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The Catalan Health Budget: A Conflicting Claims Approach*

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Abstract

The financial and economic crisis in Spain during recent years has induced public budget adjustments. The crisis has caused a great social impact due to the way the austerity measures have been implemented, affecting mainly key economic sectors such as the civil service, justice, education and health. Among all of these sectors, the current paper focuses on the health budget distribution, since the changes in the provision of the health services induce faster and clearer impacts in the social welfare. Spain is divided into 17 regions, and each region manages its own health system. Specifically, we analyze the Catalan health budget assignment since Catalonia is one of the most populated regions and one where the restrictions have been more evident. We study the health budget distribution for the period 1998-2014, from the point of view of the conflicting claims problem (O'Neill, 1982). Accordingly, alternative allocations of the health budget are proposed by using some of the most used solutions in the body of literature. Finally, in order to choose the most appropriate solution, we require the fulfillment of (i) some equity and stability criteria, and (ii) some commonly accepted social constraints.

Keywords: Distribution problems, health, axiomatic analysis, public budget.

JEL Classification: C71, D63, D71

1. Introduction

Due to the crisis that started in 2007, the USA and Europe experienced several consequences, such as economies in deep recession, millions of lost jobs, decreasing gross domestic product, and a fall in the stock market. The reaction of the countries against the so-called

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"greatest financial crisis world-wide" was heterogeneous. In the USA and Japan, the Central Banks decided to apply expansionary policies that led to injecting trillions of dollars in order to rescue the bankrupt financial entities. In contrast, in Europe, following the recommendation of the European Central Bank, countries such as Greece, Ireland, Portugal and Spain applied austerity measures (Hemerijck, 2012).

In particular, Spain has applied economic policies that are designed to reduce public expenditure. For instance, during 2013, the education sector suffered a budget reduction of 326.17 million euros more than the previous year, that is, a decrease of 14.4%; in the culture sector the budget assigned in 2013 was 175.81 million euros less than in 2012, representing a reduction of 19.6%. All these spending adjustments provoked, almost immediately, negative consequences in the provision of public services. Specifically, the Spanish health sector suffered a reduction of 8,778 million euros in the period 2009-2013, that is 12.5% of reduction, which induce that, according to the reports of the Sociedad Española de Salud Pública y Administración Sanitaria, many primary attention centers closed, and the numbers of beds, operating rooms, and sanitary staff, among others, were drastically reduced, inducing an in-crease in numbers on the waiting lists (43% from 2009 to 2012). All of these adjustments have clearly affected the welfare of the country either economically (Ayala and Triguero, 2017) or socially Cerno, Pérez and Sanz (2017), for instance, with respect to the quality of the Public services.

Among all of the aforementioned public services, the present paper focuses on health, which was defined by the World Health Organization (WHO, 1946) as "a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity"[1]. Furthermore, from an economic point of view, it is also important to ensure the protection and promotion of health, because the population's vitality increases the labor force and the productive capacity (Arrow, 1963).

Hence, we can assert that (i) the health sector generates great social impact, (ii) health is essential for social welfare, and (iii) the quality of the Spanish National Health System (Spanish: Sistema Nacional de Salud, SNS) has suffered a substantial decrease, due to the way in which the budget readjustment has been applied.

In this sense, it is noteworthy that the SNS in Spain, which is known as one of the best National Health Systems in the world (Stuckler *et al.*, 2011), is managed independently by its 17 regions.

Due to the availability of data and the significance of the public budget adjustments, we focus on Catalonia[2]. Specifically, the health services in Catalonia are managed by the Health Department, which also coordinates the central organisms: the Servei Català de la Salut, and the Institut Català de la Salut[3].

On the one hand, during the period 2010-2013 the Catalan health budget has been reduced by 1,355.85 million euros (14% decrease), which provokes some negative implications, such as: the number of patients in the waiting lists increased by 30,000, the waiting

time increased by up to 4.57 months (that corresponds to 43%), the number of public health employees was reduced to 28,700 (that is 5,6%) following data from the finance ministry, not all of the primary care centers have access to 24 h emergency attention[4], several hospital beds and operating rooms have been closed, and pharmacy spending decreased[5].

On the other hand, the conflicting claims problem approach (O'Neill, 1982) models those situations where the available resources are not enough to totally honor the aggregate claim. Usually, this model has been used to explain how to distribute the money of a failed bank among its creditors, or an inheritance among heirs. Nonetheless, it can be applied to many different situations, such as medical assistance, budget distribution in universities (for instance, Pulido, Sánchez-Soriano and Llorca, 2002, propose that the funds should be allocated proportionally to the number of teachers, students, etc., of each department), and milk quota distribution among EU member states. This theory is also applied in environmental issues such as the reduction of fishing quotas (Iñarra and Prellezo, 2008; Iñarra and Skonhoft, 2008; Kampas, 2015), and in the case of the global carbon budget where the allocation of CO_2 emissions among countries is studied (Giménez-Gómez, Teixido-Figueras and Vilella, 2016). Therefore, clearly, the Catalan health budget distribution fits the conflicting claims problem approach since the available resources cannot satisfy the aggregate needs. To the best of our knowledge, this situation has not been studied from this perspective.

