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Regulation, ownership and efficiency in the Swiss nursing home industry[§]

by

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A B S T R A C T

Switzerland is a federal State where policy decisions and implementation regarding long-term care regulation are by rights incumbent to the regional and local governments (Canton and Town Council). This situation is in part responsible for the large number of small nursing homes operating in Switzerland. Moreover, long-term care for the elderly is supplied by private for-profit nursing homes, public nursing homes and non-profit nursing homes, respectively. The mixed economy which characterizes the long-term care market raises the interesting issue of the effects that the different regulatory settings and institutional forms can have on costs.

The paper will consider an econometric estimation of a stochastic cost frontier using cross-section data for a sample of 835 Swiss nursing homes for elderly people operating in 1998. The results of this analysis are used to examine the relationship between cost efficiency and the alternative institutional and regulation forms.

KEY WORDS:

COST EFFICIENCY; REGULATORY SETTINGS; ECONOMIES OF SCALE; NURSING HOMES; STOCHASTIC FRONTIER; INSTITUTIONAL FORM.

JEL CLASSIFICATION NUMBERS: C13, C21, D24, H70, I11, I18, L30

1. INTRODUCTION

Health care costs are growing steadily in all western countries as a result of some supply and demand factors such as the aging of population, the cost-increasing technology, the higher real income (inducing health care demand) and the rise in real health care prices. A low rate of economic growth in conjunction with the increase in public social and health care spending during the 1990s induced pressure for the Swiss Government to restrain the fiscal deficit, contain costs and achieve efficiency gains. Given that a considerable part of the Swiss public social and health care budget is spent in the nursing home industry, explicit interest could be paid to the possibility of an increase in the efficiency of this sector. Moreover, the importance of the nursing home industry, with total expenditures approaching 1.5% of GDP, is expected to grow as the population ages.

Switzerland (7.2 million inhabitants) is a federal State composed of 26 "cantons"[1]. Article 3 of the Federal Constitution grants large autonomy to the single cantons in the sectors which are not regulated directly by the constitution itself, among others the health and social care sector. The decision-making autonomy of the cantons in the field of health and social care for the elderly creates a strong heterogeneity in the regulations in the various cantons[2]. Last but not least also the financial contribution from the State varies in dimension and form according to the 26 different legal platforms. Instead of having one single health system, Switzerland can be seen as an ensemble of 26 micro-systems connected to each other by the federal health insurance legislation. This law guarantees a package of social health care services to the entire population by means of a mandatory insurance. The present differences among the cantons make Switzerland an extraordinary "natural laboratory"[3], where it is possible to analyze the advantages and disadvantages of the various regulations and study their impact in terms of efficiency. Moreover, the long-term care for the elderly is supplied by private for-profit nursing homes, private non-profit nursing homes and public nursing homes, respectively.

[1] The most populated canton is Zurich with approximately 1.2 million inhabitants; the smallest is Appenzell Interrhoden with little more than 15,000 inhabitants.
[2] The Swiss nursing home sector produces both social and health care services. For this reason in this paper we consider the nursing home industry as belonging to both the social and health care sectors.
[3] See Crivelli (1998).

This mixed economy and heterogeneity of regulation between the cantons, which characterizes the long-term care market in Switzerland, raises the interesting issue of the effects on scale and cost efficiency of the different institutional organization forms and regulation structures. To analyze these issues we have estimated a translog cost frontier function for a sample of Swiss nursing homes.

This article is organized as follows: in section 2 we present the main characteristics of the Swiss nursing home industry; in section 3 the specification of the model is discussed, while the data set is described in section 4; the empirical estimation results are presented in section 5, while a closer look at economies of scale and cost efficiency is taken in section 6; conclusions are drawn in section 7.

2. THE SWISS NURSING HOME INDUSTRY

The nursing home industry, with over 1300 homes located in the whole country, represents an important element of the Swiss social and health care sector and has at least three characteristics:

- a remarkable variety of institutional forms operating in this sector;
- a market characterized by excess demand and by a large contribution from the state in financial terms and in the definition of capacity on the supply side;
- a variety of regulation models applied at the cantonal level in consideration of notable regional disparities in the supply of health care to the elderly.

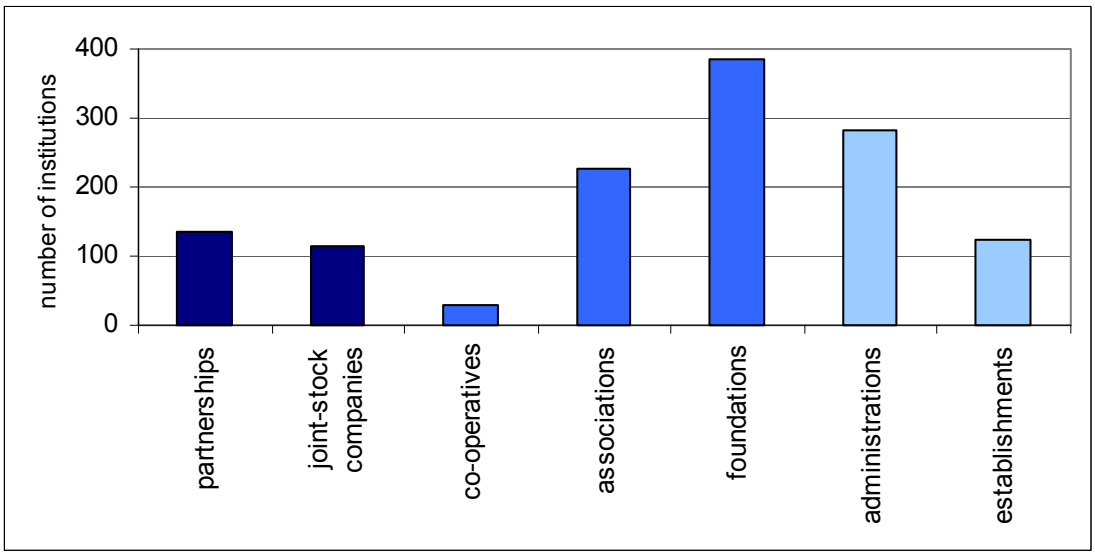
2.1 Variety of institutional forms resulting from the federalist organization

