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Institutions, health shocks and labour market outcomes across Europe

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ABSTRACT

This paper investigates the relationship between health shocks and labour market outcomes in 9 European countries using the European Community Household Panel. Matching techniques are used to control for the non-experimental nature of the data. The results suggest that there is a significant causal effect from health on the probability of employment: individuals who incur a health shock are significantly more likely to leave employment and transit into disability. The estimates differ across countries, with the largest employment effects being found in The Netherlands, Denmark, Spain and Ireland, and the smallest in France and Italy. Differences in social security arrangements help to explain these cross-country differences.

1. Introduction

The increase in the rates of recipients of disability support observed during the 1990s in almost all OECD countries has raised concerns about the labour outcomes of people with adverse health (OECD, 2003). The relevant policies often try to satisfy two possibly contradictory goals. On the one hand, they have to guarantee that individuals who are or become disabled do not endure economic hardship, and thus provide some insurance for the potential income losses. On the other hand, they also aim to avoid the exclusion of disabled individuals from the labour market by, among other measures, encouraging participation. Therefore, such policies should be designed to ensure that the incentives to work relative to being unemployed or collecting disability benefits are high. Good evidence on the magnitude of the impact of ill-health and disability on employment is needed in order to re-think the balance between income protection and incentives for labour force withdrawal. This paper aims to provide comparable evidence of the causal effect of ill-health on remaining into employment and transiting into unemployment, disability or retirement for the working-age population of nine European countries.

The literature has mostly focused on older workers (Currie and Madrian, 1999). There is evidence from both Europe and North America that worsening health is correlated with an increased likelihood of retirement for individuals over 50 years old (Au et al., 2005; Bound et al., 1999; Disney et al., 2006; Hagan et al., 2009; Jones et al., 2010). Studies that, like the present one, focus on employment effect of ill-health at younger ages are more scarce. Pelkowski and Berger (2004) use the American Health and Retirement Survey and find that permanent adverse health conditions reduce both wages (8.4% for males and 4.2% for females) and hours worked (6.3% for males and 3.9% for females). Moreover, they found that the decrease in employment and wages is larger for prime-age individuals, as the peak of loss of wages after the onset of a permanent illness occurs at ages 40–49 for males (wages are 12.1% lower) and 30–39 for females (wages are 9.2% lower). García-Gómez et al. (2010) find that general health affects both entries and exits from employment with the magnitude of the effects being similar for younger and older individuals (16–49 compared to 50–64).

Two recent studies have used accidents as unforeseen sudden changes to identify the causal effects of health shocks on labour market outcomes. Lindeboom et al. (2006) estimate an event history model for transitions between work and disability states and find that the effects of an accident on employment are not direct,

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but rather act through the onset of a disability. In addition, they find that the onset of a disability at age 25 reduces the employment rate at age 40 with around 14 percentage points. Dano (2005), using propensity score matching techniques as the present study, finds that there are both short and long run effects on the probability of being employed for Danish males after being injured in a road accident, and that this effect holds even when individuals receiving disability benefits are excluded from the analysis. Using also propensity score matching techniques, García-Gómez and López-Nicolás (2006) analyse the effects of a sudden drop on self-assessed health in Spain on the probability of leaving employment and transiting out to different states for the Spanish population. They find that suffering a health shock decreases by 5% the probability of remaining in employment and increases by 3.5% the probability of transiting into inactivity.

Thus previous literature seems to confirm the existence of an effect of health events on labour market outcomes, but there is a lack of consensus on their magnitude. Our contention here is that the international differences in estimated effects partly reflect the emphasis that each country places on the two potentially conflicting goals of protecting income and encouraging participation mentioned above. This paper attempts to contribute to this area of research by estimating the effects of health shocks on a set of labour outcomes for different European countries using an homogeneous dataset and definition across countries, and subsequently relating the differences in estimates to variations in institutional factors across these countries.

Estimation of the causal effect of ill-health on labour outcomes is plagued with potential biases (Lindeboom, 2006). The identification strategy is inspired, among others, by Smith James (2004). He uses longitudinal information for representative samples of the US population in order to condition on past health shocks before evaluating current changes in labour status and income. In this paper the best source of longitudinal information on health and socioeconomic characteristics for the European population is used: the European Community Household Panel (1994–2001, hereafter ECHP). We condition on past health and labour status to evaluate the effects of changes in health. We provide evidence on two alternative definitions of health deterioration or health shock: a sudden drop in self-assessed health and the onset of a chronic condition. Following others (Lechner and Vázquez Álvarez, 2004; Frölich et al., 2004; Dano, 2005; García-Gómez and López-Nicolás, 2006), we match individuals who experience a health shock with others who do not.

This paper contributes to the existing literature in several respects. First, it extends the knowledge of the relationship between health and labour outcomes on the working population, using a homogeneous empirical framework for nine European countries (Denmark, Netherlands, Belgium, France, Ireland, Italy, Greece, Portugal and Spain). Second, this homogeneous framework allows us to formulate hypotheses regarding the role of the differences in social security arrangements across these countries in the difference across estimates. To the best of our knowledge there is no other work containing this type of comparative analysis for the countries concerned. In addition, we use two different definitions of ill-health and analyse both the effects on employment of a drop in self-assessed health and the onset of a chronic condition. This provides evidence regarding the relative importance of the health variable chosen in explaining the effects of health on labour outcomes.

The results suggest that there is a significant effect of health on the probability of employment: individuals who incur a health shock are significantly more likely to leave employment than those who do not. As expected, differences in the estimates emerge across European countries, with the largest employment effects found in Ireland, The Netherlands, Denmark and Spain, and the smallest in France and Italy. The reduction in the likelihood of employment is paralleled by an increase in the probability of inactivity. This should be a cause for concern, as the outflow from inactivity into work is known to be close to zero (OECD, 2003).

2. Institutional background

After the onset of a health condition, an individual can follow any of several routes (Aarts et al., 1996): (i) work; (ii) early retirement (only available for older workers); (iii) traditional disability insurance schemes (sickness, general disability and work injury); (iv) unemployment; (v) means-tested schemes for those not eligible for any other option. This implies that it is not only disability policies but also the set of incentives provided by the wider social security system that determine the labour consequences of a health shock.

In order to obtain a better picture of the relevant differences between countries, Table 1 summarises the main features of the social security system in the interrelated spheres of disability, unemployment and retirement. Note first the striking differences in the way in which countries establish eligibility criteria for disability benefits. Some countries define disability in terms of a reduction in the individual's work capacity (Denmark, Ireland, Italy and Spain), while others do so in terms of a reduction in earnings capacity (Belgium, France, Greece, The Netherlands and Portugal). But even among countries that use the same concept, the minimum level of disability that entitles individuals to receive benefits varies widely: from 15% in The Netherlands to being permanently incapable of work in Ireland (OECD, 2003; European Commission, 2004). Table 1 also shows that some countries apply mandatory quotas obliging employers to have a certain proportion of disabled workers among their employees (7% Italy, 6% France, 2% Spain), or some sectors (3% in the public sector in Ireland and 5% for new recruitment in the public sector in Portugal). These quotas are absent in Denmark, The Netherlands and Belgium. Concerning measures aimed at integrating disabled individuals into the labour market, most countries allow a certain accumulation of disability benefits with earnings from work. The only exception is Ireland, where the invalidity pension requires permanent full incapacity (European Commission, 2004).

Following the analysis in OECD (2003),[1] the main components of the disability system can be summarised into two dimensions. The "compensation" dimension reflects the characteristics of the main disability benefit scheme (coverage, minimum disability level, disability level for a full benefit, maximum benefit level, permanence of benefits, medical assessment, vocational assessment, sickness benefit level, sickness benefit duration and unemployment benefit level and duration). The second is the "integration" dimension, which reflects all the employment and rehabilitation measures (coverage consistency, assessment structure, employer responsibility for job retention and accommodation, supported employment programme, subsidised employment programme, sheltered employment sector, vocational rehabilitation programme, timing of rehabilitation, benefit suspension regulations and additional work incentives). Of the group of countries considered here (and included in the OECD study), Denmark would be the country in which the integration component is the highest, whereas the lowest levels are found in Italy and Portugal. The champions in the compensation dimension are Portugal, Spain and

[1] In OECD (2003) the authors consider a different group of countries that did not include Ireland and Greece. We conjecture that these countries belong to the same cluster as the Mediterranean countries.

Table 1
Institutional features of the group of countries included.

