 2007, *Guizhou* started a pilot program of forest tenure reform for the village forestry collective in nine counties. As in other Chinese provinces, forestry tenure reform in *Guizhou* focuses on transferring forestry resources to individual households and empowering individuals with more responsibility for the collective forestland. This is therefore a highly suitable case for our study, and the results of the paper can provide relevant inputs for policy makers designing forestry contracts in forthcoming full-scale forestry tenure reforms.

In addition, we investigated the issue of whether respondents ignored attributes in the experiment and how to deal with this potential problem, following Carlsson et al. (2008). Theoretically, it is assumed by analysts that respondents consider all attributes and make trade-offs when answering stated choice questions. However, it has been observed that respondents sometimes only focus on a few attributes in a choice experiment. The empirical evidence on the effect of restricting parameters of ignored attributes is mixed (Campbell et al. 2006; Carlsson et al. 2008). While all previous studies were conducted in developed countries with relatively well-educated people, the experiment in this paper utilizes less educated farmers in China, which makes its findings quite interesting.

The paper is structured as follows. Section 2 describes the attributes and levels in the choice experiment, and Section 3 the econometric framework. The results are discussed in Section 4, and Section 5 concludes the paper.

2. Design of the Property Rights Choice Experiment

In our choice experiment, we asked the respondents to choose a contract for a hypothetical forestland. Figure 1 outlines the choice experiment scenario. In the introduction, the forestland was described to the respondents. The rotation cycles of timber on the forestland were set to 25 years. The contract had three possible tenure lengths—25, 50, and 75 years—to match the rotation cycles.

The respondents were informed of both the tenure length of a contract and the number of rotation cycles. The inheritance right of a forest contract was granted to the respondents' children or grandchildren since the longest contract was 75 years. Next, the attributes used in the choice experiment were explained. To facilitate the interview, we provided each respondent with a separate fact card describing the attributes. Figure 1 reports the scenario that was presented to each respondent. A detailed description of the attributes and their levels is given in table 1.

Figure 1 Choice Experiment Scenario Provided to Farmers

We want to understand what kinds of forest contracts you would prefer. Please think about a situation where the village offers you different types of contracts for a specific plot, and that you can only choose one of the contracts. The plot is located near the village, and it is good in terms of fertility, irrigation, and slope. The size of the plot is 2 *mu*.* It is covered by timber forest and the rotation age of the particular species is about 25 years. Last year, trees were planted on the plot. You will need to replant the same species with the same number of plants, and then give the forestland back to the village when the contract ends. The contract can be inherited by your children or grandchildren.

We will ask you to compare two different types of contracts for a specific plot. You will make seven choices, but you should see each choice as separate from the others. We ask several questions because we would like to see your choices in different situations. We will show pairs of cards that describe contracts you can choose from. We would like to know whether you would choose one of the two contracts or if you would rather not get a contract in that situation. There is no right and wrong answer; we are only interested in the choices you make. This is not a real situation, but we nevertheless ask you to make your decisions as if they were real.

* *Mu* is a Chinese unit of measure. 1 mu = 1/15 hectare.

Table 1. Attributes and Attribute Levels

Attributes	Description	Levels
Payment	Annual payment for a forestland contract	30, 60, 75, 90,120 Yuan*
Tenure length	The length of the contract	25, 50, 75 years
Risk of termination of a contract	This describes whether the contract will be prematurely terminated. If a contract is prematurely terminated, the farmer receives a small compensation, the size of which is undetermined. The risk is 5 out of 100 that the contract will be terminated.	No, Yes
Harvest quota	When the farmer applies for a harvest right, he/she does not always get it. With this contract, there is a 50% chance that he/she will get a harvest right when applying. If the farmer does not get it, he/she will have to wait 1, 2, or 4 years before harvesting.	1, 2 , 4 years
First right to renew a contract	This describes whether the farmer will be given priority to renew the contract at expiration. Note that the farmer does not know the price of the renewed contract. The price could be higher or lower than that of the old contract.	No, Yes

* US$ 1 = Yuan 7.42 (November 2007 exchange rate).

2.1 The Attributes

Since the forestry sector has an institutional background and a policy regime similar to the agricultural sector, we included some policy attributes that have proved to be important in the agricultural literature. We also included some policy attributes that are particular to the forestry sector. The attributes were identified through discussions with experts (mainly researchers specialized in forestry) and focus groups. The survey was tested in focus groups and a small pilot study was conducted in the province. Eventually, we were able to identify five important policy attributes to include in our contract design: annual payment of a

forest contract, tenure length, risk of termination of a contract, harvest quota, and first right to renew a contract.

Payment

The payment was designed as an annual payment for a forestland contract, rather than as a lump-sum payment, mainly for two reasons. First, in most cases, annual payments fit with how local village collectives collect forestland usage fees from forestland users. Second, had we used a lump-sum payment, a majority of households would most likely not be able to afford such a large amount of money, which would exclude this group from choosing a contract in a choice set. We argue that it would not be a reasonable payment scheme if, say, 50 percent of all respondents did not want to choose a contract from the alternatives. The annual payment and its five levels were ultimately decided after the pre-test in a pilot field experiment.

Tenure Length

In practice, contract length varies from village to village since there is no specific requirement from higher authorities on how long a forest contract should be. The only requirement from the central government is that forestland users must have the option to contract land for 30–70 years. Based on the information from a collective forestry tenure-reform survey in Fujian and a pilot survey in *Guizhou*, we decided that a rotation cycle of 25 years was reasonable to most local farmers. Thus, we varied the level of tenure length by multiplying the rotation cycle, leading to lengths of 25, 50, and 75 years. We believed the range was reasonable since it did not deviate much from the above-mentioned range stipulated by the central government. At the same time, it had enough variation for us to be able to observe farmers' preferences about tenure lengths of a contract.

Risk of Termination of a Contract

This attribute is used to assess how much farmers value a reduction in the risk of premature termination of a contract. Two attribute levels are given: 5-percent probability that the contract will be prematurely terminated, and zero probability that the contract will be prematurely terminated. An overview of the literature suggests that tenure security can be measured in several ways. Brasselle et al. (2002) measured tenure security in terms of inheritance, the right to lend and give, and the possibility of leasing and selling, and then constructed an index to represent tenure security. In the context of Chinese villages, most researchers use the frequency of land redistribution to capture tenure insecurity in agricultural land. Alternatively, a few studies have used tenure length to capture farmers' perceptions of tenure security. There are, however, several reasons why none of these measurements were suitable for our purpose. First, it would be difficult for farmers in a choice experiment if tenure security were measured by an index made up of various attributes. Second, there is no similar forestland redistribution system as in the agricultural sector. Third, tenure length was included to capture farmers' preferences for how long a contract they would like. Hence, the attribute "risk of termination of contract" is believed to be a more reasonable measure because it virtually coincides with farmers' experiences with previous forestry policy change. For example, the village collective took back the forest contract from individual households when the household management system reverted to collective management. Meanwhile, evidence regarding a few government policy reversals toward household ownership and use of trees over the last 25 years was found in several studies (Yin and Xu 1987). Therefore, we believe that this measure mostly captures farmers' perception of insecurity in a collective forestry sector.

Harvest Quota

Harvest quota is a forestry policy imposed by the central government. It requires that a farmer apply for a quota in order to gain the right to harvest timber.[4] Due to the limited

[4] When determining quotas, the central forest authority calculates the annual allowable harvest for each province, based on the national inventory carried out every five years. The provinces then allocate the quotas to the counties, then to the townships, and finally to the villages. Farmers apply for permission to harvest timber through township forestry stations.

number of quotas allocated to each village, farmers are not likely to get a quota for mature forests when they want it. Timber harvesting without a quota is defined as illegal logging. Farmers have to reapply for a quota the following year if they do not consider illegal logging to be an alternative. Quotas are allocated on a yearly basis.

To assess the impact of quota policy on forest farmers, we designed a policy attribute that described the rules and procedures of how the quota policy is implemented. It was constructed by varying how long the farmers would have to wait for a quota in case their application was rejected the first year. In this scenario, there was only a 50-percent chance that they would get a quota the first year. This design mimicked the actual market situation that farmers faced. We used the levels one, two, and four years of waiting for the quota if an applicant did not get the quota the first year.

First Right to Renew the Contract

One concern for the farmer is whether or not the contract can be renewed upon expiration. The possibility of renewing a contract provides farmers with more options when making a contract choice. Farmers are then not necessarily forced to choose a long contract to secure the user rights to a forestland. Alternatively, we can interpret this right as another dimension of tenure security. Tenure insecurity arises from the fact that farmers might not be able to get the same farm plot in the future, regardless of how much they have invested in that plot. Thus, the attribute "risk of termination of a contract" can be perceived as a measure of current tenure security, while the attribute "first right to renew the contract" can be perceived as an indication of future tenure security (Kung and Liu 1996).[5] In the design, we have two levels of the attribute: (1) there is a first right to renew the contract, and (2) there is not a first right to renew the contract.

[5] Note that "risk of termination of a contract" is a negative attribute, while "first right to renew the contract" is a positive attribute.

2.2 Design of Choice Sets

We used a cyclical design to construct the choice sets. A cyclical design is a simple extension of the orthogonal approach, in which the attribute level in the new alternative is the next higher attribute level to the one applied in the previous alternative. If the highest level is attained, the attribute level is set to its lowest level (Bunch et al. 1996). This design has level balance, orthogonality, and minimal overlap. Huber and Zwerina (1996) identified four principles in efficient choice design: (1) orthogonality, (2) level balance, (3) minimal overlap, and (4) utility balance. Utility balance was not considered in our design. In this particular case, it was not clear whether one alternative would dominate another alternative, since we did not know whether farmers preferred long or short tenure. We used the OPTEX procedure in SAS, which is a linear D-efficiency design procedure, to create 14 choice sets and randomly block them into two versions. Hence, there are seven choice sets in each version.

One concern in this choice experiment was whether poorly educated farmers would be able to make repeated choices with five attributes. We used six choice sets in our pilot survey, and this worked without any problems for most respondents. In the final design, we decided to take the two-way interaction effect into account.[6] Therefore, we needed to present each respondent with seven choice sets to enable estimation of the interaction effect. In each choice set, the respondents were asked to choose among three alternatives; the third choice was the "opt out" alternative, i.e., abstaining from signing a contract. All respondents were informed of each of the three alternatives. An example of a choice set for forest contracts is presented in table 1 in the appendix. In the follow-up question, we asked the respondents which attributes they had ignored when making choices.

[6] The two-way interaction is between "tenure length" and "risk of termination of a contract," and the assumption is that "risk of termination of a contract" can be valued differently for different tenure lengths.