In the nursing home sector in Switzerland there are various kinds of institutions with different origins and aims. Some nursing homes have been founded at the local level as non-medicalized centers, whereas other nursing homes have been built in order to serve a higher number of potential users (a district) and have been equipped to provide medical and health care services typical of a small hospital. In the wake of the increase in the supply of home health care services in Switzerland, which has enabled elderly people who do not have particular health problems to prolong their stay at home, and in the wake of the rise in life expectancy, in recent years there has been a

progressive aging of the population resident in nursing homes. Consequently also the average dependence and need for medical care of the residents has risen. This development has led to a convergence within the various institutions, and at present almost all nursing homes have adapted the training of their staff and the infrastructure in order to be able to provide health care services to their patients.

A peculiarity of the Swiss nursing home industry is that there are different institutional forms operating in this sector, i.e. private for-profit nursing homes, non-profit private institutions and public institutions (see figure 1).
Some of the public nursing homes (about one third of the total) are managed by the canton or by local authorities; others are run at the local level by consortiums consisting of several municipalities and are organized in the form of public autonomous establishments. Among the private non-profit institutions (that make up almost half of all nursing homes) there are different legal forms: foundations and associations are forms that can be frequently found, whereas co-operatives are less frequent (nonetheless they are numerically well represented). As far as for-profit nursing homes are concerned, there is a variety of forms of business organization, from civil-code companies to one-man businesses, from partnerships to joint-stock companies.

Figure 1: *Prevalence of the different legal forms in public, private non-profit and private for-profit institutions*



2.2 Market conditions in the Swiss nursing home industry

Economic theory has analyzed the reasons that make it unlikely for free market mechanisms to work in the nursing home industry. Two features in particular are relevant, i.e. the local natural monopoly, which is typical of nursing homes in peripheral areas, and the existence of a large information gap between providers and users of residential services. Moreover, all Swiss cantonal governments consider the services provided by nursing homes to be a merit good and therefore recognize the need to give them a financial contribution through the general fiscal system. These two natural barriers are accompanied by two other conditions that limit the functioning of the market mechanisms in the Swiss nursing home industry.

1. **Excess demand in comparison to supply.** In the case of social and health care for the elderly the strongly subsidized price of residential care is the cause of an increase in demand[4]. Very often the fall in prices leads to the fact that services that would otherwise be provided for by the relatives are passed on to institutional organizations[5].

   To counteract this "blown-up demand" the state plans the supply side by fixing the nursing home rates, and since the state has to contribute to the financing of the services by means of subsidies it tends to erect barriers to entry to the market. In order to be entitled to health insurance reimbursement and to a possible subsidy to operating costs, the nursing homes have to figure in the planning of a canton[6]. Therefore private investors do not find the option of opening a nursing home without the planning authorization of the state very attractive (and it is unlikely), since this would mean that they would have to ask potential patients to finance the services offered in the institution completely out of their own pockets. These patients could benefit from a coverage of part of the expenses through the health insurance in other institutions.
2. **A limited possibility for the users to choose the institution.** The gap between supply and demand makes the use of a rationing tool necessary; in the case of nursing homes this is represented by waiting lists. In Switzerland there are very