	Denmark	Netherlands	Belgium	France	Ireland	Italy	Greece	Portugal	Spain
Disability benefits:									
Expenditure disability/expenditure unemployment (2000)	1.13	2.29	0.79	0.81	0.55	3.55	0.78	3.42	0.66
Expenditure disability/expenditure old-age benefits (2000)	0.31	0.32	0.28	0.15	0.27	0.11	0.10	0.34	0.18
Disability is work or earn related	Work	Earn	Earn	Earn	Work	Earn	Earn	Earn	Work
Minimum level of incapacity for work to be entitled to disability benefits	50%	15%	66.6%	66.6%	Permanently incapable of work	66%	50%	Earnings capacity no more than 1/3 of normal occupation	33%
Disability benefits depend on previous earnings	No	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes

Disability benefits can be accumulated with earnings from work	Accumulation possible, but with benefit reduction.	Accumulation is possible, but the rate of benefit may be revised.	A professional activity during the period of disability may be authorised by the mutual insurance company's medical advisor. The amount of the daily benefit thus allocated may not exceed the daily amount that would be allocated if there were no accumulation.	Suspension of the pension if the pension and the salary received during two consecutive quarters are greater than the average quarterly salary for the last calendar year before stopping work prior to invalidity.	Accumulation with earnings not possible. Invalidity requires permanent full incapacity.	No accumulation possible for incapacity pension; partial accumulation for partial pension.	Accumulation with earnings from a professional activity is possible, but the payment of the invalidity pension is interrupted when the earnings from the activity exceeds the earnings that a healthy worker can attain.	Accumulation possible up to the limit of the reference earnings.	Permanent incapacity pensions are compatible with earnings, provided the activity is consistent with the pensioner's physical condition and does not imply a change in his/her capacity to work.
Preferential employment for handicapped persons	Public authorities have to give preference to handicapped persons who cannot get employment in private enterprises, but who are considered capable of working. The municipality provides subsidies to employers offering a job to the disabled.	No regulations.	No regulations.	Preferential employment of handicapped persons on staff up to 6% of total in firms with 20 or more employees.	Public authorities reserve up to 3% of suitable positions for disabled persons.	Persons disabled by industrial injuries are placed and employed in enterprises with a staff of 50 or over (one such person for each 50 workers).	For certain categories (e.g., the blind).	Firms employing a staff of at least 10 are obliged to employ handicapped persons incapacitated as a result of an accident occurring in the workplace.	Quotas may be established for the employment of handicapped workers (employers with a permanent workforce of over 50 to set aside 2% for handicapped workers). Also social security contributions relief.

Table 1 (*Continued*)

	Denmark	Netherlands	Belgium	France	Ireland	Italy	Greece	Portugal	Spain
OECD (2003): Compensation index (values from 0 to 50)	27	29	26	25	–	22	–	31	30
OECD (2003): Integration index (values from 0 to 50)	39	30	23	24	–	18	–	16	27
Unemployment benefits:									
Initial net unemployment replacement rate (as % of net earnings in work) (2004)	70	74	61	75	49	54	55	83	67
Average of net replacement rate over 60 months of unemployment (as % of net earnings in work) (2004)	70	66	61	57	64	22	35	68	49
Unemployment insurance benefit duration (months) (2004)	48	24	No limit	23	15	6	12	24	21
Average standardised unemployment rate (1994–2001)	5.6	4.5	8.7	10.6	8.7	10.7	10.3	5.7	15.2
Old-age benefits:									
Age of earliest retirement (2004)	50	60	60	60	55	60	50	55	60
Retirement net replacement rate for average earner, men (2007)	86.7	96.8	63.0	63.1	38.5	77.9	110.1	69.2	84.5

Sources: Compiled by the author using data from OECD (2003), OECD (2006), Eurostat (2007), OECD (2007), European Commission (2004), Department of Social and Family Affairs (2003).

The Netherlands, while the laggards in this dimension are France, Belgium and Italy.

Concerning the characteristics of unemployment insurance, Table 1 shows that there are marked differences in (i) the initial net unemployment replacement rate, (ii) the duration of unemployment insurance, and (iii) the average replacement rate over the course of the unemployment spell. Note that Denmark, The Netherlands and Portugal are the countries in which both the initial and the average replacement rates are highest. At the other end, Italy and Greece rank lowest in terms of initial and average net replacement rates. In the duration dimension, note that individuals are entitled to unemployment benefits from six months in Italy to an unlimited period of time in Belgium. It has been previously argued (OECD, 2003) that unemployment systems with long benefit payments are likely to reduce the pressure on the disability programme.

In several countries, (early) retirement benefits are as important as disability benefits for disabled persons of working age (OECD, 2003). In Portugal, for example, one third of non-employed disabled persons receive an early or regular retirement benefit. This is probably due to the fact that access to early retirement benefits is easy, as long as the contribution requirements are fulfilled, because there is no medical examination. An important element to determine the importance of (early) retirement as an incentive to withdraw from the labour force is the eligibility age. In four of the countries considered (Denmark, Greece, Ireland and Portugal) individuals younger than 60 are able to take early retirement. In Ireland, unemployed persons aged 55 or over who have been receiving either Unemployment Benefits or Unemployment Assistance for 15 months or more may opt to apply for the Pre-Retirement Allowance (PRETA), which is a means-tested allowance that enables individuals aged 55 or over to retire from the labour force. In Portugal, 10 years of early retirement are available on the condition that there are either 30 years of registered earnings or 20 years of registered earnings and the individual is in long-term unemployment. In Greece, mothers can retire at the age of 50 with a reduced pension if they have a dependent or disabled child and have worked for more than 5500 days. Moreover, both men and women can retire with full pension at age 55 if they have worked at least 35 years. The route to early retirement available in Denmark for individuals aged 50 and over is based on grounds of social problems without any medical cause.

The effects of financial incentives on retirement transitions is a well-studied topic (Gruber and Wise, 2004). The scarce evidence on how ill-health and the financial incentives interact suggests that financial incentives to retire are unimportant if the individual experience a health deterioration (Banks et al., 2007). On the other hand, the alternative routes available in different countries and their relative attractiveness define the set of choices considered when an individual decides to withdraw from the labour market (Gruber and Wise, 2004). Therefore, one can build several hypothesis regarding the relative magnitude of the expected outflows across countries on basis of the description presented above of the different institutional settings.[2]

First, a priori one would expect the highest outflows from employment in The Netherlands and Denmark. These countries share the most generous unemployment and disability insurance and there is no quota enforcement policy. It is difficult to hypothesize whether inflows into unemployment in these two countries would be higher than inflows into disability or vice versa. However, one would expect workers over 50 to transit into early retirement in Denmark due to the loose requirement to opt in.

The disability compensation indices in Portugal and Spain are among the highest (OECD, 2003). Therefore, one would expect that the effect of a health shock on the probability of transiting into disability should be also among the highest in these two countries. It is difficult to hypothesize about the outflow in Ireland, where individuals cannot combine disability benefits with earnings. This should provide individuals with high incentives to either continue working (low effects) or to stop working (high effects). Last, the incentives to continue working seem to be the highest in France (low average unemployment replacement rate, high minimum level of incapacity to work and high quota) where one would expect to find lower effects of the onset of a health shock on employment.

3. Empirical strategy

Labour market outcomes potentially affected by an adverse health shock are the probability of being in employment, the probability of being inactive, the probability of being unemployed and the probability of being retired.

One fundamental difficulty for our purposes is how to adequately deal with the simultaneous determination of health and labour outcomes. One possible avenue would be to find instruments for health in a reduced form for labour outcomes. However, one source of potentially valid exclusion restrictions in this setting, i.e., detailed regional information, is absent from the ECHP due to the high level of aggregation employed for the regional markers.

Another option consists in conditioning on sufficient information to replicate random assignment to treatment (in this case suffering a health shock) and then using a parametric model where the treatment variable is one of the regressors. This is essentially the route taken by Smith James (2004) in that the onset of a health shock is assumed to be exogenous (conditional on a set of observed covariates) in a labour outcomes equation. The approach of Lindeboom et al. (2006) is similar in that the authors estimate multinomial logits for different transitions between work and disability states where having had an accident is one of the explanatory variables, but in this case the specification also allows for any remaining unobserved heterogeneity affecting health shocks and labour market/disability outcomes.

Our empirical strategy relies on the possibility of conditioning on sufficient observable information to obtain a credible counterfactual against which to measure the impact of the health shock. Let $T = 1,0$ indicate treatment (health shock) and lack of treatment, respectively and let Y_{i1} and Y_{i0} denote the outcome of interest (labour status) for individual i with treatment and without treatment respectively. Since we will observe individual i either with treatment or without treatment, we cannot observe the causal effect of interest: $Y_{i1} - Y_{i0}$. Some features of this distribution are estimable, nevertheless. In particular, we may consider the Average Treatment Effect on the Treated (ATET), which measures how much the outcome of interest changes on average for those individuals who undergo the treatment (who suffer the health shock to be defined below) (Heckman et al., 1997; Blundell and Costa Dias, 2002).

