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THE DETERMINANTS OF HEALTH CARE EXPENDITURE IN SPAIN: A REEXAMINATION

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ABSTRACT

In this paper the main determinants of health care expenditure per capita in Spanish autonomous communities are analyzed. The coexistence of several models concerning the degree of spending power decentralization and financing systems converts Spain in a singular case, allowing to extract interesting conclusions for other countries in ways of decentralizing their health care system. Besides, our results allow to evaluate the incidence of some factors of over-cost underlined by the autonomous communities with a view to future changes in the autonomous communities financing model.

KEY WORDS: Fiscal Federalism; Regional Health expenditures; National Health System, regional inequalities; Spain

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I. INTRODUCTION

In this paper the determinants of public health care expenditure in Spain are analyzed. In this sense, this study joins together recent empiric literature (Freeman, 2003; Di Matteo, 2003 and 2005; Crivelli et al, 2005).

The Spanish case is specially interesting because along 90´s three different models cohabited inside the country. A first model, applied to 10 regions or Autonomous Communities (ACs from now), consistent in maintaining centralized administration and health care financing. A second model, applied to 5 ACs, consistent in decentralizing the administration and responsibility on expenditure. With expenditure financed by means of conditioned grants, low tax autonomy make difficult the allocation of additional resources to health public care. Finally, two ACs have enjoyed, at the same time, autonomy on the expenditure side and a high level of tax autonomy.

According to surveyed literature, in this paper we propose a model that is based on two main factors: per capita income and demographic structure. Additionally, a set of control variables and a proxy for technological change are also included. Our results show that the income elasticity of health public expenditures significantly changes depending on the inclusion of other variables, econometric specifications, econometric technics, and institutional arrangements. Moreover, ageing is a very relevant factor when explaining expenditure dynamics. However, multicollinearity is a serious concern when aiming at estimate the relationship between age and cost using macro data.

The structure of the paper is as follows. In the second section we present the different models that have cohabited over time. In the third section the main available empirical studies are revised. In the fourth section it is carried out a previous analysis of data and econometric specification are presented. In the fifth section the main econometric results are shown. The sixth section concludes.

II. THE SPANISH NATIONAL HEALTH SERVICE: A BRIEF DESCRIPTION

The Spanish National Health Service (NHS) is characterized by two main features: universal access to health care to all Spanish citizens and a fast and asymmetric decentralization of health care to the Spanish regions since the early eighties (Cantarero, 2005).

Population has the right of free access to services (even illegal immigrants are entitled to) and benefits are quite comprehensive, although minimal for long-term care and dental services, with some regional diversity in these concepts. Health care expenditure accounts for 7.7 per cent of GDP in 2003, and approximately three quarters (5.5) correspond to public expenditure and a quarter (2.2) to private expenditure (see Tables 1 and 2).

The devolution process of health public care, started in 1981, have distinguished among three types of ACs up 2002 (Cantarero, 2005; Costa-Font and Pons-Novell, 2005):

a) Ten new-branch type of regions (approximately half of the population) with no health care responsibilities up 2002. Before this date, the central government had all the responsibility on health care in those regions.
b) Five regions (Catalonia, Galicia, the Canary Islands, Community of Valencia, and Andalusia) with health care expenditure responsibilities[1] under limited fiscal self-responsibility, being politically more than fiscally accountable. Therefore, most of resources devoted to health care in those regions came from conditioned grants, with self-financing strongly constrained to play a minor role.
c) A third group of two ACs (Navarre and the Basque Country) both fiscally and politically accountable, in running almost all public service provision in their boundaries. While they also were granted to finance health care, they enjoy a high level of tax autonomy.

In an initial period, the assignment of resources was linked to the historical cost of health care services provided in each region, although from 1984 an about ten year-old transitory period was profiled during which the percentages should adapt to protected population's approach. Until 2002, the basic mechanism of the general system consisted in that the budget of the National Health Institute (INSALUD) was split into two big blocks. A first block transferred to regions with decentralized responsibilities on public health care, and a second one devoted to finance centralized health care in the rest of the country. The first block was distributed among the regions combining the approaches of effective cost of transferred service (subject to bilateral bargaining between the central government and each AC) and protected population.

Since 2002 the process of health care and financing autonomy decentralization in Spain has extended to all ACs. Moreover, the new effective system breaks up with the previous model of conditioned financing of the health care, integrating it in the general financing system of ACs. Health care financing is now covered by regions basically through three types of resources, as any other service offered by regional governments: own taxes, shared (totally or partially) taxes and block grants from the central government. User co-payments play a minor role.

[1] Catalonia since 1981, Andalusia since 1983, Community of Valencia since 1987, Galicia since 1991, and the Canary Islands since 1994.

In any case, those changes in responsibilities and financing have been implemented in a progressive way. In particular, it has been imposed to all regions the obligation to increase resources devoted to health care and social services at the same annual growth rate than that corresponding to the central government fiscal revenues. Moreover, a guarantee of financial dynamics is implemented. According to it, during the first three years of the new system (2002-2004) the Central Government guarantees that regional revenues increase at least as the nominal national GDP. In fact, this guarantee has been extended to 2005 and 2006.