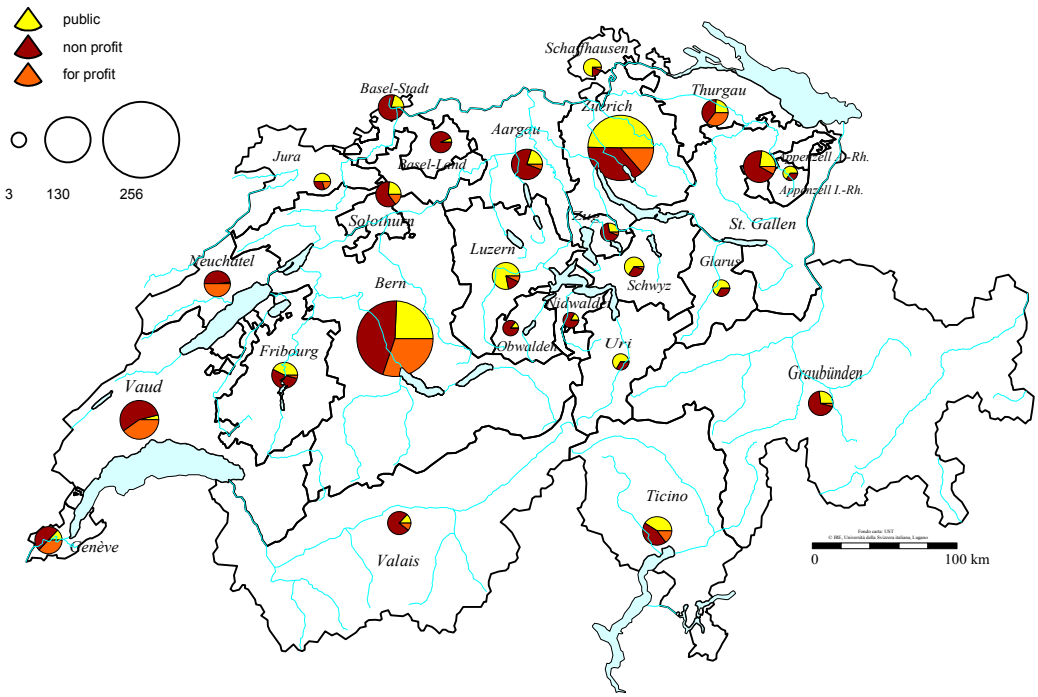
[4] This problem is known as *moral hazard ex-post*. See for example Breyer and Zweifel (1997).
[5] See Sommer (1989).
[6] See LAMal, article 39.

long waiting lists for the elderly who apply for a place in a nursing home. This implies that the choice of the institution is determined by the system's ability to find a vacancy in a short time for those elderly who urgently need to be admitted into a nursing home because of the state of their health and the inability of the family to care for them. In some cantons legislation recommends giving precedence to the elderly who most need health care, but it also attributes an important role to the fact that the user is resident in one of the municipalities which own the nursing home. Hence, seldom does a person resident in a different town have access to a local government or a private non-profit nursing home, if there is somebody on its waiting list who is resident in the municipality owning the institution.

2.3 Variation in the institutional forms and in regulatory settings across cantons

A first diversity that arises from an intercantonal comparison is the frequency of the occurrence of the various institutional forms. In figure 2 a pie-chart has been drawn within each canton.

Figure 2: *Number of public, private non-profit and private for-profit institutions*



The volume of this pie-chart corresponds to the total number of institutions operating in each canton, whereas the division of the pie-chart into three slices reflects the relative weight of public, private non-profit and private for-profit institutions.
Except for one canton (Neuchâtel) the nursing homes which are not oriented to profit (i.e. the public and the private non-profit institutions) are in a clear majority, even though in some cantons there are more public institutions and in others more non-profit private institutions. In 5 cantons (Geneva, Neuchâtel, Vaud, Bern and Thurgau) the percentage of for-profit nursing homes exceeds the 30 percent threshold and is therefore far higher than the Swiss average (19,4%). In the French part as well as in the north-western part of Switzerland and in Bern, Thurgau and in the semi-cantons Obwalden and Nidwalden the private institutions (non-profit or for-profit) represent over 75% of the total number of nursing homes. Without a deep historical analysis it is not possible to assess if there is a cause and effect connection between the frequency of the different institutional forms and the form of regulation of the nursing homes adopted in a specific canton. It is very likely that the prevalence of non-profit institutions can be attributed to the promptness with which the civil society of a canton acknowledges specific needs, anticipating an institutional reaction by the state. However it is not possible to exclude a priori that the spreading of for-profit nursing homes (mostly non medicalized institutions) has been fostered by the regulation form adopted in some cantons, which take into consideration the possibility of granting state subsidies to for-profit structures too.

A second significant difference can be seen in the average costs for a patient-day in a nursing home. Table 1 reports these costs in the year 1998 for 24 cantons. There is a considerable difference between the canton with the lowest average cost (Glarus, where a day in a nursing home costs on average Fr. 106.-) and the canton with the highest average cost (Geneva, where a day costs on average Fr. 270.-). Of course this variation can be attributed to many different factors, which must be taken into account when estimating the cost function. Among these factors we can mention the intercantonal differences in the cost of living, which are reflected in the somewhat different average wage level and price level in the health sector, the kind and number of nursing homes (both factors influence the case mix of the residents), the range of services and the average level of comfort offered in the institutions (i.e. the quality of the services), the dimension of the nursing homes in terms of bed capacity

(consequently there is the risk of inefficiencies of scale in small and slightly urbanized cantons) and the existence of cost inefficiencies.

***Table 1**: Average cost per patient-day in a nursing home (cantonal aggregates)*

Canton	Average cost per day (CHF)	Canton	Average cost per day (CHF)
AG	144.40	NW	171.55
AR	107.55	OW	143.45
BE	165.55	SH	127.35
BL	193.70	SO	172.95
BS	222.55	SZ	140.10
FR	202.75	TG	146.20
GE	271.80	TI	174.95
GL	106.15	UR	125.60
GR	126.00	VD	196.30
JU	189.55	VS	140.20
LU	164.10	ZG	157.60
NE	202.60	ZH	170.80

