Disability and the labour force participation of older workers: the importance of health

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Preliminary Draft

Do not quote

Abstract

In this article, we focus, within a European framework, the important role of health in the decision of men from 50 to 64 about whether or not they will take part to the labour market. We use a latent variable model (Bound (1991) and Campolieti (2002)) to estimate the effect of disability status on the labour force participation of older men in Europe; with data from a new European database SHARE.

Labour force participation depends on a group of socio-demographic variables and unobservable latent disability. In a preliminary step, we estimate an equation of participation by directly introducing the self-reported disability, but the 'true' disability status is unobserved. Thus in a second step following Bound methodology, we use estimations of self-reported disability. In order to take into account the self-reported biases, we instrument theses measures with information on health conditions (health indicators relating to the diseases, deficiencies, Body Mass Index,...). Although socio-demographic variables, such as a high education level or living as a couple, seem to keep seniors in activity, health indicators are also relevant. Our results suggest that if we use the self-reported health measure that leads to a downward bias in the impact of disability status on labour force participation.

Key words: labour supply, health, disability

Classification JEL : I12, J14, J82

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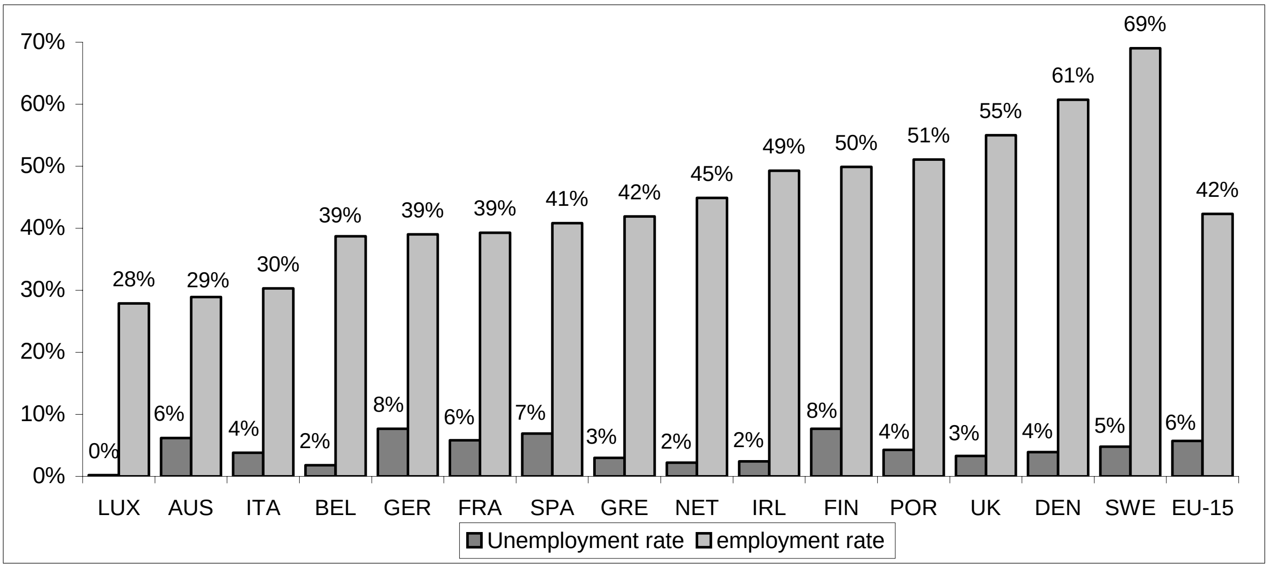
Introduction

The populations of industrialised countries, and European countries in particular, are getting older. This is because people are living longer, and the numerous baby boom generation is now moving into retirement. The resultant changes in the population age structure are altering the balance between the generations in work and those in retirement. In order to ensure the equilibrium of pay-as-you-go retirement systems different countries have essentially adopted policies of increasing the age of retirement or increasing the period during which contributions must be paid in order to qualify for full retirement benefits.

If these measures are to be effective in the long-term, it will be essential to increase the employment rate of older workers (defined here as persons aged 50 or more). However, in spite of an objective for 2010 of an employment rate of 50% for 55 to 64 year olds, announced following the Stockholm European Council, in 2003 this stood at 42.3%.With the exception of Sweden, Denmark, the UK and Portugal, the employment rate of older workers is below 50% and as low as 40% in six European countries including Germany, France and Italy (OECD, 2004). These differences in employment rates are due to institutional differences (legal age of retirement, measures available to facilitate early retirement), the structure of the labour market and also to personal choices which are influenced by family life and people's health status at the end of their working life.

Figure 1 : Employment rate and unemployment rate for 55-64 in European Union (15 countries), 2003



Sources : OECD, 2004
*Data in 2002 for France and Luxembourg

Historically, European countries had established early retirement systems in the context of policies to combat unemployment. These "classical" early retirement systems have been increasingly abandoned in favour of "active ageing", a policy advocated by the OECD among others since 1998. This concern was reflected in the implementation of measures such as lifelong learning in Sweden and Denmark, the possibility of working during retirement (Blanchet, Brugiavini et Rainato, 2005) and management of working time in the UK and the Netherlands.

However, these measures have not resulted in a significant increase in the employment rate of older workers. Thus the pathway from working life to retirement is changeing and people's health status is becoming more significant. New measures which essentially relate to individuals' health status are being developed: disability pensions or measures which enable individuals to anticipate retirement and therefore modify their labour supply. Health status is becoming an important reason for early departure from the labour market.

Even if the relationship between health status and labour supply seems obvious, the causal relations are in fact complex. Two contradictory effects seem to operate simultaneously: on one hand working conditions may have a negative effect on people's health status towards the end of their working life, and on the other hand poor health may result in early departure from the labour market. Hence in order to study the relationship between labour supply and health we must look at individual characteristics, conditions in the labour market and modes of production, the institutional context and national economic environments.

In the European context of an opening up of national labour markets, in a general situation of convergence of modes of production on the part of businesses, and of national legislation, it is important to examine and understand in more detail cultural, socio-economic, demographic and institutional differences, and in particular to look closely at labour markets and differences in health status.

Moreover, participation in the labour market at the end of a person's working life is strongly influenced by financial incentives for early retirement (OECD, 1998) and the capacity of the labour market to absorb the labour supply of older workers. It also depends on individual factors such as the job situation of the partner (under the hypothesis of complementarity of preferences within couples) or health status. In a policy context of varying the age of retirement, the effect of health status on labour force participation is crucial because the efficacy of this reform will be limited if older persons are unable to work.

In all countries, people give up work before the legal age of retirement. This difference is partly explained by the existence of a variety of measures which facilitate early retirement from paid work (pre-retirement and disability). Furthermore, the average age of retirement varies noticeably between countries, from 57,5 in Luxembourg to 64,5 in Portugal (Eurostat, 2002). If disability schemes are supposed to take into account the health status of employees, the beneficiaries do not include all persons in poor health and their state of health varies considerably. The differences across Europe in the numbers benefiting from these programmes seems to have more to do with institutional differences than variations in health status (Börsh-Supan, 2005). Disability schemes, which are particularly prevalent in Scandinavian countries (such as the Norwegian AFP programme) encourage large numbers of people to retire early, particularly during periods of recession (Lilja, 1996, and Dahl, Nilsen and Vaage, 2000). The use of disability schemes is thus one approach to early departure from the labour market. Given that these schemes are based on individuals' health status, we need to take into account the disability effect on labour force participation while controlling for health status.

