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DETERMINANTS OF GRASSLAND USE RIGHT TRANSFER IN INSTITUTIONAL CHANGE: EVIDENCE FROM PASTORAL CHINA

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Abstract

This paper focuses on factors influencing grassland lease, which will contribute to the heated debate about land use in China by extending research to more extensive and vulnerable grassland regions. Based on historical review of grassland institutional change and analysis of data from 12 villages, this paper examines the impact of variables such as grassland property rights, grazing policies and physical attributes on grassland lease. This paper also draws attention to widely practiced illegal grazing and the implementation of a grazing quota, as well as their impact on grassland lease and governance.

Keywords

Land use, Land tenure, Grassland lease, China

1 Introduction

Located in the eastern Ningxia Hui Autonomous Region, Yanchi County shares boundaries with Shanxi Province, Gansu Province and Inner Mongolia Autonomous Region. It lies in the transition zone from the Loess Plateau to the Ordos Desert, which is a transition zone from arid steppe to semi-arid grassland. Among its total 713,000 hectares of land, 557,000 hectares are grassland. Grassland provides an irreplaceable ecological environment for local people's livelihood, and is also an essential factor influencing local economic development. Although the contribution of livestock on local Gross Domestic Product (GDP) has declined from 26.0% (2000) to 15.3% (2009), livestock kept on the grassland still constitutes 31.2% of the per capita net income of farmers¹. During the last decades, grassland degradation and desertification have become a serious environmental and economic threat in China (Bao et al., 1997; Yao et al., 2001; Jiang, 2005; Han et al., 2008), so was the case in Yanchi. Till 2002, 79.3% of its total land had suffered from serious desertification (Qi et al., 2006).

Grassland lease exists when there is a gap between the amount of grassland that actors wish to have and the amount of grassland that they own in reality. Grassland lease appears to eliminate this gap by leasing in or leasing out grassland. In this paper, grassland lease refers to a mechanism through which a voluntary transaction in grassland use right is leased within rural households. The term "transaction" follows Common's definition which treats a transaction as a unit of lease of legal control, that is, to involve the transference of property rights (Hagedorn, 2008). During certain periods grassland lease declined dramatically, albeit it boomed in some areas and declined in other areas in the same time. Regarding institutional change during the considered periods, such historical observations draw our attention to the determinants of grassland lease. The thus resulting central questions are: What is the role of institutional change in grassland lease? What are the impact of other variables such as grassland size, location and the existence of fences on grassland lease? Why did several grassland leases happen exclusively in certain situations, as for example grazing quota lease?

This paper would like to contribute to the heated debate on land use in rural China by investigating more extensive and vulnerable grassland regions. Nowadays, more and more scholars

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are paying attention to arable land tenure (Brandt et al., 2002; Kung et al., 1997) and arable land lease (Li, 2003; Brandt et al., 2002; Slangen et al., 2008) in rural China. Comparatively, grassland lease and its determinants are a topic under much less research. The situations that outlaw grassland lease, or lack of protection for lease, are presumed to lead to inefficiency. As Ostrom (2003) stressed, rights to grassland and pasture use will be leased to those, who will allocate these resources to their highest value use. Leasing appears to be an important mechanism through which the rural economy is able to redistribute resources and improve resource use efficiency. Additionally, in recent decades, the increasing migration causes a huge amount of uncultivated grassland. Grassland lease could under such circumstances dramatically raise land utilization rates. Furthermore the article at hand also analyzes the relationship between institutions and grassland lease under certain biophysical conditions, which would shed light on how types of property rights and related policies jointly affect grassland lease.

The rest of this paper is organized as follows. Section 2 introduces institutions related to grassland governance, and thereby mainly focuses on current grassland property rights and grazing policies. Section 3 lists the theoretical hypothesis of grassland lease. It predicts that grazing policies, de facto property rights of grassland, and biophysical conditions will affect grassland lease. Section 4 introduces the methodology employed in this research including research strategy and techniques. Section 5 illustrates and interprets empirically results. Concluding remarks are contained in section 6.