At any rate and purpose, health care is the foremost policy responsibility of the ACs. The central government forces however some symmetry amongst different AC, that makes for some regions (different historically, culturally and in self-governance aims) a 'low quality' decentralization. Jointly with education, these social expenditure items account for 60 to 70% of total public funds in hands of ACs (Rico and Sabes, 2000). Finally, as Table 3 shows, global inequality in terms of per capita expenditure has not significantly increased with decentralization, at least until 2003 (Lago, 2006a).

Table 1. Comparative per capita health care expenditure among OECD countries in $ PPP 2003

Country	Total	Public	Private
Australia	2699	1822	877
Austria	2302	1556	746
Belgium	2827	2013	814
Canada	3001	2098	903
Czech Republic	1298	1169	129
Denmark	2763	2293	470
Finland	2118	1620	498
France	2903	2215	688
Germany	2996	2343	653
Greece	2011	1032	979
Hungary	1269	919	350
Iceland	3115	2601	514
Ireland	2451	1912	539
Italy	2258	1696	562
Japan	2139	1743	396
Korea	1074	531	543
Luxembourg	3705	3331	374
Mexico	583	271	312
Netherlands	2976	1857	1119
New Zealand	1886	1484	402
Norway	3807	3186	621
Poland	744	520	224
Portugal	1797	1253	544
Slovak Republic	777	686	91
Spain	1835	1307	528
Sweden	2703	2303	400
Switzerland	3781	2212	1569
Turkey	513	364	149
United Kingdom	2231	1861	370
United States	5635	2502	3133

Source: OECD Health Data File 2006

Table 2. Health Expenditure in Spain 1990–2003

Expenditure	1990	1995	2000	2001	2002	2003
Total Expenditure						
% Total	100,0	100,0	100,0	100,0	100,0	100,0
% GDP	6,7	7,6	7,4	7,5	7,6	7,7
Public Expenditure						
% Total	78,7	72,2	71,6	71,2	71,3	71,2
% GDP	5,3	5,5	5,3	5,3	5,4	5,5
Private Expenditure						
% Total	21,3	27,8	28,4	28,8	28,7	28,8
% GDP	1,4	2,1	2,1	2,2	2,2	2,2

Source: OECD Health Data File 2006.

Table 3. Evolution of regional public per capita health care expenditure in Spain (1992-2003) (euros)

AC	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Andalusia	449	503	527	543	567	583	618	680	766	791	837	903
Aragon	529	521	559	569	622	628	684	776	824	899	955	1069
Asturias	521	535	564	576	613	612	664	757	810	872	946	1061
Balearic Islands	427	420	460	470	506	526	552	614	637	677	800	908
Canary Islands	479	498	520	550	579	587	613	770	820	840	910	1000
Cantabria	508	528	562	576	584	631	672	773	833	921	1014	1073
Castilla y León	467	464	500	513	548	565	611	726	787	840	898	1029
Castilla La Mancha	433	447	487	501	557	560	588	675	721	774	879	936
Catalonia	455	487	525	547	576	591	642	722	777	817	869	958
Com. of Valencia	462	497	536	540	573	585	616	689	750	790	846	934
Extremadura	470	487	504	526	581	588	630	725	786	826	969	1026
Galicia	402	437	479	511	566	585	623	754	797	864	902	980
Madrid	528	522	590	570	598	598	633	725	752	788	815	870
Murcia	441	450	466	504	576	589	606	709	768	806	861	951
Navarre	420	424	437	483	542	570	615	878	933	961	1014	1089
Basque Country	459	467	513	539	576	589	613	791	836	894	957	1028
La Rioja	444	451	501	515	514	549	585	720	791	834	910	994
Total	465	488	526	540	574	587	624	721	776	818	874	954
Std. Dev.	38.87	37.25	42.28	32.91	27.42	25.33	31.85	41.82	39.11	45.64	50.43	59.43
Var. Coef. (%)	8.36	7.63	8.04	6.09	4.78	4.32	5.10	5.80	5.04	5.58	5.77	6.23

Source: Authors´ calculation based on Ministry of Health (Spain).

III. THE DETERMINANTS OF REGIONAL HEALTH CARE EXPENDITURE: A SURVEY

Health care expenditure growth and its determinants[2] is one striking issue for western economies (Hitiris and Posnett, 1992; Hitiris, 1997). After the seminal papers by Kleiman (1974) and Newhouse (1977), the examination of the determinants of health care expenditure has been a matter of extensive debate over the last two decades. The progressive large availability of international data on health care has led to the development of studies disentangling the underlying factors that determine health care expenditure, such as income, aging, time effects, availability of factors and even the technology progress (Newhouse, 1992). However, most studies are based on cross-country data to unravel the extent to which income and other determinants, such as demographics (demand side variables) and heterogeneity of health care inputs (supply side variables), explain differences in health expenditure (Vatter and Ruefli, 2003).

Most cross-country studies find that per capita income is the most important determinant of per capita health expenditure. Further, the coefficient estimate of per capita income is most often equal to or greater than one, leading to the conclusion that health care is a luxury rather than a necessity. Interestingly, there is no agreement in the literature about if health care expenditure is a luxury or a normal good[3] (Blomqvist and Carter, 1997; Bac and Le Pen, 2002; Di Matteo, 2003; Atella and Marini, 2004a and 2004b; Carrion-I-Silvestre, 2005; Sen, 2005). Also, an important element is the consideration of the regional dimension within the national health care expenditures because an aggregation fallacy in estimating the income elasticity of health care expenditure may therefore result from it.

