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HEALTH AND LABOUR FORCE PARTICIPATION OF OLDER PEOPLE IN EUROPE: WHAT DO OBJECTIVE HEALTH INDICATORS ADD TO THE ANALYSIS?

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SUMMARY

This paper studies labour force participation of older individuals in 11 European countries. The data are drawn from the new Survey of Health, Ageing and Retirement in Europe (SHARE). We examine the value added of objective health indicators in relation to potentially endogenous self-reported health. We approach the endogeneity of self-reported health as an omitted variables problem. In line with the literature on the reliability of self-reported health ambiguous results are obtained. In some countries self-reported health does a fairly good job and controlling for objective health indicators does not add much to the analysis. In other countries, however, the results show that objective health indicators add significantly to the analysis and that self-reported health is endogenous due to omitted objective health indicators. These latter results illustrate the multi-dimensional nature of health and the need to control for objective health indicators when analysing the relation between health status and labour force participation. This makes an instrumental variables approach to deal with the endogeneity of self-reported health less appropriate. Copyright © 2007 John Wiley & Sons, Ltd.

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INTRODUCTION

Population ageing is considered to be one of the most important social and economic challenges in Europe in the next decades. Life expectancy has been increasing markedly for more than a century while fertility has been declining. Furthermore, in most industrialized countries older workers retire at younger ages than they used to do (see Lazear, 1986; Lumsdaine and Mitchell, 1999). These features imply a big uncertainty concerning the long-term sustainability of public pension programmes in European countries (see Banks *et al.*, 2002, for a discussion).

It goes without saying that considerable attention has been devoted to these issues by policymakers and researchers. One basic requirement for a sound analysis of the ageing problem is, of course, the availability of adequate data sources. In this respect many European countries are lagging behind the United States that has a tradition in gathering data on older persons; see the widely explored Retirement History Study (RHS) and its successor the Health and Retirement Study (HRS). Recently, Europe

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partly made up arrears by establishing the Survey of Health, Ageing and Retirement in Europe (SHARE) covering 11 European countries.[1]

SHARE is designed as a longitudinal survey and the first wave contains data on the individual life circumstances of a representative sample of households with at least one household member aged 50 or over. The survey covers such issues like labour force participation, a wide range of physical and mental health indicators, socio-economic situation and family and social networks (see Börsch-Supan *et al*., 2005, for a sample of the issues covered by SHARE). The first wave of SHARE used in this study contains data that were collected in 2004 and were publicly released in Spring 2005. Given the availability of only one wave up to now, SHARE will expose its full strength in a couple of years when the next wave will be available. Nevertheless, its cross-national and truly multi-disciplinary dimensions which make the data set unique are immediately exploitable.

In this study we take a closer look at the labour force participation of older European men and women and explore which individual and household characteristics have an impact on individual participation decisions.

A variety of variables affecting individual retirement behaviour has been studied in the theoretical and empirical literature. Poor health is expected to have a negative effect on participation (Lumsdaine and Mitchell, 1999). Usually a single health indicator appears in equations describing labour supply decisions of older people (see Rust and Phelan, 1997; Blundell *et al*., 2002; Gustman and Steinmeier, 2005, for only a few examples). A widely used health indicator in such analyses is self-reported health. A problem with using self-reported health in an empirical analysis of labour force participation is that it may be an endogenous explanatory variable. According to the justification hypothesis, for example, individuals justify their non-participation by claiming that they are in ill health (Bound, 1991). In order to tackle this endogeneity problem some authors instrument self-reported health by objective variables related to an individual's health to obtain a single exogenous health indicator (see Bound *et al*., 1999; Kerkhofs *et al*., 1999; Disney *et al*., 2004). An important aspect when studying the effects of health on labour force participation is that different health indicators may have a divergent impact on an individual's participation decision (Dwyer and Mitchell, 1999). While a severe health condition like cancer or a stroke may force an individual to leave the labour market, this is not necessarily the case for mild conditions such as high blood pressure or diabetes. We refer to this as the multi-dimensional nature of health. It may make an instrumental variables approach to remedy the endogeneity of self-reported health less appropriate.

We therefore adopt a different approach and treat the endogeneity of self-reported health as an omitted variables problem. Here the omitted variables are the objective health indicators. These variables are allowed to not only affect labour force participation through a single health indicator, as in the instrumental variables approach described above, but also to have their own impact on labour force participation. This approach alleviates the endogeneity problem and also explicitly accounts for the multi-dimensional nature of health. This yields more precise estimates of the impact of health on labour force participation. At this point the multi-disciplinary nature of SHARE turns out to be very useful. The data set not only contains the standard self-reported health status but also a wide range of objective health indicators. Some of the latter, such as the individual's grip strength, are commonly used in the medical sciences but usually not surveyed in the social sciences.

[1] This paper uses release 1 data of SHARE 2004. For Belgium, pre-release 2 data have been used. Release 2 includes Belgium and has been made publicly available in June 2007 (www.share-project.org). The SHARE data collection has been primarily funded by the European Commission through the fifth framework programme (project QLK6-CT-2001-00360 in the thematic programme Quality of Life). Additional funding came from the US National Institute on Aging (U01 AG09740-13S2, P01 AG005842, P01 AG08291, P30 AG12815, Y1-AG-4553-01 and OGHA 04-064). Data collection in Austria (through the Austrian Science Fund, FWF), Belgium (through the Belgian Science Policy Office) and Switzerland (through BBW/OFES/UFES) was nationally funded. The SHARE data set is introduced in Börsch-Supan *et al*. (2005).

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Gruber and Wise (1998, 2002, 2005) showed that incentives inherent in a country's social security provisions also affect participation. At this stage, though, SHARE does not allow to calculate such variables.[2]

The contribution of our study is twofold. The first contribution is that we introduce the new SHARE data and shed some light on systematic differences in participation rates and health status across the countries involved. This is not only interesting in its own right but also because of SHARE's advantage that the same survey methodology is applied to all participating countries which allows easy comparison of the figures. The second contribution is a detailed analysis of how labour force participation of older people in Europe is affected by health-related and socio-demographic characteristics. In particular we examine the value added of various objective health indicators in relation to possibly endogenous self-reported health when analysing older individuals' employment status. We refer to Dwyer and Mitchell (1999) for a somewhat related exercise on the basis of the HRS. As mentioned above, SHARE contains only one wave till now and our study is therefore restricted to a static reduced form analysis of the determinants of labour force participation of older people in Europe. Nevertheless, knowing which variables are significantly associated with labour force participation is the first important step towards a more advanced analysis on longitudinal data.

The rest of the paper unfolds as follows. The second section presents the data and descriptive statistics on labour market behaviour and health of older people. The third section discusses our omitted variables approach to deal with the endogeneity of self-reported health and provides a reduced form analysis of the determinants of labour force participation of older individuals. The fourth section draws conclusion.

DATA AND DESCRIPTIVE STATISTICS

The SHARE is a multi-disciplinary and cross-national data set that collects information on the individual life circumstances of all eligible members of about 18 000 households. A household is eligible for participation in SHARE if at least one household member is born in or before 1954. An individual member of the household is eligible for interview if she or he, or her or his partner, is born in or before 1954. The SHARE data have been collected in 2004 and are a random sample of the target population.[3] The resulting SHARE survey contains information on a wide range of health indicators and socio-economic variables of over 26 000 individuals. SHARE covers 11 countries: Austria, Belgium, Denmark, France, Germany, Greece, Italy, the Netherlands, Spain, Sweden and Switzerland. The survey is designed so that the data collected will be comparable to the HRS and the English Longitudinal Study of Ageing (ELSA). Its cross-national dimension makes it a unique and particularly interesting data set in comparison with other microdata focusing on older individuals.

This study examines the labour force participation of men and women who are aged between 50 and their respective normal retirement ages (see below). Although there is an important number of individuals who are older in the data set, policies that aim to increase labour force participation of older people do not target this group. For example, one of the targets in the Lisbon Strategy is to have an employment rate of 50% for individuals aged 55–64 by 2010 (see European Commission, 2004).

To ease cross-country comparisons we retain for the descriptive analysis all individuals who are between 50 and 64 years old (both years included). After dropping individuals who are younger than 50 (partners of an individual who is 50+) or older than 64 (around 48% of the sample), and deleting

[2] In the future a link will be established between SHARE and the social security administration of some countries. This makes it possible to calculate detailed pension benefits an individual is eligible to when she or he stops working. This would allow taking into account incentive measures such as the accrual in social security wealth by working one more year or Stock and Wise's (1990) option value of postponing retirement. (Compare with the link between the HRS and the US Social Security Administration.)

[3] The data from Belgium and France were collected in 2004 and 2005.

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observations with relevant missing information (3% of the remaining sample), we retain a sample of 12 237 observations. Table I shows the number of observations and the age distribution of the selected sample for each country. The sample size varies considerably across countries. Countries like Belgium, Germany, the Netherlands and Sweden have around 1500 observations and the other countries have around 500–1000 observations.

The last three columns of Table I show the percentages of individuals in three age classes. These age classes contain about one-third of the selected sample, although there is quite some variation across countries. This variation is presumably due to the different age composition in the SHARE countries but may also be due to under- or overrepresentation of certain age groups.

