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Public Health Expenditure and Spatial Interactions in a Decentralized National Health System

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Abstract

One of the limitations of cross-country health expenditure analysis refers to the fact that the financing, the internal organization and political restraints of health care decision-making are country-specific and heterogeneous. Yet, a potential solution is to examine the influence of such effects in those countries that have undertaken decentralization processes. In such a setting, it is possible to examine potential expenditure spillovers across the geography of a country as well as the influence of the political ideology of regional incumbents on public health expenditure. This paper examines the determinants of public health expenditure within Spanish region-states (Autonomous Communities, ACs), most of them subject to similar financing structures although exhibiting 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.

Keywords: health expenditure, devolution, political ideology, political competition and spatial interactions.

JEL Classification: I18, I38, H73

Resum

Una de les limitacions de l'anàlisi de la despesa sanitària entre diferents països és el fet que el finançament, l'organització interna i les restriccions de decisió polítiques són específiques de cada país. Una forma de solucionar el problema consisteix en limitar l'anàlisi a un país que hagi descentralitzat l'organització del sistema sanitari. En aquest cas també és possible examinar l'existència d'externalitats de despesa sanitària derivades d'interaccions estratègiques, així com la influència de la ideologia sobre la despesa sanitària pública. Aquest article examina els determinants de la despesa sanitària a les comunitats autònomes (CCAA) de l'Estat Espanyol, les quals presenten una certa heterogeneïtat derivada dels diferents graus de descentralització, dels efectes polítics específics, així com diferències en la utilització de serveis, dimensió econòmica i interaccions espacials.

Paraules claus: despesa sanitària, ideologia política, competència política i interaccions espacials

1. INTRODUCTION

The growth of public health expenditure is at the forefront of the health policy debates in most Western economies. After the seminal paper by Newhouse (1977), the examination of the determinants of health care expenditure has been a matter of extensive debate over the last two decades. The progressively large availability of international data on health care has led to the development of a vast array of studies disentangling the underlying factors that determine health care expenditure, such as income, aging, time effects and availability of factors. Another factor examined is that of technology progress (Newhouse, 1992). However, most studies are based on cross-country data to disentangle the extent to which income – measured by gross domestic product (GDP) – and other determinants, such as demographics and heterogeneity of health care inputs, explain differences in health expenditure.

In the light of the long-lasting studies on whether health care is a luxury good, as pointed out by Di Matteo and Di Matteo (1998), restricting the analysis to single countries with multiple jurisdictions providing health care might, to an extent, reduce part of the existing heterogeneity on health care expenditure across countries attributable to differences in the extent of health converge and internal design. Similarly, Gionannoni and Hittris (2002) attempt to examine the determinants of regional health expenditures in Italy and find significant regional specific effects. Both studies use jurisdiction-level data and account for demographic and health care system determinants of public health expenditure. However, they do not examine the extent to which public expenditure in one jurisdiction is affected by the expenditure spillovers from neighbouring jurisdictions; although both theoretical and empirical studies suggest that the hypothesis of spatial interactions may not be ruled out (Revelli, 2002, 2001). Indeed, expenditure in one jurisdiction can provide beneficial or harmful effects

over residents in other jurisdictions (Gordon, 1983). On the other hand, prior studies do not account for political characteristics, which arguably stand at the forefront of the health care decision-making in countries where the mainstream health insurer is the public sector. Besley and Case (1995) provide an explanation on the basis of political agency where constituents and politicians respond to events in other jurisdictions.

The decentralization process that has taken place in Spain stands as a clear-cut example with which to examine these issues. Indeed, given that the system is mainly politically rather than fiscally decentralized, very few differences will come up in the funding of the system as regards regional health systems mainly funded by a single central authority (with the exception of two ACs that enjoy fiscal in addition to political responsibilities). On the other hand, it is possible to examine whether demographic and other specific regional characteristics affect health care expenditure, or issues on whether regional size determines the existence of economies of scale in the provision of health care. Along with examining the influence of regional income in explaining health care expenditure, other determinants such as availability of inputs (e.g., number of health care professionals and beds) are expected to place some influence on expanding health care expenditure consistently with prior research.

In the context of the European Union several studies have examined those effects (Hitris, 1997; Hitris and Nixon, 1997). However, only limited evidence has been reported on the effect of such determinants within region-states, namely Di Matteo in the context of Canada and Giannoni and Hitris (2002) in the Italian context. The former stresses the potentially negative effects of the split of health responsibilities into different regions, despite the specific effects of decentralization. However, the paper does not examine potential regional interactions in health care, although it acknowledges that differences in health

care expenditures could result from differences in the political ranking of health care among regions. Indeed, decentralization structures could give rise to 'competitive' mechanisms that explain the patterns of health care expenditure. Thus, it is important in dealing with regional-specific data to check for potential spatial dependency that might be important in heterogeneous countries, as is the case of Spain.

