Time devoted by elderly people to physical activities: micro-econometric evidence from Spain

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Time devoted by elderly people to physical activities: micro-econometric evidence from Spain*

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Abstract

In this paper, I analyse the differences in the time devoted to walking, cycling, gymnastics, and hunting by the elderly in Spain, considering own and socio-demographic characteristics. Using data from the Spanish Time-Use Survey (STUS) 2009-10, I estimate a simultaneous SUR model with data from the 4,036 individuals aged 65 years and over (inclusive), finding that men devote more time to the four physical activities than do women, that good health positively influences the time devoted to these activities, and that living in a large municipality positively influences the time devoted to walking, while living in a very large municipality negatively influences the time devoted to cycling. The work is important in terms of public policy, since inactive lifestyles are a major public health challenge, and an analysis of these activities may provide guidance toward better solutions. An increase in the frequency of physical activity in the Spanish population in this age range would lead to a significant reduction of health expenditure.

Keywords: Elderly, Physical activities, Time use, SUR model

JEL Classification: J14, J22, Z20

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1. Introduction

In this paper, I analyse the differences in the time devoted by individuals in Spain, aged 65 and over, to walking, cycling, gymnastics, and hunting, considering their own and socio-demographic characteristics. It is known that the practice of regular, stable, and moderate physical activity contributes to improving both the physical and psychological health of the individual (González-Serrano et al. 2013). On the other hand, being inactive or sedentary has been shown to be a risk factor, particularly of weight gain, from infancy to adulthood (Owen et al. 2010; Thorp et al. 2011). Currently, a large proportion of the world's population is physically inactive (Ng and Popkin 2012), being important in health issues, and in economic terms (Lee et al. 2012; ISCA 2015).

Inactivity costs Europe more than three times the total direct expenditure on the treatment of diseases attributable to smoking, which amounted to 25.3 billion euros in 2009 (Jarvis et al. 2012). As measured in the WHO Guidelines, over 26% of adults in the European Union are insufficiently active (WHO 2010). Inactivity imposes an economic cost of €80.4 billion per year in, the EU 28 through four major non-communicable diseases (coronary heart disease, type II diabetes, colorectal cancer, and breast cancer) and through the indirect costs of anxiety. This amounts to 6.2% of all European health expenditure (ISCA 2015). It is important to mention that, when making comparisons between EU countries, Spain is among the EU countries with the lowest levels of physical activity (Ríos et al. 2016). In Spain, the inactive population is almost triple (2.75 times) the number who engage in physical activity at least several times a month (Aragonés et al. 2016). Inactivity in Spain imposes annual direct health costs of more than €990 million (ISCA 2015), and increasing physical activity in the Spanish population could reduce health spending by 10% (Aragonés et al. 2016).

Physical activity is generally acknowledged to be a way to promote a healthy life style, and enhance prevention, treatment, and rehabilitation of disease. In addition, there is a significant interest in the promotion of health in the elderly (Barriopedro et al. 2007). One justification for this greater interest in the elderly is that most individuals today can aspire to live until well over age 60. Longer life expectancy, coupled with significant declines in fertility rates, is lading to the rapid aging of populations around the world, and the scope of opportunities for greater longevity will depend to a large extent on one key factor, health

(WHO 2015). Various studies show that physical activity has a positive influence on health, for example regular physical activity in older people is important for maintenance of mobility and independent living, the increase or preservation of muscle strength and power, and the prevention and reduction of falls and fractures (Fiatarone-Singh 2002; Keysor 2003; Miller et al. 2000; Taylor et al. 2004; Young and Dinan 2005).

Furthermore, the physical activity of older individuals is positively related to the subjective perception of well-being, so that life-satisfaction and happiness increases significantly, while the feeling of loneliness decreases significantly (Barriopedro et al. 2007; McAuley et al. 2000). Numerous studies have revealed an inverse relationship between physical activity and levels of depression in the elderly (Barbour and Blumenthal 2005; Blumenthal et al.1999; Camacho et al. 1991; Farmer et al. 1988; Ruuskanen and Ruoppila 1995; Stephens 1988). With respect to time-use studies and physical activity, the research by Ng and Popkin (2012) shows that, for individuals between 18 and 64 years old, physical activity is rapidly declining and the increased sedentary time in the United States, the UK, and China could well be due to the growth of media technologies (television, cable, computers, the Internet).