Suppose that by conditioning on an appropriate set of observables, X, the non-participation outcome Y_0 is independent of the participation status T. This is the weak version of the unconfoundedness assumption, also called ignorable treatment assignment (Rosenbaum and Rubin, 1983) or conditional indepen-

[2] Notice that, to the best of our knowledge, there are no studies that analyse the incentives provided by the alternative routes out of employment after the onset of a health shock for the overall working-age population in different European countries. It is, nonetheless, outside the scope of this paper to derive a compact measure of the financial incentives provided by each route. Consequently, here and in the forthcoming sections it is only hypothesized which policies could be related to the observed country differences.

dence assumption (Lechner, 2000) or selection on the observables, which suffices when the parameter of interest is the ATET, as only assumptions about the potential outcomes of comparable individuals are needed to estimate counterfactuals.

$$Y_0 \perp T|X \tag{1}$$

This implies that

$$E(Y_0|T=1,X) - E(Y_0|T=0,X) = 0 \tag{2}$$

In order to identify the ATET, the overlap or common-support condition is also assumed. It ensures that, for each treated individual, there are control individuals with the same X.

$$Pr(T=1|X) < 1 \tag{3}$$

Therefore, under the assumptions stated in Eqs. (1) and (3) above, we could estimate the ATET from the difference in outcomes between treated and controls within each cell defined by the conditioning variables X (see Blundell and Costa Dias, 2002). Using the law of iterated expectations and the conditional independence assumption, the ATET can be retrieved from observed data in the following way:

$$\begin{aligned} \text{ATET} &= E(Y_1|T=1) - E(Y_0|T=1) \\ &= E_x[(E(Y_1|X,T=1) - E(Y_0|X,T=1)) + T=1] \\ &= E_x[(E(Y_1|X,T=1) - E(Y_0|X,T=0)) + T=1] \end{aligned} \tag{4}$$

3.1. Defining health shocks and treatment and control groups

We use two measures of health shocks. The first is based on the responses to the question on self-assessed health in the ECHP "How good is your health in general?". From the five possible responses (very good, good, fair, bad and very bad), we consider that the respondent has undergone an adverse health shock if he or she reports "fair", "bad" or "very bad" in any given period, with the timing of the shock occurring sometime between the last period when he or she recorded any of the other two alternatives.

Since we wish to evaluate whether suffering a health shock in these terms leads to any change in labour outcomes, we want to rule out the possibility that any potential anticipation of the change in labour status causes the change in self-reported health, therefore we adopt the following strategy – motivated by the procedures used by Lechner and Vázquez Álvarez (2004) and García-Gómez and López-Nicolás (2006) – in order to construct the treatment and control groups:

(1) Consider a window of three years for each observed individual. This creates six possible sequences of three years over the time span covered by the data. We refer to these three years as $t=1$, $t=2$ and $t=3$, regardless of the sequence.
(2) For each sequence, select individuals who are healthy (good or very good health) at $t=1$, the start of the sequence, and also are employed at $t=1$ and $t=2$.
(3) The *treatment group* are individuals meeting selection criterion #2 who report fair, bad or very bad health in $t=2$ and $t=3$. That is, those individuals who undergo a health shock after $t=1$ and for whom adverse health persists at least over $t=3$.
(4) The *control group* are individuals meeting selection criterion #2 who do not report a worsening in their health status (very good in $t=1$, $t=2$ and $t=3$ or good in $t=1$, $t=2$ and $t=3$).

The second health measure used is based on responses to the question on chronic illnesses "Do you have any chronic physical or mental health problem, illness or disability?". The treatment and control group are defined as before:

(2') For each sequence, select individuals who do not have a chronic condition at $t=1$, the start of the sequence, and also are employed at $t=1$ and $t=2$.
(3') The *treatment group* are individuals meeting selection criterion #2' who report a chronic condition in $t=2$ and $t=3$.
(4') The *control group* are individuals meeting selection criterion #2' who do not report a chronic condition in $t=2$ and $t=3$.

It should be noted that potential contemporaneous effects of health transitions on labour outcomes (and contemporaneous effects of employment transitions on health) are disregarded by considering these sequences. However, this procedure ensures that the treatment occurs before the potential change in outcome, thus offering some guarantee that what we identify is not reverse causality. Moreover, as individuals suffer a health shock before leaving the labour force, we also rule out justification bias in the health responses, except in those cases where there are anticipation effects consisting in individuals who foresee a transition out of employment and report a health change one period in advance. It is not clear to what extent this anticipation effect might be empirically important, but in any case assuming it away is the price we have to pay in order to be able to rely on the timing of events as a source of identification. On the other hand, if one is willing to assume that the second health measure is not contaminated by an anticipation effect, the comparison of the results using the two health measures can shed some light on their relative importance.

3.2. Propensity score matching

The estimate of the ATET as shown in Eq. (4) turns out to be prohibitive in terms of data when the set of conditioning variables X is large. An alternative is to use the results of Rosenbaum and Rubin (1983, 1984) and condition on the probability of treatment as a function of X, the propensity score $P(X)$. Therefore, we could estimate the ATET from the differences in outcomes between treated and controls within each cell defined by values of $P(X)$.

Provided that the conditional participation probability can be estimated using a parametric method as a probit model, matching on the univariate propensity score reduces the dimensionality problem.

Moreover, it is worth mentioning that due to the strategy chosen to define the groups of treated and control individuals, the propensity score is used as a "partial" balancing score, as it is complemented by an exact matching on pre-treatment health and labour status.

Once the propensity score is estimated, we calculate the ATET using the Epanechnikov kernel algorithm (Becker and Ichino, 2002) with replacement, which matches each treated individual with all the control units within a distance measured using the propensity score and weighting the closer controls higher.

3.3. Plausibility of the conditional independence assumption

The identification of the ATET by matching methods relies on the unconfoundedness assumption, which may or not may be plausible depending on the particular context, and which is inherently untestable as the actual counterfactual cannot be observed.

Plausibility relies on the availability of a detailed group of characteristics that allow us to match treated and control units. The data used contains a rich set of pre-treatment variables on demographics, educational attainment, job characteristics, household composition and socioeconomic information. Moreover, the information for both treated and control individuals was collected with the same questionnaire, and individuals were drawn from the same local market. Heckman et al. (1997) stressed the importance of

satisfying these two conditions in order to reduce the bias when applying matching estimators.

Secondly, pre-treatment outcomes are included within the vector of conditioning variables, by restricting the sample of controls to individuals who are identical in terms of pre-treatment outcomes. This procedure aims to include fixed unobserved factors in the outcomes of interest within the vector X of conditioning variables.

Again, it is important to stress that the ability of the estimator shown in (4) to consistently retrieve the ATET relies crucially on the conditional independence assumption. That is, there are no unobserved variables that are correlated with both the exposure to treatment (the health shock) and the outcome. Therefore, if any systematic differences remain between the outcomes of treated and control individuals, matching estimation will not recover the parameter of interest. However, if we can assume that these differences are time-invariant the availability of panel data affords the possibility to correct for the hypothetical failure of this assumption. Letting the superscripts A and B denote the time periods before and after treatment occurs, the conditional independence assumption would now be stated in the following terms:

$$Y_0^A - Y_0^B \perp T|X \tag{5}$$

So that

$$E(Y_0^A - Y_0^B|T = 1, X) - E(Y_0^A - Y_0^B|T = 0, X) = 0 \tag{6}$$

Notice that as we have restricted all the individuals to be employed in the first period, the ATET estimates are identical to the ones obtained taking differences. Therefore, even in the presence of time-invariant unobserved heterogeneity the parameters of interest would be recovered.

4. Data and descriptive statistics

The European Community Household Panel (ECHP) is an annual standardised longitudinal survey which provides eight waves of microdata about living conditions in most of the EU-15 member states. The survey is based on a standardised questionnaire given to individuals aged over 16 selected from a representative household panel. The survey covers a wide range of topics, including demographics, income, social transfers, individual health, education and labour. The information contained in the ECHP is comparable both across countries and over time.

The criteria used to select treatment and control groups meant that only those countries for which comparable information was available in all eight waves could be used: Belgium, Denmark, France, Greece, Ireland, Italy, The Netherlands, Portugal and Spain.

The outcome variables considered are employment and different non-employment status. Information regarding employment status comes from the self-defined classification of main status, and individuals are classified as employed when work part-time or full-time or are self-employed. The three non-employment categories that we will consider are unemployed, retired and inactive. Therefore, we will not look at other categories such as student, doing housework, looking after children or other persons, and in community or military service.

Table A1 in Appendix A shows average health and employment outcomes in the countries of interest during the period 1994–2001. First, we can see that employment rates vary across European countries with the highest employment rates in Denmark (0.773 among individuals aged 16–49 and 0.647 among individuals aged 50–64) and the lowest in Spain (0.543 among individuals aged 16–49 and 0.398 among individuals aged 50–64). Non-employed young individuals tend to be in unemployment in all countries, while retired if aged 50–64, except in The Netherlands and Spain where the share that reports being inactive is higher than the share that reports being retired. Less than half of the population whose self-reported health is fair, bad or very bad is employed in Europe, and the figure is similar among individuals with a chronic condition. As expected, once we select the subgroup of the population in ill health, we find that the percentage that declares being inactive is increased compared to the general population. Moreover, in Ireland Greece and Portugal the percentage of young inactive is higher than the percentage of young unemployed. There are also differences in average health across countries: 0.289 report having a chronic health condition in Denmark vs. 0.082 in Italy; and 0.423 report their health to be fair, poor or very poor in Portugal vs. 0.134 in Ireland.