In most western health systems, the public sector is, with varying degrees, the mainstream health care financing body, and accordingly the association between health expenditure and income can be envisaged as being more a reflection of the Wagner Law (Lybeck, 1988, Kananvos and Mossialos, 1999), than of specific market behavioural mechanisms. Public sector behaviour is arguably influenced by the specific institutional design of the health system. One of the most frequently cited institutional features is the degree to which the political system is centralized (Pommerehne, 1990). On the other hand, Meltzer and Richard (1983) argue that the expansion of democratic participation brings greater pressure on governments to expand the size of the public sector in so far as it shifts the identity of the decisive or median voter further toward a position of strong support for government redistributive efforts. Accordingly, if the ultimate decision-makers are political incumbents with differing ideologies, we should expect according to the standard partisan ideology (Wittman, 1983) that parties of the left would favour a large and active state, particularly one committed to egalitarian forms of redistribution. Furthermore, if political parties are assumed to be agents of their constituents, the incumbents' political ideology might be thought of as representing that of the median voter in a specific constituency. Indeed, a factor that has been treated extensively in the literature on public sector growth is the ideology of the party in government and in general the composition of the parliament that is supposed to vote on health care issues. However, there is some evidence that does not confirm the role of

ideology in increasing expenditure, but stresses the potential credibility effects of left-wing governments in cutting public expenditure (Tavares, 1994).

Spain expend about 7.6% of GDP on health care, and about 5.6% of GDP on public health care in 2001, which implies that the public sector funds about 75% of total health expenditure. Two major features have defined health care reform in Spain. On the one hand, the consolidation of the National Health System (NHS), which has remained largely politicized (Lopez-Casanovas *et al*, 2005). On the other hand, the setting up of a gradual process of health care decentralization from the early eighties, whereby an increasing number of region-states (so-called Comunidades Autonomas, henceforth ACs) have taken over health care responsibilities. However, the specific sort of health care decentralization taking place in Spain falls mainly in the political arena, in so far as the main power to raise taxes (with the exception of minor taxes, e.g. petrol tax discharges) is in the hands of the central state with the exception of two ACs that are entitled to raise general taxes (Basque Country and Navarre).

Previous research has focused on understanding the political process (Rico and Costa-Font, 2005) and evaluating the system in itself (Lopez-Casanovas *et al*, 2005). However, little is known on the determinants of public expenditure on health care at the regional level and the extent to which regional interactions explain the expansion of health care expenditure. Two thirds of public health care expenditure has been decentralized to the ACs during 1992-1999 and health care has accounted for about 40% of AC public expenditure. Accordingly, the Spanish example offers some interesting questions for a broad research audience. Decentralization is arguably increasing the efficiency of health care provision as a result of reliance on regional specific knowledge, needs and preferences rather than focusing on national and uniform health care provision. However, limited research has been conducted in showing the

potential effects of decentralization, together with other determinants in the generation of health care expenditures. The first question that the developments of the Spanish health system poses to the debate on decentralization and health expenditure is whether decentralization can potentially increase the efficiency of the health system. In particular, whether the mechanisms of vertical and horizontal competition between regional health systems take place in Spain. In countries where multiple jurisdictions provide health care, one might expect some strategic interaction-taking place among regions, which arguably might influence the way health care expenditure is determined. Given the structure of Spain's political system, we are able to test whether government size in health care is determined by political ideology of the incumbent parties running the health system at the AC level and at the central levels for those ACs that were centrally ruled.

This paper aims to examine the determinants of public health care expenditure and in particular the influence of regional income, potential spatial dependency, political ideology along with availability of inputs and demand influences, such as inflation, aging and unemployment. A response to these factors might be important in finding a response to the potential impact of the design of decentralization structures in determining the design of the health care system. On the other hand, given that NHS expenditure results from political priorities, potential evidence on the influence of such priorities in driving expenditure might be a key issue in understanding the potential patterns of expenditure. Finally, the role of health inputs and income is key in examining whether health care policies have an influence on cutting expenditure.

The structure of this paper is the following. Next, we undertake a revision of the previous literature on health care determinants. Section three is devoted to

the institutional setting. Section four describes the data and methods and section five reports the results. Finally, the paper ends with a conclusion.

2. HEALTH CARE EXPENDITURE DETERMINANTS

2.1 Evidence of expenditure determinants

One of the issues, which have captured most of the debate, is whether health care is a luxury good. Okunade and Murthy (2002) find that together with income it exhibits a stable relationship with health care expenditure per capita. This issue is intriguing due to the potential implications for redistribution. Interestingly, there is no agreement in the literature. On the one hand, Getzen (2000) argues that while evidences point out that health care is a luxury good at the individual level, it is a necessary good. Clemente *et al* (2004) point out that the inconsistency of this result with that of previous literature lies in the 'aggregation problem', and therefore by separating public from private health expenditure it is possible to respond to this issue. They find a heterogeneous pattern, as both types of expenditure are significantly different. Furthermore, as noted by Culyer (1998), one would expect health care to be less dependent on the ability to pay in those countries where health care is heavily subsidized.

2.2 Methodological issues

In dealing with international health care expenditure functions, availability of international data has fostered the development of a significant amount of empirical work. However, heterogeneously regulated, financed and managed health systems are pooled together, which arguably might limit the comparability. Indeed, among OECD countries there are sizeable differences in the health care package. Accordingly, it is doubtful that data from different

countries in fact measure the same, which is the 'heterogeneity problem' (Getzen, 2000). On the other hand, by examining a large period of time, there might be a 'stability problem' (Jewell *et al*, 2003; Clemente *et al*, 2004).

