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Abstract

The last two decades have witnessed a decrease in public health expenditure relative to total health spending. One may ask whether this decreasing role of Government expenditure in the financing of health care is due to mature options on the desired health care system or is more the result of Governments complying with more binding budget constraints.

In this paper, we provide a first answer to this question, based on evidence for a set of OECD countries. The main point of the paper can be easily stated: the observed smaller role of public financing of health expenditures in total public expenditure is the result, to a significant extent, of exogenous political pressures for lower Government budget deficits.

Given an overall budget ceiling, there is no evidence supporting a general time change in health spending priority in the budget bargaining process. However, we do find that Government budget constraints lead to lower priority of health care in the Government's budget allocation process.

This conclusion seems to hold whether health public spending is determined by a bargaining process within the Government or by population needs. At least, the empirical evidence provided suggests that more research on the political process governing health care expenditures is desirable.

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1 Introduction

The last two decades or so have witnessed a decrease in public health expenditure, if not in real values, at least relative to total health spending. The smaller role of the public sector in health care financing is usually associated in people's minds with the desire of promoting more effective health care delivery and financing through the private sector. The ideas of managed care and of competition within provision of health care goods and services has been prevalent in policy discussions almost everywhere. The success of this trend of ideas is translated into reform proposals of health care systems in several countries.[1]

While one may endorse the view that competition enhances efficiency, even in the very specific context of health care, more attention should be devoted to the interpretation of this general trend for a lesser role of Government intervention in the health care sector. Although considerations of efficiency gains may have been important, one should not discard immediately other explanations. One of such explanation comes from the realm of political constraints in the action of Governments.

The past twenty-five years witnessed several important shocks in most economies (for example, the oil shocks of the seventies, both negative and positive). The slowdown in overall economic growth has led to significant pressures on Governments' budgets. At the same time, neoclassical theory has gained weight against more keynesian perspectives on the role of state. Within the European Union countries, the pressure over national budgets has recently increased with the approval of the Maastrich criteria for monetary integration and the single currency program. Even if we do not want to discuss the feasibility or appropriateness of these criteria, it is forceful to recognize the non-negligible impact on the allocation of budget funds to health care.

Against this background, one must necessarily ask whether the decreasing role of state expenditure in the financing of health care is due to mature options on the desired health care system or is more the result of Governments complying with more binding budget constraints. The pressures on public financing have been recognized several times (Jonsson, 1996, for a recent discussion) but to our knowledge no systematic treatment of this clearly important issue has been done.

In this paper, we provide a first answer to this question, based on evidence for the OECD countries. The main point of the paper can be simply stated: the observed smaller role of public financing of health care expenditures in total public spending is a result, to a significant

[1] See OECD (1994) for example.

extent, of exogenous political pressures for lower budget deficits. The aim is not to discuss the optimal size of public health expenditure but to provide a positive analysis.

Given an overall budget ceiling, taken as exogenous, there is no evidence supporting a general change over time in health spending priority in the budget bargaining process, holding other factors constant. However, we do find evidence that the pressure of budget constraints leads to a lower priority of health care in the Government's budget allocation process.

The paper is organized in the following way. Section 2 presents and estimates a bargaining model of determination of the health care budget. Section 3 presents an alternative model, which considers that public health budgets are determined solely on the basis of population needs. Section 4 tests each model against the other and reports estimates on a mixed model, incorporating features of both previous models. Finally, Section 5 concludes.

2 Health spending and Government priority – a bargaining approach

One of the main driving forces of the role of public financing in health care is the priority given to health matters in the Government budgeting procedures. The first, crudest, indicator is the ratio of health to total public spending. However, this seemingly reasonable indicator has no foundation other than intuitive appeal. To be more precise in the definition of relative importance of public health spending, we present below a theoretical bargaining model. The solution to the model yields an easily computable measure of Government priority given to health care. This indicator is then related to the usual measure mentioned above.