2 Institutions related to grassland governance in the research area

A grassland decentralization reform was implemented in the 1990s in Ningxia Hui Autonomous Region, after the introduction of the Household Responsibility System (HRS) for arable land (Lin, 1992; Kung 2002), which redefined farmland tenure arrangements by allocating land-use rights to individual households, despite the ongoing collective ownership of land (Banks et al., 2003a). Grassland is managed under a similar HRS, albeit with slight differences due to the unique features of grassland, such as difficulties in demarcation (Banks et al., 2003a). The decentralization reform aimed to allocate grassland use rights rather than ownership to individual households. While the heterogeneity of villages such as grassland size, cropping pattern and location promote diversified property rights in the end. The degree of grassland allocation varied (Ho, 2000; Banks et al., 2003b; Nelson, 2006). Some grassland was allocated to individual households as the policy encouraged, while in some areas with quite limited grassland, it was assigned to groups of several households, and some even maintained in the *status quo* situation (i.e., owned and managed by community). Until 2003 in Yanchi, 317,000 hectares grassland, about 86.6% of its total grassland, had been contracted to individual households or in the form of groups of households.

However, the real situation is much more complicated. Property rights explained above were *de jure* rights since they were lawfully recognized by formal, legal instrumentalities (Schlager et al., 1992). Property rights may also originate from resource users by cooperatively defined and enforced rights among themselves. This is called *de facto* rights when they are not recognized by government authorities (ibid.). In Yanchi, some grassland supposed to be allocated to individuals is in reality not allocated due to the fuzzy boundaries of grassland. In practice, among the grassland nominally allocated to individual households, 56,000 hectares of grassland were allocated to individual households, while 261,000 hectares had been contracted to groups of five to six households. Furthermore it is quite common that some grassland which is formally contracted to groups is still *de facto* owned and managed by communities.

In addition, several grazing policies were carried in the last decade, responding to the increasingly severe desertification. As one of the most influential land policies, a grazing ban policy was issued in 2002 in Yanchi County (Dong et al., 2007). The grassland use right was restricted by the policy and captive breeding was encouraged by the government. Admittedly, to some extent, the policy fostered the recovery of vegetation, improved the quality of grass and

stimulated the intensification of husbandry (Liu et al., 2007). However, the grassland desertification situation was not alleviated as expected, with about 0.297 million square kilometers (44.7% of land) in Ningxia being devoured by desertification (Qi et al., 2006). Meanwhile, it forced local people to abandon herding which was the most important traditional livelihood. As a result, conflicts between the government and local people intensified. More importantly, the grazing ban policy greatly limited alternative livelihood strategies for those who stay in villages. Increasing young rural migrants leave thus a huge amount of farmland uncultivated. Rural brain drain is considered to be the bottleneck of rural development. Considering these problems, ten natural villages² were selected by the local government for a pilot project of grassland management endowed with a grazing open policy in 2006. Farmers in these villages were permitted to use grassland. The pilot project was expanded to the whole township in the next year (as indicated in Table1). However, this pilot project was suspended after 2008 due to extreme drought in the following years.

Table 1: Information of different regulations in Yanchi County

	Grazing ban policy	Grazing open policy	
Time	Since Nov.1st, 2002	2006	2007
place	Whole county with 8 towns, 98 administration villages, 675 natural villages	1 administration village with 10 natural villages, covering 1001.2 hectares of grassland	15 administration villages with 96 natural villages of one town, covering 54906.6 hectares of grassland
Main content	All activities related to grassland were banned; captive breeding was highly recommended and subsidized.	Sheep herding was permitted. A grazing quota was assigned by the county government to each household based on the quality of grassland in the village, and then allocated to each household based on the grassland size the household owns. Rotational grazing was encouraged by the government.	

