UNIVERSIDAD AUTONOMA DE COAHUILA

CENTRO DE INVESTIGACIONES SOCIOECONOMICAS

Measuring Technical Efficiency in a Small-Scale Fishery: A Stochastic Frontier Analysis to an Inland Fishery in the North Side of Mexico

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Introduction

The analysis of technical efficiency (TE) on the small-scale fishery is relevant for several reasons. While this type of fishery is highly common in developing countries, there are a very limited number of analyses assessing their efficiency. Indeed, there is no precise information on the contribution of the small-scale fisheries to livelihoods and economies in developing nations (Worm et al. 2009). Exploring this gap in the research is relevant for the decision making policy. On the one hand, small-scale fisheries can generate significant profits and be more resilient to shocks and crises; two important elements to poverty alleviation and food security. But on the other hand, small-scale fisheries may overexploit stocks, harming the environment. This problem arises when the fishery is weakly regulated, with no efficiency criteria to manage the lake. The fishery management should be linked with efficiency considerations (Grafton et al. 2006). Certainly, it is desirable the preservation of common pool resources (i.e. lakes), but at the same time it is desirable an efficient use of the fishery. The question is what factors constrain the efficiency?

Objectives

Aiming to contribute in the knowledge of small-scale fisheries efficiency, this study seeks to estimate the Technical Efficiency (TE) of fishers in a small scale reservoir, in the north side of Mexico.

Method

To assess the fisher's TE, this research uses stochastic frontier analysis (SFA). The null hypothesis was: fisher's skills favor the fisher performance. The SFA procedure (Kumbhakar and Lovell 2000), in this approach uses 89 observations, gathered from a survey-census of three fishing communities. We used a joint estimation procedure using the Frontier software in R

Model

The model follows the functional form of Battise and Coelli (1995) production frontier, and it is based in Grafton et al. (2000) and Squires et al. (2003).

$$nl[\ln y_i = \beta_0 + \psi \ln(gas_i + \phi_1 row_i) + \gamma \ln l_i + \alpha \ln(n_i + \phi_2 a_i) + \varepsilon_i]$$

Eta1=$89
Eta2=1.09

$$\ln y_i = \ln \beta_0 + \beta_1 \ln l_i + \beta_2 \ln ec_i + \beta_3 \ln fc_i + v_i - u_i^{TE}$$

where
- y : Output (kg of harvest in last week)
- l : Labor (Hours fishing per week)
- ec : Effort capacity (gas expenditure + eta1*dummy row)
- fc : Factor capacity (nets used + eta2*dummy angling)
- v : Stochastic term $e = v_i - u_i^{TE}$

$$u_i^{TE} = \delta_0 + \delta_1 edu_i + \delta_2 fex_i + \delta_3 tb_i + \delta_4 class_i + \delta_5 tm_i + \delta_6 ph_i + \delta_7 shr_i + \delta_8 incf + \delta_9 bl$$

where
- u_i^{TE} : noise term to account TE
- edu : fducation (years in school)
- fex : fishing experience (years)
- class : If fisher have taken a training class (dummy)
- tm : motor age (years)
- tb : boat age (years)
- ph : family size (number of people in home)
- shr : If fisher shares the boat (dummy)
- incf : If fishing is the main source of income (dummy)
- bl : boat length

Results

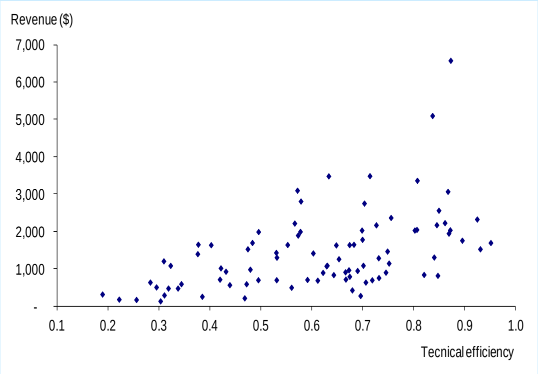
Maximum likelihood estimates of the empirical model

		Estimates	Std. Error	Signif.
Production function				
Intercept		0.839	0.656	
ln labor	*l*	0.517	0.159	**
ln effort capacity	*ec*	0.203	0.099	*
ln factor capacity	*fc*	0.417	0.123	***
Efficiency variables				
Intercept		3.346	0.924	***
Education	*edu*	-0.251	0.056	***
Fishing experience	*fex*	-0.052	0.013	***
Training class (D)	*class*	-2.867	1.064	**
Age of the motor	*tm*	0.060	0.015	***
Age of the boat	*tb*	-0.024	0.016	
Boat length	*bl*	-0.061	0.146	
Family size	*ph*	-0.106	0.055	.
Sharing the boat (D)	*shr*	0.110	0.188	
Income from fishing (D)	*incf*	-0.424	0.211	*
Sigma Sq		0.383	0.057	***
Gamma		0.000	0.000	***
log likelihood value		-83.58		

Signif. codes: '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1
ln means natural logarithm and (D) means dummy variable

Concluding remarks

We do not reject that fisher skills is the most relevant factor for efficiency. Other variables favoring TE are education, fisher experience, time using the motor and income from fishing activity. This assessment brings useful information to improve productivity and management of the fishery, relevant elements to assist the fishing communities. Knowing the factors that constrain TE would lead to an increase in the fishers' revenue (see graph) and hopefully can be useful in reducing poverty. But carefully recall, the fishery is a common pool resource, and improvements in TE without restrictions on entry may lead to a faster collapse of the fishery. Improving the net income and avoiding the overexploitation, need to be jointly tackled, not an easy task. This research not only corroborates previous findings on large fisheries, contributes in the knowledge of TE in small-scale fisheries. As Squires et al. (2003), Esmaeili (2006), and Akanni (2008, 2010), our assessment have a high TE, a finding to be corroborated in future research and see if most small-scale fisheries have a similarly high TE.



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