3. Econometric Model

The theoretical foundation of the choice experiment approach is rooted in the Lancastrian consumer theory (Lancaster 1966), as well as in the random utility theory (McFadden 1974; Manski 1977). It is also closely associated with the information processing in judgment and decision making in psychology (Hammond 1955; Slovic and Lichtenstein 1971). A concise summary of the conceptual framework that outlines an individual's decision making and choice process can be found in Louviere et al. (2000). Although sharing the same theoretical foundation with the contingent valuation method, the choice experiment approach focuses on respondent preferences regarding the attributes of the scenarios in the design, rather than on specific scenarios. Respondents are asked to choose the alternative they would prefer. Considering the choice of contract in the study, if we assume that utility depends on choices made from the set of C alternatives, the random utility function can be specified as:

$$U_{iqt} = V_{iqt} + \varepsilon_{iqt} \tag{1}$$

where q denotes individual, i is alternative, and t is the choice situation. The utility is decomposed into a non-random component (V) and a stochastic term (ε). ε is the aspect of utility that can not be observed by the researcher and captures the factors that affect the utility but are not included in (V). Suppose that the respondent is presented with two alternatives in choice situation t. Alternative i will be chosen over alternative j if and only if the utility derived from alternative i is larger than that of alternative j. Of course, the utility derived from an alternative depends on its attributes.

$$U_{iqt} = V_{iqt} + \varepsilon_{iqt} > U_{jqt} = V_{jqt} + \varepsilon_{jqt} \tag{2}$$

One approach commonly used to estimate the utility function in applied work is the random parameter logit (RPL) model, or mixed logit model. The popularity of the RPL model rests on two advantages. First, unobserved heterogeneity preference is accounted for in economic analysis by allowing model parameters to vary among individuals. Second, the IIA (independence of irrelevant alternative) assumption is relaxed with this model. (See

Train (2003) for a detailed description of the RPL model.) The utility function for an RPL model can be modeled as:

$$U_{iqt} = \alpha_{iq} + \gamma_i z_q + \beta_q x_{iqt} + \varepsilon_{iqt} \quad (3)$$

where x_{iqt} is a vector of attributes and z_q is a vector of socio-economic characteristics that will also affect utility. The alternative-specific constant α_{iq} captures an intrinsic preference for a specific alternative. In our case the alternative-specific constant is equal to 1 for the two contract alternatives, i.e., when the individual chooses a contract over the opt-out choice (i.e., no contract). A negative α_{iq} implies preferences for the status quo alternative, which in this particular case means preferring not to have a private contract. The coefficient vector β_q varies randomly among individuals, representing each individual's taste. ε_{iqt} is (independent and identically distributed) IID type I extreme value distributed.

In order to model taste variation among individuals in a RPL model, we had to assume a distribution for each of the random coefficients. We assumed that the random coefficients are normally distributed. This means that we did not restrict the sign of a coefficient to be only negative or only positive. This makes sense since it is difficult to say whether a farmer prefers a contract with long or short tenure. Except for the cost, which is a fixed variable, we treated all attributes as random variables. One reason for this is that the distribution of the MWTP is given by the distribution of the attributes. We had panel data since the respondents made repeated choices and we assumed that the random parameters were constant across the choice situations for each respondent.

In a RPL model, we do not know whether β_q is randomly distributed. The probability of a certain choice is therefore the integral over all possible variables of β_q (Train 2003). The RPL probability can be expressed as:

$$P_{iqt} = \int \frac{\exp(\alpha_{iq} + \gamma_i z_q + \beta_q x_{iqt} + \varepsilon_{iqt})}{\sum_{j \in C} \exp(\alpha_{jq} + \gamma_j z_q + \beta_q x_{jqt} + \varepsilon_{jqt})} f(\beta)\, d\beta \quad (4)$$

where $f(\beta)$ is a density function. In general, the integral in equation (4) can not be evaluated analytically; hence, we have to rely on a simulation method for the probabilities. (See *NLOGIT 4.0 Reference Guide* for more technical details of the simulation method.)

Implicit in the above model, true or not, is that respondents considered all attributes when making choices. If this is not true, how could we adjust the model? One possibility was to put different restrictions on the individual parameter β_q, based on whether the respondents ignored any attribute. Hensher et al. (2005) excluded the ignored attributes in the estimation process by restricting β_q to zero for the ignored attributes. However, this raises the issue of what we should assume about the respondents' MWTP for an attribute; e.g., did they have a positive or negative MWTP for the ignored attributes as others, or did they actually have a zero MWTP? In addition, this also involved figuring out how to deal with the particular group of respondents who ignored the cost attribute (Carlsson et al. 2008). In a linear utility function, the MWTP is simply the ratio of the coefficients of the attribute to the marginal utility of money. This implies that if we exclude the cost attribute, we lose the key information used to estimate farmers' MWTP. In section 3, we discuss this issue in detail.

4. Results

The survey was carried out in September 2007. A total of 210 randomly selected households in 11 villages from 2 counties (Jin Ping and Ma Jiang) in the *Guizhou* province participated in the choice experiment and household survey.[7] Jin Ping and Ma Jiang are both located in the southeast part of *Guizhou* and are important forestry counties. In 2007, Jin Ping was selected as one of nine counties to participate in a pilot project of a forestry tenure reform. Thus, Jin Ping is undergoing a gradual shift from a centralized to a

[7] Six villages were randomly selected from *Jinping* and 5 from *Majiang*. We randomly selected 10 households from the first village Jin Ping, and 20 households from all other villages. In total, 110 respondents were from *Jinping*, and 100 from *Majiang*. This means 210 questionnaires were available for analysis and all of the respondents answered all seven choice sets.

decentralized forestry management system. By contrast, Ma Jiang still maintains a collective management of forestry. One issue in Chinese collective forestry is whether there should be collective management or household management. Therefore, the two counties provide two different examples in terms of forestry management.

4.1 Descriptive Statistics

Guizhou is one of the poorer provinces in China. The gross domestic product per capita was around 5,700 Chinese yuan in 2006, which is the lowest among all provinces, accounting for only 15 percent of the average Chinese gross domestic product per capita—37,000 yuan in 2006 (see NBS 2007). Our sample's average per capita income was 2,882 yuan, which is above the village mean of 1,102 yuan but below the provincial mean of 5,409 yuan. Table 2 shows that the average respondent age was 49 years. The average number of years of schooling was almost 6, while the average in the province was 6.75 years.

Table 2. Descriptive Statistics

Variable	Description	Mean	Standard deviation
Attributes			
Tenure, 50 years	Whether it is a 50-year tenure contract (1=yes, 0=no)	0.24	0.43
Tenure, 75 years	Whether it is a 75-year tenure contract (1=yes, 0=no)	0.24	0.43
First right to renew the contract	Whether the household has the first right to renew the contract (1=yes, 0=no)	0.33	0.47
Risk of termination	Whether there is a risk of contract termination (1=yes, 0=no)	0.33	0.47
Harvest quota	Number of years the household has to wait for a harvest quota	2.86	1.30
Cost	Annual payment for the forestland in yuan	51.07	43.56
Socio-economic variables			
Age	Respondent's age in years	49.49	12.41
Education	Respondent's education in years	5.97	2.99
Auction allowed	Whether the use of auction is allowed to transfer the forestry land (1=yes, 0=no)	0.55	0.50
House value	The value of the house in 2007 (10,000 yuan)	1.79	2.70

In the choice experiment, 10 percent (or 22) of the farmers never chose to contract forestland. The follow-up questions revealed that the reason for this was usually labor shortage in the family, not being able to afford the annual required payment to hold a contract in forestland, or a perceived lack of forest management skills. In order to obtain a

comprehensive picture of the farmers' views on the reform, we also asked a number of questions regarding respondents' views on the ongoing or upcoming tenure reform of forestland. The results are presented in table 3.

When asked who should be in charge of the forestland, 95 percent of the respondents supported the idea that it should be allocated to individual households for management rather than control by the village collective as before. This is not surprising since the farmers had more than 20 years of experience with an agricultural reform that established better-defined property rights, bringing substantial benefits to them. We could expect the enthusiasm for a similar decentralization system in forestry to be very high. More surprising was that around 56 percent preferred auctioning the forestland instead of buying at a fixed price. Allocation of forestland among villagers through the market is definitely something new to rural societies. Although there is emerging evidence that some villages are experimenting with decentralization through auctions, it is largely unfamiliar to most forest farmers. In most cases, the price of getting a contract for the forestland as well as the payment scheme is mainly decided by the village collectives, although some farmers are involved in negotiations about the price of a contract with the local authority. Therefore, it is remarkable that farmers want to rely on the market to allocate forestland.

In terms of access to village forestland, 60 percent of the respondents supported the proposal that farmers from outside the village should be able to get a contract. Among the villagers who did not support this proposition, 62 percent changed their minds when told that the local community could get more money and spend it on the village infrastructure as a result of the proposition, since outsiders are able to offer more for a contract. Still, the remaining 25 respondents insisted that only local villagers should be entitled to contract the village forestland.

Table 3. Farmers' Attitudes toward the Forest Tenure Reform (%)

	Yes	No
1. Is it a good idea to transfer the forestland to the individual households for management?	95	5
2. Which way of transferring the local forestland do you prefer—fixed price or auction?	44*	56**
3. Should persons from outside your village be allowed to get contracts in your village?	60	40
4. Should persons from outside your village be allowed to get contracts in your village if the village gets more money to spend on infrastructure, schools, and health care by letting people from other villages get contracts?	62	38

* Fixed price. ** Auction.

4.2 RPL Results for Choice Experiment

As mentioned, the forestry management systems are different in the two sampled regions, and consequently we started by estimating separate models for each region. In order to test whether individual-specific characteristics explain the contract choice, we included the interaction between the alternative-specific constant and socio-economic variables in the estimation.[8] In addition, for simplicity, we expressed one attribute as "no risk of termination," rather than as "risk of termination."

The results of the RPL model are reported in table 2 in the appendix. They are estimated with simulated maximum likelihood, using Halton draws with 500 replications.[9] The estimated models showed that farmers had similar preferences in the two regions, except

[8] We focused on the estimates for attribute parameters. Estimates for socio-economic variables are not reported in table 2 in the appendix.