As already mentioned in the introduction, SHARE contains a lot of health information. In what follows we will focus our attention on eight different health indicators. The first two health indicators are severe and mild conditions. SHARE has information on a range of medical conditions. We classified these into severe and mild conditions according to the following classification. Severe conditions are defined as cancer, heart condition, stroke, Parkinson disease, hip problem and diseases of the lung. Mild conditions are hypertension, high blood cholesterol, diabetes, asthma, arthritis, osteoporosis, stomach condition, cataracts and other conditions. The third indicator that we will focus on is the number of restrictions in (instrumental) activities of daily living ((I)ADLs). Examples of (I)ADLs are walking 100 m, bathing or showering, dressing, using the phone and preparing meals. One relatively new health measure in social surveys is the grip strength. It is recognized that this variable, which is known to be correlated with mental as well as physical health, is a very good indicator of an individual's general health condition (see Christensen *et al*., 2001). Moreover, muscle strength (as measured by grip strength) turns out to be associated with long-term mortality risk even after conditioning on other health measures (see Rantanen *et al*., 2000). SHARE contains four measures for grip strength (two measurements for each hand). This study uses an individual's maximum grip strength which is defined as the highest value obtained in the four measurements on a scale from 0 to 100. Two other health measures are defined by means of the body mass index (BMI). A BMI that is between 25 and 30 indicates that an individual suffers from overweight. A BMI that is above 30 indicates obesity. Next we use a measure of an individual's mental health. We define mental ill health as having more than three mental ill health symptoms like depression, pessimism, suicidality or guilt. Finally, there is self-reported health. We focus on the variable good self-reported health. This dummy variable is constructed by means of the European version of self-reported general health, which is a multinomial variable with five levels that range from very bad to very good. An individual has a good self-reported health if (s)he has a self-reported general health that is good or very good.

Table I. Sample statistics and age classes

Country	Observations	Age 50–54	Age 55–59	Age 60–64
Austria	882	27.21	32.43	40.36
Belgium	1511	38.19	36.00	25.81
Denmark	866	35.22	34.76	30.02
France	785	38.73	36.31	24.97
Germany	1450	35.24	28.69	36.09
Greece	1098	42.08	31.24	26.68
Italy	1205	25.06	37.34	37.59
The Netherlands	1544	32.71	37.37	29.92
Spain	971	33.88	34.09	32.03
Sweden	1464	30.12	37.09	32.79
Switzerland	461	38.83	30.37	30.80
Total	12 307	33.95	34.45	31.59

Note: Entries for age classes are in per cent.

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Table II. Health indicators: Part 1

Country	Severe condition	Mild condition	(I)ADLs	Max. grip strength
Austria	12.02	56.69	44.22	39.26
Belgium	17.54	67.97	41.56	38.82
Denmark	17.21	62.36	31.99	40.29
France	14.14	62.29	34.27	37.26
Germany	14.76	59.59	40.41	39.97
Greece	9.93	55.28	41.44	36.99
Italy	14.19	65.98	41.08	34.23
The Netherlands	17.42	54.99	35.23	39.13
Spain	12.98	67.04	43.98	32.28
Sweden	14.62	60.52	32.59	38.41
Switzerland	9.76	45.55	24.51	39.00
Total	14.54	60.62	38.09	37.85

Note: Occurrence of conditions and (I)ADLs in per cent; maximum grip strength in kg. Men and women aged 50–64.

Table III. Health indicators: Part 2

Country	Overweight	Obese	Mental ill health	Good self-perceived health
Austria	42.29	21.54	15.76	73.81
Belgium	41.03	19.39	21.91	75.65
Denmark	40.18	13.97	16.51	76.44
France	37.32	15.54	30.70	75.80
Germany	45.03	15.52	15.17	67.10
Greece	48.36	19.95	19.58	78.78
Italy	43.82	17.93	29.63	62.16
The Netherlands	42.68	14.90	17.49	76.49
Spain	45.21	23.79	27.39	65.09
Sweden	40.92	14.34	16.73	71.58
Switzerland	33.19	12.80	17.57	86.12
Total	42.46	17.29	20.50	72.70

Note: Entries are in per cent. Men and women aged 50–64.

Summary statistics on the health variables are given in Tables II and III. About 14.5% of individuals aged 50–64 ever had a severe condition. The extremes are covered by Belgium (about 17.5%) and Switzerland (9.8%). It is difficult to claim that this is due to the age composition since the Belgian subsample is slightly younger than the Swiss (see Table I). More than 60% of the sample ever had a mild condition. The extremes are again Belgium (68.0%) and Switzerland (45.6%). About 38% of the individuals in the selected sample suffer from restrictions in (instrumental) activities of daily living. This is quite high given that we do not focus on the oldest old in this study. Note the 20 percentage point difference between Austria and Switzerland. Part of this difference can be explained by the relatively older Austrian subsample. The difference in the average maximum grip strength across countries is almost 8 points which is high given an average of 38 points. It turns out that 42 and 17% of the Europeans in the sample suffer from, respectively, overweight and obesity. Taken together, about 60% of the older people in our sample suffers from a weight that is too high.

Further, about one-fifth of the individuals aged 50–64 has mental ill health. Extremes are formed by France (30.7%) and Germany (15.2%). Finally, about 73% of the individuals in our selected sample has a good self-perceived physical health.[4]

[4] Unlike ELSA, SHARE does not contain biomedical data on health or bio-markers (see Banks and Kumari, 2005, for an illustration of the usefulness of such variables in retirement studies).

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Table IV. Labour force participation men

Country	Age 50–54	Age 55–59	Age 60–64
Austria	82.35	65.35	16.77
Belgium	79.72	51.10	18.99
Denmark	84.05	78.26	56.49
France	87.66	60.87	7.87
Germany	83.04	77.04	39.37
Greece	92.42	77.96	44.97
Italy	85.34	56.28	29.21
The Netherlands	87.00	78.13	29.57
Spain	85.37	77.30	40.54
Sweden	93.85	82.86	67.83
Switzerland	93.75	92.65	72.00
Total	86.33	71.18	38.20

Note: Entries are in per cent.

Blanchet *et al*. (2005) showed that the transition from full time employment to full time inactivity has become less relevant over the last decades. The standard pattern to retirement has been supplemented by alternative pathways. For instance, an individual may be unemployed, pre-retired or on sickness or disability insurance before actually retiring and drawing most resources from pension benefits. Given the wide variety of systems that persons aged 50 and over can make use of to bridge the period between regular employment and retirement, it can be argued that it is useful to focus on labour force participation and lumping together other social states like being unemployed or on disability insurance. In this study we consider an individual as participating in the labour market if she or he has worked for pay either as an employee or as a self-employee during the four weeks preceding the interview.

Table IV shows participation rates for men in the SHARE countries. These participation rates are given for three different age classes. As is clear from the table, there is quite some variation in labour force participation across age classes and countries. For example, participation of men aged 55–64 is relatively high in the Nordic countries (Denmark and Sweden) and in Switzerland. Their levels are far above the Lisbon target (across gender) of 50%. Participation of the same age group is less than 40% in Belgium. As could be expected, participation is decreasing with age but the pattern of decrease varies considerably across countries. Similar figures for women are provided in Table V. Participation of women is lower than that of men at the country level and for the different age groups. The notable exceptions here are French women; we have no explanation for this. Roughly speaking, for women the same broad tendencies between countries can be observed as for men. For example, female labour force participation is highest in the Nordic countries and Switzerland and lowest in Belgium.

Another issue concerns the prevalence of part-time work among older individuals in SHARE. Tables VI and VII give the percentages of individuals not participating, working part-time and working full time. An individual is defined to work part-time if her or his average weekly labour supply does not exceed 32 h. It is clear from the tables that part-time work is more common for women than for men (19.4 versus 8.2%). However, there is quite some variation between countries. For older men, the percentage part-time work ranges from 2.5% in Austria to about 13% in the Netherlands and Greece. For older women it ranges from about 9% in the Southern countries (Greece, Italy and Spain) to more than 30% in the Netherlands and Switzerland.

A question that could be rightfully asked is whether individuals decrease the amount of hour worked if they get older. Therefore, we also calculated the hour choices of men and women for the three age classes that we used above.[5] However, as it turned out, we found no evidence for diminishing working

[5] Statistics can be obtained from the authors upon request.

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Table V. Labour force participation women

Country	Age 50–54	Age 55–59	Age 60–64
Austria	67.77	38.36	11.28
Belgium	59.79	30.15	7.58
Denmark	85.92	73.62	29.46
France	68.67	58.82	16.82
Germany	78.05	60.91	23.05
Greece	40.64	28.66	15.28
Italy	47.31	28.29	7.97
The Netherlands	61.70	49.53	17.24
Spain	47.57	40.53	19.02
Sweden	84.96	79.87	62.40
Switzerland	79.80	69.44	47.76
Total	64.35	50.00	22.65

Note: Entries are in per cent.

Table VI. Labour supply choice men aged 50–64

Country	Non-participation	Half time	Full time
Austria	49.9	2.5	47.7
Belgium	46.4	7.5	46.1
Denmark	27.1	7.2	65.7
France	41.6	4.8	53.6
Germany	35.8	4.8	59.5
Greece	32.6	13.4	54.0
Italy	48.7	9.5	41.8
The Netherlands	35.1	12.8	52.1
Spain	35.4	7.3	57.3
Sweden	19.3	8.5	72.2
Switzerland	17.9	9.9	72.2
Total	36.0	8.2	55.8

Note: Entries are in per cent.

Table VII. Labour supply choice women aged 50–64

Country	Non-participation	Half time	Full time
Austria	65.3	14.1	20.6
Belgium	65.9	19.4	14.7
Denmark	35.9	21.2	42.9
France	48.7	15.5	35.8
Germany	46.3	26.2	27.6
Greece	73.0	9.1	17.9
Italy	75.9	9.7	14.4
The Netherlands	55.6	31.0	13.4
Spain	64.4	9.8	25.8
Sweden	24.6	23.2	52.3
Switzerland	35.7	31.5	32.8
Total	54.5	19.4	26.1

Note: Entries are in per cent.

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hours with age. Part-time work seems to be more common for Swedish men in the oldest age classes but in the other countries no clear pattern is observed. Of course, convincing evidence with respect to the above question can only be obtained by longitudinal data where labour supply transitions of the same individuals are observed.