Significant methodological issues have led to a questioning of the validity of these results (Clemente *et al*, 2004; McCoskey and Selden, 1998; Hansen and King 1996; Blomqvist and Carter, 1997; Karatzas, 2000; Roberts, 2000). To this end, some studies deal with specific methodological issues underlying the determination of the health care expenditure function, and in particular they account for the potential non-stationary of the data, although there is no agreement on whether the data are cointegrated (Gerdthan and Lothgren, 2000, Clemente *et a*l, 2004). The application of panel data methods allows for potential differences in tastes and preferences in the health care expenditure function. Some previous evidence (Hitris and Possnett, 1992) uses time series cross-section analysis and Di Matteo and Di Matteo (1998) employ panel data techniques to examine health care expenditure determinants. However, no spatial interactions are considered. Interestingly, not accounting for spatial dependence has been shown to lead to biased and inconsistent estimates of the parameters of an equation of public expenditure determination (Case et al, 1993, Revelli, 2002). The existence of some spatial dependence might invalidate some of the existing conclusions. Some studies identify causality problems in examining health expenditure and GDP, which apply in the Spanish case (Devlin and Hansen, 2001). In addition to causality, the set up of an economically integrated area has led to studies on whether there is a singe health care function.

2.3 Inter –governmental competition and spatial interactions

The examination of public expenditure in settings where several jurisdictions are entitled to provide health care to their population, in addition to certain economic, political and demographic characteristics, demonstrate that the level of public expenditure might be affected by expenditures of neighbouring jurisdictions due to exposure to 'common shocks' (e.g. an epidemic associated with a geographical area) or what is genuinely defined as 'policy interdependence' (Case *et al*, 1993). Indeed, strategic interaction might take place among regional governments on setting their taxes and expenditures so that some welfare competition has been suggested to take place (Sinn, 2003). Citizens of one jurisdiction might look at neighbouring jurisdictions' benefits levels in judging their own jurisdiction performance. Accordingly, incumbents at the regional level might react to this effect by both reducing taxes and benefits (health care coverage) if they are fiscally accountable governments and the other way round if they are not. On the other hand, equilibrium might take place through the so-called 'welfare migration' (Brueckner, 2000). Under welfare migration, welfare 'generosity' leads to tax increases in more generous regions to fund new recipients of welfare. However, when welfare migration is limited – as is the case in Spain (less that 1% of patients are treated in hospitals of different AC) and most European countries -, then a separate equilibrium can take place while regional incumbents might have incentives to increase coverage. When coordination by the central state is weak, there are incentives for regional incumbents to compete with the central state (Breton, 1996). The latter is catalogued as vertical competition and takes place together with yardstick competition mechanisms whereby political accountability allows constituents in one region to benchmark their demand on the basis of other regions' performance (Besley and Case, 1985; Costa-Font and Rico, 2005).

In the Spanish NHS, incentives are not to reduce taxes, in so far as taxes are uniformly defined with the exception of two ACs, but to increase expenditure. This might potentially take place in the political arena, whereby regional and national incumbents might not be willing to cut expenditure in certain areas, and welfare benefits in one region are likely to exhibit a so–called "race to the top" rather than a race to the bottom (Costa and Rico, 2005). If this is the case, we should expect some strategic interaction whereby welfare coverage of some ACs is likely to depend on the coverage of neighbouring regions.

2.4 Political competition

Several studies report evidence supporting these so-called Partisan cycles as influencing public expenditure (Cameron, 1978, Roubini and Sachs, 1989 and Haan and Sturm, 1994), although some scholars suggest that this feature should distinguish between the types of public expenditure, whereby parties of the left may favour spending of a social welfare character (Henrekson, 1988). Other partisan-related features have also been shown to be relevant, such as the kind of government, e.g. coalition vs majority governments' in so far as large coalition and minority governments may have more difficulties in reaching agreement to balance the budget (Haan and Sturm, 1997). Interestingly, some recent evidence (Tavares, 2004) indicates that the left gains credibility in cutting expenditure while the right gains credibility when it increases tax revenues. Therefore, the role of political competition and ideology seems to be far from evident in undertaking fiscal policies affecting health expenditure. Indeed, national politics (and public choice) are potentially shifting public health care expenditure (Parkin *et al*, 1987), although no evidence has yet been reported. In Spain, in the 1990s there was increasing dynamism in the political system both at the central level (two socialist and two conservative governments) and at the

AC level. Furthermore, some regions are ruled during the period examined by peripheral nationalists that arguably exhibit demand for higher self-government (e.g. Catalonia and the Basque Country).

3. THE INSTITUTIONAL SETTING

The NHS in Spain is financed by funds raised through general taxation with minor user co-payments for drugs and minor procedures. The population has the right to free access to services and benefits are comprehensive, even though coverage is minimal for preventive programmes, long-term care and dental services, albeit with some regional diversity.[1] Health care, together with education, ranks first in the responsibilities of region-states and is the first government priority of citizens. This feature might explain the degree of politicization of the system.