In the analysis of public health spending, we must recognize that a budget-setting procedure exists within Governments. We may see it as a bargaining process among Cabinet members, where each minister negotiates with all others his own budget, given an overall budget ceiling (budget-maximizing bureaucrats). It is also the case that some outside constraint on the total size of the budget exists. We take it as exogenously given. The bargaining process is assumed to take the form of a generalized Nash bargaining solution with two players of asymmetric strength:[2] the minister of health and the remaining ministers (treated as a single entity). If no agreement is reached, a fraction of the budget of previous year is implemented. This assumption defines in a precise way the threatpoint (disagreement point) of each player. Moreover, it roughly corresponds to what we observe in real life. If members of Government do not reach consensus in budget issues, the default solution is to use last

[2] On the Nash bargaining solution, see, for example, Osborne and Rubinstein (1994), chapter 15.

year's budget (instead of shutting down the Government). We could also set the objective of each part to get a share of total budget. Since the later is exogenously given, and the Nash bargaining solution is invariant to the scale of variables, both alternatives generate the same solution and the same empirical implications.

■ **The bargaining model** Define $B_h(t)$ as the budget allocated to the ministry of health in period t, and $B(t)$ is the total budget in period t. Under the Nash bargaining solution, the health budget is given by the solution to the following problem:[3]

$$\max_{B_h(t)} W = (B_h(t) - \theta B_h(t-1))^{\delta} (B(t) - B_h(t) - \gamma(B(t-1) - B_h(t-1)))^{(1-\delta)} \quad (1)$$

The parameter δ reflects the relative strength of the health minister vis-a-vis his Government colleagues. It constitutes an indicator of the priority given to health spending whithin the public sector. Parameters θ and γ reflect to which extent last years's budget contributes to set the disagreement point. If in case of disagreement, previous year budget is adopted, then $\gamma = \theta = 1$, for example. If no budget is allocated then $\gamma = \theta = 0$. We are now interested in the estimation of the parameters and on the analysis of the time evolution of δ.

The equilibrium solution to the bargaining problem is defined by:[4]

$$\frac{\partial W}{\partial B_h(t)} = 0 \quad (2)$$

For the case of $\gamma = \theta = 1$, from the equilibrium condition it is straightforward to establish:[5]

$$\delta(t) = \frac{B_h(t) - B_h(t-1)}{B(t) - B(t-1)} \quad (3)$$

This measure has a clear, intuitive, interpretation. If the budget of year t allocated to health is fixed in nominal terms, the health minister has essentially no bargaining power and $\delta = 0$. On the other hand, if the health minister is powerful and is able to get all of the budget increase, then $\delta = 1$. Notice the difference to the standard indicator of share of public spending devoted to health care. This simple measure is recovered only for $\theta = \gamma = 0$, which means that the Government would stop if no consensus is reached, as zero budget values would be implemented. It is therefore a special case in our model, and the use of this simple indicator should be preceded by its testing against more general alternatives.

[3] The problem can also be specified in terms of shares of total budget, $B(t)$. However, depending on the particular formulation adopted either the same solution results or an underidentification problem appears.

[4] It is straightforward to check that second-order conditions for a maximum hold.

[5] Decreases in the total budget mean $\theta < 1$ and $\gamma < 1$.

Solving the general form for the first-order condition yields

$$\frac{B_h(t)}{B(t)} = \delta - \gamma b \frac{B(t-1)}{B(t)} + (\gamma(1-\delta)+\gamma) \frac{B_h(t-1)}{B(t)} \quad (4)$$

This condition can be easily estimated from available data on public spending (health and total spending). Note that due to the nature of the bargaining process, all values are set in nominal terms.[6]

■ **The data** All the data are collected from the OECD database provided by CREDES. Given the nature of the data needed for the analysis, relying only on the CREDES-OECD database does not provide a balanced panel of data. However, supplementing the information from the database with other sources raises concerns of compatibility. Thus, we took the option to use only the CREDES-OECD HEALTH DATA (1996).

■ **Evidence on the bargaining model** The empirical model we look at considers that priority given to health care within the budget allocation game depends on the strength of external constraints on public spending. This strength is measured by two indicators, which are included in the Maastricht criteria for the single currency program in the European Union and constitute natural candidates to reflect Government budget pressures on politicians: budget deficit as a percentage of GDP (DEF) and the debt ratio, defined as public debt over GDP ($DEBT$). These two measures are not independent of each other, as debt values result from accumulation of deficits.

An error term was added to the first-order condition (4) and estimation by non-linear least squares was performed to recover directly structural parameters. Estimation was made on an unbalanced panel data of OECD countries, from 1981 to 1994, totalling 259 observations.[7] Although other approaches to estimation are possible, simple non-linear estimation was preferred. In particular, we might have resorted to fixed effects models (one-way or two-way fixed effects). However, such procedures throw effects into country-specific or time-specific terms the effects in an unexplained way. Since our point lies in how much are we able to explain with the bargaining model, keeping the true-to-life model is considered to be a superior approach for economic interpretation of results.