The effect of health status on labour force participation

Rather than going back to the seminal works of Becker (1964) and Grossman (1972) who showed the importance of investing in health status for the participation of individuals in the labour market, here we focus on the correlation between health status and the labour force participation of older workers. Several empirical studies have shown that health status, and more particularly disability, is a determining variable for the whole labour force participation and therefore of the labour supply of older workers (Currie and Madrian, 1999). Even if the relationship between health status and participation in the labour market appears obvious, the causal relationship is not clear (Strauss and Thomas, 1998). Two contradictory effects seem to operate: on one hand arduous work may result in worse health, particularly towards the end of working life, and on the other poor health may result in early departure from the labour market.

Several authors (Stern, 1989, and Leung and Wong, 2002) have tried to demonstrate the first effect, namely that work can damage workers' health status, but there are contrasting findings in the economic literature. Nevertheless, work by ergonomists and sociologists has shown that for specific populations, heavy exposure to difficult and arduous working conditions has severe consequences for health status (Theorell and Karasek, 1996). However this effect may be subject to bias. For example the hypothesis of justification, whereby an individual overrates his poor health to justify a situation of inactivity or unemployment, could explain in part this relationship; lack of employment may result in poorer health with a consequent over-emphasis of this relationship (Brenner, 2001).

The second effect we discuss here, concerns the impact of poor health status on workers' decisions to leave the labour market. Many empirical studies of various designs have clearly demonstrated the effect of health on labour market participation, and more particularly that poor health state results in early departure from the labour market.

According to Anderson and Burkhauser (1985), two problems are intrinsic to measuring the effect of health status on decisions to retire, or more precisely cease active employment. Firstly, measuring the effect of health status on labour supply may be subject to bias, because health status in itself is a consequence of individual choice. In the economic literature, health status is considered to be a consumption good with households making choices within their "basket of goods". Hence, for example, if the preference for work is positively (or negatively) correlated with the decision to consume health care currently or in the past, then estimation of the health effect on the decision to retire could be over- (or under-) estimated. Secondly, we must consider the relevance of the indicators chosen to measure health status. It is impossible to find an adequate variable capable of measuring "true" health status.

Reported surveys are the main means of evaluating health status using four types of health indicators. Firstly, the most commonly used indicators are those of self-reported health status ("Would you say your health is very good, good, fair, bad or very bad?"). These subjective indicators help to elicit individual true health. Secondly, indicators of disease prevalence constitute specific health indicators. Thirdly, a group of indicators measuring deficiencies (of sight, hearing etc.), functional limitations and activity limitations (Activities of Daily Living, Instrumental Activities of Daily Living) are used to assess individual health status. Finally, specific indicators, including anthropometric indicators like Body Mass Index (BMI), can provide indirect information about health status.

Rust and Phelan (1997) use only the indicator of self-reported health status to study the links between health status and participation in the labour market. Using a structural dynamic model of labour supply, Blau (1994) shows, for example, that men aged between 55 and 73 declaring themselves in poor health were three times more likely to be outside the labour market than to be working full-time. The self reported health status indicator provides a good synthesis of health status because it captures more information about disability (Idler and Kasl, 1995). Nevertheless, it is subject to considerable cultural and psychological bias (Bound, 1991). In fact, where people position themselves on the measurement scale is complex and undoubtedly influenced by their health status. Furthermore self-reporting is subject to significant endogenous bias from various sources: education, social situation, gender, social environment and family situation. Therefore it is necessary to take respondent bias into account a priori or simultaneously when studying the health effect on labour supply, by using other health indicators. Even if they are obtained using self-reported surveys, indicators like BMI or diseases diagnosed by a doctor, are less affected by endogenous bias, but may result in some intrinsic errors in health status measurement.

The question of how to measure health status is central because this will have some effect on any analysis of the relationship between health and work (Anderson and Burkhauser, 1984, and Thomas and Franck, 2000). To increase the probability of obtaining a measure of "true" health, we need then to use several different measures of health status.

The basic hypothesis is to consider "true" health as an unobservable variable. Kreider (1999) uses an indicator of activity limitation to show that unemployed persons overestimate their incapacity for work. Bound assumes that participation in the labour market depends on socio-demographic variables and on some latent self-reported disability, (a composite indicator which he defines as "true" disability). Then, he introduces a variable of self-reported disability into his model (a composite indicator derived from health indicators such as disease prevalence and BMI…), enabling an approximation of "true" disability. Using this method, Bound (1999) and Campolieti (2002) show that the effect of health on labour force participation is underestimated if self-reporting alone is used to measure health.

In this paper, we use the latter model to study the links between disability and labour force participation. After describing the model and the SHARE survey (Survey on Health, Ageing and Retirement in Europe) we present an initial descriptive analysis of the SHARE survey for ten countries. This analysis provides information about the socio-economic characteristics of the 50 to 65 year old population (employment rate, level of education, family structure), and also its health characteristics, using instruments such as the prevalence of 14 diseases, BMI and activity restrictions. On the basis of this preliminary analysis, we highlight both similarities and differences between these European countries.

In the second phase of work, we use econometric analysis to estimate the relationships between health status and labour supply of older persons, showing the importance of national contexts for individual decisions. Finally, we test the model country by country to show that the results vary between different European countries.

An econometric model

We use the classic econometric model, proposed by Bound (1991) and used again by Campolieti (2002). The first equation in the model is one which describes the labour force participation of older persons taking account of the concept of disability:

$$p = \mathrm{I}_{p^*>0} \quad \text{with} \quad p^* = X'\beta_p + \lambda\eta + \varepsilon_p \qquad \text{with} \quad \varepsilon_p \to N\left(0, \sigma^2_{\varepsilon_p}\right), \tag{1}$$

where p^* is a latent variable describing labour force participation, X is a vector which partly describes the observable characteristics of each individual and η is a latent unobservable variable describing the disability of individuals. We use an indicator p of labour force participation, which is binary.

The second equation corresponds to individuals' self-reported disability:

$$d = \mathrm{I}_{d^*>0} \quad \text{with} \quad d^* = X'\beta_d + \eta + \varepsilon_d \qquad \text{with} \quad \varepsilon_d \to N\left(0, \sigma^2_{\varepsilon_d}\right), \tag{2}$$

where d^* is a latent variable describing self-reported disability. In this equation, we suppose that the difference between "true" disability and self-reported disability depends on observable individual characteristics and an error term. We use an indicator d of self-reported disability for workers, which is also binary.

The third equation is one which explains the idea of individuals' unobservable "true" disability:

$$\eta = X'\beta_\eta + Z'\gamma + \varepsilon_\eta \qquad \text{avec} \quad \varepsilon_\eta \to N\left(0, \sigma^2_{\varepsilon_\eta}\right), \tag{3}$$

where Z is a vector of variables representing the health status characteristics of each individual. "True" disability also depends on the sociodemographic characteristics of each individual. η corresponds to a continuum of situations. We assume that the error terms in equations (1) and (3) are not correlated with the explanatory variables in each equation. Hence, logically, these two residuals are not correlated. We suppose that ε_p and Z are not correlated.

It is possible to solve the participation equation (eq.1) using the disability variable which we construct as a proxy of the latent incapacity variable. We use the strategy developed by Stern (1989) and Bound (1991) to estimate the importance of health for labour force participation. By substituting (2) into (3) we determine:

$$d^* = X'\beta_d + \left(X'\beta_\eta + Z'\gamma + \varepsilon_\eta\right) + \varepsilon_d = X'\left(\beta_d + \beta_\eta\right) + Z'\gamma + \left(\varepsilon_\eta + \varepsilon_d\right) = X'\beta_{d^*} + Z'\gamma_{d^*} + \varepsilon_{d^*} \tag{4}$$

The values of the disability, thus estimated, are used as proxies of "true" disability. We can therefore solve the following participation equation:

$$p^* = X'\beta_p + \lambda\hat{d}^* + \varepsilon_{p^*} \tag{5}$$

Bound (1991) stipulates that by using $\hat{d}^*$ as an instrument of the latent disability variable, an estimator consistent with λ is obtained. He also shows that the estimations of the coefficients

β_p must be biased by the relationship between the estimated disability variable and the variables describing the observable characteristics of each individual (see also Bound (1991) and Campolieti (2002)).

