Determinants of Nursing Homes Performance: The Case of Portuguese Santas Casas da Misericórdia

André S. Veloso[1], Clara Bento Vaz[2], and Jorge Alves[3]

[1] *Polytechnic Institute of Bragança; asveloso@ipb.pt*
[2] *Centre for Management and Industrial Engineering (CGEI/INESC TEC); Polytechnic Institute of Bragança; clvaz@ipb.pt*
[3] *OBEGEF/UNIAG; Polytechnic Institute of Bragança; jorge@ipb.pt*

17 de Março de 2017

Abstract

This study aims to evaluate the economic efficiency of Nursing Homes owned by 96 Santas Casas da Misericórdia (SCM) and the determinants that influenced their efficiency in 2012 and 2013. The SCM are the oldest non-profit entities, which belong to Third Sector in Portugal, provide this social response and receive significant financial contributions annually from the state. The study is developed in two stages. In the first stage, the efficiency scores were calculated through the non-parametric DEA technique. In the second stage, Tobit regression is used to verify the effect of certain organizational variables on efficiency, namely the number of users and existence of Nursing Home chains. The results of the DEA model show that the efficiency average is 81.9%, and only 10 out of 96 Nursing Homes are efficient. Tobit regression shows that the number of users has a positive effect on the efficiency of Nursing Homes, whereas the existence of Nursing Home chains affects their efficiency negatively.

Key words: Data Envelopment Analysis; Efficiency; Nursing Homes; Third Sector.

1 Introduction

According to Eurostat (2017a) in 2013, the average old age dependency ratio of the 28 Member States of the European Union (the ratio between the number of persons aged 65 and over, the age when they are generally economically inactive, and the number of persons aged between 15 and 64) was 27.5, which means that there were 28 people over 65 for every 100 people of working age, 17% more than in 2001. In 2060, the prediction point to a ratio of 51.6 (88% more than in 2013) (Eurostat, 2017b). In 2013, Portugal was the fifth country of the 28 Member States with the highest ratio, 29.4, being surpassed by Sweden, Greece, Germany and Italy (Eurostat, 2017a). Between 2001 and 2013 there was an increase of 21% and in 2001 Portugal was already the 9th Member State with the highest ratio (Eurostat, 2017a). Predictions for 2060 show that the ratio will continue to rise. In fact, Portugal will be the third Member State with the highest ratio (64.9), being surpassed only by Latvia (65.7) and Greece (67.9) (Eurostat, 2017b).

The observed growth of the elderly population in Portugal was followed by an increase in social responses to this target population, namely Nursing Homes, day care centers, home cares services. In 2013, there were more than 7000 social responses to elderly people, 47% more than in 2000 (GEP-MSESS, 2013). Firstly, the home care services were the social response that presented the greatest number of requests and evolution. In 2013, there were more than 2500 home care services with a relative increase of 66% over the year 2000 (GEP-MSESS, 2013). Secondly, the Nursing Homes registered close to 2500 social responses and an increase of 55% in relation to the year 2000 (GEP-MSESS, 2013). Given the predictions of the elderly population by 2060, it also easily concludes that the number of Nursing Homes will tend to increase. Thus, it is important for regulator, in this case Instituto da Segurança Social, IP (ISS, IP), to see if the efficient Institutions manage the assigned financial contributions. This information is also relevant to the central management of the SCM and to the administration of the Institutions, since it allows comparing Nursing Homes practices in the management of allocated resources, identifying efficient and inefficient units and becoming a benchmarking tool. Finally, the performance of Nursing Homes is

important for the users (and relatives) of the Institutions, as they want to know if their payments are properly applied, which ultimately affects the image of the services provided by the Nursing Homes. This study aims to evaluate the economic efficiency of Nursing Homes owned by SCM in 2012 and 2013. In this stage, the efficiency assessment is performed through the non-parametric technique DEA. Besides the study of Nursing Homes efficiency, it is important to know the determinants, namely organizational factors that influence their efficiency. This information is relevant for the regulator and institutions since solutions should be identified to provide financial sustainability to the Institutions. In this stage, the Tobit regression is used to verify the influence of certain determinants on economic efficiency, by investigating the influence of organizational variables such as the number of users of the entity, the integration into a chain of Nursing Homes and the possibility of the entity provides other social responses.

This study is organized according to the following. Section 2 presents a literature review on the evaluation of efficiency in Nursing Homes. Section 3 describes the Nursing Homes sector, introducing the case study. Section 4 presents the methodology based on the DEA method and the Tobit regression. Section 5 presents and discusses the obtained results. Finally, section 6 presents the conclusions and future research.

2 Literature Review on the Evaluation of Efficiency in Nursing Homes

The Nursing Homes efficiency has been studied worldwide (e.g. Ozcan, 2008). It is widely accepted that non-profit Nursing Homes have less efficiency than profit Nursing Homes (e.g. Anderson et al., 2003; Knox et al., 2003; DeLellis, 2009). However, concerning profit Nursing Homes, the financial and economic results appear as priorities. In what non-profit Nursing Homes are concerned, those aspects are contemplated in a secondary way, being the quality of the services provided to users the main focus (Ben-Ner and Ren, 2008). Rantz et al. (1998) interviewed a group of individuals involved in the provision of care, such as administrators, nurses, regulators, and other collaborators about the quality of care. The authors identified two models of Nursing Homes, one with good quality of care and the other with poor quality of care. In Nursing Homes with good quality of care, the main focus was the satisfaction of users. In Nursing Homes with poor quality of care, the main focus is not defined, which may be the financial survival of Nursing Home and financial results, regardless of the user needs. As Ben-Ner and Ren (2008) found in non-profit Nursing Homes, the objective is to provide the highest quality of services to users, regardless of the associated costs. This does not occur in profit Nursing Homes because financial results prevail, which invest less in the quality of care (Li et al., 2013).