[9] We also investigated the interaction effect between tenure and the risk of contract termination. The insignificance of his effect led us to proceed without it.

for when it came to the tenure attribute. Yet, at this stage, we needed to be careful with the analysis of an overall comparison, as the estimated parameters in the two sub-samples are confounded with the respective scale factor. Hence, we tested the hypothesis that the sub-samples shared the same population parameters, controlling for scale factor differences. We did this with a likelihood ratio test, where the scale parameter was estimated with a simple grid-search procedure.[10] The results suggested that we could not reject the hypothesis of both equal parameters and equal scale factors. Thus, considering that RPL is data-intensive and minor preference heterogeneity is detected across regions, we decided to proceed with a model on pooled data. In the pooled sample estimation, a regional dummy was introduced to interact with the tenure attribute so as to accommodate preferential differences across regions.[11]

Table 4 reports the RPL models. In the final specification, we included two dummy variables for the harvest quota attribute. This allowed for a non-linear effect on the MWTP to avoid having to wait for the right to harvest.[12]

The alternative-specific constant was negative and statistically significant, which indicated a preference for the status quo alternative. This may be interpreted as status quo bias, implying that the respondents had a tendency to remain in the current situation. An explanation could be that farmers felt that the cost of a change in an experimental reform is substantial, and that the expected benefits, despite possibly being large, were not very certain. The estimated standard deviations of the random parameters were highly significant, implying that we were able to capture unobserved heterogeneity, with "harvest quota, waiting for 2 years" as the only exception. Both tenure length attribute coefficients

[10] A detailed description of the test can be found in Swait and Louviere (1993). Since estimated parameters are confounded with scale parameters, we accounted for scale factor differences to test parameter differences. This was done by using the grid-search procedure. Given the estimated scale parameters, we tested whether there were real differences in estimated parameters between the two subsamples.

[11] All interaction variables between the random parameters and the regional dummy are insignificant, except for the 50-year tenure contract attribute. Therefore, we only included interaction effect with tenure attribute in the final model specification.

[12] The two dummy variables are "harvest quota, waiting for 2 years" and "harvest quota, waiting for 4 years," meaning that the waiting time for a quota was increased by 1 and 3 years, respectively, compared to the reference alternative "harvest quota, waiting for 1 year."

were insignificant in the model for *Majiang*.[13] The negative sign indicated that the longer the contract tenure, the less preferred it was, but again, both coefficients were insignificant.

By contrast, forestry farmers in the reform region *Jinping* preferred a contract with a 50-year tenure, compared to the reference alternative of a 25-year tenure; this can be seen from the positive interaction effect between 50-year tenure and the regional dummy. However, the interaction term for a contract with 75-year tenure was insignificant. Thus, in both regions, the longest, 75-year tenure, was not seen as better than a contract with a 25-year tenure.[14] All parameters of the other three policy attributes were highly significant, suggesting that these attributes do influence individuals' choice of a contract. Forestry farmers had a positive preference for the attributes of "no risk of termination" and "a first right to renew an expired contract." The negative sign for the harvest-quota dummy variables suggests that an extended waiting time reduced the perceived value of a forestry contract. Among the socio-economic variables, a farmer's age was negatively significant, suggesting that an older farmer is less likely to take a contract. In addition, farmers who preferred auctioning of land were more likely to take a contract. This can be a reflection that they are more confident and competitive in their forestry management skills.

[13] When we say the effect of "tenure, 50 years" and "tenure, 75 years," it is always compared with the base scenario "tenure, 25 years."

[14] We tried an interaction term between "tenure length" and "risk of termination of a contract" in the estimation and it was insignificant, which suggests that farmers' perceived risk of contract termination did not differ with tenure length.

Table 4. RPL Estimation Results with Pooled Sample

	Coefficient	Standard error
Alternative-specific constant (contract)	-12.77**	5.37
Tenure, 50 years	-0.36	0.21
Tenure, 50 years,* *Jinping* region[a]	0.86***	0.27
Tenure, 75 years	-0.41	0.28
Tenure, 75 years,* *Jinping* region[a]	0.51	0.34
First right to renew contract	0.73***	0.14
No risk of termination	0.80***	0.12
Harvest quota, waiting for 2 years	-0.54***	0.17
Harvest quota, waiting for 4 years	-0.42***	0.17
Cost	-0.01**	0.002
Age	-0.09**	0.04
Education	-0.22	0.15
Auction allowable	3.36***	1.29
House value	0.70	0.55
	Coefficient std.	
Alternative-specific constant (contract)	8.26***	1.56
Tenure, 50 years	0.51**	0.28
Tenure, 75 years	1.87***	0.25
First right to renew the contract	1.08***	0.17
No risk of termination	0.81***	0.16
Harvest quota, waiting for 2 years[b]	0.35	0.31
Harvest quota, waiting for 4 years[b]	1.37***	0.24
Pseudo R-square	0.37	
No. of respondents	210	
No. of observations	1440	

***, **, * significant at the 1%, 5%, and 10 levels, respectively.

[a] Majiang: Region dummy is 0; Jinping: Region dummy is 1.

[b] Reference alternative: "harvest quota, waiting for 1 year."

4.3 Marginal Willingness-to-Pay Results

Table 5 presents the estimated MWTP results. Note that this is annual MWTP per contract since we used an annual payment as the cost attribute in the choice set. This applies to all the following discussions regarding MWTP. As with the tenure attribute coefficients, the sign of the estimated MWTP is different for *Majiang* and *Jinping.* The negative sign for *Majiang* suggests that farmers preferred a contract with short tenure.[15] At any rate, it is insignificant. In *Jinping,* the MWTP is positive for a contract with tenure of 50 years or 75 years, implying that farmers in the reform region preferred a contract longer than 25 years. However, the MWTP is significant for a contract with 50-year tenure and insignificant for a contract with 75-year tenure. Meanwhile, if we use "a contract with 75-year tenure" as a reference point, then the coefficient of "a contract with 50-year tenure" is not statistically significant, indicating that there is no difference in preferences for these two tenure contracts in *Jinping*. In addition, in *Jinping* there is a substantially higher MWTP for "a contract with 50-year tenure" than for "a contract with 75-year tenure." The different preferences for the different lengths of tenure may be interpreted such that farmers who have experienced experimental reform (J*inping* region) had a clear preference regarding the duration of a forestry contract.

The actual situation is that, in the *Jinping* region, a majority of forestry land is contracted with households for 50 years. This could give us two possible explanations for farmers' tenure preferences in *Jinping*. First, farmers might argue or negotiate with the local community for a 50-year contract in the reform process, in which case this finding might represent their real preference for how long the tenure of a contract should be. More importantly, it is consistent with their true preferences revealed in a contract between community and farmers. Second, the tenure of a contract might be decided by the local community, and in that case farmers might act as policy makers when they answer the questions (because they know most contracts in the villages are as long as 50 years). Nyborg (2000) argued that people might take the social point of view, i.e., applying social

[15] In the present application, when marginal WTP is negative for a certain policy attribute, i.e., a contract with a 25-year tenure, it means a measure of value that a household would be willing to forego in order to sign a forest contract without this attribute.

rather than personal preferences. If this is true, we can speculate that farmers might indicate the optimal duration of a contract based on the existing contracts in the village.

The MWTP for the other attributes is highly significant. In general, the results suggested that forestry farmers would be willing to pay a substantial amount of money to reduce uncertainty in forestry management. The uncertainty is due either to the risk that the contract will be prematurely terminated by the village for whatever reason, or that there will be no harvest quota available when the farmers need it, or even to the fact that there will be no possibility of renewing a contract when it expires. The MWTP is 136 yuan for an improvement in current tenure security, and 125 yuan for an improvement in future tenure security. In addition, the MWTP is 92 yuan for a reduction of the waiting time for a quota by one year, and 73 yuan for a reduction of the waiting time for a quota by three years. However, if we ask farmers to compare a contract that implies waiting for two years for a quota to one that implies waiting for 4 years, no significant preference is revealed.[16] In our opinion, this is additional important evidence that farmers suffer when there is an extended waiting time for a quota.

In order to understand the relative importance of these policy attributes, we ranked the MWTP of the attributes. Forestry farmers in *Majiang* ranked "no risk of termination" highest, and then "first right to renew the contract," followed by "harvest quota, waiting time 2 years." The ranking was the same for *Jinping.* Overall, the results showed that forestry farmers in both regions valued the current tenure security and future tenure security as the most important attributes. This conforms to the concern among the forestry policy makers and researchers that high uncertainty was created in the forestry sector by historical policy changes. More importantly, the uncertainty has not been reduced in the process of reform. This could have a negative impact on forestry performance if farmers lack confidence that a stable forestry policy environment will be created after the forestry tenure reform.

[16] If we change the reference alternative in the estimation and instead use "harvest quota, waiting time 4 years," then the coefficient for "harvest quota, waiting time 2 years" is statistically insignificant.

Table 5. Mean MWTP for All Attributes

	Mean MWTP	Standard error
Jinping		
Tenure, 50 years	85.20*	51.26
Tenure, 75 years	17.31	45.23
Majiang		
Tenure, 50 years	-61.69	40.49
Tenure, 75 years	-69.32	55.94
First right to renew the contract	125.01**	59.84
No risk of termination	136.34**	59.44
Harvest quota, waiting time 2 years	-92.72*	51.35
Harvest quota, waiting time 4 years	-73.38*	41.54

***, **, * significant at the 1%, 5%, and 10% level respectively.

4.4 Ignored Attributes

Respondents might ignore one or several attributes when making choices in the experiment, and this could have some impact on the estimated model parameters and the corresponding MWTP estimates. Table 6 summarizes the percentages of respondents who ignored a certain attribute, identified by a follow-up question after the choice experiment. In general, attributes were ignored to the same extent. The only exception was the tenure attribute, which was the least ignored attribute. If we compare this, for example, to Carlsson et al. (2008), the shares of respondents who ignored a certain attribute are higher in our study. Another way to analyze this issue is to look at how many attributes that the respondents ignored. As in table 7, a majority of the respondents ignored at least one attribute. In addition, around 10 percent ignored two, three, and four attributes, respectively.

Table 6. Share of Respondents Ignoring a Certain Attribute (%)

Region	Tenure	First right to renew contract	Risk of termination of a contract	Harvest quota	Cost
Jinping	10.0	23.6	28.2	27.3	19.1
Majiang	23.0	35.0	32.0	29.0	33.0
Total	16.2	29.0	30.0	28.1	25.7

Table 7. Share of Respondents Ignoring One or Several Attribute in Various Combinations (%)

Region	Ignored at least one	Ignored 1 attribute	Ignored 2 attribute	Ignored 3 attribute	Ignored 4 attribute
Jinping	54.5	27.3	10.3	8.2	9.0
Majiang	64.0	25.0	10.0	13.0	14.0
Total	59.5	26.2	10.5	10.5	11.4

Next, we focused on estimating MWTP, accounting for the fact that respondents ignored attributes. One way of doing this is to restrict the individual attribute parameters β_q to zero, and estimate MWTP by taking the ratio of the particular attribute to the cost parameter. However, we must be careful when interpreting these results. As mentioned by Carlsson et al. (2008), if we want to compare the results from the restricted model to the results from the standard model without restrictions, we have to make an assumption about the MWTP of those who ignored one or several attributes. The MWTP we obtained from the restricted model is the MWTP for those who did not ignore the attributes. Thus, if we compare this directly with the MWTP from the model without restrictions, we implicitly make the assumption that those who ignored one or several attributes generally had the same preferences as those who did not ignore, which further implies that the conditional MWTP from the model that considers ignored attributes is the unconditional average MWTP.[17]

[17] For a detailed discussion, see Carlsson et al (2008).

