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Abstract

This study examines the disparities in the evolution of Spanish regional public health expenditures from 1991 to 2010. We find that the recent development of the Spanish regional public health system have led the regions to reflect a very heterogeneous pattern of behaviour. These differences depend on economic and demographic factors, but also on the ideology of the regional governments. The longer a region is governed by a right-wing party, the lower the public health expenditure. This result suggests the presence of clear partisan behaviour in the Spanish public health system.

Keywords: Convergence analysis, Phillips-Sul; Health expenditure; Partisan behaviour.

JEL Classification. C22;

1. Introduction

The debate on the importance and influence of public expenditure in a determined economy is almost as old as the history of Economics itself as a discipline. Keynes (1936) was one of the precursors of public intervention in the economy with the aim of fomenting aggregate demand in periods of recession. This idea, which remains fully valid in the current economic context, was already present in Malthus (1820), the first economist to realize the importance of strengthening demand through more generous models of public expenditure. As a fundamental part of public expenditure, health expenditure has not escaped from this discussion, becoming especially important in recent years due to, among other reasons, the economic crisis that has struck economies worldwide and the austerity policies that have tried to combat it. From an economic perspective, researchers have tried to work out the most efficient quantity of public expenditure, a major question, especially in times of crisis when public expenditure seems to be the cause of all economic evils and has motivated policies of cutbacks defended with special fervour by parties situated to the right of the political spectrum, an aspect that we will deal with during this study.

A review of how the study of the evolution of health expenditure has been undertaken shows that many papers seek a relation between health expenditure and some macroeconomic and demographic variables, mainly using cross-sectional data. These works include Newhouse (1977), Leu (1986), Parkin *et al* .(1987) and Brown (1987). This cross-sectional approach has the drawback of hiding the dynamic behaviour of the variables, an essential aspect if one wishes to obtain a performance measure for a certain situation, distinguishing between policies and short- and long-term performance. Given this interest, and benefitting from the development of better databases, we have recently witnessed a new upsurge in studies of health expenditure that, using panel data[2] or cointegration analysis[3], allow the inclusion of the temporal dimension that is absent from cross-sectional studies.

In spite of the notable progress propitiated by the inclusion of the dynamic component in these studies, it is no less true that previous works fail to take into account one key

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2 See Hitiris and Posnett (1992), Gerdtham *et al.* (1998) and Barros (1998), amongst many others, in this regard.

3 Culyer (1990) and Blomqvist and Carter (1997) are good examples of the use of these techniques.

aspect when trying to explain the evolution of public health expenditure, namely, geographic disaggregation. If we bear in mind that, in many economies, the decision-making centres have been transferred from the central to the regional governments, it is easy to understand why using this type of regional data has been recently highlighted by Costa-Font and Pons-Novell (2007), amongst others. As a consequence, it comes as no surprise that some papers have recently emerged with the aim of studying the evolution of the health expenditure in countries with an important degree of territorial decentralization. In this regard, we can cite the papers of Di Matteo and Di Matteo (1998), Gianoni and Hitiris (2002), Mosca (2007) and Nguyen *et al.* (2009) for the cases of Canada, Italy, Switzerland and Finland, respectively. The conclusion that can be drawn from these papers is that the use of regional data may complement the analysis of the national ones, as well as minimizing the distortion caused by the aggregation of data on the elasticity of the GDP. A case of special interest that has, to our knowledge, not received much attention is that of Spain. We should note that the Spanish health system has undergone an important process of decentralization that has transferred the decision-making power from the central government to each of the 17 regional governments in a relatively short time. We, thus, wonder whether, in this short time, the regional governments have maintained a similar policy with respect to health expenditure or whether, on the contrary, there are different visions of health expenditure across regions due to, among other factors, questions of an ideological nature.

The latter point has recently been considered in some papers. For instance, Liang and Mirelman (2014) analyse the influence of political factors such as socio-political risk, government stability, corruption and ethnic tensions on public health expenditure, whilst Potrafke (2010) studies how government ideology and electoral results explain the growth of health expenditure in 18 OECD countries from 1971 to 2004. An even better example of the relationship between partisan policies and health expenditure growth is provided in Herwartz and Thelein (2014) who incorporate the ideological factor and the electoral cycles into the analysis of the determinants of public health expenditure for the OECD countries. These authors offer evidence of partisan behaviour, in the sense that right-wing governments spend less on health expenditure than left-wing governments.

Against this background, the aim of the paper is twofold. First, as commented above, we want to know whether the transfer of health competencies from the central government to the respective regional governments has produced changes in health policies or whether a common behaviour has been maintained in all of them. Second, assuming the existence of regional differences, we want to analyse whether some political and institutional factors, such as partisan behaviour, may help to explain them.

The rest of the paper is organized as follows. Section 2 first introduces the Spanish process of regional decentralization in health care and, subsequently, describes the database used. Section 3 analyses the possible existence of common health policies by testing for convergence and carrying out a cluster analysis which allows us to prove the existence of different clubs of regions which share a similar evolution of public health expenditure. Section 4 is devoted to the explanation of these clubs and, particularity, to offering evidence about the presence of partisan behaviour in Spanish public health expenditure. Section 5 concludes.

2. Public health expenditure in Spain

Arguably, the main characteristic of the recent evolution of Spanish public health expenditure has been its decentralization. The Spanish process of regional decentralization was accompanied by the General Health Law of 1986 which consolidates a universal health care system. In 2001, a new finance plan was approved. This plan increased the fiscal responsibility of the regions and accelerated the process of decentralization in the management of the health system.

This complex process implied a case-by-case negotiation between the central and regional governments and the use of very different finance systems for each region (Tamayo-Lorenzo, 2003), mainly due to the influence of historical and political motivations (Costa-Font and Rico, 2006). Seven regions (Cataluña, Galicia, Islas Canarias, Comunidad Valencia, Andalucia, Navarra and País Vasco) gradually implemented their regional health policy after 1991 whilst, in the rest, the health competences were transferred in 2002.

This institutional context has been taken into account in the analysis of the determinants of regional health expenditure in Spain and some empirical papers, such as Cantarero and Lago-Peñas (2012), analyse the influence of these three finance systems on health expenditure by region. Furthermore, Lauridsen *et al.* (2008) analyse the behaviour of pharmaceutical expenditure for the Spanish provinces and Costa-Font and Moscone (2008) study, separately, pharmaceutical, inpatient care and primary care expenditures. The latter paper is of special relevance given that these authors find some of both neighbouring and political effects in total health expenditure decisions.