According to Hollingsworth (2003), who conducted a survey about the techniques used in the investigation of the efficiency of medical care units (among which the equivalents to Nursing Homes), the author verified that the nonparametric DEA technique was the most used. According to the author, the use of efficiency scores as a dependent variable in Tobit regression has been increasingly used. The objective is to verify the influence that determinants have on efficiency. Two characteristics commonly used in regression, besides ownership status, are the number of users and the integration into a chain of Nursing Home (e.g. Nyman and Bricker, 1989; Anderson et al., 1999).

Concerning the Nursing Home chains, the relationship with efficiency has led to mixed results (Anderson et al., 1999). Arling et al. (1987); Fizel and Nunnikhoven (1993); Knox et al. (2003) found that Nursing Home chains affect efficiency positively. The fact that Nursing Homes are integrated into a chain can increase efficiency through the effect of economies of scale, in particular by sharing resources (e.g. human resources such as nurses and doctors) which leads to lower general and administrative costs (Anderson et al., 2003). In addition, Nursing Home chains move faster in the learning curve through the sharing and adoption of new information among Nursing Homes (Anderson et al., 2003). However, the increase in operational activity in Nursing Home chains is not always positive (Fizel and Nunnikhoven, 1993). In fact, increased operational activity can increase maintenance costs and slow down decision making process, which ultimately can reduce efficiency (Jensen and Meckling, 1976). In the study by Anderson et al. (1999), Nursing Home chains were less efficient than independent Nursing Homes. The explanation may lie in the size of the Nursing Homes, since they tend to waste resources on bureaucracies instead of benefiting from economies of scale and experience curve.

Regarding the relationship between Nursing Homes efficiency and the number of users, Nyman and Bricker (1989); Rosko et al. (1995); Ozcan et al. (1998); Anderson et al. (2003) concluded that the number of users influences positively their efficiency. The economies of scale explain, once again, the relationship found, through average expenditures with users being smaller, (Banaszak-Holl et al., 2002; Bazzoli and

Chan, 2000), particularly with human resources expenditure (Ozcan et al., 1998).

In terms of performance assessment of Portuguese Nursing Homes, the regulator (ISS, IP) has information derived from reports of inspections on the quality of services for profit and non-profit Nursing Homes (art.° 19.° from Portaria n.° 67/2012 of 21st March) and the income statement of non-profit Nursing Homes (Instituto da Segurança Social, IP, 2015). In this case, the income statement consolidates the financial information for each non-profit independent Nursing Home or Nursing Home chain. Regarding non-profit Nursing Homes, until 2014, this information is not available for public consultation in Portugal. From 2015, non-profit Nursing Homes have to publish yearly this information on their website (n.° 2 from art.° 14.°-A from Decreto Lei (DL) n.° 172-A/2014 of 14th November) but some of them do not fulfill this obligation.

As far as we know, no study was published in applying the DEA methodology to Portuguese Nursing Homes. In the next section we contextualize the Nursing Homes area to introduce the case study.

3 Nursing Homes Case Study

3.1 The Nursing Homes of Portugal

Nursing Homes are establishments for collective housing, "for temporary or permanent use, in which social support activities and nursing care are provided" (n.° 2 from art.° 1.° from Portaria n.° 67/2012 of 21st March). The objectives of the Nursing Homes are "Provide permanent and adequate services to the biopsychosocial problems of the elderly; Contribute to the stimulation of an active aging process; Create conditions that allow preserving and encouraging the intra-family relationship; Promote social integration" (art.° 3.° from Portaria n.° 67/2012 of 21st March). The users of Nursing Homes, as a rule, are persons over 65 years of age, and in certain cases, persons under 65 may be admitted (art.° 5.° from Portaria n.° 67/2012 of 21st March). The maximum capacity of Nursing Homes is 120 residents (art.° 6.° from Portaria n.° 67/2012, of 21st March).

According to the (GEP-MSESS, 2016), currently[1], in Portugal, there are 2 381 Nursing Homes managed by profit and non-profit entities, as summarized in Table 1. The installed capacity is 93 373 beds and the number of users is 85 569, which corresponds to an occupancy rate of 91.6%. About 70% of the total Nursing Homes are managed by non-profit entities and more than 80% of the users are installed in these entities. The occupancy rate in non-profit organizations is 95%, while in profitable entities it is 79%.