The share of treated individuals in employment one year after the health shock occurs is higher than the percentage of sick individuals in employment[3] in all countries. This is expected as we start with a sample of workers. Around 80% of the treated individuals are still working in $t = 3$ in Denmark, The Netherlands, Belgium and France; around 65% in Ireland, Italy, Portugal and Spain; and as few as 33% in Greece. The percentage of individuals working in $t = 3$ is on average 8.6 percentage points higher in the control group, independently of the measure of health used. In addition, individuals who incur a health shock have, with respect to the control group, lower equivalent household income, lower educational attainment, and are older. The average health status in the first period is, as expected, worse for the treated than for the control group. There are major differences across countries in the initial health status. For example, among the subgroup of treated individuals defined on basis of self-assessed health, the percentage who have been hospitalised in the last 12 months ranges from 2.4% in Portugal to 10.3% in Ireland. This difference is also observed in the number of nights hospitalised, as the mean varies from 1.1 in Denmark to 0.221 in Portugal. The same differences appear when we look at the subsample of treated individuals defined by the onset of a chronic condition. The percentage that went to the hospital varies from 6.7% in Portugal to 14.7% in Belgium or 16.5% in Italy. These differences can be due to differences in initial health status across countries and/or differences in health care use.

5. Results

We construct the propensity score for suffering a health transition using a probit model in which the probability of belonging to the treated group is a flexible function of the following pre-treatment characteristics[4]: age, gender, marital status, logarithm of the household equivalent income, number of children in the household, percentage of total household income that comes from the individual's labour income, whether she works full-time, more than 10 years in the same firm, in the public sector, self-employed, sector, occupation, number of days lost because of illness in the last month, if she is severely limited by any chronic condition, limited by any illness, limited in daily activities by any illness or mental problem, indicators of health care utilisation and indicators of region and year.

As the routes out of employment differ between young and older workers, the analysis is shown for the pooled sample of workers (age 16–64) and for the two age groups: young (16–49) and old (50–64). A different specification of the propensity score for each country and each group and each health measure have been used, ensuring in all cases the satisfaction of the balancing hypothesis. To test the latter, we have followed Dehejia and Wahba (1999, 2002). In particular, the observations are divided into strata until

[3] Results not shown but available from the author upon request.
[4] Propensity score estimates are available from the author upon request.

there are no statistically significant differences within strata in the mean estimated propensity scores between treated and controls. Subsequently, the null hypothesis of no significant differences in the means of each covariate between treated and controls is tested within each stratum. The distribution of scores among treated and controls in each country does not differ, giving support to the conditional independence assumption. In any event, all the estimates shown are obtained under the common support.

Table 2 presents the estimates of the ATET on the probability of employment, unemployment, inactivity, retirement, and a combined category of either retirement or inactivity for the pooled sample of workers aged 16–64. The Epanechnikov kernel algorithm with a bandwidth equal to 0.05[5] have been used. We have included the combined category of either retirement or inactivity because, as has been previously noted in the literature (Bardasi et al., 2002; Disney et al., 1994), retirement is not a well-defined state and some individuals classify themselves as retired when they have permanently exited from the labour market, while others do so only if they receive a pension. Moreover, there can be cultural differences across countries, reinforced by the different routes available into retirement.

The first five columns of Table 2 show the estimated effects of a drop in self-assessed health from good or very good to fair, bad or very bad on the probability of remaining employed, transit to unemployment, inactivity or retirement. The last five columns show the effects of the onset of a chronic physical or mental problem, illness or disability on the same labour outcomes. First notice that the results are robust to the measure of health deterioration used. The Spearman rank correlation between the two sets of results for the ATET of being employed is positive and significant ($r_s = 0.767$). In most of the countries considered here, individuals who suffer a health shock are significantly more likely to transit to a non-employment status than those who do not. However, there are differences in the estimates across countries, with the largest employment effects being found in Ireland.

Table 2 also reveals that in most of the countries the exit from employment as a result of a health shock leads to exit from the labour force rather than unemployment. The exceptions seem to be Netherlands and Denmark (at 10% significance level when the onset of a chronic illness is used), where individuals' probability of entering into unemployment is higher than the corresponding probability for inactivity. In Spain the estimates show that the reduction in the likelihood of employment, which is among the highest, is paralleled by an increase in the probability of entering inactivity. In France, Italy and Belgium, the estimated ATET is not statistically significant. In addition, the estimates suggest that in most countries individuals do not opt for early retirement following a health deterioration, except in Denmark, Greece and Spain, although the effect in the last two countries is only significant after a sudden drop of self-assessed health.

The estimates across health definitions are comparable not only in rank but also in magnitude, being the effects slightly stronger when the health deterioration is captured by the onset of a chronic condition, except in Denmark and Belgium. The effects in Belgium are only significant after the drop in self-assessed health which can be due to the higher number of treated individuals in this case (403 vs. 197). On the other hand, the probability of transiting into inactivity is significant in Italy (2.75% increase) and Greece (2.47% increase) only after the onset of a chronic condition, while the probability of transiting into retirement is significant in Greece (2.54% increase) and Spain (1.34% increase) only after self-assessed health drops. However, the differences in Greece and Spain disappear on the combined retirement or inactivity category.

The availability and attractiveness of exit routes in each country differ for young and old individuals. For example, a worker aged 30 with impaired health can leave the labour market via unemployment or disability, while if aged 50 and lives in Denmark could claim for retirement benefits on grounds of an adverse social situation. Table 3 shows the results for old (50–64) and young (16–64) workers, respectively, but conclusions are limited due to smaller sample sizes. The results for the two age groups are also robust to the measure of health used.

The results for both subgroups are in line with the pooled results, although significance is reduced in few cases. In general, the magnitude of the effect is higher among the older group. This is an expected result as the likelihood of a more severe health impairment is higher among the older group, together with higher social security incentives to withdraw from the labour market in most countries. The most interesting difference appears on the probability of transiting into unemployment in Denmark and The Netherlands. The subgroups analysis shows that the probability of transiting into unemployment in Denmark is found only among the old workers (at least 5% increase), while in The Netherlands the positive effect is only found among the young workers (at least 4% increase).

From the results shown in Table 3, it is worth noting that the effects found among the younger workers (16–49) are non-negligible as the probability of leaving employment and transiting into inactivity for this subgroup is as high as 7.7% in Ireland or 6.3% in Spain.

The size of the ATET estimates for the probability of being in employment varies from almost zero in France to −0.11 in Ireland. However, in order to gauge the relative importance of these effects, it is useful to compare them with the probability of non-employment that these individuals would have faced had they not suffered a health shock. This is shown in Fig. 1. The lighter part of the bars shows the probability of non-employment that these individuals would have faced had they not suffered a health shock. It is obtained as the weighted average of the outcomes observed for the control individuals, using the weights from the Epanechnikov kernel algorithm. The darker part shows the estimated ATET, and the relative effect[6] is shown at the top of the bars.

The figure shows that the relative magnitude of the effects of a health shock on employment is not trivial, as it gets higher than 10% in most cases when the effect is significant. In addition, it gets over 60% among the old Danish (60–83% depending on the health measure) and over 90% among the young Dutch (90–127%). Moreover, Fig. 1 does not suggest a clear association between the probability of leaving the labour market for the matched non-treated and the estimated ATET. For example, the estimated ATET is similar in The Netherlands and Greece, but while in The Netherlands the probability of leaving the labour market without having had a health shock is the smallest, in Greece it is largest. Thus, in relative terms, in The Netherlands is where the effect is largest.

5.1. The association between the magnitude of the estimates and Social Security arrangements

As the results shown in Tables 2 and 3 and Fig. 1 point out, there are important differences in the magnitude of the estimates across countries, which may be at least partly explained by the differences in Social Security arrangements across the countries

[5] Results using a bandwidth of 0.1 and a bandwidth of 0.01 were qualitatively similar. These are not shown, but available from the authors upon request.

[6] The relative effect is obtained as $[\text{ATET}/\text{Prob}(\text{non-employment}_{t=3}|T=0)] \times 100$.

Table 2
ATET on the probability of several activity statuses. All age groups.