The Spanish NHS has followed until 2002 a model of *asymmetric federalism* where health care accounts for about 40 per cent of regional expenditure. Two thirds of the Spanish population received health care from their own region-states — legally named as autonomous communities (ACs).[2] The ACs were responsible for health care planning, organization and management, and thus are politically accountable to their constituents as regards

[1] While the Basque Country and Andalusia cover child dental care, other regions do not. Similarly, whereas long-term care is defined as a public responsibility in some regional basic statutory Law (e.g., Castille-La Mancha), in some other regions it is defined as an individual responsibility (e.g. Catalonia).

[2] The reasons for setting up a model of asymmetric federalism lie in the pre-existing differences in the management capacity of some ACs as opposed to newly created ones as well as supply side dissimilarities. For example, the Catalan health care structure relies mainly on private non profit-making private organizations.

health expenditure.[3] Regional parliaments in the seven ACs that were empowered with health care responsibilities enjoyed large legislative capacity only limited by basic legislation of the central state, although in practice given the evidence of vertical competition this did not operate as a tight constraint (Costa-Font and Rico, 2005). Health care in the remaining ten ACs remained centrally managed by the National Institute of Health (*Instituto Nacional de la Salud*, INSALUD) and regional governments in those regions only had some restricted powers in the fields of primary and community care.[4] The transfer of health responsibilities to Catalonia was completed in 1981, followed by Andalusia (1984), the Basque Country and Valencia (1988), Galicia and Navarre (1991), the Canary Islands (1994), and from 2002, the remaining ACs were empowered with health care responsibilities.

Funds are centrally collected and allocated to ACs under a single central transfer following the lines of a block grant in accordance with an unadjusted capitation formula, with the exception of Navarre and the Basque Country – which are entitled to do so themselves. Some fiscal capacity exists for minor taxes and tax surcharges in the remaining ACs and though fiscal regional responsibility has been progressively increasing - by transferring an increasing percentage up to 30% of revenues plus a 20% surcharge on the personal income tax –the 'vicious cycle' of overspending (prevalent as normal practice both before and after the devolution process) has persisted (Lopez Casanovas *et al*, 2005). Previous evidence on the evolution of health care expenditure using decomposition analysis of health care expenditure data suggests that after the 1990s when the decentralization process was deepened by transferring health

[3] With the exception of some sanitation functions, which are carried out by local health authorities, most other public health and health promotion activities were transferred to the regions during the 1980s.

care responsibilities to five ACs, volume was the main determinant of health care expenditure rather than prices (Lopez-Casasnovas *et al*, 2005).

4. THE DATA AND METHODS

4.1 The data

We have collected data on public health care expenditure from the Ministry of Health and Consumption, 2003 (Cuentas Satélites del Sistema Sanitario, 1992-1999) as well as complimentary statistical information at the regional level (GDP, population and inflation rates) from a specific tool published by the (Spanish) National Institute of Statistics (INE) containing desegregated data at the AC level (Contabilidad Regional de España). Information on health care inputs and in particular the number of doctors and beds at the AC level has been gathered from the INE database for several years. Data on electoral results has been collected from Eleweb[5], a web page of Spanish political scientists that contains a collection of updated information on electoral results for different electoral calls in Spain. We have collected data from all Spanish regions from 1992-1998 given that this is the period where the largest decentralization move took place. As aforementioned, the devolution process was asymmetrically developed. Indeed, while 7 ACs were empowered with health care responsibilities, the MoH, through a specific agency called INSALUD, centrally ruled the remaining 10 ACs. Therefore, given the information on the specific characteristics of different ACs and the extent to which each AC has been empowered with health care responsibilities, the

[4] For certain common decisions, it draws on the input of the Inter-territorial Council of the NHS — an advisory committee comprising representatives from the central and regional governments — where coordination should legally take place.
[5] http://www.eleweb.net/eleccionsespanya/autonomiques/ (consulted December 2004).

database contains a set of dummy variables for regionally specific institutional arrangements.

4.2 The empirical model

A standard empirical model for public health expenditure determination is usually expressed in a linear specification, as follows:

$$H_{it} = X_{it}\beta + \mu_{it} \quad (1)$$

where the vector of public health care expenditure per capita for each AC (in real terms) is defined by H_{it} , X_{it} is a matrix (NxK) of explanatory variables, β is a vector of parameters and μ_{it} is an identical and independently distributed error term. Yet, the above model might suffer from spatial autocorrelation and therefore might not be correctly specified, given that spatially autocorrelated variables are likely to exert some influence over H_{it} in decentralized NHS models[6]. Reasons for spatial dependence in health care expenditures might be the existence of differences in preferences for health care or heterogeneity in needs. On the other hand, there might be common effects from central governmental policies which can be modelled by specifying a spatial process in the error term of the public health expenditure equation as follows:

$$\mu_{it} = \lambda W\mu + \xi \quad (2)$$

[6] Spatial autocorrelation might adopt two different forms (see Anselin and Florax, 1995 and Anselin *et al.*, 2004 for a detailed description). On the one hand, in autoregressive spatial models, some structural dependence exists between the value of the endogenous variable in an area and the values taken by this variable in other neighbouring areas. On the other hand, in models of autoregressive spatial error disturbances, the spatial dependence is included in the term error.