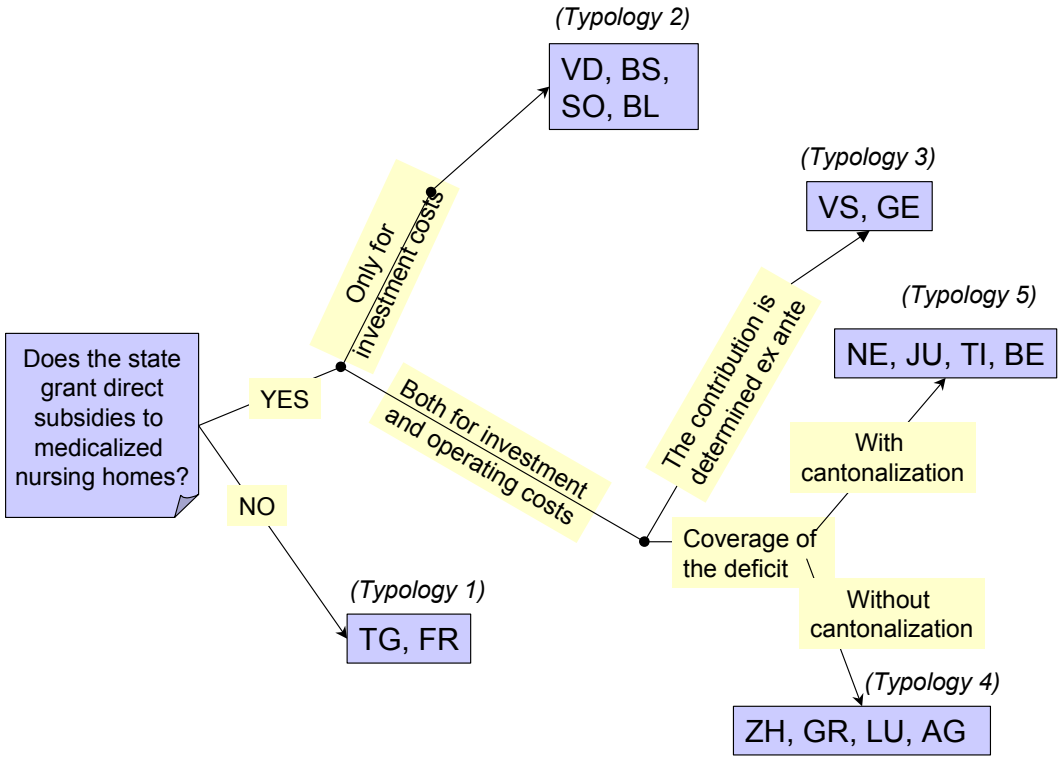
Finally the Swiss cantons still apply different subsidizing models in the nursing home industry. On the basis of a study carried out in 16 of the 26 Swiss cantons, figure 4 distinguishes 5 different types of regulation[7]. First of all, it is important to point out that in most cantons the State intervenes in public and private for-profit institutions by regulating the daily rates, determining the minimum necessary infrastructure and staff requirements and, above all, by granting a financial contribution in form of subsidies (which again vary a lot). Usually private for-profit nursing homes are excluded from receiving subsidies. However, this cannot be generalized. The legislation in canton Vaud for example provides that a for-profit nursing home can voluntarily decide to be subject to the canton's regulations and therefore benefit from the subsidies granted to public and private non-profit institutions. On the other hand, in some cantons non medicalized non-profit nursing homes are not considered by the regulation and consequently they are not entitled to receive a subsidy.

[7] 10 cantons were excluded from this analysis because we did not have sufficient and precise information about the regulatory setting. Nevertheless we were able to include 563 observations in the analysis.

The lightest form of regulation can be found in those cantons where the state does not give nursing homes any direct financial contribution aimed at covering the operating costs (type 1). Instead it grants a personal subsidy in form of a voucher to the elderly persons whose economic situation (income and wealth) would not make it possible for them to enter a nursing home. Very often this type of subsidy is a residual help that is granted to those elderly people who otherwise could only resort to public assistance. The advantage of the voucher system is that it distributes the state contribution in a targeted way to the less wealthy, thus avoiding the "sprinkling" principle, it leads to an increase in equity and to savings in resources where such aid is not really necessary[8].

The voucher system has been adopted in several cantons, but in most cases this method has not totally replaced the traditional subsidizing systems. In fact in 4 cantons (type 2) the local government still covers part of the investment cost of the nursing homes.

Figure 3: *Models of subsiding medicalized nursing homes subject to regulation*



[8] In the cantons where the subsidies are paid in form of vouchers the daily rates cover a percentage of the operating costs, which are on average higher compared to the cantons where the state subsidizes the costs.

In the remaining 10 cantons the state finances residential care for the elderly by means of object subsidies (which are granted directly to the institutions), covering both investment costs and part of the operating costs.

There are two different forms of subsidies aimed at covering operating costs: a retrospective coverage of the deficit and a fixed contribution to the costs in the form of a global budget.

Nursing homes in the cantons Geneva and Wallis receive a fixed contribution (type 3).

In the other cantons (Zurich, Jura, Neuchâtel, Ticino, Bern, Grisons, Aargau and Lucerne) the state guarantees a retroactive coverage of the deficit, which is covered jointly (but not always in the same ratios) by the canton and the local treasuries.