In the light of the long-lasting studies on whether health care is a luxury good and about the determinants of this kind of expenditure, Di Matteo and Di Matteo (1998) found that key determinants of health care expenditure were real provincial per capita income, the proportion of the provincial population over age 65 and real provincial per capita federal transfer revenues. Also, an income elasticity of 0.77 implied that health care is not a luxury good.

Ariste and Carr (2001) use error correction and cointegration techniqued on Canadian provincial health care expenditure data (1966-1998). They find an income elasticity of 0.88 and conclude the same as Di Matteo and Di Matteo (1998).

Lopez i Casasnovas and Saez (2001) apply a multilevel hierarchical model using data for 110 regions in eight countries in 1997 (included Spain). Two sources of random variation (within countries and between countries) are identified.Variability between countries amounts to (SD) 0.5433, and just 13% of that can be attributed to income elasticity and the remaining 87% to autonomous health expenditure. Within countries, variability amounts to (SD) 1.0249; and the intra-class correlation is 0.5300. They conclude that it is necessary to take into account the degree of fiscal decentralisation

[2] A survey of determinants of health care appears in Gerdtham and Jonsson (2000) and Atella and Marini (2004a).

[3] Looking at the literature, it is easy to understand that disagreement on the income elasticity values arise from two main sources: 1) sensitivity of results to inclusion/exclusion of specific regressors (e.g., linear time trend), and 2) functional specification used to estimate the parameters, that in turn leads to econometric methodology.

within countries in estimating income elasticity of health expenditure. Two reasons lie behind this: where there is decentralisation to the regions, policies aimed at emulating diversity tend to increase national health care expenditure; and without fiscal decentralisation, central monitoring of finance tends to reduce regional diversity and therefore decrease national health expenditure. The results do seem to validate both these points.

Similarly, Giannoni and Hittris (2002) attempt to examine the determinants of regional health expenditure in Italy and find significant regional specific effects.

The principal findings of Freeman (2003) are that health care expenditures and incomes at the US states for the years 1966-1998 are non-stationary and cointegrated. Dynamic OLS cointegrating regressions of the pooled state time series estimate the income xelasticity of health care at 0.817 to 0.844..

In Di Matteo (2003) parametric and nonparametric estimation techniques are compared in estimating the relationship between income and health expenditures with implications for the reliability of past estimates of health expenditure income elasticity. The results for three time series cross-section data sets (the US state and Canadian province level data and national level data for 16 OECD countries) confirm that income elasticity does vary by level of analysis, with international income elasticities being generally larger than national or regional studies.

The aim of Cantarero (2005) was to analyze the determinants of regional health care expenditure in Spain because there exist important differences among regions. Results show that the most important determinant in the explanation of the volume of regional health care expenditure is the ageing population while other factors like the regional income and the relative structural characteristics of the supply variables have less importance.

Also, in Costa-Font and Pons-Novell (2005) is shown that Spanish regions exhibit significant heterogeneity as a result of the increasing decentralization, region-specific political factors along with different use of health care inputs, economic dimension and spatial interactions. A potential limitation of these studies lies in the fact that no evidence of Spanish private health expenditure is available at the regional level.

In Di Matteo (2005) the determinants of real per capita health expenditures in the United States and Canada are examined. Ageing population distributions and income explain a relatively small portion of health care expenditures when the impact of time effects, which is a partial proxy for technological change, is controlled for.

Finally, in Crivelli *et al.* (2005) the income does not have any influence on the level of health care expenditures. This result might be considered surprising, but in reality it shows that one of the main objectives of the Swiss health care system has been reached (horizontal equity).

Table 4 summarizes all above studies. In short, most of them find a positive income elasticity for regional public health expenditure, but below unity. Moreover, demographics is another key issue. Both factors are deeply analyzed in next sections.

Table 4. Summary of data and results for previous studies. Dependent variable: regional health care expenditure

Reference	Countries studied	Period	Model description	Main results
Di Matteo and Di Matteo (1998)	Canadian provincial government health expenditures	1965-1991	Pooled time-series cross-section regression analysis	Key determinants: real provincial per capita income, the proportion of the provincial population over age 65 and real provincial per capita federal transfer revenues. Income elasticity: 0.77 (health care is not a luxury good)
Ariste and Carr (2001)	Canadian provincial government health expenditures	1966-1998	Error corrction and cointegration techniques	Income elasticity: 0.88 (health care is not a luxury good)
López I Casasnovas and Saez (2001)	110 regions in Australia, Canada, France, Germany, Italy, Spain, Sweden and United Kingdom	1997	Multilevel hierarchical model	Key determinants: Income and population over 65 years and over.
Gionannoni and Hittris (2002)	Italy´s regions	1980-1995	Pooled regional time-series cross-section data	The most important determinant is regional income. Among the factors of lesser importance are: (i) the ageing population; and (ii) structural characteristics, relating to economies of scale and productivity.
Freeman (2003)	American state-level data	1966-1998	Dynamic OLS cointegrating regressions	Income elasticity: 0.817 to 0.844 (health care is a necessity good)
Di Matteo (2003)	American state-level data, Canadian province-level data and national level data for 16 OECD countries	1980-1997 (American), 1965-2000 (Canada) and 1960-1997 (16 OECD countries)	Ordinary Least Squares regression model	Income elasticity does vary by level of analysis with international income elasticities being generally larger than national or regional studies.
Cantarero (2005)	Spanish regions	1993-1999	Panel data	The most important determinant is ageing population while other factors such as income differences and structural characteristics of the supply variables (the physicians´ and bed´s density) have less importance
Costa-Font and Pons-Novell (2005)	Spanish regions	1992-1998	Ordinary Least Squares and the Lagrange multipliers methods (ML-SER)	Key Determinants: Income, number of doctos and beds, and stays per population, foral regime, health care responsabilities and political variables. Income elasticity: 0.98 and 0.66 (health care is not a luxury good)
Di Matteo (2005)	American state-level data and Canadian province-level data	1980-1998 (American) and 1975-2000 (Canada)	Multivariant analysis	Key factors: Income and population over 65 years, and time effect (proxy for technological change).
Crivelli, Filippini and Mosca (2005)	Swiss cantons	1996-2001	Panel data	Key factors: the physicians´ density, the percentage of over 75 in the population, the percentage of under 5 in the population and the unemployment rate. Income does not have any influence on health expenditures.