Source: own survey data

3 Literature Review and Hypothesis

Hypothesis 1 *Grassland fences are expected to exert a positive impact on grassland lease by clarifying de facto property rights, decreasing the difficulty of exclusion and the transaction cost of grassland lease.*

The grassland in the research area is defined as a common-pool resource, since each person's use of a resource system subtracts units of that resource from a finite total amount available for harvesting, while it is hard to exclude other beneficiaries (Ostrom, 2005). However, common-pool resources are not automatically associated with common-property rights, or with any other particular type of property right. It may be owed by national, regional or local governments, by communal groups or by, private individuals or corporations (ibid.). Existing literature provides successful and unsuccessful cases for common-pool resources governance by different groups such as the state as well as communal groups (Ostrom, 1990; Banks, 2003). Grassland governance in the research area provides an example of a common-pool resource with diverse property rights. Some grassland allocated to groups are still used and managed by communities since there are no specific boundaries of group grassland. Some grassland contracted to individual households is managed by a group or even a community for the same reason. It has been pointed out that the capacity of exclusion depends on the technology of physical exclusion devices, such as barbed wire fences, as well as enforcement of various bundles of property rights (Ostrom, 2003). Without specific and visible boundaries of

grassland, *de jure* grassland property rights are hard to implement and enforce. It is hard to distinguish the boundaries of grassland without artificial mechanisms such as grassland fences building (Banks et al., 2003a). Grassland fences are a technique commonly used because the local government provides a subsidy for fencing and the costs are relatively low. It is reasonable to define the *de facto* grassland property right based on the fence situation: Grassland with a village fence can be characterized as being managed as a common property. Grassland with an individual household fence is classified as a quasi private property. In contrast, grassland with a group fence is categorized as a group property.

A Grassland fence is expected to have positive impacts on grassland lease since it determines *de facto* grassland property rights by clarifying the boundaries of grassland, which diminishes the costs of excluding other potential beneficiaries. In addition, grassland fences would contribute to grassland lease since they diminish the negotiation costs by simplifying the leasing process occurring between two individual households with clear boundaries of grassland. In this way, grassland transfer would be less ambiguous or controversial. It also enables the formalization of grassland lease from oral agreement to written documents by feasibly defining specific and visual boundaries of grassland. In the case of individual grassland fences, potential conflict between a tenant and a landowner caused by an unclear boundary of grassland will be solved by the construction of such a grassland fence.

Compared with grassland with *de facto* common property rights (i.e. fenced to a village or a group of households), grassland with *de facto* private property rights (i.e. fenced to a individual household) is expected to have a higher probability of being leased, which means that the more decentralized property right system the actors involved, the more possible grassland would be leased. Even for grassland allocated to a group, grassland fence is expected to exert a positive impact on grassland lease since it reduces enforcement and negotiation costs, compared with grassland managed at village level (Banks, 2003). Ambiguous rights originating from a less decentralized property right system lead to inefficiency, since actors cannot or have difficulty to trade their interest in such a system for other goods or money. Moreover, the potential actors interested in goods with less decentralized property right are quite limited since actors involved in such a system usually have to face the conflict with other owners in the same system. Hypothetically, if one actor wants to rent grassland under a group property right system from a group of households, the agreement has to be achieved between the actor and all households of the group. The transaction cost is much higher, compared with negotiation between two households.

Hypothesis 2 *Grazing policies have a profound influence on grassland lease. The grazing ban policy is expected to have a negative impact on it.*

As Ostrom (2005) asserts, “rules affect the types of actions that individuals can take the benefits and costs of those actions and potential outcomes and the likely outcomes achieved”. When a grazing ban policy is implemented to regularize the use of grassland, it does impose a constraint on grassland use and change the incentives that actors face. On the one hand, as transactions are institutionalized, actors will adjust their choices to the new rules and enforcement mechanism (Hagedorn, 2008). We assume that when grassland use is institutionalized by a grazing ban policy, it is probable that the actors will adjust their choices to reduce grassland use which inevitably decreases incentive to lease grassland use rights. With a grazing ban policy, grassland is enclosed for vegetation recovery and not for grazing. Villagers are required to change the pattern of raising livestock from grazing to captive breeding. Therefore the incentives for grassland lease are reduced. The lease probability will drop dramatically under such circumstances, in particular in the first few years when – as in the case of Yanchi – official monitoring of illegal grazing was extremely intensive and strict. Illegal grazing happened frequently in recent years since the official monitoring was much looser especially in the evening. Accordingly, we assume that the incentive of leasing grassland use rights gradu-