The time period (1981 onwards) was chosen on the basis of two criteria: (i) quality and

[6] Before proceeding to estimation, we should stress that the same type of condition could be derived from a generalized Nash bargaining solution, with N players (ministers), with a symmetry assumption on the factors $\gamma_i, i \neq h$, to generate the disagreement point of each player other than the health minister.

[7] Summary statistics on the data are presented in the appendix.

Table 1: Changes over time in bargaining power

	unrestricted	$\delta_1 = \delta_2 = 0$	$\delta_1 = \delta_2 = 0, \theta = \gamma$	$\delta_1 = \delta_2 = 0, \theta = \gamma = 1$
δ_0	0.133	0.118	0.114	0.130
	(6.81)	(21.78)	(23.40)	(34.74)
δ_1 (t)	-0.002			
	(-0.24)			
δ_2 (t^2)	-0.0001			
	(-0.21)			
θ	1.109	1.123	1.136	1.000
	(61.64)	(55.56)	(63.12)	
γ	1.103	1.115	1.136	1.000
	(55.40)	(50.04)		
Adjusted R^2	0.922102	0.921456	0.921672	0.920260
Log Likelihood	944.584	942.570	941.422	923.341

Note: White-robust t-statistics in parenthesis; N = 250.[8]

availability of data to generate a not too unbalanced panel (to avoid dominance by a small set of countries); and (ii) it was during the eighties that a clear downward trend of public financing of total health expenditure took place.

As changes over time in priority setting are a possible explanation for the decreasing role of the State in health care, we allow, in estimation, for a quadratic time evolution of the bargaining power of the health ministry. In particular, the following scheme is assumed:

$$\delta(t) = \delta_0 + \delta_1 t + \delta_2 t^2 \tag{5}$$

This time evolution is tested prior to the consideration of budget constraint variables. The procedure provides a first step to the evaluation of statistical and economic significance of the role of Government budget constraints. Table 1 presentes estimates for the basic model of time changes in bargaining power and variants.

Hypothesis testing by means of standard likelihood ratio tests was performed. [9] It reveals that the hypothesis of a constant bargaining power, δ, over time is not rejected, as well as the hypothesis of $\theta = \gamma$. However, $\theta = \gamma = 1$ is clearly rejected, implying that on average players are able to increase disagreement points over previous year nominal budget level.

■ **The role of budget pressures** Even if time effects on the budget priority measure δ are non-significant, other elements may induce some systematic pattern. In particular, pressure on Government budgets may change the relative importance of health care spending. On a priori grounds there is no reason to believe that the bargaining power of the health minister should

[8] Presented in the Appendix.

Table 2: Budget pressure and priority of health care spending

	unrestricted	$\delta_1 = \delta_3 = \delta_4 = 0$	$\delta_1 = \delta_3 = \delta_4 = 0, \theta = \gamma$
δ_0	0.083	0.089	0.144
	(2.33)	(3.66)	(6.46)
δ_1 (t)	-0.006		
	(-1.40)		
δ_2 (t^2)	0.0004		
	(1.27)		
δ_3 (DEF)	0.489		
	(0.38)		
δ_4($DEBT$)	-0.374	-0.402	-1.528
	(-1.93)	(-2.01)	(-2.13)
γ	0.834	0.877	1.057
	(5.98)	(9.02)	(55.96)
θ	0.989	0.962	1.057
	(19.70)	(17.71)	
Adjusted R^2	0.892667	0.892030	0.891781
Log likelihood	173.550	171.711	169.339

Note: White-robust t-statistics in parenthesis; N = 41.

increase relative to other areas of Government spending in "bad times." This is essentially an empirical issue. To shed some light on it, the following relationship is assumed:

$$\delta_{it} = \delta_0 + \delta_1 t + \delta_2 t^2 + \delta_3 DEF_{it} + \delta_4 DEBT_{it} \tag{6}$$

Plugging this expression into the condition (4), which determines the bargaining solution and proceeding to estimation by non-linear least squares leads to the results in Table 2. It is important to notice the reduction in sample size, as the new data requirements are not met for the sample of previous estimation. Due to this, the results are not directly comparable, although the inference of no time effects holds also in the restricted sample.[10]

From the two variables used as proxies for the pressure of budget constraints, only one, the ratio of public debt to GDP, is significant.[11] It is also the case that the null hypothesis of equal coefficients in the disagreement payoffs is not rejected.