There is also a difference in the calculation method for the contribution that each single local authority has to pay. In Zurich, Lucerne, Grisons and Aargau the contribution paid by every municipality is determined on the base of the deficit of the nursing home it owns, alone or with other municipalities (type 4). In the remaining cantons the contribution each municipality has to pay is calculated on the basis of the total deficit of all the subsidized nursing homes. In this case an allocation key is used which considers the financial power of the municipality and the number of resident days supplied to its own citizens. This system is called "cantonalization of deficit" (type 5).

The cantonalization system is an equalizing allocation of the financial burdens among the municipalities, and as with all equalizing systems it can create great problems in terms of promoting an efficient use of resources. The cantonalization system runs the risk of institutionalizing the phenomena of free riding among the municipalities. Indeed, thanks to cantonalization, local authorities which make no effort to contain the operating costs of their nursing home benefit from the savings made in other nursing homes, whereas a local authority which makes an effort to render its nursing homes more efficient has to share its savings with all other municipalities. On the other hand, it is important to underline that big territorial disparities could emerge in the provision of residential care for the elderly if there were no equalizing mechanism in small and medium-sized municipalities. In some exceptional cases some municipalities could even resort to the so called cream skimming method; in order to reduce the financial burden they could be tempted to dissuade elderly people from moving to their town. In order to discourage municipalities from resorting to cream skimming, it would be sufficient to use equalizing systems that define the capital flow among municipalities

ex ante (on the basis of the financial power and the density of the elderly population) and not ex post (taking the effective deficit into consideration as well). This would reallocate resources, but it would not deprive the municipalities of the full financial responsibility for every franc spent in their nursing homes.

3. COST MODEL FOR SWISS NURSING HOMES

In this paper we consider the estimation of a stochastic frontier cost function using a composed error term[9]. To illustrate this econometric approach consider the cost function:

$$\ln C_i = \ln C(y_i, w_i) + u_i + v_i \quad u_i \geq 0 \qquad i = 1, 2, ..., N \qquad (1)$$

In this specification the error term is composed of two parts: the first, u_i, is a one-sided non negative disturbance reflecting the effect of inefficiency (a mixture of allocative and technical inefficiency); the second, v_i, is a two-sided disturbance capturing the effect of (white) noise. The statistical noise (v_i) is assumed to follow a normal distribution, and the inefficiency term u_i is generally assumed to follow either an exponential or a half normal distribution.

The costs of operating a nursing home may be divided into two main categories which are: 1) building and equipment costs; 2) the costs of taking care of the residents. These costs may depend on:

- the total number of resident-days of nursing home care (output);
- the type and quality of care provided per resident-day;
- the level of assistance required by the residents with normal daily activities such as eating, personal care or performing physiological functions;
- the level of medical assistance required by the residents;
- the capacity (size) of the nursing home;
- the institutional form;

[9] Starting from the paper of Aigner, Lovell and Schmidt (1977), the stochastic frontier approach has been intesively used in the literature. For a useful discussion on the properties of this method see Fabbri, Fazioli and Filippini (1996) and Battese , Coelli and Rao (1998).

- the regulation environment (federal state);
- the price of labor and the price of capital.

A nursing home can, therefore, be represented as a firm transforming two major inputs (capital and labor) into patient-days of nursing home care. Moreover, in the cost model specification we take into account a number of variables describing output characteristic as well as regional differences, which should capture the heterogeneous dimension of the output of a nursing home. Assuming that output and input prices are exogenous[10], and that (for a given technology) firms adjust input levels in order to minimize costs, the firm's total cost of operating a nursing home can be represented by the cost function

$$TC = h (Y, P_k, P_l, Q1, D_{fo}, D_{rimb}, D_{serv}, D_{medosp}, DKTi) \quad (2)$$

where TC represents total cost and Y is the output, represented by the total number of patient-days of nursing home care. P_K and P_L are the prices of capital and labor, respectively. The price of labor is computed as the ratio between total labor expenses divided by the number of (full time equivalent) employees[11]. Unfortunately the data which would allow us to calculate the capital stock using the capital inventory method are not available. According to Wagstaffs (1989) and Filippini (2001) the capital stock is approximated by the number of beds owned and operated by a nursing home. The cost of capital is the sum of depreciation, debt cost of capital and the cost of renting the buildings[12]. Hence the capital price is the ratio between capital expenses and capital stock.

Q1 is the average assistance time given to a home's patients including both normal daily activities (eating, personal care or performing physiological functions) and medical care. This variable can be interpreted as a proxy for the quality of the services supplied. Moreover, we have introduced a set of dummy variables (Dfo, Drimb, Dmedosp, Dserv, Dkti) in the model, which should allow us to capture in a more

[10] These assumptions are the object of debate in literature with contrasting opinions. For a well presented discussion see Brayer (1987).

[11] Unfortunately the source of the salary data was at aggregate level and it was impossible to distinguish between the labor price of the different professional categories working in a nursing home: doctors, nurses, administrative and technical staff.