Source: Authors' elaboration.

IV. ECONOMETRIC SPECIFICATION AND DATA

According to surveyed literature, our econometric specification is based on two main factors: per capita income and demographic structure. As control variables, several physical indicators and a proxy for technological change are also included.

Per capita income

The income elasticity of health expenditure is a central issue in empirical works. Income elasticity below one involves that health expenditure would be a "necessary" good. In contrast, elasticities ranging above one would make it a "luxury" good. In our opinion two questions must be taken into account when estimating and interpreting results regarding income elasticities:

1. Income elasticities should not be estimated using income as unique regressor. The right interpretation of income elasticity is the percentage change in health expenditure in response to a given percentage change in income, anything else constant. Health expenditure may grow because of ageing, technological change, and so on. If those factors are positively correlated (as they often are) with income bivariate regressions will produce upward biased estimates of income elasticity.

2. Regions are not countries. In the case of countries, public revenues rely on national GDP. Government budget constraint tightly relates revenues and expenditure. In the case of regions, things may be very different. If powers on health care are not decentralized, regional income may be irrelevant. And the same may be true if a strong equalization grants scheme is implemented or/and public health expenditure is financed by conditioned grants from the central government. Let us suppose one country composed by two identical regions A and B with powers on public health. An asymmetrical regional shock makes that GDP growth rates were 4% in region A and 0% in region B (national economic growth is then 2%). With full fiscal equalization, an unitary income elasticity at country level (a growth rate of public health expenditure of 2%) is compatible with a null correlation between income and health expenditure at regional level. While growth rates of the former are very different, the growth of the latter is equalized at 2%. In sum, the more the fiscal interdependence of regions, the lower the regional income elasticity of public health expenditure.

Demographic structure

In this case, two considerations must be made again:

1. If changes in the structure of population are slow and/or the time span of sample is short, within-variation of some population brackets may be very low. This may be a problem if individual effects must be included into estimates and those are correlated with regressors. In this case, the fixed-effects specification is preferable to random-effects, and then coefficients of variables with scarce within-variation are imprecisely estimated.

2. Correlation between population brackets may be also high, producing multicollinearity if several brackets are simultaneously included into estimates. For instance, correlation between the proportion of population aged 0-4 may be negatively correlated to the proportion of population aged 65 and over; or the proportion of population aged 65-74 may be correlated to that aged 75 and over.

Those four caveats help to understand some results in literature and are very relevant in the Spanish case, as we show below.

Control variables

Also, we have considered the proxy consumption of medical services through the number of general practitioners per 1000 population (*Ch*) and acute care beds per 1000 population (*Ph*).

With respect to technological change, empirical literature has paid little attention on it. Di Matteo (2005) is an exception. While it is often accepted that innovations in medical cares boost health services costs there are not aggregated statistical indexes to measure it. As in the literature on economic growth a time trend or a set of time-effects may be used as a proxy. Di Matteo (2005) chooses the second option, finding than time accounts for approximately two-thirds of health expenditure increases in the US and Canada. In this paper both proxies are used alternatively.

Information is available for the period 1992-2003 and the 17 Spanish regions, which yields 204 observations. The list of variables, definitions, and data sources are shown in Table 5 and basic descriptive statistics in Table 6.

Basic econometric specification is the following:

$$Loggspc_{it} = \alpha_i + \beta_1 Logy_{it} + \beta_2 Ch_{it} + \beta_3 Ph_{it} + \beta_4 trend + \sum_j \gamma_j Pob_{jit} + \varepsilon_{it} \qquad [1]$$

where *i* indicates region and *t* indicates year. Different numbers (*j*) of population brackets are used in each estimate. Logarithms are only use in the case of expenditure and income because the rest of variables are expressed in percentages: taking logarithms on percentages has no sense (Giannoni and Hitiris, 2002).