These very important results have an important drawback because) they only consider a very short period which, additionally, finishes just after the completion of the transfer process and, consequently, cannot capture the consequences of the adoption of different regional health policies. Thus, it seems to be appropriate to use a more extended database, such as that recently provided by the BBVA Foundation and IVIE (2013), to capture the possible differences after the completion of the transfer process. This database contains statistical information on regional public health expenditure in Spain in 1991-2010. The total public health expenditure is also disaggregated into several components, the most important being hospital services, pharmaceutical, primary and capital expenditures. They represent, on average for the total sample, 55%, 21%, 15% and 4% of the total expenditure, respectively. We have transformed these data into real per capita values by using the corresponding regional GDP deflator. Appendix A includes the list of the 17 regions, with their respective acronyms that we will in this paper, and the average growth values. A quick glance at these results permits us to observe that the region of MAD shows the lowest growth rate ratios, except in the case of pharmaceutical expenditure, in which the lowest rate is shown by BAL. By contrast, MUR presents the highest growth rates for total and hospital services expenditure, BAL for primary and capital expenditures and GAL for pharmaceutical expenditures. We can also observe that pharmaceutical and, especially, capital expenditure exhibit a great heterogeneity, especially when comparing them with total expenditure or hospital services expenditure.

In order to better interpret the evolution of the different public health expenditures, Figure 1 presents the coefficient of variation for the regional health expenditure components[4]. We can observe that most of these components reduce the value of this coefficient from the beginning of the sample up to 2001 but, after the end of the transfer

[4] Capital expenditure exhibits very heterogeneous behavior and its inclusion in Figure 1 impedes the correct interpretation of the results. Consequently, we have opted to eliminate it**.**

process, the coefficient of variation grows. We can interpret this result as evidence against the existence of a convergence process. The exception is the case of hospital services, which reduces its coefficient of variation and, therefore, we should expect this component to show a higher degree of convergence.

This initial analysis allows us to conclude that regional public health expenditure may show a high degree of heterogeneity, casting doubt on the existence of a common regional health policy. Instead, it seems to be appropriate to consider the possible existence of several clubs with different regional health policies, determined by political trends of the regional government. The next section is devoted to offering evidence in this regard by using convergence tests.

3. Testing for convergence in Spanish public health expenditure

The previous analysis has shown the disparities that exist between the behaviours of public health expenditure in the different regions of Spain. However, we should note that there seems to be a high level of correlation between these expenditures. To analyse this point, we have obtained some statistics in order to verify the possible existence of spatial correlation, as suggested by Costa-Font and Moscone (2008). In particular, we have taken into account the results of Pesaran (2004) who develops a new statistic for testing cross-sectional dependence. This statistic is defined as follows:

$$CD=\sqrt{\frac{T}{N(N-1)}}\sum_{i=1}^{N-1}\sum_{j=i+1}^{N}\hat{\rho}_{ij} \qquad (1)$$

with $\hat{\rho}_{ij}$ being the pair-wise Pearson's correlation coefficient of the residuals obtained from augmented Dickey-Fuller type regression equations. This statistic asymptotically converges towards a standard N(0,1) distribution under the null hypothesis of no cross-sectional dependence. Alternatively, we can use the statistic proposed in Breusch and Pagan (1980), which can be defined as follows:

$$LM=T\sum_{i=1}^{N-1}\sum_{j=i+1}^{N}\hat{\rho}_{ij}^{2}\xrightarrow{AS}\chi^{2}_{N(N-1)/2} \qquad (2)$$

The results for the CD and the LM statistics are reported in Table 1. We can observe that the null hypothesis of no cross-sectional dependence is easily rejected, which confirms our intuition about the high correlation in the health expenditures for the 17 regions.

[Insert Table 1]

This initial result confirms the existence of spatial correlation for regional public health expenditure. However, if we take into account the huge differences between regions, we can easily conclude that the presence of spatial correlation is not enough to guarantee the existence of a unique pattern of behaviour. To this aim, we can test for the presence of a convergence process in Spanish public health expenditures. To do so, we have followed the recent papers of Phillips and Sul (2007, 2009) (PS hereafter) in which they develop a very interesting framework to, first, test for the convergence hypothesis and, if this is rejected, to analyse the existence of clubs of regions that show similar patterns of behaviour.

Following these authors, let us consider that X_{it} represents the variable of interest (in the present case, the per capita health expenditure either total or its functional components) with i=1, 2, …, 17 and t= 1991, …, 2010. This variable can be decomposed as $X_{it} = \delta_{it} \mu_t$, where μ_t is a common component and δ_{it} is the idiosyncratic one. PS suggest testing for convergence by analysing whether δ_{it} converges towards δ. To do so, they first define the relative transition component:

$$h_{it} = \frac{X_{it}}{N^{-1}\sum_{i=1}^{N} X_{it}} = \frac{\delta_{it}}{N^{-1}\sum_{i=1}^{N} \delta_{it}} \quad (3)$$

In the presence of convergence, h_{it} should converge towards unity, whilst its cross-sectional variation (H_{it}) should go to 0 when T moves toward infinity,

$$H_{it} = N^{-1}\sum_{i=1}^{N}\left(h_{it}-1\right)^2 \rightarrow 0,\ as\, T \rightarrow \infty \quad (4)$$

PS test for convergence by estimating the following equation:

$$\log\frac{H_1}{H_t}-2\log\left[\log\left(t\right)\right]=\alpha+\beta\log(t)+u_t,\ t=\left[rT\right]+1,...,T \quad (5)$$

with r taking values in the (0.2, 0.3) interval, following the results of PS. Equation (5) is commonly known as the log-t regression. The null of convergence is tested by way of a standard t-statistic and, according to PS, the null hypothesis is rejected whenever this t-statistic takes values lower than -1.65. If we reject convergence, we can use the PS algorithm to consider the existence of clubs[5].

The results that we have obtained are reported in Tables 2 and 3. Table 2 shows that the convergence null hypothesis is rejected for the total public health expenditure as well as for most of its functional components. The only exception is the hospital services expenditure. Furthermore, Table 3 confirms the presence of different clubs of regions that exhibit a similar pattern, a first step toward finding possible partisan health policies. Panel I of this table shows the original clubs obtained from the application of the PS algorithm. Given that this procedure tends to estimate more clubs than necessary, it is advisable to test for convergence between adjacent clubs. The final result leads us to the unification of some initial clubs for pharmaceutical and primary expenditures.

[Insert Table 2]

[Insert Table 3]

To facilitate the interpretation of the results) we have presented them on coloured maps in Figure 2.