where $|\lambda| < 1$ is a spatial scalar measuring spatial dependence, W is a spatially standardized matrix (contract's matrix) containing observation location information so that the row sums one and ξ is an error term identically and independently distributed over space. On the other hand, public health expenditure might be influenced by spatial interdependence, so that each jurisdiction's health expenditure decision might be affected by their neighbours' health expenditures, which could be written as:

$$H_{it} = \rho W H_{it} + X_{it}\beta + \zeta \tag{3}$$

where $|\rho| < 1$ is a coefficient diagnosing the existence of spatial dependence, so that each public health expenditure observation is simultaneously determined with health expenditures of neighbouring jurisdictions through spatial weights W. Thus, in the presence of spatial dependence, OLS estimates will be unbiased but inefficient, and hence the inference based on the individual parameter's significance tests will be biased and potentially invalid if omitted from the model in so far as some spatial dependence will remain in the residuals (Revelli, 2001).

Our empirical strategy has been to estimate the basic functional form proposed by OLS with fixed effects and to test whether there is evidence of spatial autocorrelation, either at the level of the endogenous variable or at the residual level. Following the traditional approach, we have computed the Moran I test and the tests based on the Lagrange multipliers principle, LM-LAG and LM-ERR (Anselin and Florax, 1995). The Moran I contrast is a general test that measures the similarity between the correlation in value and space of public health expenditure in this context. However, it provides no additional information about the spatial process form. To investigate this issue in detail, we

employ the robust Lagrange multiplier test for 'spatial lag dependence' (LM-LAG) and the robust Lagrange multiplier test for 'spatial error dependence' (LM-ERR), which allow us, in the case of spatial dependence, to discriminate between the two forms that this dependence can adopt. As noted before, we first need to define a contact's matrix (W), which captures potential interactions or spatial dependence between the different regions. We used a contact's matrix based on the inverse of the squared distance between each region-state capital. The only restriction in using these tests refers to the fact that these two contrasts assume a normal distribution in the errors of the models estimated by OLS. To examine the normality hypothesis, we employ the Kiefer and Salom test that leads us to accept the assumption of normality of the residuals. On the other hand, in the estimated models, we calculated the Breusch and Pagan test and could not reject the null hypothesis of the sample's homoscedasticity in either case. Finally, the model is estimated using a log-log form in so far as then the coefficient can be interpreted as elasticity.

4.3 The variables

On the basis of prior studies, our empirical model includes information on per capita GDP of each AC and population, demographics as well as relative use of inputs, such as number of doctors and beds, and stays per population. FORAL is a dummy variable for those fiscally accountable ACs, GDIR is a dummy variable for those ACs that have health care responsibilities and POLI1 is a dummy variable that takes the value of 1 if the regional and the national incumbent are members of the same party. POLI2 refers to the share of left-wing MPs within each regional parliament[7]

[7] Left-wing parties in Spanish regions in this period refer to the socialist party (PSOE) and the coalition of ecosocialists and former communist party (IU). Alternative specifications, such as an interaction between decentralized responsibilities and political ideology of regional parliaments, was considered in the first instance but was never significant at the 5% level.

We expect income to have a positive coefficient consistently with the previous literature. Aging is a more controversial issue, in so far as on the one hand it might be an indicator of need (higher demand for health care), although some evidence questions whether aging leads to higher health expenditures. A larger availability of inputs should be expected to raise health care expenditure, although dependent on the efficiency of its use. Fiscally accountable regions, in the context of health care being a higher priority for citizens, should be expected to display a positive coefficient. The ideology of the regional and/or national incumbent is expected to follow the traditional left wing and right-wing effects on public expenditure-specific signs.

Previous descriptive analysis indicates significant heterogeneity in health care expenditure pre capita. Interestingly, those regions that are classified as fiscally accountable (the Basque Country and Navarre) exhibit higher health care expenditure per capita. Table 1 summarizes the main expenditure patterns among ACs, with and without health care responsibilities. Interestingly, simple descriptive analysis indicates that the two regions with fiscal responsibilities exhibit a higher expenditure per capita and that regions with a larger GDP are more likely to exhibit higher public health care expenditure.

[Insert Table 1 about here]

Table 2 reports the evolution of the variables examined in the model. Amongst those variables, per capita health expenditure exhibits an increasing pattern consistent with the fact that Spain is experiencing an increasing income per capita as well as a rising pattern of physician's density. Furthermore, during the period analysed we find an increasing number of regions governments ruled by the same party as the one ruling the central government. Finally, table 2

exhibits that the share of the elderly roughly increases over the period examined consistently with the aging process of the Spanish population and the number of hospital stays has remained almost constant.

[Insert Table 2 about here]

5. RESULTS

In explaining our results we distinguish different objectives of our paper, so that the results can be discussed in the light of previous literature. The results obtained are shown in Table 3 and we summarize them in this section as responding to the different specific issues we posed in the paper objectives. Odd columns refer to OLS estimates (provided for comparative purposes) and even columns refer to ML estimates of serial error dependence (SER). All the models estimated exhibit similarly high explanatory power and the number of observations is 119 (7x17).