Table 1: Nursing Homes of Portugal, 2016

Sector	No. Entities	No. Nursing Homes	Nursing (%) Homes (%)	No. Beds	% Beds	No. Users	% Users
Profit		695	29%	19 537	21%	15 519	18%
Non-profit		1686	71%	73.836	79%	70.05	82%
Total: SCM and Nursing Homes	300	467	20%	26.645	29%	25.375	30%
SCM: Independent Nursing Home	198	198					
SCM: Nursing Home chain	102	269					
Total		2.381	100%	93 373	100%	85 569	100%

In case of non-profit sector, there are 300 SCM (out of a total of 358[2]) that manage 467 Nursing Homes, representing 20% of total Nursing Homes. The number of beds and number of users correspond to 26 645 and 25 275, respectively, which show an occupancy rate of 95%. There are 198 SCM that only have 1 Nursing Home (Independent Nursing Home) while the remaining SCM (102) hold more than one (Nursing Home chain). It should be noted that SCM have more beds and more users than that in the entire profit sector which indicates the high importance that SCM has in Nursing Homes sector. Next section explores in detail the Particular Case of Nursing Homes owned by SCM.

3.2 The Particular Case of Nursing Homes Owned by SCM

The SCM entities are "associations recognized in the canonical legal system, with the purpose of satisfying social needs and practicing acts of Catholic worship, in harmony with their traditional spirit, guided by the principles of Christian doctrine and morality" (n.° 1 from art.° 68.° from DL n.° 172-A/2014 of 14th November). The SCM are also non-profit entities, which have the status of Private Institutions of Social Solidarity (IPSS) (n.° 1 from art.° 1.° from DL) n.° 172-A/2014 of 14th November). The IPSS

---

[1] There is no information available for previous years.

[2] (UMP, 2017).

are non-profit collective persons with the "purpose of giving organized expression to the moral duty of justice and solidarity, contributing to the realization of the social rights of citizens, provided they are not administered by the State or another public entity" (n.° 1 from art.° 1.° from DL n.° 172-A/2014 of 14th November). The objectives referred in the previous article are mainly for the provision of services in several areas, namely in the support of the elderly, disabled people, support for children and youth, among others (art.° 1.°-A from DL n.° 172-A/2014 of 14th November). It should be noted that holding the IPSS status confers a set of tax advantages, namely being exempt from taxation (e.g. Value-Added Tax, Income Tax) (Marques, 2010). In addition, the Institutions receive from the ISS, IP a monthly payment per user that is covered by a cooperation agreement settled between the ISS, IP and the entity.

The activities developed by SCM are commonly referred to as social responses. A social response shall be deemed to be the support services provided to persons and families whose purpose is: "(1) To prevent and remedy situations of social and economic deprivation and inequality, social dependence and social dysfunction, exclusion or vulnerability; (2) The community integration and promotion of people and the development of their capacities; (3) Special protection for the most vulnerable groups, including children, young people, the disabled and the elderly ". (art.° 3.° from DL n.° 64/2007 of 14th March). Thus, the activities developed by SCM are branched out by several intervention areas: a) Children and Youth; b) Children, youth and adults with Disabilities; c) Elderly people; d) Family and community; e) People with drug addiction; f) People infected by HIV/AIDS; g) People with Mental Disease; h) People in a Dependency Situation. In each of these areas there are several services provided for this specific population. For example, in the area of the elderly population there are the following activities: Host families for the elderly; Day care center; Night care center for elderly, Home cares services and Nursing Homes. In the area of Children and Young People there are kindergarten, preschool, after school activities center, children and youth households, among others (GEP-MSESS, 2013). In the case of SCM, for the year 2016, the most developed intervention areas are at children/young people and elderly levels. In fact, of the total 2041 social responses involving the various intervention areas, 1216 belong to the elderly people area and 684 belong to the children and youth area (GEP-MSESS, 2016).

In the specific case of Nursing Homes, adequate food services are provided to the needs of the users, personal hygiene care, clothing treatment, space hygiene, socio-cultural activities, support in the users daily life activities, nursing care, as well as access to health care, administration of medicines (art.° 8.° from Portaria n.° 67/2012 of 21st March). The infrastructure of the Nursing Home is organized in 9 areas: a) Reception area; b) Management Area, technical and administrative services; c) Facilities area for personnel; d) Area of activities; e) Dining area; f) Accommodation area; g) Kitchen and laundry area; i) Nursing services area. The provision of services is ensured by staff 24 hours a day. In addition, each Nursing Home is obliged to comply with the staff ratios per user summarized in Table 2 (art.° 12.° from Portaria n.° 67/2012 of 21th March). In the case of the users are in major dependence situation, each entity has to change the ratios of nurses, auxiliary nurse and assistant employee to 1/20, 1/5 and 1/15, respectively.

Table 2: Staff Ratios per User

Staff	Schedule	No. Users
Sociocultural Animator / Educator / Geriatrics Technician	Part-Time	40
Nurses	Full-Time	40
Auxiliary nurse	Full-Time	8
Auxiliary nurse- Night Schedule	Full-Time	20
Housekeeping Clerk	Full-Time	≥ 40
Chief Cook	Full-Time	By Nursing Home
Assistant Cook	Full-Time	20
Assistant Employee	Full-Time	20

The operational activity of each SCM is regulated by ISS, IP. The cooperation agreements are established between IPSS and ISS, IP (n.° 4 from Norma I from Despacho Normativo (DN) 75/92 of 20th May). The agreements have the objective of "the pursuit of actions by the institutions aimed at supporting children, young people, the disabled, the elderly and the family, as well as preventing and remedying situations of lack, dysfunction and social marginalization and the development of communities and social integration and promotion." (Norma III from DN 75/92 of 20th May). The conclusion of cooperation agreements implies the allocation of financial contributions by ISS, IP. The allocation of the contributions is made by the user and varies according to the social response. Usually, the conclusion of cooperation agreements occurs when a social response, for example a Nursing Home is opened. Suppose that a Nursing Home has 60 beds. Only a proportion of these 60 beds is covered by the cooperation agreement.