By implementing the conflicting claims approach, firstly, we analyze, during the period 2011-2014, how the budget is distributed among the different economic areas of the public health expenditure (consolidated health budgets): salary, current expenditures of goods and services, current transfer, transfer of capital, real investment, and variation of financial assets. Secondly, we apply some of the solutions that have been proposed in the literature to mediate conflicts: the proportional, the constrained equal awards, the constrained equal losses, the Talmud, the adjusted proportional and the α-min. Thirdly, since, our aim is to find the most appealing and fairest solution, and we introduce the power index, which is a criterion of stability and fairness that ensures a reasonable assignment of the budget. Fourthly, in order to analyze the even distribution of the budget, we apply the Gini inequality coefficient. Finally, we introduce several commonly accepted social constraints in the health context; and we choose the solution that satisfies the fairness criterion, the equity indexes and the social constraints.

Hence, dealing with the health budget problem in this way may be potentially more effective than the current distribution, since we provide new different allocations in terms of appealing principles of fairness and equity related to the current needs.

The remainder of the paper is organized as follows. Section 2 provides an overview of the health sector in Catalonia and the budget problem in this sector after the crisis. Section 3 describes the health budget as a conflicting claims problem. Section 4 presents some theoretical solutions to the conflicting claims problem. Sections 5 and 6 introduce equity and stability criteria, and some commonly accepted social constraints, respectively. Finally, Section 7 concludes. All tables and figures are in the Appendix.

2. The health department of Catalonia

The SNS is the organization responsible for the coordination, cooperation and administration of health services. It is organized at two levels: primary and specialist health care. The population can receive basic services in the primary health care centers, and if individuals need a specialized treatment, they can be attended to in specialized centers and hospitals.

Of the 17 regions in Spain, each region administers its health system independently. Specifically, each region is responsible for the management of the centers and the health services within the region.

We focus on the region of Catalonia, mainly for the availability of data, but also because (i) it is the second region with the greatest population density, (ii) it is the region that allocates more budget to the health sector; (iii) it has been the Spanish region where the most budget adjustments have been applied.

Following a report of the State Association of Directors and Managers of Social Services (AEDGSS is the Spanish acronym), Catalonia was the region that experienced the highest adjustments in the healthcare system during the period 2009-2015, representing 15% of the total SNS budget adjustment. Focusing on the readjustment of the health sector, specifically the staff's health salaries and the expenditures of goods and services suffered an adjustment of 409.56 (19%) and 400.39 (7%) million euros, respectively.

Nonetheless, the population's health needs became greater, since the total number of inhabitants during the same period increased by 41,269. Hence, while the Catalan health resources were reduced by 14%, the total population grew by 1%. Thus, the consequences of these adjustments were reflected in many aspects of the Catalan health system. The waiting time increased with respect to access to medical tests or surgical interventions. For instance, waiting time in orthopedics went from 8 to 10 months and waiting time in gynecology increased by up to 7 months. Operating rooms were closed during some time periods. The hospital staff, the number of beds and the hospital stay time were also reduced. Clearly, all of these adjustments have had a great social impact, since they induced a lower quality of the public service[6].

The Health Department in Catalonia is the highest authority and manages its regional health policies. The Servei Català de la Salut (CatSalut) is responsible for the funding and purchase of health services, and for supplying these services to health centers and hospitals. A set of entities is responsible for the provision of these health services to the population[7] These entities can be either public, concerted (50% public, 50% private) or fee-paying private. Figure 1 shows the organization chart of the Catalan Health System.

In this paper, we study the CatSalut because it is the supplier of health services to all centers and hospitals, and the ICS because it is the most important public entity that provides these health services to all users. The main objective of the CatSalut and the ICS is to ensure

the equity, quality and efficiency of the health system in order to improve the population's quality of life.

In order to analyze the health budget distribution as a conflicting claims problem, we formally introduce this approach in the following section.

3. The Catalan health budget as a conflicting claims problem

As aforementioned, note that the conflicting claims problem approach, which originates formally with O'Neill (1982), has been used by many authors to analyze conflicts of interests in actual situations.

Formally, consider a set of agents $N = \{1,2,\ldots,n\}$, such that each agent has a claim $c_i \in R_+$ on an infinitely divisible resource, the endowment $E \in R_+$. Let $c \equiv (c_i)_{i \in N}$ be the claims vector. Then, a **conflicting claims problem** is a pair (E,c) with $C = \sum_{i=1}^{n} c_i > E$, that is, the endowment is not enough to honor all of the claims. Without loss of generality, we order the agents in an increasing manner, according to their claims, $c_1 \leq c_2 \leq \ldots \leq c_n$. We denote by B the set of all claims problems.