[Figure 2]

The analysis of these figures leads us to some interesting insights. A simple look at the maps provides some evidence against the existence of a homogeneous pattern of behaviour for all the expenditures considered. In any event, we can test for the similarity of the estimated clubs by using the statistics of van der Waerden and Kruskal-Wallis. These statistics take the values 7.12 and 6.28, which leads us to reject that the

[5] See Phillips and Sul (2007, 2009) or Panopoulou and Pantelidis (2013) for a description of the use of this algorithm.

composition of the estimated clubs for the 3 components of public health expenditure are similar, when we use a standard 5% significance level. However, if we exclude the pharmaceutical expenditures and only consider the estimated clubs of primary expenditure and capital expenditure, we cannot reject the null hypothesis because these statistics take the values of 0.60 and 0.42, respectively, well below the critical value even for a liberal 10% significance level. Moreover, we cannot reject the null hypothesis of similarity of the distributions when we consider the clubs of primary and capital expenditures (0.61 and 043, respectively, for the van der Waarden and Kruskal-Wallis statistics), whilst we obtain the opposite result when we analyse pharmaceutical versus primary (4.72 and 5.14) and versus capital expenditure (4.05 and 3.65). Therefore, it seems clear that the pattern of behaviour of pharmaceutical expenditure is rather different to that of the other components.

We should also interpret the composition of the different clubs. To make this easier, the arithmetic means of these clubs have been obtained and included in Figure 3. If we begin with public health expenditure, Figure 8a, we can observe that all the indexes grow, including those of the divergent regions (AND, EXT and MAD). Moreover, the growth rate for the whole sample does not vary very much between the club indexes (3.1, 2.8, and 3.0, respectively, for clubs 1-3), whilst the divergent regions exhibit an average growth of 2.0, 3.7 and 1.3 for AND, EXT and MAD, respectively. However, the behaviour at the end of the sample is very different. The club indexes show a growth of 2.3, 2.8, and -1.4 for 2009-2010, whilst AND, EXT and MAD grow at -2.7, 0.4 and -2.2, respectively. Thus, the behaviour is quite heterogeneous after the advent of the crisis because only AND, MAD and the regions included in club 3 diminished their per capita public health expenditure, whilst EXT maintains it and the rest have increased it at a rate similar to the pre-crisis one, especially the regions included in club 2 which showed a positive growth both in 2009 and in 2010.

[Figure 3]

The three functional components which do not exhibit convergence (pharmaceutical, primary and capital expenditure) show different patterns of behaviour. The pharmaceutical component grows at a rate over of 4% in 1991-2010. This growth rate is lower for primary expenditure, especially for MAD and the regions included in club 2 and even lower for capital expenditure, which is divided into two clubs that show a growth rate lower than 1.5%. However, the differences are even greater when considering 2009-2010. First, we can see that primary expenditure hardly varies for clubs 1, 2 and EXT during this period. By contrast, it clearly diminishes for MAD. Pharmaceutical expenditure increases for clubs 1 and 2, although at slow growth rates, whilst it decreases for club 3 (which includes MAD and other regions). Finally, capital expenditure shows a dramatic drop during the post-crisis period.

4. Explanation of the clubs: Is there partisan behaviour?

The previous section has shown that the public health expenditure of the Spanish regions exhibits different patterns of behaviour. Thus, it is of interest to investigate the sources of these differences. We should bear in mind that these differences can be explained by several factors, including geographical factors, socio-economic factors and partisan behaviours. In order to capture these effects, we have selected the following variables.

- Geographical and spatial factors may be useful because the geomorphological characteristics of a region may condition its public health expenditure. For instance, if the population is disseminated over a large area, the regional government may need to increase expenditure to cover the whole population. By contrast, if the population is concentrated, the control and optimization of the expenditure is clearly easier and, consequently, this should imply a reduction in health expenditure. Thus, variables such as the extension of the each region (SURF), measured in km^2 and the population density (DEN) may help us to explain the creation of the clubs.

- Education: it is generally admitted that increases in the education level of a particular area can lead to increments in the health level of this area. This variable is proxied by the percentage of population with tertiary studies (SUP) and the percentage of illiterate population (ILLIT).

- Climate Factors: health may be influenced by some climatic factors. We use the level of humidity (HUM) and the temperature in terms of days with a temperature above 25 (TG25) and below zero degrees (TL0).

- Population structure: the structure of the population is also important in determining the volume of public health expenditure. A high proportion of dependent population may lead to an increase in expenditure. To cover this possibility, we use the percentage of population over 65 years old (G65) and under 15 years old (L15).

- Economic characteristics: it has been appropriately documented that health expenditure can be explained by per capita GDP. It is possible, however, that the elasticity of the per capita GDP does not vary for the different regions and, consequently, this variable cannot help to explain the differences. To check this we use the average per capita GDP of each region (GDPpc).

- Fiscal regime: in Spain, different fiscal regimes co-exist. NAV and PAV have a special status. To capture this effect, we have employed the dichotomous variable FISCAL, which takes the value 1 for NAV and PAV and 0 for the rest.

- Partisan decisions: public health expenditure clearly depends on the decisions taken by the regional government. If the government favours the private sector over the public sector, it will probably enact policies to reduce public spending and, consequently, public health expenditure. The type of behaviour is defended by the Popular Party (PP), which has governed some Spanish regions since the arrival of the democracy in the late 1970's. To measure this partisan characteristic, we will use the average percentage of votes for the Popular Party, the percentage of years over the total sample that this party has governed a region (PPGOV) and the percentage of years over the total sample that a right-wing party has governed a region (RWGOV)[6]. Furthermore, we should note the existence of some regionalist or nationalist parties that play a very important role in the government of some regions. In order to take into account the influence of these regionalist/nationalist parties on public health expenditures, we have additionally created the variable NAT which reflects the percentage of votes for these parties.

- Dummy variables: we have also considered some dummy variables for regions that consist of islands) (DISLAND) and for regions formed by a single province (DSINGLE).

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[6]We have chosen to consider as right-wing parties the Popular Party and the following nationalist/regionalist parties: the PAR (Aragonese Party), the Canary Coalition, the PNV (Basque nationalist party) and Convergence and Union (Catalan nationalist party).

Prior to the use of these variables to estimate an appropriate model, we consider it useful to carry out a simple descriptive analysis of these data. Table 4 summarizes the average values of these variables for all the regions included in each club, taking as reference the case of the total public health expenditure.

[Table 4]

The average values of the different explanatory variables show that the regions assigned to club 1 have mainly been governed by a left-wing party, exhibit a low population density, maintain a degree of dependent population above the national average and have a per capita value higher than the Spanish average. By contrast, the regions included in club 3 have mostly been governed by right-wing parties, show a high population density, a population over 65 which is lower than the national average and a high level of education.