[Insert Table 3 about here]

5.1 Spatial dependence and decentralization

Table 3 reports the results of different specifications of the public health expenditure determination. Interestingly, in all the different specifications we find that the Moran statistic points towards some form of spatial autocorrelation, but it is unable to discriminate between the aforementioned spatial lag and the spatial error dependence. In all the model's specifications in Table 3 we reject the null hypothesis of absence of spatial dependence. The results obtained

suggest that the spatial dependence is included in the error term and so we re-estimated the model with autoregressive spatial disturbances using the Lagrange multipliers methods (ML-SER). The results obtained using the two estimation methods (OLS and ML-SER) are similar, and the conclusions we can derive from the analysis of estimated parameters' values and signs are the same. However, the non-inclusion of spatial dependence in the model estimation could have affected the inference realized and the validity of the specification tests performed. In addition, the Akaike (AIC) statistic indicates that it is better to use the model with spatial dependence. Thus, there is evidence of spatial dependence among regional health systems in Spain. In NHS systems, which have undertaken decentralization processes, we expect that the mechanisms of inter-governmental competition would take place. The estimates of the spatial error dependence in Table 3 (λ) yield a large and significant estimate. This coefficient indicates that there is a dependence between the decisions taken by the different Autonomous Communities within the sphere of health expenditure per inhabitant.

Consistently with prior evidence, we find that regions that have decentralized health care are more likely to exhibit higher health care expenditure per capita (Lopez-Casasnovas et al, 2005). GDIR exhibits, as expected, positive and significant signs, indicating evidence of the influence of decentralized responsibilities on increasing health care expenditure. This result is consistent with Costa and Rico (2005), whereby vertical competition among ACs results in legitimate and politically accountable regions that are likely to increase the amount of health care expenditure. Indeed, political accountability determines power that leads to policy innovation rather than path dependency, which translates into higher health care expenditure .On the other hand, a similar effect is identified when FORAL is included in the equation: regions that were empowered with fiscal responsibilities exhibit higher public health expenditure.

This result indicates a reversion of the Leviathan hypothesis (Brenan and Buchanan, 1983). In a setting where health care stands as a main priority of constituents, as well as one of the few responsibilities in the hands of regional jurisdictions, one might expect that the mechanisms of the political agency would lead to an expansion of health care expenditure.

5.2 Is Public health care a luxury good?

Our results in Table 3 suggest that unambiguously income elasticities are lower than one in contrast with most studies using aggregate cross-country evidence. Regardless of the specification, we systematically find that public health care expenditure is not a luxury good. Income elasticity estimates lie between 0.98 and 0.66, depending on the model specification, and the coefficients are slightly lower when the model controls for spatial dependence. Therefore, by specifically examining health care as funded by the public sector, we find that on the basis of income elasticity, it is a 'necessity' rather than a luxury good. This evidence is in line with some previous research (Di Mateo and Di Matteo, 1998) and indicates that in examining health care expenditure significant differences emerge when expenditure is decomposed between public and private. Public expenditure might be politically driven, and in countries that structure their health care system along the lines of an NHS system, public health insurance is the mainstream funder and offers health care coverage irrespective of individuals' income. However, the positive and significant sign of the coefficient for GDP might be capturing some evidence of the Wagner law, according to which public expenditure expands with economic development.

5.3 Does ideology and political competition matter?

In NHS countries, the public sector is the mainstream financer of health care. Accordingly, differences in the composition of regional governments are likely to influence the priority of health care as compared to other sources of health expenditure. Interestingly enough, Table 3 provides evidence pointing out that a left-wing composition of regional governments (POL2) was overall less likely to increase health expenditure while when controlling for the coincidence of the same party in government (POL1), it shows the opposite effect. This coincidence of the same government determines an increase in expenditure rather than what could be expected if the mechanisms of a political agency were to take place. Although the coefficient of POLI2 might seem counterintuitive, similar results were found in Tavares (2004) for an aggregate dataset of several European countries.

5.4 The effect of health inputs and size

In line with other studies (Guianoni and Hitris, 2002, Di Matteo and Di Matteo 2003), we find that availability of certain health inputs explains in conjunction with other determinants the expansion of the public health care sector at the regional level. However, as expected, health expenditure is determined by differences in health care inputs and their use. A 1% increase in the relative number of physicians' concentration in a specific AC leads to an increase in 0.5% in per capita health care. On the other hand, a higher use of existing resources leads to a reduction of health care expenditure and number of stays. Another remarkable finding indicates that although an unadjusted capitation mechanism is followed when allocating health care expenditures across ACs, a larger population leads to lower health care expenditure resulting from potential economies of scale in the provision of health care. However,

aging was never significant and is not displayed in Table 3. This result can be explained by the fact that the public financing system has not undertaken a risk adjustment for needs.