In this paper, the endowment is the health budget assigned to the health sector in each one of the evaluated years (from 2011 to 2014). In addition, this, we use an inflation rate by using the consumer price index (CPI) in order to compare the real and the nominal values of the changes in the yearly budget.

Furthermore, since we focus our analysis on the financial adjustment that the health sector suffered from the crisis to the present day, we use the economic classification of the public health expenditure to define who the claimants are. Specifically, there are six claimants: salaries (S), current ex-expenditures of goods and services (EGS), current transfers (CT), transfers of capital (TC), real investment (RI), and variation of financial assets (VFA).

Finally, in order to define the amount of resources that the six economic areas will claim from the year 2010 on, it is noteworthy that the number of inhabitants has increased. Additionally, as Table 1 shows, the health budget has been diminishing in all economic areas from the year 2011 onwards. Therefore, it seems natural to assume that each economic area would claim, at least, the same resources it has before the crisis. Likewise, we define the claims with the health budget assigned to each claimant (economic area) for the year 2010.

Summing up, our set-up corresponds with $(E;c)$ = CPI revised annual health budget; (*TC, VFA, RI, CT, EGS*), so that,

– There are four different endowments, corresponding with each health annual budget (in million euros), considering the inflation rate (see Table 2): 8,952.8; 8,403.8;

7,840.6; and, 7,841.8 for 2011, 2012, 2013 and 2014, respectively. Hence, there are four conflicting claims problems, one per each year during the period 2011-2014.

– There are six claimants, corresponding to the economic classification of expenditures: TC, VFA, RI, CT, S, and EGS (increasingly ordered with respect to the claims). In this sense, and due to the increase in population, the claims are the largest amount the claimants received before the adjustments (2010), considering the inflation rate, *i.e.*, c = (44.1; 82.1; 207:8; 1,497.7; 2,080.6; 5,391.1).

Since we propose an alternative way to allocate the Catalan health budget, in the next section we introduce some different proposals (rules) that are considered in the literature of conflicting claim problems.

4. How to distribute the health budget

Once the conflicting claims problem is properly defined, some methods are provided by the literature to allocate the endowment. These methods or rules propose a distribution of the endowment among the agents, taking into account their claims.

Formally, a rule is a function $\phi = B \rightarrow R^n_+$ that associates with each conflicting claims problem an awards vector for it, such that $\phi_i(E,c) \geq 0$, for all $i \in N$ (**non-negativity**), $\phi_i(E,c) \leq c_i$, for all $i \in N$ (**claim-boundedness**), and $\sum^n_{i=1} \phi_i(E,c) = E$ (**efficiency**).

According to our framework, a rule distributes the total health budget among all of the economic areas with respect to their claims. In other words, the application of a rule implies that no economic area can receive a negative amount (*i.e.*, no area is lending money), no area will receive an award higher than its claim, and the total health budget is distributed.

Among all of the rules that have been proposed in the conflicting claims literature, we introduce those that have actually been used in similar situations: the proportional, the constrained equal awards, the constrained equal losses, the Talmud, the adjusted proportional and the α^{min} rules. For the sake of comprehension, we define the rules that we apply to our framework.

The **proportional** (**P**) rule divides the health budget proportionally with respect to each economic area's claim.

For each $(E,c) \in B$ and each $i \in$ N, $P_i\,(E,c) \equiv \lambda c_i$; where $\lambda = E/\sum_{i \in N}) \; c_i$. (1)

The constrained equal awards (CEA) rule (Maimonides, 1135, 1204), proposes an equal distribution of the health budget subject whereby no one can receive more than his claim.

For each $(E,c) \in B$ and each $i \in N$, $CEA_i(E,c) \equiv \min\{c_i,\mu\}$;

where μ is such that $\sum_{i\in N}\min\{c_i,\mu\}=E$. (2)

The constrained equal losses (CEL) rule (Maimonides, 1135, 1204; Aumann and Maschler, 1985) focuses on distributing losses, that is, all the economic areas must lose equally, but none of them must receive a negative amount.