The SHARE database

SHARE (Survey on Health and Ageing in Europe) is a longitudinal survey which aims to collect medical, social and economic data on the population aged over 50. Eleven European Union countries are participating at present (Germany, Austria, Belgium, Denmark, Spain, France, Greece, Italy, the Netherlands and Sweden) as well as Switzerland. It has been designed after the British and American role models: the Health and Retirement Survey (HRS) in the USA, which is in its sixth wave, and the British ELSA panel (English Longitudinal Survey of Ageing) for which a first wave has already been completed, and which may join the SHARE project.

The project has two main features which distinguish it from other European surveys. The first is its multidisciplinary scope. Although a group of economists were mainly responsible for starting it, the idea is to approach the issue of the ageing of individuals from a variety of disciplines. To take just one example, the usual approach to the issue of selecting an appropriate age for retirement (Gruber and Wise, 2004) is generally restricted to considering the financial aspects of this problem, because of missing data. However, an important issue here is health conditions. It should be possible to consider both dimensions of the problem using the SHARE, while controlling for numerous other variables which may affect retirement behaviour, such as the family situation, work satisfaction etc..

The other is the desire to have an instrument as harmonised as possible between the participating countries. There are two possible uses for a highly harmonised data collection tool. The first is the production of reliable comparative statistics: is health status impairing with age in a similar way between countries? How can we compare the relative standard of living of older persons, their level of use of health services, their participation in the labour market, their level of informal employment, the density of their family networks etc.? The second is the use of survey data not as a series of national surveys, but as a single database of micro-data, in which international variability is not the direct object of measurement. Rather it is a factor in inter-individual variability enabling a deeper analysis of various issues. For example, the effects of institutions on variables such as individual saving can be measured much more precisely if countries where these institutional factors differ greatly are grouped. A large transnational sample can also be a useful tool for investigating various epidemiological hypotheses. For example, if the prevalence of a risk behaviour varies widely from one country to another, a much more precise estimation of the consequences of these behaviours can be obtained from an international database than from a sample limited to one country.

The descriptive statistics

In this paper we focus on the male population aged between 50 and 65, questioned in 10 countries[2].

The analysis in Table 1 shows numerous socioeconomic differences between countries. Thus, between 50 and 65 years old, the Swiss, Swedes and Greeks have the highest labour force participation rate[3], with employment rates above 70%, while the Austrians, Italians and French have a slightly lower rate (below 60 %). It is important to remember that the study of the relationship between health status and work among 50 to 65 year olds is also strongly influenced by measures to facilitate early departure from the labour force (early retirement, exemption from job seeking) and by the institutional context whereby financial incentives have an important effect on individual behaviour.
Level of education and participation in the labour market seem to be positively correlated. In fact, those countries with the highest labour force participation rate are those with the highest levels of education. Moreover a third of persons aged between 50 and 65 have qualifications above upper secondary level in Germany, Switzerland and Sweden, compared to only 12.9% for Spaniards and 9.5% for Italians. The large differences are the result above all of historical differences between the education systems of southern Europe and the Scandinavian countries.

Because family structures are a product of the sociocultural features of a country, highly specific national differences persist. The aged family, a household with at least one child, is the commonest model in southern Europe (Spain, Italy and Greece), while in Scandinavia the aged childless couple is the most prevalent model.

Table 2 presents the different health status variables. These variables are declared by individuals, thus certain biases exist due to the intrinsic characteristics of individuals. The first relates to the presence of a diagnosed disease The second is constituted by Body Mass Index (BMI) calculated from responses to the question “What is your weight?” and “What is your height?”. Finally, we use a subjective variable of activity limitation: “Do you consider that your activity is limited for reasons of health?”.

The diseases most often diagnosed among 50 to 65 year olds are high blood pressure hypertension (23,5 %) and high blood cholesterol (18 %). Other diseases are prevalent in less than 10 % of the population. Older persons from Denmark and Italy are most affected by arterial hypertension. However cholesterol is more prevalent in Spain and Austria (23,3% and 19,3% respectively) and diabetes affects more than one older person in ten in Spain and France.

If we consider the population for whom the BMI is below 18 (i.e. very thin) or above 30 (obese) this indicator varies from 14% in Holland and Switzerland to more than 20% in Austria and Spain.

The variable of activity limitation enables us to focus on the population which considers itself handicapped. We are more likely to be able to establish a link between work and this variable.

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[2] For reasons not related to statistics, Belgium is not included in our analysis. (at = Austria; de = Germany; se = Sweden ; nl = Netherlands ; es = Spain ; it = Italy; fr = France; dk = Denmark; gr = Greece; ch = Switzerland).
[3] These figures are higher than those in Table 1 because they relate to the male population aged between 50 and 64 which is more often in employment than 55 to 64 year olds.

The differences are very pronounced. 36,5% of Austrians report activity limitation, compared to only 13,5 % of Greeks. If we consider very severe limitation of activities of daily living, the rank order of countries changes. Thus 2,9% of Greeks report severe limitations, compared to 11,3% in Sweden and 15,3% in Holland.

Table 1 : Countries comparison for sociodemographic variables (in %)

	At	De	Se	Nl	es	It	fr	dk	Gr	ch	Ens
Labour force participation	43,02	60,31	76,64	65,74	62,14	44,72	57,14	68,48	70,2	79,75	62,61
Primary level	0,23	1,13	25,21	10,96	45	39,89	29,31	0,45	29,39	21,1	19,4
Lower secondary level	13,26	4,52	18,66	31,62	28,1	26,83	8,37	12,24	11,22	22,36	17,83
Upper secondary level	56,28	55,23	21,65	28,43	14,05	23,79	38,18	54,65	30,2	19,41	34,65
Tertiary level	30,23	39,12	34,47	28,99	12,86	9,48	24,14	32,65	29,18	37,13	28,12
Alone	16,05	13,28	14,25	8,74	10,48	9,12	13,05	17,23	12,65	16,03	12,71
Couple (without children)	56,98	57,06	62,11	58,67	22,62	28,09	46,31	60,77	25,92	62,45	48,71
Family	26,98	29,66	23,65	32,59	66,9	62,79	40,64	22	61,43	21,52	38,58
Age 50-51	7,91	9,6	9,83	13,18	12,14	7,16	15,27	18,14	13,88	16,46	11,85
Age 52-53	12,56	14,97	13,96	13,04	14,76	8,59	17,98	11,56	16,53	11,39	13,57
Age 54-55	14,65	15,68	10,97	13,18	12,86	12,52	17,73	15,65	14,69	12,24	13,92
Age 56-57	11,63	11,16	13,82	18,31	10,48	15,38	13,79	12,47	13,88	11,39	13,57
Age 58-58	12,56	11,16	17,09	13,87	15,71	17,71	9,85	11,56	13,67	15,19	13,92
Age 60-61	14,42	16,1	16,38	12,62	13,33	14,49	9,36	14,29	10,61	16,46	13,9
Age 62-63	19,07	13,56	12,11	11,93	12,86	15,03	12,07	11,34	9,8	12,66	12,98
Age 64-65	7,21	7,77	5,84	3,88	7,86	9,12	3,94	4,99	6,94	4,22	6,28
	430	708	702	721	420	559	406	441	490	237	5 144

Share, 2004

Table 2 : Countries comparison for health status variables (in %)