Having determined and described the data set, we should analyse the interaction between the explanatory variables and club membership. To that end, an ordered probit model has been used to predict how regional characteristics affect the likelihood that any given region would be found to be a member of each convergence club. To explain the structure of the model, we should note that the values of the variable y_i depend on the number of estimated clubs. In general, we have that:

$$y_i = m \text{ for } m=1,\ldots,M \tag{6}$$

with M being the number of clubs estimated by the PS methodology. These assigned values are assumed to be derived from some unobservable latent variable y_i^* where:

$$y_i^* = x_i'\beta + u_i, \quad i=1,2,\ldots,17 \tag{7}$$

where β is a $k\times 1$ parameter vector and u_i reflects the stochastic disturbance term.

We could interpret that the different m values imply an ordination of the clubs and, therefore, the observed variable y_i can be related to the latent variable by way of the following equation:

$$y_i = m, \text{ if } \alpha_{m-1} \leq y_i^* \leq \alpha_m \tag{8}$$

for a set of parameters α_0 to α_M , where $\alpha_o<\alpha_1<\alpha_2...<\alpha_M$, with $\alpha_o=-\infty$ and $\alpha_M=\infty$.

The conditional probability of observing the m-th category can be written as:

$$Pr(y_i=m/x_i)=Pr(\alpha_{m-1}\leq y_i^*\leq\alpha_m) = Pr(\alpha_{m-1}\leq x_i'\beta + u_i \leq\alpha_m) =$$

$$= Pr(u_i\leq\alpha_m - x_i'\beta) - Pr(u_i \leq \alpha_{m-1} - x_i'\beta) \text{ for } m=1,.., 4. \quad (9)$$

To evaluate the conditional probability, a distributional assumption for the disturbance term u_i is required. In the present case, we assume a normal distribution, yielding the ordered probit model[7]. Table 5 reports the results of the estimation of this model for total health expenditure, as well as for the functional components that reject the convergence null hypothesis. For all these models, the final specification has been selected by following a general-to-particular strategy, where the non-significant variables have been iteratively removed. Finally, we should note that the quality of the estimations is limited by the shortness of the sample because we have only 17 possible observations. The sample availability is even shorter for total public health expenditure and for its primary component if we exclude the divergent regions. In order to mitigate this problem, it seems advisable to assign the divergent regions to some of the estimated clubs. The cases of EXT and MAD are not very complicated, given that it seems to be appropriate to include them in the first and last club, respectively. The case of AND is more problematic. However, as this region is included in club 1 for primary and capital expenditure and its relative transition path is more correlated with that of club 1 than with those of clubs 2 or 3, we have decided to include AND in club 1 for total public health expenditure[8].

[Table 5]

The estimated model for health expenditure includes the following variables: the per capita GDP (GDPpc), the population density of the region (DEN), a dummy variable that takes value 1 if the region is made up of islands (DISLAND) and, the most important for our purposes, the percentage of years that the region has been governed by a right-wing party (RGOV).

[7] The ordered logit model leads us to similar results, although with a slightly lower explanatory power.
[8] We should note that the results remain almost unaltered when AND is excluded from the sample for total public health per capita expenditure.

The interpretation of the model is quite easy. The evolution of public health expenditure is directly related to the growth of the economy and the higher the GDPpc, the more likely it is that the region will be assigned to clubs with higher per capita health expenditure. By contrast, the higher the population density, the more likely it is that the region will be assigned to clubs with low public health expenditure. The two island regions, BAL and CAN, show a lower value of public health expenditure and, therefore, are included in clubs 2 and 3.

But, in our view, the most important result is that of the relevance of the variable RWGOV in explaining the behaviour of the different clubs. This variable measures the number of years that a right-wing party has governed a region and, consequently, the influence of its policies on public health expenditure. As we can easily see, the longer a region has been governed by a right-wing party, the lower the public health expenditure and, therefore, the higher the probability of being in clubs 2 and 3. Thus, we should conclude that there is a clear and significant partisan behaviour in the evolution of Spanish public health expenditure.

To better appreciate the magnitude of the estimated effects, we have carried out a sensibility analysis by drawing the predicted probability of being in each club for an "average region"[9], allowing each explanatory variable to vary in turn. The graphical results of these simulations are shown in Figure 4. We can see (Figure 4a) that regions where a right-wing party has not governed have a high probability of being included in club 1, which implies comparatively lower public health expenditure. The longer that a region has been governed by a right-wing party, the lower the probability of belonging to club 1.

We can appreciate more variations when the demographic variable (DEN) is considered. For instance, Figure 4b shows that a population density lower than 200 inhabitants per km^2 implies a probability greater than 50% of this region being included in club 1. The fact that 9 regions have a population density lower than this value leads us to understand the importance of this variable in determining the adscription of a particular region to a

[9] Assuming that the variable DISLAND takes the value 0, the estimated probability of this average region being in club 1 is 60% and 37% for club 2. If DISLAND takes the value 1, these probabilities change to 27% and 65%, respectively

club. Finally, as we can observe in Figure 4c, the higher the per capita GDP, the greater the probability of being assigned to club 1.

[Figure 4]

The results for the disaggregated components are quite heterogeneous, as expected. We can observe that the economic dimension of the region is not statistically important to explain the cluster results. By contrast, the demographic variable (DEN) maintains its importance and appears in all the estimated models, although its effects seem to be lower for capital and pharmaceutical than for primary expenditures. If the region consists of islands, the pharmaceutical expenditure, but not the other functional components, is negatively affected. We should also note that we use two additional explanatory variables. The primary and pharmaceutical expenditure models include a variable that reflects the administrative composition of the region. The variable SINGLE takes the value 1 if the region is made up of a single province and 0 otherwise. Its effect is different in the two models, implying a comparatively lower per capita pharmaceutical expenditure but a greater per capita primary expenditure. Finally, the age structure helps us to explain the evolution of capital expenditure and the higher the percentage of population under 15 (L15), the higher the expenditures.

We have left until last the analysis of the presence of partisan behaviour in the functional components. The results in Table 6 corroborate its existence in Spanish regional public health expenditure**.** It is true that the estimated model for pharmaceutical expenditure does not include any partisan variable, but this is understandable if we bear in mind that there is some lack of decentralization in the decisions related to this expenditure. Nevertheless, it can be seen that the variable RWGOV is statistically significant for explaining the results of the regional clusters of primary service expenditure. The estimated effect is similar to that observed in total public health expenditure and the longer a region has been governed by a right-wing party, the greater the probability of being included in the group of the smallest spenders. We can also offer some evidence of partisan behaviour for capital expenditure given that we observe the existence of some effects associated with nationalist/regionalist parties. However, the meaning of this partisan effect is the opposite of that previously seen because the regions with a higher regionalist vote are more likely to be included in the clubs that exhibit a higher level of expenditure. This result can be understood if we bear in mind the way these nationalist/regionalist parties act: they tend to be deeply-rooted in certain areas, leading them to favour these areas to the detriment of the rest of the region and indicating some level of patronage. However, given the lower precision of the results for this level of disaggregation and the difficulty of defining what is and what is not capital expenditure, we believe that this result should be interpreted with some caution until new data help us corroborate this finding.