Several factors may have their influence on the different participation rates across European countries. These range from a country's particular institutional context, like its normal retirement age, possibilities for early retirement schemes and how labour income is taxed when an individual receives a pension, to individual characteristics such as educational attainment and health status. In the next section we model labour force participation and analyse its determinants by means of a reduced form approach.

APPROACH AND ESTIMATION RESULTS

Introduction

As mentioned above, self-reported health is widely used as the sole explanatory health status variable in participation models. This health measure is subjective in nature and is potentially endogenous. For example, an individual could justify her or his non-participation by reporting to have worse health than her or his true health status. This type of underreporting of true health status entails an overestimation of the impact of self-reported health on employment (see Bound, 1991). This bias is often referred to as the justification bias. But this is not the only source of bias. Self-reported health may also suffer from measurement error (see Crossley and Kennedy, 2002). In this case, the estimated impact of self-reported health on employment would be attenuated due to classical errors in variables (Wooldridge, 2002). Things become even more complicated if other variables are also subject to measurement error. An example could be the objective health indicators that may be subject to justification bias too (see Baker *et al.*, 2004, for some evidence).

In what follows, we will deal with the possible endogeneity of self-reported health from a different perspective. More specifically, we will approach the endogeneity of self-reported health as an omitted variables problem. In this case the omitted variables are objective health indicators like grip strength or dummy variables capturing whether an individual ever had a severe condition. Such measures are usually omitted in labour supply analyses simply because they are unavailable. In some studies, as mentioned in the introduction, they act as instruments for endogenous self-reported health. We will argue below that such an approach is not always innocuous.

In an omitted variables context two conditions must be satisfied to obtain biased estimates in participation equations that only control for self-reported health (see, for example, Wooldridge, 2002). *Firstly*, self-reported health and objective health indicators must be correlated. This condition is not expected to pose too many problems since it can be argued that self-reported health is at the least a rough summary of the information provided by an individual's objective health indicators. *Secondly*, both self-reported health *and* the set of more objective health indicators must have an impact on the decision to participate. This occurs if self-reported health contains true health information that is not captured by the objective health indicators but at the same time does not summarize all the information that is provided by the latter variables. There is ample evidence that self-reported health indeed contains unmeasured true health that does not show up in more objective health indicators. Idler and Benyamini (1997), for example, showed that self-reported health is a good predictor of mortality even after conditioning on a wide range of alternative specific health indicators. A related and important issue for our study is the finding of Dwyer and Mitchell (1999) that specific objective health indicators each have their own impact on participation.[6] This is of importance because an instrumental variables approach to

[6] They did not additionally control for self-reported health though.

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deal with endogenous self-reported health explicitly assumes that the instruments do not have any direct impact on participation. However, if the second condition is satisfied then objective health indicators are invalid instruments for self-reported health. This renders an IV approach to deal with endogenous self-reported health less appropriate.

Taking the correlation between self-reported health and the objective health indicators for granted, four different cases can be distinguished.

(1) If both self-reported health and the set of objective health indicators have an impact on participation, then self-reported health is endogenous in models that do not control for the objective health indicators. Estimates of the impact of self-reported health on participation will thus be biased. The bias caused by omitted objective health indicators is mitigated by our approach. Note, however, that after controlling for objective health indicators and thus alleviating the endogeneity problem, one cannot completely exclude any bias.[7] A significant coefficient associated with self-reported health after controlling for objective health indicators can reflect both unmeasured true health that is not captured by the other health variables or some remaining justification bias. Further, if self-reported health and/or objective health indicators are ill measured, then parameters are still subject to attenuation bias. Measurement error is difficult to handle with the data at hand and is therefore beyond the scope of this study. Still, the results obtained should be interpreted with caution in light of this issue.

(2) If the additional objective health indicators do not have any impact on participation on top of self-reported health, then there is no empirical evidence for endogeneity of self-reported health due to omitted objective health indicators. Such a situation would arise, for example, if self-reported health is a sufficient statistic for an individual's general health in the sense that objective health indicators do not provide extra information. (Of course, as discussed above, there may still be other (unobserved) omitted health indicators.)

(3) If self-reported health has no impact on participation once one also controls for objective health indicators, then there is also no empirical evidence for endogenous self-reported health due to omitted objective health indicators. Note that in this case self-reported health and (a linear combination of) objective health indicators act as very close substitutes. Either of the two (sets of) regressors can be taken up in the participation equation.

(4) Finally, there is the case that neither of the two (sets of) health-related regressors have an impact on participation. Of course, also in this case, self-reported health is not subject to endogeneity bias due to omitted objective health variables.

In the empirical analysis, we test whether the two conditions for endogenous self-reported health due to omitted objective health indicators are satisfied for each country. We focus on the extensive margin of the labour supply decision in the application. More specifically, we model the choice between working and not working. Given the data at hand this is probably the most relevant dimension for further investigation (see also 'Data and descriptive statistics' section). We make use of standard probit regressions to describe the individual participation decision. These regressions are separately applied to men and women, and to each country. This allows us to let the data speak as much as possible for themselves. It is probably safe to argue that only individuals below the respective normal retirement ages are making a participation decision and may feel the need to justify their non-participation. For this reason we restrict the sample that we discussed above to individuals below their respective normal retirement ages.[8]

[7] We thank an anonymous referee for pointing this out.

[8] The normal retirement age in 2004 differs between the SHARE countries. For the men in our sample, the normal retirement age is 65 years in all countries except for France where it is 60 years. For the women in the sample, a more divergent pattern applies. In Austria, France, Greece and Italy it is 60 years, in Belgium 62 years, in Switzerland 64 years, while it is 65 years in Germany, the Netherlands, Denmark, Spain and Sweden.

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Apart from health-related variables we also control for other individual characteristics. A first set of such regressors are yearly age dummies. This level of detail allows us to partly capture the countries' social security characteristics that are defined in terms of an individual's age (for example, arrangements for early retirement). The final set of regressors that we focus on capture an individual's socio-demographic situation, like her or his education level, marriage status, number of children and whether the respondent has children who are still in education.

Results for men

Tables IX and X show the estimation results for men aged between 50 and their respective normal retirement ages. Two specifications are shown per country. The first specification is with only self-reported health included and the second specification is with a full set of health-related variables. To ease interpretation we present the average marginal effects (along with their standard errors) associated with the different regressors.[9] Note that most of the regressors are dummy variables. The only exceptions are the grip strength and the number of children. To compare their relative importance we standardized these variables by subtracting their means and dividing by their standard deviations. Consequently, their marginal effects are associated with the effect on participation when they increase by one standard deviation.

Let us first concentrate on Specification 1. In line with previous studies, self-reported health is significantly associated with participation in all the countries but Italy. The percentage point difference in the probability of participation when a man claims to have good health compared to a similar man who reports bad health ranges from 13.2 percentage point in Greece to 28.8 percentage point in Germany. However, as discussed above, self-reported health is potentially an endogenous explanatory variable and the corresponding estimates in Specification 1 may be biased due to omitted objective health indicators. For this reason we add in Specification 2 the six objective health-related variables to the regression.

The first condition for endogenous self-reported health (due to omitted health indicators) is that this variable and the set of objective health indicators are correlated. To check this condition, we ran country-specific probit regressions with the dummy for self-reported health as the explained variable and the set of objective health indicators, together with the individual and household characteristics of the employment equations, as explanatory variables. The set of objective health indicators and self-reported health turn out to be strongly correlated. Probability values of a Wald test for the hypothesis that parameters associated with objective health indicators are jointly insignificant are equal to zero up to four digits in each country.[10]

The second condition for endogenous self-reported health (due to omitted health indicators) is that both self-reported health and the set of additional objective health indicators have an impact on participation. Wald tests were conducted to check these respective null hypotheses and the results are summarized in Table VIII. Table VIII shows that the test results differ between countries. Both self-reported health and the set of objective health indicators have a significant impact on male participation in Denmark, the Netherlands and Sweden. For these countries, the impact of self-reported health is biased if one would not condition on the other objective health indicators. These results also suggest that an instrumental variables approach would be less appropriate. Moreover, the marginal effect of self-reported health considerably decreases once one takes into account objective health indicators (see Tables IX and X). Although we take as a starting point the inclusion of self-reported health, excluding this variable would, in this case, also yield a biased impact of objective health indicators.

[9] We first calculated individual marginal effects for the whole data set. In a second step, the average of the individual marginal effects was taken. Standard errors were obtained by means of the delta method. The marginal effect of a dummy variable is calculated as the discrete change in the probability of working for pay as the dummy variable changes from 0 to 1.

[10] More detailed results can be obtained from the authors.

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Table VIII. Wald test results on impact health-related variables

	Objective health indicators	
Self-reported health	Significant	Not significant
Men		
Significant	DK, NL, SE	BE, DE, GR, CH
Not significant	AU, ES	FR, IT
Women		
Significant	BE, DK, SE	DE, GR, ES
Not significant	FR, NL, CH	AU, IT*

Note: Test results are based on Wald tests with a 5% significance level. An asterisk denotes that the self-reported health is significant at the 10% significance level.

For the other countries the results for men in Table VIII show no direct evidence of endogenous self-reported health due to omitted objective health indicators. In France and Italy, both sets of health variables turn out to be insignificant. Two further cases can be distinguished. For Austria and Spain only objective health indicators have a significant impact on participation. The initially significant and economically rather important parameter associated with self-reported health turns insignificant and economically less important when one also conditions on the full set of health-related variables. In these countries self-reported health appears to be strongly correlated with a linear combination of the objective health indicators. Note that in Austria no less than three other health variables seem to be associated with self-reported health (severe health condition, grip strength and mental ill health). This makes the sole conditioning on self-reported health not too much of an issue. In fact, either of the two sets of health variables can be used as a control in the participation equation. The final set of countries consists of Belgium, Germany, Greece and Switzerland for which only self-reported health has a significant impact on participation in Specification 2. Following Benítez-Silva *et al.* (2004), this result could be explained by the fact that self-reported health summarizes a lot of unobserved health-related information that cannot be captured by the objective health indicators.