The purpose of the contributions is to "subsidize the running expenses of the equipment or services" (n.° 2 from Norma XXII from DN 75/92 of 20th May). The amounts of contributions granted from

the ISS, IP are annually defined by the Cooperation Protocol established between the ISS, IP and the representative organizations of the (União das Misericórdias, União das Misericórdias Portuguesas, Confederação Nacional das Instituições de Solidariedade and União das Mutualidades Portuguesas) (n.° 4 from Norma XXII from DN 75/92 of 20th May). In 2012 and 2013, the value covered by the Nursing Home cooperation agreement was €351.83 and €355.0 per user and per month, respectively. This financial contribution per month may be subject to variations in the following cases (MSSS and UMP, 2012; MSSS et al., 2012):

- For users who are in a dependency situation, the amount of €65.35 in 2012 and €65.94 in 2013 should be added.

- When the frequency of elderly people with dependence is higher than 75%, there is a complementary contribution of €45.78 in 2012 and €46.19 in 2013. The dependency situation is proven through a medical statement in which shall state the type of required care subject to review by the relevant services of the ISS, IP.

- If the vacancies are filled out by the competent services (namely the ISS, IP), the financial contribution of the ISS, IP is determined by the difference between the value of €869.91 and the sum between the user's contribution and their descendants or other legitimate heirs.

- If the vacancies are filled out and it is necessary to allocate new users, the ISS, IP may resort primarily Institutions from the non-profit sector. If there is no availability in the non-profit sector, ISS, IP uses the institutions from the profitable sector. The financial contribution, in these situations, is €578.00 per user, in 2012, plus the user's family contribution (in 2013 the value was €583.20).

In addition to the financial contribution of the ISS, IP, the IPSS can receive payments from users and their families. The contribution of the users corresponds to the application of a rate (maximum limit 85%). This rate is defined internally by the Institution and should be proportional to the per capita income of the household (DGSS, 1997), taking into account the economic and financial capacity of the users and their descendants.

To sum up, the main source of IPSS income corresponds to the sum of the following amounts: payments from users and family descendants plus the contributions granted by the ISS, IP. It should be noted that for users who are covered by cooperation agreement there is a limit of income that the Institution may receive. The limit corresponds to the product of the reference value per user, by the number of users in a cooperation agreement, plus 15%. For example, a Nursing Home with 60 beds covered by a cooperation agreement, the annual sum from 60 users could not exceed €770,089.68 [(938.43 x 60 x 12) x 115%] in 2012 and €777,020.04 in 2013. The reference value per user is defined in each year between the ISS, IP and the representative organizations of the Institutions. The reference value was €930.06 and €938.43 in 2012 and 2013, respectively.

4   Methodology

This study aims to evaluate the economic efficiency of Nursing Homes owned by SCM and the determinants that influence their efficiency in 2012 and 2013. The study is developed in two stages. In the first stage, the efficiency scores were calculated through the non-parametric DEA technique. Only economic variables were used based on the Income Statement variables. In the second stage, a Tobit regression was performed to verify the effect of determinants on efficiency. The number of users, the number of social responses and the existence of Nursing Home chains were the variables used. The information used in this study was collected from the ISS, IP and involves 96 SCM in 2012 and 2013 whose income statement was validated by ISS, IP until the third quarter of 2015.

This financial information is only available for the entities themselves and the ISS, IP. In order to obtain the information about the entities, diligences were established with the ISS, IP and only the information from the Nursing Homes developed by SCM was obtained. Regarding the number of users, this information is available on the site developed by GEP-MSESS (2013) which is yearly updated. Although, it is not possible to establish, for a given year, a match between the organizational characteristics of the profit Nursing Home, namely the number of users and its income statement, since their time reference has a lag of 1 year and information from previous years is not available in the site.

It is verified that the quality of the services provided by the Nursing Home is a major aspect in the management of the units. In the literature, there are many authors who use different aspects of

quality (for example users who received the flu vaccination, users with depression symptoms or weight loss) (DeLellis, 2009). These aspects are mostly based on inspections carried out by accredited entities (for example, state entities) and by ISS, IP, in our case study. Globally, these quality assessment results are displayed to the public (e.g. Nursing Home Compare; Online Survey, Certification, and Reporting Systems), although this does not happen in Portugal. Specifically, the reports from inspection of the Nursing Home, carried out by ISS, IP, are not available for public consultation. It should be noted that this information has already been requested to ISS, IP. However, it was not yet possible to obtain such information, hindering the study of the quality of the services provided by the Nursing homes. In this study we assume that Nursing Homes meet the quality standards established by ISS, IP and it is *ceteris paribus*.