For each $(E,c) \in B$ and each $\in N$, $CEL_i(E,c) \equiv \max\{0,c_i-\mu\}$;

where μ is such that $\sum_{i\in N}\max\{0,c_i-\mu\} = E$. (3)

The Talmud (T) rule (Aumann and Maschler, 1985) contains the CEA and the CEL. It takes the middle of the claims as a reference point. If half of the aggregate claim is lower than the health budget, then the CEA is applied over the half-claims. Otherwise, each economic area receives half of its claim and the CEL is applied in order to distribute the remaining budget.

$$\text{For each } (E,c) \in \mathcal{B} \text{ and each } \in N,\ T_i(E,c) \equiv CEA_i\left(E,\left(\frac{c_i}{2}\right)_{i\in N}\right) \text{ if } E \leq \frac{\sum_{i\in N} c_i}{2};$$
$$\text{or } T_i(E,c) \equiv \frac{c_i}{2} + CEL_i\left(E-\frac{\sum_{i\in N} c_i}{2},\left(\frac{c_i}{2}\right)_{i\in N}\right), \text{ otherwise.} \quad (4)$$

The Adjusted Proportional (AP) rule (Curiel, Maschler and Tijs, 1987) ensures that each economic area receives its minimal right m_i (O'Neill, 1982) which, for each $(E,c) \in B$ and each $i \in N$, guarantees to each agent the not unclaimed part of the endowment, *i.e.*, $m_i(E,c) = \max\{E - \sum_{j\neq i\in N} c_j,0\}$. Afterwards, it divides the remaining health budget in proportion to the revised claims, given that if a claim is greater than the available budget, it is truncated accordingly.

$$\text{For each } (E,c) \in B \text{ and each } \in N,\ AP_i(E,c) = m_i(E,c) + P_i(\mathrm{E} - \sum_{j\in N} m_j(E,c),$$
$$(\min\{c_i - m_i(E,c),\ E - \sum_{j\in N} m_j(E,c)\})_{i\in N}). \quad (5)$$

The α-min (α^{min}) rule (Giménez-Gómez and Peris, 2014) ensures, for each $(E,c) \in B$, an equal division of the health budget among the economic areas as far as the smallest claim is totally honored; then, the remaining budget is distributed proportionally.

$$\text{For each } (E,c) \in B \text{ and each } i \in N, \text{ if } c_1 > E/n \text{ then, } \alpha^{min}(E,c) =$$
$$E/n, \text{ or } \alpha^{min}(E,c) = c_1 + P(E - nc_1,(c_i - c_1)_{i\in N}, \text{ otherwise.} \quad (6)$$

Next, in Table 2 we summarize the comparison among the introduced rules for each of the conflicting claims problems defined in Section 3. Recall that, we consider six economic areas (TC, VFA, RI, CT, S, EGS), whose claims are c (44.1; 82.1; 207.8; 1,497.7; 2,080.6; 5,391.1), and the CPI revised consolidated health budget is 8,952.8; 8,403.8; 7,840.6; and 7,841.8 for the years 2011, 2012, 2013 and 2014, respectively.

Among all possible allocations, the natural question that arises is: which is the most appealing way to distribute the available public health budget among all the economic areas? As a response, we propose to use an equity criterion that induces with respect to the most suitable rule in our framework.

5. Equity and stability criteria

Following Robert (1974), "the complete principle of distributive justice would say simply that a distribution is just if everyone is entitled to the holdings they possess under the distribution". Hence, in order to determine the rule that induces a larger commitment among the different economic agents involved in the health budget distribution, we are introducing some equity criteria.

Firstly, it is noteworthy that there are different inequality indexes that are widely used: the Atkinson index (Atkinson, 1970), the generalized entropy index (Theil, 1967), and the Gini index (Gini, 1921). Among them, the latter is the most popular, being vastly used in both official and scientific reports, and it is considered in the literature as the best single measure of inequality (see, for instance, Atkinson, 1970, and Aaberge and Brandolini, 2015).

The Gini index (*Gi*) (Gini, 1921), is formally defined as:

$$Gi = \frac{1}{2\,N^2\,\mu} \sum_i \quad \sum_{j<i} \left| r_i - r_{j<i} \right|, \tag{7}$$

Where N is the total number of agents $n_1,n_2\ldots n_k$, r_i is the the ith claimant's allocation of the health budget proposed by a particular rule and is the average of $r_1,r_2\ldots r_k$. Note that this index considers the average distribution and the differences between one economic area and the next, following an increasing ordering. Hence, it takes values in the interval [0,1], where Gi=0 means perfect equality, and Gi=1 means complete inequality, so that the lower the index the more equality the allocation.

Table 3 shows the computation of this coefficient for each studied year and for each proposed rule. By comparing the obtained results with our baseline (the actual way in which the health budget was distributed in 2010), it seems plausible to choose only those rules that induce no more inequality in the way of allocating the available budget: the P, CEA and α^{min} rules.

Secondly, note that the economic areas with a larger budget relevance might be damaged by using only one equity criterion, since it is not considering any priority measure. Nonetheless, and after considering the information provided by the economic resources department of the Catsalut, there are no previously established priority parameters to make the allocation of the health budget. Hence, the implementation method of Moulin (2000) becomes unfeasible. For the sake of facing this issue, as a measure of stability, we introduce the coefficient of variation, which has been applied to select stable solutions for cooperative problems (Dinar and Howitt, 1997; Read, Madani and Inanloo, 2014).