Note that the above results are driven by the significance levels used in the Wald tests focusing on self-reported health and the set of objective health indicators. As a robustness check, we redid the exercise with a significance level of 10% instead of 5%. As is clear from Table VIII, the results for men would not be affected by this alternative significance level.

Let us now discuss the average marginal effects of the objective health indicators (see Tables IX and X). Having experienced a severe health condition implies a significant lower probability for participation only in Austria, Denmark and Spain. The economic impact of a severe condition varies in a quite important way between these countries. In Denmark, the probability of participation is 11.1 percentage point lower for a man who experienced a severe condition compared to an individual who never had a severe condition and who is in all other aspects equal. In Spain, this decrease in participation amounts to 20.0 percentage point. As could be expected, the impact of a mild condition is less important. Its marginal effect is insignificant in all 11 countries. Having restrictions in (instrumental) activities of daily living has a significant and economically important impact in Spain and Sweden with marginal effects between -13.5 and -20.2. Obesity has no significant average marginal effect in all 11 countries. A new health indicator in social surveys is the grip strength. The results show that the indicator is quite important in five countries in the analysis (Austria, Denmark, Germany, the Netherlands and Sweden). All else being equal, the higher a man's grip strength the more likely he is to participate in the labour market. In Austria, for example, an increase of one standard deviation in grip strength implies a higher probability of working of about 5 percentage point. For Swedish men, the impact is economically less important with an average marginal effect of about 3.1 percentage point.

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Table IX. Marginal effects on the participation probability of men: Part 1

	Austria				Belgium				Denmark				France				Germany				Greece			
	Specification 1		Specification 2		Specification 1		Specification 2		Specification 1		Specification 2		Specification 1		Specification 2		Specification 1		Specification 2		Specification 1		Specification 2	
	Marg. eff.	St. err.	Marg. eff.	St. err.	Marg. eff.	St. err.	Marg. eff.	St. err.	Marg. eff.	St. err.	Marg. eff.	St. err.	Marg. eff.	St. err.	Marg. eff.	St. err.	Marg. eff.	St. err.	Marg. eff.	St. err.	Marg. eff.	St. err.	Marg. eff.	St. err.
Age dummies																								
Age 51	−0.060	(0.133)	−0.115	(0.137)	0.007	(0.082)	−0.006	(0.080)	−0.041	(0.109)	0.001	(0.100)	0.152	(0.097)	0.153	(0.098)	−0.132	(0.139)	−0.146	(0.130)	−0.028	(0.114)	−0.025	(0.113)
Age 52	0.073	(0.147)	−0.022	(0.149)	−0.034	(0.079)	−0.037	(0.078)	0.009	(0.111)	0.034	(0.105)	0.044	(0.106)	0.064	(0.100)	−0.126	(0.135)	−0.147	(0.125)	0.037	(0.106)	0.031	(0.105)
Age 53	−0.010	(0.134)	−0.080	(0.141)	0.015	(0.080)	0.014	(0.079)	−0.167	(0.117)	−0.128	(0.113)	−0.162	(0.132)	−0.142	(0.132)	−0.170	(0.134)	−0.166	(0.126)	−0.042	(0.117)	−0.046	(0.118)
Age 54	−0.115	(0.122)	−0.158	(0.122)	0.020	(0.078)	0.025	(0.077)	−0.091	(0.107)	−0.060	(0.100)	0.060	(0.107)	0.110	(0.091)	−0.022	(0.133)	−0.021	(0.124)	−0.173	(0.122)	−0.175	(0.122)
Age 55	−0.002	(0.127)	−0.072	(0.128)	−0.054	(0.076)	−0.052	(0.075)	−0.041	(0.103)	−0.032	(0.100)	−0.212	(0.126)	−0.171	(0.128)	−0.012	(0.140)	−0.009	(0.133)	−0.088	(0.120)	−0.085	(0.117)
Age 56	**−0.253**	(0.114)	**−0.297**	(0.110)	**−0.198**	(0.069)	**−0.193**	(0.070)	0.033	(0.098)	0.074	(0.086)	−0.221	(0.137)	−0.184	(0.139)	−0.095	(0.145)	−0.106	(0.137)	−0.145	(0.125)	−0.159	(0.125)
Age 57	−0.133	(0.128)	−0.189	(0.124)	**−0.240**	(0.073)	**−0.220**	(0.074)	−0.150	(0.121)	−0.118	(0.114)	−0.241	(0.127)	−0.208	(0.131)	−0.157	(0.140)	−0.147	(0.132)	−0.221	(0.118)	−0.216	(0.118)
Age 58	−0.139	(0.120)	−0.156	(0.122)	**−0.294**	(0.066)	**−0.269**	(0.070)	−0.094	(0.124)	−0.056	(0.115)	**−0.282**	(0.130)	−0.234	(0.133)	−0.219	(0.136)	−0.213	(0.128)	**−0.233**	(0.117)	**−0.234**	(0.117)
Age 59	**−0.223**	(0.111)	**−0.233**	(0.112)	**−0.395**	(0.059)	**−0.375**	(0.063)	−0.114	(0.128)	−0.066	(0.122)	**−0.366**	(0.148)	**−0.327**	(0.157)	−0.237	(0.143)	−0.212	(0.137)	**−0.387**	(0.119)	**−0.385**	(0.118)
Age 60	**−0.326**	(0.100)	**−0.322**	(0.108)	**−0.440**	(0.052)	**−0.418**	(0.057)	−0.084	(0.114)	−0.025	(0.106)					**−0.311**	(0.129)	**−0.305**	(0.123)	**−0.374**	(0.122)	**−0.383**	(0.121)
Age 61	**−0.493**	(0.057)	**−0.498**	(0.056)	**−0.429**	(0.056)	**−0.421**	(0.058)	−0.226	(0.119)	−0.169	(0.117)					**−0.503**	(0.101)	**−0.496**	(0.097)	**−0.375**	(0.123)	**−0.392**	(0.120)
Age 62	**−0.490**	(0.068)	**−0.509**	(0.061)	**−0.448**	(0.056)	**−0.433**	(0.060)	**−0.314**	(0.122)	**−0.255**	(0.122)					**−0.432**	(0.115)	**−0.403**	(0.116)	**−0.564**	(0.094)	**−0.565**	(0.094)
Age 63	**−0.512**	(0.058)	**−0.515**	(0.059)	**−0.482**	(0.052)	**−0.463**	(0.060)	**−0.457**	(0.127)	**−0.408**	(0.130)					**−0.429**	(0.114)	**−0.423**	(0.108)	**−0.499**	(0.117)	**−0.508**	(0.115)
Age 64	**−0.502**	(0.058)	**−0.513**	(0.053)	**−0.473**	(0.052)	**−0.459**	(0.057)	**−0.548**	(0.104)	**−0.482**	(0.120)					**−0.512**	(0.098)	**−0.487**	(0.101)	**−0.672**	(0.068)	**−0.672**	(0.069)
Demographic-variables																								
Secondary education	0.009	(0.059)	0.004	(0.052)	0.041	(0.038)	0.036	(0.038)	0.059	(0.054)	0.070	(0.055)	**0.102**	(0.050)	**0.104**	(0.049)	0.105	(0.070)	0.103	(0.073)	−0.015	(0.040)	−0.016	(0.039)
Higher education	**0.152**	(0.064)	**0.123**	(0.060)	**0.120**	(0.036)	**0.125**	(0.035)	**0.131**	(0.052)	**0.143**	(0.053)	**0.186**	(0.051)	**0.186**	(0.049)	**0.196**	(0.071)	**0.189**	(0.075)	−0.015	(0.040)	−0.017	(0.040)
Children	0.034	(0.019)	**0.038**	(0.019)	0.039	(0.020)	0.036	(0.020)	0.049	(0.033)	0.043	(0.032)	0.024	(0.027)	0.026	(0.026)	0.017	(0.020)	0.014	(0.020)	−0.005	(0.015)	−0.003	(0.015)
Couple	**0.107**	(0.051)	0.065	(0.046)	0.073	(0.048)	0.066	(0.048)	**0.150**	(0.052)	**0.150**	(0.052)	0.071	(0.070)	0.055	(0.068)	−0.010	(0.044)	−0.013	(0.044)	−0.060	(0.047)	−0.066	(0.046)
Child in school	0.055	(0.051)	0.073	(0.049)	0.060	(0.048)	0.064	(0.048)	0.001	(0.046)	−0.009	(0.044)	**0.136**	(0.048)	**0.132**	(0.047)	0.047	(0.042)	0.047	(0.041)	0.011	(0.037)	0.010	(0.038)
Health-related variables																								
Self-reported health	**0.156**	(0.041)	0.043	(0.048)	**0.139**	(0.038)	**0.092**	(0.044)	**0.269**	(0.051)	**0.206**	(0.061)	**0.146**	(0.062)	0.081	(0.073)	**0.288**	(0.037)	**0.228**	(0.046)	**0.132**	(0.049)	**0.146**	(0.056)
Severe condition			**−0.170**	(0.059)			−0.062	(0.042)			**−0.111**	(0.054)			−0.024	(0.083)			−0.019	(0.043)			0.033	(0.049)
Mild condition			−0.002	(0.039)			−0.017	(0.034)			0.066	(0.037)			0.034	(0.048)			0.000	(0.035)			0.042	(0.034)
(I)ADL			−0.052	(0.043)			−0.037	(0.036)			−0.025	(0.051)			−0.110	(0.067)			−0.033	(0.035)			−0.003	(0.036)
Obese			0.019	(0.042)			0.033	(0.039)			0.070	(0.048)			−0.007	(0.068)			−0.062	(0.045)			0.013	(0.041)
Grip strength			**0.054**	(0.018)			0.031	(0.016)			**0.049**	(0.019)			0.008	(0.024)			**0.040**	(0.017)			0.017	(0.017)
Mental ill health			**−0.188**	(0.056)			0.008	(0.044)			−0.055	(0.064)			−0.115	(0.063)			−0.051	(0.055)			−0.048	(0.057)
Wald test (p-value)			**0.000**				0.240				**0.007**				0.228				0.111				0.727	
Observations	407		407		737		737		432		432		269		269		674		674		546		546	
Pseudo R^2	0.369		0.421		0.248		0.256		0.212		0.246		0.217		0.242		0.263		0.277		0.236		0.242	

Note: Bold entries are significant at the 5% significance level. Wald test results refer to the hypothesis that the parameters associated with the objective health indicators are jointly insignificant.