The main challenge in most studies analyzing ignored attributes is that analysts do not have sufficient information about why respondents ignore a certain attribute. Thus, in our study, we made assumptions about the farmers' MWTP in different scenarios. This allowed us to have an upper and a lower bound of MWTP. The respondent may revert to a simplifying strategy when answering these choice questions since Choice experiment generally is cognitively demanding (DeShazo and Fermo 2002).

One possible simplifying strategy is to ignore one or several attributes. This might be the case here since the respondents are poorly educated forestry farmers. For example, in a study with respondents in a developed country, Carlsson et al. (2008) found that people with a university education were less likely to ignore a non-monetary attribute than those with lower levels of education. If we can argue that ignoring a few attributes does not necessarily mean that a respondent is not interested in an improvement of those attributes, we might in fact believe that he/she would be willing to pay for a change in those ignored attributes. This leads to a natural assumption that the farmer has the same preference as those who did not ignore the attributes. On the other hand, farmers might ignore a certain attribute for other reasons.

Since a contract is a private good, the farmers might use their experience, knowledge, or something else to decide whether the fact described in the contract will happen to them. One example is a risk of contract termination. We described to the farmers that there was a small risk that a contract might be taken back by the village community for some reason. However, respondents might not believe this could happen to them. In such a case, the act of ignoring certain attributes may truly reflect the fact that the respondent is not willing to pay anything for a change in the attribute. Then, we can assume that the zero MWTP reflects true preferences.

The special case is how we dealt with ignored cost attributes. To simplify, we assumed that those who ignored the cost attribute had the same mean marginal utility of income as those who did not ignore the cost attribute. By doing so, we restricted the marginal utility of money to be positive. Carlsson et al. (2008) concluded in their paper that it was safe to say that those who ignored the cost attribute did not have zero marginal utility of money.

Table 8 reports the results for three different models.[18] The first model is the standard case, where we did not put any restriction on the estimated parameters. In the second and third models, we restricted the individual parameters for ignored attributes to zero. The difference between the second and the third model is the assumption about the MWTP for those who ignored the given attribute. In the second model, we assumed that respondents who ignored a certain attribute had the same MWTP for that attribute as those who did not ignore the attribute. In the third model, we assumed that respondents who ignored a certain attribute had a zero MWTP for that attribute.

In the third model, the average MWTP is substantially lower than that in the second model. For example, the mean MWTP is 76 yuan for the attribute "first right to renew the contract" in the second model, while it is 54 yuan in the third model. The difference in MWTP between the two models depends on the share of respondents who ignored one or several attributes. However, the ranking of MWTP displays the same pattern for both restricted scenarios. The attribute "no risk of termination" ranked the highest, and then "first right to renew the contract," followed by "harvest quota, waiting time 4 years." There is a slight difference if we compare it to the ranking in the standard model. The attribute found to be the third most important was "harvest quota, waiting for 2 years" in the first model. It makes sense that a farmer is willing to pay more to avoid a contract with longer waiting time for a quota. We can attribute the improvement of the results to the fact that the ignored harvest quota attribute is accounted for via follow-up questions. This, in turn, illustrates the importance of concern about ignored attributes in a stated preference method.

Our results differ from those presented by Carlsson et al. (2008). In their study, the WTP for the attributes did not vary between the standard model and the models where attribute parameters were restricted. However, our results are in line with the findings in Campbell et al. (2006), where estimated MWTP was systematically 50-percent lower for all attributes after accounting for respondents who ignored attributes. As suggested by them, high WTP

[18] We already have three different scenarios by assuming the preference for ignored non-cost attributes. The issue becomes more complex if we consider how to model preference for ignored cost attributes. Also, we believe that the range in MWTP of the scenarios is sufficiently large for us to show the differences in model between with restriction and without restriction.

without accounting for ignored attributes was probably due to the fact that a larger proportion of respondents ignored the cost attributes and thus did not make a trade-off between contract improvement and cost change.

In our study, further analysis regarding estimated MWTP suggested that the impact of restricting the parameters of MWTP is different for various attributes.[19] The difference between the model without restriction and the one restricting ignored attributes was largest for the attribute "tenure, 50 years" (79.4 percent) and "tenure, 75 years" (78.9 percent) in *Majiang*, although these two attributes are the least ignored ones (see tables 6 and 8[20]). A possible explanation for this is the heterogeneous preferences for tenure length among forestry farmers. The fact that some farmers might prefer a long contract and others might prefer a short contract had a greater impact on the mean WTP when we restricted those who ignored the tenure attributes and assumed they generally had the same preferences as those who did not ignore. By contrast, in a situation where all farmers have homogeneous preferences (either positive or negative), the impacts due to restricting ignored attributes are expected to be smaller. In this study, the difference in WTP varies from 31 percent to 79 percent, indicating a larger discrepancy than, for example, in Campbell (2006), where the difference varied from 56 percent to 77 percent.

[19] The impact is larger in the *Majiang* region.

[20] In order to know which scenario is closer to actual estimates (table 8, "Mean Unconditional MWTP for All Attributes with and without Restriction of Ignored Attributes"), we needed to know why respondents ignored certain attributes, and therefore used this information in the model estimation. This is an important future research topic.

Table 8. Mean Unconditional MWTP for All Attributes with and without Restriction of Ignored Attributes

	Without restriction	**Restricting ignored attributes**		
		Assumption about those who ignored the attributes		
	(1)	*Same MWTP (2)*	*Zero MWTP (3)*	*Difference between (1) and (3) in percent*
Jinping				
Tenure, 50 years	85.20	44.27	39.84	48.0
Tenure, 75 years	17.31	11.70	10.53	32.4
Majiang				
Tenure, 50 years	-61.69	-12.71	-9.78	79.4
Tenure, 75 years	-69.32	-14.63	-11.26	78.9
First right to renew the contract	125.01	76.06	54.00	39.2
No risk of termination	136.34	93.91	65.74	31.1
Harvest quota, waiting time 2 years	-92.72	-37.84	-27.24	59.2
Harvest quota, waiting time 4 years	-73.38	-56.46	-42.35	23.1

5. Conclusions

What property right attributes are important to forestland farmers in China? Based on a choice experiment, we assessed farmers' valuation of various property right attributes in collective forestry. The study was conducted in China's southwestern province, where collective forestry reform has not yet formally started. Hence, it is a suitable place to conduct this type of research since it can provide policy makers with useful inputs for future policy reforms. The major findings are that: (1) farmers are more concerned with what rights they get in a contract than with the length of a contract, and (2) farmers are very sensitive to any uncertainty related to a forestry contract. Uncertainty can occur within the contract period, at the end of the contract period, or even after an old contract expires.

Twenty years after the first round of Chinese forestry tenure reform (initiated in the 1980s), tenure security is still a crucial issue that remains unsolved in the Chinese collective forestry sector. Farmers are highly concerned with the risk of premature contract termination, and are willing to pay a high cost to avoid a contract with this attribute. Forestry tenure reform is not new to forest farmers. In the 1980s, forestland was distributed to the local farmers for management. However, the forestland was often quickly taken back by village collectives after the reform. So, with these experiences in mind, why would farmers believe that this new reform is different, and that it will establish well-defined property rights for individual-managed forestland? While it is no doubt important to promote the performance of forestry through decentralization, experience shows that, equally importantly, forestland management in the long run warrants a stable policy environment so that households gain more confidence in forestland tenure arrangement.

This paper contributes to the literature by analyzing farmers' perceived value of future tenure security of a contract. To our knowledge, this is the first study to separate tenure security into two dimensions—current tenure security and future tenure security—and then examine how important each is to a forest contract. A high MWTP for an improvement in future tenure security suggests that farmers place an equal value on a contract with future tenure security as on one with current tenure security. In the *Majiang* region, farmers are

more or less indifferent to the tenure length of a contract. Instead, they focus on what rights a contract stipulates. This may partly reflect the lack of confidence in forestry contracts in this collective forestry region, where no formal forestry reform has ever been conducted.

In the *Jinping* region, the farmers would like contracts longer than 25 years. This can be seen as a positive sign of forestry reform, and that confidence in individual forestry management arises as a result of reform policy. However, the fact that MWTP is higher for the attribute "a first right to renew a contract" than for "a contract longer than 25 years" may also partly reveal the farmers' prevailing concern for current tenure insecurity, even in a reform region. In addition, farmers are concerned with harvest regulations. The farmers have a clear and strong preference for a contract that includes an extended waiting time for a quota of only one year. This is an important point since we can expect that any contract that delays a farmer's harvest effort by more than one year could dampen his/her incentive to manage a forest plot into the future.

In both the academic and policy spheres of China, it is continually debated whether China's leaders should privatize land. Supporters of privatization argue that land rights is one of the areas most in need of reform in the rural sector and that privatization would promote efficiency. Others disagree with this and argue that the gains from land privatization would not be large and that, in fact, farmers are not in favor of privatization since they actually enjoy more security under current collective ownership of land where tenure rights are devoted to the individual farmers for management.[21] In our study, farmers did not show strong preferences for tenure lasting as long as 75 years. In most cases, only private forestland[22] has tenure as long as 75 years, making farmers perceive the land as their own. It is surprising that farmers are not interested in a contract of this length, especially since we did not find that farmers were more sensitive to the risk of contract termination the longer the contract. What, then, could be the reasons?

Kung and Liu (1997) pointed out that non-farm activities are an increasingly important source of household income in China. The decreasing reliance on land as the primary

[21] For more discussions, see Li et al. (2000)
[22] This is called self-keeping land by some researchers.

source of income is found to have significantly altered farmers' attitudes toward a host of issues pertaining to land ownership, i.e., private ownership. This could also be one potential reason in our study why forestry farmers were not in favor of 75-year contracts. We intentionally included a long contract with 75 years as a way of eliciting farmer's preference for "hidden privatization." The insignificant and low positive, or even negative, MWTP for this attribute seems to suggest that establishment of well-defined forestland user rights should be given priority in the political agenda, rather than comprehensive and fast privatization. At least, the latter is not in line with the farmers' current tenure preferences.