Based on this framework, I analyze a field of research less studied for this age range, namely the time devoted by the elderly in Spain to different physical activities. I use data from the Time-Use Survey for Spain (2009-10), and analyse the time devoted to walking, cycling, gymnastics, and hunting. I estimate a linear seemingly unrelated regressions (SUR) model for these four activities, and I observe that men devote more time to walking, cycling, gymnastics, and hunting than do women. With respect to education level, I find that, as this increase, older individuals spend less time in hunting. Good health status (self-reported) positively influences the time devoted to the four physical activities, Belonging to a large or small municipality, compared to a very small municipality, influences individuals to devote more or less time in different physical activities. The fact of living in a large municipality positively influences the time devoted to walking, while living in a very large municipality negatively influences the time devoted to cycling. As to gymnastics, the elderly who live in a small municipality devote less time to this activity.

My contribution to the literature is twofold. First, I analyze the impact of socio-demographic variables on how elderly Spaniards distribute their time to different physical activities. Most time-use studies have focused on studying how individuals spend their time in different activities, such as leisure but those studies tend to focus on individuals of working age (Gimenez-Nadal and Sevilla 2012; 2014). Furthermore, it is important to study this age range, since the physical activity usually decreases with age (Aragonés et al. 2016). Second, I disaggregate physical activities into four categories because of the importance of analysing activities separately (Molina et al. 2016, 2017; Wang and Gimenez-Nadal 2017). Generally, physical activities are aggregated in one main category (Ng and Popkin 2012). In terms of public policy, physically inactive lifestyles are a major public health challenge, and activities such as walking and cycling may provide guidance toward better solutions (Sallis et al. 2004). An increase in physical activity in the Spanish population would lead to a significant reduction of health expenditure (Aragonés et al. 2016).

The rest of the paper is organized as follows. Section 2 describes the data and variables. Section 3 describes the empirical strategy and presents our results, and Section 4 concludes.

2. Data and variables

I use the data from the time use survey of Spain (STUS) for the period from the fourth quarter of 2009 and the first three quarters of the year 2010. Time-use surveys provide information on individual time use and are the typical instrument used to analyse time-allocation decisions (Aguiar and Hurst 2007; Gimenez-Nadal and Sevilla 2012). Respondents are all household members from the age of 10. In these surveys, each respondent keeps a diary for one specific day of the week, indicating their activities in 10-minute intervals (144 intervals in total). I restrict the sample to the 4,036 individuals who are aged 65 years and older (inclusive), and I focus on analysing the time dedicated by those surveyed to four physical activities: walking, cycling, gymnastics, and hunting[1].

For the variables that could influence whether the respondents dedicate more or less time to these four activities, I consider the standard individual and household characteristics (Sevilla et al. 2010): age, age squared divided by 100 (Kalenkoski et al. 2005; Aguiar and

[1] Gymnastics includes gymnastics, fitness, and bodybuilding and hunting includes both hunting and fishing.

Hurst 2007; Gimenez-Nadal et al. 2011), and gender (Gimenez-Nadal and Sevilla 2012), with female being the reference category. I control for three levels of education: Primary education (reference category), Secondary education, and University education. Education, as is well-known, influences the distribution of time that individuals allocate to different activities (Kalenkoski et al. 2005; Guryan et al. 2008; Gimenez-Nadal and Molina 2013; Campaña et al. 2017). I consider whether the individuals surveyed are living together in couple, since this can also influence the time dedicated to the four activities. I control for the state of health of the individual (self-reported) with five levels (1=very good health, to 5=very poor health). Gimenez-Nadal and Molina (2015) show that individual good health can lead to the dedication of more time in market work and less time in leisure activities.

Following Molina et al. (2016, 2017), I include the number of household members and I also consider the size of the municipality where the respondents live, with five classifications: municipality with a population greater than 100,000, municipality with a population of between 50,000 and 100,000, municipality with a population of between 20,000 and 50,000, municipality with a population of between 10,000 and 20,000, and municipality with a population of less than 10,000.

Descriptive statistics are shown in Table 1 for the average time that our sample dedicated to walking, cycling, gymnastics, and hunting, as well as the descriptive statistics for their individual and household characteristics, with Column 1 applying to men, Column 2 to women, and Column 3 for the whole sample. In terms of walking, men devote more time (1.31 hours per day) than do women (0.75 hours per day) to this activity. Men spend 0.02 hours per day cycling and women spend 0.001 hours per day in the same activity. Men devote 0.04 hours per day to gymnastics, while women spend only 0.02 hours per day in the same activity. Men spend 0.04 hours per day hunting, while the time spent by women on hunting is negligible, 0.003 hours per day. The average age of the men in our sample is 74.39 years, compared to 75.20 years for women. The majority of the sample have had a primary education (85%). I observe that 80% of men and 48% of women live with a partner. As for health status (self-reported), 37% of men report being in good health, while 36% of women report being in acceptable health. Regarding household characteristics, there is an average of

more than 2 inhabitants per household. Furthermore, 44% of the men and women in our study live in a municipality with a population of more than 100,000.