In doing so, we consider that each economic area $i \in N$ should be treated differently, depending on its long-run average health budget share W_i. This long-run average health budget share of the *i's* agent is the average of the resources that agent i receives from 1997 to 2014.

To compute the CV, we consider r_i^{max}, the best distribution (*i.e.*, the rule that assigns a greater amount) for the i economic area across all the rules, and r_{ik}, the actual amount proposed by each of the rules in comparison to the others. Furthermore, for each economic area $i \in N$, we also compute its Power Index,

$$PI_i \ \frac{W_i\,(r_i^{max} - r_{ik})}{\sum_j W_j\,(r_j^{max} - r_{jk})} \tag{8}$$

Therefore, the coefficient of variation (CV) is formally defined as: $CV = \frac{\sigma}{\mu\,(PI)}$, where σ and $\mu(PI)$ are the standard deviation and the mean of the Power Index PI respectively. Therefore, the higher the value of CV, the greater the instability (Dinar and Howitt, 1997; Kampas, 2015).

Next, Table 4 presents the CV index for each rule and for each year analyzed. Note that, the rules that have a lower index in comparison to the baseline (that is, the real-life way of applying the distribution in the year 2010) are P, CEL, T, AP and α^{min} rules.

It is noteworthy that this CV measure depends on the PI, which means the degree of satisfaction of the parts involved in the distribution problem with the final allocation, so that none of them has any incentive to deviate from the proposed allocation. In this regard, Dinar and Howitt (1997) note that Shapley and Shubik (1954) suggest this index as a method of measuring power in voting games: "...the power of an individual member depends on the chance he has of being critical to the success of a winning coalition".

Thirdly, we study which rules satisfy both the equity and priority criteria. In doing so, the intersections in Tables 3 and 4 show that there are only two rules having a lower Gini index and satisfying the CV criterion: the P and the α^{min} rules[8].

Finally, we apply an election method to select one of the remaining rules. The idea is to select (among the proportional and α^{min}) the rule preferred by most economic areas. In doing so, we introduce the Borda count election method: each economic area assigns 1 point to its preferred rule, and zero, otherwise. Consequently, the rule that gets more votes will be chosen.

Formally, the Borda count (B) (Black, 1976) is given by,

$$B = max_m(Bm), \tag{9}$$

Where m is each one of the feasible rules, R_{im} denotes the points assigned by each economic area $i \in N$ to each of the proposals, and $B_m = \sum_{i \in N} R_{im}$.

As shown in Table 5 the rule with more votes is the α^{min} rule. Therefore, we may conclude that the economic areas prefer the allocation of the health budget proposed by the α^{min} rule for each of the analyzed years.

For the sake of comparison, in Table 6 we observe a remarkable difference in the allocation of the health budget. Note that the agents with a lower claim get a larger share of the resources than the actually assigned amount. Specifically, the salaries area receives more resources which, as aforementioned, could positively affect the social impact regarding the quality of the public health service.

The following section provides some commonly accepted social constraints in order to enrich the comparisons between the proposed rules.

6. Commonly accepted social constraints

In this section, we provide an axiomatic justification of the proposed allocations through some commonly accepted social constraints that should determine the way in which the Catalan health budget is distributed. Note that in our context, this approach is totally suitable since there is a regulatory entity (the Health Department) that manages the assignments of the budget among the different economic areas, in accordance with some principles or constraints.

Next, we introduce some properties that adapt to our context. In doing so, we propose those commonly accepted social constraints (see, for instance, Moulin, 2000; and Thomson, 2015) that gather the idea of ensuring a fair distribution and treatment among all economic areas, not only taking into account an equity criterion, but also the relative relevance of each economic area with respect to the total health budget distribution.

Equal treatment of equals states that economic areas with similar claims should be rewarded with the same health budget allocation: for each $(E,c) \in B$, and each $\{i,j\} \subseteq N$ if $c_i = c_j$, then where $\phi_i(E,c) = \phi_j(E,c)$.

Note that this property gathers the simple idea of fairness that equal economic areas should be treated equally, *i.e.,* they should receive the same award.

Order preservation (Aumann and Maschler, 1985) requires respecting the ordering of the economic areas: if *i'* claim is at least as large as *j's* claim, agent i should receive and lose at least as much as *j* does, respectively: for each $(E,c) \in B$, and each $i,j \in N$, such that $c_i \geq c_j$, then $\phi_i(E,c) \geq \phi_j(E,c)$, and $\phi_i(E,c) \geq c_j - \phi_j(E,c)$.

This property is relevant because it maintains the order of the areas when distributing the health budget. That is, the larger the historical relevance of an economic area with respect to the health budget is, the larger the allocation received.