In order to test differences in the effect of income in the several groups of regions, two dummy variables *FORAL* and *NOTAX* are included. Interactions between both variables and *logy* are then included into the basic specification

$$Loggspc_{it} = \alpha_i + \beta_1 Logy_{it} + \beta_2 Ch_{it} + \beta_3 Ph_{it} + \beta_4 trend + \\ + \sum_j \gamma_j Pob_{jit} + \beta_5 Logy_{it} FORAL_i + \beta_6 Logy_{it} NOTAX_{it} \varepsilon_{it} \qquad [2]$$

Table 5: Variable definitions and data sources

Variable	Definition	Data Source
Loggspc	Logarithm of Health Care expenditure per capita.	Spanish Ministry of Health.
Logy	Logarithm of Real per capita income.	Spanish National Statistics Institute.
Ch	Acute Care Beds per 1000 population.	Spanish National Statistics Institute.
Ph	General Practitioners (density per 1000 population).	Spanish National Statistics Institute.
Pobmen4	Population with age less than 4years old	Spanish National Statistics Institute.
Pobmay75	Population with age greater than 75 years old	Spanish National Statistics Institute.
Pob6575	Population with age between 65 and 75 years old	Spanish National Statistics Institute.
Trend	Time Trend	
Foral	Dummy variable for Foral Autonomous Communities. It values 1 for observations corresponding to the Basque Country and Navarre and 0 otherwise	
NOTAX	Dummy variable for Common Autonomous Communities with responsibilities public health care during the 90's. It values 1 for observations corresponding to Andalusia, the Canary Islands (since 1995), Catalonia, Community of Valencia and Galicia and 0 otherwise	

Table 6: Descriptive Statistics

Variable	*Mean*	*Std. Dev. (All)*	*Std Dev (Between)*	*Std. Dev. (Within)*	*Min.*	*Max.*
Loggspc	6.47	0.26	0.05	0.25	6.00	6.99
Logy	7.13	0.29	0.20	0.21	6.47	7.79
Ch	3.88	0.63	0.61	0.20	2.68	4.97
Ph	2.43	0.38	0.31	0.23	1.65	3.20
Pobmen4	4.63	0.82	0.80	0.25	3.03	6.40
Pobmay75	7.08	1.55	1.42	0.71	4.00	11.07
Pob6575	9.83	1.44	1.42	0.42	5.94	12.35
Foral	0.12	0.32	0.33	0.00	0	1
NOTAX	0.28	0.45	0.45	0.10	0	1

Source: Authors´ calculation.

V. ECONOMETRIC RESULTS

In the case of some regressors, within-variation is clearly lower than between-variation. (see Table 6) This is the case of *pob6575* (within-variation is 3.4 times lower than between-variation), *pobmen4* (3.2 times) and *ch* (3.1 times). Collinearity with individual fixed-effects may be a real problem when those are necessary. Unfortunately, this is the case. Econometric results show that individual effects significantly increase the goodness of fit (column 1 versus column 5 and column 2 versus column 6). It has been formally verified using a simple F-test on the null hypothesis that the constant terms are equal[4]. Moreover, correlation between individual effects and regressors is high, involving that fixed-effects is a better choice than random effects. According to the Hausman test applied on column 5 the hypothesis of uncorrelation should be discarded (p-value=0.0006).

As expected, the inclusion of individual effect into the estimates changes the estimated coefficients for variables with a low within-variation. This is the case of variable *pobmen4*. In column 2 its coefficient is positive (p-value=0.198). However, it becomes negative and marginally significant when individual effects are included (column 6).

As expected again, correlations between the different population brackets are high. Multicollinearity is then a serious concern when some combinations of brackets are simultaneously used. For instance, when both *pob6575* and *pobmay75* (r=0.89) are included, the coefficient for the first one is negative (column 2). But it becomes positive when *pobmay75* is set aside (column 3). Some of the results by Di Matteo (2005) concerning the effect of the structure of population on spending could be explained by this reason[5].

As an alternative to the standard within-estimator, the three-stage estimator proposed by Plümper and Troeger (2004a and 2004b) was used. This estimator, called *xtfevd*, allows to simultaneously include time-invariant variables and individual fixed effects. Moreover, according to monte Carlo simulations show that *xtfevd* performs better than the fixed-effect model when the between variation clearly exceeds the within variation (by at least factor 2.5). Results confirmed the positive sign of variable *pobmen4*.

Correcting for cross-sectional heteroscedasticity and contemporaneous cross-correlation do not significantly change results. In column 6 p-values corresponding to Beck and Katz (1995) robust t-statistics are also reported in brackets.

In column 7, results from the between-groups estimator are reported. Only three regressors are included due to the small sample size. Comparing with the within-groups estimator in column 6, results clearly show that our model is much more useful to understand within variation than cross-section variation in *Loggspc*.

On the contrary, estimates in columns 1 to 8 may suffer from biases due to serial autocorrelation. The modified Bhargava et al. Durbin-Watson statistic was computed for

[4] See Greene (2003, p.289). In both columns 2 and 5, p-value was clearly below 0.0001

[5] "When the more complex specification was used, the proportion of population aged 65-74 was not a positive and statistically significant determinant of real per capita provincial government health expenditure. Indeed, the age categories serving as positive drivers of health spending are now those aged 18-44 and 45-64 although the age 45-64 category is only significant at the 10% level" (Di Matteo, 2005, p.35).

estimate in column 6. It yielded value of is 0.90. According to critical values calculated by Bhargava et al. (1982) the hypothesis $\rho=1$ must be rejected.

