IS THERE AN EARNINGS LOSS BEFORE BECOMING DISABLED?

October 2013

María Cervini-Plá **Judit Vall Catelló**

(very preliminary and incomplete, please do not quote)

Abstract

Although a number of papers in the literature have shown the employment and wage differences between disabled and non-disabled individuals, not much is known about the differences before entering the disability system. Therefore, in this paper we make use of a large microeconomic dataset from the Spanish Social Security administration and apply matching models to compare the annual earnings growth of individuals who are disabled due to a working accident (sudden health shock) to those that become disabled due to an ordinary illness. Our results reinforce the findings of Kofi Charles (2003) and show that the wage growth patterns of both groups of workers become significantly different four years before entering the DI system although these differences start to accelerate from the third year before DI. Our estimates suggest that one year before entering the system, there is a difference of 47 euros/month in the wages of the two groups.

1. Introduction

There is now strong empirical evidence showing that disabled individuals have lower employment rates and earnings than their non-disabled counterparts everywhere in Europe (OECD, 2009). This is also the case for the Spanish labour market. However, a less studied question is whether disabled workers are already suffering from some other disadvantage in terms of labour market outcomes before the recognition of the disabling condition. Therefore, in this paper we try to shed some light to this question by estimating the extent to which workers are already suffering from reduced wages before being recognized as disabled and, thus, before receiving the corresponding benefits. We make use of a large microeconomic dataset from the Spanish Social Security administration (the Muestra Continua de Vidas Laborales, MCVL) and apply matching models to compare the annual earnings growth of individuals who are disabled due to a working accident to those that become disabled due to an ordinary illness. The argument behind this comparison relies on the fact that individuals that suffer from a working accident are not disabled before entering DI. Therefore, we match individuals in these two groups 10 years before the receipt of the benefits and compare their earnings growth until they enter the disability insurance system (DI). This allows us to estimate the decrease in earnings (before receiving the benefits) suffered by individuals that become disabled due to an ordinary illness in a longer and more progressive way.

In the MCVL database we have information on the entire employment and pension history of the workers, including the exact duration of employment, unemployment and disability pension spells, and for each spell, several variables that describe the characteristics of the job or the unemployment/disability benefits. There is also some information on personal characteristics such as age, gender, nationality and level of education. In our sample we select everybody that becomes disabled between 1996 and 2010 and we follow them from the 10 years before becoming disabled until the year in which they enter the DI System. The database also includes information on the source of the disability and it allows us to distinguish between individuals that become disabled due to a working accident (2.337 individuals) from individuals that become disabled due to an ordinary illness (30.865 individuals). We use this distinction to apply a matching technique to compare the wage growth pattern of two individuals with similar observable characteristics ten years before the onset of the disabling condition. We argue that, after matching the individuals on a number of observable characteristics such

as sector of activity, education, gender, etc. ten years before the onset of the disabling condition, the only important difference between these two workers is that one will become disabled by an accident (that is, by a sudden health shock) while the other will suffer from a progressive deterioration of his/her health condition until the moment of being accepted into the DI system. Therefore, we attribute the observed differences in the wage growth path of these two similar workers to the progressivity of the disabling condition of one of the workers. Indeed, both groups of workers exhibit similar wage growth rates paths until four years before entering DI.

Our results show that the wage growth patterns of both groups of workers become significantly different four years before entering the DI system although these differences start to accelerate from the third year before DI. One year before entering the system, we estimate a difference of 47 euros/month in the wages of the two groups. Results using separate regressions for both groups of workers instead of matching models give a similar result (62 euros).

Previous literature on the topic of wage losses due to the onset of a disability has mostly been focused on the earnings loss after becoming disabled. In this line of research Cervini et al (2012) find that disabled individuals in Spain earn around 293-342 euros/month less than similar individuals without a disability. The authors also show that part of this lost is only temporary and is recovered by the worker while another part of this lost is of a permanent nature. In a previous paper also for Spain and using a different database (ECHP) Garcia-Gomez and Lopez Nicolás (2006) estimate that a health event reduces the income for disabled workers in 1648 euros/year.