Resource monotonicity (Curiel, Maschler and Tijs, 1987), Young (1987) notes that if the health budget increases, then all economic areas should get at least the awards they received initially: for each $(E,c) \in B$ and each $E' \in R_+$ such that $C > E' > E$, then $\phi_i(E',c) \geq \phi_i(E,c)$, for each $i \in N$.

Resource monotonicity implies that the larger the health budget, the larger the financial support received by each economic area.

Super-modularity (Dagan, Serrano and Volij, 1997) requires that if the health budget increases, the economic areas with the greater claim experience a larger gain than the other areas: for each $(E,c) \in B$, all $E' \in R_+$ and each $i,j \in N$ such that $C > E' > E$ and $c_i \geq c_j$, then $\phi_i(E',c) - \phi_i(E,c) \geq \phi_j(E',c) - \phi_j(E,c)$.

Note that this property gives, somehow, priority to those economic areas with a larger historical relevance in the health budget, since they receive a greater share of the increasing budget.

Reasonable lower bounds on awards (Moreno-Ternero and Villar, 2004; Dominguez and Thomson, 2006) ensures that each economic area receives at least the minimum of (i) its claim divided by the number of areas, and (ii) the health budget divided by the number of areas: for each $(E,c) \in$ B and each $i \in N$, $\varphi_i(E,c) \geq \frac{\min\{c_i,\ E\}}{n}$

This is an important property since it ensures a minimum amount for each economic area, so that no one area can be completely punished. In other words, in doing so it induces a fair distribution.

Table 7 summarizes the axiomatic comparative among the considered rules. Note that, not only is the α^{min} rule the unique rule satisfying the equity and stability criteria (introduced in Section 5), but it also fulfills all the commonly accepted social constraints that may be considered as the basic criteria to guarantee a fair allocation of the health budget.

7. Final Remarks

Spain applied the economic policy of austerity in order to address the crisis. As a consequence, some areas that affect the social welfare, such as health, education and culture, have been significantly affected. In this paper we focus on the Catalan health system. Specifically, by implementing the classical conflicting claims problem approach (O'Neill, 1982), we propose an alternative way of allocating the health budget among the different economic areas.

We consider some rules together with some equity and stability criteria in order to evaluate the different allocations. Accordingly, by using the Gini index and the Coefficient

of Variation, we look for the most appropriate way to distribute the available health budget. Furthermore, we analyze this problem from an axiomatic point of view, that is, we study the fulfillment if some commonly accepted social constraints that are widely used in the related literature. Among all of the considered rules, we find that the $\alpha^{\min}$ rule is the only rule satisfying all of the aforementioned criteria.

Appendix

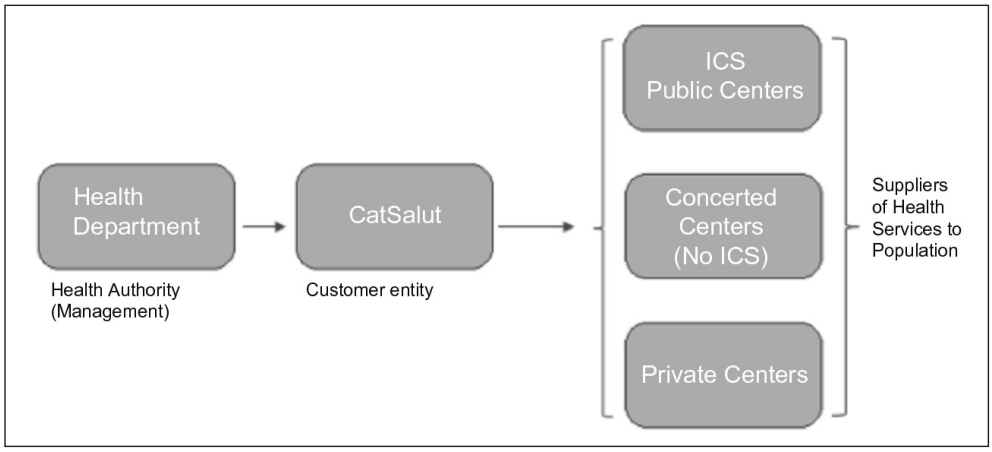

Figure 1: Organization chart of the Catalan Health System

Table 1
CURRENT HEALTH EXPENDITURE BUDGET FOR THE PERIOD 2009-2014 DISAGGREGATED BY ECONOMIC CHAPTERS (IN MILLION EUROS). AS A REFERENCE POINT, WE INCLUDE 2009, THE YEAR BEFORE THE ADJUSTMENTS WERE MADE

	2009	2010	2011	2012	2013	2014
TC	24	44,10	43	39,60	36,90	37,40
VFA	66,40	82,10	69,40	70,40	65,60	74,20
RI	192,20	207,80	147,50	131,80	123,10	114,80
CT	1.872,30	1.497,70	1.353,70	1.028,50	959,5	950,40
S	1.946,00	2.080,60	1.922,60	1.861,50	1.736,80	1.735,50
EGS	5.183,10	5.391,10	5.416,70	5.272,00	4.918,70	4.929,90
Total	**9.194,00**	**9.302,80**	**8.952,80**	**8.403,80**	**7.840,60**	**7.841,80**