ally increased. In addition, we also consider the impact of the grazing open policy on grassland lease. It is reasonable to consider that the open grazing policy will stimulate grassland lease. The grazing open policy provides a formally recognized and authorized arena for grassland use right lease by legalizing grazing activity.

Hypothesis 3 *Physical attributes of the community will also influence individual's decision-making on grassland lease.*

Individuals' incentives are also affected by attributes of the biophysical and material condition. As Ostrom (2005) stressed, human actions are also affected by other attributes including how institutions are combined with biophysical conditions to generate positive or negative incentives. What actions are physically possible, or what outcomes can be produced depends upon the actual situation and context. This is also supported by Hagedorn (2008) who argues that the physical world (and related physical properties of a transaction) is as important as the social world (and the related physical characteristics of actors). For institutional analysis, in the case of grassland lease, Banks et al. (2003a) identified several physical attributes of grassland, including ecological fragility, remoteness from residential quarters, difficulties in demarcation and institutional attributes such as heavy reliance on enforcement for sustainable use.

The size of grassland might affect actors' incentives by causing different consequences of institutions. The larger the grassland an individual household possesses, the more benefit the grassland originates. The location of grassland would also influence grassland lease. In the studied region, grassland is located in either hilly or plain areas. As Ostrom (2003) stated whether it is difficult or costly to develop physical or institutional means to exclude non-beneficiaries depending both on the availability of relevant technologies, and the relationship of cost of these solutions to the expected benefits of achieving exclusion. Generally, it is more costly and difficult to build grassland fences in hills than in plain areas. Besides, the geographical attributes of grassland in hilly areas could reduce the incentive of grassland lease, not only because it is hard to graze in those places with the complicated geographical characteristics but also because transportation cost is high. Usually the hilly areas are remote and hard to reach from the residential areas. Irrigated farmland is expected to have a positive impact on grassland lease, since grassland is usually leased as an appendage to irrigation farmland. It is reasonable to assume that the amount of farmland would be a determinant of decision on grassland lease, since farmers often spread the risk of production with different farming activities in order to smooth their income (Ellis, 2000).

4 Methodology

According to the outlined research questions, a combination of qualitative and quantitative methods has been employed in the empirical research. Participatory rural appraisal was employed in each village to get the general information about the village, including geographical information, population, self-governing organizations and so on, supplemented by key informant interviews. Household data has been collected by face to face interviews directly by the project team, ensuring for high data accuracy.

4.1 Sampling procedure

Twelve villages were selected along with the Poverty Alleviation Office and a local non-governmental organization with taking account of diverse physical attributes influencing grazing activities. The criteria included the average grassland in a village, fence situation, and arable land situation. The sample covered four villages with more than 100 mu grassland size per person, 4 villages with less than 100 mu while more than 50 mu per person and four villages with less than 50 mu per person. The fence situation of grassland is included as an indicator of *de facto* property rights, with the different possible values: fence to villages, fence to

groups and fence to individual households. Grazing policies implementation was as well considered during case selection. Four pilot villages with an open grazing policy implemented in 2006-2007, and eight villages with a grazing ban policy since 2002 were selected.

At household level, a random sample selection has been conducted. According to the research plan, 10 questionnaires should have been collected in each of the 12 village. However due to increasing migration, it is hard to find ten households who raise sheep in some villages. Therefore, we modified the number of questionnaires for each village according to the village population in the process of data collection. In the end, 111 questionnaires have been collected.

Forty-two of the interviewed households are in four natural villages with the open grazing policy, and 69 are from eight natural villages with the grazing ban policy. In order to test the impact of grazing policies on grassland lease, we asked questions to trace back the situations of grassland in 2006-2007, when the open grazing policy was enacted.