(Table 1 about here)

3. Empirical strategy and Results

I estimate linear regressions for the time devoted to walking, cycling, gymnastics, and hunting, and I consider that the time individuals spend in any activity (e.g., walking) cannot be devoted to any of the other three activities. I cannot use individual time in any specific activity as an explanatory variable of other uses of time, since that would lead to endogeneity problems, and for this reason I estimate a Seemingly Unrelated Regression (SUR) on the time devoted to the four physical activities.[2]

The statistical model is as follows: for an individual "*i",* W_i, C_i, $G_{i,\text{ and }} H_i$ represent the hours reported by the individuals dedicated to walking, cycling, gymnastics, and hunting, respectively, X_i is the vector of the characteristics of the household and of the individuals, and $\varepsilon_{wi,}$ $\varepsilon_{ci,}$ ε_{gi} and ε_{hi}, represented the random variables for factors not measured. Then, I estimate the following four equations.

$$W_i = \alpha_w + \beta_1 x_i + \varepsilon_{wi} \quad (1)$$

$$C_i = \alpha_c + \beta_1 x_i + \varepsilon_{ci} \quad (2)$$

$$G_i = \alpha_g + \beta_1 x_i + \varepsilon_{gi} \quad (3)$$

$$H_i = \alpha_h + \beta_1 x_i + \varepsilon_{hi} \quad (4)$$

[2]The SUR model has been used to describe the simultaneity of consumption goods (see, for example, for the case of Spain, Molina, 1994, for food; Molina, 1997, for transport goods; Molina, 1999, for leisure; Molina, 2002, for all consumer goods). Furthermore, the SUR model has been used in other time-use studies such as Gimenez-Nadal and Molina 2013, 2015; Molina et al. 2016,2017; Campaña et al. 2017.

Concerning the specification of the error terms for each individual, I permit the correlations in the unobserved determinants of the activities, and the error terms are normally distributed as a whole, without restrictions in the correlation. This specification shows the time limitation that could lead individuals to spend more time on one activity, and less time on another. Moreover, I assume that the error components are independent:

$$\begin{pmatrix} \varepsilon_{wi} \\ \varepsilon_{ci} \\ \varepsilon_{gi} \\ \varepsilon_{hi} \end{pmatrix} \sim N \left(\begin{bmatrix} 0 \\ 0 \\ 0 \\ 0 \end{bmatrix} \begin{matrix} \sigma^2_{wi} & \rho_{wici}\,\sigma_{wi}\,\sigma_{ci} & \rho_{wigi}\sigma_{wi}\,\sigma_{gi} & \rho_{wihi}\,\sigma_{wi}\sigma_{hi} \\ \rho_{ciwi}\,\sigma_{ci}\sigma_{wi} & \sigma^2_{ci} & \rho_{cigi}\sigma_{ci}\sigma_{gi} & \rho_{cihi}\sigma_{ci}\sigma_{hi} \\ \rho_{giwi}\,\sigma_{gi}\sigma_{wi} & \rho_{gici}\,\sigma_{gi}\sigma_{ci} & \sigma^2_{gi} & \rho_{gihi}\,\sigma_{gi}\sigma_{hi} \\ \rho_{hiwi}\,\sigma_{hi}\sigma_{wi} & \rho_{hici}\,\sigma_{hi}\sigma_{ci} & \rho_{higi}\,\sigma_{hi}\sigma_{gi} & \sigma^2_{hi} \end{matrix} \right)$$

Table 2 (Columns 1, 2, 3 and 4) shows the results of our estimations for the time dedicated to walking, cycling, gymnastics, and hunting. As shown, gender influences the time spent on the four activities; being a man generates a positive influence on the time devoted to walking, cycling, gymnastics, and hunting, relative to being a woman. In terms of age, I find a negative effect on the time dedicated to cycling. I find that having a secondary education (compared to primary education), the time devoted to gymnastics and hunting increase and decrease, respectively. Having a university education (compared to primary education) decreases the time devoted to walking and hunting. Health status has a significant influence on the time dedicated to all four activities. When I compare good health to very poor health, individuals with good health spend more time in all these activities. As for the size of the municipality (compared to municipality with a population less than 10,000, or municipality size 5), I see significant and positive values for the municipality size 2 (municipality with a population between 50,000 and 100,000) for the time devoted to walking, and I find significant and negative values for the municipality size 1 (municipality with a population greater than 100,000) and municipality size 4 (municipality with a population between 10,000 and 20,000) for the time devoted to cycling and gymnastics, respectively. Thus, living in larger cities produces a positive effect on the time devoted to walking, while the opposite effect occurs in relation to cycling. In addition, living in small municipalities reduces the time spent on gymnastics