	Changes in SAH					Changes in chronic				
	Employed	Unemployed	Inactive	Retired	Retired + inactive	Employed	Unemployed	Inactive	Retired	Retired + inactive
Denmark	−0.0689	0.0250	0.0164	0.0335	0.0498	−0.0394	0.0180	0.0154	0.0168	0.0322
	(0.0319)	(0.0196)	(0.0099)	(0.0158)	(0.0189)	(0.0174)	(0.0108)	(0.0072)	(0.0081)	(0.0102)
Netherlands	−0.0561	0.0279	0.0131	−0.0009	0.0122	−0.0679	0.0342	0.0128	−0.0009	0.0118
	(0.0154)	(0.0097)	(0.0068)	(0.0005)	(0.0065)	(0.0169)	(0.0105)	(0.0066)	(0.0006)	(0.0065)
Belgium	−0.0230	0.0084	0.0162	0.0102	0.0265	0.0192	−0.0001	0.0106	0.0023	0.0129
	(0.0168)	(0.0091)	(0.0094)	(0.0103)	(0.0132)	(0.0250)	(0.0116)	(0.0109)	(0.0141)	(0.0166)
France	0.0195	−0.0050	0.0000	−0.0157	−0.0157	−0.0134	0.0095	0.0075	−0.0165	−0.0090
	(0.0151)	(0.0098)	(0.0000)	(0.0085)	(0.0080)	(0.0280)	(0.0184)	(0.0078)	(0.0144)	(0.0160)
Ireland	−0.1123	−0.0012	0.0557	0.0060	0.0617	−0.1102	−0.0010	0.0678	0.0056	0.0734
	(0.0324)	(0.0098)	(0.0196)	(0.0099)	(0.0218)	(0.0406)	(0.0106)	(0.0263)	(0.0098)	(0.0271)
Italy	0.0079	−0.0022	0.0004	−0.0028	−0.0024	−0.0239	−0.0034	0.0275	0.0232	0.0506
	(0.0085)	(0.0032)	(0.0028)	(0.0044)	(0.0050)	(0.0215)	(0.0071)	(0.0117)	(0.0140)	(0.0183)
Greece	−0.0559	0.0097	0.0126	0.0254	0.0381	−0.0658	0.0017	0.0247	0.0030	0.0277
	(0.0194)	(0.0110)	(0.0100)	(0.0128)	(0.0153)	(0.0223)	(0.0105)	(0.0116)	(0.0118)	(0.0159)
Portugal	−0.0214	−0.0035	0.0082	0.0038	0.0120	−0.0534	0.0076	0.0294	0.0093	0.0387
	(0.0109)	(0.0050)	(0.0025)	(0.0031)	(0.0040)	(0.0159)	(0.0072)	(0.0082)	(0.0064)	(0.0109)
Spain	−0.0687	−0.0007	0.0584	0.0134	0.0718	−0.0805	0.0116	0.0662	0.0054	0.0716
	(0.0172)	(0.0084)	(0.0103)	(0.0060)	(0.0119)	(0.0201)	(0.0114)	(0.0136)	(0.0053)	(0.0140)

Note: Bootstrapped standard errors in parentheses. Spearman rank correlations on the ATET on the probability of employment among the two health measures is 0.767 (p-value = 0.0159). Number of treated (T) and controls (C): Denmark: T_{SAH} = 326; C_{SAH} = 5325; T_{CH} = 469; C_{CH} = 6358; Netherlands: T_{SAH} = 632; C_{SAH} = 9541; T_{CH} = 524; C_{CH} = 12,787; Belgium: T_{SAH} = 403; C_{SAH} = 6235; T_{CH} = 197; C_{CH} = 9085; France: T_{SAH} = 1735; C_{SAH} = 8737; T_{CH} = 545; C_{CH} = 18,968; Ireland: T_{SAH} = 224; C_{SAH} = 6127; T_{CH} = 198; C_{CH} = 8778; Italy: T_{SAH} = 1779; C_{SAH} = 11,075; T_{CH} = 286; C_{CH} = 24,612; Greece: T_{SAH} = 375; C_{SAH} = 11,487; T_{CH} = 229; C_{CH} = 15,485; Portugal: T_{SAH} = 2005; C_{SAH} = 11,047; T_{CH} = 549; C_{CH} = 18,852; Spain: T_{SAH} = 772; C_{SAH} = 7721; T_{CH} = 400; C_{CH} = 14,430.

Table 3
ATET on the probability of several activity statuses, by age-groups.

	Changes in SAH					Changes in chronic				
	Employed	Unemployed	Inactive	Retired	Retired + inactive	Employed	Unemployed	Inactive	Retired	Retired + inactive
Old workers (50–64)										
Denmark	−0.1072	0.0640	0.0146	0.0219	0.0366	−0.0786	0.0515	0.0152	0.0357	0.0509
	(0.0448)	(0.0338)	(0.0134)	(0.0326)	(0.0339)	(0.0364)	(0.0216)	(0.0131)	(0.0254)	(0.0286)
Netherlands	−0.0308	−0.0011	0.0281	−0.0015	0.0267	−0.0242	0.0129	0.0241	−0.0035	0.0206
	(0.0372)	(0.0104)	(0.0207)	(0.0014)	(0.0207)	(0.0316)	(0.0119)	(0.0190)	(0.0027)	(0.0207)
Belgium	−0.0121	0.0330	0.0151	0.0182	0.0333	0.0393	0.0140	0.0000	−0.0301	−0.0301
	(0.0585)	(0.0266)	(0.0203)	(0.0501)	(0.0498)	(0.0662)	(0.0303)	(0.0006)	(0.0592)	(0.0610)
France	−0.0172	0.0235	0.0000	−0.0171	−0.0171	0.0186	0.0021	0.0000	−0.0348	−0.0348
	(0.0440)	(0.0237)	(0.0000)	(0.0274)	(0.0260)	(0.0508)	(0.0258)	(0.0000)	(0.0373)	(0.0392)
Ireland	−0.1689	0.0100	0.0417	−0.0114	0.0303	−0.1085	−0.0020	0.0149	0.0354	0.0503
	(0.0767)	(0.0246)	(0.0305)	(0.0363)	(0.0496)	(0.0556)	(0.0254)	(0.0186)	(0.0342)	(0.0386)
Italy	0.0104	0.0019	−0.0002	−0.0025	−0.0027	−0.0339	−0.0106	0.0539	0.0116	0.0655
	(0.0187)	(0.0059)	(0.0059)	(0.0137)	(0.0155)	(0.0328)	(0.0036)	(0.0238)	(0.0258)	(0.0347)
Greece	−0.0578	0.0178	0.0138	0.0354	0.0492	−0.0258	−0.0020	0.0272	−0.0067	0.0205
	(0.0290)	(0.0112)	(0.0162)	(0.0188)	(0.0237)	(0.0289)	(0.0083)	(0.0165)	(0.0178)	(0.0242)
Portugal	−0.0275	−0.0142	0.0127	0.0123	0.0250	−0.0235	−0.0055	0.0362	0.0104	0.0466
	(0.0266)	(0.0147)	(0.0051)	(0.0096)	(0.0115)	(0.0249)	(0.0089)	(0.0132)	(0.0144)	(0.0185)
Spain	−0.0754	0.0205	0.0789	0.0372	0.1161	−0.0582	0.0082	0.0727	0.0129	0.0856
	(0.0329)	(0.0154)	(0.0219)	(0.0158)	(0.0249)	(0.0342)	(0.0180)	(0.0223)	(0.0149)	(0.0286)
Young workers (16–49)										
Denmark	−0.0513	0.0060	0.0215	0.0156	0.0371	−0.0188	0.0029	0.0170	0.0040	0.0210
	(0.0403)	(0.0215)	(0.0131)	(0.0118)	(0.0175)	(0.0184)	(0.0121)	(0.0090)	(0.0041)	(0.0099)
Netherlands	−0.0681	0.0408	0.0082	−0.0004	0.0078	−0.0837	0.0426	0.0045	−0.0002	0.0043
	(0.0186)	(0.0115)	(0.0048)	(0.0003)	(0.0055)	(0.0203)	(0.0118)	(0.0046)	(0.0001)	(0.0044)
Belgium	−0.0205	0.0007	0.0167	0.0000	0.0167	−0.0244	−0.0042	0.0199	0.0000	0.0199
	(0.0193)	(0.0095)	(0.0109)	(0.0000)	(0.0097)	(0.0286)	(0.0115)	(0.0149)	(0.0000)	(0.0154)
France	0.0109	−0.0180	0.0000	0.0000	0.0000	−0.0090	0.0079	0.0130	−0.0002	0.0128
	(0.0145)	(0.0091)	(0.0000)	(0.0000)	(0.0000)	(0.0329)	(0.0259)	(0.0095)	(0.0002)	(0.0096)
Ireland	−0.0819	−0.0219	0.0771	0.0000	0.0771	−0.0919	0.0070	0.0628	−0.0003	0.0625
	(0.0421)	(0.0155)	(0.0270)	(0.0000)	(0.0288)	(0.0416)	(0.0152)	(0.0249)	(0.0002)	(0.0248)
Italy	0.0116	−0.0043	0.0009	0.0009	0.0018	0.0138	0.0083	0.0038	0.0132	0.0170
	(0.0105)	(0.0044)	(0.0028)	(0.0013)	(0.0030)	(0.0317)	(0.0132)	(0.0082)	(0.0115)	(0.0160)
Greece	−0.0523	0.0173	0.0106	0.0110	0.0216	−0.0826	0.0018	0.0212	0.0105	0.0317
	(0.0371)	(0.0214)	(0.0128)	(0.0120)	(0.0155)	(0.0357)	(0.0248)	(0.0170)	(0.0118)	(0.0193)
Portugal	−0.0145	−0.0002	0.0060	0.0010	0.0069	−0.0325	0.0199	0.0215	0.0000	0.0214
	(0.0110)	(0.0043)	(0.0026)	(0.0010)	(0.0029)	(0.0218)	(0.0122)	(0.0092)	(0.0000)	(0.0098)
Spain	−0.0536	−0.0168	0.0447	0.0000	0.0447	−0.0753	0.0147	0.0630	0.0000	0.0630
	(0.0195)	(0.0084)	(0.0117)	(0.0000)	(0.0111)	(0.0282)	(0.0151)	(0.0176)	(0.0000)	(0.0165)

Note: Bootstrapped standard errors in parentheses.