	At	De	se	nl	es	It	fr	dk	gr	ch	Ens
Heart attack	6,28	8,76	10,11	9,02	8,57	7,87	8,87	5,9	8,98	4,22	8,23
High blood pressure hypertension	22,33	28,39	23,22	19,69	21,43	28,8	21,18	22,68	21,84	22,36	23,45
High blood cholesterol	19,3	17,09	16,24	17,34	23,33	16,64	24,14	14,97	18,98	17,3	18,22
Stroke	3,95	2,54	2,42	3,05	0,71	1,79	2,22	4,08	1,02	0,84	2,37
Diabet	8,6	9,18	7,83	6,24	11,43	7,69	10,34	6,35	6,12	5,06	7,92
Chronic lung disease	3,49	3,67	2,14	4,85	5	5,19	4,93	5,22	2,04	2,53	3,91
Asthma	4,19	2,82	5,56	3,74	2,62	3,04	4,43	6,58	1,22	4,64	3,83
Arthritis	7,67	7,34	4,7	4,85	14,52	17,17	15,52	16,55	4,49	4,22	9,35
Osteoporosis	2,79	2,4	0,14	1,8	1,43	1,25	0,74	0,23	0	1,27	1,23
Cancer	1,86	3,25	3,28	3,88	2,62	2,33	3,45	2,49	0,61	4,64	2,84
Stomach	6,51	4,38	4,84	4,99	7,62	6,26	5,42	8,16	7,76	1,69	5,79
Parkinson	0,23	0,28	0,14	0,14	0	0,18	0	0,91	0,2	0	0,22
Cataracts	2,09	2,68	2,42	2,08	3,1	1,79	1,97	2,27	1,84	2,53	2,27
Hip fracture	0,23	0,99	1,28	1,53	1,43	1,07	0,25	1,59	1,02	0	1,04
BMI < 18 or >30	20,23	15,4	14,96	14,01	21,19	17,35	15,76	15,42	16,73	14,35	16,35
Activity limitation	36,51	35,88	34,62	39,53	32,86	22,72	24,38	32,88	13,47	24,89	30,76
Severe activity limitation	10,93	10,59	11,25	15,26	4,05	6,08	9,85	9,52	2,86	8,44	9,35

Share, 2004

These preliminary descriptive statistics seem to confirm the importance of using several health variables simultaneously. If we based our analysis of the health status-work relationship on one variable alone, our conclusions might vary depending on the indicator selected. For example, Sweden has the highest employment rate among those countries studied (76,6 %); however, one third of older persons report some activity limitation (one of the highest rates). In contrast, this country has one of the lowest rates of BMI outside the normal range. These health indicators provide different types of health information.

Even if these initial descriptive analyses are interesting, we cannot draw any firm conclusions about the impact of health status on participation in labour markets. The following econometric study aims to validate the hypothesis that health status affects labour force participation. Because one of the difficulties with this approach lies in the measurement of health status, we try to measure "true" disability by controlling for the different possible biases. We then estimate the effect of disability on labour force participation for each country.

Estimation of the effect of health status on labour force participation

In the first phase of our analysis, in order to confirm the relevance of our model we solve the participation equation (eq. 1), by directly introducing the concept of "true" disability equation (eq. 3). We therefore obtain an equation of labour force participation which depends directly on health status and some socio-demographic variables. Our strategy consists of introducing different health status variables stage by stage: first we introduce the group of diseases (A), then only BMI (B), then the two together ((C) = A + B)), then self-reported activity limitation (D), and finally all the variables (E = C + D).

The first results are presented in Table 4, showing that the variable "activity limitation" (tab. 4 columns D and E) has a negative effect on labour force participation. Reporting "severely restricted in one's activity" reduces the probability of labour force participation by 43 points if we only use this indicator (D), and by 39 points if disease prevalence and BMI used (E). This is confirmed by the descriptive statistics. Thus, among older persons reporting activity limitation, the proportion who are inactive is 73,1% compared to 33,7% for the rest of population.

If we consider the effect of the health status variables (tab. 3 columns (A), (B) and (C)), they all appear to have a negative effect, significant or otherwise, on labour force participation. Thus, the prevalence of a disease reduces labour force participation, with cardiovascular disease reducing the probability of labour force participation by 14 points. By looking at the marginal effects, it is possible to rank the effect of disease on labour force participation. Thus, the diseases with the greatest effect are: Parkinson's disease (-36 points), stroke (- 32 points), hip fracture (- 30 points) etc.. However these are not the commonest diseases. On the contrary a number of the listed diseases do not have a significant effect on labour force participation (high blood pressure hypertension, high blood cholesterol, asthma, osteoporosis, stomach). Moreover this negative effect is also found in individuals with a BMI which is too low or too high. Although this is significant, the marginal effect is weak (- 7 points (B) and – 5 points (C)).

Table 3 : Determinants of activity limitation and labour force participation

	% of concerned population	Severe activity limitation		labour force participation	
		no	yes	no	yes
Heart attack	8,2	76,2	23,8	56,8	43,2
High blood pressure hypertension	23,4	88,2	11,8	44,9	55,1
High blood cholesterol	18,2	89,5	10,5	41,2	58,8
Stroke	2,4	55,4	44,6	71,9	28,1
Diabet	7,9	83,5	16,5	55,3	44,7
Chronic lung disease	3,9	72,0	28,0	59,5	40,5
Asthma	3,8	84,2	15,8	43,4	56,6
Arthritis	9,3	78,7	21,3	54,4	45,6
Osteoporosis	1,2	71,4	28,6	57,1	42,9
Cancer	2,8	76,6	23,4	57,9	42,1
Stomach	5,8	81,8	18,2	45,9	54,1
Parkinson	0,2	54,5	45,5	81,8	18,2
Cataracts	2,3	82,8	17,2	51,7	48,3
Hip fracture	1,0	73,6	26,4	64,2	35,8
BMI < 18 or >30	16,3	87,7	12,3	44,5	55,5
Labour force participation	62,6	96,0	4,0	-	100,0
Activity limitation	30,8	69,6	30,4	55,0	45,0
Severe activity limitation	9,3	-	100,0	73,0	27,0
Primary level	19,4	87,3	12,7	50,6	49,4
Lower secondary level	17,8	89,3	10,7	39,4	60,6
Upper secondary level	34,6	90,7	9,3	38,0	62,0
Tertiary level	28,1	93,7	6,3	26,2	73,8
Alone	12,7	85,4	14,6	45,5	54,5
Couple (without children)	48,7	90,3	9,7	40,9	59,1
Family	38,6	92,9	7,1	30,3	69,7
Age 50-51	11,8	93,1	6,9	15,0	85,0
Age 52-53	13,6	93,2	6,8	16,3	83,7
Age 54-55	13,9	89,9	10,1	19,7	80,3
Age 56-57	13,6	90,2	9,8	26,5	73,5
Age 58-58	13,9	89,7	10,3	36,9	63,1
Age 60-61	13,9	91,1	8,9	56,3	43,7
Age 62-63	13,0	88,7	11,3	70,0	30,0
Age 64-65	6,3	88,2	11,8	79,8	20,2
total	100,0	90,7	9,3	37,4	62,6

Share, 2004

Using the three indicators together (E) reduces the marginal effects of each one. Nevertheless, the orders of magnitude and the rankings do not change. The only noticeable change relates to osteoporosis. The coefficient associated with this disease is significant if activity limitation is not taken into account (A and C), and is not with (E). The specification using the BMI only (B) has the weakest log likelihood followed by the equation solved with the health status indicators (A and C). The log likelihood values are highest for the equations using the self-reported variable of activity limitation. We find the same ranking as Bound et al (1999) and Campolieti (2002).

We also find the classic effects of socio-demographic variables on employment participation. The level of education has a positive effect on employment participation, while age has the opposite effect. In model (E), the marginal effects on the employment rate of Lower secondary, Upper secondary and Tertiary level are respectively 5, 9 and 17 points. The reduction in labour supply with increase in age of older persons is significant from age 56 onwards (in each model), taking into account the different measures for early withdrawal from the labour market in place in different countries. Moreover, men living with a partner or with other persons have a higher rate of labour force participation than those living alone.