[12] We could also use the residual capital approach following Friedlaender and Wang Chiang (1983) and Filippini e Maggi (1993)

precise way the heterogeneity of the nursing homes included in the sample. D_{fo} controls for difference in cost between nursing homes with and without sheltered home facilities[13]. D_{rimb} can be considered a proxy variable for case-mix since there is a positive correlation between the health condition of a resident and the medical expenses reimbursed by the health insurance system. We assigned a value equal to one to the firms which received a reimbursement equal to or greater than SFr 20,000 per patient per year, and zero elsewhere[14]. In this way we control for nursing homes dealing with a severe case mix. The dummy variable D_{medosp} is the result of the ratio between medical and nursing staff and the residents. We assign value one to the nursing homes where this ratio was greater than 0.35 (one worker every three residents), which corresponds to the first quartile of the distribution of this variable. This variable should distinguish nursing homes operating with a very low level of medical and nursing staff from the others. Finally the dummy Dserv is introduced to control for the heterogeneity in the supply of therapeutic and infrastructural services in the nursing homes, and we assign value one to the firms which have a sufficient structural complexity[15].

The set of dummy variables together with variable Q1 shapes the cost model in such a way that it considers several quality characteristics of the output and the production process, even though in a partial and indirect way. To complete the model we have introduced a set of cantonal dummies which should reflect the effects on costs of belonging to one particular canton.

The properties of the cost function (2) are that it is concave and linearly homogeneous in input prices and non-decreasing in input prices and output.[16]

Estimation of the cost function (2) requires the specification of a functional form. The translog cost function offers an appropriate functional form for answering questions about economies of scale.[17] Most important for our purposes, it does not impose a

[13] The sheltered homes are outside the main building and offer a more independent life condition to residents with a high degree of self-government.

[14] The threshold of CHF 20,000 corresponds to the third quartile of the reimbursement variable distribution.

[15] To separate the observations we have chosen the value of 8 services which represents the first quartile of the distribution.

[16] See Cornes (1992), p.106.

[17] A translog function requires the approximation of the underlying cost function to be made at a local point, which in our case is taken at the median point of all variables. Thus, all independent variables are normalized at their median point.

priori restrictions on the nature of technology, allowing the values for economies of scale to vary with output. Since linear homogeneity is imposed in factor prices, the price of capital will act as a numeraire and the complete cost model frontier function results:

$$\ln(\frac{TC}{P_K}) = \alpha_0 + \alpha_y \ln y + \alpha_L \ln(\frac{P_L}{P_K}) + \alpha_{Ql} \ln Ql + \frac{1}{2}\alpha_{yy}(\ln y)^2 + \frac{1}{2}\alpha_{LL}(\ln\frac{P_L}{P_K})^2 + \frac{1}{2}\alpha_{QlQl}(\ln Ql)^2 +$$
$$+ \alpha_{yL} \ln y \ln\frac{P_L}{P_K} + \alpha_{yQl} \ln y \ln Ql + \alpha_{LQl} \ln\frac{P_L}{P_K} \ln Ql + \alpha_{Dfo} D_{fo} + \alpha_{Drimb} D_{rimb} + \qquad (3)$$
$$+ \alpha_{Dmedosp} D_{medosp} + \alpha_{Dserv} D_{serv} + \alpha_i D_{KTi} + u_i + v_i$$

4. THE DATA

This study is based on a cross-sectional data set for 835 Swiss nursing homes for elderly people operating in 1998. The original data set was composed of 1299 nursing homes and reduced to the final size after a deep analysis on some important aspects such as bed occupancy rate or average costs as well as missing values or outliers. We also did not consider nursing homes with less than 10 beds since it is reasonable to assume that they have a different producing technology.

The sample is composed of 93 for-profit, 530 private non-profit and 212 public nursing homes. This clearly indicates that the Swiss nursing home industry is characterized by the presence of a strong non-profit sector.

All the data we have used for the estimation have been put at our disposal by the Swiss Federal Statistical Office and in particular by the health department. Despite the great amount of information in the data set, we could not find a reliable synthetic measure of quality, and the financial section reported only the main information on costs. The data set was sufficiently detailed to ensure a good specification of the cost model, nevertheless we would like to warn about the major difficulties we had to face preparing the data for the econometric estimation.

The sample composition represents the different size (in terms of population) of the cantons in a reliable way.

In Table 2 we present the main descriptive statistics for the variables included in the regression.

Table 2: *Descriptive statistics for cost model variables*

Variable	Measurement unit	First quartile	Median	Third quartile	Average
Total cost	CHF	1,724,000	2,837,000	4,911,000	3,750,419
Output	Patient-days	11,000	18,064	27,169	21,221
Labor price	CHF per employee	57,326	66,463	74,333	66,505
Capital price	CHF per capital unit (1 bed)	1,347,8	4,050	7,529,4	5,452
Q1	care hours per resident	1.82	2.4	3.1	2.64
Reimbursement	CHF per resident	2,905	10,711	20'786	13,900
Medosp	personnel per resident	0,.35	0.53	0.71	0.55
Serv	number of services	8	12	15	11.89
Number of nursing home beds		33	52	79	62

5. ESTIMATION RESULTS

In this section we report the econometric results obtained by estimating the total frontier cost function model specified in equation (3) and using the data described in the previous section[18].

The estimated coefficients and their associated standard errors of the cost frontier model (3) are presented in Table 3. The estimated function is well behaved. All first order parameters and part of the second order parameters estimates are statistically significant.

[18] The stochastic frontier has been estimated using the computer program LIMDEP 7.0 imposing an exponential distribution for the inefficiency term u_i.