6. CONCLUSION

This paper has explored the determinants of public health care expenditure of regions within the Spanish 'system of regional health services' (Lopez-Casasnovas *et a*l, 2005). The Spanish example offers significant evidence of the potential effects resulting from spatial autocorrelation in public expenditure. These effects reject the null hypothesis of absence of spatial interactions and support the hypothesis that spatially autocorrelated residuals might provide some evidence of potential spatial interactions taking place through the mechanisms of the political agency. On the other hand, we have found evidence suggesting that the developments of political and fiscal decentralization in a context characterized by some inter-jurisdictional competition might increase public health expenditure. As expected, those regions with fiscal in additional to political responsibilities in health care (namely the Basque Country and Navarre) expend the most, given that health care stands as the main priority (together with education) of Spanish citizens. On the other hand, on the basis of our findings, we have found that regardless of the specification, public health care expenditure is not a luxury good. Finally, the distribution of health care expenditure is not independent of partisan politics. Indeed, the ideology of the region-state and central state incumbent does have an influence on the expansion of the health care system. Accordingly, in the design of health care systems, decentralization might foster mechanisms leading towards the expansion of health care expenditure. However, political ideology might also influence how health expenditure is distributed within a specific

country and might have counter effects on other areas of public expenditure. However, this issue surpasses the scope of this paper.

Overall, our results suggest that under NHS systems, other factors such as availability of inputs (e.g. number of beds and doctors) do play a role in determining public health care expenditure. The larger the number of inputs employed by one AC, the larger the health expenditure consistently with previous findings that a significant share of health expenditure in Spain is driven by volume of health care rather than prices (Lopez-Casasnovas et al, 2005). Furthermore, whether or not health care is a luxury good largely depends on the capacity of the NHS to reduce the economic and social barrier to access to health care.

A potential limitation of our study lies in the fact that no evidence of private health expenditure is available at the regional level. Some studies indicate that the role of private health insurance (PHI) does play a role in supplementing public coverage, and it is found to be heterogeneously distributed across Spanish regions. Interestingly, PHI is found to normally exhibit elasticities above the one (Costa and Garcia, 2003). Altogether this evidence might suggest that rather than total health care, some share of health care expenditure might be a luxury good. Furthermore, at the aggregate level, private health expenditure has not significantly changed in the period examined and remains at 2.1% of GDP. Therefore, the expansion of the private sector might have expanded in certain ACs and declined in others.

Policy implications can be drawn from our results, especially in the presence of a high demand for health care (health care ranking high in Spanish citizens) and a decentralization process enacting mechanisms for spatial dependence and inter-jurisdictional interactions. However, the nature of political

competition taking place in Spain indicates that regional and national incumbents have incentives to expand health care expenditure as a way to remain in power. Interestingly, since 2002 all 17 ACs have been empowered with health care responsibilities. Our results indicate that unless coordination mechanisms play a more active role, the development of the NHS is likely to be fostered. Potentially, one way to prevent the expansion of health care coverage has to do with the transfer of fiscal responsibilities to regions so that the mechanisms of vertical and horizontal competition take into account potential 'wickesellian connections' (Breton, 1996), whereby constituents are able to compare current levels of health care coverage with levels of taxation.

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TABLES

Table 1. Health expenditure and GDP of Spanish AC

	Health expenditure per capita (Spain =100)	GDP per capita (Spain =100)	Population share (%)	GDP share (%)
Andalucía	99.8	72.9	18.0	13.3
Aragón	103.9	108.3	3.0	3.3
Asturias	106.5	82.8	2.7	2.5
Baleares	83.7	131.1	1.9	2.2
Canarias	93.9	100.0	4.0	3.7
Cantabria	95.0	90.9	1.3	1.3
Castilla-La Mancha	104.1	83.9	4.3	3.6
Castilla y León	91.2	95.9	6.4	6.0
Cataluña	97.8	121.2	15.6	19.1
C. Valenciana	101.6	101.0	10.1	9.6
Extremadura	96.9	67.9	2.7	1.8
Galicia	97.0	80.5	6.9	5.6
Madrid	103.9	129.3	13.0	17.0
Murcia	91.8	82.3	2.8	2.3
Navarra	120.2	125.5	1.4	1.8
País Vasco	112.9	114.4	5.3	6.3
Rioja	96.8	116.5	0.7	0.8
	100	**100**	**100**	**100**

Table 2. Evolution of key health system variables (total Spain) (mean and standard error below)

	Per capita GDP (€)	Per capita expenditure (€)	Physicians /1000 h.	Hospital stays s/pob.	% pop. > 65	POLI1	POLI2	GDIR	FORAL
1992	9,474.1	465.5	3.98	1.23	16.7	Yes: 9	0.49	Yes: 7	Yes: 2
	1,828.5	42.9	0.70	0.36	2.9	No: 8	0.12	No: 10	No: 15
1993	9.715,7	498.4	4.02	1.20	16.9	Yes: 9	0.48	Yes: 7	Yes: 2
	1,849,3	51.9	0.68	0.34	2.9	No: 8	0.13	No: 10	No: 15
1994	10,274.7	498.9	4.08	1.19	17.1	Yes: 9	0.47	Yes: 7	Yes: 2
	1,967.5	53.8	0.66	0.33	3.0	No: 8	0.13	No: 10	No: 15
1995	10,976,8	544.3	4.09	1.23	17.2	Yes: 3	0.40	Yes: 7	Yes: 2
	2,156.8	46.0	0.65	0.32	3.1	No: 14	0.11	No: 10	No: 15
1996	11,571.9	582.0	4.21	1.25	17.2	Yes: 11	0.40	Yes: 7	Yes: 2
	2,284.0	45.9	0.61	0.35	3.2	No: 6	0.11	No: 10	No: 15
1997	12,227.2	601.8	4.28	1.26	17.4	Yes: 11	0.39	Yes: 7	Yes: 2
	2,471.6	52.7	0.62	0.34	3.2	No: 6	0.11	No: 10	No: 15
1998	12,932.1	640.2	4.36	1.27	17.5	Yes: 11	0.39	Yes: 7	Yes: 2
	2,646.7	50.6	0.62	0.36	3.1	No: 6	0.12	No: 10	No: 15
Mean	11,024.7	547.3	4.15	1.23	17.1	Yes: 63	0.43	Yes: 49	Yes: 14
s.e	2,451.2	54.1	0.69	0.38	3.4	No: 56	0.12	No: 70	No: 105

