

University of Goettingen

Determinants of Technical Efficiency of Dairy Processing Firms in Southern Brazil



Caetano Luiz Beber, Sebastian Lakner, Ioannis Skevas & Ludwig Theuvsen

University of Goettingen, Department of Agricultural Economics & Rural Development

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

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;

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 => SIE or SIE => SIF)

(TE) of the **dairy processing firms** in Paraná state, Brazil

Methods

We use a stochastic frontier model

$$y_i = x_i'\beta + v_i - u_i$$

with output y and input x and β as k x 1 vector of parameters to be estimated.

 \boldsymbol{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 λ_i :

$$u_i \sim Exp(\lambda_i)$$

We estimate the determinants of inefficiency:

$$\lambda_i = e^{\mathbf{z}_i^{\prime}\delta}$$

 λ_i expressed as a function of firm-management characteristics with z as a vector of determinants of TE, and δ is a L × 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).

- Dummy for *different criteria of payment* different from volume of milk
- **Dummy** for *cooperatives*

Results

Tab. 1: Estimated Production Frontier

Posterior means, standard deviations and 95% credible intervals with respect to inputs and the variance parameters

Variable	Mean	Std. dev.	95% Credible Interval	
Intercept	0.303**	0.051	[0.216, 0.385]	
Transport costs	0.001	0.014	[-0.023, 0.024]	
Labour	0.354**	0.054	[0.267, 0.442]	
Production capacity	0.822**	0.041	[0.754, 0.889]	
σ _u	6.183	0.827	[4.910,7.601]	
σ	0.405	0.027	[0.363, 0.451]	
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

companies increase efficiency by 0.06%.

Tab. 2: Determinants of Tech. Efficiency

Marginal effects of the variables in Z on inefficiency

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

under increasing returns to scale

This suggests a margin for growth through expansion and/or merging,

• We expect **structural change**

 A *limit* of this study lies on the estimation of the output variable, since companies were not willing to provide their total revenue.

References

 Broeck, Julien van den, Gary Koop, Jacek Osiewalski, and Mark F.J Steel. 1994. "Stochastic Frontier Models." *Journal of Econometrics* 61 (2): 273–303. doi: 10.1016/0304-4076(94)90087-6.

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



ACKNOWLEDGMENTS

CAPES/CNPq – Program Science Without Borders, BRAZIL Paraná Economic and Social Development Institute – IPARDES