Focusing now on the selected model (third column), the main inference to be drawn is the negative coefficient of the debt ratio (which holds consistently through the several model variants). It implies that a stronger pressure on budget spending is likely to reduce the relative importance of health spending in the bargaining process ruling budget allocation. The values suggest that disagreement points entail about a 5.7% nominal increase on previous

[10] See the appendix for the estimation of time effects with the restricted sample and their descriptive statistics.
[11] The relevant likelihood ratio tests are presented in the Appendix.

year budget, a reasonable order of magnitude.

The increased budgetary pressures on Governments have resulted in a downgrading of health expenditure in the Governments' priorities. In an environment of increasing needs and availability of more expensive techniques and technology coupled with a more intense pressure on control of public spending leads to an increase of the relative role of the private health sector.

Such change in relative roles is due not only to changes in the desired private-public mix for the health system but also to the influence of the political process underlying the health budget. Of course, it is a little bit of jumping to conclusions, as the evidence respects only to a lower priority level of health expenditure when budget pressures (measured by the debt ratio) are higher. The other link in the argument is still to receive evidence in favor of it.[12] Finding such evidence is not a trivial task as the research methodology must isolate forces that drive overall health expenditure and the factors behind public expenditure. Reduced form models are unlikely to produce an unambiguous answer. The specification of a more structured approach is needed. This is left for future research. Nonetheless, the finding of a lower Government priority of health spending in periods of more severe budget constraints is robust.

3 An alternative model – a 'needs' approach

So far, we have tested the bargaining model of public health spending determination against unspecified alternatives. We now present an alternative model of determination of the health share in Government's budget. A competing hypothesis is that health spending is determined solely on the basis of population needs and financial constraints of the government.[13] This means that the budget share devoted to health depends, in a reduced form model, on characteristics of the health care system, on the one hand, and on the tightness of the budget constraint, on the other hand. Formally,

$$\frac{B_h(t)}{B(t)} = X(t), I - 1, \ldots, \frac{B_h(t-1)}{B(t-1)} \qquad (7)$$

where $X(t)$ is the vector of characteristics of the health system, which includes variables describing the tightness of the budget constraint. The parameters to be estimated are the

[12] Computation of simple correlations shows a negative correlation of -0.26 between the share of public on total health spending and the share of health on total public spending.

[13] Still, another alternative would be a voting procedure to determine the social preferences for public spending in health care. See Gouveia (1996) for the specification and estimation of a model in this vein.

vector β, and the scalar φ. The last period's ratio of public health expenditures can result from an adjustment costs model.

The economic fundamentals of this model are population needs and the existence of adjustment costs in public spending. In particular, assume that Government's health expenditure is determined by the joint minimization of two loss functions: the first loss function measures how far from the desired level is the expenditure actually incurred; the second loss function measures the cost of increasing the budget devoted to health care.

The desired level of public health spending is a function of health care system characteristics. Several explanatory variables are included, as well as control (dummy) variables for the type of health care system. The driving forces considered are demographic structure of population, per capita income and budget pressures. The structure of population effect leads to the introduction of two variables: dependency ratio and percentage of population over 65 years. There are several reasons why different population structures may originate distinct shares of public over total health care financing. The well-known failures of private insurance markets to deal with the elderly suggest that a higher proportion of old-age individuals in the population leads to a higher share of public financing. To capture this effect, the proportion of population over 65 is included.

It is also the case that important public health care programs are typically directed to children and old-aged people. Thus, the dependency ratio reflects the relative importance of these main recipients of state financing of health care goods and services on the population structure.

The type of health care system a country has cannot be changed from one year to the other. Any process of reform will necessarily span over several years (or even a decade or more). Thus, comparisons of the sort we are doing here must take into account the nature of the health care system. To incorporate this element in the analysis, we resort to the introduction of dummy variables reflecting the type of health care system. The OECD (1992) classification is employed and three categories of systems are identified: public contract, public reimbursement, integrated. The integrated system is arbitrarily taken to be the base case.

Another (potentially) significant channel comes from income levels. Of course, as important as income level is income distribution. For countries of the same per capita income level, one may expect a more important role of state financing in the countries where income distribution is more asymmetric. Unfortunately, the lack of information on the latter issue precludes its inclusion in the analysis. The only variable available is income level per capita.