Table 2
ALLOCATION OF EACH HEALTH BUDGET ACCORDING TO EACH CONSIDERED RULE BETWEEN THE PERIOD 2011-2014. WITHIN EACH YEAR, ROWS PROVIDE THE ALLOCATIONS RECOMMENDED TO EACH OF THE SIX CONSIDERED ECONOMIC AREAS

		Actual	P	CEA	CEL	T	AP	α^{min}
Health Budget 2011: 8,952.8	TC	43	42,4	44,1	0	22,1	32,9	44,1
	VFA	69,4	79	82,1	20,8	41,1	61,3	80,6
	RI	147,5	200	207,8	146,5	135,9	155,2	201,5
	CT	1.353,70	1.441,30	1.497,70	1.436,40	1.425,80	1.409,00	1.441,30
	S	1.922,60	2.002,20	2.080,60	2.019,30	2.008,70	1.991,90	2.001,60
	EGS	5.416,70	5.187,90	5.040,50	5.329,80	5.319,20	5.302,40	5.183,70
Health Budget 2012: 8,403.8	TC	39,6	39,8	44,1	0	22,1	31	44,1
	VFA	70,4	74,2	82,1	0	41,1	57,8	78,3
	RI	131,8	187,7	207,8	14,45	103,9	146,16	191,5
	CT	1.028,50	1.352,90	1.497,70	1.304,40	1.253,50	1.230,90	1.353,00
	S	1.861,50	1.879,41	2.080,60	1.887,30	1.836,40	1.813,80	1.877,90
	EGS	5.272,00	4.869,80	4.491,50	5.197,70	5.146,90	5.124,30	4.858,90
Health Budget 2013: 7,840.6	TC	36,9	37,2	44,1	0	22,1	30,4	44,1
	VFA	65,6	69,2	82,1	0	41,1	56,7	76
	RI	123,1	175,1	207,8	0	103,9	143,4	181,3
	CT	959,5	1262,2	1497,7	1121,4	1.065,80	1.044,60	1.262,50
	S	1.736,80	1.753,50	2.080,60	1.704,30	1.648,70	1.627,50	1.751,00
	EGS	4.918,70	4.345,40	3.928,30	5.014,80	4.959,20	4.938,00	4.525,80
Health Budget 2014: 7,841.8	TC	37,4	37,2	44,1	0	22,1	30,4	44,1
	VFA	74,2	69,2	82,1	0	41,1	56,7	76
	RI	114,8	175,2	207,8	0	103,9	143,4	181,3
	CT	950,4	1.261,40	1.497,70	1.121,80	1.066,20	1.045,00	1.262,60
	S	1.735,50	1.753,70	2.080,60	1.704,70	1.649,10	1.627,90	1.751,30
	EGS	4.929,90	4.544,10	3.929,50	5.015,20	4.959,60	4.938,40	4.526,50

Table 3
COMPUTATION OF GINI COEFFICIENT. EACH ROW SHOWS THE GINI INDEX FOR EACH OF THE CONSIDERED RULES IN EACH STUDIED YEAR. THE "*" DENOTES THE RULES THAT PROPOSE A LOWER INEQUALITY DISTRIBUTION THAN THE BASELINE

		*P**	*CEA**	*CEL*	*T*	*AP*	α^{min*}	*Baseline*
Gini index	2011	0,609	0,601	0,632	0,627	0,622	0,609	0,609
	2012	0,609	0,585	0,653	0,638	0,631	0,608	
	2013	0,609	0,568	0,666	0,648	0,641	0,606	
	2014	0,609	0,57	0,67	0,65	0,641	0,604	

Table 4
COMPUTATION OF THE COEFFICIENT OF VARIATION. EACH ROW SHOWS THE CV FOR EACH OF THE CONSIDERED RULES AND EACH STUDIED YEAR. THE "*" DENOTES THOSE RULES THAT PROPOSE A LOWER CV THAN THE BASELINE

		*P**	*CEA**	*CEL*	*T*	*AP*	α^{min*}	*Baseline*
CV	2011	1,819	2,449	1,228	1,235	1,254	1,828	1,917
	2012	1,819	2,449	1,237	1,26	1,268	1,828	
	2013	1,528	2,449	1,325	1,351	1,224	1,546	
	2014	1,528	2,449	1,504	1,271	1,224	1,546	

Table 5
BORDA COUNT FOR THE *P* AND α^{MIN}* RULES. EACH ECONOMIC AREA ASSIGNS 1 POINT FOR ITS PREFERRED WAY OF DISTRIBUTING THE BUDGET (RULE)