Estimates in columns 8 and following control for this problem. The Arellano-Bond (1991) dynamic panel estimator (xtabond) in used in column 9. In the remaining columns we use the Baltagi and Wu (1999) estimator for cross-sectional time-series regression models with first-order autoregressive disturbance terms (xtregar). In the case of the Arellano-Bond estimator, two lags of the dependent variable are included in the model in order to reject the null hypothesis of no second-order serial correlation in the residuals. Moreover, the null hypothesis in the Sargan test of over-identifying restrictions cannot be rejected when the two-steps estimator is used. As we will see, some coefficients change when autocorrelation is controlled for.

A time trend is included in columns 10 and 13. In columns 11 and 14 the time trend is replaced by time fixed-effects. While results using a common time trend or time fixed-effects are similar, there are significant differences with estimates where the effect of time is not controlled for.

The income elasticity of health public care expenditures significantly change depending on the inclusion of other variables, specifications, and econometrics technics. In columns 1 and 5 *logy* is the only regressor. Because specification estimated in column 5 is better than that in column 1 (individual effects are included), one should conclude that health services is a "luxury" good: elasticity is over unity (1.11). However, once other regressors are included, elasticity dramatically drops until 0.39 (column 6). Moreover, when serial correlation is controlled for elasticity becomes 0.12 (column 8) or 0.03 when the Arellano-Bond estimator is used (column 9). Finally, income is a non-significant variable when the time trend (column 10) or time fixed-effects (column 11) are included. Assuming that this last result may be partially explained by collinearity between time trends and income (R^2 of *logy* on *trend* is 0.870), income elasticity is very low once omitted variable bias and econometric problems are corrected.

In columns 12 at 14 homogeneity of coefficients is contrasted for the variable *logy* for the three aforementioned groups of ACs. The results show that variation of GDP per capita would be more influential, with positive sign, for the foral AC. In other words, regional GDP growths would be translated in more health care expenditure only in foral AC.

And in those with responsibilities on public health spending but a low tax autonomy? Although estimates demonstrate that their behavior like group is not different to those under central control in what concerns to the answer to changes in GDP per capita, it is worthwhile to analyze the individualized behavior of AC and, in particular if a relationship exists between GDP and health care expenditure. With this aim average values in time for the 5 AC with transferred health care powers but low fiscal autonomy are computed. Four variables are considered: *logy*, *lgspc*; the logarithm of per capita grants conditioned to finance health care (*ltrpcsa);* and the logarithm of the difference between *gspc* and *trpcsa* (*lar*). Correlation between logy and the other three variables are then computed. We distinguish among three periods corresponding to three different financing models: 1992-1993, 1994-1997 and 1998-2001. The sign of correlations and their statistical significativity appear in Table 8. Health care expenditure per capita is not positively correlated with GDP per capita (column 1). GDP per capita influences

positively on conditioned grants per capita, but only significantly in 1994-1997. Finally, autonomous revenues are related negatively and marginally significant with health care expenditure.

Keeping in mind the reduced number of observations, a possible interpretation of these results is the following one. Low tax autonomy of the AC of common régime during the analyzed period gives little margin to increase its global resources. Before on the contrary, low levels of GDP per capita have been translated mainly in more resources per capita thanks to capital grants associated to regional policy[6]. Those greater resources would have, marginally, facilitated to drive more resources to health care and compensated a worse treatment of the effective health care financing pattern model between 1994 and 1997. Data show that the richest region in this group, Catalonia, is the one that more conditioned resources receive and Andalusia, the poorest, the one that less. In sum, to understand results concerning income elasticity one must take into account that the decisions in health care in Spain are strongly affected by a model of health care that puts the accent in the equality of the citizens' access. Strong income elasticities of health care expenditure at the national level are compatible with weak regional elasticities. If the central government controls expenditure directly or equalizes per capita regional revenues (reducing tax autonomy and/or granting less developed regions), spending and income may be weakly correlated. In this sense we have shown that income is translated into higher expenditure only in those Spanish regions with particular fiscal arrangements (Navarre and the Basque Country) with a higher income and tax autonomy. They enjoy a greater capacity to convert regional income into health public care expenditure.

[6] In this sense, Lago-Peñas (2006b), shows that the conditioned grants to AC would have assigned in 90% to finance investment and in 10% to reduce deficit, without a clear effect on saving and ordinary expenditure.