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Table X. Marginal effects on participation probability of men: Part 2

	Italy				Netherlands				Spain				Sweden				Switzerland			
	Specification 1		Specification 2		Specification 1		Specification 2		Specification 1		Specification 2		Specification 1		Specification 2		Specification 1		Specification 2	
	Marg. eff.	St. err.	Marg. eff.	St. err.	Marg. eff.	St. err.	Marg. eff.	St. err.	Marg. eff.	St. err.	Marg. eff.	St. err.	Marg. eff.	St. err.	Marg. eff.	St. err.	Marg. eff.	St. err.	Marg. eff.	St. err.
Age dummies																				
Age 51	0.060	(0.170)	0.029	(0.165)	0.000	(0.086)	−0.009	(0.088)	0.165	(0.111)	0.197	(0.093)	−0.084	(0.154)	−0.048	(0.145)	−0.122	(0.125)	−0.126	(0.144)
Age 52	−0.147	(0.138)	−0.178	(0.127)	0.079	(0.082)	0.071	(0.084)	0.029	(0.126)	0.052	(0.119)	−0.037	(0.153)	−0.006	(0.144)	0.032	(0.091)	0.015	(0.101)
Age 53	−0.002	(0.174)	−0.040	(0.166)	0.027	(0.089)	0.041	(0.088)	0.128	(0.111)	0.110	(0.109)	0.025	(0.123)	0.066	(0.103)				
Age 54	−0.071	(0.142)	−0.093	(0.134)	0.039	(0.080)	0.048	(0.079)	0.059	(0.124)	0.078	(0.108)	−0.033	(0.140)	−0.025	(0.139)				
Age 55	−0.150	(0.132)	−0.174	(0.122)	−0.002	(0.093)	−0.004	(0.093)	0.118	(0.118)	0.122	(0.115)	−0.026	(0.141)	0.024	(0.122)	−0.012	(0.108)	0.000	(0.098)
Age 56	**−0.237**	(0.109)	**−0.263**	(0.098)	−0.029	(0.084)	−0.032	(0.084)	−0.098	(0.141)	−0.051	(0.133)	−0.163	(0.157)	−0.131	(0.157)	−0.042	(0.130)	−0.066	(0.146)
Age 57	**−0.229**	(0.112)	**−0.264**	(0.099)	−0.035	(0.083)	−0.020	(0.083)	−0.082	(0.135)	−0.074	(0.130)	−0.163	(0.160)	−0.107	(0.151)	−0.008	(0.118)	0.013	(0.108)
Age 58	**−0.316**	(0.096)	**−0.343**	(0.084)	−0.090	(0.083)	−0.081	(0.084)	0.054	(0.116)	0.082	(0.108)	−0.189	(0.151)	−0.144	(0.148)	0.075	(0.071)	0.074	(0.070)
Age 59	**−0.438**	(0.073)	**−0.455**	(0.064)	−0.134	(0.094)	−0.140	(0.095)	−0.021	(0.123)	0.021	(0.113)	−0.220	(0.167)	−0.151	(0.161)	−0.115	(0.127)	−0.151	(0.140)
Age 60	**−0.442**	(0.071)	**−0.462**	(0.060)	**−0.321**	(0.094)	**−0.315**	(0.093)	**−0.374**	(0.128)	**−0.283**	(0.140)	−0.300	(0.162)	−0.231	(0.164)				
Age 61	**−0.391**	(0.083)	**−0.408**	(0.074)	**−0.317**	(0.089)	**−0.304**	(0.091)	**−0.343**	(0.135)	−0.264	(0.143)	−0.279	(0.165)	−0.234	(0.168)	−0.158	(0.140)	−0.119	(0.136)
Age 62	**−0.452**	(0.070)	**−0.471**	(0.061)	**−0.415**	(0.088)	**−0.403**	(0.090)	−0.159	(0.132)	−0.101	(0.128)	−0.265	(0.167)	−0.201	(0.166)	−0.158	(0.137)	−0.173	(0.151)
Age 63	**−0.505**	(0.051)	**−0.523**	(0.041)	**−0.574**	(0.066)	**−0.564**	(0.068)	**−0.282**	(0.134)	−0.211	(0.140)	**−0.388**	(0.174)	−0.302	(0.183)	−0.279	(0.167)	−0.275	(0.175)
Age 64	**−0.394**	(0.085)	**−0.421**	(0.073)	**−0.524**	(0.074)	**−0.491**	(0.083)	**−0.344**	(0.131)	**−0.271**	(0.138)	**−0.402**	(0.167)	−0.320	(0.177)	−0.351	(0.190)	−0.319	(0.209)
Demographic variables																				
Secondary education	**0.132**	(0.045)	**0.126**	(0.045)	**0.073**	(0.033)	**0.059**	(0.033)	0.024	(0.059)	0.015	(0.054)	−0.005	(0.038)	−0.010	(0.038)	0.038	(0.047)	0.016	(0.045)
Higher education	**0.233**	(0.059)	**0.224**	(0.059)	**0.069**	(0.034)	**0.072**	(0.034)	0.063	(0.059)	0.035	(0.061)	0.038	(0.032)	0.021	(0.032)	0.054	(0.041)	0.026	(0.041)
Children	0.014	(0.020)	0.019	(0.020)	0.014	(0.016)	0.012	(0.016)	0.009	(0.018)	0.011	(0.017)	**0.047**	(0.022)	**0.043**	(0.021)	−0.011	(0.024)	−0.013	(0.025)
Couple	0.073	(0.064)	0.073	(0.064)	0.066	(0.048)	0.035	(0.047)	0.053	(0.064)	0.053	(0.058)	**0.116**	(0.044)	**0.107**	(0.043)	−0.005	(0.051)	0.012	(0.049)
Child in school	0.048	(0.055)	0.040	(0.054)	0.067	(0.040)	0.073	(0.039)	0.030	(0.054)	0.014	(0.052)	0.004	(0.032)	0.008	(0.031)	**0.146**	(0.031)	**0.147**	(0.031)
Health-related variables																				
Self-reported health	0.045	(0.042)	0.039	(0.046)	**0.252**	(0.041)	**0.219**	(0.047)	**0.173**	(0.048)	0.015	(0.052)	**0.185**	(0.038)	**0.110**	(0.038)	**0.231**	(0.080)	**0.171**	(0.087)
Severe condition			−0.045	(0.058)			0.012	(0.036)			**−0.200**	(0.069)			−0.057	(0.038)			0.000	(0.061)
Mild condition			0.002	(0.039)			0.007	(0.029)			0.013	(0.042)			0.024	(0.029)			−0.004	(0.040)
(I)ADL			0.018	(0.043)			0.012	(0.034)			**−0.202**	(0.058)			**−0.135**	(0.039)			0.027	(0.050)
Obese			−0.096	(0.049)			−0.020	(0.044)			−0.038	(0.051)			−0.018	(0.038)			−0.027	(0.051)
Grip strength			−0.013	(0.020)			**0.039**	(0.014)			0.012	(0.020)			**0.031**	(0.015)			0.030	(0.021)
Mental ill health			−0.010	(0.051)			**−0.133**	(0.046)			−0.007	(0.059)			−0.021	(0.048)			−0.205	(0.101)
Wald test (p-value)			0.525				**0.007**				**0.000**				**0.000**				0.842	
Observations	517		517		709		709		412		412		670		670		223		223	
Pseudo R^2	0.219		0.226		0.324		0.341		0.198		0.266		0.167		0.206		0.275		0.322	

Note: Bold entries are significant at the 5% significance level. Wald test results refer to the hypothesis that the parameters associated with the objective health indicators are jointly insignificant.

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The above results demonstrate that specific health indicators have an own impact on participation in six countries, which concurs with earlier findings by Dwyer and Mitchell (1999). Different health indicators have divergent and significant average marginal effects in Austria, Denmark, Germany, the Netherlands, Spain and Sweden. In addition to mitigating the endogeneity problem associated with self-reported health, taking into account a broader set of health-related variables allows to draw a more refined picture of how employment and health are associated in these countries.

Next we discuss the estimated age patterns. Tables IX and X show that many age dummies are significantly different from zero and generally increase in importance for older individuals.[11] This is likely due to the existence of age-specific early retirement and disability schemes in most countries. The probit results show that the age dummies do not start having any impact before the age of 56. A significant age effect can be observed as soon as an individual is 56 in Austria, Belgium and Italy. Especially in Austria this effect is rather important. The probability that an Austrian man of age 56 participates is 25.3 (29.7) percentage point lower than the participation probability of a similar 50-year-old man in Specification 1 (2). In countries like Germany, the Netherlands and Spain there is only a significant impact of the age dummies associated with ages that are at least equal to 60. A remarkable result is obtained for Sweden and Switzerland. Although the marginal effects get smaller for older ages, none of these are significantly different from zero in Specification 2. This implies that age does not seem to be associated with employment before an individual reaches the normal retirement age in Sweden and Switzerland.