Table 3. The determinants of Health expenditure (per capita) in Spain AC. Estimation results (OLS and ML-SER)

	[1] OLS	[2] ML-SER	[3] OLS	[4] ML-SER	[5] OLS	[6] ML-SER	[7] OLS	[8] ML-SER	[9] OLS	[10] ML-SER	[11] OLS	[12] ML-SER	[13] OLS	[14] ML-SER
Ln (GDP per	0,987[a]	0,976[a]	0,714[a]	0,702[a]	0,677[a]	0,662[a]	0,752[a]	0,743[a]	0,714[a]	0,702[a]	0,752[a]	0,716[a]	0,750[a]	0,714[a]
capita)	(0,000)	(0,000)	(0,000)	(0,000)	(0,000)	(0,000)	(0,000)	(0,000)	(0,000)	(0,000)	(0,000)	(0,000)	(0,000)	(0,000)
Ln (population)	-1,053[a]	-1,012[a]	-1,211[a]	-1,167[a]	-1,254[a]	-1,184[a]	-1,351[a]	-1,192[a]	-1,211[a]	-1,197[a]	-1,351[a]	-1,204[a]	-1,354[a]	-1,210[a]
	(0,000)	(0,000)	(0,000)	(0,000)	(0,000)	(0,000)	(0,000)	(0,000)	(0,000)	(0,000)	(0,000)	(0,000)	(0,000)	(0,000)
Ln (Physistians/			0,533[a]	0,542[a]	0,508[a]	0,512[a]	0,463[b]	0,481[b]	0,533[a]	0,551[a]	0,463[a]	0,489[a]	0,465[a]	0,491[a]
population)			(0,001)	(0,004)	(0,002)	(0,006)	(0,033)	(0,029)	(0,001)	(0,002)	(0,003)	(0,004)	(0,003)	(0,005)
Ln			-0,004[b]	-0,006[b]	-0,006[a]	-0,006[a]			-0,004[b]	-0,005[b]				
(Stays/poplation)			(0,020)	(0,034)	(0,003)	(0,004)			(0,020)	(0,034)				
POLI1					0,020[b]	0,018[b]	0,016[b]	0,015[c]			0,016[b]	0,018[c]	0,016[b]	0,018[c]
					(0,021)	(0,019)	(0,045)	(0,064)			(0,045)	(0,059)	(0,044)	(0,055)
POLI2							-0,338[a]	-0,317[a]			-0,338[a]	-0,316[a]	-0,337[a]	-0,319[a]
							(0,001)	(0,001)			(0,001)	(0,002)	(0,001)	(0,003)
GDIR									17,479[a]	17,023[a]	19,507[a]	18,783[a]		
									(0,000)	(0,000)	(0,000)	(0,000)		
FORAL													21,315[a]	20,769[a]
													(0,000)	(0,000)
λ		0,274[a]		0,281[a]		0,294[a]		0,291[a]		0,317[a]		0,325[a]		0,323[a]
		(0,004)		(0,007)		(0,008)		(0,003)		(0,001)		(0,001)		(0,002)

R^2 adj.	0,998	(*)	0,998	(*)	0,999	(*)	0,999	(*)	0,998	(*)	0,999	(*)	0,999	(*)
AIC-Akaike	-3,588	-3,987	-3,689	-4,024	-3,728	-4,112	-3,752	-4,205	-3,690	-4,171	-3,753	-4,259	-3,712	-4,264
I-Moran	3,137[a]	----	3,098[a]	----	3,127[a]	----	3,412[a]	----	3,392[a]	----	3,278[a]	----	3,280[a]	----
LM-ERR	9,127[a]	----	9,766[a]	----	9,814[a]	----	10,146[a]	----	10,076[a]	----	10,237[a]	----	10,215[a]	----
LM-LAG	1,267	1,198	1,342	1,129	1,323	1,204	1,419	1,219	1,317	1,285	1,328	1,191	1,311	1,184
N	119	119	119	119	119	119	119	119	119	119	119	119	119	119

Notes: Columns 1-14 report panel regressions with fixed effects

p-values in parenthesis

Null hypothesis rejected at significance level [a]ω=0,01, [b]ω=0,05 and [c]ω=0,10

OLS: Ordinary least squares

LM-SER: Maximum likelihood estimation with spatial error autocorrelation

λ : Spatial autocorrelation coefficient

(*) The presence of spatial autocorrelation means the adjusted determination coeffient (R^2 adj.) is inadequate for determining the goodness of fit, and so, as is usual in the literature, we calculated Akaike's infomation criterion (AIC) for each of the estimated models.