The variables included as determinants of the desired level of public expenditure are the

GDP per capita, *GDP*, a dummy variable for the existence of a gatekeeping system, *GK*, the type of health care system according to the OECD (1992) classification, *PR* for public reimbursement (integrated is the baseline case, and there is no case of public contract in the reduced sample), population over 65, *POP65*, and the dependency ratio, *DEP*.

The variables describing the tightness of the budget constraint are the debt ratio, *DEBT*, and the Government deficit over GDP, *DEF*.

The variable income per capita is valued at constant 1990 prices (in national currency units) and converted to the same basis by PPPs at the base year.

The dummy variables that reflect the system's type are constructed as: *PR* for public reimbursement, covering Australia, Belgium, France, Japan, Switzerland and the US; *PI* for integrated, includes Denmark, Finland, Greece (from 1983), Iceland, Ireland, Italy , New Zealand, Norway, Portugal , Spain (from 1984), Sweden and the UK. The remaining case is the baseline system, public contract, which covers Austria, Canada, Germany, Greece (up to 1982), The Netherlands, Spain (up to 1983) and Turkey.

The dummy variable *GK* controls for the existence of gatekeeping, *GK*. It assumes value 1 if the system has gatekeepers, zero otherwise. The countries for which gatekeeping is considered are Austria, Canada, Denmark, Germany, Iceland, Ireland, Italy, The Netherlands, New Zealand, Norway, Portugal, Spain and the UK.

The estimates are presented in Table 3. The number of observations was restricted to 37 due to data availability. The short sample size precludes the use of specific effects techniques (one- or two-way fixed effects or random effects), and forces the exclusion of the PI dummy variable.

The estimation and selection procedures of the model reveal some persistence in public health care expenditure,[14] reflecting the existence of adjustment costs (given the statistical significance of the coefficient associated with $B_h(t-1)/B(t-1)$). Also relevant is the negative sign of the variable public deficit over GDP. It means that pressures on Government budget result in a lower share of public expenditure allocated to the health sector. Thus, the effect identified in the bargaining model also shows up in this model, even if through a different proxy variable: budget constraints lead to a smaller importance of health expenditure in total Government spending.

As to the remaining significant variables, the coefficient signs are reasonable. First, the existence of general practitioners as gatekeepers to the health system is associated with a

[14] The likelihood ratio test has 4 degrees of freedom, a computed value of 7.994, below the critical value of 9.49.

Table 3: Estimates for the needs model

	unrestricted model	reduced model
constant	-0.016	0.714
	(-1.20)	(0.089)
$\frac{B_i(t-1)}{B(t-1)}$	0.709	0.793
	(5.06)	(13.45)
DEF	-0.868	-0.649
	(-2.94)	(-1.97)
DEBT	-0.021	
	(-0.17)	
GDP	2.331	
	(1.15)	
GK	-6.165	-4.217
	(-2.36)	(-2.07)
PR	-8.881	
	(-0.60)	
POP65	-2.297	
	(-0.93)	
DEP	0.998	0.380
	(2.20)	(2.69)
Log likelihood	157.822	153.925
Adjusted R^2	0.899475	0.891414

Note: White-robust t-statistics in parenthesis, N=37.

lower share of Government spending devoted to public health care expenditure. Second, the positive coefficient associated with the dependency ratio means that a higher the proportion of the population in the endpoints of population age distribution implies a higher share of public funds devoted to health care. This accords with intuition, as state support of elderly and children is usually more generous and expensive (especially for the former group of the population).

The essential point of the estimates is the detection, as in the bargaining model, of a negative effect on health care priority of the Government level associated with budget pressures. In addition, the structural for of this model seems to have reasonable fit as well. We have, thus, two distinct explanations for the same phenomenon. We now proceed to a comparison between them.

4 Test of non-nested models

In the previous sections, two distint models explaining the determination of the share of public funds allocated to health care were estimated. Both models reveal a fairly good explanatory power. However, despite the robustness of findings to the exact structural model and even if the main insight of the analysis appears in a clear way in both models, we may be interested in identifying which of the proposed models obtains more support from the data.

Since the models are non-nested, an appropriate test must be performed. An additional problem is the difference in sample sizes used to estimate one and the other model. To cope with this problem, the shorter sample size (corresponding to the needs model) was adopted.