A final set of estimates refers to an individual's socio-demographic characteristics. The estimation results indicate that education plays a rather important role in the participation decision in most countries. All else being equal, the higher the level of education the higher the probability of participation. In Greece, Spain, Sweden and Switzerland, education does not seem to be associated with participation in a significant way.[12] The impact of a household's demographic composition is not extremely important. Although, *ceteris paribus*, more children imply a higher probability of participation, this is only significantly estimated in Austria and Sweden. Furthermore, having children who are still in education positively and significantly affects participation in France and Switzerland. Finally, only in the Nordic countries (Denmark and Sweden) the parameter associated with the dummy variable that captures whether a man lives in a couple is significantly estimated in both specifications. All else being equal, Danish (Swedish) men who live in a couple have a participation probability that is 15.0 (10.7) percentage point higher than that of men who are single.

It is noteworthy that the marginal effects of the regressors that are not health related are rather similar between the two specifications. This seems to indicate that the set of health-related variables and the other regressors are close to being independent of each other. The endogeneity problem associated with omitted health variables is thus less important as far as the impact on participation of socio-demographic characteristics is concerned. Of course, there is no guarantee that this conclusion can be transferred to economic variables. Answering this question will be possible in the future when a link is established between SHARE and detailed social security data (see above).

Results for women

Marginal effects and standard errors associated with the probit regression results for women aged between 50 and their respective normal retirement ages are shown in Tables XI and XII, and the results associated with the endogeneity test can be found in the bottom panel of Table VIII. We again consider two specifications. Specification 1 only takes into account self-reported health and Specification 2

[11] Due to a relatively small sample size, some of the age dummies for Switzerland were perfectly correlated with participation. We collapsed problematic age categories with the preceding age category.

[12] This is also formally confirmed by means of a Wald test associated with the null hypothesis that both education dummies do not have any joint impact on participation.

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Table XI. Marginal effects on participation probability of women: Part 1

	Austria				Belgium				Denmark				France				Germany				Greece			
	Specification 1		Specification 2		Specification 1		Specification 2		Specification 1		Specification 2		Specification 1		Specification 2		Specification 1		Specification 2		Specification 1		Specification 2	
	Marg. eff.	St. err.	Marg. eff.	St. err.	Marg. eff.	St. err.	Marg. eff.	St. err.	Marg. eff.	St. err.	Marg. eff.	St. err.	Marg. eff.	St. err.	Marg. eff.	St. err.	Marg. eff.	St. err.	Marg. eff.	St. err.	Marg. eff.	St. err.	Marg. eff.	St. err.
Age dummies																								
Age 51	0.011	(0.125)	0.009	(0.124)	−0.031	(0.071)	−0.026	(0.073)	0.031	(0.106)	0.051	(0.103)	0.090	(0.107)	0.074	(0.106)	0.061	(0.085)	0.061	(0.085)	−0.075	(0.082)	−0.066	(0.084)
Age 52	−0.033	(0.117)	−0.020	(0.116)	0.023	(0.080)	0.017	(0.080)	−0.111	(0.123)	−0.076	(0.120)	−0.045	(0.127)	−0.094	(0.124)	0.118	(0.088)	0.115	(0.088)	0.071	(0.093)	0.101	(0.096)
Age 53	−0.149	(0.106)	−0.154	(0.105)	−0.121	(0.069)	−0.121	(0.068)	−0.040	(0.106)	0.002	(0.105)	−0.078	(0.113)	−0.125	(0.108)	0.143	(0.084)	0.145	(0.083)	0.051	(0.091)	0.073	(0.095)
Age 54	0.064	(0.131)	0.077	(0.133)	**−0.181**	(0.054)	**−0.172**	(0.056)	0.146	(0.100)	0.158	(0.091)	−0.038	(0.125)	−0.009	(0.123)	0.125	(0.084)	0.123	(0.084)	−0.108	(0.076)	−0.100	(0.078)
Age 55	**−0.240**	(0.090)	**−0.224**	(0.092)	**−0.204**	(0.055)	**−0.190**	(0.058)	0.005	(0.114)	0.019	(0.113)	0.044	(0.114)	0.024	(0.109)	0.080	(0.087)	0.091	(0.085)	**−0.227**	(0.071)	**−0.225**	(0.070)
Age 56	−0.063	(0.110)	−0.042	(0.111)	**−0.223**	(0.052)	**−0.197**	(0.058)	0.021	(0.105)	0.040	(0.106)	−0.129	(0.118)	−0.155	(0.117)	−0.089	(0.089)	−0.095	(0.088)	−0.136	(0.086)	−0.129	(0.086)
Age 57	**−0.295**	(0.090)	**−0.268**	(0.095)	**−0.339**	(0.040)	**−0.320**	(0.045)	−0.067	(0.115)	−0.007	(0.111)	−0.106	(0.113)	−0.147	(0.110)	−0.092	(0.093)	−0.080	(0.093)	0.029	(0.112)	0.047	(0.114)
Age 58	**−0.285**	(0.090)	**−0.246**	(0.096)	**−0.311**	(0.044)	**−0.296**	(0.049)	−0.168	(0.115)	−0.121	(0.119)	**−0.274**	(0.109)	**−0.296**	(0.104)	−0.095	(0.094)	−0.094	(0.095)	0.026	(0.099)	0.050	(0.102)
Age 59	**−0.409**	(0.078)	**−0.383**	(0.088)	**−0.275**	(0.051)	**−0.246**	(0.058)	**−0.247**	(0.109)	**−0.216**	(0.113)	**−0.309**	(0.127)	**−0.321**	(0.121)	−0.082	(0.097)	−0.087	(0.096)	−0.117	(0.108)	−0.100	(0.114)
Age 60					**−0.394**	(0.028)	**−0.384**	(0.031)	**−0.303**	(0.113)	**−0.262**	(0.120)					**−0.272**	(0.084)	**−0.263**	(0.084)				
Age 61					**−0.352**	(0.037)	**−0.334**	(0.043)	**−0.451**	(0.103)	**−0.415**	(0.114)					**−0.319**	(0.080)	**−0.315**	(0.081)				
Age 62					**−0.366**	(0.035)	**−0.350**	(0.040)	**−0.448**	(0.103)	**−0.418**	(0.113)					**−0.305**	(0.083)	**−0.296**	(0.084)				
Age 63									**−0.447**	(0.106)	**−0.414**	(0.114)					**−0.335**	(0.081)	**−0.325**	(0.082)				
Age 64									**−0.473**	(0.103)	**−0.419**	(0.118)					**−0.488**	(0.055)	**−0.484**	(0.056)				
Demographic variables																								
Secondary education	0.100	(0.061)	0.098	(0.063)	0.016	(0.038)	0.005	(0.038)	0.083	(0.045)	0.068	(0.044)	−0.007	(0.059)	−0.035	(0.058)	0.060	(0.046)	0.055	(0.046)	0.019	(0.051)	0.027	(0.051)
Higher education	**0.357**	(0.072)	**0.355**	(0.072)	**0.177**	(0.044)	**0.152**	(0.043)	**0.252**	(0.052)	**0.231**	(0.051)	0.127	(0.067)	0.111	(0.066)	**0.140**	(0.051)	**0.130**	(0.051)	**0.279**	(0.065)	**0.279**	(0.066)
Children	−0.017	(0.029)	−0.015	(0.030)	−0.012	(0.020)	−0.010	(0.020)	0.032	(0.045)	0.036	(0.047)	**−0.046**	(0.026)	**−0.052**	(0.025)	−0.003	(0.023)	−0.001	(0.023)	−0.029	(0.022)	−0.030	(0.022)
Couple	−0.092	(0.058)	**−0.107**	(0.057)	−0.007	(0.041)	−0.012	(0.040)	0.005	(0.041)	0.002	(0.040)	**−0.121**	(0.057)	**−0.178**	(0.055)	−0.067	(0.041)	−0.073	(0.041)	**−0.177**	(0.053)	**−0.172**	(0.053)
Child in school	0.034	(0.082)	0.037	(0.084)	0.022	(0.060)	0.036	(0.060)	−0.057	(0.044)	−0.054	(0.044)	−0.026	(0.070)	0.004	(0.067)	0.004	(0.041)	0.005	(0.041)	0.047	(0.059)	0.039	(0.059)
Health-related variables																								
Self-reported health	**0.124**	(0.062)	0.112	(0.069)	**0.146**	(0.037)	**0.092**	(0.047)	**0.215**	(0.049)	**0.113**	(0.057)	0.106	(0.065)	0.038	(0.069)	**0.118**	(0.034)	**0.087**	(0.039)	**0.107**	(0.053)	**0.128**	(0.057)
Severe condition			0.016	(0.081)			−0.060	(0.048)			−0.102	(0.051)			**−0.255**	(0.092)			−0.030	(0.048)			0.133	(0.098)
Mild condition			−0.050	(0.060)			−0.020	(0.036)			−0.007	(0.039)			0.012	(0.059)			−0.038	(0.034)			−0.064	(0.048)
(I)ADL			−0.028	(0.061)			−0.020	(0.037)			−0.022	(0.042)			0.032	(0.057)			−0.048	(0.034)			0.027	(0.046)
Obese			−0.024	(0.065)			−0.032	(0.043)			0.059	(0.052)			**−0.163**	(0.073)			0.020	(0.044)			0.048	(0.056)
Grip strength			0.030	(0.028)			**0.060**	(0.018)			0.056	(0.020)			0.025	(0.028)			−0.025	(0.016)			0.001	(0.024)
Mental ill health			0.102	(0.066)			0.013	(0.040)			**−0.094**	(0.050)			**−0.112**	(0.057)			−0.009	(0.042)			−0.001	(0.052)
Wald test (p-value)			0.631				**0.012**				**0.013**				**0.013**				0.420				0.541	
Observations	280		280		735		735		434		434		320		320		776		776		408		408	
Pseudo R^2	0.196		0.206		0.191		0.208		0.329		0.363		0.083		0.121		0.221		0.226		0.130		0.140	

Note: Bold entries are significant at the 5% significance level. Wald test results refer to the hypothesis that the parameters associated with the objective health indicators are jointly insignificant.