As far as we know, this is the first attempt to use the stated preference method to elicit farmers' preferences for various (the most important) property rights attributes in a contract. We hold that our results are policy relevant and that input of this type can be used to help design contracts that are in line with farmer preferences. There are successful examples of agricultural reform in developing countries, but unsuccessful reform cases are also frequently observed. Among all the factors that will influence the final outcome, one crucial factor is whether policy reform leads to a tenure arrangement that fits the needs of the locals (Ostrom 2006). This, however, is often ignored by policy makers.

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Appendix

Table 1. An Example of a Choice Set of the Forest Contract in the Questionnaire

What if you were offered the following two contracts?

Would you choose either of them, and if so, which one?

	Contract 1	***Contract 2***	***No contract***
Tenure length (years)	75	25	You do not get a contract for the plot
First right to renew a contract	You will not be given priority to renew the contract when the old contract expires.	This describes whether the farmer will be given priority to renew the contract at expiration. Note that the farmer does not know the price of the renewed contract. The price could be higher or lower than that of the old contract.	
Risk of termination of a contract	The contract will not be prematurely terminated.	This describes whether the contract will be prematurely terminated. If a contract is prematurely terminated the farmer receives a small compensation, the size of which is undetermined. The risk is 5 out of 100 that the contract will be terminated.	
Harvest quota	When you apply for a harvest right, you do not always get it. With this contract there is 50% chance that you get a harvest right when applying. If you do not get it, you have to wait 4 years to harvest.	When the farmer applies for a harvest right, he (she) does not always get it. With this contract there is a 50% chance that he (she) will get a harvest right when applying. If the farmer does not get it, he (she) will have to wait 1, 2, or 4 years before harvesting.	
Total payment (Yuan)	6750	1500	
Annual payment (Yuan)	90	60	

Your choice *Mark the chosen alternative with an X.*

Table 2. Estimation Results of RPL for Each Region

	Jinping		Majiang	
	Coefficient		***Coefficient***	
Alternative-specific constant (contract)	-21.24***	(6.80)	-4.19	(7.64)
Tenure, 50 years[a]	0.66***	(0.22)	-0.11	(0.22)
Tenure, 75 years[a]	0.17	(0.27)	-0.18	(0.30)
First right to renew the contract	0.79***	(0.20)	0.58***	(0.19)
No risk of termination of contract	0.97***	(0.19)	0.62***	(0.16)
Harvest quota	-0.15*	(0.08)	-0.21**	(0.08)
	Coefficient std.		***Coefficient std.***	
Alternative-specific constant (contract)	8.97***	(2.02)	7.68***	(1.74)
Tenure, 50 years	0.68**	(0.33)	0.93***	(0.32)
Tenure, 75 years	1.93***	(0.34)	2.23***	(0.40)
First right to renew contract	1.21***	(0.24)	1.11***	(0.25)
No risk of termination of contract	0.99***	(0.25)	0.80***	(0.22)
Harvest quota	0.57***	(0.12)	0.51***	(0.12)
Pseudo R-squared	0.38		0.36	
No. of respondents	110		100	
No. of observations	770		700	

***, **, * significant at 1%, 5%, and 10% levels, respectively. Standard errors are in parentheses.

[a] The reference alternative is "Tenure, 25 years."

Forestland Rights and Farmers' Investment Incentives in China --- An Empirical Study of Fujian Province

Ping Qin[1]

Abstract:

This study assesses the impact of tenure types, property rights, and harvest quota regulation on farmer investment behavior in Chinese collective forests, using household survey data from the *Fujian* province. The results indicate that investment incentives have increased due to the recent tenure reform in 2003, in which property rights have gradually been established, and granted to individual farmers via contracts. However, some issues remain. Farmers still perceive some tenure arrangements to be more uncertain than others, discouraging them from undertaking plot investments. The harvest quota regulation, introduced for stock conservation purposes, has acted as a disincentive in forestry management and development. These findings imply that further improvements regarding incentives to invest could be made if some of these constraints were relaxed through a policy reform.

Key words: Property rights, Forestry, Investment, China

JEL classification: Q15, Q23

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1. Introduction

Understanding land rights formation and measuring its effects on production are two central issues of political economy of development (Eggertsson, 1990; Besley, 1995). China's agricultural reform, widely regarded as successful, has been analyzed intensively (e.g., McMillan et al., 1989; Lin, 1992; Wen, 1993). Seeing the agricultural reform as a positive example, and given the depletion of forest in the 1950s and in the mid-1970s (Liu, 2001), a number of reforms in the Chinese forest sector have aimed at improving the property rights in order to avoid depletion of forest resources and at the same time increase or at least maintain timber production. Forestry is different from agriculture in the sense that in addition to private goods like fruits, fuel wood, and timber, forests also provide public goods like environmental benefits to society. Along with socio-economic development and continuous improvement of people's livelihoods in China, the forestry sector has become increasingly important in environmental protection for its role in wind breaking and sand fixation, water and soil conservation, headwater conservation, air purification, biodiversity and habitat conservation, sequestration of carbon dioxide, and eco-tourism (FAO, 1997).

To alleviate the shortage of forestry products and to improve incentives for forestry production in a sustainable manner, a number of policy reforms in the forestry sector have been introduced in China over the last two decades. These reforms have changed the administration, marketing, and investment infrastructure of the forest sector, as well as the tenure of collective forests (Liu and Edmunds, 2003). China's first round of tenure reform started in the early 1980s when a large area of collectively owned forestland in several provinces was allocated to individual farmers for management. The impact of this early tenure reform has been studied extensively, and the general conclusion has been that household management is more effective than collective management, given that property rights are better established in devolving the authority for forest management from the collective to the household. However, mostly based on national or regional data, the studies have primarily focused on the link between tenure types (household management, collective owned, and state owned) and investment incentives, rather than on the link between particular rights and investment incentives (Yin and Newman, 1997; Rozelle et al.,

2003; Zhang et al., 2003). A tenure type contains a bundle of rights. Therefore, if one finds that poor performance is associated with a certain tenure type, one may not be able to identify which imperfection in the bundle of rights leads to poor performance without detailed information on the exact composition of land rights. Hence, when we disaggregate the various tenure types into their components, it is possible to study how specific rights, instead of tenure types, affect production behavior.

This paper complements previous work by providing plot-level evidence on the performance of forest tenure reforms in *Fujian* in 2003, with a particular focus on the impacts of property rights. In 2006, we surveyed 520 households in *Fujian*, a province in southeastern China. We collected detailed information regarding farmers' perceived forest property rights, their investment behavior on the land, and socio-economic characteristics. The present study analyzes the impacts of the tenure arrangements and property rights on farmers' incentive to invest in individually managed forests. We focus on household forest investment, measured as the input intensity in terms of chemical fertilizer and labor. However, we do not consider the impact of the recent tenure reform[2] on harvest, mainly due to lack of sufficient data. In a forestry context, it could be questioned whether the time period is long enough to properly observe production behavior changes at the household level. The survey was generally conducted three years after tenure reform of 2003, although at some locations the reform had been introduced only one or two years before the survey.

Fujian is a province with a large area and volume of collectively owned forests. It is the only province that essentially did not participate in the first round of the tenure reforms of the 1980s. Instead, the provincial government re-formulated the collective management system into a so-called share-holding system, which did not result in any physical redistribution of land and forests to households. Instead, forests were divided into monetary shares that were distributed equally among villagers (Liu, 2001). Dividends from the forests were then divided among shareholders once a year or when dividends were available (Chen and Gao, 1997). In fact, the true essence of this system was to maintain forests under

[2]We mean the recent tenure reform *in Fujian* in 2003.

collective management, which was welcomed by the central forestry authority. Two decades later, the system was recognized as a failure since the contributions of forestry to rural income had been minimal (despite the fact that forestland occupies 80% of the rural land) and forest conservation had been difficult due to widespread farmer non-cooperation (Jiang and Liu, 1997). Under these circumstances, the *Fujian* provincial government approved the forestry tenure reform in 2003, whereby user rights were delegated to private farmers via tenure contracts. The primary objective of the provincial reform was to clarify or improve the property rights in order to improve the performance of collective forestry.

The outline of the paper is as follows: Section 2 introduces the property rights reform experience in China's non-state forestry sectors over the last two and a half decades, with a primary focus on the most recent reform initiatives in the beginning of the 21st century. Section 3 provides a summary of our field work and the sampled data. Sections 4 and 5 present the model specification and empirical findings. Section 6 concludes the paper.

2. Institutional Background

This paper focuses on the collective forestry sector. Chinese forests are either state-owned or collectively owned. State-owned forests are directly controlled by the government via the forest authority, while collective forests are owned by village collectives. However, the village collective forests are nevertheless heavily, if not completely, controlled by the government (Miao and West, 2004). Chinese collective forests account for 61% of the total forestland area.

Since 1978 when China started its agricultural reform and the household responsibility system swept the countryside, a number of reforms have been introduced in the collective forest sector as well, due to the great success seen in the agricultural sector. The major feature of the policy reform was similar and forestry user rights were delegated to the individual households, giving them more control over trees and other forestry resources. Yin and Xu (2002) hold that the two fundamental components of China's numerous reforms are, land tenure rearrangement and the introduction of market mechanisms. The

differences in terms of these two components are particularly large between the northern and southern regions. Forest farmers in the northern region[3] are subject to fewer forestry regulations and enjoy a higher degree of freedom in forest operations, while forestry decentralization has been carried out to a lesser extent in the southern region.[4] Although rural farmers in the southern region pushed local governments to allocate forestry land to them, the expansion of the contract responsibility system has been much slower. Farmers gained more control and access to forest resources during the reform period, but there was little enthusiasm among the farmers for tree planting due to the lack of confidence in property right security. The farmers were not convinced that the government would sustain the new policy (Yin and Xu, 1987). Under these circumstances, the *Fujian* forest authorities, who belong to the southern production region, decided to introduce the household-based management system in 2003. The objective was to clarify the property rights in the areas that had adopted the household-based production responsibility system in the 1980s,[5] and to establish the individual management system in the areas that had forests managed by village collectives or by a shareholding system.

In our study area, there are eight major types of collective forestland management: (1) Private forestland (*ziliu shan*),[6] (2) The planter owning the plantation (*shui zao shui you*), (3) Joint-household contracting (*lian hu jing ying*), (4) Single-household contracting (*dan hu jing ying*), (5) Leasing (*zu lin*), (6) Mortgage contracting (*ya jin guan hu cheng bao*), (7) Transferred young and middle-aged plantations (*zhuan rang zhong you lin*), and (8) Responsibility forestland (*zeren shan).*

[3] The Northern Production Region (or Central/North/Northwest Farm Forest Region) includes Beijing, Hebei, Henan, Liaoning, Shaanxi, Shandong, Tianjin, and parts of Anhui.
[4] The Southern Production Region (or Southern Collective Forest region) includes Zhejiang, Fujian, Jiangxi, Hunan, Guangdong, Guangxi, Hainan, Guizhou, and parts of Anhui.
[5] Thirty-two percent of households in *Fujian* adopted the household-based management system in the 1980s (Dai et al., 2002).
[6] This is sometimes referred to as self-keeping forestland. Following Jacoby et al. (2002), we use the term "private forestland".