Table 2: Attributes of selected villages

	The scale of grassland (unit: mu/person)			Fence situation			location	Cultivation type		
	Less than 50	51-100	More than 100	Village level	Group level	Household level	In hilly areas	In plain areas	Without irrigated lands	With irrigated lands
Observation (N)	4	4	4	2	6	4	3	9	5	7
Percentage (%)	33.3	33.3	33.3	16.7	50.0	33.3	33.3	66.7	41.7	58.3

Source: own survey data

4.2 Multivariable Analysis

A probit model is employed to analyze determinants of grassland lease. The ordinal regression model is a nonlinear model in which the magnitude of change in the outcome probability for a given change in one of the independent variables depends on the levels of all of the independent variables (Long and Freese 2001). The likelihood of grassland lease is treated in the model as an ordinal dependent variable (P). It represents the probability that a household makes the decision to lease grassland. Otherwise, 1-P represents the likelihood that a household decides not to lease grassland. Although the villagers only possess grassland use right, they still can lease it to others (Li, 2003). In order to avoid double counting, we only count the number of the households who lease in grassland, instead of the figure of leasing out. Two types of grassland lease are considered. One is directly renting the grassland, and the other is renting a grazing quota, defined as a regulated amount of sheep that is allowed to graze in the grassland of an individual household. From primary statistics, we notice that the latter one mainly took place in villages with the open grazing policy in 2006 and 2007.

The hypothesis formulated in Section 3 pointed out that, variables including irrigated land size (*ir*), dry land size (*dr*), grassland per household (*gr*), sheep amount (*s*), and fence situation (*fence*), location of village (*l*) and types of grazing policy (*policy*) will influence grassland use right lease. Accordingly, such variables are included into the model to explore their impact on the probability of grassland lease:

$$P = \Phi (\beta_0 + \beta_1 ir + \beta_2 dr + \beta_3 gr + \beta_4 lab + \beta_5 s + \beta_6 fence + \beta_7 l + \beta_8 policy)$$

The amount of irrigated land (*ir*), dry land (*dr*), grassland (*gr*), labor (*lab*) and sheep (*s*) that each household has, and land area is measured in unit of mu. The dummy variable *l* refers to the location of grassland as a control variable to reflect whether grassland is located in a hilly (0) or plain area (1). The dummy variable *policy* represents grazing policies. When *policy*=1,

it means an open grazing policy. When $policy=0$, it refers to a grazing ban policy. The dummy variable *fence* refers to *de facto* property rights of grassland in natural villages. In reality, *de jure* property rights hardly function without clear boundaries defined by a grassland fence. In the surveyed area, even if grassland is allocated to households, it might be managed at collective, group or household level depending on the fence situation. Therefore we use the situation of fences as a proxy for *de facto* property rights of grassland which takes the value of 0 and 1, meaning non-private property rights (i.e. collective and group property rights) and private property rights respectively.

5 Empirical Results

5.1 Attributes of dependent variables

A Lease contract provides an arena for the lease of grassland use right. It defines the boundaries of a transaction: The subject of a transaction, the validity of a transaction, and the responsibilities of tenants and landowners. We found that there are different types of grassland leasing, and the commonly existing practice works through an oral agreement instead of written documents covering a short period, usually one or two years, between two households living in the same village. Landowners usually lease out all their grassland to one tenant. Only 22% of the households leased grassland with a written agreement. However, all of these agreements only consist of lease time, lease price and a specification of the contractors, while they do not fix any specific responsibilities of the contractors, neither any rules of contract violation. Thus mutual trustworthiness based on the past life experience is one of the essential factors influencing contractors' decision making. Another type of grassland lease is to rent both, grassland and farmland, instead of renting grassland separately. It did happen in villages with irrigated farmland. Due to severe scarcity of farmland, the comparatively higher economic value of farmland generates farmland leasing markets before the appearance of grassland lease. Under such circumstances, in villages with irrigation farmland, sometimes grassland is taken as a bundled product of farmland lease, and this kind of lease contract tends to be more formal (i.e., signed by contractors in written agreement) than the usual forms of grassland lease.