This study involves a sample of 96 (represents 32% of total Nursing Homes in 2016) Nursing Homes owned by SCM during the year 2012 and 2013 and their data is achieved from income statement after validated by ISS, IP. Note that the income statement for each SCM can include the data concerning one Nursing Home or consolidates the data concerning all Nursing Homes chain affiliated. Thus, the SCM corresponds to the decision making unit (DMU). Thus, the 96 SCM have 149 Nursing Homes in 2012 and 150 Nursing Homes in 2013 (one SCM opened a new Nursing Home in 2013), as summarized in Table 3.

Table 3: Final sample of case study

	2012	2013
Number of SCM	96	96
Number of Nursing Homes	149	150

4.1 Data Envelopment Analysis (1st Stage)

The DEA technique, initially introduced by Charnes et al. (1978) enables to assess the relative efficiency of homogenous organizational units, Decision Making Units (DMU), which use multiple inputs to produce multiple outputs. Considering the input orientation, the efficiency value of each DMU is calculated through the ratio between inputs of the efficient unit producing similar outputs to the evaluated unit over the inputs of this unit (Banker et al., 1984). In the case of the DMU using multiple inputs to produce multiple outputs, the DEA technique assigns weights in order to maximize the ratio obtained, subject to the restriction that all DMUs, for the same set of weights, hold a maximum value of 100% (Banker et al., 1984). Thus, the DEA technique identifies the frontier of the set of production possibilities (PPS) defined by the efficient DMUs and the segments that connect them. The remaining DMUs are inefficient, being evaluated by reference to the obtained frontier.

Consider a set of n Nursing Homes named by $j(j = 1, \ldots, n)$ that use m inputs x_{ij} $(x_{1j}, \ldots, x_{mj}) \in R_+^m$ to obtain s outputs y_{rj} $(y_{1j}, \ldots, y_{sj}) \in R_+^s$. In the DEA model, input orientation was used, since Nursing Homes have more control over inputs than outputs (Ozcan, 2008). The relative efficiency of the Nursing Home$_o$ can be evaluated considering the frontier with variable returns to scale and the orientation of the inputs, using the linear programming model (1), obtaining an optimal solution, θ_o^*.

$$\min \left\{ \theta_o | \ \theta_o \ x_{io} \geq \sum_{j=1}^n \lambda_j \ x_{ij}, \ \ i = 1, \ldots, m; \ \ y_{ro} \leq \sum_{j=1}^n \lambda_j \ y_{rj}, \ \ r = 1, \ldots, s; \ \ \sum_{j=1}^n \lambda_j = 1; \ \ \lambda_j \ \geq 0; \ \ \forall_{j,i,r} \right\} \tag{1}$$

The pure technical efficiency (θ_o^*) of Nursing Home$_o$ corresponds to the minimum factor with which all its inputs can be reduced taking into account the obtained results. The efficiency measure will reach 100% when the evaluated Nursing Home$_o$ is considered efficient, while lower values will indicate the existence of inefficiencies. The variable returns to scale frontier is considered since there are marked differences in SCM size (e.g. Coelli et al., 2005).

In the evaluation of efficiency, only economic variables were used based in the Income Statement. Since the Income Statement is composed of income and expenses, we used indicators of expenditure on inputs and income on outputs. It was decided to aggregate the variables of expenditures and income with the objective of reflecting that efficient entities had positive net results. Bearing in mind this perspective, the DEA model is constructed using two inputs (Operational Expenses and Other Costs) and a single output (Total Revenue). Operating Expenses include Costs of Goods Sold and Consumed, External Supplies and Services and Personnel Expenses. Other Costs include, between others, other expenses related to expenses with depreciation and losses in inventories. It was considered a single output (Total

6

revenue) resulting to the income of each unit, i.e. Sales (user and family payments), Subsidies received from the ISS, IP, and other subsidies (e.g. European Community funds and funds of national programs for non-profit institutions). Note that the choice of the previous variables was restricted by the available information obtained from ISS, IP.

Table 4 shows the averages, coefficients of variation, maximum and minimum of the inputs and output used. There is a large discrepancy in the data (a coefficient of variation of more than 50% in Operating Costs and Revenues and over 100% in Other Expenses). This means that the size of Nursing Homes under analysis is quite different, as is also shown by maximum and minimum values.

Table 4: Descriptive Statistics of Inputs and Output

	2012				2013			
	Mean	C.V.	Maximum	Minimum	Mean	C.V.	Maximum	Minimum
Operating Expenses (€)	838.692,3	56,7%	2.401.267,3	137.748,9	864.356,8	56,6%	2.469.842,5	134.876,5
Other Costs (€)	82.122,2	131,0%	911.463,0	9.208,1	79.410,1	126,7%	897.019,3	7.520,4
Total Revenue (€)	897.167,8	57,1%	2.229.108,8	159.450,4	924.890,8	56,2%	2.282.380,7	138.586,1

4.2 Tobit Methodology (2nd Stage)

In the second stage, a Tobit regression is performed with three independent variables: (X_1) number of users; (X_2) existence of Nursing Home chains (binary variable with value 0 if it has a single Nursing Home and value 1 otherwise); (X_3) number of social responses. The variables number of users and existence of associated Nursing Homes in chains are often used in efficiency studies (e.g. Nyman and Bricker, 1989; Anderson et al., 2003). Regarding the inclusion of the variable number of social responses, the SCM can develop other activities besides the Nursing Homes, such as Day Care Center and Home Care Service for eldery, Kindergarten, Pre-school, among others. The Tobit regression is appropriate for this study since the dependent variable, the efficiency score ranges from 0 and 1 (e.g. Fizel and Nunnikhoven, 1993; Kooreman, 1994; Wang and Chou, 2003; Garavaglia et al., 2011; Iparraguirre and Ma, 2015). The regression model is presented in (2).

