（別紙様式第３号）

学 位 論 文 要 旨

氏名: Li Li

題目: Effects of the Grain for Green Program on Rural Household Productivity and Efficiency in Loess Plateau, China
(中国黄土高原における退耕還林政策が農家の生産性と効率性に及ぼす影響)

The Loess Plateau, with the most serious soil erosion worldwide, is among the most poverty-stricken areas in China. Land reclamation, overgrazing and deforestation for growing foods and subsistence needs aggregate both economic and environmental circumstances for the farmers and brought about significant negative externalities. The Chinese government responded with a Program called Grain for Green Program in 1999. The Program committed to sustainable development of the target area through financial support, technical assistant and institutional improvement at national or regional scale, with an intention of prevent the unsustainable agricultural practices through improvement (or at least maintenance) in agricultural production, and transfer of surplus labor force to off-farm jobs.

Indicators of total factor productivity (TFP, measured as the ratio of aggregate output to aggregate input) and technical efficiency (TE, measured as the ratio of actual to potential output) are of particular significance for evaluating the Program for sustainable development. The objectives of this study are to shed some light on issues related to effects of the Program based on TFP and efficiency indicators and find out ways to improve the effectiveness of the Program.

Specifically, the study addresses the following mutually related questions:

(1) What changes had been induced by the Program on TFP and TE at the farm level? Among the components of TFP growth - technological growth and TE changes, what is (are) the driver(s) of TFP change? What are the factors responsible for the TFP change and its components?

(2) How is the rural households' efficiencies at the farm level under the prevailing circumstances (the emerging technology and shrinkage of land area, etc.), brought about by the Program? What are the factors responsible for the inefficiencies at the farm level?

(3) Off-farm income has increasingly become an important income sources for participant households. It not only reshapes the labor allocation of the rural households, but also affects their agricultural production and household welfare. So how is the farm-household technical efficiency (or TE at the farm-household level) after the implementation of the Program? What are the factors responsible for the inefficiencies at the farm-household level?

Here by farm level, TFP and efficiencies are estimated with only agricultural inputs (e.g. land, labor, capital and material) and outputs (e.g. crop and livestock); and by farm-household level, efficiencies are estimated with not only agricultural inputs and outputs, but also inputs (e.g. labor used in off-farm jobs) and outputs (e.g. off-farm income) used in off-farm employment.

To answer these questions, three investigations were taken with random sampling in the study areas, including

Zhifanggou catchment and Xiannangou catchment, in 2008 and 2009. Zhifanggou catchment and Xinannangou catchment are located in Ansai County, Shaanxi Province on Loess Plateau. They are agriculture-dominated areas with semi-arid continental climate. The economic, social and ecosystem environment are typical in the rural society of the Loess Plateau, and both of them were among the pilot areas in the Grain for Green Program, which makes the observations and references in this thesis reliable and significant.

The first question was answered with a case study using panel data in 1999 and 2007 of 59 sample farm-households from Zhifanggou catchment. TFP changes at the farm level was estimated and decomposed using data-envelopment-analysis based Malmquist-TFP-index, and then TFP changes and its components were regressed against with some variables of farm-specific socio-economic characteristics and measures participations. The result shows that TFP has been greatly improved by 52.5%. The improvement in TFP stemmed solely from technological growth, which increased by 76.0%. In contrast, the TE of farms under the improved technology has decreased by 13.5%. The distribution of TE turned to be more equal. Regression analysis shows, land terracing is the only variable significantly related to TFP growth, technological growth and TE changes and its directions are all positive; Access to credit is positively related to TFP growth and technological growth; Extension services are positively related to technological growth, while age is negatively related to TE changes.

The second question was answered with a case study using cross-sectional data in 2007 of 112 sample farm-households from Zhifanggou catchment and Xiannangou catchment. Second stage data-envelopment-analysis were employed at a farm level for the purpose, in which the first stage involves an estimation of the efficiency scores using data-envelopment-analysis, and the second, a regression analysis of the farm-specific socio-economic variables against the obtained efficiency scores. The first stage analysis suggests the existence of substantial inefficiencies under the improved technology together with other changing context within the framework of the Program. Cost efficiency (CE) averaged at 0.274 (0, inefficient; 1, perfect efficient), allocative efficiency (AE) 0.389, TE 0.689, SE 0.819 and PTE 0.821. The distribution and statistic analysis shows scale inefficiency was mainly due to suboptimal size of farms. And regression analysis shows, farm size is the only variable that is significantly related to AE, TE and SE and its directions are all positive. For other significant variables, tenancy ratio (the ratio of rented cultivated land to total cultivated land) and Simpson index (a measure of land fragmentation, higher value means more fragmented) are negatively related to TE and SE; and remittance ratio is positively related to TE and SE.

The third question was answered with a case study using cross-sectional data in 2007 of 59 sample farm-households from Zhifanggou catchment. A household model was given to estimate farm-household TE, and they are regressed against with some variables of household-specific socio-economic characteristics. The result shows that farm-household TE is still quite low, averaged at 0.356. Regression analysis suggests, the extent of off-farm involvement is positively related with farm-household TE. And land fragmentation is negatively related with farm-household TE.

To sum up, the results of case studies in our study, suggest that farm TFP, technology has greatly improved as a result of the Program. Farm TE becomes more equally distributed. Terracing sloping land, providing access to credit and extension services, expanding farm size, secure land tenancy, alleviate land fragmentation and facilitating off-farm employment and rural-urban migration would improve the effectiveness of the Program.