Table 7: Econometric estimates

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)*	(12)	(13)	(14)*
Intercept	**2.09 (0.000)**	**2.14 (0.000)**	**3.1T6 (0.000)**	**1.85 (0.000)**	**-1.76 (0.000)**	**2.45 (0.000) [0.000]**	**6.28 (0.000)**	**3.67 (0.000)**	**0.02 (0.009)**	**5.28 (0.000)**	**5.76 (0.000)**	**3.61 (0.000)**	**5.24 (0.000)**	**5.85 (0.000)**
Logy	**0.62 (0.000)**	**0.50 (0.000)**	**0.44 (0.000)**	**0.54 (0.000)**	**1.11 (0.000)**	**0.39 (0.000) [0.000]**	0.015 (0.831)	**0.12 (0.029)**	0.03 (0.229)	0.001 (0.978)	0.04 (0.364)	**0.13 (0.016)**	-0.01 (0.808)	0.03 (0.510)
Ch		-0.04 (0.153)	**-0.06 (0.015)**	-0.03 (0.252)		-0.06 (0.152) [0.177]		**-0.11 (0.012)**	**-0.06 (0.079)**	**-0.08 (0.064)**	-0.03 (0.408)	**-0.11 (0.016)**	-0.06 (0.159)	-0.02 (0.483)
Ph		**0.18 (0.000)**	**0.14 (0.003)**	**0.21 (0.000)**		**0.34 (0.000) [0.000]**	0.01 (0.930)	**0.19 (0.000)**	**0.25 (0.000)**	**0.13 (0.009)**	**0.08 (0.047)**	**0.22 (0.000)**	**0.15 (0.001)**	**0.11 (0.010)**
Pobmen4		0.03 (0.198)				-0.03 (0.113) [0.140]		0.07 (0.093)	0.01 (0.457)	0.05 (0.144)	0.05 (0.298)	0.04 (0.368)	0.03 (0.378)	-0.01 (0.818)
Pobmay75		**0.05 (0.000)**	**0.10 (0.000)**			**0.05 (0.000) [0.000]**	0.01 (0.396)	**0.23 (0.000)**	**0.05 (0.008)**	**0.08 (0.003)**	**0.06 (0.028)**	**0.21 (0.000)**	**0.007 (0.006)**	**0.05 (0.030)**
Pob6575			**-0.06 (0.002)**	**0.04 (0.000)**										
Trend										**0.05 (0.000)**			**0.005 (0.000)**	
Logy*foral												0.15 (0.204)	**0.21 (0.016)**	**0.27 (0.003)**
Logy*NOTAX												0.09 (0.439)	0.001 (0.860)	0.004 (0.477)
$Loggspc_{-1}$									**0.52 (0.000)**					
$Loggspc_{-2}$									**-0.14 (0.009)**					
Rho								0.68		0.59	0.73	0.63	0.52	0.63
R^2	0.481	0.673	0.687	0.641	0.901	0.955	0.06	0.807		0.893	0.893	0.846	0.918	0.932
Obs	204	204	204	204	204	204	17	187	153	187	187	187	187	187
Hausman Test (p-value)					0.0006									
Method	OLS	OLS	OLS	OLS	Xtreg, fe	Xtreg, fe [xtpcse]	Xtreg, be	Xtregar, fe	Xtabond	Xtregar, fe	Xtregar, fe	Xtregar, fe	Xtregar, fe	Xtregar, fe

Among parenthesis the p-values corresponding to t-statistics appear. * Includes fixed temporary effects

Table 8: Between correlations with *logy*. NOTAX regions

Variable	*lgsps*	*ltrpcsa*	*lar*
1992-93	+	+	- (**)
1994-97	+	+ (*)	-
1998-01	+	+	- (***)

In the table coefficient and p-value corresponding to *logy* appears
(*) Significant at 5% level
(**) Significant at 10% level
(***) Significant at 20% level

VI. CONCLUSIONS

In this paper the main determinants of health care expenditure per capita in Spanish regions (autonomous communities) are analyzed. The Spanish National Health Service (NHS) is based on an universal access to health care to all Spanish citizens and a decentralization process of health care to the Spanish regions during the last 28 years since the new democratic regime (1978). The coexistence of several models regarding the degree of spending power decentralization and financing systems converts Spain in a singular case; that it allows to extract interesting conclusions for other countries in ways of decentralizing their health care system.

According to surveyed literature, our model is based on two main factors: per capita income and demographic structure. As control variables, two physical indicators (Acute care beds and General Practitioners per 1000 populations) and a proxy for technological change are also included. Nevertheless, multicollinearity is then a serious concern when some combinations of variables are simultaneously used.

The income elasticity of health public expenditures significantly change depending on the inclusion of other variables, specifications, and econometrics. Also, it is interesting to point out that regional GDP growths would be translated in more health care expenditure in regions enjoying higher tax autonomy but not in the rest. To understand results concerning income elasticity one must take into account that choices on in health care in Spain are strongly affected by a NHS that puts the accent in the equality of the citizens' access and controls the revenues devoted to regional public health care. For that reason, only in regions with a high tax autonomy a positive (although not very strong) relationship between regional income and public expenditure are found. The model have changed in 2002, when responsibilities on public health care were ceded to all regions and more tax autonomy accorded. While it may be hypothesized a future increase in regional divergences, we must wait several years in order to expand the sample to check it.

Finally, our results allow evaluating the incidence of some factors of excessive cost stressed by the autonomous communities with a view to the future renegotiation of the ACs financing system.

REFERENCES

-Arellano, M. and Bond, S. (1991): "Some Tests of Specification for Panel data: Monte carlo Evidence and an Application to Employment Equations", *The Review of Economic Studies*, **58**, 277-297.

-Ariste, R., Car, J. (2001): *Nouvelles considerations sur l´etude des determinants des dépenses de santé des gouvernements provinciaux au Canada: 1966-1998*. Health Canada Applied Research and Análisis Directorate.

-Atella, V., Marini, G. (2004a): "Is health care expenditure really a luxury good? Re-assessment and new evidence based on OECD data", *Working Paper,* http://papers.ssrn.com/abstract=383004.

-Atella, V., Marini, G. (2004b): "The determinants of health care expenditure: a never ending story?", *Working Paper*, http://papers.ssrn.com/abstract=607162.

-Bac, C., Le Pen, Y. (2002): "An international comparison of health expenditure determinants". *10th International Conferences on Panel Data*, Berlin, July 5-6.

-Baltagi, B. H. and Wu, P.X. (1999): "Unequally Spaced Panel Data Regression with AR(1) Disturbances", *Econometric Theory*, **15**, 814-823.