$$\theta_j = \alpha + \beta_1 X_{1j} + \beta_2 X_{2j} + \beta_3 X_{3j} + \varepsilon_j \tag{2}$$

Where α is the intercept, β_1, β_2 and β_3 are estimated coefficients of regression, ε_j is the error term $\varepsilon_j \sim N(0,1)$ and X_{1j}, X_{2j} and X_{1j} are the dependents variables, number of users, number of social responses and the existence of Nursing Home chains. This is a binary variable with value 0 if it is an independent Nursing Home and 1 otherwise. There are 61 independent Nursing Homes and 35 Nursing Home Chains. Table 5 presents the descriptive statistics of independents variables X_{1j}, X_{2j} and X_{1j}. It is observed a high variance regarding all indicators. This is symptomatic of the variability of the SCM dimension, as observed for example in the maximum and minimum of social responses, ranging from 1 and 53.

Table 5: Descriptive Statistics of Variables used in the Tobit Regression

	2012				2013			
	Mean	C.V.	Maximum	Minimum	Mean	C.V.	Maximum	Minimum
Number of Users	83	54%	232	12	85	56%	244	12
Number of Nursing Homes	2	58%	5	1	2	59%	5	1
Number of Social Responses	10	80%	53	1	10	75%	53	1

As seen in the literature, Nursing Home chains can increase efficiency through economies of scale (Anderson et al., 2003). However, the reverse may occur due to management problems, such as resource wastage. The increasing firm size may increase monitoring costs and slow decision making process (e.g. Jensen and Meckling, 1976; Anderson et al., 1999). In addition, non-profit Nursing Homes focus on the quality of care provided, and financial results are considered secondary (Ben-Ner and Ren, 2008). Given the Portuguese context, Nursing Homes must meet staff ratios for each Nursing Home (art.° 12.° from Portaria n.° 67/2012 of 21st March). That is, the opening of new equipment always involves the hiring of at least 8 people, and thus there is no possibility of rationalization of human resources. The same applies in other activities developed by the SCM, namely in the area of the elderly population and childhood and youth, namely home care service and kindergarten (it is necessary to comply with the staff ratios established in Portaria n.° 67/2012 of 21st March). Moreover, Nursing Homes in the analysis are non-profit, so the focus on quality is the main objective, which implies a greater consumption of resources. Thus, it is expected that the variables existence of Nursing Home chains and number of social

responses have a negative effect on efficiency. Conversely, the number of users is expected to have a positive effect on efficiency due to the possibility to have scale economies through the rationalization of resources, namely human resources, which reduces the average costs (Ozcan et al., 1998). Therefore, there are three research hypotheses:

H_1: The number of users has a positive effect on efficiency;

H_2: The existence of Nursing Home chains has a negative effect on efficiency;

H_3: The number of social responses has a negative effect on efficiency.

5   Results and Discussion

5.1   Efficiency Assessment of Nursing Homes (1st Stage)

In the first stage, the economic efficiency of a Nursing Home in a given year is estimated through the model (1), considering the best practices observed during 2012 and 2013. The results show that the average efficiency is 81.9% which means that each Nursing Home can reduce its expenses (inputs), on average, 18.1%, given the level of revenues obtained. Ten out of 96 Nursing Homes are considered efficient: 3 units are efficient in 2012, 6 are efficient in 2013 and only one is efficient in the both years. These Nursing Homes are considered as benchmarks for inefficient Nursing Homes. The efficient Nursing Homes have different characteristics, namely in the organizational dimension. In fact, 5 are independent Nursing Homes and 5 are Nursing Home chains (2 chains are composed by 2 Nursing Homes, 1 chain is composed by 3 Nursing Homes, 1 chain is composed by 4 Nursing Homes and 1 chain is composed by 5 Nursing Homes). The same occurs for the number of users, ranging from a minimum of 12 to a maximum of 244. Furthermore, the number of social responses from the corresponding SCM has also a large variance. There are 5 SCM with less than 10 social responses, 4 SCM with social responses ranging from 11 to 16 and one SCM with 43 social responses.

The average efficiency of independent Nursing Homes is 81.9% (standard deviation is 9%), while in Nursing Home chains is 81.8% (standard deviation is 12%). In addition there are 75 Nursing Homes that have slacks in the input Other Expenses and one with slack in the input Operating Expenses. These SCM should reduce their expenses without disturbing the provision of social services.

5.2   Tobit Regression (2nd Stage)

In the second stage, the Tobit regression is used to verify the influence of organizational variables on efficiency. Specifically, we investigate the influence of organizational variables such as the number of users of the entity, the integration into a chain of Nursing Homes and the possibility of the entity provides other social responses. The results are present in the next Table 6. Concerning the model' goodness of fit. The Variance Inflaction Factor (VIF) for each independent variable does not present problems of collinearity; and residues, according to the $p = 0.658$ value of the chi-square test, follow a normal distribution (the null hypothesis of the error distribution is not rejected). The Kolmogorov-Smirnov test was run for each variable and the results show that the independent variables do not follow a Normal distribution. However, it is not an obstacle due to the Central Limit Theorem, which justifies the asymptotic normality for large samples (n $\geq$ 30). Thus, the model's goodness of fit is considered acceptable (Wooldridge, 2006).

