

# Technical Efficiency of Swiss Nursing Homes

## A DEA and Stochastic Frontier Analysis

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### Introduction

A large number of aspects of long-term care for the elderly have been studied, but relatively little attention has been focused on the technical efficiency of facilities and the various characteristics that influence their performance.

In this study, we attempt to establish if and up to what point Swiss nursing homes are using their resources in an optimal way. We have based our analysis on detailed data collected from 1,431 facilities operating in 2004. Our aim is to evaluate the technical efficiency of each unit and to highlight its determinants by means of a two-step procedure.

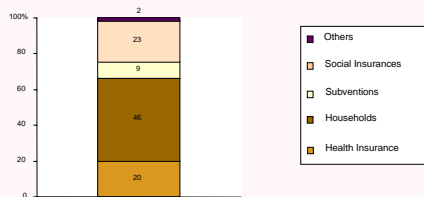
We construct a frontier in relation to which each unit's efficiency is assessed, with the relationship between resources and products as the starting point. We apply and compare two different methods, a non-parametric (Data Envelopment Analysis, "DEA") and a parametric one (Stochastic Frontier Analysis, "SFA") to model the production process and to obtain efficiency estimates for each unit. In a second step, determinants of these efficiency scores are analyzed by multivariate regression

### Context

In 2005, the health expenditure to GDP ratio in Switzerland was 11.6%. More than 12% (Swiss Francs 6 billion) of this expenditure was linked to long-term care facilities. There are many different subsystems in Switzerland. This diversity implies planning and control difficulties for the government.

Some solutions are being suggested to contain costs (rationing, increasing out-of-pocket payments, prevention); one of which is to increase the efficiency of facilities.

#### How do Swiss nursing homes get financed?



Family out-of-pocket payments cover a substantial part of nursing home costs.

### Data

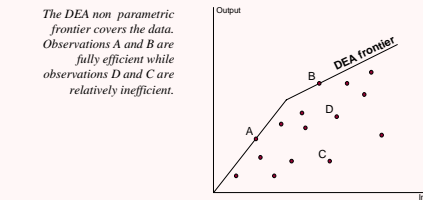
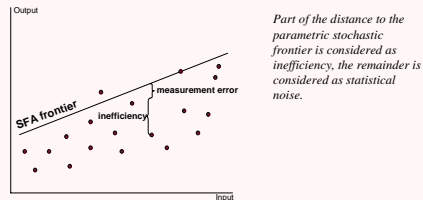
The « Official database of the non-hospital health services facilities » provides the following information for 1,431 Swiss facilities (98% of the total):

- characteristics of facilities
- accounting (expenses and revenues)
- services provided
- characteristics of patients
- medical and non-medical staff

### Method

The objective is to define a frontier by means of a parametric (SFA) or non parametric (DEA) method. The output-oriented technical efficiency (to provide the greatest volume of services with a given set of inputs) is computed in relation to this frontier.

DEA is a data-driven approach that does not imply any statistical assumption, whilst SFA focuses on the distribution of the error term, a part of which is considered as inefficiency.



Efficiency scores and the ranking of the facilities obtained with each method are compared.

We then try to identify explanatory factors of good and bad performances by applying a multivariate tobit regression with efficiency as a dependent variable.

### Application

#### Ressources (Inputs)

- medical labour force
- non medical labour force
- other running costs

#### Product (Output)

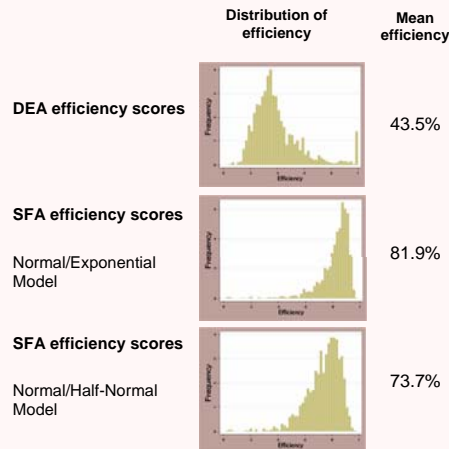
patient-days

Two stochastic frontiers are estimated, each with different distributional assumptions for the error term (half-normal and exponential).

Intensity of care needs vary a lot among patients and quality of care is not constant; in order to compare the facilities equitably, we therefore adjust efficiency scores using environmental variables:

- Case-mix variables
  - patients over 85 years old (%)
  - patients who need more than 3 hours of care a day (%)
- The range of services as a proxy of quality of care

### Results



### Correlation and ranking

Results obtained with both SFA frontiers are very similar (pearson correlation = 0.9755). Moreover, both frontiers rank the observations in almost the same order (spearman rank correlation = 0.9918).

On the other hand, the correlation is very low between SFA and DEA efficiency scores (pearson correlation = 0.04). Units that are fully efficient with the DEA frontier have a medium efficiency score with SFA.

### Explaining efficiency scores

Variable	DEA efficiency		SFA (half-normal) efficiency		SFA (exponential) efficiency	
	Coef.	T-value	Coef.	T-value	Coef.	T-value
Correlat.	0.007**	4.38	0.007**	13.11	0.007**	19.02
Scale	0.000***	2.87	0.000***	14.82	0.000***	19.85
Staff	-7.20E-05**	-4.17	-0.000***	-7.04	-7.00E-05**	-7.77
Subventions	-0.017**	-4.69	-0.004**	-4.19	-0.004**	-3.22
Occupancy	0.000	1.26	0.112**	2.88	0.110**	3.02
Profit	-0.070	-4.28	-0.070	-10.22	-0.070**	-8.64
pseudo R <sup>2</sup>	17.6%		22.8%		17.8%	

More than 75% of the inefficiency remains unexplained

### Discussion

In applying two different methods to assess the technical efficiency of Swiss nursing homes, we have observed that results are very sensitive to methodological choices. Indeed, mean efficiency scores obtained are equal to approximately 40% with DEA and 80% with a stochastic frontier. Moreover, we have observed non-similar classification and ranking amongst methods, differences are thus not only due to a shift in efficiency scores.

Which method with which assumption do we have to apply? What are the efficiency scores that describe reality better?

The tobit regression shows that the size of facility, regulation and subsidising schemes have a significant impact on efficiency, this result being valid for both DEA and SFA.

To obtain a preciser estimation of efficiency, we need better case-mix and quality of care indicators.

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