



Grassland rental markets and herder technical efficiency: ability effect or resource equilibration effect?

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ABSTRACT

To fully explore how grassland rental markets improve herder technical efficiency and to what extent, we apply a Metafrontier-DEA approach in this study to examine the impacts of herder participation in grassland rental markets and its technical efficiencies. We collect field data from 416 herder households, and our result shows that herders involved in the grassland rental markets can increase their technical efficiency by 2.75% on average. Compared with the autarky group, the lessors increase their efficiency by 3.36%, and the lessees increase their efficiency by 2.76%. No significant difference in efficiency is found between the lessors and the lessees. We conclude that grassland rental markets improve herder technical efficiency mainly through resource equilibration effect rather than ability effect. As long as herders participate in the grassland rental markets, they can improve their efficiency by balancing family resources and thus enhance production efficiency. This suggests that under the current institutional environment, more attention should be drawn on the normalization and guidance of grassland rental markets. More efforts should be made to allow herders to participate in the markets on their own will, rather than to address land transfer from the less able producers to the more-able producers.

1. Introduction

Grassland is a dominant land use pattern from which herders in arid and semi-arid areas generate their main income (McGahey et al., 2014; Asner et al., 2004; Li et al., 2008; Undargaa and McCarthy, 2016). China has the second largest grassland area in the world, accounting for about 42% of its territory. Directly and indirectly, grasslands support a population of more than 40 million people, and serve as a crucial ecological barrier (between grazing and farming areas) in northern China. With the implementation of the Household Responsibility System (HRS) in grazing areas, the traditional communally managed grasslands with open mobility to herds of the communal were distributed to individual herder households about three decades ago. The original relatively balanced resource combination of “people (labor)-grass(land)-livestock-productive assets” came to an end. Together with the subsequent subdivision of grasslands among the grown-ups, the herder household resource combination became unbalanced to a certain extent (Tan and Tan, 2017). Given the Liebig's Law of the Minimum in livestock production, the imbalance of family resources reduces the efficiency of livestock production, and poses damage to the livelihood of herders.

Theoretically and empirically, land rental markets are regarded as ways to improve production efficiency by helping farm households

adjust land in terms of other non-land resources, or by transferring land from the less-able farmers to the more-able farmers (Feder, 1985; Deininger, 2003; Otsuka, 2007; Jin and Jayne, 2013). Can grassland rental markets improve herder household efficiency? How and to what extent? It is important to study these, as the present inefficient livestock production (Huang et al., 2016; Tan et al., 2018) aggravated the “pasture overstocking—grassland productivity loss—poverty increase—increased stocking” vicious cycle in grazing system (Li et al., 2014; Du et al., 2013). Although a series of ecological measures have been taken to alleviate grassland degradation, to recover the deteriorated grazing system and to improve herder livelihoods, the effects of ecological governance are limited (Gao et al., 2016; Hou et al., 2014; Tan et al., 2014; Liu et al., 2018). Furthermore, compared with agricultural production which comprises a combination of people, land, and other production factors, livestock production is more complicated as it adds livestock as a crucial factor. Correspondingly, compared to farmers, the unbalanced combination of resources is more severe for herders. Moreover, the frequent movement of livestock in search of forage may cause *feet-disaster* (*Tizai in Chinese*) (Hai Shan, 2012; Liu, 2016). Grassland rental markets are expected to enable herders to better balance their resources and to break the grassland degradation-poverty cycle. To our knowledge, however, the impact of grassland

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rental markets on herder efficiency is not well understood.

Understanding the impacts of grassland rental markets and their impact mechanisms on herder livestock production can, in turn, help normalize and develop functional grassland rental markets. To facilitate such understanding, our study applied a Metafrontier approach to analyze the effects of grassland rental markets on animal husbandry production efficiencies. A comprehensive dataset with 416 sampled herder households from east Inner Mongolia was used for this purpose. Detailed information about the place-based context of this research can be referred to 2.1 (The HRS and subsequent grassland subdivision), 3 (Regulations on grassland rental markets), 4.1 (Sampling and data collection) and 4.3 (Empirical model) in Tan et al. (2017). The remaining part of the paper is organized as follows: Section 2 reviews literature and proposes hypotheses. Section 3 elaborates the methodology comprising two parts. The first part introduces the basic theory of the Metafrontier approach, and how it can be applied to examine the impacts of grassland rental markets on herder technical efficiency—the level of outputs attained with a given level of production inputs; the second part introduces the sampling, data collection and variables used in the study. Section 4 discusses the results, and Section 5 concludes the study.

2. Literature review

Land is the most important production factor. In many agriculturally dominant countries, however, land and non-land factors are usually unbalanced for smallholders. Land rental markets can potentially improve production efficiency by equilibrating land and non-land factor ratios across farms in the presence of imperfections in non-land factor markets (Deininger, 2003; Otsuka, 2007). The land tenancy transaction is thus the most common way to adjust different factor endowments among farming households (Deininger et al., 2008; Rahman, 2010; Kimura et al., 2011). Despite the emerging evidence, there are still quite entrenched perceptions that land rental markets may contribute to land concentration for some and increase poverty for the rest. Therefore, understanding the major drivers and allocative roles of land rental transactions is crucial for rural economies, especially in countries with limited land resources and high population pressure (Holden and Otsuka, 2014).