5. Conclusions.

This paper has analysed the evolution of regional public health expenditure in Spain. The sample data covers the period 1991-2010. During these years, the Spanish health system underwent a very important centrifugal movement that transferred the decision-making centres for health from the central government to regional governments. We first studied whether there is a single public health expenditure policy or whether, on the contrary, different patterns of behaviour exist. To do this, we used the PS convergence test, which does not support the convergence hypothesis. This statistic led us to conclude that there are important disparities in the regional evolution of the per capita public health expenditure in spite of the short time elapsed since the beginning of the process of transferring health competencies from the central government to the regions.

The PS methodology allows us to group the Spanish regions. Again, we observe a heterogeneous behaviour, especially in the evolution of health expenditure after the crisis. With respect to the three functional components, pharmaceutical, primary and capital expenditure, which showed different patterns of behaviour during the pre-crisis period, our results lead us to conclude that these differences are even greater in 2009-2010.

The presence of clubs in regional public health expenditure invites us to examine the determinants of this grouping. According to our results, the inclusion of a region in a particular club mainly depends on its population density, its per capita GDP and, very importantly, the percentage of years that this region has been governed by a right-wing party (RWGOV). This result comes to corroborate previous findings in the literature, such as those of Costa-Font and Moscone (2008) or Herwartz and Theilen (2014), and reinforces the idea that institutional factors play a decisive role in the determination of the regional health expenditure. In particular, our results prove that regions with right-wing governments tends to show lower public health expenditure than similar regions governed with a different ideology, confirming the existence of partisan behaviour in Spanish public health expenditure.

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Table 1. Testing for spatial dependence.

	CD	LM
Total Public Health expenditure	9.67*	437.31*
Hospital Services Expenditure	6.84*	327.81*
Pharmaceutical Expenditure	16.54*	587.57*
Primary Expenditure	15.57*	435.24*
Capital Expenditure	4.51*	222.48*

This table reflects the values of the statistics for testing the non cross-sectional dependence null hypothesis. CD represents the statistics defined in Pesaran (2004) whilst LM is the statistic defined in Breusch and Pagan (1980).

* means the rejection of the null hypothesis for a restrictive 1% significance level.

Table 2. Testing for convergence.

Variable	$\widehat{\beta}$	t-stat
Total Public Health Expenditure	-1.29	-13.55*
Hospital Services Expenditure	-0.28	-1.39
Pharmaceutical Expenditure	-1.40	-13.63*
Primary Expenditure	-1.02	-6.88*
Capital Expenditure	-0.79	-2.81*

The table reports the statistics proposed by Phillips and Sul (2007) to test for convergence. The term log t stands for a parameter which is twice the speed of convergence of this club towards the average. t-stat is the convergence test statistic, which is distributed as a simple one-sided t-test with a critical value of -1.65 (see Phillips and Sul, 2007 for further details).

* means the rejection of the convergence null hypothesis.

Table 3. Estimated Clubs.

Panel A. Total Public Health Expenditure			
I. Original Clubs		II. Testing for adjacent clubs.	
Regions	t-stat	Clubs	t-stat
Club 1: ARA, AST, CLM, MUR, NAV, PAV, LAR	0.69	1+2	-3.17
Club 2: BAL CAB CYL CAT CVA	-1.50	2+3	-1.76
Club 3: CAN GAL	1.62		
No convergence: AND, EXT, MAD			
Panel B. Pharmaceutical Expenditure			
I. Original Clubs		II. Testing for adjacent clubs.	
Regions	t-stat	Clubs	t-stat
Club 1: ARA AST CVA EXT GAL	0.87	1+2	-0.91
Club 2: CYL CLM MUR PAV	2.39	1+2+3	-11.64
Club 3: AND CAN CAB CAT NAV LAR	1.48	3+4	-5.47
Club 4: BAL, MAD	2.28		
Panel D. Primary Expenditure			
I. Original Clubs		II. Testing for adjacent clubs.	
Regions	t-stat	Clubs	t-stat
Club 1: AND, ARA, BAL, CAB, CYL, CLM, CAT, NAV, PAV, LAR	-0.71	1+2	-1.04
Club 2: AST MUR	-1.52	1+2+3	-5.64
Club 3: CAN CVA GAL	1.32		
No convergence: EXT, MAD			
Panel E. Capital Expenditure			
I. Original Clubs		II. Testing for adjacent clubs.	
Regions	t-stat	Clubs	t-stat
Club 1: AND, ARA, BAL, CAN, CAB, CYL, CLM, CAT, CVA, EXT, GAL, MUR, NAV, PAV	1.21	1+2	-2.81
Club 2: AST, MAD, LAR	-1.23		

The clubs reported have been obtained by applying the algorithm proposed by Phillips and Sul (2007) which aims to find groups of regions with similar convergence speeds to the average. t-stat is the convergence test statistic, which is distributed as a simple one-sided t-test with a critical value of −1.65 (see Phillips and Sul, 2007 for further details).

Table 4. Average values of the different variables.

Variable	Definition	club1	club2	club 3	Total Spain
PPGOV	Percentage of years in which the region has had a PP president	0.31	0.56	0.52	0.42
RWGOV	Percentage of years in which the region has had a right-wing party president.	0.42	0.69	0.82	0.57
NATIO	Percentage of votes for nationalist / regionalist parties in elections. Average	0.1	0.2	0.2	0.2
DENSITY	Regional population density. Average	93.02	165.16	395.71	167.64
SURFACE	Regional surface area (in km2)	33,445	31,981	15,017	29,762
PC GDP	GVA at constant 2000 prices divided by the population. Period average.	18,764	17,786	18,906	18,501
L15	Percentage of population under 15 years old. Period average.	15.34	14.83	15.39	15.20
G65	Percentage of population over 65 years old. Period average.	17.42	17.11	15.21	16.94
RAIN	Average rainfall.	595.96	606.02	680.34	613.81
HUM	Average degree of humidity.	61.79	63.22	60.14	61.92
TG25	Average number of days with temperatures below 0.	111.90	106.89	101.16	108.53
TL0	Average number of days with temperature above 0.	25.60	19.56	15.54	22.05
ILLITERACY	Percentage of population without studies. Average	2.70	1.61	2.31	2.31
SUP STUDIES	Percentage of population with higher education and doctoral degrees. Average	21.59	20.65	22.89	21.54

This table presents the average values of the variables that have been used in the ordered probit estimation. Clubs 1-3 correspond to the results of the application of the cluster algorithm to the per capita total public health expenditure.