In the field research, there are 23 cases of grassland lease in 2007, among which 10 were in villages under the open grazing policy. Additionally, grazing quota lease was quite popular in these villages. Since the quota system allocates a grazing quota based on household's grassland size, quota lease is also included in grassland lease in this research. In a village with group grassland fences, the village leader told us that about 60% of the households leased in or out grassland during the implementation of the open grazing policy. Six cases of grazing quota lease were found in our field research. With in-depth examining, we found out that four households having grassland under group management. For these people, what they lease in was not grassland but a grazing quota. It is easier to lease the quota instead of leasing grassland in villages with common property rights. In other words, a grazing quota reduces negotiation costs without specifying a certain piece of grassland in a village, and thus facilitates grassland lease.

In those villages without specific fence, the frequency of grassland lease (0%) is lower than that in villages with group fences (14.3%) or household fences (37.8%). This supports hypothesis 1, which suggested that the probability of grassland lease is expected to be higher in grassland with fenced to individual households than in grassland with fenced to groups or villages. The result also reveals a positive correlation between grassland size and grassland lease. The frequency of grassland lease in areas of per capita average grassland of less than 50 mu is 10.71%, of those grassland ranging from 50 to 100 mu is 18.18%, and areas larger than 100 mu is 20.72%.

5.2 Primary statistic description of independent variables

The distribution of households and some of their characteristics are shown in Table 3. It is interesting to notice that there are still 13 households leasing grassland in villages with the grazing ban policy, which is in disagreement to our expectation that no grassland lease would exist under this constraint. This might be caused by cases of illegal grazing in villages with grazing ban policy. According to our assumption, considering the compulsory constraint originating from the grazing ban policy, no grassland leasing should exist in these villages. However, the appearance of illegal grazing violates the assumption. Because of high financial and labor costs for monitoring grazing, policy implementation tends to be loose in recent years. In our field research, we found that illegal grazing was popular despite of the implementation of the grazing ban policy. More than 54% people admit that they were grazing every day in 2010. Usually, illegal grazing happens in mid-night when monitoring becomes loose. Moreover herders are familiar with local geography while the governmental monitoring committee is usually not, so it is easy for herders to avoid monitoring in the evening. The cost of grazing is much lower than captive breeding (Qi et al., 2006) which is the main reason for the frequent occurrence of illegal grazing. Apparently, the economic value of grassland stimulates the illegally grazing which in turn increases the incentives for grassland leasing.

Table 3: Features of the households and villages

Variable	Obs (N)	Mean	Std. Dev.	Min	Max
Amount of irrigated land	111	7.910	12.00	0	50
Amount of dry land	111	30.15	24.34	0	90
Amount of grassland	111	346.0	243.3	0	1080
Amount of labor	111	3.37	1.73	1	9
Amount of sheep	110	50.109	32.086	0	200
<i>De facto</i> property rights [#]	111	0.333	0.474	0	1
Location of grassland [#]	111	0.793	0.407	0	1
Grazing policy [#]	111	0.378	0.487	0	1

(Note: [#] refers to dummy variables; *De facto* property rights refer to private rights and non-private rights including collective rights based on groups and communities. For the amount of sheep, one observation is dropped because information about the amount of sheep is missing.)

Source: own survey data

From the tabulation of grazing policy and the number of grassland lease, it is found that in villages under the open grazing policy, the frequency of grassland lease is 23.81%, higher than in villages with the grazing ban policy (18.84%). As stated previously, albeit more than 86% of grassland has been formally allocated to groups or individual households in 2002, *de facto* grassland property rights instead of *de jure* rights are measured in this model by the existence of fences as indicator. We tabulate the grassland fence situation and grassland leased by merging variables of group fence with community fence, since there is perfect multicollinearity between the dummy variable of group fence and the variable of community fence when we use dummy variables including household fence, group fence, and community fence to measure the situation of *de facto* rights, which might be resulted from only 11 observations of community fence. It is found out that the percentage of leased grassland with a household grassland fence is 37.84%, higher than that with group grassland fence (12.16%). The overall p value is less than 0.05 ($p = 0.002$), which implies that there is a significant difference between the mean of grassland leased in different grassland fence situations. In the following regression analysis, only one dummy variable referring to the occurrence of a household fence and absence of a household fence is employed.