To compare each model against the other, we resort to the artificial regression technique. We now briefly describe the procedure.[15] The two models can be summarized as

$$y = x(\beta) + u_1 \qquad\qquad y = z(\nu) + u_2$$

and are clearly non-nested. The first step is to construct two artificial regressions:

$$y = x(\beta)(1-\lambda) + \lambda\hat{z} + u_1 \tag{8}$$

$$y = (1-\lambda)z(\nu) + \lambda\hat{x} + u_2 \tag{9}$$

where $\hat{z} = z(\hat{\nu})$, $\hat{x} = x(\hat{\beta})$ and $\hat{\nu}, \hat{\beta}$ denote the estimates of ν and β respectively, under the assumption that the associated model is the true one. Then, the null hypothesis $\lambda = 0$ is tested in each case. This testing procedure does not tell which model is the best in the set of available possibilities. It corresponds more to a specification test.

[15] A more detailed treatment can be found in Davidson and MacKinnon (1993, section 11.3).

Table 4: Artificial regressions

Bargaining model			Needs model		
δ_0 (const)	0.147	0.241	a_0 (const)	0.001	0.044
	(5.48)	(1.63)		0.08	(1.44)
δ_2 $(DEBT)$	-1.666	-6.017	a_1 $(B_i(t-1)/B(t-1))$	0.793	1.367
	(-1.93)	(-1.07)		(13.45)	(3.86)
	1.068	1.077	a_2 (DEF)	-0.648	1.201
	(62.16)	(78.74)		(-1.97)	(0.88)
			$a_3(GK)$	-4.218	10.610
				(-2.07)	(1.04)
			$a_4(DEP)$	0.380	-1.392
				(2.69)	(-1.27)
λ		0.715	λ		1.380
		(2.671)			(4.98)
Log Likelihood	156.224	158.941	Log Likelihood	153.925	162.497
Adjusted R^2	0.914931	0.921520	Adjusted R^2	0.891414	0.931173

Note: White-robust t-statistics in parenthesis; number of observations = 37.

Estimation of the above artificial regressions yields the results presented in Table 4.

In both cases, the coefficient associated with the artificial variable is positive, significantly different from zero and we cannot reject it is equal to unity.[16] On the basis of results, we must recognize that both models apparently fit the data equally well. In a literal interpretation, the results mean that the hypothesis that each model is the true one is rejected against the alternative. Thus, we cannot decide, on the basis of this test, by the superiority of one of the models, as each shows signs of misspecification. Hence, a possible interpretation of the analysis is that both theories contribute to the explanation of the evolution of the share of health spending in total public expenditure.

In fact, one may think that public health expenditure has a disagreement point determined by population needs, and bargaining takes place on the fringe of Government commitments to health provision and financing. On the other hand, we maintain the disagreement point of remaining Government members indexed to previous year budget.

Under this formulation, public health spending is determined by:

$$\max_{B_h(t)} W = (B_h(t) - X_{it}\beta)^{\delta_{it}} (B(t) - B_h(t) - \gamma(B(t-1) - B_h(t-1)))^{1-\delta_{it}} \qquad (10)$$

The corresponding equilibrium solution can be written as:[17]

$$\frac{B_h(t)}{B(t)} = \delta_{it} - \gamma\delta_{it}\frac{B(t-1)}{B(t)} + \gamma\delta_{it}\frac{B_h(t-1)}{B(t)} + (1-\delta_{it})\beta\frac{X_{it}}{B(t)} \qquad (11)$$

[16] Standard t-tests on λ are straightforward to compute.

[17] By derivations similar to previous ones.

where

$$\delta_{it} = \delta_0 + \delta_1 t + \delta_2 t^2 + \delta_3 DEF_{it} + \delta_4 DEBT_{it} \tag{12}$$

The adjusted bargaining-needs model includes in its solution for the share of total public expenditure devoted to health care elements of both individual models. It is, however, different from a simple convex combination of stand-alone bargaining and needs models. It does not include them as special cases.

We proceed now to the estimation of the combined model. Note that results are to be interpreted with extreme caution as our demands on very short panel of data have grown relative to previous models.

The variables included in the vector X are the same ones used in the 'needs' model: population over 65, the dependency ratio, a dummy variable reflecting the existence of gatekeepers in the system and a dummy for the system type (public reimbursement).

The budget constraint pressure can be added in two ways: in the bargaining power of the health minister or in the disagreement point for the public health budget. As we do not want to make the decision over the influence channel a priori, we allow for both types of effects.