Table 5. Ordered probit estimates of health expenditure convergence club.

	Total	Pharmaceutical	Primary	Capital
GDP pc	-0.0002			
	(-3.50)			
RWGOV	1.82		1.88	
	(2.08)		(1.66)	
DEN	0.008	0.004	0.005	0.004
	(4.18)	(3.15)	(2.65)	(2.29)
DISLAND	1.66	2.27		
	(2.81)	(3.71)		
DSINGLE		1.50	-1.61	
		(2.01)	(-2.17)	
L15				-0.64
				(-3.16)
NATIO				-9.00
				(-2.51)
Pseudo R^2	0.44	0.44	0.48	0.63
Percentage of cases correctly predicted	70.6%	77%	82.4%	88.2%

This table includes the results of the estimation of ordered probit models for the total public health expenditure (per capita) and its components. The dependent variable is the ordinal value of the different clubs in which the health expenditures are clustered. In order to mitigate the lack of freedom degrees, we have included the divergent regions (AND and EXT) in club 1, whilst MAD has been joined to the regions of club 3.

The values in parentheses represent the robust estimations of the standard deviations of the estimators.

Appendix A.

Table A1. List of regions and growth rates of the public health expenditures

Number	Region	Acronym	Total Expenditure	Hospital Services	Pharmaceutical Expenditure	Primary Expenditure	Capital Expenditure
1	Andalucía	AND	1.91	1.69	2.65	1.88	17.8
2	Aragón	ARA	2.90	2.93	3.43	1.45	22.1
3	Asturias	AST	3.03	3.27	4.37	2.28	7.1
4	I. Baleares	BAL	3.15	3.88	2.37	3.39	48.2
5	Canarias	CAN	2.31	2.82	7.20	1.20	9.7
6	Cantabria	CAB	2.89	2.55	4.58	2.13	31.8
7	Castilla y León	CYL	2.81	3.11	4.12	1.46	27.1
8	Castilla-La Mancha	CLM	3.41	4.27	3.29	2.06	22.0
9	Cataluña	CAT	2.58	3.36	2.97	1.54	21.4
10	C.Valenciana	CVA	2.24	3.03	2.97	1.21	16.8
11	Extremadura	EXT	3.60	3.75	4.49	2.56	25.5
12	Galicia	GAL	3.52	3.39	9.15	2.29	16.9
13	Madrid	MAD	0.98	0.95	3.38	0.11	7.0
14	Murcia	MUR	4.04	4.62	4.90	2.51	14.9
15	Navarra	NAV	2.03	2.61	2.86	0.99	41.4
16	País Vasco	PAV	2.61	2.85	4.36	1.75	26.1
17	La Rioja	LAR	3.64	4.45	4.86	2.91	6.3
	Average values		**2.80**	**3.12**	**4.10**	**1.87**	**21.3**

Figure 1: σ-convergence: Evolution of the coefficient of variation.

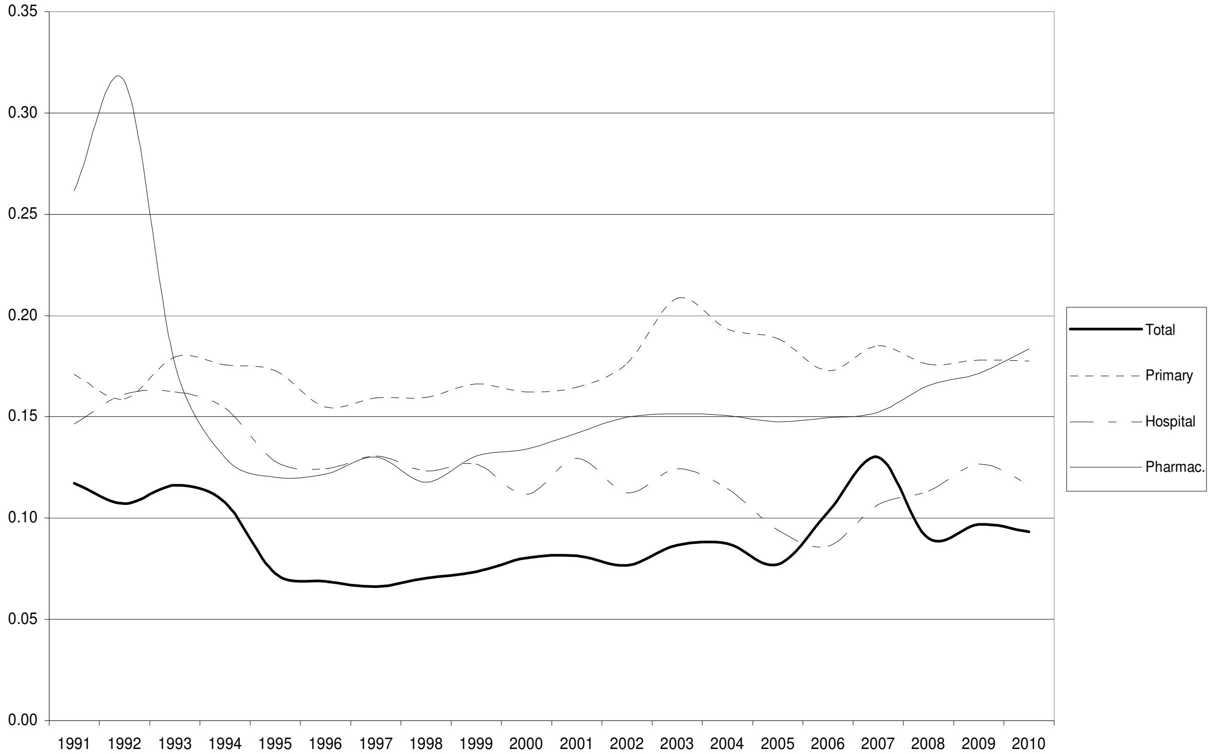
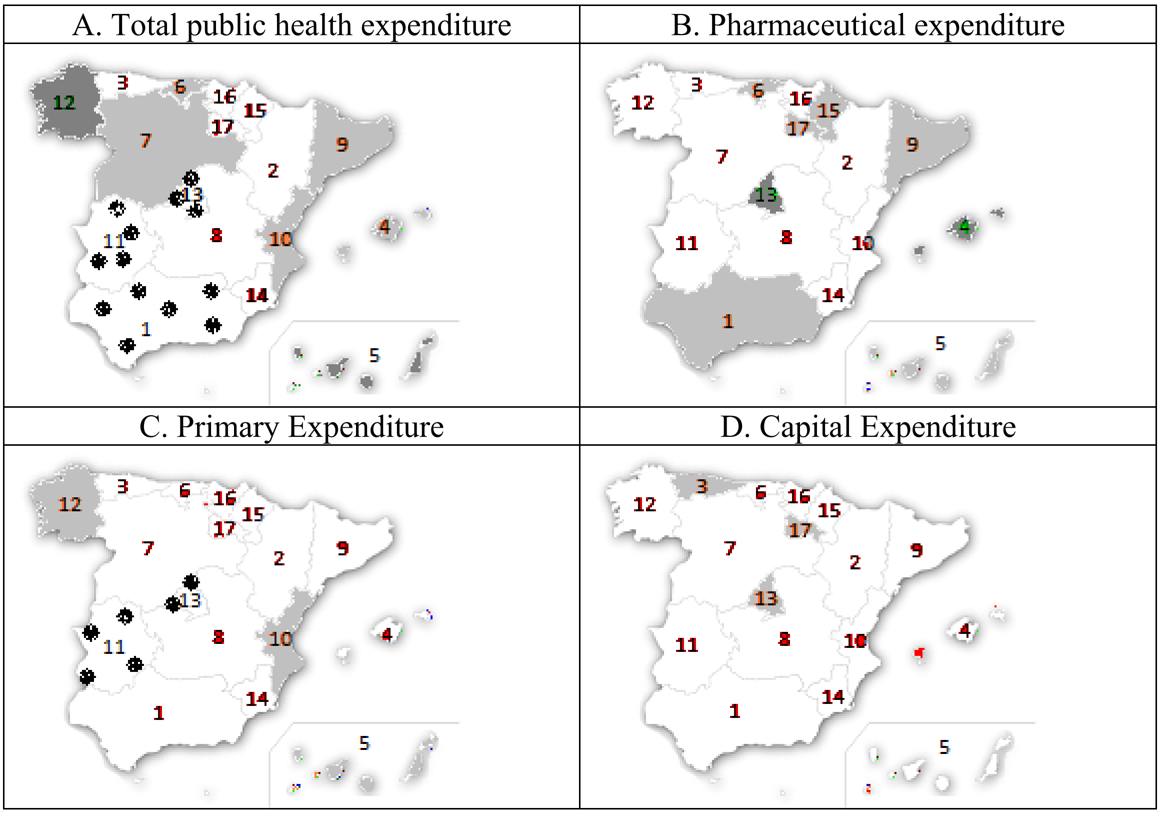