Finally, we introduce dummies country by country to take into account the specific characteristics (socio-demographic, institutional and economic) of each, selecting French men as the reference. Only the Austrians, all other things being equal, have a lower participation rate than the French. Every country, except Italy, has a higher participation rate.

Table 5 presents the solution of the estimation equation. Using the same method, several types of model are tested. The diseases and the dummy variables by country are introduced in model (A'). Model (B') includes the diseases, the BMI and the dummy variables by country. Model (C') estimates disability using diseases and national unemployment rates, and finally model (D') includes diseases, the BMI and national unemployment rates.

Most diseases (except cholesterol) have a positive effect on the declaration of disability. The ranking of diseases with the greatest marginal effect on disability is not the same as that produced by the labour force participation equations. Thus, for example, strokes have a very significant effect on disability and do not affect labour force participation. On the other hand BMI has no effect on self-reported activity limitation.

It appears that the age of individuals has no effect on reporting disability. The disease variables would subsume the effect of age. The level of education is strongly associated with disability and even more so when the dummy variables by country are included (models (A') and (B')). Furthermore, family structure also has an effect, with persons living with their partner or children reporting less disability than single persons.

Table 4 : Estimation of labour force participation equation with direct introduction of health status with dummy variables per country.

	(A)		(B)		(C)		(D)		(E)	
Labour force participation	Coef,	Mar effect	Coef,	Mar effect	Coef,	Mar effect	Coef,	Mar effect	Coef,	Err,
Heart attack	-0,35**	-0,14			-0,35**	-0,13			-0,23**	-0,09
High blood pressure hypertension	-0,03	-0,01			-0,01	0,00			-0,01	0,00
High blood cholesterol	0,07	0,03			0,07	0,02			0,06	0,02
Stroke	-0,82**	-0,32			-0,82**	-0,32			-0,55**	-0,21
Diabet	-0,27**	-0,10			-0,25**	-0,10			-0,22**	-0,08
Chronic lung disease	-0,42**	-0,16			-0,41**	-0,16			-0,27**	-0,11
Asthma	-0,11	-0,04			-0,11	-0,04			-0,10	-0,04
Arthritis	-0,16**	-0,06			-0,15**	-0,06			-0,04	-0,01
Osteoporosis	-0,13	-0,05			-0,13	-0,05			-0,02	-0,01
Cancer	-0,48**	-0,19			-0,48**	-0,19			-0,37**	-0,14
Stomach	-0,10	-0,04			-0,10	-0,04			-0,03	-0,01
Parkinson	-0,95*	-0,36			-0,95*	-0,36			-0,63	-0,25
Cataracts	-0,14	-0,05			-0,15	-0,06			-0,10	-0,04
Hip fracture	-0,77**	-0,30			-0,76**	-0,30			-0,69**	-0,27
BMI < 18 OR >30			-0,19**	-0,07	-0,13**	-0,05			-0,13**	-0,05
Activity limitation							-1,15**	-0,43	-1,02**	-0,39
Lower secondary level	0,17**	0,06	0,21**	0,08	0,17**	0,06	0,17**	0,06	0,15**	0,05
Upper secondary level	0,30**	0,11	0,34**	0,12	0,30**	0,11	0,28**	0,10	0,25**	0,09
Tertiary level	0,57**	0,20	0,62**	0,21	0,57**	0,20	0,54**	0,19	0,50**	0,17
Couple (without children)	0,30**	0,11	0,31**	0,11	0,30**	0,11	0,26**	0,10	0,26**	0,09
Family	0,37**	0,14	0,39**	0,14	0,37**	0,13	0,35**	0,13	0,34**	0,12
Age 52-53	-0,04	-0,02	-0,04	-0,01	-0,05	-0,02	-0,03	-0,01	-0,05	-0,02
Age 54-55	-0,10	-0,04	-0,12	-0,05	-0,10	-0,04	-0,09	-0,03	-0,08	-0,03
Age 56-57	-0,34**	-0,13	-0,38**	-0,15	-0,35**	-0,13	-0,36**	-0,14	-0,36**	-0,14
Age 57-58	-0,65**	-0,25	-0,69**	-0,27	-0,65**	-0,25	-0,69**	-0,27	-0,67**	-0,26
Age 60-61	-1,14**	-0,43	-1,20**	-0,45	-1,15**	-0,43	-1,25**	-0,47	-1,22**	-0,46
Age 62-63	-1,49**	-0,54	-1,55**	-0,56	-1,51**	-0,54	-1,57**	-0,56	-1,55**	-0,55
Age 64-65	-1,79**	-0,59	-1,84**	-0,60	-1,79**	-0,59	-1,86**	-0,61	-1,84**	-0,60
Austria	-0,31**	-0,12	-0,28**	-0,11	-0,30**	-0,12	-0,26**	-0,10	-0,27**	-0,10
Germany	0,15*	0,06	0,15*	0,05	0,16*	0,06	0,19**	0,07	0,20**	0,07
Sweden	0,84**	0,26	0,84**	0,26	0,84**	0,26	0,91**	0,27	0,92**	0,27
Netherlands	0,32**	0,11	0,31**	0,11	0,32**	0,11	0,41**	0,14	0,41**	0,14
Spain	0,41**	0,14	0,42**	0,14	0,41**	0,14	0,33**	0,11	0,35**	0,12
Italy	-0,05	-0,02	-0,03	-0,01	-0,05	-0,02	-0,10	-0,04	-0,11	-0,04
Denmark	0,39**	0,13	0,35**	0,12	0,39**	0,13	0,39**	0,13	0,42**	0,14
Greece	0,42**	0,14	0,47**	0,16	0,42**	0,14	0,39**	0,13	0,38**	0,13
Switzerland	0,86**	0,25	0,90**	0,26	0,86**	0,25	0,95**	0,27	0,93**	0,26
_cons	0,26**		0,14		0,29**		0,31**		0,41**	
Likelihood	-2559,4		-2630,2		-2556,6		-2496,6		-2458,8	

Share, 2004

Table 5: estimation of disability equation with dummy variables per country and unemployment rate