-Banting, K.G., Corbett, S. (2002): *Health Policy and Federalism. A Comparative perspective on multi-level governance*. McGill-Queen´s University Press, Kingston.

-Beck, N., Katz, J.N. (1995): "What to Do (and Not to Do) with Time-Series Cross-Section Data", *American Political Science Review*, **89**, 634-647.

-Bhargava, A.; Franzini, L. and Narendranathan, W. (1982): "Serial Correlation and the Fixed Effects Model", *The Review of Economic Studies*, **49**, 533-549.

-Blomqvist, A. G. and Carter, R.A.L. (1997): Is health care really a luxury?, *Journal of Health Economics*, **16**, 207-229.

-Cantarero, D. (2005): "Decentralization and health care expenditure: The Spanish case", *Applied Economics Letters,* **12 (15)**, 963-966.

-Carrion-I-Silvestre, J.L. (2005): "Health care expenditure and GDP: Are they broken stationary?", *Journal of Health Economics,* **24**, 839-853.

-Costa-Font, J. and Pons-Novell, J. (2005): "Public Health Expenditure and Spatial Interactions in a Decentralized National Health System", *Documents de Treball de la Facultat de Ciéncies Económiques I Empresarials, Universitat de Barcelona*.

-Crivelli, L., Filippini, M. and Mosca, I. (2005): "Federalism and regional health care expenditures: an empirical analysis for the Swiss cantons", *Health Economics*, **10 (1)**, 20–26.

-Di Matteo, L. and Di Matteo, R. (1998): "Evidence on the determinants of Canadian provincial government health expenditures: 1965–1991", *Journal of Health Economics*, **17**, 211–228.

-Di Matteo, L. (2003): "The income elasticity of health care spending A comparison of parametric and nonparametric approaches", *European Journal of Health Economics*, **4**, 20–29.

-Di Matteo, L. (2005): "The macro determinants of health expenditure in the United States and Canada: assessing the impact of income, age distribution and time", *Health Policy*, **71**, 23–42.

-Freeman, D.G. (2003): "Is health care a necessity or a luxury? Pooled estimates of income elasticity from US state-level data", *Applied Economics,* **35**, 495-502.

-Gerdtham, U.G., Jonsson, B. (2000): "International comparisons of health expenditure: theory, data and econometric analysis". In Culyer, A.J, Newhouse, J.P. (eds.): *Handbook of health economics*, Vol. 1, Elsevier, Amsterdam.

-Giannoni, M. Hitiris, T. (2002): "The Regional Impact of Health Care Expenditure: the Case of Italy", *Applied Economics,* **34(14)**, 1829-1836.

-Greene, W.H. (2003) *Econometric Analysis*, 5th Edition, Prentice Hall, New York.

-Hitiris, T. (1997): "Health care expenditure and integration in the countries of the European Union", *Applied Economics,* **29**, 1-6.

-Hitiris, T., Posnett, J. (1992): "The determinants and effects of health expenditure in developed countries", *Journal of Health Economics,* **11**, 173-181.

-Kleiman, E. (1974): *The determinants of national outlay on Health.* Macmillan, London.

-Lago-Peñas (2006a): "La evolución del gasto sanitario: situación comparada y distribución territorial". In Martinez, D., Sanchez Maldonado, J. (coord.): *Financiación regional de la sanidad. Perspectivas de reforma*, 229-244, Centro de Estudios Andaluces, Seville.

-Lago-Peñas, S. (2006b): "Capital Grants and regional Public Investment in Spain: Fungibility of Aid or Crowding-in Effect?", *Applied Economics*, **38(15)**, 1737-1748

-López i Casasnovas, G., Costa, J. y Planas, I. (2005): "Diversity and Regional Inequalities: Assesing the Outcomes of the Spanish System of Health Care Services", *Health Economics,* **14**, 221-235.

-López i Casasnovas, G., Saez, M. (2001): "A multilevel analysis on the determinants of regional health care expenditure. A note", *Working Papers Universitat Pompeu Fabra,* Nº 572.

-Newhouse, J. (1977): "Medical care expenditure: a cross national survey", *Journal of Human Resources,* **12**, 115-125.

-Newhouse, J. (1992): "Medical care costs: How much welare loss?", *Journal of Economic Perspectives,* **6**, 3-21.

-OECD (2006): *OECD Health Data File* 2006.

-Plumpër, T. and Troger, V. (2004a): "The Estimation of Time-Invariant Variables in Panel Analyses with Unit Fixed Effects", University of Konstanz and Max-Planck-Institute for Research into Economic Systems".

-Plumpër, T. and Troger, V. (2004b): "Efficient Estimation of Rarely Changing Variables in Fixed Effects Models", University of Konstanz and Max-Planck-Institute for Research into Economic Systems".

-Rico, A., Sabés, R. (2000): *Spain,* Health Care Systems Transition Series, Copenhagen: Euopean Observatory on Health Care Systems.

-Sen, A. (2005): "Is health care a luxury? New evidence from OECD Data", *International Journal of Health Care Finance and Economics,* **5**, 147-164.

-Vatter, A., Ruefli, C. (2003): "Do political factors matter for health care expenditure? A comparative study of Swiss cantons", *Journal of Public Policy*, **23 (3)**, 301–323.