(Table 2 about here)

4. Conclusions

The regular and controlled practice of physical activity is the best way to maintain functional capacity and provide healthy aging and a better quality of life (De Figueiredo Queiros et al. 2006). In this sense, and in addition to the literature showing the benefits of physical activities on the physical and mental health of the elderly, and the high health costs of inactivity, this paper sets out to provide information as to what factors may influence the elderly in Spain to devote more or less time to physical activities. Using the Spanish Time Use Survey (STUS) (2009-10), I consider all individuals over 65 (inclusive) and I estimate a SUR model for the time devoted to four physical activities - walking, cycling, gymnastics, and hunting.

Our findings show that men devoted more time to all four activities, compared to women, that high levels of education lead to a decrease in the time devoted to hunting. And that good health positively influences the time devoted to the four physical activities, with men reporting better health than women. With respect to the municipality size, living in a large municipality leads to more time spent walking, while living in a very large municipality reduces the time devoted to cycling, and living in a small municipality means that less time is sent on gymnastics.

Assessing our results in terms of public policy, it is necessary to consider that the life expectancy of the Spanish population at 65 years old, in both men and women, is among the highest in the European Union and, indeed in the world (Abellán et al. 2017). Solé-Auró and Alcañiz (2015) have shown that the deterioration of mobility associated with old age can be delayed by educating younger individuals about the benefits of regular physical exercise. According to our data, women perform less physical activity than do men, so it is important to raise awareness among women of the benefits of physical activity, especially since women over age 65 have a longer life expectancy than men, but their healthy life expectancy is lower, because of increased morbidity and increased survival rates (EHLEIS Country Reports 2015). With respect to the activities analyzed, more walking and cycling as substitutes for transportation could produce benefits related to traffic congestion and demand for parking,

as well as air pollution (Sallis et al. 2004). Living in large municipalities positively influences the elderly to spend more time walking, but the opposite happens with cycling. It would make sense, in this context, for large cities to provide more bicycle lanes and car-free places where the elderly can go by bicycle. Physical inactivity has a significant impact in the socio-economic area, and a decrease in physical inactivity in all age groups should be a priority (Aragonés et al. 2016).

One limitation of our analysis is that our data is a cross-section of individuals, and it does not allow us to identify differences in the time devoted to walk, cycling, gymnastics, and hunting, net of (permanent) individual heterogeneity in preferences. There are no panels of time-use surveys currently available, and I leave this issue for future research.

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Table 1: Descriptive statistics

	Men		Women		Total	
Variables	Mean	SD	Mean	SD	Mean	SD
Walking (daily hours)	1.31	(1.54)	0.75	(1.07)	0.99	(1.32)
Cycling (daily hours)	0.02	(0.25)	0.001	(0.01)	0.01	(0.16)
Gymnastics (daily hours)	0.04	(0.24)	0.02	(0.18)	0.03	(0.21)
Hunting (daily hours)	0.02	(0.27)	0.003	(0.10)	0.01	(0.19)
Age	74.39	(6.823)	75.20	(7.052)	74.85	(6.965)
Primary education	0.81	(0.394)	0.89	(0.312)	0.85	(0.352)
Secondary education	0.10	(0.302)	0.06	(0.241)	0.08	(0.269)
University education	0.09	(0.288)	0.05	(0.213)	0.07	(0.249)
Living as a couple	0.80	(0.397)	0.48	(0.500)	0.62	(0.486)
Very good health	0.06	(0.229)	0.05	(0.211)	0.05	(0.219)
Good health	0.37	(0.483)	0.29	(0.456)	0.33	(0.469)
Acceptable health	0.35	(0.478)	0.36	(0.479)	0.35	(0.478)
Poor health	0.18	(0.386)	0.24	(0.427)	0.21	(0.411)
Very poor health	0.04	(0.201)	0.07	(0.247)	0.06	(0.229)
N. household members	2.35	(1.032)	2.12	(1.137)	2.22	(1.099)
Municipality size 1	0.42	(0.494)	0.46	(0.499)	0.44	(0.497)
Municipality size 2	0.09	(0.292)	0.09	(0.282)	0.09	(0.286)
Municipality size 3	0.11	(0.312)	0.09	(0.289)	0.10	(0.299)
Municipality size 4	0.10	(0.295)	0.09	(0.286)	0.09	(0.290)
Municipality size 5	0.28	(0.450)	0.27	(0.444)	0.28	(0.447)
Observations	1734		2302		4036	