	(A)		(B)		(C)		(D)	
disability	Coef,	Err,	Coef,	Err,	Coef,	Err,	Coef,	Err,
Heart attack	0,64**	0,12	0,64**	0,12	0,64**	0,13	0,64**	0,12
High blood pressure hypertension	0,00	0,00	-0,01	0,00	0,00	0,00	-0,01	0,00
High blood cholesterol	-0,13*	-0,02	-0,13*	-0,02	-0,13*	-0,02	-0,13*	-0,02
Stroke	1,12**	0,27	1,12**	0,27	1,13**	0,29	1,13**	0,29
Diabet	0,26**	0,04	0,25**	0,04	0,27**	0,04	0,27**	0,04
Chronic lung disease	0,63**	0,12	0,63**	0,12	0,64**	0,13	0,64**	0,13
Asthma	0,05	0,01	0,05	0,01	0,07	0,01	0,07	0,01
Arthritis	0,59**	0,10	0,58**	0,10	0,53**	0,10	0,52**	0,10
Osteoporosis	0,46**	0,08	0,46**	0,08	0,50**	0,09	0,50**	0,09
Cancer	0,64**	0,12	0,64**	0,12	0,65**	0,13	0,65**	0,13
Stomach	0,28**	0,04	0,28**	0,04	0,26**	0,04	0,26**	0,04
Parkinson	1,22**	0,32	1,21**	0,32	1,17**	0,31	1,17**	0,31
Cataracts	0,31**	0,05	0,31**	0,05	0,31**	0,05	0,31**	0,05
Hip fracture	0,62**	0,12	0,62**	0,12	0,63**	0,13	0,63**	0,13
BMI < 18 OR >30			0,06	0,01			0,04	0,01
Lower secondary level	-0,20**	-0,02	-0,20**	-0,02	-0,11	-0,01	-0,11	-0,01
Upper secondary level	-0,34**	-0,04	-0,34**	-0,04	-0,18**	-0,02	-0,18**	-0,02
Tertiary level	-0,54**	-0,06	-0,53**	-0,06	-0,37**	-0,04	-0,37**	-0,04
Couple (without children)	-0,30**	-0,04	-0,30**	-0,04	-0,26**	-0,03	-0,26**	-0,03
Family	-0,26**	-0,03	-0,26**	-0,03	-0,32**	-0,04	-0,32**	-0,04
Age 52-53	0,03	0,00	0,03	0,00	0,06	0,01	0,06	0,01
Age 54-55	0,15	0,02	0,16	0,02	0,16	0,02	0,16	0,02
Age 56-57	0,07	0,01	0,07	0,01	0,06	0,01	0,07	0,01
Age 57-58	0,12	0,02	0,13	0,02	0,11	0,02	0,11	0,02
Age 60-61	-0,12	-0,01	-0,12	-0,01	-0,11	-0,01	-0,11	-0,01
Age 62-63	0,04	0,01	0,04	0,01	0,03	0,00	0,04	0,01
Age 64-65	0,11	0,01	0,11	0,02	0,07	0,01	0,08	0,01
National unemployment rate					-0,08**	-0,01	-0,08**	-0,01
Austria	0,25*	0,04	0,25*	0,04				
Germany	0,26**	0,04	0,26**	0,04				
Sweden	0,22*	0,03	0,22*	0,03				
Netherlands	0,44**	0,07	0,44**	0,07				
Spain	-0,56**	-0,05	-0,56**	-0,05				
Italy	-0,39**	-0,04	-0,38**	-0,04				
Denmark	0,08	0,01	0,08	0,01				
Greece	-0,53**	-0,05	-0,53**	-0,05				
Switzerland	0,12	0,02	0,12	0,02				
_cons	-1,25**		-1,26**		-0,70**		-0,70**	
Likelihood	1322,40		-1322,10		-1358,3		-1358,10	

Share, 2004

To take into account institutional, cyclical and economic differences between the countries, we introduce a macroeconomic indicator: the national unemployment rate. It has a negative effect on disability (with a very weak coefficient: - 0,08).

The estimation in two stages (eq. 5) is presented in Table 6. The proxies correspond to the estimations of disability with the variables used for estimation of the columns (A') and (B') from Table 5. For the models (1) and (2), the dummy variables by country and the proxies for disability: calculated from the diseases for (1) and from diseases and BMI for (2) are introduced. On the other hand, in models (3) and (4) the national unemployment rates and the disability proxies: calculated from the diseases for (3) and from diseases and BMI for (4) are introduced.

Table 6 : Estimation of labour force participation equation in two steps with dummy variables per country.

Labour force participation	(1) Coef,	(1) Marg. effect	(2) Coef,	(2) Marg. effect	(3) Coef,	(3) Marg. effect	(4) Coef,	(4) Marg. effect
	Diseases		Diseases+BMI		Diseases		Diseases+BMI	
Disability proxy	-2,59**	-0,96	-2,59**	-0,96	-2,62**	-0,97	-2,63**	-0,98
Lower secondary level	0,11	0,04	0,11	0,04	0,08	0,03	0,08	0,03
Upper secondary level	0,18**	0,07	0,18**	0,07	0,06	0,02	0,06	0,02
Tertiary level	0,40**	0,14	0,40**	0,14	0,38**	0,13	0,38**	0,13
Couple (without children)	0,17**	0,06	0,17**	0,06	0,19**	0,07	0,19**	0,07
Family	0,26**	0,10	0,26**	0,10	0,17**	0,06	0,17**	0,06
Age 52-53	-0,03	-0,01	-0,03	-0,01	-0,04	-0,02	-0,05	-0,02
Age 54-55	-0,03	-0,01	-0,03	-0,01	-0,10	-0,04	-0,10	-0,04
Age 56-57	-0,32**	-0,12	-0,32**	-0,12	-0,36**	-0,14	-0,36**	-0,14
Age 57-58	-0,61**	-0,24	-0,61**	-0,24	-0,64**	-0,25	-0,64**	-0,25
Age 60-61	-1,19**	-0,45	-1,19**	-0,45	-1,19**	-0,45	-1,19**	-0,45
Age 62-63	-1,48**	-0,54	-1,48**	-0,54	-1,51**	-0,54	-1,51**	-0,54
Age 64-65	-1,76**	-0,59	-1,75**	-0,59	-1,79**	-0,59	-1,79**	-0,59
National unemployment rate					-0,04**	-0,02	-0,04**	-0,02
Austria	-0,23**	-0,09	-0,23**	-0,09				
Germany	0,23**	0,08	0,23**	0,08				
Sweden	0,91**	0,28	0,91**	0,28				
Netherlands	0,50**	0,17	0,50**	0,17				
Spain	0,24**	0,08	0,24**	0,08				
Italy	-0,17*	-0,06	-0,17*	-0,06				
Denmark	0,40**	0,14	0,40**	0,14				
Greece	0,30**	0,10	0,29**	0,10				
Switzerland	0,89**	0,26	0,89**	0,26				
_cons	0,55**		0,55**		1,26**		1,26**	
Likelihood	-2567,00		-2566,80		-2695,30		-2694,80	

Share, 2004

The estimated coefficients of the proxy values are significantly negative and equal whichever model is chosen. The value associated with this proxy is higher in absolute value than the value estimated in Table 4 (columns (D) and (E)) of the self-reported activity limitation variable. Hence, the effect of disability on labour force participation would appear to be greater if one uses a disability proxy than if health status variables are introduced directly. More precisely, the marginal effect at the mean of disability status on the labour force participation obtained with the direct introduction is evaluated between – 39 points and –43 points. If we use the disability proxy, this marginal effect becomes equivalent at - 71 points, whatever the selected proxy. This suggests that if we use the self-reported health measure that leads to a downward bias in the impact of disability status on labour force participation. Bound (1991) and Campolieti (2002) find the same result.

Moreover, the coefficients for the other variables are significant and of the same signs. However their values are slightly lower. The national unemployment rate has a negative effect on the employment rate of older men. It may be obvious that the unemployment rate cannot subsume all of the economic and institutional characteristics of the countries studied. The decision to seek work on the part of this group would appear to be influenced by the general economic situation.

National differences

We investigate the determinants of labour market participation for each of the ten countries, and look in particular at the effect of disability. Using the same methodology, we first construct a model explaining labour force participation, using disease variables, the BMI and activity limitation (Table 7). Table 8 presents the results for the disability equation using the disease and BMI variables. Finally the results of the introduction of the disability proxy (using diseases and the BMI) in the labour force participation model are presented in Table 9.

The results of the direct solution of the labour force participation equation highlight national differences (Table 7). Although reported activity limitation has a negative effect on employment rates in every country, the effect of BMI and of disease prevalence varies widely. Disease prevalence does not affect the participation of older persons in the labour market in Austria or in Switzerland, and BMI only affects participation in Germany. The coefficient associated with self-reported activity limitation varies from – 0,75 in Austria to – 1,84 in Switzerland. These differences certainly reflect specific differences in health status, but also differences in measures relating to disability in different countries. Elsewhere, depending on the rules which apply in different retirement systems and the different measures available, the coefficients associated with increasing age become significant in every country from age 58. However, the other socio-demographic variables do not have the same influence on labour market participation of older persons in any of the countries.

