Conversion to Organic Farm Management: A Dynamic Programming Approach

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Introduction

Previous studies have found that organic cropping systems have greater per-acre returns than conventional rotations in the Midwest (Locke et al. 1978; Delate et al. 2003; Chavis, Posner, and Heddeke 2009; Delbridge et al. 2011a). Noting that relatively few conventional crop farms have adopted organic management despite these higher returns, other studies have attempted to model the decision to undertake farm conversion (Acs et al. 2009; Wossink and Kumbier 2010). This study advances this literature by using long term trial data on organic and conventional crop rotations and recent results on the differing management requirements for these two systems (Delbridge et al. 2011b), to more realistically model the decision to convert to organic crop production in the Midwestern U.S.

Objectives

This study uses 18 years of agricultural trial data along with empirical whole farm cost data to model the relationship between organic, conventional, and transitional returns to crop management and investigate the degree to which policy and farm size affect the rate of organic conversion. Specifically, our objectives are:

1. Determine the steady state probability of organic transition for various farm sizes.
2. Investigate how the likelihood of transition might be affected by incentives for transitioning farmers or fully organic farmers.
3. Compare steady state outcomes with short-run transition probabilities for different “starting points”

Methods

Net returns to management are calculated for a four-year organic crop rotation (com-soybean-oat-alfalfa) and a two-year conventional rotation (corn-alfalfa) and a two-year organic crop rotation (corn-alfalfa) and a two-year organic crop rotation (corn-alfalfa) and a two-year organic crop rotation (corn-alfalfa). Potential subsidy policies to encourage organic transition are shown to be effective, though simply subsi...

Results: Steady State Transition

Under all three subsidy scenarios, farm size #1 (in which the organic and conventional farms are both 320 acres) has a higher probability of transition than the other farm size scenarios. Farm size scenarios #2 and #3 have nearly equal transition probabilities. The net effect of the transition subsidy in the steady state is to encourage transition, though the effect is small compared to that of a subsidy on all organically managed acres. Including both of the subsidies at the same time, which is equivalent to a $100 per acre subsidy during transition years and a $50 per acre subsidy thereafter, has an effect substantially larger than the sum of the individual subsidy effects.

Results: Short-term Transition

Unlike the probability of organic transition in the steady state, the probability of transition in the short-run (10 years) is affected by the initial value of the transition band and a set of system returns. Because higher conventional returns make organic transition less attractive, the transition probabilities decrease as the model’s initial conventional return value increases. Just as in the long-run, short-run transition probabilities increase with the transition and organic subsidies, though the impact of each depends on the initial value of conventional returns. For all farm sizes, the higher the initial value, the smaller the impact of the subsidy. For example, for farm size #3, the organic subsidy increases the probability of transition by 0.18 when the initial return level is $450 but by only 0.09 when the initial level is $750. As in the steady state we see that for all three farm size scenarios, the transition subsidy has a much stronger effect in conjunction with the organic subsidy than alone.

Conclusions

Even though the 4 year organic rotation has a higher average net return than the conventional 2 year system, the costly transition period and the uncertainty of future returns lessen the probability of a farm transitioning to the more profitable organic system. When conventional returns are high, as they have been in recent years, not only does the probability of organic transition decrease, but the optimal decision can be to abandon organic management. Potential subsidy policies to encourage organic transition are shown to be effective, though simply subsidizing farmers during the 3 year transition has much less impact than a subsidy on all organically managed acres.

References

http://journals.ageconsearch.umn.edu/bitstream/103790/2/Delbridge%20AAEA%202011%20v2.pdf.