



Household-level effects of China's Sloping Land Conversion Program under price and policy shifts



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ABSTRACT

This study examined how agricultural households involved in China's Sloping Land Conversion Program (SLCP) could respond to expected changes in environmental and livestock policies and changing commodity prices. We calibrated a farm household model using 2009 survey data collected in northeast Gansu Province, China, and examined the responses of four different household groups. Household groups were distinguished based on the resources they possessed for either cropping, livestock husbandry or off-farm employment. We also calculated the opportunity cost of converting sloping land from grain crop production to perennial grass production and included the net value of the replacement crop in these calculations. Our model simulations indicated that subsistence-oriented households were most likely to participate in the SLCP, and that SLCP payment reductions could have large negative income effects for this group. Reductions in SLCP payments increased income inequality among households in the study area. Migration- and cropping-oriented households have fewer incentives to participate in the SLCP. With rising commodity prices, SLCP payments need to rise to avoid that subsistence-oriented households reconvert their land from perennial grasses to annual grain crops. Local government policies related to livestock production are being devised in Gansu as a method to lift incomes, and these policies could also have positive environmental benefits by increasing grass production on sloping land. The introduction of these livestock promotion policies had modest income effects but did not alter the area grown with grasses under the SLCP.

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Introduction

China's Sloping Land Conversion Program (SLCP) is one of the world's largest programs offering ("supply-side") payments for environmental services in terms of scale, payment and duration (Liu et al., 2008; Qu et al., 2011). The program uses central government funds to encourage households in the upper and middle reaches of the Yellow and Yangtze River Basins to convert steep-sloped cropland back to forestland and grassland. To encourage participation, households are offered annual payments in cash and in kind for each converted hectare.

The SLCP, also known as the "Grain for Green" program, involves ambitious environmental targets and affects the livelihoods of tens of millions of rural households. In this context, rigorous debates are emerging on the household economic effects of program participation (Xu et al., 2006a; Uchida et al., 2007, 2009; Xu et al., 2010; Li et al., 2011). Consensus is developing that program participation

reduces crop incomes and increases livestock production but has mixed effects on participation in off-farm employment and net household incomes. In addition rapid SLCP expansion has generated discussions about its impact on national food security (Xu et al., 2006b) and its fiscal risks for governments, income risks for participants, and ecological risks for program-covered areas (Xu et al., 2010). Several studies have also examined the expected effects of program cessation. Available estimates of the share of farmers in different locations who would return to pre-payment enterprises if SLCP payments end range from 38% to 67% (Bennett, 2008; Zhang et al., 2008; Cao et al., 2009; Grosjean and Kontoleon, 2009).

Although the above comprehensive studies provide many useful insights for current and future policy making, there appear to be at least three overlooked aspects in the available literature that have emerged as the SLCP has evolved over time. Firstly, opportunity cost estimates of SLCP participation are based on lost grain production and are compared with the amount of payment received to examine the extent to which households are being over- or under-compensated for retiring grain land (Uchida et al., 2005; Gauvin et al., 2010; Xu et al., 2010). This approach implicitly assumes that the replacement crop has no value. This may be a sound approach if

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the replacement crops are trees with a low survival rate or limited economic value, as can be the case in western China (Bennett, 2008; Bennett et al., 2011; Cao, 2011). However, if the trees or grasses planted to replace grain crops have substantial economic value, this approach should be modified.

Secondly, changes in the economic and policy environment may greatly affect households' incentives for program participation. For example, wheat and maize producer prices have increased by 71% and 59%, respectively, during the period 2001–2010 (NBS, various). These strong price increases may have greatly reduced household willingness to convert land or increased incentives to reconvert already converted land. Likewise, household land (re)conversion decisions are likely to be influenced by central or local policies that stimulate the planting of grain crops and promote livestock husbandry. Limited attention has been focused towards understanding how changes in the external environment of households influence SLCP participation. A notable exception is Grosjean and Kontoleon (2009). They use contingent behaviour questions related to household land and labour allocation intentions after the SLCP expires, and find that enhanced off-farm employment opportunities and more secure land property rights contribute to the long-term viability of the program.