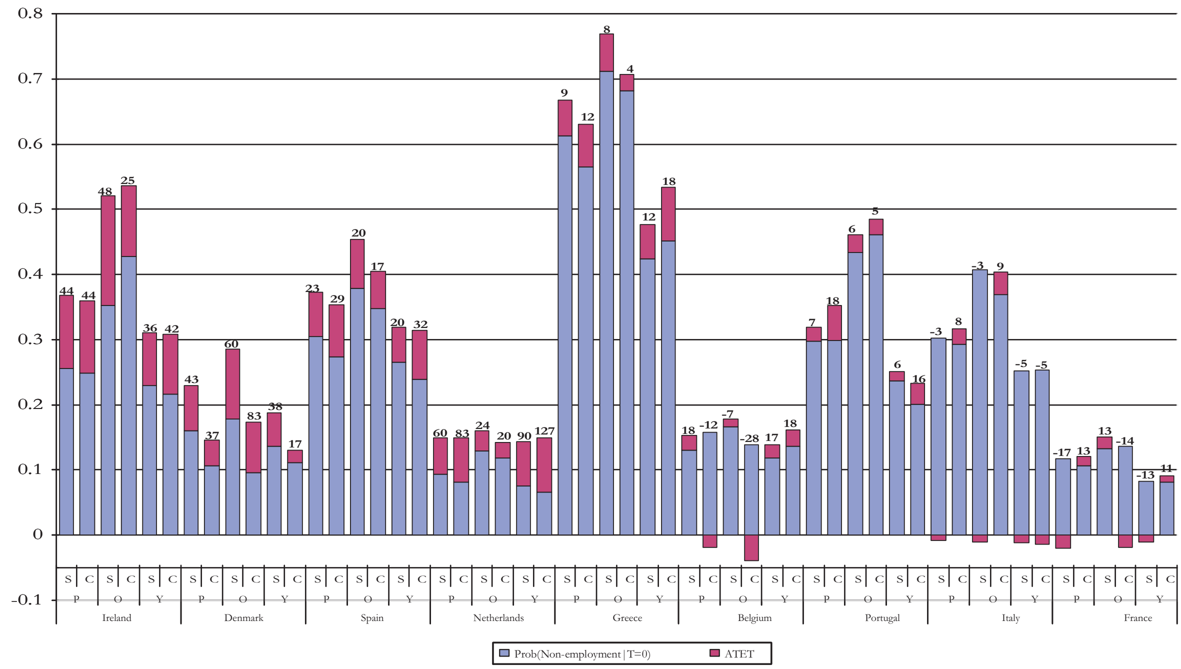

Fig. 1. Probability of non-employment for treated individuals if they had not suffered a health shock, estimated ATET and relative effects. *Note:* Prob(non-employment|$T=0$) is the mean of prob(non-employment) at $t=3$ for matched control individuals. The ATET is the corresponding effect on the probability of being non-employed for treated individuals estimated by nearest neighbour matching P: pooled sample; O: Individuals aged 50–64: Y: Individuals aged 16–49. S: Health deterioration defined as changes in Self-assessed Health; C: Health deterioration defined as onset of a chronic condition. Numbers at the top of the bars indicate relative effects (in percentage).

analysed. The discussion provided in this section aims to suggest some institutional features that could be driving the observed differences. Although it poses some hypothesis on the importance of these institutional features, their full evaluation remains a pending research question.

In addition, as can be derived from the descriptive statistics shown in Table A1, there is not a clear relationship between the average health status of the different countries and their average labour market outcomes. This suggests that other variables besides health may play an important role across countries in explaining labour market outcomes. For example, Low and Pistaferri (2009) argue that at least three types of shocks may lead individuals to apply for Disability Benefits: health shocks, lack of job offers and permanent non-health related productivity shocks. The institutional setting and the economic conditions will affect how individuals respond to these shocks. Here we focus on the first of them and conjecture to what extent the different institutional settings explain the differences in the magnitude of the effects. Therefore, it is outside the scope of this paper to analyse the effect of other plausible relevant variables.[7]

Ireland is the country in which the drop in the probability of remaining in employment is highest. This is consistent with the institutional feature mentioned in Section 2: disability benefits are not compatible with any kind of work. Therefore, individuals in Ireland who suffer even a partial disability are forced to leave the labour market in order to get any benefit from social security. This hypothesis is reinforced by the fact that the top six incapacity codes reported by individuals with any kind of disability benefits in Ireland are back/neck/rib/disc injury, anxiety/depression, other incapacity, arthritis/rheumatism/osteo-arthritis, nervous debility/bereavement, and hypertension (Department of Social and Family Affairs, 2003).

The other two countries where the effect is among the highest are Denmark and The Netherlands. They share with Ireland the non-existence of a quota regulation. This could partly explain why in these two countries the drop in the chances of remaining in employment after a health shock is, like Ireland, relatively high. However, a concomitant factor is the fact that compensation policies in both Denmark and The Netherlands are among the most generous across Europe (OECD, 2003). Also, the comprehensiveness of integration policies, as discussed in Section 2, is among the highest within the countries considered here. If individuals with a health shock can receive generous unemployment benefits in these two countries, they will tend to exit employment after a health shock, but if there are good integration policies they will not leave the labour market, unlike in Ireland, where they seem to remain in inactivity instead. However, another possible explanation comes through the unemployment replacement rate, as in Denmark and The Netherlands this is the highest. In order to disentangle whether the incentives come from the integration policies or the generosity of unemployment benefits (or both), one would need to be able to follow individuals through time to see whether they go back to work or transit to inactivity once the unemployment benefits expire. Unfortunately, the data at hand does not allow us to maintain a sample size large enough to perform this analysis.

The absence of any effect in the cases of Italy and France may reflect the existence of mandatory employment quotas for disabled workers. These two countries have the highest quotas for disabled people in firms' workforce (7% in Italy and 6% in France). So this evidence is consistent with the perception that in countries in which the quotas are higher, individuals who become disabled are more likely to keep their jobs (OECD, 2003). Moreover, France is an exception as a country in which special employment programmes for people with disabilities seem to make an important contribution

[7] For example, Benítez-Silva et al. (2010) show that local unemployment rates have an important explanatory role for disability benefit receipt. In addition, demand factors that explain whether employers are willing to keep and hire older workers may also play an important role (Sigg, 2007).

to the employment of severely disabled people and people with intellectual and mental disabilities.

The significant ATET for the probability of retirement in Denmark is consistent with the previously discussed arrangement whereby individuals can claim retirement benefits on grounds of an adverse social situation. This estimate is also significant in Greece, where men and women can retire with full pension at age 55 if they have worked at least 35 years. This suggests that differences in retirement arrangements across countries have an effect on the transitions out of employment following a health shock when the institutions allow individuals to easily withdraw from the labour market at younger ages.

5.2. Sensitivity analysis

Imbens (2004) suggests that some support for the plausibility of the CIA can be obtained by estimating the ATET for the treatment of interest on a pre-treatment variable. This ATET should be null, so evidence suggesting otherwise will question the validity of the CIA. We will estimate the ATET of the two measures of health shocks on pre-treatment income variables[8] (personal income from work, household income from work, total household income from work and total household social security income).[9] The effect was estimated on 216 outcomes (9 countries, 3 age groups, 2 health measures and 4 pre-treatment income variables). The results show that the null hypothesis of no effect cannot be rejected for 197 of the pre-treatment income variables at a 5% significance level, which is slightly lower than the 95% that one would expect from the chosen significance level. On the other hand, the same hypothesis cannot be rejected for 104 out of 108 of the cases (96.2%) when health shocks are defined using changes in self-assessed health. This provides evidence in favour of the conditional independence assumption that we have maintained throughout the analysis at least for the first of the health variables used.

6. Discussion and conclusion

This paper presents evidence suggesting that the occurrence of a health shock has a causal effect on the probability of being in employment. Interestingly, the magnitude of the effect differs across countries. There are two countries (France and Italy) where the point estimate for this effect is not statistically significant. On the other hand, the largest effects exceed 6% in Denmark, The Netherlands, Spain and Ireland. In general, the magnitude of these effects is high in relative terms, because the chances of being non-employed are more than 10% higher compared to the probability that treated individuals would have faced had they not suffered a health shock, and they are even more than 60% higher among the old Danish and the young Dutch. In addition, the subgroup analysis brings out that the probability of leaving employment and transiting into inactivity among the young workers (aged 16–49) is non-negligible. This should be a cause of concern, as the outflow from inactivity is known to be close to zero (OECD, 2003).

The results also suggest that the chances of an individual staying in employment after a health shock are affected by the disability policies in his country. For example, in Ireland, one of the countries where the effect of a health shock on the probability of employment is highest, individuals who experience a disability cannot even opt to work part-time if they want to be entitled to disability benefits. The corresponding effect is not significantly different from zero in France and Italy, the two countries that apply the highest mandatory quotas for disabled workers (7% Italy and 6% France).

Concerning income adequacy after a health shock, it has been argued (OECD, 2003) that disabled individuals who are employed earn on average as much as non-disabled employed individuals, but they are better off than disabled individuals who do not work. In this context it is unfortunate that some countries have institutional arrangements that are relatively more conducive to withdrawal from the labour force after an individual suffers a health shock. Inevitably not all individuals who suffer a health shock could or should be employed. Many individuals with a short-term health problem may have jobs to return to once they recover from their illness. Other individuals, because of their illness, age or local market characteristics may not be capable to work. However, these results are consistent with the idea that there are individuals whose incentives to remain in the labour market are affected by social security arrangements in a substantial way.

In addition, these results also suggests that a health shock tends to reduce activity more in countries where the integration dimension of disability policies is lower (Ireland) than in countries that score high on this dimension (Denmark and The Netherlands). However, the higher likelihood of a transition to unemployment in Denmark and The Netherlands could also be the result of their higher unemployment replacement rates.

These results cast some doubt on the view held by, for example, the OECD (2003) that unemployment systems with long benefit periods are likely to reduce the pressure on disability programmes. In particular the results for Belgium are at odds with this notion. Belgians are entitled to an unlimited period of unemployment benefits, so according to the OECD's stylised fact, we should expect them to transit to unemployment after an adverse health shock. However, the estimates show that health shocks cause transitions to inactivity instead.

The results also show that, except in Denmark (where individuals can claim early retirement on grounds of an adverse social situation) and Greece (where individuals can retire with full pension at age 55), a health shock has no effect on the probability of retirement. This is not an unexpected result in Ireland and Portugal where individuals need to be unemployed before being able to become early retirees. For these two countries, the significant increases in the probability of reporting inactivity and the non-significant effect on the probability of reporting unemployment after a health shock duly reflect this institutional feature.

The health measures used are all based on subjective perceptions, and although the methods used help to minimise the problems of endogeneity, justification bias and unobserved heterogeneity, there could still be some differences across countries in the objective health changes associated with these measures of health shocks. However, any such differences cannot entirely explain the differences in the estimates across countries. An indirect test of the latter assertion is that there is no association between the proportion of treated individuals who report being hampered and the estimated causal effects. For example, in France and Ireland around 8% of the individuals in the treated group defined by a drop in self-assessed health declare to be severely hampered in their daily activities by a chronic physical or mental health problem, illness or disability, but the employment effects discussed earlier are clearly different in these two countries (no effect for France and above 11% in Ireland). In addi-

[8] Imbens (2004) also proposes a test based on the presence of multiple control groups (e.g., individuals who are eligible and individuals who are non-eligible for treatment), where one can estimate the ATET of interest considering one of these control groups as the "treated" sample. In that case, the treatment effect is known to be zero, thus the non-rejection of the null hypothesis of no treatment effect makes the satisfaction of the CIA more plausible. However, due to the characteristics of our setting, there are no different control groups to be used.

[9] Results not shown but available from the author upon request.

tion, the robustness of the results - both in sign and magnitude - to the two health measures used (drop in self-assessed health and onset of chronic condition) adds further confidence in our two main findings, i.e. (i) the importance of health as a causal determinant of labour market transitions and (ii) the existence of differences in the magnitude of these effects across European countries.

The analysis also identifies lines for future research. First, it would be of interest to analyse transitions between the different non-employment states. A specific aim could consist of testing whether individuals transit from unemployment to inactivity and/or to employment once unemployment benefits expire. Another useful avenue of research, in order to assess the relative effects of reintegration policies across countries, would be to try to analyse differences in the outflow from inactivity after individuals recover from their adverse health episodes.

Notwithstanding these research needs, the results presented in this paper show that more inspiration is needed in order to avoid the adverse employment effects detected in some European countries. The good news is that there seems to be scope for learning from the experience in neighbouring countries.

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Appendix A.

See Table A1.

Table A1
Mean employment outcomes and health variables across countries of analysis.

	All sample			SAH = fair, bad or very bad			Chronic = 1		
	All	Young (16–49)	Old (50–64)	All	Young (16–49)	Old (50–64)	All	Young (16–49)	Old (50–64)
All countries									
Employed	0.590	0.634	0.465	0.488	0.597	0.362	0.444	0.553	0.321
Unemployed	0.080	0.093	0.044	0.079	0.105	0.050	0.081	0.106	0.053
Inactive	0.026	0.018	0.052	0.069	0.056	0.083	0.111	0.098	0.124
Retired	0.053	0.005	0.189	0.116	0.016	0.232	0.126	0.024	0.240
Chronic = 1	0.152	0.109	0.274	0.436	0.378	0.504	1.000	1.000	1.000
SAH = fair, bad or vbad	0.259	0.188	0.460	1.000	1.000	1.000	0.742	0.654	0.840
Denmark									
Employed	0.741	0.773	0.647	0.531	0.641	0.404	0.635	0.716	0.488
Unemployed	0.064	0.066	0.057	0.092	0.116	0.064	0.068	0.076	0.054
Inactive	0.013	0.014	0.013	0.035	0.044	0.025	0.024	0.027	0.019
Retired	0.076	0.016	0.246	0.274	0.106	0.465	0.182	0.057	0.405
Chronic = 1	0.289	0.252	0.397	0.743	0.716	0.774	1.000	1.000	1.000
SAH = fair, bad or vbad	0.169	0.121	0.306	1.000	1.000	1.000	0.440	0.351	0.599
Netherlands									
Employed	0.633	0.684	0.474	0.470	0.566	0.327	0.498	0.588	0.351
Unemployed	0.074	0.077	0.062	0.130	0.155	0.092	0.124	0.143	0.093
Inactive	0.033	0.009	0.107	0.081	0.029	0.158	0.076	0.026	0.159
Retired	0.005	0.000	0.020	0.007	0.000	0.016	0.005	0.001	0.011
Chronic = 1	0.223	0.184	0.341	0.702	0.675	0.742	1.000	1.000	1.000
SAH = fair, bad or vbad	0.214	0.169	0.352	1.000	1.000	1.000	0.674	0.620	0.763
Belgium									
Employed	0.637	0.702	0.425	0.474	0.599	0.276	0.468	0.615	0.245
Unemployed	0.078	0.079	0.073	0.126	0.143	0.099	0.108	0.115	0.098
Inactive	0.024	0.015	0.052	0.087	0.061	0.126	0.125	0.083	0.189
Retired	0.068	0.004	0.272	0.120	0.013	0.287	0.131	0.014	0.309
Chronic = 1	0.137	0.108	0.230	0.408	0.355	0.491	1.000	1.000	1.000
SAH = fair, bad or vbad	0.206	0.164	0.340	1.000	1.000	1.000	0.607	0.536	0.714
France									
Employed	0.623	0.671	0.477	0.568	0.655	0.423	0.480	0.583	0.352
Unemployed	0.079	0.088	0.053	0.082	0.097	0.058	0.088	0.107	0.065
Inactive	0.007	0.007	0.006	0.006	0.007	0.005	0.008	0.009	0.005
Retired	0.073	0.003	0.283	0.114	0.006	0.294	0.152	0.012	0.325
Chronic = 1	0.155	0.114	0.276	0.379	0.312	0.491	1.000	1.000	1.000
SAH = fair, bad or vbad	0.329	0.274	0.494	1.000	1.000	1.000	0.819	0.768	0.882
Ireland									
Employed	0.586	0.622	0.478	0.369	0.422	0.306	0.381	0.431	0.310
Unemployed	0.065	0.075	0.036	0.090	0.125	0.048	0.069	0.091	0.037
Inactive	0.030	0.024	0.049	0.155	0.148	0.163	0.190	0.194	0.184
Retired	0.021	0.000	0.081	0.055	0.002	0.119	0.055	0.002	0.130
Chronic = 1	0.151	0.118	0.248	0.675	0.653	0.703	1.000	1.000	1.000
SAH = fair, bad or vbad	0.134	0.098	0.240	1.000	1.000	1.000	0.599	0.548	0.670

