Technical Efficiency of Farms under Multiple Output Technology

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Selected Poster prepared for presentation at the International Association of Agricultural Economists (IAAE) Triennial Conference, Foz do Iguaçu, Brazil, 18-24 August, 2012.

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BACKGROUND

Agricultural policies in most OECD countries recognize and promote multifunctionality of farms. In that sense, more and more farms will diversify their outputs and will be engaged in different activities which go beyond agriculture. These activities include ecosystem services such as protection of biodiversity, maintenance of rural landscape etc. Furthermore, competitiveness of rural areas implies a further diversification of farm businesses, e.g. the involvement in rural tourism, on-farm direct selling etc.

Since farm outputs are heterogeneous in their nature, it could be appropriate to model them separately when assessing farm performance. In this study, we analyze performance of Swiss dairy farms in three different regions considering multiple output technology. Outputs produced by Swiss farms can be divided into three types: (1) agricultural output; (2) para-agricultural output and (3) goods and services of public interest which are remunerated through direct payments.

METHOD

We use distance function approach which allows representation of the production technology with multiple inputs and multiple outputs. A stochastic output distance function model is expressed as follows: $1 = D_s(x; y; \beta) \cdot \exp[u_i - v_i]$, where $x$ denotes the vector of inputs, $y$ is the output vector, $v_i$ is noise component $\sim N(0, \sigma_{v}\chi^2)$; $u_i$ is technical inefficiency $\sim N(0, \sigma_{u}\chi^2)$; both are heteroscedastic [1].

- Distance function is specified by translog functional form.

RESULTS

Elaboration of inputs and returns to scale

Swiss dairy farms in the sample show high technical efficiency on average. However, the efficiency scores range between 0.37 - 1.00 indicating potentials for improvement.

Determinants of technical inefficiency

<table>
<thead>
<tr>
<th></th>
<th>Plain1</th>
<th>Hill1</th>
<th>Mountain1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Share off-farm income</td>
<td>-0.043 ***</td>
<td>-0.031 ***</td>
<td>-0.028 ***</td>
</tr>
<tr>
<td>Share rented land</td>
<td>0.004 n.s.</td>
<td>0.015 ***</td>
<td>0.014 ***</td>
</tr>
<tr>
<td>Share para-agriculture</td>
<td>-0.052 **</td>
<td>-0.244 **</td>
<td>-0.097 ***</td>
</tr>
<tr>
<td>Altitude</td>
<td>0.002 **</td>
<td>0.002 ***</td>
<td>0.002 ***</td>
</tr>
<tr>
<td>Age</td>
<td>-0.018 *</td>
<td>-0.003 n.s.</td>
<td>0.003 n.s.</td>
</tr>
<tr>
<td>Education</td>
<td>0.584 ***</td>
<td>-0.133 n.s.</td>
<td>0.179 **</td>
</tr>
<tr>
<td>Share hired labor</td>
<td>0.020 ***</td>
<td>0.016 ***</td>
<td>0.022 ***</td>
</tr>
<tr>
<td>Ecologic. direct paym. per anim.</td>
<td>0.012 ***</td>
<td>0.010 ***</td>
<td>0.006 ***</td>
</tr>
</tbody>
</table>

CONCLUSION AND POLICY IMPLICATIONS

- Swiss farms are closer to optimal scale when general direct payments are not considered in the outputs (models 2). Especially notable is this for dairy farms in mountainous region of Switzerland. This could be an indication for the fact that by using general direct payments Swiss agricultural policy sent false signals to farmers regarding optimal use of their resources. Another study also found suboptimal scale of production for Swiss farms [2].
- Farms with higher share of para-agricultural activities seem to be more efficient. Thus, in order to support development and competitiveness of rural areas policy should encourage those kind of activities. 
- Negative influence of ecological direct payments on technical efficiency of farms can be explained by the fact that farms receiving higher payments are strongly dependent on policy and typically use more extensive farming practices. In order to compensate those farmers for losses caused by extensive production a better targeting of this political instrument is required.

References: