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Regional Differences In Sports Participation: The Case of Local Authorities in England

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Abstract

This paper investigates the determinants of sports participation at regional level in England by applying beta models to Sport England's Active People Survey. We analyse the differences in the regional characteristics among 325 English Local Authorities (LAs). The results show the importance of some socio-demographic variables such as educational level, ethnicity, and size of population; economic variables (income levels and occupations); sport volunteering; and weather conditions. Neither medium term sports funding, nor sports infrastructure are significant factors in explaining differences of sports participation among the English LAs. The findings suggest a need for cross party consensus on sports policy over time to safeguard continuity of policy objectives beyond the four year government term.

Keywords: Sports participation, Beta model, England, Sports infrastructure, Regional analysis.

Introduction

Between the 1960s and the 1990s there was a significant increase in the number of people taking part in sports in Europe (Gratton & Taylor, 2000). Nevertheless, over the last years, this tendency has dramatically stopped: around 40% of Europeans don't participate in sports (European Commission, 2010). Many European countries, such as Austria, Belgium, Finland and Portugal (Van Bottenburg, 2005), Great Britain (Sport England, 2012) and Spain (García & Llopis, 2011), seem to have reached a stag-

nation point, while countries such as The Netherlands and Italy show a decline (Van Bottenburg, 2005). Beyond Europe, Canada and the US suffer a disconcerting decrease in sports participation (Bloom, Grant, & Watt, 2005; Barnes, 2007).

This stagnation in sports participation is of considerable concern to health and social policy. In this respect, there is a large body of scientific evidence regarding the positive impact of sport and physical activity on health and wellbeing (e.g., WHO, 2010, ; Downward & Rasciute, 2011). At the same time, surveys show a dramatic increase in the numbers of over-weight and obese people in developed societies.

England has not been an exception in this context. During the period 1993-2010, as English sports participation reached a stagnation point, obesity increased by 13% and 10% in male and female population respectively. Consequently, in 2010, more than a quarter of adults and 30% of children aged 2 to 15 were classified as obese (NHS, 2010). The expansion of obesity in England has a noteworthy regional character, with poorer areas in the Northern regions being stronger hit than the prosperous South. Within the ten year period to 2010, the number of prescription items dispensed for obesity increased from 127 thousand to 1.45 million items, a rise greater than 1,000%. This relationship between sport and obesity was central to the new coalition government's policy of public health as outlined in the White Paper '*Healthy Lives, Healthy People: Our Strategy for Public Health in England*' (Department of Health, 2010), raising the question of whether public investment in sport is able to negotiate the regional character of obesity.

Consequently, the stagnation of sports participation in the last ten years, coupled with evidence of health, has resulted in a strong increase in academic interest in sports participation research in several European countries: Belgium (Scheerder & Vos, 2011), Germany (Breuer & Wicker 2008, 2009; Wicker, Breuer, & Pawlowski, 2009), Great Britain (Downward, 2007; Downward & Rasciute, 2011; Eberth & Smith, 2010), Scandinavian countries (Fridberg, 2010) and Spain (Downward, Lera-López, & Rasciute, 2011; García, Lera-López, & Suárez, 2011).

Generally speaking, these contributions have examined sports participation using microdata obtained in various surveys. As far as we know, in spite of the significant regional differences shown in many studies (Sport England, 2010, ; García & Llopis, 2011), no contribution has tried to explain differences in sports participation from a regional perspective, considering only regional characteristics. This paper endeavours to fill this gap by developing an economic approach to investigate sports participation among the English Local Authorities (LAs). Using the information provided by Sport England through the Active People Survey 5 for the period 2010-2011, we analysed the determinants of sports participation and regular participation considering the regional differences in 325 English Local Authorities. Methodologically, we use a beta model, which is a continuous distribution, providing positive density only in a finite length interval. This feature, together with its flexibility, makes this model particularly appropriate for the analysis of variables that express percentages, as in the case of sports participation, letting us determine how participation relates to other variables through a regression structure.

Finally, it must be underlined that in this study the examined regional element is synonymous to Local Authority analysis. In England, Local government refers collectively to administrative authorities of local areas. This may have different forms including:

a. two-tier authorities: where district (lower-tier) councils, responsible for council housing, leisure and recycling, interact with single (upper-tier) councils responsible for schools, public transport and social services;
b. unitary: where there is a single layer of administration responsible for local services, and spanning over metropolitan district councils, boroughs, and city, country or district councils;
c. town and parish councils, covering smaller areas than district councils and having responsibility for allotments, public toilets, parks, pond, war memorials and local halls or community centres, and
d. shared services across administrative bodies such as police, fire service and public transport.

The remainder of the paper is as follows. Section 2 analyses sports participation in England, section 3 reviews the empirical evidence concerning the key determinants of sports participation, section 4 describes the data set and the methodology adopted in the study, section 5 presents the main estimation results, and section 6 concludes with a summary of the main findings, policy implications and opportunities for further research.

Sports Participation in England: Facts and Trends

The expansion of leisure centres in England contributed towards increasing sports participation rates steadily through the 70s and 80s, reaching for the first time stagnation and decline in the 90s. At the same time there was an expansion of female participation through some sports related to keep fit and swimming, although gender inequalities still prevailed. Table 1 shows this decline throughout the 1990s. In the case of 'at least one activity' sports participation declined from 64.5% in 1990 to 58.5% in 2002. Similarly, using the most restrictive definition (i.e., excluding walking), participation declined from 47.8% in 1990 to 43.2% in 2002.

For the period 2005-2006, in England; according to the Active People Survey, 21% of adults were involved in sports activities at least three times a week and 40% at least once a week. In 2006, we have a reversal of the ten-year decline, with sports participation rising to 48.3% (excluding walking) and 68.2% (in general). Nevertheless, switching from the General Household Survey (GHS) questionnaire to the Active People Survey, despite the consistency of the definition, may have contributed to the sudden rise in participation. It is possible that the Active People Survey questionnaire in its detail helps people recall more information than in the case of GHS.

The detail of the Active People Survey enables the derivation of several sport definitions; the one used here is the KPI1, defined as adults (16+) participating at least three times a week for at least 30 minutes, with moderate intensity, for the purpose of leisure or recreation Although the policy focus has shifted to other definitions, such as the 'one million indicator', it remains an important overall indicator of sport and active recreation at national, regional and sub-regional level.

After adjusting for incomplete data and seasonality, the post-2005 element in Table 1 was derived from the Active People Surveys 1-5. As it is shown in this Table, following an initial rise in 2007, the participation rate for the intensive KPI1 definition fluctuated with biannual peaks at exactly 21.9%. It is remarkable that this pattern negotiated the most important crisis of capitalism since the Second World War without changing

Table 1: Sports participation. England 1987-2011, %

	1987	1990	1993	1996	1999	2002	2005	2006	2007	2008	2009	2010	2011
At least one activity (excluding walking) once every 4 weeks	44.7	47.8	47.3	45.6	44.4	43.2	47.0	48.3	—	—	—	—	—
At least one activity once every 4 weeks	60.7	64.5	63.7	63.6	61.1	58.5	65.8	68.2	—	—	—	—	—
At least three 30' activities per week, moderate intensity (KPI1)	—	—	—	—	—	—	20.9	21.2	21.9	21.2	21.9	21.4	21.9

Source: General Household Survey, Active People Survey, SIRC

Note: From 1971 to 2002, sports participation figures were derived from the General Household Survey (GHS). The main definition of sports participation was "at least once in the last four weeks. In 2005, Sport England developed the Active People Survey, a survey with a bigger sample size including information about frequency and intensity of sports participation. Despite consistency in sports definitions, the series are not completely homogenous and comparable.

its structure. In part, this may be due to the increased level of participation that results from a rising stock of free time as unemployment increases, or to the inspiration effect on the way to the 2012 Olympic Games (see Kokolakakis, Lera-López, & Panagouleas, 2012).

Empirical Evidence of the Determinants in Sports Participation

Our theoretical motivation is Becker's (1965) model of labour and leisure choice, which assumes that agents derive satisfaction from consuming 'basic' commodities (such as going to the theatre, a meal or sports participation). The production and consumption of those commodities represents time out of work. Economic consumer choice models of sports participation are built, under which agents have to decide if they participate at all and the amount of time spent in participation (Humphreys & Ruseski, 2010). In this way, sports participation can occur directly by committing goods and time in the production or consumption of sport, or indirectly through acquiring consumption or social capital that eventually may lead to sports participation (Downward, Lera-Lopez, & Rasciute, 2012). This further implies that relationships of causality are ambiguous. For example, income may be seen as a positive determinant of sports participation, as one requires it for the acquisition of sport equipment or membership fees. At the same time people with higher income are likely to have a more active social life and civic participation (social capital), leading to a better chance of sports participation. Yet, according to the Taking Part Survey (DCMS, 2011), cultural participation (and participation in general) tends to be higher among upper socioeconomic groups even in the least

deprived areas of England. This is also a pattern observed in the case of sports participation. For a given income category, as we introduce sport we are likely to reach higher income levels. For example the practice of sport can provide management experience to young people within clubs, self-discipline and an expanded social circle and social capital, all critical factors in generating income (LIRC, 1997). Because of the aforementioned cyclical nature in sports participation and the cross section data used, the analysis should be seen in terms of correlation rather than causal determination.

Since the first empirical studies dealing with leisure and sports participation, the modelling of sports participation decision has increased in complexity. Rather than applying Ordinary Least Squares, logistic and two-step Heckman models opened the way for more developed models, such as double-hurdle and zero-inflated ordered models (Downward et al., 2011).

Due to the different approaches used, caution should be exercised in any comparison of determinants of sports participation. Firstly, the list of sporting activities varies from one study to another and there is no common definition agreed upon participation in the literature. Secondly, the sports participation variable is measured in various ways: participation or not, frequency and intensity in sports participation, time spent in participation, etc. Thirdly, most studies use secondary data sources with a long sample size while other studies develop ad-hoc surveys with primary data (Breuer, Hallmann & Wicker, 2011). Fourthly, the comparability of estimates from different statistical methods may be difficult in both sign and magnitude.

However, despite these problems, it is possible to make some qualitative general assessments concerning the main determinants of sports participation. Following Downward et al. (2011, 2012) we classify the key determinants into three different groups: socio-demographic, economic and sports variables.

Among the socio-demographic variables, most cross-sectional studies reveal an age-sport participation/frequency negative relationship (Humphreys & Ruseski 2006, 2010, 2011; Downward, 2007; Breuer &Wicker, 2008; Hovemann & Wicker, 2009; Wicker et al., 2009; Eberth & Smith, 2010; Fridberg, 2010; Downward & Rasciute, 2011; Scheerder & Vos, 2011; Kokolakakis et al., 2012) due to biological and physical limitations, affecting males more than females (Breuer & Wicker, 2009). On the other hand, using a longitudinal perspective, Stamatakis and Chaudhury (2008) claim an increasing participation among middle-aged and older adults. Also, in some countries, frequency increases with age (Humphreys & Ruseski, 2006; Lera-López & Rapún-Gárate, 2007; García et al., 2011), perhaps due to a higher level of health awareness among older people.

Gender is another important determinant of sports participation, with a consensus about the fact that men, in general, not only participate in sport more than women (Humphreys & Ruseski, 2006; Downward, 2007, Lera-López & Rapún-Gárate, 2007; Breuer & Wicker, 2008; Hovemann & Wicker, 2009; Eberth & Smith, 2010; Fridberg, 2010; Downward & Rasciute, 2011; Kokolakakis et al., 2012) but they also show a higher frequency of participation (Humphreys & Ruseski, 2006; Eberth & Smith, 2010). This asymmetric behaviour can be attributed to biological factors or cultural and social influences (eg., differences in housing and relative family responsibilities).

Similarly, a consensus about the positive effect of education has been formed (Humphreys & Ruseski, 2006, 2010; Downward, 2007; Breuer & Wicker, 2008; Hovemann & Wicker, 2009; Wicker et al., 2009; Eberth & Smith, 2010; Fridberg, 2010;

Downward & Rasciute, 2011; Scheerder & Vos, 2011; Kokalakakis et al., 2012). Following Fridberg (2010), it could be argued that a higher level of education might lead to a greater awareness of the personal benefits and importance of sport. Traditionally, higher educational levels are associated with higher hourly wages and more available resources to take up sporting activities. However, the evidence is less conclusive in terms of frequency, with a negative relationship suggested in some studies (e.g., Downward & Riordan, 2007) while others, such as Humphreys and Ruseski (2010) and Ruseski, Humphreys, Hallmann and Breuer (2011), reported a positive relationship.

Ethnicity has been widely included into analysis of sports participation in countries such as England (Downward, 2007; Stamatakis & Chaudhury, 2008) and the US (Humphreys & Ruseski, 2006). Generally, there is a positive correlation between participation and being white while other ethnicities could suffer from cultural barriers (Breuer et al., 2011).

According to Downward et al. (2011, 2012), household influence on sports participation is commonly determined through variables such as marital status and number of both children and adults in the household. Since time is finite, any increase in the time devoted to sport will always be constrained by competing demands from other leisure activities and other uses (family, etc.). In this context, it should be expected that married people and families with more members participate less in sport (Humphreys & Ruseski, 2006, 2010; Downward, 2007; Hovemann & Wicker, 2009; Eberth & Smith, 2010; García et al., 2011; Ruseski et al., 2011), although this negative relationship does not happen in other studies (e.g., Downward & Rasciute, 2011).

Population size is commonly considered a proxy variable, measuring the availability of sports facilities with ambiguous effects. On the one hand, the empirical evidence might lead us to expect less access to certain types of sporting facilities in rural areas than in suburbs or cities (Hovemann & Wicker, 2009); on the other hand, in large cities there is greater availability of a wider range of entertainment options and consequently more substitute leisure activities for sport. In some European countries, the latter effect is greater than the first one, leading to a higher sports participation in rural areas (García et al., 2011), while in the EU-25 it seems that individuals living in large towns tend to be more involved in sport (Van Tuyckcom et al., 2010).

As sports participation requires consumption of some sporting goods and services, a second group of key determinants show the influence of economic variables. There is consensus on a positive relationship between income and sports participation (e.g. see Downward, Dawson, & Dejonghe, 2009 and Breuer, Hallmann, Wicker, & Feiler, 2010, for a literature review). However, among regular practitioners, income has no influence on the frequency of sports participation (Gratton & Taylor, 2000) or the influence is negative (Humphreys & Ruseski, 2006, 2010, 2011; Downward & Riordan, 2007). As García et al. (2011) argued, this could be explained because the higher the income, the higher the opportunity cost of time spent on any sports activity. Professional status as a proxy income variable is positively related to sports participation, with higher professional level groups (Van Tuyckom & Scheerder, 2010) and white-collar jobs (Humphreys & Ruseski, 2010) having the highest level of sports involvement.

In addition, working, in general, is negatively related to sports participation (Downward, 2007, Breuer & Wicker, 2008; Hoveman & Wicker, 2009; Eberth & Smith, 2010), confirming a substitute effect between sport and other leisure and work choic-

es. However, other authors (Downward et al., 2009; Wicker et al., 2009), found a positive relationship, as sport is used 'to compensate' for work life.

Finally, a third group of determinants included in many studies relate to the influence of sport supply. Generally speaking, sports participation is induced or constrained by sport supply. For example, Downward and Rasciute (2011) report that sports facilities in general promote participation in sports. Wicker et al. (2009) show that a poor supply of sports facilities reduces the regularity of sports activities. Nevertheless, the empirical evidence is far away from being clearly conclusive. Hallmann, Wicker, Breuer, and Schönherr (2012), at municipality level in Germany, show that sports facilities are of importance when predicting sports participation, although the influence depends on the type of both sport and sporting facility. Similar results are shown by Humphreys and Ruseski (2007) in the US: the effect of government spending on participation depends on the nature of the sporting and physical activity. According to Hallmann, Wicker, Breuer, and Schüttoff (2011), the impact of sport supply on sports participation depends on the size of population where a sports facility is located. In Spain, Pascual, Regidor, Martínez, Calle, and Domínguez (2009) found no relationship between the provision of sporting facilities and participation in jogging, swimming and gymnasium use.

To sum up, a positive relationship is expected between some demographic/economic variables ([such as gender (males), education, ethnicity (white), and income)] and sports participation. In addition, a negative relationship with age and unclear effects of population size and sports infrastructure on sports involvement should be tested more carefully.

Methodology and Data and Methodology

Data

The majority of data was taken directly from the Active People Survey 5 (2010/2011), the largest ever survey of sport and active recreation in Europe (Sport England, 2012). This was the latest survey available at the time of writing. Further in adopting a cross sectional approach we follow the practice of all the economic impact reports in the UK, starting with the Henley Centre for Forecasting report (19876). The Survey started in mid October 2010 and ran continuously for 12 months until the middle of October 2011. 166,000 English adults (age 16 and over) were interviewed by telephone across the country. The sample was randomly stratified and the results are representative of the total adult population in the country, at regional and local levels. From the Survey, a dataset was developed, collecting information about the 325 English Local Authorities. In this sense, all examined variables relate directly to the Local Authorities as percentages, without specific references to personal information.

From the Survey, two variables were selected as dependent variables: "sports participation" and "regular sport participation". They correspond, respectively, to the definitions: *"percentage of adults participating at a sport activity for training, competition or recreation, at least in one 30 minutes moderate intensity session, during the last four weeks*" and "*percentage of adults participating at a sport activity for training, competition, or recreation, in sessions of at least 30 minutes of moderate intensity, at least three times per week*". The second definition, being the more intensive one, is closer to the

current health policy recommendations and is more relevant in informing policy (KPI1, as explained in the previous 'facts and trends' section). The first is more inclusive and remains relevant for comparisons with previous datasets. This definitional distinction is consistent with much of participation analyses in Europe, examining people passing through a hierarchy of participation stages (e.g., COMPASS Project, see for more details Gratton, Rowe, and & Neal, 2011). In both definitions above, walking is included if it is intensive, while recreational cycling for commuting purposes is excluded. From this point onwards, the first variable is referred as 'sports participation' and the second as 'regular sports participation'.

As independent variables, and following our theoretical motivation and the empirical evidence available, four different groups have been considered:

- First, socio-demographics variables including gender (male), age (three intervals: 16-34 – omitted as a base variable –, 35-64 and over 64), ethnicity (white), size of households (including: single households, presence of children and households with four or more adults), educational level (degree level, A-level and GCSE or not finishing GCSE – omitted), percentage of urban population, and health limitations (long standing illness).

- Second, economic variables, including: income level (with three categories: up to 20,799, 20,800- 41,599, and over 41,600 – omitted), council house, type of occupation (professional, managerial and technical, skilled – non-manual, skilled – manual, partly skilled, and unskilled occupations; from them, only '*skilled non-manual*' and '*unskilled*' were included in the final analysis), economic/working status (six categories: full-time jobs, part-time jobs, retired – omitted –, looking after children, students, and unemployed), median gross weekly level of earnings, and 'live and work in the same area'.

- Third, sports variables, including not only some variables closely related to sports participation, such as the percentage of sports volunteers in the region, but also some others reflecting the level of sports infrastructure. In particular, access to sporting facilities has been incorporated into the analysis, through three variables: a) the percentage of population that have 20 minute access to three types of facility (taken from pool, hall, health & fitness, grass pitch, synthetic turf pitch or golf course) of which at least one has a high level of quality ('Quality Assured'); b) the percentage of population that live within 20 minutes travel time from three types of facilities (without any Quality Assured restrictions); and finally c) the percentage of people living within 20 minute travel of one type of facility, as defined above. We have also taken into account variables reflecting the sport funding in the region (Local Funding) and the quality of the regional provision of some services (Comprehensive Performance Assessment Score), including sports services, to the population. As local funding in sports we have included Lottery funding and Exchequer awards (both distributed through Sport England to the English regions) and capital expenditure in sports, derived from Local Authority sources. As these funds could vary from one year to another, we have considered the total amount in the period 2007-2010[1].

- Finally, another set of variables, such as the total area of inland water (*lake area*) and the costal length, relates to participation in water-sports. Information is included on temperature and number of days with rain higher than 1mm to check the influence of the weather on sports participation. *Lake area* and *Coast length* were derived using

Table 2: Selected variables. Descriptive statistics

	Mean	Std. Dev.	Var. Coef. (%)
1. Dependent variables			
Sports participation: Percentage of adults (+16) participating at a sport activity at least 30 min. (moderate intensity session) during the last four weeks.	46.27	4.48	9.6823
Regular sports participation: Percentage of adults (+16) participating at a sport activity at least 30 min. (moderate intensity session) at least three times per week.	22.27	3.29	14.7732
2. Explanatory variables			
2. 1. Socio-demographic variables			
Single households: Percentage of one-member households in the region.	19.8175	3.4139	17.2267
Children: Percentage of households with at least one child in the region.	30.4746	3.6563	11.9979
Four or more adults: Percentage of households with four or more adults in the region.	11.4180	2.9828	26.1237
A-Levels: Percentage of people having an A-Level certificate in the region.	17.7810	2.6088	14.6718
Higher education: Percentage of people having a degree (as their highest qualification) in the region.	27.5323	9.0100	32.7252
Long standing illness: Percentage of people with a limiting long lasting illness, disability or infirmity.	23.6543	3.8742	16.3784
Male: Percentage of people/population being male in the region.	40.4276	2.3945	5.9229
Age 35-64: Percentage of people/population between 35 and 64 years old in the region.	54.8096	3.0018	5.4768
Age over 64: Percentage of people/population over 64 years in the region.	28.4572	4.6292	16.2672
White: Percentage of people/population being white in the region.	92.6929	10.9147	11.7751
Urban: Percentage of people/population living in urban areas in the region.	85.1043	15.9083	18.6927
2. 2. Economic variables			
Council house: Percentage of people in the region living in council houses (Council houses are built and operated by Local Authorities to supply well-built homes on secure tenancies at reasonable rents to, primarily, working class people).	6.2961	4.6148	73.2962
Income up to 20,799: Percentage of people with personal income below 20,799 per year in the region.	33.5227	8.0226	23.9318
Income 20,800 - 41,599: Percentage of people with personal income between 20,800 - 41,599 per year.	33.8473	4.2712	12.6190
Skilled occupation Non-manual: Percentage of people developing skilled occupation (non manual) in the region.	16.9187	2.8327	16.7430
Unskilled occupation: Percentage of people developing unskilled occupation in the region.	2.9872	1.4558	48.7346

Table 2: Selected variables. Descriptive statistics, continued

	Mean	Std. Dev.	Var. Coef. (%)
Full-time: Percentage of people working in full-time jobs in the region.	44.9449	4.4786	9.9646
Part-time: Percentage of people working in part-time jobs in the region.	13.4348	2.1556	16.0449
Looking after children: Percentage of people looking after children and not working in the region.	3.9910	1.1825	29.6292
Student: Percentage of students as working status in the region.	7.4113	2.8313	38.2025
Unemployed: Percentage of unemployed people as working status in the region.	4.5358	1.9544	43.0883
Median earnings: Level of median gross weekly level of earnings in the region in .	412.4990	69.5110	16.8512
Live and work same area: Percentage of residents in a region that also work within it.	57.2479	15.9102	27.7918
2. 3. Sport variables			
Local funding 2007-2010: Total Lottery Funding, Exchequer Awards and Capital Expenditure in sport during the period 2007-2010 in LAs, 000s.	6,532.9	10,892	166.7359
CPA: Number of stars per region of the Comprehensive Performance Assessment (CPA). It measures the Local Authority performance in providing services. The score has five categories from zero to four stars.	2.5670	1.0504	40.9194
Sport volunteers: Percentage of people in the region who have volunteered in sport related work in the last year (at least one hour a week).	6.3086	1.5598	24.7250
20 min 1 facility quality assured: Percentage of population that have 20 minutes access (on foot in urban areas and by car in rural areas) to three types of facility (from pool, hall, health & fitness, grass pitch, synthetic turf pitch or golf course) of which at least one is Quality Assured.	24.5439	21.0374	85.7134
20 min 3 facilities: Percentage of population that live within 20 minutes travel time (on foot in urban areas and by car in rural areas) from three types of facilities (without any Quality Assured restrictions).	79.7480	10.4587	13.1147
20 min 1 facility: Percentage of population living within 20 minutes travel time (on foot in urban areas and by car in rural areas) from one sporting facility.	98.5723	2.4218	2.4569
2. 4. Others			
Lake area: Total area of inland water in a region, including lakes totally within its limits and lakes that intersect its 10km radius based perimeter.	9.1708	4.5567	49.6871
Coast length: Total length of coast in the region, including sea and major rivers within 10km radius.	325.6930	417.8815	128.3053
Temperature: An index on temperature variability in the region based on maximum and minimum values derived from 192 weather stations across the UK.	1.9840	0.1106	5.5746
Rainy days: Number of days with a rain higher than 1mm over the month of the interview in the region.	4.7960	0.1357	2.8294

Geographic Information System (GIS) analysis, *Temperature* and *Rainy days* were obtained from meteorological data provided by the Met. Office, UK.

Table 2 shows the list of the variables finally selected to be included in our empirical study, and their main descriptive statistics (mean, standard deviation and Pearson's variation coefficient).

Methodology

The selection of the modelling methodology is constrained by the characteristics of the dependent variable. In our case, both variables measuring sports participation are continuous proportions as they take values in the interval (0, 1). The question that focuses our research is how participation in sports is related to other variables through a regression structure.

As Kieschnick and McCullough (2003) point out, although researchers most frequently estimate the parameters of a linear regression model for proportions using OLS, such an approach contravenes two conditions: the conditional expectation function must be nonlinear since it maps onto a bounded interval; and its variance must be heteroskedastic since the variance will approach zero as the mean approaches either boundary point. Due to these problems, a linear model may give impossible predictions (out of the range 0-1), non-normal errors, heteroskedasticity and nonlinear effects (Paolino, 2001).

From Kieschnick and McCullough's (2003) detailed analysis of the advantages and shortcomings of some alternatives to avoid the aforementioned problems, we opted for applying a beta regression model, which was found to be the best option in our circumstances. In this sense, for instance, we could use neither a Tobit model, because our dependent variable is not censored but limited [to the interval (0, 1)], nor a logit regression, since this implies a discrete (binary) dependent variable, whereas proportions ('sports participation' in our case) are continuous variables.

This distribution belongs to the family of continuous distributions, and has the characteristic – unlike other models, such as the normal or the exponential distributions, which have a positive density in an infinite interval – of providing positive density only in a finite length interval, (0, 1). According to the conventions of Generalized Linear Models (GLM), the standard beta model is defined by (Ferrari & Cribani-Neto, 2004)

$$f(x;\mu,\phi) = \frac{\Gamma(\phi)}{\Gamma(\mu\phi)\Gamma((1-\mu)\phi)} x^{\mu\phi-1}(1-x)^{(1-\mu)\phi-1} \qquad \text{with } \mu > 0, \phi > 0$$

$$\text{E}(X) = \mu \qquad \text{Var}(X) = \frac{Var(\mu)}{1+\phi} = \mu(1-\mu)\frac{1}{1+\phi}$$

where $Var(\mu) = \mu(1-\mu)$, μ(location parameter) is the mean of the response variable, and ϕ (scale parameter) can be interpreted as a 'precision' parameter in the sense that, for fixed , the larger the value of ϕ, the smaller the variance of X. The variance is therefore a function of both the mean and the parameter ϕ. As Paolino (2001) points out (p. 326), 'one particularly attractive feature of the beta distribution is its recognition of a relationship between the mean and the variance that may occur with proportions. A normally distributed variable can have any variance. But a beta-distributed variable with a mean close to either 0 or 1 generally has a smaller variance than a proportion with a mean of 0.5. Any covariate in a quantitative model that has a large effect upon the mean is also likely to imply a heterogeneous variance'.

The beta distribution models heteroskedasticity in such a way that the variance is largest when the average proportion is near 0.5, while the mean assumes different values in different regions depending on the values of the explanatory variables $\mu_i = f(b_0 + b_1 x_{1i} + b_2 x_{2i} + ...)$.

The beta distribution uses the logistic transformation

$$\mu_i = \frac{\exp(b_0 + b_1 x_{1i} + b_2 x_{2i} + ...)}{1 + \exp(b_0 + b_1 x_{1i} + b_2 x_{2i} + ...)}$$

to ensure that μ_i remains between 0 and 1, and the resulting regression coefficients can be interpreted as log-odds (Smithson & Verkuilen, 2006).

The beta density function can have quite different shapes (symmetrical, 'J', 'inverted J', 'U') depending on the values of the two parameters, so it is very flexible and versatile: this model can produce a unimodal, uniform, or bimodal distribution of points that can be either symmetrical or skewed. Therefore, its empirical use comprises a wide range of applications. Modelling proportions is just one of them (see more details in Gupta and Nadarajah, 2004).

Results and Discussion

Before modelling sports participation in the English LAs, the degree of correlation of various potential explanatory variables was analysed. In this case, since the beta regression is a non-linear model estimated by ML (Maximum Likelihood), multicollinearity has not the serious implications associated with the traditional linear models estimated by OLS (Ordinary Least Squares). Following the parsimony principle, redundant variables are eliminated, deriving a model with a virtually equal explanatory power to the one with all variables included, but with a shorter set of regressors. For this reason, variables showing high correlations levels (Pearson's coefficient higher than 0.7) are examined, rejecting variables which (i) showed significant correlations with a large number of covariates, and (ii) their elimination avoids deleting a large number of other variables. This process implied the elimination of eighteen variables from the preliminary list of potential candidates[2].

The descriptive results collected in Table 2 show a relatively low dispersion level in sports participation, which is more significant in the case of the variable *regular sports participation*. On average, *sports participation* is about 46% in the English regions, while *regular sports participation* is less than half this value, at 22%.

The behaviour of the explanatory variables is much more heterogeneous in terms of dispersion. Most of them show low or moderate levels, but there are exceptions, for example (in decreasing order with Pearson's variation coefficients in parentheses): *Local funding 2007-2010* (166.74), *Coast length* (128.31), *20 min 1 facility quality assured* (85.71) or *Council house* (73.30).

In relation to the socio-demographic variables, it is important to point out that almost one in five households is a single household, children are present in less than a third of them and the households size is generally small: with only 11% of them consisting of four or more adults. In terms of educational levels, we can highlight that more than a quarter of people have a higher education degree or equivalent. Almost 25% of people suffer from a limiting long lasting illness, disability or infirmity, and males represent only about 40% of the total sample. Most of the individuals surveyed

Table 3: Model to explain Sports participation. Estimates

			Number of obs	=	354
			Wald chi2(33)	=	793.29
Log likelihood = 806.2489			Prob > chi2	=	0.0000
			AIC	=	-1544.50
			BIC	=	-1412.94
Variable	**Coef.**	**Std. Err.**	**z**	**P>z**	
Socio-demographic variables					
Single households	-.002422	.002999	-0.81	0.429	
Children	.000926	.002192	0.42	0.673	
Four or more adults	.000438	.002403	0.18	0.856	
A-Levels	.005702	.002551	2.23	0.025	**
Higher Education	.009930	.001615	6.15	0.000	***
Long standing illness	-.007264	.002599	-2.80	0.005	***
Male	.000432	.002358	0.18	0.855	
Age 35-64	-.003316	.002955	-1.12	0.262	
Age over 64	-.005982	.003123	-1.92	0.055	*
White	.007052	.001206	5.85	0.000	***
Urban	.002027	.000571	3.55	0.000	***
Economic variables					
Council house	-.001562	.001871	-0.83	0.404	
Income up to 20,799	-.003520	.001737	-2.03	0.043	**
Income 20,800 - 41,599	-.001543	.001754	-0.88	0.379	
Skilled_Non-manual	.001179	.002352	0.50	0.616	
Unskilled	-.009241	.004947	-1.87	0.062	*
Full-time	.003886	.003026	1.28	0.199	
Part-time	.002025	.004113	0.49	0.623	
Looking after children	.007661	.006118	1.25	0.211	
Student	.006798	.004049	1.68	0.093	*
Unemployed	.003792	.004999	0.76	0.448	
Live & work same area	-.000196	.000491	-0.40	0.690	
Sport variables (investment, infrastructure)					
Local funding 2007-2010	8.06e-07	5.51e-07	1.46	0.143	
CPA	.002381	.005397	0.44	0.659	
Sport volunteers	.014008	.005013	2.79	0.005	***
20 min 1 facility quality assured	.000277	.000279	0.99	0.320	
20 min 3 facilities	.000415	.000698	0.59	0.552	
20 min 1 facility	-.001226	.001397	-0.88	0.380	
Other variables (weather, etc.).					
Lake area	-.001017	.001366	-0.74	0.457	
Coast length	-8.83e-06	.000015	-0.59	0.554	
Temperature	-.174835	.071385	-2.45	0.014	**
Rainy days	-.033891	.057718	-0.59	0.557	
Constant	-.428475	.583720	-0.73	0.463	
Phi	400.5597	30.0707			

Notes: * Statistically significant at the 10% level ** Statistically significant at the 5% level
*** Statistically significant at the 1% level

Table 4: Model to explain Regular sports participation. Estimates

			Number of obs	=	352
			Wald chi2(32)	=	354.69
Log likelihood = 806.2489			Prob > chi2	=	0.0000
			AIC	=	-1586.85
			BIC	=	-1459.35
Variable	**Coef.**	**Std. Err.**	**z**	**P>z**	
Socio-demographic variables					
Single households	.000303	.004597	0.07	0.947	
Children	-.005246	.002971	-1.77	0.077	*
Four or more adults	-.001805	.003233	-0.56	0.577	
A-Levels	.004229	.003461	1.22	0.222	
Higher Education	.008693	.002151	4.04	0.000	***
Long standing illness	.004677	.003484	1.34	0.174	
Male	.006723	.003178	2.12	0.034	**
Age 35-64	.000361	.004038	0.09	0.929	
Age over 64	-.000549	.004225	-0.13	0.897	
White	.006641	.001630	4.07	0.000	***
Urban	-.001590	.000743	-2.14	0.032	**
Economic variables					
Economic variables					
Council house	-.001760	.002526	-0.70	0.486	
Income up to £20,799	-.001006	.002524	-0.40	0.690	
Income £20,800 - £41,599	-.004723	.002450	-1.93	0.054	
Full-time	.010422	.004054	2.57	0.010	
Part-time	.005562	.005552	1.00	0.316	
Looking after children	.007676	.008213	0.93	0.350	
Student	.008141	.005509	1.48	0.139	
Unemployed	-.001628	.006815	-0.24	0.811	
Median earnings	.000095	.000241	0.39	0.695	
Live & work same area	.000673	.000676	0.99	0.320	
Sport variables (investment, infrastructure)					
Local funding 2007-2010	-9.50e-07	7.54e-07	-1.26	0.208	
CPA	.008557	.007291	1.17	0.241	
Sport volunteers	.015540	.006793	2.29	0.022	**
20 min 1 facility quality assured	.000261	.000378	0.69	0.490	
20 min 3 facilities	.000328	.000930	0.35	0.725	
20 min 1 facility	-.001879	.003306	-0.57	0.570	
Other variables (weather, etc.)					
Lake area	.001479	.001806	0.82	0.413	
Coast lenght	-.000018	.000020	-0.90	0.368	
Temperature	-.194950	.097146	-1.98	0.048	**
Rainy days	.142723	.076509	1.87	0.062	*
Constant	-3.034523	.823151	-3.69	0.000	***
Phi	319.2353	24.0374			

Notes: * Statistically significant at the 10% level ** Statistically significant at the 5% level
*** Statistically significant at the 1% level

belong to the age interval of more than 35 years old (about 84%), are white (almost 93%) and live in urban areas (about 85%).

Regarding the economic variables, only about 6% of people live in council houses, and the income distribution is almost identical among the three income categories (i.e. a 33% share for each). Most of the individuals are qualified workers (unskilled occupations account for only 3%) that hold full-time jobs (almost 45%) and have a median gross weekly earning of 412. The significance of commuting is clear, as less than 60% of people live and work in the same area.

In relation to the sports variables, about 6% of people have been volunteers in sport. There are very high levels of proximity to sports facilities: almost 99% and 80% of people live within twenty minutes travel time of one or three types of facilities respectively.

After the descriptive statistics, in Tables 3 and 4, the beta regression model results are reported. On the one hand, in the case of *Sports participation* eleven explanatory variables are significant: five at the 1% level (*Higher Education*, *Long standing illness*, *White*, *Urban* and *Sport volunteers*), three at the 5% level (*A-Levels*, *Income up to 20,799* and *Temperature*) and, finally three at the 10% level (*Age over 64*, *Unskilled* and *Student*). On the other hand, in the case of the *Regular sports participation* ten regressors show statistical significance: three at the 1% level (*Higher Education*, *White* and *Full-time*), four at the 5% level (*Male*, *Urban*, *Sport volunteers* and *Temperature*) and, lastly, three variables at the 10% level (*Children*, *Income 20,800 - 41,599* and *Rainy days*).

Since the beta model is nonlinear, cross-regression comparisons for the effect of explanatory variables on sport participation cannot be made. For this purpose, as in the case of other nonlinear models (such as the logit model), we have to use the marginal effects ($\partial y/\partial x_i$) which help us understand the impact of each covariate. Table 5 reports the marginal effects of the beta regression models with respect to the different regressors, evaluated at their sample means. For the sake of simplicity, only the marginal effects of the statistically significant explanatory variables are included. The interpretation of the marginal effects is straightforward.

The variable *Sports participation* (SP) depends on some socio-demographic variables such as education, age, ethnicity, and population size. As it is shown in Tables 3 and 5, it depends positively on the educational levels, confirming the empirical evidence in previous studies in England (Downward, 2007; Downward & Rasciute, 2011; Kokolakakis et al., 2012). On average, an increase of 1% in the percentages of people with A-Levels or Higher Education implies an increase of 0.14% and 0.25%, respectively, in sports participation.

As it is expected, long-standing illnesses and old age (over 64 years) have a negative impact on SP: an increase of 1% in those regressors involves a reduction in sports participation of 0.18% and 0.15% correspondingly. Consequently, physical limitations due to illness or age are clearly constraints on participation. Finally, SP has a positive relationship with being white and urban living: an increase of 1% in these variables causes an increase of 0.18% and 0.05%, respectively, in SP. In the English LAs, as in the case of the EU-15 (Van Tuyckom & Scheerder, 2010), it seems that, the sport supply effect is higher than the substitute effect in urban areas. Significantly, neither gender nor household characteristics have an important influence on explaining differences in sports participation.

Table 5: Models to explain Sports participation and Regular sports participation.

Sports participation Variable	dy/dx	Regular sports participation Variable	dy/dx
A-Levels	.001418	Children	-.000905
Higher Education	.002469	Higher Education	.001500
Long standing illness	-.001806	Male	.001160
Age over 64	-.001487	White	.001146
White	.001753	Urban	-.000274
Urban	.000504	Income £20,800 - £41,599	-.000815
Income up to £20,799	-.000875	Full-time	.001798
Unskilled	-.002298	Sport volunteers	.002681
Student	.001690	Temperature	-.033114
Sport volunteers	.003482	Rainy days	.024622
Temperature	-.043466		

Among the economic variables, low income levels or low-skilled jobs imply a reduction in SP: on the one hand, an increase of 1% in the percentage of people with income lower than 20,799 involves a reduction of 0.09% in SP and, on the other hand, a similar increase in the proportion of unskilled people is associated with a lessening of 0.23% in the dependent variable. Consequently, in the English LAs, low income is a factor explaining differences in regional participation in sports, confirming the empirical evidence analysed by Downward et al. (2009) and Breuer et al. (2010). With regard to the occupation variables, only 'being a student' is statistically significant, confirming that the substitute effect between sport and work neutralises the compensation effect. In other words, the negative effect of lesser income among students is neutralised by the positive influence of free time available to commit in sports participation. An increase of 1% in students leads, on average, to an increase of 0.17% in SP. In other words, differences in local sports participation are partially explained in terms of the distribution of student population.

Unexpectedly, neither sports expenditure in the region nor the sports infrastructure are determinants of sports participation. A possible explanation for the absence of impact of expenditure in sport is that we examined only a three-year period of investment. Note however, that this is in line with major research economic impact studies (such as Henley Centre, 19876), where while adopting a cross sectional context, investment is treated as characteristic investment over a three year period. Other more general studies (Sport England, 2010) have found Lottery funding to be significant, but only after going back to 1995. Hence, when considering a medium term horizon, spending on its own cannot explain regional variations in sports participation. In the case of the lack of influence of sports infrastructure, various explanations could be considered. This is partly because public policy targets worse off areas and partly because the private sector looks for business opportunities in places where there is no saturation in terms of health and fitness clubs and leisure centres. For example, the health and fitness operator "Pure Gym" has targeted the low-cost sector, offering facilities without a monthly contract. More significantly, the business plan of another operator, "Anytime Fitness,", involves identifying and expanding on areas without health and fitness facilities. These trends ensure that there is enough sports infrastruc-

ture in place to absorb the current demand both nationally and regionally. Because of that, in the medium term, although spending and infrastructure may be important determinants in national policy (or in a single region), they are not sufficient to explain variations of participations across regions. Public policy usually seeks to help disadvantaged areas (to increase participation), tending to resolve regional differences.

The level of sports volunteers in the regions has a positive and statistically significant impact on sports participation: a raise of 1% in the proportion of sport volunteers in a local area implies an increment of 0.35% in SP. Sports volunteers normally develop their work in voluntary sports clubs, confirming the importance of these clubs to increase sports participation, as it has been shown by Reid (2012) in Scotland.

Finally, weather conditions explain differences in SP; temperature variation has a negative effect: each 1% increase in the difference between the maximum and minimum temperatures registered within a local area involves a decrease of 0.04% in participation.

The *regular sports participation* (RSP) model and its marginal effects are shown in Tables 4 and 5 respectively. As in the previous model, significant variables include education, ethnicity and population size. In addition, gender and the presence of children in the household are also significant. For example, having children has a negative impact on regular sports participation: an increase of 1% in people who have children implies a reduction of 0.09% in RSP, endorsing the results of Humphreys and Ruseski (2010) in the US and Ruseski et al. (2011) in Germany. Gender also plays a role; in this sense, an increase of 1% in the percentage of male individuals is associated with a 0.12% of increase in RSP, confirming empirical evidence shown by Eberth and Smith (2010) for Scotland, and Humphreys and Ruseski (2006) for the US.

Educational level has, again, a positive impact, although slightly lower than in the case of *sports participation*. In this case, A-level is not statistically significant and only higher education has a positive impact: on average, an increase of 1% in that explanatory variable implies an increase of 0.15% in RSP. A more general conclusion is that as we switch to more intensive forms of sports participation only high levels of education become relevant in explaining regional variations. The current structure of general education (up to A-levels) contributes effectively towards a basic structure of sports participation (once a month), but is less relevant when we focus on regular participation.

As in *sports participation*, white ethnicity has a positive impact, although now this impact is slightly lower: an increase of 1% in the proportion of white people implies an increase of 0.12% in RSP. Unlike SP, living in urban areas has a negative effect on RSP: an increase of 1% in that explanatory variable involves a reduction of 0.03% in RSP. In other words, when considering regular sports participation, the substitution effect between sport and other leisure activities is higher than the positive sport supply effect in urban areas.

Among the economic variables, the role of individuals' income is important: an increase of 1% in the proportion of people included in the 'middle class' (i.e., income between 20,800 and 41,599) implies a reduction of 0.08% in RSP. Consequently, low-income level is a barrier to participate in sport, while regular sports participation is more constrained by middle-income levels (which are likely to be more restricted in terms of free time). With regard to occupation, people with full-time jobs are more likely to be regular sports participants: more precisely, a raise of 1% in full-time occupations involves a 0.18% increase in RSP.

As mentioned before, neither the sports expenditure in the region nor the sports infrastructure are determinants of regular sports participation. Only the level of sports volunteers in the LAs seems to have a positive and statistically significant impact on regular participation, although slightly lower than in the former case: an increase of 1% in the proportion of sports volunteers is associated with a rise of 0.27% in RSP.

Finally, weather conditions have a significant impact on regular sports participation. On the one hand temperature variation has a similar effect in sign and quantity compared to the previous model, and on the other hand, rainfall has a positive and unexpected effect on RSP: an increase of 1% in the number of rainy days implies an increase of 0.03% in RSP.