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Table XII. Marginal effects on participation probability of women: Part 2

	Italy				Netherlands				Spain				Sweden				Switzerland			
	Specification 1		Specification 2		Specification 1		Specification 2		Specification 1		Specification 2		Specification 1		Specification 2		Specification 1		Specification 2	
	Marg. eff.	St. err.	Marg. eff.	St. err.	Marg. eff.	St. err.	Marg. eff.	St. err.	Marg. eff.	St. err.	Marg. eff.	St. err.	Marg. eff.	St. err.	Marg. eff.	St. err.	Marg. eff.	St. err.	Marg. eff.	St. err.
Age dummies																				
Age 51	0.049	(0.097)	0.054	(0.097)	0.080	(0.088)	0.098	(0.088)	−0.076	(0.085)	−0.088	(0.084)	0.091	(0.069)	0.087	(0.065)	−0.031	(0.165)	−0.012	(0.157)
Age 52	0.039	(0.100)	0.047	(0.100)	0.079	(0.088)	0.070	(0.087)	−0.108	(0.079)	−0.111	(0.078)	−0.069	(0.093)	−0.080	(0.091)	−0.264	(0.162)	−0.211	(0.155)
Age 53	0.036	(0.100)	0.037	(0.101)	−0.019	(0.079)	0.014	(0.079)	−0.091	(0.081)	−0.082	(0.082)	0.030	(0.077)	0.033	(0.076)	−0.019	(0.145)	−0.040	(0.143)
Age 54	−0.063	(0.085)	−0.058	(0.085)	0.026	(0.087)	0.030	(0.086)	−0.140	(0.077)	−0.144	(0.075)	0.029	(0.072)	0.018	(0.069)	−0.094	(0.134)	−0.070	(0.134)
Age 55	−0.030	(0.088)	−0.022	(0.090)	−0.021	(0.085)	0.009	(0.084)	−0.011	(0.091)	−0.017	(0.092)	−0.033	(0.086)	−0.018	(0.079)	0.012	(0.190)	−0.017	(0.191)
Age 56	**−0.189**	(0.070)	**−0.180**	(0.071)	−0.028	(0.081)	0.003	(0.080)	**−0.191**	(0.069)	**−0.185**	(0.070)	0.055	(0.073)	0.051	(0.070)	−0.224	(0.167)	−0.234	(0.146)
Age 57	**−0.154**	(0.077)	**−0.146**	(0.080)	0.012	(0.082)	0.047	(0.082)	−0.145	(0.079)	−0.138	(0.080)	0.019	(0.075)	0.029	(0.070)	−0.275	(0.161)	**−0.292**	(0.159)
Age 58	−0.112	(0.081)	−0.110	(0.081)	−0.113	(0.081)	−0.096	(0.081)	−0.093	(0.088)	−0.094	(0.090)	−0.066	(0.086)	−0.049	(0.078)	−0.306	(0.156)	−0.210	(0.159)
Age 59	**−0.165**	(0.079)	**−0.163**	(0.078)	−0.093	(0.086)	−0.042	(0.088)	−0.088	(0.085)	−0.064	(0.090)	−0.031	(0.077)	−0.020	(0.073)	−0.178	(0.147)	−0.100	(0.145)
Age 60					**−0.311**	(0.062)	**−0.289**	(0.066)	−0.121	(0.087)	−0.108	(0.090)	0.025	(0.079)	0.005	(0.078)	**−0.365**	(0.132)	**−0.280**	(0.138)
Age 61					**−0.296**	(0.067)	**−0.261**	(0.071)	**−0.247**	(0.062)	**−0.229**	(0.067)	**−0.201**	(0.092)	**−0.166**	(0.087)	**−0.350**	(0.159)	**−0.282**	(0.158)
Age 62					**−0.252**	(0.074)	**−0.219**	(0.080)	**−0.327**	(0.045)	**−0.315**	(0.049)	−0.089	(0.093)	−0.085	(0.089)	**−0.311**	(0.158)	−0.161	(0.170)
Age 63					**−0.398**	(0.047)	**−0.374**	(0.054)	−0.142	(0.090)	−0.130	(0.092)	**−0.277**	(0.105)	**−0.274**	(0.099)	**−0.566**	(0.124)	**−0.488**	(0.153)
Age 64					**−0.323**	(0.065)	**−0.286**	(0.075)	**−0.320**	(0.052)	**−0.313**	(0.055)	**−0.342**	(0.105)	**−0.310**	(0.103)				
Demographic variables																				
Secondary education	**0.257**	(0.054)	**0.258**	(0.054)	**0.104**	(0.039)	**0.088**	(0.038)	**0.178**	(0.061)	**0.171**	(0.061)	0.059	(0.032)	**0.061**	(0.031)	0.113	(0.064)	0.059	(0.067)
Higher education	**0.484**	(0.059)	**0.481**	(0.060)	**0.257**	(0.040)	**0.231**	(0.040)	**0.308**	(0.071)	**0.278**	(0.073)	**0.091**	(0.030)	**0.089**	(0.030)	**0.158**	(0.064)	**0.158**	(0.061)
Children	**−0.041**	(0.019)	**−0.042**	(0.019)	0.007	(0.022)	0.007	(0.021)	0.009	(0.016)	0.011	(0.016)	0.003	(0.027)	0.001	(0.027)	**−0.064**	(0.030)	**−0.060**	(0.028)
Couple	**−0.126**	(0.059)	**−0.127**	(0.059)	−0.058	(0.046)	−0.061	(0.045)	**−0.156**	(0.050)	**−0.159**	(0.050)	0.020	(0.038)	0.007	(0.036)	0.024	(0.067)	0.020	(0.064)
Child in school	0.037	(0.057)	0.026	(0.058)	0.022	(0.045)	0.023	(0.044)	0.001	(0.048)	0.013	(0.048)	0.012	(0.032)	0.018	(0.032)	0.027	(0.078)	0.043	(0.070)
Health-related variables																				
Self-reported health	**0.091**	(0.043)	0.086	(0.050)	**0.157**	(0.036)	0.063	(0.043)	**0.154**	(0.040)	**0.125**	(0.049)	**0.248**	(0.034)	**0.121**	(0.037)	0.021	(0.084)	−0.045	(0.083)
Severe condition			−0.012	(0.061)			−0.076	(0.043)			0.076	(0.062)			−0.073	(0.043)			0.137	(0.081)
Mild condition			−0.043	(0.047)			−0.045	(0.034)			0.016	(0.044)			−0.017	(0.030)			−0.079	(0.062)
(I)ADL			0.056	(0.046)			−0.067	(0.035)			−0.048	(0.046)			**−0.098**	(0.032)			−0.067	(0.072)
Obese			**−0.052**	(0.057)			**−0.153**	(0.040)			−0.021	(0.043)			0.001	(0.037)			0.147	(0.071)
Grip strength			0.025	(0.024)			**0.032**	(0.015)			**0.050**	(0.022)			**0.030**	(0.014)			**0.102**	(0.037)
Mental ill health			0.021	(0.046)			0.019	(0.039)			0.024	(0.044)			**−0.103**	(0.036)			0.113	(0.063)
Wald test (p-value)			0.701				**0.000**				0.239				**0.000**				**0.001**	
Observations	437		437		835		835		559		559		794		794		226		226	
Pseudo R^2	0.195		0.202		0.176		0.203		0.152		0.164		0.167		0.207		0.121		0.183	

Note: Bold entries are significant at the 5% significance level. Wald test results refer to the hypothesis that the parameters associated with the objective health indicators are jointly insignificant.

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conditions on a full set of objective and subjective health indicators. Given that the results for women are qualitatively similar to those obtained for males we will keep the discussion concise.

Like in the men's case, self-reported health and the set of more objective health indicators are strongly correlated. Probability values of a Wald test for the joint insignificance of the parameters associated with objective health indicators in a probit regression of self-reported health on objective health indicators and other individual characteristics are all equal to zero up to four digits.

Table VIII summarizes the test results for the second condition for endogenous self-reported health due to omitted objective health indicators. Recall that this second condition requires that both self-reported health and the set of additional health indicators have a significant impact on participation. Table VIII (bottom panel) shows that self-reported health is likely to be endogenous in Belgium, Denmark and Sweden. A Wald test strongly rejects the null hypothesis that the parameters associated with the set of objective health indicators are jointly insignificant and also the effect of self-reported health is significantly different from zero in Specification 2. Moreover, taking into account the full set of health-related variables has a strong negative impact on the marginal effect of self-reported health.

For Austria and Italy both self-reported health and the set of other health indicators do not have any significant impact on participation in Specification 2. This implies that there is no evidence that self-reported health is endogenous as a consequence of omitted health indicators. The same conclusion can be drawn for the other countries. Two cases can again be distinguished. In France, the Netherlands and Switzerland, only objective health indicators have a significant impact on participation in Specification 2. These indicators take over the role of self-reported health which was significant in Specification 1. This demonstrates that self-reported health and a linear combination of objective health indicators are strongly correlated. Both measures can act as the sole controls in the female labour force participation equation. Finally, we have Germany, Greece and Spain where self-reported health does a fairly good job. Only self-reported health has a significant impact on participation in Specification 2. This suggests that objective health indicators do not provide much additional information.