Table 6: Descriptive Statistics of Variables used in the Tobit Regression

	Expected Sign	Coefficient	Standard Error	Z	$P - Value$	VIF
Intercept		0,774	0,016	48,080	<0,001	
Number of Social Responses	-	-0,001	0,001	-0,697	0,486	1,324
Integration into a chain of Nursing Homes	-	-0,040	0,019	-2,043	0,041	1,761
Number of Users	+	0,001	0,000	4,107	<0,001	1,568

The Tobit regression shows that number of users and the existence of Nursing Home chains are statistically significant. The chain affiliation of Nursing Homes negatively affects efficiency. The results confirm the conclusions of Anderson et al. (1999). That is, Nursing Home chains have lower efficiency than independent Nursing Homes. Such as Anderson et al. (1999) concluded the greater size of the entities may make it difficult to manage them. The non-profit status and compliance with staff ratios explain the differences found. Given that the Nursing Homes in question are non-profit, the focus is on the quality of care for the users, which leads to a greater expenditure of resources. Since Nursing Homes have to meet staff ratios for each Home, with at least 8 employees, entities that have more than one Nursing Home, in turn, have to hire more staff. That is, there is no possibility of rationing human resources, which

means more expenses, which can cause difficulties in the management of Nursing Homes. On the other hand, the number of users positively affects efficiency. The results are in agreement with the literature (e.g. Nyman and Bricker, 1989; Rosko et al., 1995; Ozcan et al., 1998), that is, the greater the number of users, the more efficient the Nursing Homes are due to economies of scale. The Nursing Homes can benefit from lower average costs, namely human resources, feeding and energy. It is interesting to note that the fact that an SCM has more than one Nursing Home does not mean that it is more efficient than another SCM that has only one unit. That is, SCM are more efficient with only one Nursing Home and with the largest number of users. Therefore hypotheses H_1 and H_2 are validated.

Regarding the number of social responses of SCM, no statistical significance was obtained. However, the negative coefficient should be highlighted, which indicates that the number of social responses negatively influences efficiency, which can support the regulator in allocating the social responses to each SCM. Furthermore, as SCM increases its social activities, the associated costs, such as human resources, also increase, which may hinder the management of activities. However, this hypothesis (H_3) was not validated.

6 Conclusions

The objective of this study is to assess the economic efficiency of non-profit Nursing Homes owned by SCM and the organizational variables that can influence their efficiency. In the first stage, a DEA model (1) is used to assess the efficiency of the Nursing Homes, considering the best practices observed during 2012 and 2013. In the second stage, a Tobit regression is used, using as the dependent variable the efficiency scores obtained from the DEA and as independent variables the number of users, the existence of a Nurse Homes chains and the number of social responses.

The DEA model showed that the efficiency average of the Nursing Homes is 81.9% and 10 out of 96 Nursing Homes are efficient. Furthermore, the efficiency average between independent Nursing Homes and Nursing Home chains is practically the same. It should be noted that there were 76 Nursing Homes with slacks in the inputs, so it is inferred that these entities should reduce their inputs without disturbing the provision of social services.

The Tobit regression reveals that number of users and the existence of Nursing Home chains are statistically significant, influencing their efficiency. The number of users has a positive effect while the existence of a chain of Nursing Homes affects negatively their efficiency. This means that although Nursing Homes can benefit from economies of scale by increasing the number of users (e.g. Banaszak-Holl et al., 2002; Bazzoli and Chan, 2000), but when this increase implies the opening of new Nursing Home may lead to difficulties in management, reducing their efficiency (Anderson et al., 1999).

In terms of future research, it would be interesting to compare the efficiency among non-profit to profit Nursing Homes and verify the impact that certain aspects concerning the quality of social services (e,g., safety conditions, hygiene and comfort conditions, food safety, among others).

References

Anderson, R., Lewis, D., and Webb, J. (1999). The Efficiency of Nursing Home Chains and the Implications of Non-profit Status. *Journal of Real Estate Portfolio Management*, 5(3):235 − 245.

Anderson, R., Weeks, H., Hobbs, B., and Webb, J. (2003). Nursing Home Quality, Chain Affiliation, Profit Status and Performance. *Journal of Real Estate Research*, 25(1):43 − 60.

Arling, G., Nordquist, R., and Capitman, J. (1987). Nursing Home Cost and Ownership Type: Evidence of Interaction Effects, Health Services Research. 22:255 − 269.

Banaszak-Holl, J., Berta, W., Bowman, D., Joel, C., and Mitchell, B. (2002). The Rise of Human Service Chains: Antecedents to Acquisitions and their Effects on the Quality of Care in US Nursing Homes. *Managerial and Decision Economics*, 23(4):261 − 282.

Banker, R. D., Charnes, A., and Cooper, W. W. (1984). Some models for estimating technical and scale inefficiencies in Data Envelopment Analysis. *Management Science*, 30(9):1078–1092.

Bazzoli, J. and Chan, B. (2000). The Financial Performance of Hospitals Belonging to Health Networks and Systems. *Inquiry*, 37(3):234 − 252.