Since total cost and the regressors are in logarithms and have been normalized, the first order coefficients can be interpreted as cost elasticities evaluated at the sample mean. All these coefficients have the expected signs and are highly significant. The output elasticity is positive and implies that an increase in supply will cause a rise in total cost. A 1% increase in the number of patient-days of nursing home care will increase the total cost by approximately 0.97%.

Table 3: *Total cost parameter estimates (standard errors in parentheses)*

Model			
α (Constant)	14.64*** (0.034)	α_{yQ1}	-0.003 (0.004)
α_y	0.970*** (0.020)	α_{LQ1}	0.003 (0.001)
α_L	0.849*** (0.011)	α_{fo}	-0.132*** (0.025)
α_{Q1}	0.218*** (0.025)	α_{rimb}	0.092*** (0.025)
α_{yy}	0.095*** (0.027)	α_{medosp}	0.234*** (0.022)
α_{LL}	0.058*** (0.005)	$\alpha_{servizi}$	0.078*** (0.023)
α_{Q1Q1}	0.043* (0.004)	α_{KTi}	@
α_{yL}	0.020* (0.009)		
Log Likelihood = 10.44 Theta = 6.82*** Sigma= 0.019***			

*, **, *** significantly different from zero at the 90, 95 and 99 % confidence level. @ You can request the values of the cantonal dummy variables from the authors.

The cost elasticity with respect to the output characteristics variables, Q1, is, as expected, positive. This result implies that an increase in the average assistance required by a home's patients with normal daily activities will lead to a rise in total cost.

The labor and capital cost shares are positive, implying that the cost function is monotonically increasing in input prices. The labor costs account for approximately 85% of the nursing homes total operating costs, while capital accounts for approximately 15%.

The dummy variable Dfo included in the model in order to distinguish nursing homes which offer a relatively small percentage of the residents the chance to live in an apartment located beside the main building (sheltered homes) with discreet support is negative and statistically significant. This result is not surprising, because generally people living in these apartments require a lower degree of assistance than those living in the normal rooms of a nursing home. As expected, the dummy variable Drimb has a significant positive coefficient. This result shows that the value of the reimbursement per patient from the health insurance tends to be positively correlated with a higher degree of assistance, and therefore, of staff. The dummy variable Dmedosp included in the model in order to distinguish the nursing homes working with a high percentage of specialized staff has a positive significant coefficient. Finally, the effect of the number of services on the cost (Dserv) also has a positive impact on the total costs.

Parameter estimates of the translog cost function satisfy the regularity condition of concavity in input prices at the median point of approximation, which requires that the own-price elasticities of inputs be negative and that the Hessian Matrix, $\left[\partial^2 C / \partial w_i \partial w_j\right]$, be negative semi-definite. Because homogeneity in input prices and symmetry of the second order terms were imposed, the estimated functions satisfy all regularity conditions of a theoretically valid total cost model.

6. EFFICIENCY OF THE SWISS NURSING HOMES

In this section a closer look is taken at the estimation results as far as efficiency is concerned. Basically, we have used two different concepts of efficiency: scale and cost efficiency. Moreover, we analyze some potential factors affecting cost inefficiency. In particular we are interested in the following factors: ownership and regulatory settings.

6.1 Scale efficiency

Scale efficiency indicates the degree up to which a company produces at optimal scale. Frisch (1965) defines the optimal scale as the level of operation where the scale elasticity is equal to one. Economies of scale (ES) are defined as the proportional increase in total cost resulting from a proportional increase in output (Y), holding all input prices and Q1 fixed. This is equivalent to the inverse of the elasticity of total cost with respect to the output (Caves, Christensen, and Tretheway 1984):

$$ES = \frac{1}{\frac{\partial \ ln \ TC}{\partial \ ln \ Y}} \qquad (4)$$

We will talk of economies of scale if ES is greater than 1, and accordingly, identify diseconomies of scale if ES is less/lower than 1. In the case of ES = 1 there are no economies or diseconomies of scale. Economies of scale exist if the average costs of a nursing home decrease as output increases.

The estimation results indicate that the production of approximately 50% of Swiss nursing homes is characterized by economies of scale. Table 4 presents in more detail the results for small, medium-sized and large nursing homes, respectively. We note that the values of the indicator for economies of scale (ES) for small and medium-sized nursing home are greater than 1. However, the value for the medium-sized nursing homes is very close to 1. The optimal size (ES=1) for a nursing home is reached with approximately 79 beds. Nevertheless, there is no considerable cost reduction following an increase in the nursing home capacity from 60 to 80 beds. The economies of scale are exhausted up to a capacity of 80 beds.

Table 4: *Economies of scale* [19]

	Small (30 beds)	Medium (58 beds)	Large (74 Beds)	Optimal size
ES	1.102	1.031	1.006	1 (79 beds)

[19] Equation (3) has been evaluated at the input prices and the output characteristic variables, Q1, of the average nursing home.

6.2 Cost efficiency

The estimation results reported in Table 3 can be used to recover estimates of the level of cost inefficiency of each nursing home along the line suggested by Simar (1992) and Coelli (1996). Thus, the inefficiency indicator can be measured as the ratio of present costs to the efficient level of costs. In our model this indicator ($EFSCO_{i)}$) can be calculated using the following expression[20]

$$EFSCO_i = \exp(u_i) \tag{5}$$

Table 5 shows some summary statistics of EFSCO calculated for the nursing homes of our sample. Predicted cost inefficiencies range from a minimum of 9% to a maximum of 80%, the median value being 12%.[21] More than 50% of the sampled nursing homes have mean inefficiency scores lower than 15%. This result shows that the majority of Swiss nursing homes are operating relatively close to the fully efficient cost frontier.