We use the first three types but group types 4-8 into one category, *single-household contracting*, since they have many features in common and since we have few observations for some of these types. Among the sampled 52 villages, 24 have all four tenure types, 19 have three types, 8 have two and 1 has only one tenure type.

Private forestland[7] refers to the collective forestland distributed to the farmers to meet household needs for fuel wood and timber. In 2003, in the sample region private forestland plots represented about 7% of the total forestland area, and the proportion increased slightly after the reform in 2005. The collective in theory still ultimately owns the private plots and farmers cannot sell them. However, our field experience is that most village leaders do not exercise much control over farmer decisions on private plots such as leasing and transferring. In addition, compared to other tenure types, private forestland usually has longer tenure contracts. Some interviewed farmers think there is no time limitation with this contract, and even perceive the land as their own rather than as contracted. This tenure type applies to 32% of timber forests, 30% of bamboo forests, and 23% of economic forests.

The planter owning the plantation is the only tenure type where the investment leads to tenure right. This form of tenure has developed since the 1980s based on the principle that state-planted trees are state-owned, community planted trees are community-owned, and the fragmented trees planted by community members are privately owned. Prior to the reform in 2003, this tenure type provided almost the same tenure rights as private forestland. However, farmers' perceptions of tenure security were very low, primarily because forestland was not formally distributed to households and a majority of the households did not have contracts with the local authority. As a result, the focus of the reform was to confirm the ownership rights and issue the forest right certificate to the households. This tenure type is the dominant form of ownership in economic forest management in *Fujian* (in our sample, 14% of timber forests, 6% of bamboo forests, and 37% of economic forests are managed with this tenure contract).

[7] Tenure length might not be very strongly associated with tenure type. The requirement from the central government is that forestland users must have the option to contract land for 30-70 years. This suggests that the longest tenure for a forest contract can reach 70 years, which is similar to that of private forestland.

Single-household contracting is used to manage 32% of timber forests, 60% of bamboo forests, and 40% of economic forests. This is the tenure type where individuals' forestland management is based on a formal contract with the village community. Single household contracting differs from the other three tenure types in three major ways: (1) The difference between single household contracting and private forestland lies in the fact that many farmers in villages across China in fact treat their private plots as their own land whereas they do not have the same confidence for the forestland under single household contracting. (2) The single household contracting is the type of contract where tenure right can be obtained without any prior investment. The planter owning the plantation contract is the tenure type where the tenure right is obtained for the one who makes some investment in the land. (3) Under single household contracting, forests are owned and managed by one household, while under joint household contracting, they are owned and managed by several households. Bamboo is a special case in terms of *single-household contracting*. Most bamboo trees were allocated to the household for management in the 1980s, the first round of forestland decentralization. Thus, bamboo forests have a longer experience of *single-household contracting* relative to timber and economic forests.

Joint-household contracting refers to the case where several households manage the forestland jointly in a cooperative manner. In the sample, forest plots under the management of joint-household contracting accounted for 9% in 2003, and increased to 13% in 2005. *Joint-household contracting* is favored by the local authority as equity is important for both villagers and village leaders (Rozelle, 1994), and often it is perceived as an objective of the villager leader in local resource management (Rozelle and Li, 1998). In addition, egalitarian objectives in forestland redistribution are easier to achieve with *joint-household contracting* compared to single household contracting as forestland for redistribution differs in quality. The local community mainly organizes and directs this type of collective action. In many cases, participation of the farmers is not voluntary, though the level of participation can vary from region to region. In addition, it is widely perceived that property rights are not very strong. Joint-household contracting is widely adopted in timber forest management.

The harvest quota is an important regulation in China's forest sector that also implies a significant intrusion of the households' forestland property. The system was implemented in 1987 as a response to a rapid decline in the forest volume. According to Xu (2002), the forest authority has been unwilling to give up control over forest resources, and has been reluctant to further liberalization of the forest sector. The main reason is that government officials think that the state has invested heavily in the forest sector, and should reap the economic returns from this. Additionally, the harvest quota is considered a crucial policy to prevent drastic deforestation. The quota intends to constrain harvest within the scale of annual net growth. The basis of the quota setting is the national inventory carried out every five years. Based on the national inventory, the central forest authority calculates annual allowable harvest for each province. The provinces then allocate the quotas to the county level, then to townships, and finally to the village level.

The harvest quota is a controversial policy. Some argue that it has been successful in reducing forestry degradation and depletion, and that it is still needed (Zhang, 2002). Others argue that it has not been successful neither from a financial, nor from an environmental perspective (Hyde, 2002). Critics stress that the objective to protect China's ecological forest resources has not been achieved under the harvest quota system, and despite heavy investments by the government in the management of forest resources and forest planting, the quality of forests has deteriorated (Xu, 2002; Liu, 2001). Moreover, some critics hold that the harvest quota system leads to negative effects like illegal logging, rent seeking, high government administrative costs and low efficiency (Xu, 2002). We found a related example in one of our sampled villages where the village leaders are in control of the harvest quota. The villagers complained that it is difficult to obtain harvest quota, and that they are forced to sell all forest timber to the village leaders far below market prices, while the village leaders who have access to harvest quota can make a profit by selling the timber forest at market prices.

3. Field survey

Fujian, located in southeastern China, is a mountainous, ethnically diverse province. The area of designated forestland is around 9,000,000 hectares, accounting for almost 75% of the total land area. The forest coverage is around 63%, the highest in the country. In *Fujian*, forests are essential to the livelihoods of indigenous inhabitants, especially to the marginal groups, including the poor, women, and ethnic minorities. Seventy percent of the ethnic minorities are concentrated in the remote upland valleys, where they mainly depend on forest products. In addition, forestlands play an important role in preventing soil erosion, a major environmental issue in China.

The data was collected in March and April of 2006. The enumerators were graduate and undergraduate students from Beijing University and Fujian Agricultural and Forestry University. The survey sampled seven districts from the three major forestry prefectures in *Fujian*: Nanping (*Yanping, Jianyang and Songyi*) and Ningde (*Fuan and Pingnan*) in the north and northeast part of *Fujian*; and Longyan (*Changting and Liancheng*) in the southwest and west part of *Fujian*. From each district, three counties were randomly selected. In the counties, townships are divided into three groups according to the endowment of forest resources (rich, middle, and poor) so that one will be selected from each group. Two villages are randomly selected in each township and ten households are randomly selected from the registration list provided by the village authority. In total, 520 forestry farmers participated in our survey. A total of 445 questionnaires from 52 villages are available for analysis.[8]

[8] 75 questionnaires are not use mainly due to strange or missing values.

4. Model specification and data

Theories on the link between property rights and investment incentives suggest a positive impact of rights on farm investment. Broadly speaking, when such rights prevail, landowners are expected to be both more willing and more able to undertake investment. Most studies on investment incentives have been done in the agricultural sector. For example, Jacoby et al. (2002) found a positive relation between tenure security and investment incentives in a Chinese context. Li et al. (2000) provided evidence that better tenure security encourages land-saving investments in China. Besley (1995) captured the positive link between tenure security and investment based on the argument that insecure tenure increases the risk associated with farming through the threat of dispossession in Ghana. In addition, tenure security is more important when one considers medium- to long-term investments, such as tree planting and construction of terrace or soil conservations structures (Ali et al., 2007; Deininger et al., 2006).

This paper distinguishes itself from the research above in that we are interested in investment decisions in the forestry sector. Some studies show that the effect might be different for forestry than for agriculture. For example, Holden and Yohannes (2002) investigated the planting of perennial crops using data from 15 different sites in southern Ethiopia, and showed that tenure insecurity has little effect on the decision of farmers to plant perennials, while it is the main factor behind under-investment in tree crops. Our paper focuses on farm investments such as labor and fertilizer. Based on the theoretical work on links between farm investment and land rights (Besley, 1995; Li et al., 2000; Brasselle, et al., 2002), and considering the investment decision in a forestry context, we model the impact of tenure type, tenure security and harvest quota on investment as:

$$Y_P = X(S_p, R_p, D_p, H_p)$$

where for plot p, S_p is a vector of tenure types; R_p is a vector of property rights; D_p is a vector of plot attributes; and H_p is household attributes. In the study, we focus on the two major inputs labor and chemical fertilizer. In timber forest management, labor is the most

important input. We measure labor inputs as the number of working days on a plot.[9] Although fertilizer is rarely used in timber plantation and few households use chemical fertilizer on plots, it is intensively used in economic forests and on bamboo. Chemical fertilizer inputs are measured as the monetary value of total fertilizer applied on each plot. Application of the two major inputs varies among forest species. For example, the average labor input per mu is 22.42 working days in economic forest production, but only 3.64 in bamboo production and 1.46 in timber production.[10] Similarly, fertilizer is most intensely used in economic forests with 98.85 Yuan/mu, and it reduces to 5.28 Yuan /mu in bamboo forest production, and 1.54 Yuan/mu in timber forest production.[11] Note that the inputs in joint household contracting are the total amount jointly invested by all involved households.

The input intensity, Y_P, can be either zero or positive. Since trees do not require inputs every year, it is very likely that there were some plots without any labor or fertilizer inputs in the year we collected survey data. Forest farmers solve optimization problems, and for some farmers the optimal choice will be the corner solution at a given year, $Y_P = 0$ (Wooldridge, 2002). This does not mean that the farmers never invest; it just means that they did not invest under these conditions and in this particular year. Thus, to deal with the censoring at zero of the dependent variables, a censored regression model is used to estimate. The standard Tobit model is:

$$Y_p = \beta' x_p + \varepsilon_p \qquad \varepsilon_p \sim N(0, \sigma^2)$$

where Y_p is the investment made on a plot, and the vector x_p includes the variables we previously discussed that will influence the investment decision. The vector β is the coefficients to be estimated, and ε_p is the error term assumed to be normally distributed. σ is the standard error. We only observe zero or positive amounts of investments:

$$Y_p = Y_p^* \ if \ \ Y_p^* > 0 \quad \text{and} \quad Y_p = 0 \ if \ \ Y_p^* \le 0$$

[9] One working day equals approximately eight hours.
[10] *Mu* is a Chinese unit of measure. 1 mu = 1/15 hectare.
[11] 1 USD=8.02 Yuan in March 2006

$$E(Y_p) = \Phi(\beta' x_p / \sigma)(\beta' x_p + \sigma\lambda_p) \quad \lambda_p = \frac{\phi(z)}{\Phi(z)}$$

$\Phi(z)$ and $\phi(z)$ are the standard normal distribution function and standard normal density function, respectively.