The estimates of disability by country (Table 8) confirm the results of the general study. The diseases affecting to disability are generally the same: heart attack, strokes, diabetes and Chronic lung disease; and here also BMI has no effect. By introducing an approximate value for disability in the labour force participation equation (Table 9), we see once again an increase in the effect of health status on participation in the labour market compared to direct estimation (except for Italy). The effect of the disability proxy varies widely between countries, and compared to the direct estimation the inter-country differences seem to be greater. These considerable differences in the effect of health status on labour force participation may be related to both cultural and institutional characteristics.

Conclusion

Using Bound's model (1991), used by Campolieti (2002), we have shown the importance of health status for labour force participation in ten European countries. While socio-demographic variables seem to affect the labour force participation after the age of 50, as well as a high level of education and living with a partner, health status variables are also very significant. Despite the inadequacy of health status indicators, these results show that the approximation of "true" disability using these indicators makes it possible to identify a very strong relationship between health status and withdrawal from the labour market. Policy makers should pay particular attention to the role of health status in older persons' decisions to withdraw from the labour market.

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Appendix 1 : Brief literature review of health impact on the labour force participation

	Article's aim	*Data*	*Analysis Method*	*Type of health status' measure*	*Results*
Bound (1991)	Evaluation of the impact of health problems on the male labour force participation	RHS *Retirement History Survey* (1969-1979) 6 022 men of 58-63 (workers and private sector)	Ordinary Least Squares (OLS) + Probit and Instrumental Variables (IV) Dependent variable : Labour force participation	**Subjective Health Measures (SHM)** : Work limitation Perceived health **Objective Health Measures (OHM)** : Date of death	OLS results : Work limitations -1,366 (0,046) Poor Health - 1,449 (0,047) Date of death : Ex : 1971 -0,924 (0,131)
Berkovec and Stern (1991)	Explaining the job exit behavior	NLS (National Longitudinal Survey of Mature men) 1966-1983 5 020 men of 45-59	Method of simulated moments in a dynamic programming model of job exit behavior	**SHM** : Work limitation	Individual effect (in dynamic model) of work limitation on : Retirement : 11,1 (1,00) Part-time : 5,93 (2,46) Full-time : - 5,77 (2,04)
Blau (1994)	Assessment pathways' probabilities between different labour market states (full-time employment, part-time employment and out of the labour force)	RHS *Retirement History Survey* 7 157 men of 55-73	Logit Dependent variable : Different states on the labour market	**SHM** : Perceived health	Multinomial Logit : (from age 55) Poor health [F state to O state] 0,627 (0,099)
Bound *and alii* (1999)	Assessment of dynamic effect of disability status on the labour force participation transitions	HRS (first wave) 2875 men 3826 women 51-61 years	Dynamic model multinomial probit estimates of labor force transitions	**SHM** : Work limitation Perceived health	Simulated effects of health status on employment at Wave 3 among respondents employed at Wave 2 Applied for disability : If good health in waves 1 et 2 : Poor health (Wave 3 for men) 0,38 Poor health (Wave 3 for women) 0,43
Dwyer and Mitchell (1999)	Evaluation of the impact of	HRS (1992)	OLS + IV estimations	**SHM** :	OLS results :

	health problems on men's retirement plans.	4 369 men of 51-61	<u>Dependent variable</u> : worker's expected age of retirement.	Work limitations Perceived health **OHM** : Health Conditions Index ADL / IADL / LF Chronic diseases	Work limitation -2,2 (0,41) Poor health -1,03 (0,36) Health Index : -0,19 (0,04)
Kreider (1999)	Assessment of effect of disability status on the labour force participation and test of endogeneity (construction of continuous disability index)	HRS (first wave) 5 205 men 5 623 women 50-64 years	Latent variable model bivariate probit	**SHM** : Work limitations Perceived health **OHM** : ADL / IADL / LF Chronic diseases BMI **Other index** : Tobacco and alcohol consumption	disability index : men : - 0,542 (0,0416) women : - 0,433 (0,0501)
Kerkhofs *and alii* (1999)	Estimation of a dynamic model for retirement behaviour that explicitly takes account of health and eligibility conditions and replacement rates of alternative exit routes from the labour force.	CERRA panel survey (dutch panel) First wave 1993 : 4727 respondents 43-63 years.	maximum likelihood method fixed effects panel data model IV	**SHM** : Work limitations **OHM** : Hopkins Symptom Checklist (validated objective test of general health used in the medical sciences to assess the psychoneurotic and somatic pathology of patients)	1/ Direct introduction of work limitations : Transition to retirement : 0.28 (1.8) Transition to disability insurance : 3,11 (12,0) 2/ introduction of time-varying instrumented health measure based on truly exogenous regressors. Transition to retirement : 0.06 (1.7) transition to Disability system : 0,15 (2,6)
Chan et Stevens (2001)	Examination of employment patterns of workers who have experienced an unvoluntary job loss	HRS 1992-1994-1996 4973 men 4695 women of 50 and over	Reduced form hazard model – probit <u>Dependent variable</u> : Entry to work hazard	**SHM** : Work limitation Perceived health	Random work limitation effects probit - 0,1675 men - 0,1790 women
Campolieti (2002)	Assessment of effect of disability status on the	NPHS (National Population Health Survey -	Latent variable model probit	**SHM** Activity limitation	(Direct introduction into the labour force

	labour force participation of older men	Canada) 1994-1995 2 096 men of 45-64	<u>dependent variable</u> : Labour force participation	**OHM** Body Mass Index Chronic diseases	participation model) Activity limitation : -1,1908 (0,0763) Two-step estimates of participation equation (men of 45-64) <u>Disability status proxy</u> [diseases] : -1,6229 (0,1586) [diseases + BMI] - 1,6247 (0,1588) Comparison HRS/NPHS for men of 55-64 <u>Disability status proxy</u> [diseases] HRS : -1,475 (0,141) NPHS : - 1,510 (0,207)

Appendix 2 : Estimation tables

Table 7 : Estimation of labour force participation per countries

Labour force participation (Diseases + BMI)	Austria	germany	Sweden	Netherl.	spain	italy	denmark	greece	Switzerl.	france
Heart attack	-0,58	-0,34*	0,03	-0,14	-0,63**	-0,02	-0,39	-0,38*	0,15	-0,45
High blood pressure hypertension	-0,10	0,03	-0,08	0,07	-0,06	0,05	-0,05	0,08	-0,21	-0,20
High blood cholesterol	-0,10	0,12	0,14	-0,20	0,02	0,03	0,41*	0,07	0,17	-0,15
Stroke	-0,63	-0,93**	-0,76**	-0,30	-0,56	0,15	-0,48	-0,54		-0,59
Diabet	-0,23	-0,58**	-0,25	0,14	-0,16	-0,13	-0,34	0,06	-0,10	-0,45
Chronic lung disease	-0,71	-0,45	0,55	-0,14	-0,51	-0,15	-0,94**	0,75	-0,28	0,35
Asthma	0,28	-0,78**	0,25	-0,54*	-0,42	-0,24	0,36	0,63	-0,55	-0,37
Arthritis	0,21	-0,21	0,15	-0,18	-0,05	0,08	-0,11	0,18	0,53	-0,33
Osteoporosis	-0,65	-0,38		0,75*	-0,52	1,23*			-1,12	
Cancer		-0,51	-0,27	-0,38	-1,07**	-0,40	-0,43	0,57	-0,20	-0,16
Stomach	0,06	0,56*	-0,18	0,36	-0,53*	0,31	-0,34	0,29	-1,21	-0,37
Parkinson							-1,24			
Cataracts		0,39	-0,14	-0,30	-0,17	-0,20	0,45	0,12	-0,60	-0,10
Hip fracture		-1,32	-0,97**	-0,93*	-1,26*	-0,91	0,14	0,02		
BMI < 18 or >30	0,17	-0,31**	-0,12	-0,18	-0,16	-0,24	0,31	-0,19	-0,46	0,08
Activity limitation	-0,75**	-0,99**	-1,27**	-1,10**	-1,35**	-1,10**	-0,96**	-1,76**	-1,84**	-1,05**
Upper secondary level	0,02	0,41*	0,05	0,34**	0,25	0,49**	0,08	-0,02	0,10	0,31
Tertiary level	0,63**	0,92**	0,15	0,52**	0,45*	0,98**	0,19	0,01	-0,22	0,78**
Couple (without children)	0,49**	-0,12	0,32*	0,73**	0,30	0,05	0,68**	-0,12	-0,15	0,35
Family	0,61**	0,03	0,46**	0,75**	0,47*	0,04	0,99**	-0,21	-0,02	0,78**
Age 52-53	0,56	-0,19	0,04	-0,11	-0,63**	0,13	0,50	-0,34	0,72	-0,58*
Age 54-55	-0,09	0,18	0,05	-0,07	-0,31	-0,10	0,30	-0,70**	0,30	-0,20
Age 56-57	-0,52	-0,12	-0,39	-0,13	-0,60*	-0,45	0,18	-1,15**	0,08	-0,78**
Age 58-59	-0,36	-0,37	-0,51*	-0,59**	-0,64**	-1,26**	0,00	-1,42**	0,56	-1,29**
Age 60-61	-1,55**	-1,20**	-0,86**	-1,41**	-1,72**	-1,47**	-0,31	-1,33**	-0,43	-2,69**
Age 62-63	-2,35**	-1,43**	-0,95**	-2,23**	-1,22**	-1,72**	-0,90**	-2,12**	-0,76*	-2,53**
Age 64-65		-1,74**	-1,45**	-2,11**	-1,58**	-1,76**	-1,93**	-2,54**	-1,61**	
_cons	0,13	0,64*	1,17**	0,53**	1,01**	0,60**	0,09	1,90**	1,60**	0,77**
Likelihood	-167,6	- 337,2	- 295,3	- 303,4	- 214,0	- 284,2	- 203,2	- 227,8	- 77,8	- 151,9