The basic starting point of the combined model is that previous health budget does not contain all the information on population health care 'needs' that presumably determines the minimum public health care budget politically acceptable. Otherwise, we would fall back into the initial bargaining model. Estimates for the model are presented in Table 5.

The first observation to make is to recognize the high demands of the model on the short data set available. Thus, the results must be interpreted cautiously. The main point to stress is the overalll consistency with previous models. In particular, we find a negative effect associated with Government budget constraints on the priority given to health care, which corroborates the inference drawn from previous models.

Besides this result, in the unrestricted model some estimates reveal serious contradictions with theoretically expected signs. In particular, the negativity of coefficient estimates for $B_h(t-1)$ and γ are difficult to interpret. Even in the restricted model, the negative coefficient associated with elderly people lacks a sound economic explanation. The remaining 'needs' variables have signs in accordance with earlier findings. It is also noticeable the detection of a time trends, with an inverted U-shape, while previously no such effect was present.

Overall, serious reservations remain on the analysis of the mixed model. Nonetheless, the most important point is the non-contradiction of the role of budget pressures on the priority given to health care.

Table 5: Estimates for the mixed model

	Unrestricted model	Selected model
δ_0	0.121	0.116
	(11.81)	(7.25)
$\delta_1(DEF)$	-4.120	-3.593
	(-8.75)	(-15.83)
$\delta_2(DEBT)$	-0.110	
	(-1.38)	
$\delta_3(t)$	8.552	4.160
	(3.77)	(2.27)
$\delta_4(t^2)$	-0.501	-0.290
	(-4.37)	(-3.18)
?	-1.798	
	(-1.46)	
a_0	-0.138	-0.146
	(-15.65)	(-16.13)
$a_1(B_h(t-1))$	-0.026	
	(-1.38)	
$a_2(DEF)$	22.020	
	(1.24)	
$a_3(DEBT)$	-13.228	-19.410
	(-2.52)	(-5.38)
$a_4(PIB)$	0.290	0.387
	(5.78)	(9.07)
$a_5(GK)$	-1.271	-1.223
	(-13.03)	(-10.94)
$a_6(PR)$	-2.169	-2.291
	(-6.81)	(-7.78)
$a_7(POP65)$	-0.291	-0.303
	(-4.85)	(-5.66)
$a_8(DEP)$	0.208	0.205
	(15.55)	(14.22)
Log likelihood	173.964	169.039
Adjusted R^2	0.946535	0.940961

Note: White-robust t-statistics in parenthesis; N = 37.

5 Final Remarks

Taking together all the evidence presented, we may say that a robust pattern is the negative and significant effect of "budget tightness" variables on the relative role of health care in Governmental budget allocations across OECD countries.

The empirical analysis unveils an important relationship between health care priority (within the budget allocation game) and Government financing issues: the results show that increased budget pressures lead to a lower priority of health spending. Since such pressures have been increasing in the recent past, they may be a potentially important explanation for the decreasing role of state spending in the health care sector.

Some caveats must be mentioned. First, the variables used as proxies for budget tightness may not be the most appropriate ones. This criticism is based on the fact that higher public health spending implies a higher deficit and future debt. In this last case, inertia in the budget setting process can make both variables highly correlated. We concede some value to this objection. However, since the budget share given to the health sector varies typically between 10 and 20%, it is difficult to argue that this is the single determinant for the statistical relationship found in the data. Second, the complete data set for the analysis is but a small subset of the OECD database. It remains an open question whether the same results are obtained with a more comprehensive database.[18] Third, we have so far set aside a (potentially) significant element: ideology. The lack of data prevented an analysis of the importance of this factor, which is left for future research. Nonetheless, we believe to have provided robust evidence on the importance of political pressures on Government's budget spending as a determinant of the share of public funds devoted to health care.

The results suggest that more research should be directed to the explanation of budget pressures on the political process underlying public health care expenditure and its implications for the recent evolution of the relative role of public health care expenditure. This is especially important for the European Union countries, where the so-called Maastricht criteria for convergence and the Economic and Monetary Union programme are putting more pressure on national Governments budgets.

[18] It should be added that dropping one variable allows to reestimate the models with more observations. This exercise, with the current database, does not change the qualitative results.

