



## Rural land rights reform and agro-environmental sustainability: Empirical evidence from China



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### ABSTRACT

The landscape of China's rural land market has been changed by several significant land right reforms since the 1970s. It is always of great interest to both the government and the public to gauge the effectiveness of these reforms. We address this question by investigating the impact of a recent land use right reform, namely, the 'Three Rights Separation Policy', on agro-environmental sustainability. By separating land management right from land contracted management right, this new reform is believed to be a powerful tool to encourage land transfer, optimize land resource allocation, and increase the economy of scale in the agriculture sector. Using a PSM-DID model applied to panel data for the years 2008 and 2014, our study demonstrates that the new policy also increases the use of organic fertilizers by 48.641 kg/mu in total, which is a very important step to ensure agro-environmental sustainability in China. The new policy is more effective in encouraging the application of organic fertilizer when the issuing of land certificates is enforced and administrative barriers to land right transfers are removed. The findings add value to the growing literature on rural land right reforms in China and may also have significant implications in developing countries with similar rural land tenure systems and underdeveloped land and labor markets.

### 1. Introduction

Soil degradation is a major threat to agricultural productivity and food security in many developing countries (Bewket, 2007; Kassie et al., 2008; Mazvimavi and Twomlow, 2009). According to *The Status of the World's Soil Resources Report* (SWSR), erosion carries away 25–40 billion tonnes of topsoil every year, significantly reducing crop yields and the soil's ability to store and cycle carbon, nutrients, and water.<sup>1</sup> Annual cereal production losses due to erosion are estimated at 7.6 million tonnes each year. According to the "Bulletin on the national quality grading of cultivated land" made public by the Chinese ministry of agriculture in 2014, cultivated land degradation area accounts for more than 40% of the total area of arable land in China.<sup>2</sup> The main causes of soil degradation are erosion, compaction, salinization, nutrient depletion, contamination and soil sealing. Moreover, inappropriate agricultural practices play an important role in reducing the economic and

ecological productivity of land (Li et al., 2015; Xu et al., 2015).

Economic reforms in developing countries might significantly change the socioeconomic environment of rural households, and can have a major impact on the sustainability of land use and soil conservation decisions (Heerink et al., 2001). Chinese agricultural institutions underwent a dramatic reform in the late 1970s, which led to the replacement of Collective Farming by the Household Responsibility System (HRS). Under HRS, rural households become the basic production units while land continues to be owned by collectives. After paying the agricultural tax and completing a production quota, households make production decisions independently and keep the revenue. The HRS effectively released agricultural productivity in China and resolved free-rider issues. From 1978–1984, grain output in China increased at an annual average rate of 5% and the gross value of agriculture by 7.7% (Lin, 1997; Mcmillan and Zhu, 1989). However, problems associated with the new land tenure system have emerged

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<sup>1</sup> The Food and Agriculture Organization of the United Nations, 4 December 2015 (<http://www.fao.org/3/a-i5199e.pdf>).

<sup>2</sup> <http://politics.people.com.cn/n/2014/1218/c1001-26228635.html>.

including the dwindling of farmland size, excessive fragmentation of farmland and a noticeable decline in investment in farmland (Dong, 1996). In particular, the excessive use of chemical fertilizers to boost production has caused a decline in soil fertility. This creates a vicious circle (Cui et al., 2010; Ju et al., 2006, 2009; Zhu and Chen, 2002). As a result, the amount of fertilizer used in China is 21.90 kg/mu<sup>3</sup> which is higher than the global average level (8 kg/mu), or 2.6 times of the amount used in the United State and 2.5 times that used in the European Union. Table 1 shows that the use of chemical fertilizer in China increased nearly fourfold from 1978 to 2013. Other countries shown for comparison largely reduced fertilizer use over the same period while improving cereal yields.

The apparent impotence of the HRS to sustain households' investment in farmland and sustainability in China led to calls for further reform of the land tenure system. Facing new challenges, the government of China enacted the 'Three Rights Separation Policy' (TRSP), which further separates land management rights (LMR) from land contracted management right (LCMR). A system that consists of 'three rights', namely, land ownership right, land contract rights (LCR) and land management right (LMR) was formed. This new strategy aims to activate the land transfer mechanism, optimize land resource allocation, and advance the rural economy. The Chinese government considers TRSP as the core of the new rural land tenure system reform. It consists of three steps: (1) recognize collectives' ownership right (*luoshi jiti suoyouquan*), (2) protect farmers' contract rights (*wending nonghu chengbaoquan*); and (3) accommodate land management rights (*fanhuo tudi jingyingquan*). The first step is based on the Article 59 of the Property Law in China, which stipulated that rural lands are owned by farmers' collectives. The second step allows farmers to lease rural land from their collectives, and profit from managing the contracted lands. The final step allows farmers to transfer their land management rights to any third parties who are willing and capable of managing the lands. The last step is crucial to achieving a moderate to high level of economy of scale, as well as the optimal allocation of agricultural production resources.