Ben-Ner, A. and Ren, T. (2008). Does Organization Ownership Matter? Structure and Performance in For-Profit, Non-profit and Local Government Nursing Homes. *Annual Conference Industry Studies*, Boston, MA, USA.

Charnes, A., Cooper, W., and Rhodes, E. (1978). Measuring the Efficiency of Decision Making Units. *European Journal of Operational Research*, 2(6):429 − 444.

Coelli, T., Rao, D. S., O'Donnell, C., and Battese, G. (2005). *An Introduction to Efficiency and Productivity Analysis*. Springer Science, Business Media, New York.

DeLellis, N. (2009). *Determinants of Nursing Home Performance: Examining the Relationship Between Quality and Efficiency*. PhD thesis, Virginia Commonwealth University, Richmond, Virginia, USA.

DGSS (1997). Circular de Orientação Normativa. Technical Report 3, Direção Geral da Segurança Social.

Eurostat (2017a). Old Age Dependency Ratio. Technical report.

Eurostat (2017b). Projected Old Age Dependency Ratio. Technical report.

Fizel, J. and Nunnikhoven, T. (1993). The Efficiency of Nursing Home Chains. *Applied Economics*, 25:49 − 55.

Garavaglia, G., Lettieri, E., Agasisti, T., and Lopez, S. (2011). Efficiency and Quality of Care in Nursing Homes: An Italian Case Study. *Health Care Management Science*, 14:22 − 35.

GEP-MSESS (2013). Carta Social - Rede de Serviços e Equipamentos. Technical report, Gabinete de Estratégia e Planeamento do Ministério de Solidariedade.

GEP-MSESS (2016). Rede de Serviços e Equipamentos. Technical report, Gabinete de Estratégia e Planeamento do Ministério de Solidariedade.

Hollingsworth, B. (2003). Non-parametric and Parametric Applications Measuring Efficiency in Health Care. *Health Care Management Science*, 6:203 − 218.

Instituto da Segurança Social, IP (2015). Guia Prático - Orçamento e Contas de Instituições Particulares de Solidariedade Social. Technical report.

Iparraguirre, J. and Ma, R. (2015). Efficiency in the provision of social care for older people. A three-stage Data Envelopment Analysis using self-reported quality of life. *Socio-Economic Planning Sciences*,, 49:33 − 46.

Jensen, M. and Meckling, W. (1976). Theory of the Firm: Managerial Behavior, Agency Cost and Ownership Structure. *Journal of Financial Economics*, 3(4):305 − 360.

Knox, K., Blankmyer, E., and Stutzman (2003). Organizational Efficiency and Quality in Texas Nursing Facilities. *Health Care Management Science*, 6:175 − 188.

Kooreman, P. (1994). Nursing Home Care in the Netherlands: A Nonparametric Efficiency Analysis. *Journal of Health Economics*, 13(3):301 − 316.

Li, Y., Cai, X., Ye, Z., Glance, L., Harrington, C., and Mukamel, D. (2013). Satisfaction with Massachusetts Nursing Home Care was Generally High During 2005-2009, with Some Variability Across Facilities. *Health Aff (Millwood)*, 32(8):1416 − 1425.

Marques, M. (2010). IPSS: Uma Abordagem Fiscal. *TOC*, 120:45 − 47.

MSSS and UMP (2012). Protocolo de Cooperação 2011-2012. Technical report, Ministério da Solidariedade e da Segurança Social and União das Mutualidades Portuguesas.

MSSS, UMP, CNIS, and UMP (2012). Protocolo de Cooperação 2013-2014. Technical report, Ministério da Solidariedade e da Segurança Social, União das Misericórdias Portuguesas, Confederação Nacional das Instituições de Solidariedade and União das Mutualidades Portuguesas.

Nyman, J. and Bricker, D. (1989). Profit Incentives and Technical Efficiency in the Production of Nursing Home Care. *The Review of Economics and Statistics*, 71(4):586 − 594.

Ozcan, Y. (2008). *Health Care Benchmarking and Performance Evaluation - An Assessment using Data Envelopment Analysis (DEA)*. Stanford: Fred Hillier.

Ozcan, Y., Wogen, S., and Mau, L. W. (1998). Efficiency Evaluation of Skilled Nursing Facilities. *Journal of Medical Systems*, 22(4):221 − 224.

Rantz, M., Mehr, D., Popejoy, L., Stauffacher, M., Hicks, L., Grando, V., Conn, V., Porter, R., Scott, J., and Maas, M. (1998). Nursing Home Care Quality: A Multidimensional Theoretical Model Integrating The Views of Consumers and Providers. *Journal of Nursing Care Quality*, 12(3):47 − 54.

Rosko, D., Chilingerian, A., Zinn, S., and Aaronson, E. (1995). The Effect of Ownership, Operating Environment and Strategic Choices on Nursing Homes Efficiency. *Medical Care*, 33(10):1001 − 1021.

UMP (2017). Misericórdias Nacionais. Technical report, União das Misericórdias Portuguesas.

Wang, Y. and Chou (2003). The Efficiency of Nursing Homes in Taiwan: An Empirical Study Using Data Envelopment Analysis. Technical report.

Wooldridge, J. (2006). *Introductory Econometrics - A Modern Approach*. Ohio: South Western College Publishing.