Dealing with corner solutions in multi-crop micro-econometric models: An endogenous switching regime approach with regime fixed costs

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Objectives

To present an econometric multi-crop model accounting for corner solutions in acreage choices with two original features:

- Farmers are assumed to be expected profit maximizers. They consider the crops included in the crop set $K$ and the production regimes included in the feasible regime set $R$.
- Farmers simultaneously choose the crop set to be produced and the acreages of the produced crops. Crops with null acreages are simply situations that are not produced.

Farmers’ acreage choice problem, basic assumptions:

- Farmers' acreage choice problem can be decomposed into two steps according to a backward induction approach.

1. Computation of the optimal profit level in each feasible regime. This steps, for each feasible regime, the optimal acreage choices:

$$\Pi'_{k}(r) = \max_{s} \Pi_{k}(r, s)$$

where $s$: acreage share of crop $k$ with $r$ (i.e. $k \in K$) $x_{k}$: expected return of crop $k$ $\Pi_{k}(r, s)$: implicit management cost of acreage $x_{k}$ $s_{k}$: subset of crops not produced in regime $r$.

2. Computation of the optimal production regime, regime fixed costs included

$$r_{*} = \max_{r} \left( \Pi_{r}(r) - g_{r}(r) \right)$$

Of course, farmers’ optimal acreage choice is that defined by the optimal production regime, $(x_{i},r_{*})$.

Structure of the ERS multi-crop model

The ERS multi-crop econometric model is composed of six parts:

1. A system of crop yield supply equations describes the yield levels obtained by farmers.

2. A system of crop variable input demand equations describes farmers’ variable input uses.

3. The crop expected returns are constructed within the model.

4. A system of acreage share choice equations describes the acreages of the crops that are protected by farmers.

5. The regime expected profit levels constructed within the model.

6. A probabilistic discrete choice model describes farmers’ production regime choices.

Table 2: Average own-price crop acreage elasticities

<table>
<thead>
<tr>
<th>Crop</th>
<th>Average</th>
<th>Std. Dev.</th>
<th>Mean</th>
<th>Std. Dev.</th>
<th>Mean</th>
<th>Std. Dev.</th>
<th>Mean</th>
<th>Std. Dev.</th>
<th>Mean</th>
<th>Std. Dev.</th>
<th>Mean</th>
<th>Std. Dev.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Protein peas</td>
<td>5.3%</td>
<td>0.2%</td>
<td>15.4%</td>
<td>2.5%</td>
<td>5.0%</td>
<td>1.5%</td>
<td>2.5%</td>
<td>1.1%</td>
<td>6.4%</td>
<td>2.6%</td>
<td>8.8%</td>
<td>1.1%</td>
</tr>
</tbody>
</table>

References