Conclusions and Policy Implications

In this paper the determinants of sports participation among the English LAs are examined under two different definitions: a basic participation in the last four weeks and a more intensive participation of at least three times per week (regular). The focus of our analysis is not on the significant factors determining sports participation within a region, but on the factors that can help us explain the differences among them. As far as we know, this is the first time that a regional approach is exclusively followed to explain sports participation, with a huge sample of individuals and regions (LAs). Using the information provided by Sport England through the Active People Survey 5 for the period 2010-2011, we analysed the determinants of sports participation and regular participation considering the regional differences in 325 English Local Authorities.

As the dependent variables are measured in terms of proportions of regional population (aged 16 and over), we developed beta regression models. These models have significant advantages compared to the traditional linear regression models (OLS). Beta distribution is a continuous model with the characteristic of providing positive density only in a finite length interval. This feature and, also, its flexibility make this model particularly appropriate for variables representing proportions, as in the case of sports participation. We identified four groups of regional characteristics: socio-economic variables, economic determinants, sports variables and other regional characteristics (weather conditions, etc.).

The results show the importance of some socio-demographic variables, such as educational level, ethnicity, and size of population, economic variables (income levels and occupations), sports volunteering and weather conditions. Nevertheless, sports infrastructure is not significant in explaining differences in sports participation among the English LAs. The important implication here is that public sports policy is well-targeted and/or private investment in sports facilities is effective in balancing demand and supply across regions. It is important to emphasise that this does not mean that sports infrastructure is unimportant in general; however, in this case it cannot explain the existing variations among LAs.

Sports participation (SP) is positively affected by the educational level in the region, the percentage of white population, the percentage of people living in urban areas, and the percentage of students and sports volunteers in the region. At the same time, the percentages of aged population and people suffering from long standing illnesses as well as the percentages of unskilled workers (the lowest level of professional status) in the regions and the local temperature variation have a negative impact on SP. Finally, a low-income level is a clear constraint on participation across LAs.

Regular sports participation (RSP) is, on the one hand, positively affected by educational and income levels in the region, being male and white, and working full-time but, on the other hand, it is negatively influenced by having children and living in urban areas. Additionally, the percentage of sports volunteers and the number of rainy days have a positive impact on regular participation, while the impact of regional temperature variation is negative.

These results suggest alternative regional sports policies to boost sports participation in England, in the context of stagnation of sports participation rates and a drastic increase in obesity and health problems in the population. In addition, sports policies have to draw a distinction between the decision to participate in sport and the decision about the frequency of participation – regular participation – (Downward et al., 2011). If the final policy aim is to improve the health level of population, special attention should be focused on the determinants of regular sports participation.

Firstly, some implications could be highlighted comparing both decisions. There are some common variables in both models, such as educational and income levels, ethnicity, sports volunteers and regional temperature variation. In general, the impact of these variables is greater (comparing marginal effects) when explaining SP than RSP.

In particular, low-income level is clearly a barrier to participate in sport, but its effect on RSP is not relevant. Consequently, in order to attract new participants with incomes up to 20,799, partially or totally subsidized regional sports programmes should be developed. However, marginal variations in price are not going to be very effective in transforming a basic participation into a regular one. If the middle class participation lacks at this level is not because they cannot afford it, but because they might not have sufficient free time or inclination to transform radically their life style.

Similarly, some conclusions could be drawn from the impact of education. Having middle and high educational level helps people to be involved in sport, but only higher education has a significant impact on regular sports participation. Information about the healthy benefits associated with regular sports participation should be underlined in secondary education. Informative and persuasive messages through the mass media (e.g., about the positive impacts on health and appearance, the opportunities of socialisation, etc.) could attract new participants among people having only GCSEs or nothing at all.

Moreover, any attempt to promote sports volunteering in sports clubs and other sports institutions could have a positive effect on sports rates, especially in general participation.

Secondly, the fact that some variables affect exclusively one participation definition (and not the other) allows us to develop some additional policy conclusions. For example, the percentage of people aged over 64 years has a negative impact on sports participation. Public policy should counteract this trend utilising resources and targeting participation within this age group. The fact that this group has a lot of free time should make it more responsive to policy both from the public and the private sector. Furthermore, the negative impact of having children and living in urban areas together with the positive impact of being male in regular participation, suggest the development of regular family sporting activities in urban areas including adults and children participating together in activities such as swimming, paddle, tennis, etc.

Additionally, the results suggest the possibility of a regional gap between rural and urban areas in terms of participation and between male and female in terms of regu-

lar participation. Consequently, regional sports programmes could be carried out in rural areas to boost some sports practices, such as cycling, mountaineering, climbing, etc. Similarly, emphasis should be given to regular participation among women, paying special attention to possible motivations (health, physical appearance, etc.) and to developing sport activities for the whole family.

Thirdly, the results show that the general problem of stagnation in sports participation rates could not be solved simply by pouring increasing levels of public funds into the industry. It is extremely important to fine tune policy according to regional characteristics and intervene on education and youth sport. Finally, it was shown that, in the medium term, government funding policy is not effective in terms of boosting sports participation. Any financial plan will need more than a single government term to achieve the desired results. Hence, any short-term decisions designed to bring imminent gains in sports participation are likely to be counterproductive. There is a need for cross party consensus on sports policy, especially with regards to school sports, and policy objectives to safeguard continuity beyond the four year term of a government.

Some limitations of this study could provide new ideas for further research. For example, longitudinal analysis could be used to study dynamic clusters of regions and to evaluate possible changes in the impact of the independent variables on the two participation definitions (basic participation and regular participation) over time.

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Endnotes

[1] The data of 'sports participation' are from the period 2010/2011, whereas the data of 'sports expenditure' are from the period 2007/2010 (there were not data available for the period 2010/2011 at the time of carrying out our study); hence the variable 'sports expenditure' is

lagged in relation to the variable 'sport participation'. In this way, as past could affect present but not vice versa, it is clear that in our circumstances there is no chance for reverse causality (Humphreys & Ruseski, 2007). The only feasible causal relationship we could study with our data is the one which stems from 'sports expenditure' to 'sports participation', so the first appears just as an explanatory variable of the second. The potential reverse causality, shown by some papers, between education or income and sports participation (e.g., Lechner, 2009), should be carefully considered in further analysis. As we are considering exclusively regional variables, this potential reverse causality is much less relevant.

[2] Both the full and detailed list of potential variables that were considered in this study and their correlation coefficients are not included in this paper for the sake of space. They can be obtained from the authors upon request.