Figure 2. Estimated clusters for Total Public Health Expenditure and its functional components.



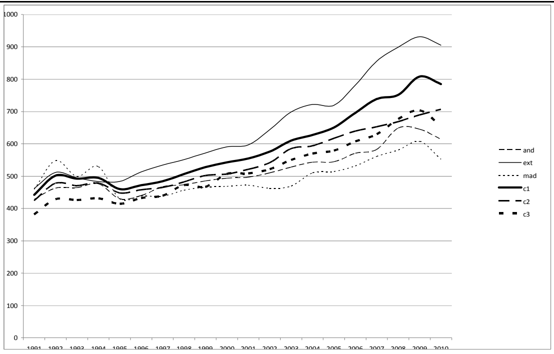
Regions of Cluster 1: white
Regions of Cluster 2: light grey.
Regions of Cluster 3: dark grey.
Divergent regions: black dotted.

Source: Own elaboration.

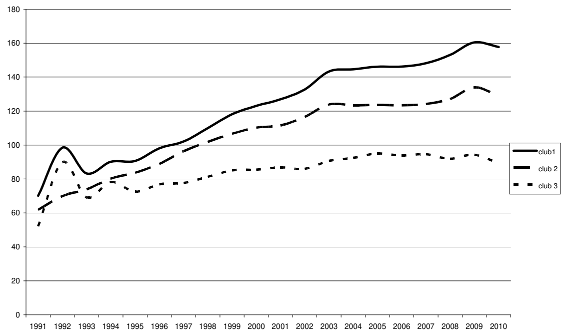
The regions are numbered in Table A1.

Figure 3. Average value of the different clubs and divergent regions

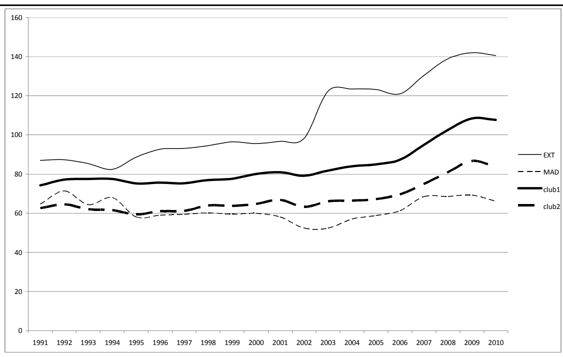
a) Total Public Health Expenditures



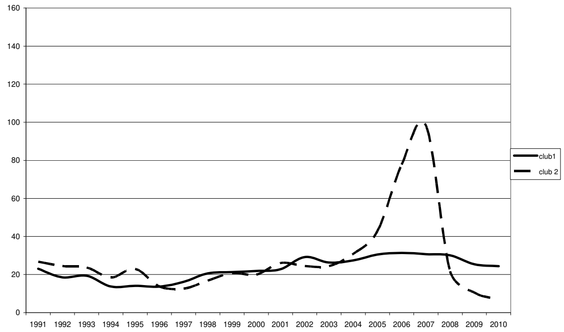
b) Pharmaceutical Expenditures



c) Primary Expenditures



d) Capital Expenditures



This figure represents the average value of the health expenditure of the regions included in the different clubs, jointly with the health expenditure of the divergent regions

Figure 4. Sensibility analysis. Total Public Health Expenditure

Figure 4a. Variation of the probabilities due to change in the number of years that a region is governed by a right-wing party.