5.3 Regression results

The impact of grazing policies, *de facto* grassland property rights and physical attributes of grassland on grassland lease are estimated by a probit model. Table 4 presents the results of the probit estimation. Probit1 only examines the impact of treatment variables. In Probit2 and Probit3, we include control variables measuring household's capital and physical attributes of grassland, such as location. The standard errors in Probit1 and Probit2 are measured by robust error estimation, and the standard deviations in Probit3 are robust and clustered on the village level. The advantage is that it allows correlation between independent variables in the same cluster, which is quite common in reality. Based on the probit estimation, we find out that property rights have a significant impact on grassland lease, while the effects of the location of grassland, grazing policies and household characteristics are not as significant as expected.

De facto property rights have significantly positive impacts on the probability of grassland lease. The probability of grassland lease will increase by 35.41% when grassland is managed by individual households, compared with the grassland managed by groups of households. This supports hypothesis 1, namely, private property rights have a positive impact on the probability of grassland lease, since private property rights with more explicitly fenced boundaries need less labor inputs for adequate management. In field research, we found out that in some villages with household grassland fence, traditional grazing (i.e. supervising the sheep through the whole night) has been substituted by a new way: Sheep are sent to farmers' own grassland in the evening and are left with no inspection during the night. Then farmers return home and herd the sheep back in the early morning. As one herder said, this way of grazing reduces working hours and workload. In this way, herders can take other jobs during the day. He also admitted that sometimes they were caught by the monitoring committee and fined for illegal grazing, but they continued to do so. It might solve difficulties in demarcation and lower the cost of monitoring, bargaining and decision-making. The impact of grazing policies on grassland lease is significant in Probit2, but not significant in Probit3 after the standard errors are robust and clustered on the village level. Admittedly, widely existing illegal grazing greatly challenges the assumption that no grassland leases should appear in villages with a grazing ban policy. However, the economic value of using grassland increases since the risk of being sanctioned for illegal grazing by government representatives decreased. Compared with farmers in villages with grazing ban policy, farmers in villages with an open grazing policy were endowed with recognized and assured grassland use rights. Additionally, the grassland quota system further provides farmers with incentives to lease grassland, because it avoids conflicts caused by fuzzy boundaries and property rights of grassland.

Table 4: Linear probability estimates of grassland lease decisions

Dependent variable: Rent grassland (0,1)	Mean of X	Probit1	Probit2	Probit3
Irrigated land area per household	7.76		0.0032 (0.0037)	0.0032 (0.0027)
Dry land area per household	30.38		-0.0037 (0.0030)	-0.0037 (0.0035)
Grassland area per household	346.44		-0.00006 (0.0002)	-0.00006 (0.0001)
Labor per household	3.38		0.2167 (0.0287)	0.2167 (0.0275)
Amount of sheep per household	50.11		0.0009 (0.0010)	0.0009 (0.0014)
<i>De facto</i> property rights [#]	0.33	0.3261** (0.1055)	0.3541** (0.1244)	0.3541** (0.1260)
The location of grassland [#]	0.79	-0.0816 (0.1130)	-0.2163 (0.1357)	-0.2163 (0.1655)
Grazing policies [#]	0.38	0.1040 (0.08270)	0.2070* (0.1073)	0.2070 (0.1195)
Pseudo R ²		0.1088	0.1490	0.1659
Observations (N)		110	110	110
Wald chi square		11.08	16.81	159.17
Log pseudo likelihood		-50.27	-47.05	-47.05

(Note: * p<0.05, ** p<0.01, *** p<0.001. Coefficients refer to marginal effect of mean of independent variables. (#)The coefficient is for discrete change of dummy variable from 0 to 1. The standard errors in Probit 1 and Probit 2 are measured by robust error estimation. The standard errors in Probit 3 are robust and cluster on the village level. One observation is dropped because information about the amount of sheep is missing.)

