

Modeling Discrete Technology Choice: An Application to Standard and Organic Farming in Finland

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Finland has a long experience in implementing a public policy program to promote organic farming. Farmers' choice alternatives under the Finnish incentive program are characterized as follows. A farmer, who is currently applying the standard production technology, is facing a choice between two mutually exclusive alternatives. At the beginning of each year he decides whether to sign a five-year contract and switch to organic farming or to continue standard farming while retaining the option to switch later. Similarly, a farmer currently farming organically decides whether to switch back to standard farming, or to continue farming organically while retaining the option to switch later.

These discrete choices are solutions to a multi-period, dynamic optimization problem in which the future returns are stochastic. Therefore, estimating the farmer's choices in the structural form requires a solution to two distinct problems: (1) the solution to the stochastic dynamic optimization problem on which these choices are based; (2) the estimation of choice probabilities together with the underlying structural parameters of the behavioral equations.

In this study¹, the dynamic optimization problem is solved by first defining choice specific value functions that obey the Bellman equation and next numerically iterating on the Bellman equation backwards, starting from the terminal period. The maximized random return streams are simulated using crude Monte Carlo simulation. These maximized return streams then determine the next period optimal value functions. A Probit-type endogenous switching model using Maximum Likelihood Estimation (MLE) is used to estimate the choice probabilities.

The results suggest that decreasing output prices and increasing direct subsidies have been triggering switches to organic farming. Therefore, income neutral policy reforms, which decrease price support and compensate the resulting income losses by direct income transfers, increase incentives to switch into organic farming. It is also found that the switch is more likely on farms having large land areas and low yields and less likely on farms with intensive livestock or either labor or capital intensive production.

Keywords: Technology Choice, Organic Farming, Dynamic Programming, Switching Model

¹ A preliminary paper on this work has been presented on the 65th EAAE Seminar. The revised final version is forthcoming in the *European Review of Agricultural Economics*, Volume 28.