2.1. Drivers of land rental markets

Empirical analyses on the driving forces of land rental markets at farm level are mainly based on a household model (Jin and Deininger, 2009; Tan et al., 2017). Three types of explanatory variables and control variables are distinguished: 1) The main characteristics of farmers which reflect their farming ability, including the basic information of household head such as age, education level, gender and so on. Normally, the head's age and education level are used to represent the farm households' characteristics, including their farming ability (e.g. Jin and Jayne, 2013; Rahman, 2010; Holden and Ghebru, 2016; Chamberlin and Ricker-Gilbert, 2016), as household land rental behavior and other production decisions are mainly made by the head; or a comprehensive indicator used to reflect the farming ability of household (e.g. Jin and Jayne, 2013; Huang et al., 2014); 2) Farm household resource endowments and their combination, including land, labor force and productive assets; 3) The related institutions and policy environment which may encourage or discourage farmers to participate in land rental markets, for example, land tenure insecurity, law restrictions. (e.g. Holden and Ghebru, 2016) and subsidy policy for land transfer, etc.

The existing literature shows that farm household failures of equilibrating their resources are the major driving forces of land rental participation (e.g. Jin and Deininger, 2009; Jin and Jayne, 2013; Chamberlin and Ricker-Gilbert, 2016). For example, according to Holden and Ghebru (2016), given other factors, farm households with

more cattle in Tigray of Ethiopia tend not to rent out land while, in contrast, households with more land tend to rent out land. Rahman (2010) had similar findings for Bangladesh. Households with more cultivated land did not tend to rent in but tended to rent out land; whereas more household assets encouraged land rent-in. More significant results were observed for impacts of livestock on participation in land rental markets (Rahman, 2010).

Jin and Jayne (2013) found that compared with the autarky groups, farmers who rented in land were younger and had higher education levels. This suggests that farmers with higher farming ability represented by age and education level tend to participate more in land rental markets. However, this study did not find the significant effects of comprehensive farming ability on farmer participation in land rental markets. A recent study on Saharan Africa confirmed that household resource equilibration and farming ability affected farmer participation in land rental markets (Chamberlin and Ricker-Gilbert, 2016). In Malawi, for example, farm households with more land tended to rent out, but not to rent in land, while households with more adults (representing labor availability) tended to rent in, but not to rent out land. Age of household head (representing farming ability) had similar patterns. Observations in Zambia had similar results with those in Malawi (Chamberlin and Ricker-Gilbert, 2016).

This suggests that farm households tend to equilibrate their resources, keeping the staves of Liebig's barrel for livestock production balanced. Under imperfect non-land factor markets, in order to maintain a higher barrel capacity, farmers would equilibrate their resources by renting out when land is surplus and renting in when land is lacking with respect to non-land factors so as to avoid sunken cost caused by surplus assets. Besides, household farming ability also plays a key role in land rental market participation.

2.2. Land rental markets and agricultural efficiency

Some existing studies show that auto-participated land rental markets facilitate improvement in both efficiency and fairness (e.g. Crookes and Lyne, 2003; Jin and Deininger, 2009; Jin and Jayne, 2013). The main reason is that land rental markets are venues for equilibrating land with non-land resources (Deininger, 2003; Feder, 1985). When the allocated land is out of the optimal management structure, land rental markets help transfer land to more-able farmers and thus improve agricultural efficiency (Deininger et al., 2008; Huy et al., 2013). As found by Chamberlin and Ricker-Gilbert (2016) in Saharan Africa, rented-in land improved the welfare of farmers. Jin and Jayne (2013) found that in Kenya, land rental markets allowed farmers to get access to land, and to equilibrate other factors with land so as to promote efficiency and fairness. In some situations, however, land rental markets may transfer land from land-poor farmers to land-rich farmers, resulting in land concentration for the latter and continued poverty for the former. Such incidents took place in Rwanda (André and Platteau, 1998), Bukina Faso (Zimmerman and Carter, 2003), India (Kranton and Swamy, 1999) and Ethiopia (Deininger et al., 2009; Ghebru and Holden, 2009).

Most current studies indicate that effective land rental markets can improve farmer efficiency for the following reasons: on one hand, farmers can obtain some income by renting out their surplus or insufficiently used land; on the other hand, land rental markets facilitate farm households lacking land (with respect to non-land capitals) to better balance their productive assets (by obtaining extra land). For example, Crookes and Lyne (2003) analyzed the effects of land rental markets on the efficiency and fairness of leases and lessors by comparing their inputs and outputs; Deininger et al. (2008) explored the impact of farming ability on land rent-in and rent-out, and found that transferring land to more-able farmers allowed the improvement of production efficiency. A recent study on the Philippines (Koirala et al., 2016) estimated the impact of land rental on the technical efficiency of rice farmers by applying one-step Statistical Frontier Analysis (SFA).

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