Furthermore, considering the fact that a farmer might apply the same investment strategy for several of his plots, we estimate a random effects Tobit model. By allowing for the correlation between error terms, the model relax the assumption that the investment decision for each plot is made independently by farmers (Wooldridge, 2002). We therefore specify the error term as:

$$\varepsilon_{ip} = u_i + v_{ip} \qquad u_i \sim N(0, {\sigma_u}^2); v_{ip} \sim N(0, {\sigma_v}^2)$$

where u_i denotes the unobservable individual specific effect and v_{ip} the remainder disturbance. The components of the error term are independently distributed. The correlation term between the errors, denoted with rho, is:

$$Corr[\varepsilon_{it}, \varepsilon_{is}] = \rho = \frac{\sigma_u^2}{\sigma_u^2 + \sigma_v^2}$$

In the model specification, it is assumed that the correlation between successive disturbances for individual plots can be reduced to ρ. If the household-specific characteristics are invariant across the plots, and the characteristics of the plots are variant, this may cause a potential problem of correlation among plots. Thus, this lays the basis for using a random effects estimator (Wooldridge, 2002). We can conduct a t-test for rho to decide whether a random effects model is more suitable. If rho is significant, then we can not reject the random effects model.

Since the dependent variable is zero and positive, another model that accounts for this type of problem is a so-called two-equation model, where the first equation is a Probit model and the second is a Truncated model (Wooldridge, 2002). In a two-equation model, the two decisions –whether to invest and if so how much to invest – are modeled and estimated separately. Obviously, this is a less restrictive model compared to the Tobit, where the two

decisions are estimated as a single equation. Therefore, we estimate this two-equation model as a comparison.

There is a large variation in the number of zero investment on plots among different tree species. In terms of labor input, the number of plots on which farmers do not apply any labor is 283 out of 533 for timber, 71 out of 478 for bamboo, and 27 out of 196 for economic forests. For fertilizer, the number of plots on which farmers do not apply any fertilizer is 393 out of 478 for bamboo and 63 out of 196 for economic forests.

In what follows, we will focus on how to measure tenure types, property right levels, and harvest quota.

Measurement of tenure types. Following Jacoby et al. (2002), Li et al. (2000), and our discussion in Section 3, we define four major tenure types: *Private forestland*, *The planter owning the plantation*, *Joint-household contracting* and *Single-household contracting*. We include dummy variables that are supposed to capture the impacts of the tenure types relative to the reference alternative. One concern is that there is an issue with endogeneity with respect to tenure types. At the village level, there is considerable variation in tenure types. Among the 52 villages, 43 have at least three tenure types. Thus, tenure type is not necessarily correlated with village characteristics. At the same time, there could be an endogeneity problem at the household level. For example, a farmer could be more active in obtaining a specific tenure type for land in which he has made large investments.

Measurement of property right levels. We use two different alternatives for measuring property right levels, and call the first one the *Rights completeness approach*, and the second the *Redistribution approach*.

For the *Rights completeness approach*, we construct an overall indicator of security based on a set of rights that farmers enjoy. Table 1 describes the farmers' perceived rights for the different forest species. We take the bamboo as an example. The right to choose the type of

forest to plant and the right to grow crops under the trees is enjoyed by more than 98% and 79% of all households, while the figures for the right to transfer forestland to local villagers and the right to transfer the land to outside villagers is 73% and 58%, respectively.

Table 1. Farmers' perceptions of their rights for each forest species.

Type of land right	**Timber**	**Bamboo**	**Economic Forest**
		Percentage (%)	
1 Right to grow crops under the trees			
Yes	98.7	98.11	98.98
No	1.3	1.89	1.02
2 Right to choose the type of forest to plant			
Yes	88.5	78.45	92.34
No	11.5	21.55	7.66
3 Right to transfer the forestland to local villagers			
Yes	81.0	72.80	80.10
No	19.0	27.20	19.90
4 Right to transfer the land to outside villagers			
Yes	69.9	57.74	64.26
No	30.1	42.26	36.74
No. of observations	554	478	196

We characterize the rights completeness by three levels. If a farmer only has the right to choose the type of forest to plant and the right to grow crops under the trees, we label it weak property rights. If the farmer also has the right to transfer the forestland to local villagers, we label it medium property rights. Those who are entitled to all four rights in Table 1, have strong property rights. Table 2 presents property right levels by forest species. Based on the *Rights completeness approach*, a high percentage of farmers enjoy a high level of property rights.

Table 2. The category of rights completeness level for each forest species.

Property right level	**Timber**	**Bamboo**	**Economic Forest**
Weak	105 (19%)	130 (27%)	39 (20%)
Medium	62 (11%)	72 (15%)	33 (17%)
Strong	387 (70%)	276 (58%)	124 (63%)
Number of observations	554	478	196

For the *Redistribution approach*, we focus on rights insecurity caused by the frequency of land redistribution, assuming that the higher the frequency, the more insecure the farmers feel about their rights to the forests. Given the concern that the number of forestland redistributions could be endogenous, we use the frequency of crop land redistributions as an instrument since these are decided by the same village leaders who decide about forestland redistribution. In the questionnaire, we asked the farmers how many agricultural land redistributions they had experienced in the last five years. By asking about this number, we can capture how insecure they feel about tenure in the agricultural sector. Second, since most villages use the same strategy to manage resources in different sectors, we can argue that the frequency of agricultural land redistribution might affect farmers' perception of tenure security in terms of forestland management. The farmers in our sample had on average experienced 1.26 (see Table 3) redistributions of agricultural land, with a maximum of 8 and a minimum of 0.

Harvest quota. There is one important reason why the harvest quota may influence farmers' investment decisions in forest development. Uncertainty of the return on long-term investment increases if farmers are not allowed to harvest timber when they need it. Since farmers have little power in the market to make forestland transfers when the quota is in the hands of local elites, their bargaining power is limited. In this sense, we might interpret the negative impact of the quota policy on investment as a result of decreased profit of rental activity. For example, Li et al. (2000) concluded that better rental rights appear to have a positive effect on fertilizer use. One way to capture the restrictiveness of the quota

regulation is to use the amount of quotas obtained at the household level.[12] However, since we only sampled 10 households in each village and due to random sampling, we only observe a few households with quotas. In addition, household level measurement of harvest quota is likely to be endogenous. For example, individuals' access to quota depends on their efforts to lobby the local authority, and therefore, more powerful or well-connected farmers may obtain quota in a timely fashion. Therefore, we decided to use a village level measure, allowable harvest as a proportion of the total standing volume, as a proxy. In addition, this proportion is averaged over three years (2003-2005) to eliminate yearly fluctuations. The rationale behind this is that harvest quota could be allocated to different villages by township government more or less evenly within a longer time period.

Other control variables. We also control for some physical characteristics of the plots and for household attributes since they may also affect farmer's investment decisions. The included variables are: age and education of the household head, male labor and female labor inputs per unit of land, current monetary housing value, and total amount of forest acreage. Plot attributes include plot acreage, distance of a plot to closest road, and the distance of a plot to homestead. In addition, we control the average off-farm wage in a village since farmers may invest less in forestry when they have better off-farm opportunities. Descriptive statistics are reported in Table 3.

[12] Harvest quota regulation does not strictly apply to *private forestland.* However, since timber on private forestland is normally harvested for home use, and the amount allowed is relatively small, we believe that the problem of some correlation between harvest quota and tenure type should be minor.

Table 3. Descriptive statistics

Variable		Timber		Bamboo		Economic Forest	
		Means	**Std. dev**	**Means**	**Std. dev**	**Means**	**Std. dev**
Dependent variable:							
Labor input (Working day/mu)		1.46	3.73	3.64	8.08	22.42	33.40
Fertilizer (Yuan /mu)				5.28	26.31	198.86	364.53
Independent variable:							
Plot attributes:							
The size of plot (Mu)		20.00	32.71	15.40	25.11	3.26	4.11
Distance from homestead (Km)		2.26	1.93	1.99	1.86	1.53	1.17
Distance from road (Km)		1.51	1.77	1.19	1.24	1.01	0.89
Young or middle aged forest (1 yes, 0 no) [b]		0.51	0.50				
Near matured forest (1 yes, 0 no)		0.26	0.44				
Mature forest (1, 0 otherwise)		0.23	0.42				
Household attributes:							
Household head age		49.86	10.27	50.76	11.45	51.23	10.17
Household head education (Years)		4.79	3.25	4.78	3.22	4.58	2.92
Female laborers (Numbers/mu)		0.17	0.33	0.12	0.23	0.21	0.26
Male laborers (Numbers/mu)		0.19	0.36	0.14	0.35	0.21	0.25
Off=farm wage rate (Yuan /day)		32.95	9.96	32.32	9.08	32.89	8.01
Tenure type:	Private land (1 yes, 0 no)	0.32	0.47	0.33	0.46	0.23	0.42
	The planter owning the plantation (1 yes, 0 no)	0.14	0.35	0.06	0.24	0.37	0.48
	Joint-household contracting (1 yes, 0 no)	0.22	0.41				
	Single-household contracting (1 yes, 0 no)	0.32	0.47	0.61	0.35	0.40	0.49
Tenure security:	Redistribution approach	1.26	1.65				
Tenure security:	Benchmark (1 yes, 0 no)	0.19	0.39	0.27	0.46	0.20	0.40
	Weak property (1 yes, 0 no)	0.11	0.32	0.15	0.36	0.17	0.38
	Strong property (1 yes, 0 no)	0.70	0.46	0.58	0.49	0.63	0.48
Harvest quota: Allowable harvest / Standing volume (%)[c]		9.47	1.40				

Note: [b] Forest age is the villager's subjective evaluation. [c] Averaged over three years, 2003-2005.

5. Results

Table 4 presents marginal effects of the random effects Tobit model of impacts of tenure and rights on investment for each forest species. We also estimated the two-equation model. In terms of signs and significance levels of marginal effects, there were small differences compared to the Tobit model. The estimated correlation between error terms across decisions, rho, is significant, which suggests that we cannot reject the random effects model in favor of the model with no correlation. Therefore, we will focus on the results from the random effects Tobit model.[13]

We begin with discussing the results for timber forest. The marginal effect is largest for the planter owning the plantation, followed by private forestland, and then single-household contracting. All of these three marginal effects are positive and statistically significant. The differences in marginal effects between the planter owning the plantation and private forestland is 0.02, and the difference increased to 0.063 with joint-household contracting. However, the differences in marginal effects among these three tenure types are not statistically significant. In summary, the results show that farmers are less likely to invest labor inputs in plots that are jointly managed by several households, compared with the other tenure types. Why is the labor intensity lower for plots with joint management? As discussed before, the joint-household contracting system is in an experimental stage, and primarily initiated and organized by the local government. The property rights involved are in many cases not yet well established or clearly defined. Thus, a potential weak link between efforts and returns discourages households from investing their labor inputs in this type of plot.