Table A1 (*Continued*)

	All sample			SAH = fair, bad or very bad			Chronic = 1		
	All	Young (16–49)	Old (50–64)	All	Young (16–49)	Old (50–64)	All	Young (16–49)	Old (50–64)
Italy									
Employed	0.530	0.573	0.409	0.473	0.589	0.339	0.369	0.504	0.265
Unemployed	0.095	0.120	0.023	0.067	0.100	0.028	0.062	0.111	0.024
Inactive	0.017	0.014	0.026	0.035	0.036	0.035	0.098	0.135	0.068
Retired	0.083	0.007	0.293	0.157	0.016	0.319	0.236	0.039	0.388
Chronic = 1	0.082	0.049	0.174	0.231	0.173	0.297	1.000	1.000	1.000
SAH = fair, bad or vbad	0.311	0.226	0.545	1.000	1.000	1.000	0.860	0.782	0.920
Greece									
Employed	0.561	0.598	0.467	0.359	0.473	0.305	0.341	0.448	0.277
Unemployed	0.075	0.096	0.023	0.050	0.100	0.026	0.048	0.088	0.024
Inactive	0.019	0.017	0.024	0.080	0.131	0.056	0.112	0.163	0.081
Retired	0.063	0.007	0.203	0.214	0.058	0.288	0.226	0.069	0.318
Chronic = 1	0.100	0.053	0.213	0.641	0.674	0.625	1.000	1.000	1.000
SAH = fair, bad or vbad	0.139	0.063	0.320	1.000	1.000	1.000	0.842	0.758	0.892
Spain									
Employed	0.507	0.543	0.398	0.389	0.504	0.280	0.353	0.455	0.254
Unemployed	0.109	0.125	0.061	0.091	0.123	0.060	0.091	0.125	0.057
Inactive	0.051	0.028	0.123	0.155	0.110	0.197	0.221	0.176	0.265
Retired	0.020	0.000	0.080	0.049	0.001	0.094	0.050	0.001	0.099
Chronic = 1	0.160	0.104	0.332	0.503	0.419	0.585	1.000	1.000	1.000
SAH = fair, bad or vbad	0.238	0.154	0.493	1.000	1.000	1.000	0.720	0.595	0.842
Portugal									
Employed	0.657	0.703	0.537	0.575	0.673	0.467	0.449	0.550	0.361
Unemployed	0.051	0.055	0.039	0.054	0.063	0.044	0.054	0.067	0.042
Inactive	0.037	0.029	0.057	0.072	0.073	0.070	0.144	0.175	0.117
Retired	0.060	0.009	0.190	0.122	0.026	0.226	0.182	0.059	0.290
Chronic = 1	0.178	0.115	0.342	0.401	0.345	0.463	1.000	1.000	1.000
SAH = fair, bad or vbad	0.423	0.308	0.717	1.000	1.000	1.000	0.961	0.934	0.985

References

Aarts, L., Burkhauser, R., de Jong, P., 1996. Curing the Dutch Disease: An International Perspective on Disability Policy Reform. Avebury, Aldershot.

Au, D., Crossley, T.F., Schellhorn, M., 2005. The effects of health shocks and long-term health on the work activity of older Canadians. Health Economics 14, 999–1018.

Banks, J., Emmerson, C., Tetlow, G., 2007. Healthy Retirement or Unhealthy Inactivity: How Important are Financial Incentives in Explaining Retirement? Working Paper. The Institute for Fiscal Studies, London.

Bardasi, E., Jenkins, S.P., Rigg, J.A., 2002. Retirement and the income of older people, a British perspective. Ageing and Society 22, 131–159.

Becker, S., Ichino, A., 2002. Estimation of average treatment effects based on propensity scores. The Stata Journal 2 (4), 358–377.

Benítez-Silva, H., Disney, R., Jiménez-Martín, S., 2010. Disability, capacity for work and the business cycle: an international perspective. Economic Policy 25, 483–536.

Blundell, R., Costa Dias, M., 2002. Alternative approaches to evaluation in empirical microeconomics. Portuguese Economic Journal 1, 91–115.

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.

Currie, J.y., Madrian, B.C., 1999. Health, health insurance and the labour market. In: Ashenfelter, O., Card, D. (Eds.), Handbook of Labour Economics, 3. Amsterdam, North-Holland.

Dano, A.M., 2005. Road injuries and long-run effects on income and employment. Health Economics 14, 955–970.

Dehejia, R.H., Wahba, S., 1999. Causal effects in non-experimental studies, re-evaluating the evaluation of training programs. Journal of the American Statistical Association 94, 1053–1062.

Dehejia, R.H., Wahba, S., 2002. Propensity score-matching methods for nonexperimental causal studies. The Review of Economics and Statistics 84, 151–161.

Department of Social and Family Affairs, 2003. Report on the Working Group on the Review of the Illness and Disability Payment Schemes. Department of Social and Family Affairs, Dublin.

Disney, R., Meghir, C., Whitehouse, E., 1994. Retirement behaviour in Britain. Fiscal Studies 15, 24–43.

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.

European Commission, 2004. Mutual Information System on Social Protection in the EU Member and the EEA. Comparative Tables on Social Protection. Situation on 01/05/2004.

Eurostat, 2007. European social statistics. Social protection, expenditure and receipts. In: Data 1996–2004. Eurostat Statistical Book. Eurostat, Luxembourg.

Frölich, M., Hesmati, A., Lechner, M., 2004. A microeconometric evaluation of rehabilitation of long-term sickness in Sweden. Journal of Applied Econometrics 19, 375–396.

García-Gómez, P., López-Nicolás, A., 2006. Health shocks, employment and income in the Spanish labour market. Health Economics 15, 997–1009.

García-Gómez, P., Rice, N., Jones, A.M., 2010. Health effects on labour market exits and entries. Labour Economics 17, 62–76.

Gruber, J., Wise, D.A., 2004. Social Security Programs and Retirement Around the World: Micro-estimation. The University of Chicago Press, Chicago.

Hagan, R., Jones, A., Rice, N., 2009. Health and retirement in Europe. International Journal of Environmental Research and Public Health 6 (10), 2676–2695.

Heckman, J., Ichimura, H., Todd, P., 1997. Matching as an econometric evaluation estimator. Review of Economic Studies 64, 605–654.

Imbens, G.W., 2004. Nonparametric estimation of average treatment effects under exogeneity, a review. The Review of Economics and Statistics 86, 4–29.

Jones, A.M., Rice, N., Roberts, 2010. Sick of work or too sick to work? Evidence on self-reported health shocks and early retirement from the BHPS. Economic Modelling 27, 866–880.

Lechner, M., 2000. An evaluation of public-sector—sponsored continuous vocational training programs in East Germany. The Journal of Human Resources 35, 347–375.

Lechner, M., Vázquez Álvarez, R., 2004. The effect of disability on labour outcomes in Germany, evidence from matching. Discussion Paper #4223. Centre for Economic Policy Research, London.

Lindeboom, M., 2006. Health and work of older workers. In: Jones, A.M. (Ed.), Elgar Companion to Health Economics. Edward Elgar, Aldershot.

Lindeboom, M., Llena-Nozal, A., van der Klaauw, B., 2006. Disability and Work, The Role of Health Shocks and Childhood Circumstances. IZA Discussion Paper No. 2096, Bonn.

Low, H., Pistaferri, L., 2009. Disability risk, disability insurance and the life-cycle behaviour. NBER Working paper 15962, Cambridge.

OECD, 2003. Transforming Disability into Ability. Policies to Promote Work and Income Security for Disabled People. OECD, Paris.

OECD, 2006. Employment Outlook 2006. Boosting Jobs and Incomes. OECD, Paris.

OECD, 2007. Pensions at Glance 2007. Public Policies Across OECD Countries. OECD, Paris.

Pelkowski, J.M., Berger, M.C., 2004. The impact of health on employment, wages, and hours worked over the life cycle. The Quarterly Review of Economics and Finance 44, 102–121.

Rosenbaum, P., Rubin, D.B., 1983. The central role of the propensity score in observational studies for causal effects. Biometrika 70, 41–55.

Rosenbaum, P., Rubin, D.B., 1984. Reducing bias in observational studies using subclassification on the propensity score. Journal of the American Statistical Association 79, 516–524.

Sigg, R., 2007. Extending working life: evidences policy challenges and successful responses. In: Marin, B., Zaidi, A. (Eds.), Mainstreaming Ageing: Indicators to Monitor Sustainable Progress and Policies. Ashgate, Farnham, pp. 447–489.

Smith, J.P., 2004. Unravealing the SES Health Connection. The Institute for Fiscal Studies. Working Paper WP04/02, London.