Thirdly, it is important to take household resources into account when analysing responses to SLCP incentives. Several insightful studies distinguish between responses of relatively poor and rich households to SLCP measures (Xu et al., 2006a; Wang et al., 2007; Li et al., 2011). Recently, Liang et al. (2012) examined household heterogeneity in terms of demographic characteristics and found that households with children but without elderly tend to have lower migration rates and lower incomes after participation in the SLCP. Limited attention is paid in the available literature to differences in responses between households that depend for their livelihoods mainly on either cropping, livestock husbandry or off-farm employment, even though it can be expected *a priori* that responses to land conversion incentives will differ between these households.

In this article we used a farm household modelling approach to gauge how different types of farm households may respond to changes in program incentives as well as changes in the economic and policy environment. Using in-depth household data collected from 94 farms in Huan County, Qingyang Prefecture, in north-eastern Gansu Province in 2009, we (1) compared SLCP payments with the opportunity costs of land conversion when the replacement crop was valued and (2) simulated responses of different household groups to price and policy changes using a farm household model. Our study covered households from one county in western China. By collecting detailed whole farm data for those households and dividing them into different groups based on differences in assets for earning income from either arable farming, livestock husbandry or off-farm employment, we intended to offer modest insights into the whole-farm interactions and typical responses of farm households if policy and price shifts occur. This complements previous econometric studies which have used data collected from larger samples to examine the direct consequences of the SLCP on farm livelihoods.

Background, data collection and household classification

Background

Huan County is in a semi-arid region that contains a mixture of sloping and flat land. Soils in the county are a sandy loam and the county's average annual rainfall between 2004 and 2009 was 329 mm (308 mm in 2009). These biophysical factors result in the predominant farming system being a wheat–maize rotation with alfalfa continuously grown on a separate field. Grain crops are

grown on both flat and sloping land, and alfalfa is mainly grown on sloping land, but can also be grown on flat land. Alfalfa is a perennial grass that is a valuable livestock feed source grown in many parts of western China; it is eligible for payments under the SLCP.

In Huan County, the SLCP commenced in 2002 and households are currently in the second phase of the program. Payments are not expected to end at the completion of the second phase; rather payments are envisaged to be reduced from 2400 to 1350 RMB/ha/annum (at the time of research in 2009, 1 \$US ≈ 6.4 Chinese Yuan Renminbi, RMB), this reduction is determined by central government policy, with the central government providing funds to local governments to implement the SLCP. At a more aggregate level (Appendix), payments across the Yellow River Basin have also declined since 2007 (Yin and Zhao, 2012). Given the SLCPs vast coverage and differences in local–central government interactions, households in different regions may be subject to different policies with payment removal or reduction both being possible outcomes.

Huan County authorities are contemplating the use of different interventions aimed at increasing livestock and alfalfa production (Brown et al., 2009). Envisaged measures include providing farmers with a subsidy of 150 RMB/breeder to buy breeder goats, and promoting two new cropping activities: one is improved alfalfa harvesting, and the other is the production of maize silage. The subsidies for buying breeder goats provide incentives to increase flock sizes and may also ease liquidity constraints on the purchase of additional forages. Evidence from alfalfa management research in western China suggests that the protein content of alfalfa will be approximately 15% higher if it is harvested when 50% of a field is starting to produce flowers, instead of the current practice of harvesting daily from mid-April (Philp, 2011). Maize silage is produced by placing maize stover, the part of the crop that remains in the field after grain harvest, into concrete pits (anaerobic conditions) for approximately 45 days. Maize silage has higher energy content than maize stover. The two new cropping activities are common in other agricultural systems, but households in Huan County have had limited exposure to these activities due to a lack of dissemination and co-ordinated extension, a common challenge in western China (Brown et al., 2008).

Commodity prices

The overall trend for major agricultural commodity prices in Huan County between 2004 and 2009 has been a modest rise in grain prices, strengthening of meat prices and a decline in cashmere wool prices (Fig. 1). Despite sizeable price fluctuations in the global grains market in 2006–2008, domestic grain prices in China have been somewhat insulated from global market variations. For example, the increase in wheat prices from 2006 to 2008 within Gansu was 23%, compared to a 71% in the global wheat prices during the same period (Lu and Yu, 2011). Carter et al. (2012) and Lu and Yu (2011) attribute this insulation to government food self-sufficiency policies.

Data collection and household classification

A household survey, to collect the data necessary for building a farm household model, was conducted in Huan County in November 2009. A stratified random sample was used for selecting the households, with two different townships forming the strata (Appendix). A total of 94 households were interviewed. The main purpose of the survey was to collect detailed information on the farming systems in the county that can be used for model building. We therefore opted for in-depth data collection using a relatively small sample.

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