Share, 2004

Table 8 : Estimation of disability equation per country

Disability (Diseases + BMI)	Austria	germany	Sweden	Netherlands	spain	italy	denmark	greece	switzerland	france
Heart attack	0,68*	0,56**	0,50**	0,34*	1,05**	0,78**	1,62**	0,60	4,13**	0,90**
High blood pressure hypertension	-0,24	0,00	-0,04	0,09	0,87**	0,01	-0,34	-0,52	0,36	-0,17
High blood cholesterol	-0,30	0,11	-0,20	-0,06	-0,41	0,28	-0,32	1,15**	0,08	-0,42
Stroke	1,43**	1,28**	1,00**	1,17**	1,25	2,28**	1,46**			1,68**
Diabet	1,22**	0,56**	-0,33	0,22	-0,31	0,03	0,38	1,04**	0,67	-0,04
Chronic lung disease	0,46	0,89**	0,78**	0,82**		0,92**	0,54	1,30	2,41**	0,75*
Asthma	-0,06	-0,03	-0,28	0,24		-0,45	0,72*		-0,34	0,52
Arthritis	0,37	0,58**	0,71**	1,11**	-0,97	0,34	1,08**	3,49**	0,51	0,80**
Osteoporosis	0,29	0,49		0,32	1,36	0,79				0,57
Cancer	1,61**	0,42	0,50	-0,10	0,35	1,51**	1,43**	3,49**	0,99	0,42
Stomach	0,69**	0,09	0,46*	0,11	0,61	-0,43	0,79**	-0,05	2,09	0,33
Parkinson		0,60								
Cataracts		0,43	0,66*	0,55	-0,13	0,49	0,48	1,02	1,48	-0,82
Hip fracture		1,40**	0,24	0,11	1,52*	0,86		2,27**		
BMI < 18 or >30	-0,05	-0,25	0,14	0,20	0,02	-0,45	0,07	-0,05	0,39	0,22
Upper secondary level	-0,59**	-0,38	-0,25	-0,14	0,22	0,05	0,17	0,08	-2,45*	-0,47*
Tertiary level	-1,02**	-0,69**	-0,67**	-0,28*	-0,29	-0,68	0,12	-0,12	-0,72*	-0,41
Couple (without children)	0,08	-0,57**	-0,26	-0,08	-0,13	-0,58	-0,79**	0,06	-1,13**	-0,07
Family	-0,21	-0,53**	0,01	-0,14	-0,46	-0,23	-0,84**	0,03	-1,05*	0,01
Age 52-53	-0,02	0,49	-0,04	-0,30	-0,65	-0,43	0,67*		0,83	-0,21
Age 54-55	0,24	0,13	0,43	0,08	-0,90	0,09	0,41	-0,45	1,47*	0,27
Age 56-57	0,53	0,74*	0,15	-0,12		0,14	-0,23	-0,45	0,53	-0,02
Age 57-58	0,65	0,74**	0,38	-0,03	-0,55	-0,09	0,05	-0,47	0,21	-0,42
Age 60-61	-0,25	0,35	0,29	-0,19	-0,54	-0,06	-0,61	-0,12	-0,81	-0,54
Age 62-63	-0,23	0,45	0,40	-0,08	-1,07*	0,17	-0,36	-0,57	0,91	0,24
Age 64-65	-0,14	0,71*	0,56	-0,18	-0,26	0,58		0,20	-0,42	-0,34
_cons	-1,20**	-1,18**	-1,31**	-1,06**	-1,29**	-1,81**	-1,57**	-2,03**	-1,59**	-1,43**
Likelihood	- 99,8	- 193,1	- 208,2	- 269,4	- 50,6	- 91,9	- 93,2	- 44,9	- 33,3	- 94,7

Share, 2004

Tableau 9 : Estimation of labour force participation equation in two stages per country

Labour force participation	Austria	germany	Sweden	Netherl.	spain	italy	denmark	greece	Switzerl.	france
Disability proxy	-1,99**	-3,24**	-1,88**	-1,59**	-3,09**	-0,67	-2,00**	-1,82**	-2,11**	-1,71**
Upper secondary level	-0,07	0,13	0,01	0,34**	0,31	0,46**	0,10	0,01	0,06	0,28
Tertiary level	0,49*	0,53**	0,07	0,48**	0,44*	0,94**	0,21	0,05	-0,20	0,71**
Couple (without children)	0,51**	-0,36**	0,31*	0,56**	0,32	0,13	0,63**	-0,13	0,00	0,19
Family	0,58**	-0,24	0,45**	0,63**	0,50**	0,09	0,88**	-0,26	0,07	0,61**
Age 52-53	0,55*	-0,04	0,03	-0,05	-0,57*	0,21	0,49*		0,66	-0,55*
Age 54-55	0,01	0,13	0,02	0,00	-0,39	-0,05	0,44	-0,44*	0,21	-0,30
Age 56-57	-0,35	0,12	-0,38	-0,05		-0,37	0,11	-0,80**	0,07	-0,78**
Age 58-59	-0,27	-0,16	-0,43	-0,47**	-0,59**	-1,16**	0,02	-1,13**	0,37	-1,29**
Age 60-61	-1,55**	-1,03**	-0,76**	-1,23**	-1,60**	-1,36**	-0,34	-1,03**	-0,47	-2,66**
Age 62-63	-2,30**	-1,27**	-0,87**	-1,95**	-1,43**	-1,63**	-0,87**	-1,87**	-0,67*	-2,31**
Age 64-65		-1,44**	-1,40**	-1,92**	-1,39**	-1,62**		-2,11**	-1,55**	
_cons	0,19	1,07**	1,15**	0,51**	0,82**	0,44	0,16	1,64**	1,32**	0,78**
Likelihood	- 175,1	- 295,3	- 328,3	- 335,7	- 188,9	- 295,3	- 202,1	- 234,3	- 88,1	- 169,7