Note: Standard deviations in parentheses. Data from the Spanish TUS 2009-2010. The sample is restricted to individuals aged 65 years (inclusive) and older. Gymnastics includes the following activities: gymnastics, fitness and bodybuilding, and hunting includes both hunting and fishing. Primary education is equivalent to having less than a secondary school diploma. Secondary education is equivalent to having a secondary school diploma. University education is equivalent to having more than a secondary school diploma. Municipality size 1 is equivalent to a municipality with a population greater than 100,000, municipality size 2 is equivalent to a municipality with a population between 50,000 and 100,000, municipality size 3 is equivalent to a municipality with a population between 20,000 and 50,000, municipality size 4 is equivalent to a municipality with a population between 10,000 and 20,000, and municipality size 5 is equivalent to a municipality with a population less than 10,000.

Table 2: Estimations of the SUR model

	(1)	(2)	(3)	(4)
Variables (Adults since 65 years)	Walking	Cycling	Gymnastics,	Hunting
Man	0.565***	0.0207***	0.0137*	0.0150**
	(0.0459)	(0.00605)	(0.00743)	(0.00599)
Age	0.0779	-0.00915*	-0.0137	-0.00517
	(0.0493)	(0.00546)	(0.00886)	(0.00548)
Age squared	-0.0531*	0.00554	0.00822	0.00295
	(0.0318)	(0.00345)	(0.00571)	(0.00331)
Secondary education	-0.104	-0.00630	0.0292*	-0.0199***
	(0.0774)	(0.00550)	(0.0157)	(0.00726)
University education	-0.158*	0.0202	0.0301	-0.0231***
	(0.0865)	(0.0185)	(0.0187)	(0.00874)
Living as a couple	-0.0456	-0.00541	0.00101	-0.00557
	(0.0471)	(0.00665)	(0.00779)	(0.0107)
Very good health	0.662***	-0.00632	0.0253	0.0406
	(0.123)	(0.00434)	(0.0240)	(0.0250)
Good health	0.437***	0.0161**	0.0245**	0.0153**
	(0.0818)	(0.00662)	(0.0108)	(0.00656)
Acceptable health	0.401***	0.00147	0.00434	0.00264
	(0.0785)	(0.00277)	(0.00957)	(0.00460)
Poor health	0.269***	0.00293	-0.00571	-0.000744
	(0.0817)	(0.00339)	(0.00904)	(0.00213)
N. household members	-0.0275	0.000911	-0.00279	0.00804
	(0.0193)	(0.00232)	(0.00230)	(0.00845)
Municipality size 1	0.00674	-0.0160**	0.0104	0.00218
	(0.0492)	(0.00720)	(0.00781)	(0.00789)
Municipality size 2	0.143*	-0.00810	0.0130	0.00673
	(0.0793)	(0.0130)	(0.0136)	(0.0131)
Municipality size 3	0.0718	-0.00897	-0.000461	-0.00937
	(0.0802)	(0.0102)	(0.00898)	(0.00636)
Municipality size 4	-0.0410	-0.00837	-0.0147**	1.02e-05
	(0.0726)	(0.0121)	(0.00693)	(0.00982)
Constant	-2.363	0.381*	0.551	0.208
	(1.905)	(0.216)	(0.340)	(0.221)
R-squared	0.058	0.012	0.020	0.010
Observations	4,036	4,036	4,036	4,036

Note: Robust standard errors in parentheses. Data from the Spanish TUS 2009-2010. The sample is restricted to individuals aged 65 years (inclusive) and older. Gymnastics includes gymnastics, fitness, and bodybuilding, and hunting includes both hunting and fishing. Primary education is equivalent to having less than a secondary school diploma. Secondary education is equivalent to having a secondary school diploma. University education is equivalent to having more than a secondary school diploma. Municipality size 1 is equivalent to a municipality with a population greater than 100,000, municipality size 2 is equivalent to a municipality with a population between 50,000 and 100,000, municipality size 3 is equivalent to a municipality with a population between 20,000 and 50,000, municipality size 4 is equivalent to a municipality with a population between 10,000 and 20,000, and municipality size 5 is equivalent to a municipality with a population less than 10,000. Sunday taken as a reference day. * Significant at 90%. ** Significant at 95%. *** Significant at 99%.