	P	α^{min}
Transfer current		
Variation of financial assets	0	1
Real investment	0	1
Current transfer	0	1
Salaries	1	0
Current expenditures of goods and services	1	0
Total	**2**	**4**

Table 6
COMPARISON BETWEEN THE MIN RULE AND THE REAL DISTRIBUTION OF THE HEALTH BUDGET BETWEEN 2011-2014

		Actually	α^{min}
Health Budget 2011: 8, 952.8	TC	43	44,1
	VFA	69,4	80,6
	RI	147,5	201,5
	CT	1353,7	1441,3
	S	1.922,60	2.001,60
	EGS	5.416,70	5.183,70
Health Budget 2012: 8,403.8	TC	39,6	44,1
	VFA	70,4	78,3
	RI	131,8	191,5
	CT	1.028,50	1.353,00
	S	1.861,50	1.877,90
	EGS	5.272,00	4.858,90
Health Budget 2013: 7,840.6	TC	36,9	44,1
	VFA	65,6	76
	RI	123,1	181,3
	CT	959,5	1.262,60
	S	1.736,80	1.751,00
	EGS	4.918	4.525,80
Health Budget 2014: 7,841.8	TC	37,4	44,1
	VFA	74,2	76
	RI	114,8	181,3
	CT	950,4	1.262,60
	S	1.735,50	1.751,30
	EGS	4.929,90	4.526,50

Table 7
THE CONSIDERED RULES AND THE COMMONLY ACCEPTED SOCIAL CONSTRAINTS. EACH ROW SHOWS THE INTRODUCED PROPERTIES AND EACH COLUMN THE CONSIDERED RULES. FOR FURTHER DISCUSSIONS ABOUT THE FULFILLMENT OF PROPERTIES, SEE THOMSON (2003, 2015), AND GIMÉNEZ-GÓMEZ AND PERIS (2014)

	P	*CEA*	*CEL*	*T*	*AP*	α^{min*}
Equal treatment of equal	Yes	Yes	Yes	Yes	Yes	Yes
Order preservation	Yes	Yes	Yes	Yes	Yes	Yes
Resource monotonicity	Yes	Yes	Yes	Yes	Yes	Yes
Super-modularity	Yes	Yes	Yes	Yes	Yes	Yes
Reasonable lower bounds on awards	No	Yes	No	Yes	No	Yes

Notes

1. Preamble to the Constitution of the World Health Organization as adopted by the International Health Conference, New York, © June 19-22, 1946; signed on July 22, 1946 by the representatives of 61 States (Official Records of the World Health Organization, no. 2, p. 100) and entered into force on April 7, 1948.
2. See Amigot, B. (2013).
3. Catalan Health Service (SCS) and Catalan Institute of Health (ICS), respectively.
4. See Ferran Balsells (2012).
5. Health department will withdraw 456 commonly used drugs from public funding. *El PAÍS*, 2012.
6. See Gallardo, A. (2016) and Sevillano G. Elena. (2014).
7. Catalan Health Services (CatSalut) and Catalan Institute of Health, respectively.
8. See Thomson, 2007; Bosmans and Lauwers, 2011 and Giménez-Gómez and Peris, 2014 for a Lorenz (Gini) comparison among the proposed rules. In this sense, note that the CEA and CEL rules are the most and the least equitable ways of distributing the resources, respectively. There is no fixed relationship among the rest of the rules in these terms. Consequently, the results with respect to the Gini and CV analysis observed in the current paper remain true for the CEA and CEL rules, but not in general for the other rules.

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Resumen

La crisis financiera y económica en España durante los últimos años ha provocado reajustes en el presupuesto público. La crisis ha causado un gran impacto social debido a la forma en que se han implementado las medidas de austeridad, que afectan principalmente a sectores económicos clave como la administración pública, la justicia, la educación y la salud. Entre todos estos sectores, este artículo se centra en la distribución del presupuesto de salud, ya que los cambios en la provisión de los servicios de salud tienen impactos claros y rápidos en el bienestar social. España está dividida en 17 regiones, y cada región gestiona su propio sistema de salud. Específicamente, analizamos la asignación del presupuesto sanitario catalán, ya que Cataluña es una de las regiones más pobladas y donde las restricciones han sido más evidentes. En este contexto, estudiamos la distribución del presupuesto de salud para el período 1998-2014, desde el punto de vista del problema de conflicto de intereses (O'Neill, 1982). En consecuencia, se proponen asignaciones alternativas del presupuesto de salud mediante el uso de algunas de las soluciones más utilizadas en esta literatura. Finalmente, para elegir la solución más adecuada, requerimos el cumplimiento de (i) algunos criterios de equidad y estabilidad, y (ii) algunas propiedades sociales más comúnmente aceptadas.

Palabras clave: problemas de distribución, salud, análisis axiomático, presupuesto público.

Clasificación JEL: C71, D63, D71