Table 5: *Efficiency scores statistics*

	1st quartile	**Median**	**3rd quartile**	**Average**
EFSCO	1.09	1.12	1.18	1.17

6.3 Explaining cost inefficiency of Swiss nursing homes

In this section we report our attempt to explain differences in the calculated cost inefficiencies of the Swiss nursing homes.

[20] We derived the conditional *u* using the decomposition suggested by Jondrow-Lovell (1982). For further details see Coelli (1996).

[21] EFSCO is calculated as the ratio of present costs to the efficient level of costs. Therefore, a value of this indicator of 1.12 corresponds to an inefficiency level of 12%.

A first source of inefficiency may be related to the different ownership and institutional forms of the nursing homes. In our sample we distinguish private for-profit, private non-profit and public nursing homes.

In comparing the relative efficiency between public ownership and private ownership, property rights models and public choice models have often been adopted.[22] These models suggest the possibility that politicians and public managers may pursue goals independent of the constituency they represent and of the organization in which they operate. In particular, the public choice literature suggests that the process of political decision-making does not set the appropriate incentives and schemes in order to control the public firms effectively. Furthermore, the boards of directors are generally politically appointed and represent political parties whose objectives may not be cost minimization. Therefore, in this situation public nursing homes do not have as many incentives to reach cost efficiency as private nursing homes. However, in the analysis of the determinants affecting efficiency it is important to make the distinction between private non-profit nursing homes and private for-profit nursing homes. Many economists agree that private non-profit firms tend to choose a higher level of non-pecuniary benefits than the private for-profit firms. If these non-pecuniary benefits, for instance, determine an over-capacity in staff and space, then the private non-profit firm will tend to be more inefficient than the private for-profit firm[23].

The summary statistics of mean inefficiency for these different types of nursing homes are presented in Table 6.

Table 6: *Summary statistics on mean inefficiency by ownership form*

Ownership form	Mean EFSCO (standard error)	Number of nursing homes
Public	1.158 (0.263)	212
Private non profit	1.175 (0.218)	530
Private for profit	1.181 (0.194)	93

[22] For an overview on the property right arguments see Demsetz (1967); for an overview on the public choice models see Mueller (1979) and Bartel and Schneider (1991).

[23] For the application of the property rights theory to non-profit health-related firms see Frech (1976).

By running a statistical test to check the significance of the difference we find out, according to the results of Vitalino and Toren (1994), that in our sample the ownership type does not seem to be related to the (mean) level of efficiency in any significant way[24].

Another source of inefficiency may be related to the presence of different types of regulatory settings. In our sample, as presented in section 2 of this paper, we can distinguish 5 types of regulation settings. In Table 7 we present the estimates of inefficiency classified by regulation type.

Table 7: *Efficiency scores by regulatory settings*

Regulatory setting	Mean efsco (standard error)	Number of homes[25]
Type 1	1.158 (0.103)	54
Type 2	1.154 (0.089)	74
Type 3	1.135 (0.079)	73
Type 4	1.141 (0.107)	130
Type 5	1.146 (0.074)	131

A statistical test at a 95% confidence level indicates no significant differences in the average efficiency score among regulation types[26]. This result is not surprising because none of the regulation approaches is based on incentive regulation schemes, which would promote cost efficiency, as suggested by Laffont and Tirole (1993).

[24] We tested the mean difference being equal to zero and we could not reject the hypothesis either at the 5% level or at 10% level of significance.

[25] As we pointed out in section 2, the base sample for the regulation analysis includes 582 nursing homes due to lack of information from small cantons. Therefore this part of the analysis considers 462 regulated nursing homes. The non regulated firms (120) are of interest in this part of analysis.

[26] We have run a Tobit regression to check our descriptive findings. We found exactly the same relationship between efficiency scores and ownership type or regulatory settings, but the statistical inconsistency of the model suggested we give only a descriptive picture of the phenomenon.

7 CONCLUSIONS

The purpose of this study was to analyze the cost structure of a sample of Swiss nursing homes in order to assess economies of scale and cost inefficiency. Policy-makers in particular have been interested in cost information in order to determine the optimal size of a nursing home. Moreover, this paper explores the relation between cost efficiency and the different institutional and ownership forms (public nursing homes, for-profit nursing homes and non-profit nursing homes).

The paper considers estimation of a stochastic frontier cost model. A translog cost function was estimated using a cross section for a sample of 735 nursing homes operating in 1998.

The outcome of this analysis shows that approximately 60% of the nursing homes included in our sample operate close to the national standard for efficiency, achieving scores of 15% or lower, in terms of cost difference in relation to the Swiss best-practice technology.

Non-profit nursing homes and the public nursing homes are found to be just as efficient as for-profit nursing homes. Moreover, the type of regulation does not seem to be related to efficiency in any significant way.

Empirical evidence indicates that economies of scale are exhausted up to a capacity of 80 beds. This result suggests that the effects of the size on costs have to be taken into account when building a new nursing home.

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