For economic forests, tenure of the planter owning the plantation has a positive and significant impact on farm investments compared with a single-household contract. The

[13] We also estimate the model with a village dummy, rather than with a regional dummy. The significance of the marginal effects of tenure types is then similar to the result in Table 4. All models are available upon request from the author.

marginal effect is 0.662 and significant.[14] There are two potential explanations for the positive effect. One is that the tenure dummy variable captures the effects of other rights that are not explicitly included in the estimation.[15] Yet, these missing rights have significant power in influencing the investment decision (Li et al., 2000). The other explanation is that the tenure dummy variable captures farmers' general confidence about the current land rights, which cannot be explicitly captured by expressed rights (Besley, 1995). The planter owning the plantation is the primary tenure for economic forest management, and this was regarded as the tenure with low security prior to reform. Subsequently, there was a lack of confidence among farmers investing in plots with this tenure. The positive impact of this tenure type could be due to that tenure security increased after the tenure reform, making inputs more likely to be invested in these plots. However, we do not find a significant effect for bamboo forest, suggesting there was not much change in investment incentives during the reform process for this tenure type, compared to for single-household contracting.[16] One possible reason is that single-household contracting for bamboo forests started as early as the 1980s via formal contract, which gave farmers more security in terms of tenure rights. The relatively high confidence among farmers in bamboo management has led to similar and reasonable investments for all tenure types.

The results indicate that tenure security measured by our set of property rights does not affect input intensity for any forest species. We believe that this has to do with trust and expectations. More rights specified in a contract do not necessarily lead to farmers enjoying a higher level of tenure security. If a village community for some reason decides to take back a forest contract, the farmers lose the forest, although they are given much decision power on the forestland. The two tenure types, private forestland and the planter owning the plantation are examples of this. Although private forestland provides almost the same

[14] The difference in marginal effects between private forestland and the planter owning the plantation is not statistically significant.
[15] Tenure type is a conglomeration of many specific rights. As mentioned by Li et al. (2000). If we include all of the potential rights that have significant influence on the investment decisions, tenure type should be redundant and the coefficients of tenure type should be insignificant.
[16] As for economic trees, the difference in marginal effect between private forestland and the planter owning the plantation is also not statistically significant for bamboo forest.

tenure rights as when the planter owns a plantation, we observed in the field that a majority of rural households regard private forestland as a more secure tenure type. In other words, they think it is less likely that they will lose private forestland relative to the planter owning the plantation. Tenure security measured by the frequency of cropland redistribution is a significantly negative determinant of input use for bamboo forest. However, we do not find similar evidence for timber or economic forest.

The empirical analysis shows that the impact of a less strict harvest quota leads to increased labor intensity for timber forests. This effect does not diminish when we control for tenure types.[17] The result implies that the harvest quota regulation, implemented to prevent deforestation, is a disincentive to undertake plot investment. This finding is in line with a number of observations in other studies that regulation may help protect existing forests, while acting as a disincentive for households to establish new timber plantations (Xu, 2002).

The other control variables gave mixed results for different forest species and inputs. Plot size is a negative and significant determinant of labor input for timber, which might be due to the presence of economies of scale. The estimated marginal effect for young or middle aged forest is positive and significant, suggesting that more labor inputs are needed at an early stage. The estimated marginal effect for age and total amount of acreage per household is only negative in the fertilizer equations for economic forests. The estimated marginal effect for current value of residential house is significantly positive in the fertilizer equation for bamboo trees.

[17] Harvest quota indicates the relationship between allowable harvest and standing volume. This means that more quotas, or less restrictive regulation, affects forest timber investment positively.

Table 4. The impact of tenure and rights on the input use in different forest species- Marginal Effects

	Labor			Fertilizer	
	Timber	**Bamboo**	**Economic forest**	**Bamboo**	**Economic forest**
Forestland rights:					
Private forestland (1 yes, 0 no)	0.419***	0.072	0.185	-0.071	-0.349
	(0.104)	(0.076)	(0.303)	(0.079)	(0.576)
The planter owns the plantation (1 yes, 0 no)	0.439***	-0.191	0.662**	0.052	1.407***
	(0.139)	(0.149)	(0.263)	(0.199)	(0.537)
Single-household contracting (1 yes, 0 no)	0.376***	Reference	Reference	Reference	Reference
	(0.104)				
Joint household contracting	Reference				
Tenure insecuirty:					
1) Weak property rights	-0.066	0.012	0.304	0.190	0.091
	(0.116)	(0.144)	(0.412)	(0.200)	(0.812)
Strong property rights	0.061	0.047	0.009	-0.044	0.090
	(0.088)	(0.107)	(0.296)	(0.121)	(0.580)
2) Tenure insecurity (redistribution approach)	0.022	-0.077***	0.027	-0.074*	0.036
	(0.026)	(0.035)	(0.081)	(0.042)	(0.160)
Harvest quota	0.063***				
	(0.026)				
Plot attributes:					
The size of plot (in log value)	-0.099***	-0.205***	-0.017	0.016	0.470
	(0.035)	(0.037)	(0.184)	(0.039)	(0.366)
Distance from homestead (in log value)	0.062	0.038	-0.323	-0.148	0.585
	(0.067)	(0.075)	(0.304)	(0.098)	(0.589)
Distance from road (in log value)	0.005	-0.044	-0.081	0.047	-1.044
	(0.063)	(0.081)	(0.339)	(0.103)	(0.657)
Young or middle-aged forest (1 yes, 0 no)	0.187***				
	(0.070)				
Near matured forest (1 yes, 0 no)	-0.030				
	(0.076)				

Table 4 Continued

		Labor		Fertilizer	
	Timber	**Bamboo**	**Economic forest**	**Bamboo**	**Economic forest**
Household attributes:					
Age of head	0.003	0.004	-0.012	-0.007	-0.058**
	(0.004)	(0.005)	(0.013)	(0.005)	(0.026)
Formal education of head	0.033	0.018	-0.026	0.031	-0.115
	(0.014)	(0.018)	(0.051)	(0.019)	(0.103)
Male laborer	0.117	0.039	0.726	0.067	1.792
	(0.216)	(0.188)	(0.767)	(0.700)	(1.502)
Female laborer	-0.248	0.198	0.526	-0.511	-0.496
	(0.236)	(0.301)	(0.739)	(0.860)	(1.443)
Off-farm wage rate	-0.004	-0.002	0.021		
	(0.004)	(0.006)	(0.015)		
The current value of house (in log value)	0.029	-0.047	-0.184	0.190***	0.286
	(0.045)	(0.071)	(0.133)	(0.072)	(0.262)
Total amount acreage per household	0.001	0.000	-0.287	-0.003	-1.171**
	(0.049)	(0.001)	(0.230)	(0.063)	(0.548)
Regional dummy: Sanming	0.282	0.114	-0.582*	0.002	-0.756
	(0.203)	(0.193)	(0.308)	(0.215)	(0.590)
Nanping	-0.099	0.268	-0.801**	0.435	-1.693**
	(0.961)	(0.191)	(0.339)	(0.397)	(0.574)
Longyan	0.004**	0.225	-1.097**	0.727*	-0.964
	(0.193)	(0.159)	(0.539)	(0.435)	(1.034)
Rho	0.64	0.66	0.34	0.76	0.37
Wald chi-square	65 (23)	66 (18)	35 (18)	33 (17)	33 (17)
No. of observations	553	478	196	478	196

*** and ** significant at the 1% and 5% level. Standard error in parentheses.

Default region is Ning De.

6. Conclusions

More empirical studies are needed to better understand the impacts of tenure and management arrangements on forestry. We believe that our analysis of China's experience provides an opportunity to understand both how these policy reforms worked and how well they have worked. The experience gained in China can be shared with other developing countries that are undergoing a similar economic transition. In summary, this study illustrates several policy implications by investigating the experimental reform experience in that particular sampled region.

China has a unique experience in ownership transformation to share with the rest of the world by devolving authority of forestry management from community to the individual farmers, rather than from the state to the community as done in other countries. One major objective of the study was to examine how well the new tenure arrangements work. Based on household survey data from the *Fujian* province, the findings support the argument that devolution of forest management rights from village collectives to individuals is likely to promote confidence in tenure security among farmers, and that it performs better in this regard than joint-household contracting. The conclusion is that farmers tend to increase investment in plots characterized as planter owning the plantation following the reform, which was widely perceived as a tenure type with a low security level; consequently, the farmers were less likely willing to invest heavily on these forestlands prior to the formal reform.

Despite highly uniform, centralized policies at the provincial level, there is plenty of space and capacity for local institutional innovation. This leads to a high degree of variation in practice. For example, the local government experimented with various alternatives in the form of joint-household contracting. This kind of system was present in almost all surveyed localities. Joint household contracting can be classified into two major forms: household-based joint contracting and village small group-based joint contracting. The results show that forest farmers in a joint contracting system are less willing to invest labor and capital, which is in line with findings in other studies. The limited success of this tenure type can be

explained by its similarities with collective management. Villagers were excluded from the planning and management process, and from decision making regarding the distribution of benefits, and as a result, they were discouraged from investing labor and capital, just as in the era of collective management. We observed that in most cases, farmers only have limited decision-making authority over forest management, product use, and income distribution. Hence, this system is merely a disguised form of the former collective management. The policy implication here is that the government may need to take on a more facilitative role in supporting local initiatives, and more work needs to be done to understand how this role should be carried out, and what policies and other interventions are needed and appropriate (Liu, 2001).

The harvest quota policy is given particular attention in this study. The challenge is how to analyze the role of policy in forest management and development. Many researchers who support the regulation argue that it has been successful in reducing forestry degradation and depletion (Zhang, 2002). However, this study points to the contrary and shows that there is in fact a negative relationship between the harvest quota regulation and investment incentives in timber forests at the household level. Then, a natural question is whether we should continue to rely on the regulation to protect forest resources or whether we should disregard it, since possibly less forest harvesting should occur in the long run as a result of less investments made by households. To address this issue, more research is needed in order to understand whether the policy can protect and develop the forests in a sustainable way. As an example, one alternative is to look at the impact of the harvest quota policy on the standing volume of timber on macro-level evidence in a long run perspective.

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