The TRSP changes the land tenure security in China by improving the stability of property rights and developing land transfer rights. So collective members can maintain land contract rights and transfer land management rights, without worrying about losing their land. Through this new system, participants in China's agricultural sector are not limited to the members of the collectives. It effectively attracts all available resources to engage in agricultural production by transferring land. As such, the transition from two rights division to three rights separation is considered a significant advance in policy development by the Chinese government. Existing studies focus on the positive impacts on the agricultural growth (Huang et al., 2014; Shao and Zhang, 2016). But the effects on agro-environmental sustainability have not received much attention. This paper bridges this gap in the literature.

Land rights are important factors for making soil conservation decisions. Households often put the security of land rights as their first consideration in their soil conservation investments. Research suggests that the stability of the land use right can promote farmers to invest, especially in the long-term, in improving soil quality (Abdulai et al., 2011; Besley, 1995; Carter et al., 1989; Feder, 2007). In addition, land transfer right has a significant effect on soil conservation investment too. Besley (1995) and Yao and Carter (1999) show the existence of land rental markets also help to increase investment in soil conservation. Since clearly defined property rights may encourage the development of land transfer markets, this can give rise to the option value of the land investment. When the land management right transfer is allowed in rental markets, farmers may invest more in their contracted lands in anticipation of increased rents in future. In the meanwhile, there are also warnings about the adverse effects of an agricultural

**Table 1**  
Fertilizer consumption and cereal yields in China and selected countries (1978 & 2013).

	1978	2013	Change
Total NPK (Nitrogen, Phosphorous, and Potash) Fertilizer consumption (million tonnes nutrients) <sup>a</sup>			
●China	10.60	52.71	397%
●Republic of Korea	0.82	0.47	-43%
●United Kingdom	2.13	1.54	-28%
●United States	20.36	20.18	-1%
NPK Fertilizer consumption (kg per ha of arable land and permanent crops) <sup>b</sup>			
●China	106	430	306%
●Republic of Korea	369	276	-25%
●United Kingdom	303	245	-19%
●United States	106	131	24%
Total cereal yields, kg/ha <sup>c</sup>			
●China	28020	58893	110%
●Republic of Korea	56676	64802	14%
●United Kingdom	45225	66296	46%
●United States	41098	73404	78%

Source:

<sup>a</sup> Total NPK consumption (chemical fertilizers only) is obtained from the International Fertilizer Industry Association, IFADATA, ([www.fertilizer.org/Statistics](http://www.fertilizer.org/Statistics)).

<sup>b</sup> Total arable land and permanent crops is obtained from the FAOSTAT, Food and Agriculture Organization of The United Nations, Statistics Division ([www.fao.org/home/E](http://www.fao.org/home/E)).

<sup>c</sup> FAOSTAT, Food and Agriculture Organization of The United Nations, Statistics Division ([www.fao.org/home/E](http://www.fao.org/home/E)).

economy in which most of the cultivated land is tilled by tenants. For instance, Yu et al. (2003) demonstrated that during the 1990s when a piece of land was rented to a tenant, its fertility (measured in terms of organic matter) declined relative to plots that were not rented out. However, Feng et al. (2010) found that households use similar quantities of organic and green manure on rented plots as they do on their own contracted plots.

Thus we can see that the results of TRSP can be mixed. To examine the effect of the new land right system on households' soil conservation decisions, we focus on one type of investment- the application of organic fertilizer – following the strategy in Jacoby et al. (2002). There are two reasons for this interest. First, organic fertilizer contains trace amounts of nitrogen and other minerals that promote healthy crop growth in the season during which it is applied, its primary benefit is from maintaining soil structure. This benefit is long lasting; a single application of organic fertilizer in most subtropical and temperate climatic zones (areas covering most of China and all of the sample locations) can have an effect on the soil for four to five years. In contrast, long-term use of chemical fertilizer leads to soil hardening; soil salinized, soil acidification and water pollution. Second, and more importantly, soil quality improvement is one of the most important farmland investment decisions at the household level that can be affected by land rights reform in China. Many other fixed investments, such as surface irrigation, drainage, and terracing, either do not depend directly on rights to a specific piece of cultivated land or are more efficiently organized at the communal or village level irrespective of the property rights regime (Jacoby et al., 2002).

We follow the practice in the literature by using OLS to analyze the effects of policy on farm households' decisions. However, OLS is prone to issues such as unobserved effects, sample selection bias, and endogeneity. To circumvent these issues, we adopt the Propensity Score Matching method to control observable characteristics that may bias the impact of TRSP on farm households' decisions. Additionally, we use Difference-in-Difference estimators to control treatment level group fixed-effects, which is one important component of bias from omitted variables. Through this process, we are able to isolate the net effect of TRSP's effect on households' soil conservation decision- organic fertilizer application.

<sup>3</sup> 1 mu = 0.067 hm<sup>2</sup>.

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