Introduction

- Increasing demand for domestic dairy products by Brazilian consumers
- National companies with low performance and high competition against the international dairy industry
- Minor efforts to increase the productivity, technology adoption or professionalization
- Companies are facing difficult challenges in order to organize the supply chain in their coverage area
- We analyse productivity, efficiency and the determinants of technical efficiency (TE) of the dairy processing firms in Paraná state, Brazil

Data / Variables

Data base from IPARDES of 2009

- 243 dairy processing companies
- 35 cooperatives /208 ‘Investor Owned Firms (IOFs)’ from Paraná state, Brazil

Production function

- Output \( Y \) = total revenue (estimated)
- Inputs \( X \) = capacity of processing, labour and transport.

Determinants of technical efficiency (z)

- Idle capacity of the processor
- Type of inspection service (SIM, SIE or SIF) adopted in Brazil;
- Dummy for different criteria of payment different from volume of milk
- Dummy for cooperatives

Methods

We use a stochastic frontier model

\[ y_i = x_i \beta + v_i - u_i \]

with output \( y \) and input \( x \) and \( \beta \) as k x 1 vector of parameters to be estimated.

\( v_i \) as two-sided symmetric error term

\( u_i \) as non-neg. one-sided error component captures inefficiency assumed to follow an exponential distribution with parameter \( \lambda_i \):

\[ u_i \sim \text{Exp}(\lambda_i) \]

We estimate the determinants of inefficiency:

\[ \lambda_i = e^{z_i} \]

\( \lambda_i \) expressed as a function of firm-management characteristics with \( z \) as a vector of determinants of TE, and \( z \) is a L x 1 vector of parameters to be estimated.

Bayesian estimator

We use a Bayesian techniques to estimate the model above (van den Broeck et al. 1994).

Results

Tab. 1: Estimated Production Frontier

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
<th>Std. dev.</th>
<th>95% Credible Interval</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>0.307**</td>
<td>0.051</td>
<td>[0.216, 0.385]</td>
</tr>
<tr>
<td>Transport costs</td>
<td>0.001</td>
<td>0.014</td>
<td>[-0.023, 0.024]</td>
</tr>
<tr>
<td>Labour</td>
<td>0.354**</td>
<td>0.054</td>
<td>[0.267, 0.442]</td>
</tr>
<tr>
<td>Production capacity</td>
<td>0.822**</td>
<td>0.041</td>
<td>[0.754, 0.889]</td>
</tr>
<tr>
<td>( \alpha_1 )</td>
<td>6.183</td>
<td>0.827</td>
<td>[4.910, 7.601]</td>
</tr>
<tr>
<td>( \alpha_2 )</td>
<td>0.405</td>
<td>0.027</td>
<td>[0.363, 0.451]</td>
</tr>
</tbody>
</table>

Source: Own calculations

- Output elasticity of Labour is 0.35% and of production capacity 0.82%.
- Mean TE of all firms: 79%, i.e. firms can increase their production by 21%
- Scale elasticity: 1.18; companies operate under increasing returns to scale
- This suggests a margin for growth through expansion and/or merging,
- We expect structural change

Results (Contd.)

Fig. 1: Histogram of Technical Efficiency scores

- Increase in the idle capacity by 1%, leads the efficiency to decrease by 0.22%.
- Cooperatives 0.08% less eff. than IOFs.
- Applying a more restrictive inspection services (SIM \( \Rightarrow \) SIE or SIE \( \Rightarrow \) SIF) companies increase efficiency by 0.06%.

Tab. 2: Determinants of Tech. Efficiency

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
<th>Std. dev.</th>
<th>95% Credible Interval</th>
</tr>
</thead>
<tbody>
<tr>
<td>Log idle capacity</td>
<td>0.224**</td>
<td>0.031</td>
<td>[0.172, 0.277]</td>
</tr>
<tr>
<td>Dummy for cooperatives</td>
<td>0.079**</td>
<td>0.042</td>
<td>[0.007, 0.145]</td>
</tr>
<tr>
<td>Dummy for different payment criteria</td>
<td>-0.002</td>
<td>0.048</td>
<td>[-0.076, 0.082]</td>
</tr>
<tr>
<td>Type of inspection service</td>
<td>-0.059**</td>
<td>0.025</td>
<td>[-0.102, -0.020]</td>
</tr>
</tbody>
</table>

Source: Own calculations

Conclusion

- A Reduction of idle capacities could improve technical efficiency
- In contrast: Increasing size of companies improves scale efficiency
- More restrictive sanitary inspection services increase efficiency
- Cooperatives seem to be less efficient than IOFs when treated as a simple profit maximizing company.
- A limit of this study lies on the estimation of the output variable, since companies were not willing to provide their total revenue.

References


Contact:
MSc. Caetano Luiz Beber (cbeber@gwdg.de)
Georg-August- University Göttingen, Germany
Department of Agricultural Economics & Rural Development