



Impact of the Sloping Land Conversion Program on rural household income: An integrated estimation



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ABSTRACT

The objective of this study is to identify the pathways of the potential impacts of the Sloping Land Conversion Program (SLCP) on household income and quantify these impacts along the identified pathways. We fulfill this objective by developing an integrated analytic framework and using data collected from Wuqi county of Shaanxi for the period 2004–2010. This integrated analytic framework enables us to formulate a structural equation model for testing hypotheses regarding the direct and indirect impacts of the SLCP. It is found that the direct effect of the SLCP on household income is positive but very small and insignificant, suggesting that retiring cropland has, at least, not reduced income from farming. Moreover, the SLCP has had a much higher and even increasing indirect impact on household income through promoting labor transfer and relaxing liquidity constraints. Overall, the SLCP's total impact on household income ranged from 3% in 2004 to 9% in 2010 excluding the insignificant direct impact. The research and policy implications of our work are discussed.

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Introduction

Rural poverty and a fragile ecological environment were predominant in China's Loess Plateau region before the turn of the century (Yin, 2009). This is partly because the marginal farmland on slopes, coupled with out-dated farming techniques, was inadequate to ensure the subsistence needs for the majority of households and partly because open grazing also played a role in maintaining the basic livelihoods of the local people (Yao et al., 2010). However, these farming and grazing practices aggravated the deterioration of cultivated cropland and vegetation covers, leading to severe water runoff, soil erosion and even desertification. These environmental challenges in turn caused widespread low farming productivity and thus unsustainable development. To mitigate the environmental and economic problems, and to move regional development onto a more sustainable path, the Chinese government piloted the retirement and conversion of sloping cropland during 1999–2000 in Shaanxi, Gansu, and Sichuan, before formally launching the Sloping Land Conversion Program (SLCP) in 2001 nationwide (State Forestry Administration, 2011).

Under the first eight years of the SLCP, farmers in the upper and middle reaches of the Yellow River received annual subsidies of food and cash worth 160 yuan for retiring 1 mu of degraded

cropland and converting it to tree or grass cover, whereas those in the upper reaches of the Yangtze River received subsidies worth 230 yuan¹ (Liu et al., 2010; Uchida et al., 2009; Yin, 2009). The annual subsidies in the Yellow and Yangtze basins were reduced, respectively, to 90 yuan and 125 yuan per mu in the following eight years. The extension of subsidies at reduced levels since 2008 was intended to help the large number of participating farmers to complete their transition into new and more viable employment, business and livelihood opportunities while promoting the continued efforts in land restoration and vegetation recovery. By the end of 2010, the SCLP had retired and restored 9.06 million hectares of degraded, marginal cropland, with the total subsidies amounting to \$32.14 billion (State Forestry Administration, 2011).

Thus far, many scholars have conducted evaluations of the socioeconomic changes induced by the SLCP, as reflected in labor transfer into off-farm and even off-village activities (Xie et al., 2006; Yao et al., 2010), relaxation of the family liquidity constraint on productive expenditure (Groom et al., 2008; Uchida et al., 2009), reduction in poverty and stimulation of income growth (Uchida et al., 2005; Liu et al., 2010) and/or modification of the household earning structures (Yao et al., 2010; Yin and Liu, 2013). While it is understandable for researchers to concentrate on certain, separate dimension(s) of the economic impact(s), these studies have so

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¹ Note that mu is a Chinese measure of land area where 1 mu = 1/15 ha; the yuan is a Chinese currency unit (\$1 = 6.25 yuan as of March 2013).

far not incorporated all the impacts into an integrated assessment. The goal of this paper is to fill this significant knowledge gap using a comprehensive modeling framework that covers all the major income-mediating factors, based on household survey data from northern Shaanxi.

Using a difference in differences model (DID) and data derived from household surveys carried out in 1999, 2002 and 2004 in three provinces including Shaanxi, Uchida et al. (2009) found that the SLCP had indeed significantly relaxed households' liquidity constraints on their wide-ranging engagement in off-farm employment. Similarly, with a DID model and household data for 1999 and 2006, Yao et al. (2010) showed that the SLCP had had significant positive effects on labor transfer, off-farm income and total income in northern Shaanxi. While these and other studies have greatly improved our understanding of the potential short-term socioeconomic impacts of the SLCP, they feature estimations of separate DID equations, leaving the exact contributions to income of the increases in labor transfer and relaxation of the liquidity constraint little tested. Another limitation of the previous assessments is that they are generally based on data for only two or three time points in a short period, with one point before the program was initiated and one or two points thereafter. In contrast, the study by Yin and Liu (2013) was unique in that it used data covering ten consecutive years (1999–2008) to examine the SLCP's impacts on various production and employment activities and thus on corresponding incomes. As such, it has shed new light on the dynamic performance of the program. Nonetheless, it did not consider the possible role of the subsidy payments in relaxing the liquidity constraint, nor examined the relationships between labor transfer and income growth explicitly.

Consequently, questions remain concerning the specific mechanisms and magnitudes of how the SLCP has affected different production and employment activities and, ultimately, different components of family income. To what extent have the subsidy payments directly affected household income above and beyond the opportunity cost of lost grain yields from retiring cropland? How have the induced labor transfer and relaxed liquidity constraint mediated their impacts on household income? What about the dynamic trends of those direct, indirect and total income effects? Clearly, answers to these questions are of great interest because they provide not only a complete picture of the effectiveness and efficiency of the SLCP but also much-needed insights for improving the design and execution of similar ecological restoration programs. At a time when payments for ecosystem services have attracted broad international attention (Pagiola and Platais, 2005; Bennett, 2008; Yin and Zhao, 2012; Richardson et al., 2012), efforts to tackle these questions are timely and important.

Field observations and government statistics point to substantial production and employment shifts and tremendous income growth in rural China over the last decade (Uchida et al., 2009; Yao et al., 2010; State Forestry Administration, 2011). In northern Shaanxi, for example, the area of cropland of those households participating in the SLCP has experienced a dramatic decline—from 11.8 mu in 1999 to only 4.8 mu in 2008 (Yin and Liu, 2013). This has, in turn, triggered a fast reallocation of labor force, as reflected in its transfer from farming and grazing to a whole host of off-farm and off-village activities in construction, transportation, energy exploration and services (Yin and Liu, 2013). Of course, this great trend in labor transfer has been greatly enhanced by the job opportunities generated by the rapid growth of the local and national economy as well as the urbanization (State Forestry Administration, 2009). As a result, rural households' income in northern Shaanxi increased by more than 250% between 1999 and 2008, even though the SLCP subsidy payments accounted for no more than 25.43% at their peak level in 2005 (Yin and Liu, 2013). It thus seems reasonable to

surmise that the indirect impacts of the SLCP on household income might have been much greater than the direct subsidies.

So, it is necessary and worthwhile to incorporate these induced direct and indirect income effects into a unified analytic framework to reach a clear conclusion about the overall income impact of the SLCP. Specifically, we posit that the SLCP would have had a positive direct effect on household income so long as the subsidies for cropland retirement and conversion were higher than the lost revenues from farming, brought about by cropland reduction and from displaced livestock production, brought on by banning open grazing. Meanwhile, carrying out the SLCP has resulted in a continued decline of household labor allocated to on-farm production activities and an increase in off-farm employment and business activities. If true, one of the indirect effects of the SLCP on household income should be manifested through labor transfer (Yao et al., 2010; Yin and Liu, 2013). Moreover, the SLCP subsidy payments could have relaxed household liquidity constraint on various productive activities and thus enabled further income growth (Uchida et al., 2009). This suggests yet another indirect effect on household income.

In this paper, we will analyze the complex relationships between the SLCP and subsidy payments, labor transfer, relaxed liquidity constraint and household income. We will do so by developing an integrative structural equation model and using household survey data from northern Shaanxi from four years—2004, 2006, 2008 and 2010—covering a longer and more up-to-date time span. It is hoped that, by quantifying those direct and indirect income impacts of the program and their changes over time, this study will not only improve the understanding of the specific pathways of the SLCP effects and their magnitudes, it also will contribute to better design and implementation of ecological restoration efforts in China or elsewhere. In the next section, we outline our conceptual framework and hypotheses in regards to the pathways of the SLCP and their direct and indirect impacts on household income. Then, the study site and data will be described in next section and empirical results presented in section "Estimated results". Finally, conclusions and discussion will be described in last section.

Theory and hypotheses

To estimate the magnitudes of the direct and indirect impacts of SLCP on income, we need to identify the influence pathways first and then define the functional structure and determinants of household income along each pathway. According to the composition and change of production/employment activities in our study area, household income consists of on-farm income, off-farm income and other income. On-farm income refers to the net revenue derived from farming, forestry and livestock production activities; off-farm income refers to the net revenue generated from off-farm employment and business opportunities, including both self-employment and wage-earning activities. Other income refers to payments received from grain and livestock production subsidies from the central and provincial governments, receipts from leasing out land and other assets, welfare transfers from government and cash support and gifts from relatives and friends.

Here, it should be made clear that we exclude the subsidy payments for participating in the SLCP from other income to avoid possible over-estimation of the SLCP's income effect, because they are treated as one of the sources of the direct income impact. If so, the SLCP could have made a direct positive effect on the income of participating households as long as the payments are higher than the opportunity costs of the lost grain yields as a result of retiring their cultivated land. Based on the surveys in seven provinces including Shaanxi, Xu and Cao (2002) and Xu et al. (2004) revealed that more than 80% of the plots selected for the SLCP were marginal

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