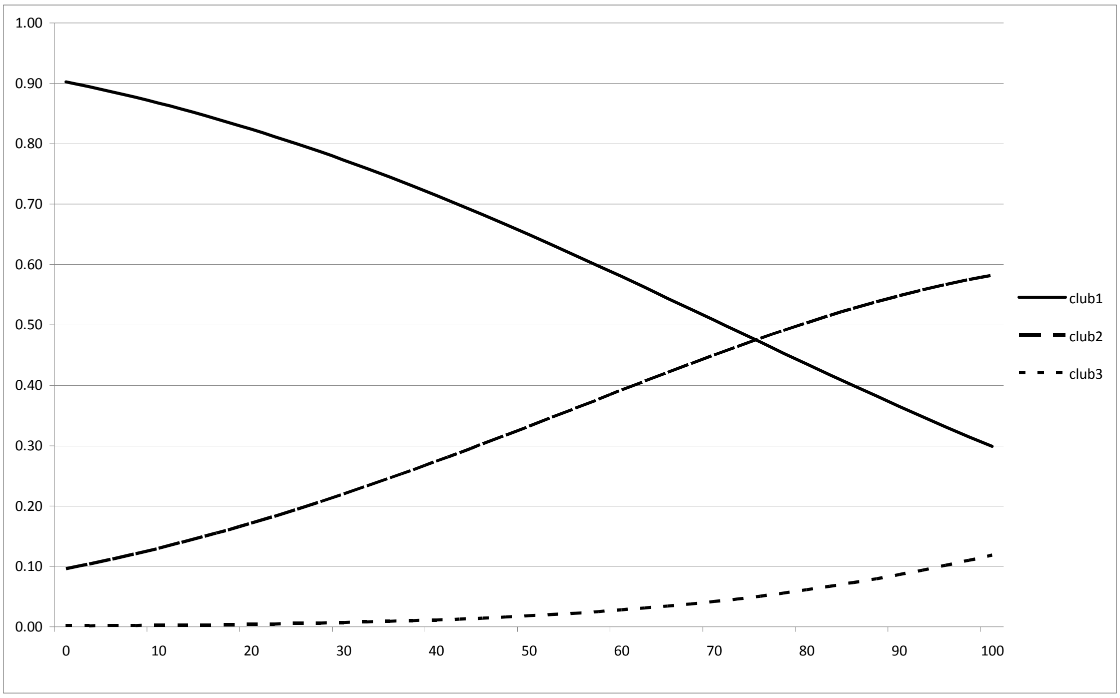


Figure 4b. Variation of the probabilities due to change in the density of the region.

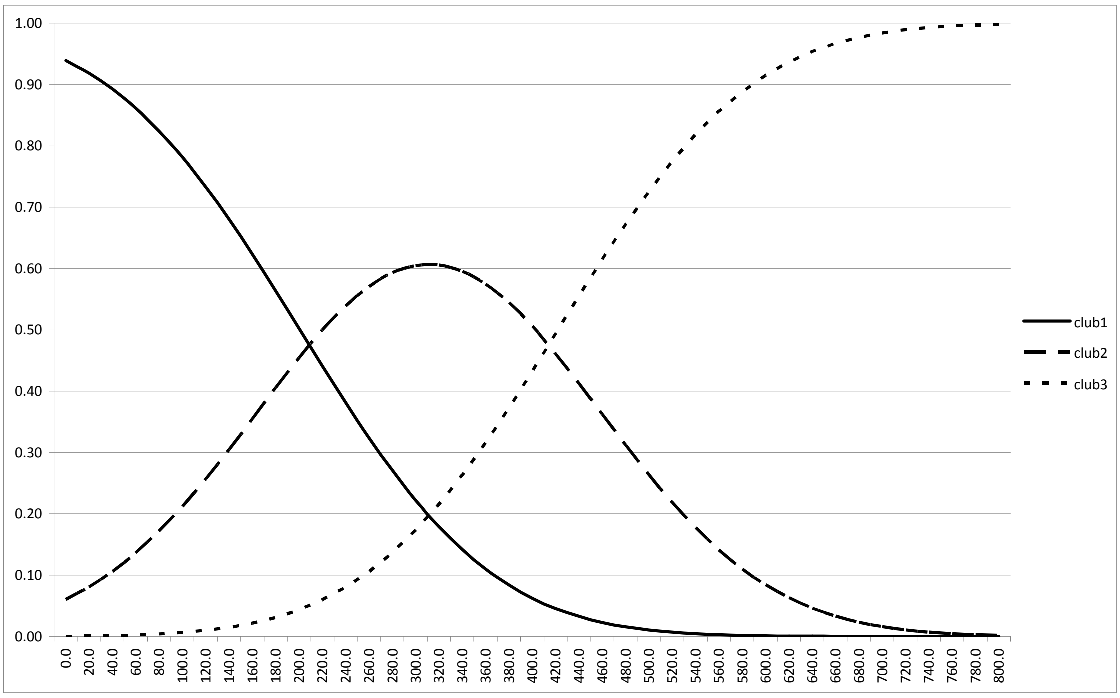
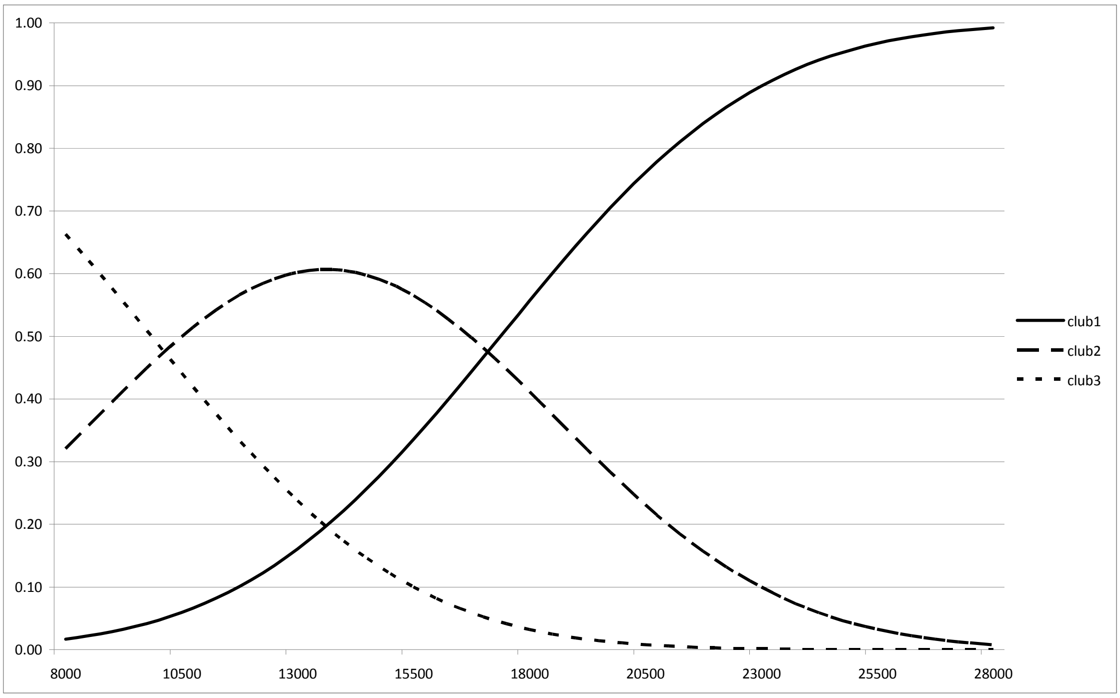


Figure 4c. Variation of the probabilities due to change in the per capita GDP.



Note: This table exhibits the estimated probability of a non-insular region being included in clubs 1-3 when one of the explanatory variables varies and the rest of the explanatory variables take the sample average values.