Appendix

■ Summary Statistics

Table 6: Composition of sample (average values)

Year	Freq.	Share of Public Spending	Debt Ratio (on GDP)	Budget Deficit (% GDP)
1980	3	0.114	34.60	4.67
1981	2	0.114	30.90	4.60
1982	2	0.117	29.65	3.45
1983	2	0.119	28.75	2.60
1984	2	0.113	28.85	5.10
1985	2	0.111	29.85	6.55
1986	3	0.105	42.73	4.13
1987	6	0.120	47.30	2.17
1988	7	0.118	44.96	1.96
1989	5	0.123	40.74	3.28
1990	3	0.118	43.80	4.17

Country	Freq.	Share of Public Spending	Debt Ratio (on GDP)	Budget Deficit (% GDP)
1	3	0.143	27.60	0.96
4	3	0.086	57.40	2.13
5	11	0.115	17.56	3.39
12	4	0.123	72.03	1.85
15	10	0.118	43.9	5.03
18	1	0.115	37.5	4.90
20	4	0.119	51.65	4.32
23	1	0.114	42.20	0.1

■ Estimates and Tests

Table 7: Tests on time effects - large sample)

Test	χ^2 value	d.f.	Critical value	Accept/Reject
$\delta_1 = \delta_2 = 0$ vs unrestricted	4.028	2	5.99	A
$\delta_1 = \delta_2 = 0, \theta = \gamma$ vs unrestricted	6.324	3	7.81	A
$\delta_1 = \delta_2 = 0, \theta = \gamma = 1$ vs unrestricted	42.486	4	9.49	R
$\theta = \gamma$ given $\delta_1 = \delta_2 = 0$	2.296	1	3.84	A

Table 8: Budget pressure and priority of health care spending - full estimates
Equation (4) with $\delta = \delta_0 + \delta_1 t + \delta_2 t^* \delta_3 DEF + \delta_4 DEBT$.

	unrestricted	$\delta_1 = \delta_4 = \delta_2 = 0$	$\delta_1 = \delta_3 = \delta_2 = 0, \theta = \gamma$	$\delta_1 = \delta_2 = 0$	$\delta_1 = \delta_2 = 0$ $\theta = \gamma$	$\theta = \gamma$	$\delta_1 = \delta_4 = \delta_2 = 0$ $\gamma = \theta = 1$
δ_0	0.083	0.089	0.144	0.087	0.148	0.232	0.128
	(2.33)	(3.66)	(6.46)	(2.80)	(5.96)	(5.14)	(11.95)
δ_1	-0.006					-0.033	
	(1.40)					(-2.40)	
δ_2	0.0004					0.003	
	(1.27)					(2.20)	
δ_3	0.489			0.335	-1.454	-2.956	
	(0.38)			(0.19)	(-0.29)	(-0.85)	
δ_4	-0.374	-0.402	-1.528	-0.403	-1.467	-2.227	-0.621
	(-1.93)	(-2.01)	(-2.13)	(-2.03)	(-1.95)	(-2.56)	(-2.25)
γ	0.834	0.877	1.057	0.875	1.056	1.076	1.000
	(5.98)	(9.02)	(55.96)	(8.77)	(49.67)	(116.88)	
θ	0.989	0.962	1.057	0.964	1.056	1.076	1.000
	(19.70)	(17.71)		(17.61)			
R^2	0.892667	0.892030	0.891781	0.889157	0.889388	0.896385	0.885458
LLV	173.550	171.711	169.339	171.334	169.362	171.909	168.653

Note 1: t-statistics in parenthesis. Based on White heteroskedastic-robust standard errors.
Note 2: Number of observations = 41; LLV =Log Likelihood Value.

Table 9: Tests on effects (small sample)

Test	χ^2 value	d.f.	Critical value	Accept/Reject
$\theta = \gamma$ vs unrestricted	3.28	1	3.84	A
$\delta_1 = \delta_2 = 0$ vs unrestricted	3.63	2	5.99	A
$\delta_4 = 0$ given $\delta_1 = \delta_2 = 0$	0.46	1	3.84	A
$\delta_1 = \delta_2 = \delta_4 = 0$ vs unrestricted	3.68	3	7.81	A
$\theta = \gamma$ given $\delta_1 = \delta_2 = \delta_4 = 0$	4.74	1	3.84	R
$\theta = \gamma, \delta_1 = \delta_2 = \delta_4 = 0$	8.42	4	9.49	A
$\theta = \gamma = 1$ given $\delta_1 = \delta_2 = \delta_3 = 0$	6.12	2	5.99	R

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