Modeling farm-household decisions under imperfect markets: a case study in Sierra Leone

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This paper presents a generic farm-household model for use in the context of low income economies to gain knowledge on food security and rural poverty alleviation under different policy options. This model, named FSSIM-Dev (Farming System Simulator for Developing Countries), is based on the extension of an existing model, Farm System Simulator (Louhichi et al., 2010), that has been developed in the framework of SEAMLESS project (Van Ittersum et al., 2008) and applied to several EU countries.

FSSIM-Dev is a farm-household model for use in the specific context where farm household production, consumption and labour allocation decisions are non-separable due to market imperfections. As long as markets are perfect for all goods, households are indifferent between consuming own-produced and market-purchased goods, and allocating production between consumption and market sales. However, if market fails for a household, separability does not hold any more and the household's decision problem of production and consumption must be solved simultaneously (Singh et al., 1986).

Contrary to most well-known household models which are econometric based, FSSIM-Dev is a non-linear optimization model which relies on both the general household's utility framework and the farm's production technical constraints, in a non-separable regime. It is referred to as a static-comparative Positive Mathematical Programming (PMP) which simultaneously solves a set of microeconomic farm models reproducing the behaviour of representative farm households. The main strength of this modelling approach are: (i) very detailed representation of farm household production process in terms of commodities coverage, land heterogeneity and technology choices; (ii) capture endogenously the inter-linkage between transaction costs and market participation decision; (iii) takes into account farm household heterogeneity with respect to their both consumption baskets (demand side) and resource endowments (supply side); (iv) capture the interaction among farm households for factor markets as well as the seasonality of farming activities and resource use; and (iv) lastly but not least, smoothly integrate results from bio-physical models needed to assess the environmental effects of production process. From technical perspective, FSSIM-Dev was designed sufficiently generic and modular to be re-usable, adaptable and easily extendable to achieve different modelling goals.

Model use is illustrated in this paper by simulating the impact of rice seed policy on the livelihood of representative smallholder farmers in Sierra Leone and, more specifically, on land use, production and consumption of basic food commodities, farm-household's welfare and poverty level. Results show that the seed policy would improve farm productivity and boost household income but it is not sufficient to fight poverty since 90% of the surveyed farm households would continue to live below the extreme poverty line of 1 USD-equivalent per day.

Keywords: Farm household model, Transaction costs, Agricultural Policy, Poverty, Sierra Leone

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