Source: own survey data

6 Conclusions and discussions

This paper examines the impact of formal institutions as well as biophysical conditions of grassland on the probability of grassland lease decisions made by households. According to the model, grazing policies have limited effects on grassland lease. Farmers responded to the institutional environment but often in a different way than expected by policy makers. The assumption that farmers in villages with a grazing ban policy have low willingness to lease grassland is challenged by increasing illegal grazing. Some farmers were still renting in grassland. On the other hand, farmers in villages with an open grazing policy were endowed with high willingness to lease grassland, especially fostered by a grassland quota system. This paper examines the impact of *de facto* property rights, which is related to the problem of difficulties in the demarcation of grassland. It is evident that *de facto* property rights measured as grassland fences situation have positive and significant effects on the probability of grassland lease. As Wade (1987) points out, boundaries of common-pool resources matter for self-governance, clear boundaries are important for grassland lease. Property rights with clear boundary overcome the difficulties in demarcation and reduce the transaction cost. According to our research, a village with more than 100 mu of grassland per person usually has fenced grassland to individually household. Accordingly, grassland is a 'quasi private goods' which can be managed individually. While in other villages with quite limited grassland sizes, in particular in villages with less than 50 mu of grassland per person, fences are built on the group level or village level, which means that it is difficult or even impossible to lease grassland under some circumstances. As to these villages, we propose community based grassland lease in the form of grazing quota lease combined with a grazing open policy, which solves

the problem of fuzzy boundaries and diminishes the possibility of conflict resulting from lease. The community-based grassland lease refers to the leasing of grassland use rights within a community. Regarding the term ‘community’, it is not equivalent to the community definition and boundaries as taken on the administrative level. An area could be a “community” as long as the people who live within it share the same informal institutions such as norms. Accordingly, a community might be a natural village or a group of people with the same religion.

We need to be aware of the potential bias resulting from the lack of information about household income. Local people are quite sensitive to topics about income. In the first village survey, the data we collected about income are hardly convincing since interviewees either refused to answer our questions or gave us a false reply. Therefore, instead of income, we asked them the percentage of income change in last few years, which is less sensitive, but it is hard to integrate this variable into our modeling. In our analysis, we use the amount of arable land, sheep and grassland land to represent the household income. We could only count the number of households leasing in grassland to minimize the effect of migration. We assume that the determinants of land leased in are determined by the same coefficients that determine the amount of land leased out. This may be equivalent to the average level of the figures in reality. Additionally, it is hard to collect information about grassland leased out. This might be caused by the increasing migration in rural China. Most of those households leasing out grassland have migrated to cities to work. People living in rural areas are mainly the old and the poor who live on grazing. In addition, we have not solved the potential endogeneity problem which might result from the correlation between the amount of grassland lease and the fence situation, due to the lack of strong and reliable instrumental variable. Last but not least, as a snap-shot, the disadvantage of a cross section analysis is that we cannot correct the bias resulting from the selection of villages for a grazing open policy in the policy design progress. However, in order to reduce or eliminate all the limitations, we combine multivariable analysis with reliable qualitative analysis, while the information retrieved from both approaches support both our main hypothesis. With future research we will improve the data and explore more information about the topic of grassland property rights lease.

Note

1. Calculated based on data from Ningxia Hui Autonomous Region Bureau of Statistics, National Bureau of Investigation Corps Ningxia (2010), Statistical Yearbook of Ningxia Hui Autonomous Region. Beijing: China Statistics Press.
2. Natural villages refer to the settlements which constitute an administrative village. They spontaneously and naturally exist.
3. In research area, the usual unit used in describing grassland and farmland size is mu. 1 hectare equals to 15 mu.

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