A number of health indicators have their own significant marginal effects and there is quite an important variation between countries. Only one health variable has a significant marginal effect in Germany, Greece, Italy and Switzerland. But in France and Sweden, respectively, three and four health indicators have an own significant marginal effect. The average marginal effects of the individual health variables are generally comparable to those obtained for men.

Similar to the men's results there is a significant age pattern. The main difference with men is that for women the decline with age starts earlier in many countries. In Belgium, for example, women who are 54 years old are about 17 percentage point less likely to work compared to a 50-year-old woman. In Germany and the Netherlands age comes into play as soon as a woman reaches the age of 60. This is actually also the case for German and Dutch men. For Swedish women the age effect becomes significant for women who are 61. Contrary to the estimation results for men there are no countries that are characterized by the absence of any age effects.

The impact of education is both economically and statistically significant for all countries. A higher education implies, *ceteris paribus*, a higher probability of participation.[13] The lowest average impact is observed in Sweden where higher educated women are 8.9 percentage point more likely to participate than lower educated women. In Italy, higher educated women have a probability of participation that is even 48.1 percentage point higher than otherwise similar lower educated women.

Other striking differences can be observed for the regressors that are related to a household's demographic composition. All else being equal, in many countries women have a lower probability to participate if they live in a couple (up to about 17.8 percentage point in France) and/or if there are children present in the household. Having children in school does not explain this. Given the positive

[13] For France the null hypothesis of joint insignificance of the education effects is rejected at the 5% significance level.

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impact of the dummy variable associated with living in a couple and the number of children in many of the men's equations, this could indicate that there is some coordination going on within couples: on average men seem to specialize in market work while women stay home and care for the children.

Following the men's results it must be stressed that the impact of the endogeneity problem due to omitted objective health indicators on the other regressors is not very dramatic. Average marginal effects associated with the latter do not differ much across the two specifications. This holds both in terms of statistical and economic significance.

We also conducted a robustness check by redoing the exercise for women with a significance level of 10% instead of 5%. As is clear from Table VIII, only the results for Italy would be affected by the alternative significance level. However, results would still indicate no endogeneity problem due to omitted objective health indicators since the latter remains insignificant.

CONCLUSION

In this paper we studied labour force participation of older individuals in Europe. The data used were drawn from the first wave of the new Survey of Health, Ageing and Retirement in Europe (SHARE). This survey is designed as a longitudinal survey and contains detailed data on the life circumstances of a representative sample of individuals aged 50 and over in 11 European countries. Its cross-national and multi-disciplinary nature makes it a very valuable source for all kinds of social and economic analyses.

We had two objectives in mind. Firstly, we introduced the new SHARE data and described participation and health patterns for the countries involved. The identical questionnaires for each of the 11 countries allow an easy comparison of the figures discussed. We have shown the substantial differences in participation rates and health across the SHARE countries.

Secondly, we examined the value added of objective health indicators in studies analysing labour force participation of older people. Usually a single self-reported health indicator appears in such studies. We approached the possible endogeneity of this self-reported health as an omitted variables problem. This exercise turned out to be a perfect illustration of the 'empirical minefield', which Benítez-Silva *et al*. (2004) used to describe the empirical literature on the reliability of self-reported health with its far from unambiguous results. In some countries the subjective health measure does a fairly good job and controlling for additional objective health indicators does not seem to add to the analysis. Within our model this implies exogeneity of self-reported health. In other countries, however, self-reported health is clearly endogenous due to omitted objective health indicators. The empirical results illustrate the multi-dimensional nature of health in the sense that in addition to self-reported health different objective health indicators have their own impact on participation. As a consequence, instrumenting self-reported health by a set of objective health indicators appears to be an insufficient remedy for these countries. On the positive side, marginal effects of the other socio-demographic regressors in the analysis seem to be not much affected by endogenous self-reported health and whether objective health indicators are included in the participation model. Of course, these conclusions are conditional on our participation model in which we could not control for economic variables like the accrual in social security wealth. It is a bridge too far to transfer this latter conclusion to the impact of economic variables on participation of older people.

What implications can be drawn from our results? We would suggest to account for both self-reported health and objective health indicators in employment studies. In a number of countries that we investigated, the objective health indicators mitigate the endogeneity bias of self-reported health that is due to omitted health indicators while they take the multi-dimensional nature of health into account. One should remain careful, though, when interpreting the results. A significant impact of self-reported health after conditioning on the other health indicators may identify the impact of unmeasured true health that is not captured by the objective health indicators, but may also be due to some remaining

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justification bias. Moreover, our approach does not take into account endogeneity bias due to measurement error. These issues, however, cannot be analysed further with the data at hand. And, of course, this potential problem also applies to the more standard instrumental variables approach to endogenous self-reported health.

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REFERENCES

Baker M, Stabile M, Deri C. 2004. What do self-reported, objective, measures of health measure? *Journal of Human Resources* **39**: 1067–1093.

Banks J, Blundell R, Disney R, Emmerson C. 2002. Retirement, pensions and the adequacy of saving: a guide to the debate. *IFS Briefing Note* **29**, Institute for Fiscal Studies, London.

Banks J, Kumari M. 2005. Health and retirement in England: new evidence from the English Longitudinal Study of Ageing. *Mimeo*.

Benítez-Silva H, Buchinsky M, Chan HM, Cheidvasser S, Rust J. 2004. How large is the bias in self-reported disability. *Journal of Applied Econometrics* **19**: 649–670.

Blanchet D, Brugiavini A, Rainato R. 2005. Pathways to retirement. In *Health, Ageing and Retirement in Europe. First Results from the Survey of Health, Ageing and Retirement in Europe*, Börsch-Supan A, Brugiavini A, Jürges H, Mackenbach J, Siegrist J, Weber G (eds.). Mannheim Research Institute for the Economics of Ageing: Mannheim; 246–252.

Blundell R, Meghir C, Smith S. 2002. Pension incentives and the pattern of early retirement. *Economic Journal* **112**: C153–C170.

Bound J. 1991. Self-reported versus objective measures of health in retirement models. *Journal of Human Resources* **26**: 106–138.

Bound J, Schoenbaum M, Stinebrickner T, Waidmann T. 1999. The dynamic effects of health on the labor force transitions of older workers. *Labour Economics* **6**: 179–202.

Börsch-Supan A, Brugiavini A, Jürges H, Mackenbach J, Siegrist J, Weber G (eds). 2005. *Health, Ageing and Retirement in Europe. First Results from the Survey of Health, Ageing and Retirement in Europe*. Mannheim Research Institute for the Economics of Ageing: Mannheim.

Christensen H, Mackinnon A, Korten A, Jorm A. 2001. The 'common cause hypothesis' of cognitive aging: evidence for not only a common factor but also specific associations of age with vision and grip strength in a cross-sectional analysis. *Psychology and Aging* **16**: 588–599.

Crossley T, Kennedy S. 2002. The reliability of self assessed health status. *Journal of Health Economics* **21**: 643–658.

Disney R, Emmerson C, Wakefield M. 2006. Ill health and retirement in Britain: a panel data based analysis. *Journal of Health Economics* **25**: 621–649.

Dwyer D, Mitchell O. 1999. Health problems as determinants of retirement: are self-rated measures endogenous? *Journal of Health Economics* **18**: 173–193.

European Commission. 2004. *Report from the Commission to the Spring European Council. Delivering Lisbon*. Reforms for the Enlarged Union, Commission of the European Communities, Brussels.

Gruber J, Wise D (eds). 1998. *Social Security Programs and Retirement Around the World*. University of Chicago Press: Chicago.

Gruber J, Wise D. 2002. Social security programs and retirement around the world: micro estimation. *NBER Working Paper 9407*, NBER, Cambridge.

DOI: 10.1002/hec

Gruber J, Wise D. 2005. Social security programs and retirement around the world: Fiscal implications. Introduction and summary. *NBER Working Paper 11290*, NBER, Cambridge.
Gustman A, Steinmeier T. 2005. The social security early entitlement age in a structural model of retirement and wealth. *Journal of Public Economics* **89**: 441–463.
Idler E, Benyamini Y. 1997. Self-rated health and mortality: a review of twenty-seven community studies. *Journal of Health and Social Behavior* **38**: 21–37.
Kerkhofs M, Lindeboom M, Theeuwes J. 1999. Retirement, financial incentives and health. *Labour Economics* **6**: 203–227.
Lazear E. 1986. Retirement from the labor force. In *Handbook of Labor Economics*, vol. 1, Ashenfelter O, Layard R (eds). Elsevier: Amsterdam.
Lumsdaine R, Mitchell O. 1999. New developments in the economic analysis of retirement. In *Handbook of Labor Economics*, vol. 3, Ashenfelter O, Card D (eds). Elsevier: Amsterdam.
Rantanen T, Harris T, Leveille S, Visser M, Foley D, Masaki K Guralnik J. 2000. Muscle strength and body mass index as long-term predictors of mortality in initially health men. *The Journals of Gerontology Series A*: *Biological Sciences and Medical Sciences* **55**: M168–M173.
Rust J, Phelan F. 1997. How social security and medicare affect retirement behavior in a world of incomplete markets. *Econometrica* **65**: 781–831.
Stock J, Wise D. 1990. Pensions, the option value of work and retirement. *Econometrica* **58**: 1151–1180.
Wooldridge J. 2002. *Econometric Analysis of Cross Section an Panel Data*. The MIT Press: Cambridge, MA.

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