A number of authors have tried to estimate a similar model for different countries and the results are not clear as some of the papers show no evidence of reduction in income due to a disability (see for example Lechner & Vazquez-Alvarez (2011) for Germany or Walker and Thomson (1996) for the UK) while some others find moderate to strong losses in annual earnings after the onset of a disabling condition (Kofi Charles (2003), Mok et al. (2008) and Jolly (2011) for the USA, Kidd et al. (2000) and Contoyannis and Rice (2001) for the UK, Halla and Zweimüller (2013) for Austria)[1]. Additionally,

[1] See also Malo et al. (2012) for a comparative study of the wage differentials for diferent types of disabled workers across European countries.

Lundborg et al. (2011) also point out that the reduction in labour earnings is stronger for low educated and older individuals (for the case of Sweden).

The only paper in the literature (that we are of) that focuses on earnings losses before entering the DI system is the one by Kofi Charles (2003) in which he estimates a 23% drop in annual earnings in the year of onset of the disability and finds that the drop in earnings begins already 2-3 years before onset. Therefore, our results reinforce the findings of Kofi Charles as, even if we observe that earnings loss begin four years before onset, the real difference in monetary terms occurs during the last three years before entering DI.

The results of our paper are important for policy-makers as they suggest that taking the last years of labour market experience as a base to calculate the amount of DI benefits may not reflect the real wage pattern of individuals before entering DI if they suffer from an ordinary illness that is making them incur in important earnings losses long before being accepted in the DI system.

2. The Spanish DI System

The disability system in Spain distinguishes between two types of permanent disability benefits: i) contributory, which are given to individuals who have generally contributed to the Social Security system before the onset of the disabling condition; ii) and non-contributory, which are given to individuals who are assessed to be disabled but have never contributed to the Social Security system (or do not reach the minimum contributory requirement to access the contributory system). Non-contributory disability benefits are means-tested and managed at the regional level. [2]

The size of the non-contributory system is relatively small compared to the contributory system (197,126 individuals received non-contributory disability benefits in 2009, while 920,860 received contributory benefits during the same year). The amount of benefits received is also smaller in the non-contributory case (the average non-contributory pension is 417.09 Euros/month compared to an average contributory disability pension of 831.49 Euros/month). As we want to assess the effect of disability on wages, in the remaining of the paper we focus only on the permanent contributory disability system in Spain.

[2] Income is evaluated yearly. The income threshold in 2010 was set at 4,755.80 Euros/year for an individual living alone. This amount is adjusted if the individual lives with other members.

The Social Security defines the permanent contributive disability insurance as the economic benefits to compensate the individual for losing a certain amount of wage or professional earnings when affected by a permanent reduction or complete loss of his/her working ability due to the effects of a pathologic or a traumatic process derived from an illness or an accident.

In order to capture the different situations in which a person can be after suffering from a disabling condition, the Spanish Social Security administration uses a classification of three main degrees of disability that depend on the working capacity lost:[3]

(i) Partial disability (57% of claimants): the individual is impaired to develop all or the fundamental tasks of his/her usual job or professional activity, but he/she is still capable of developing a different job or professional activity.

(ii) Total disability (40% of claimants): the individual is impaired for the development of any kind of job or professional activity.

(iii) Severe Disability (3% of claimants): Individuals who, as a result of anatomic or functional loses, need the assistance of a third person to develop essential activities of daily living such as eating, moving, etc.

The eligibility requirements and the pension amount depend on the source of the disability (ordinary illness, work related or unrelated accident or occupational illness), the level of the disability and the age of the onset of the disabling condition. Table 1 summarizes the main parameters of both the eligibility criteria and the pension formula. With respect to eligibility, the number of years of contributions required depends on the age of the onset of the disabling condition for common illness while there are no contributory requirements if the health impairment is due to either an accident or an occupational illness.

The total amount of the pension is obtained by multiplying a percentage, which varies depending on the type of pension and the degree of disability (as shown in the last rows of Table 1) to the regulatory base, which depends on the source of the disability and on previous salaries.[4] The percentage is 55% or 75% for partial disability beneficiaries, 100% for total disability and 150% for severe disability.

[3] There is a fourth degree of disability benefits (permanent limited disability) but this type of benefits is already extinguished and it only consists on a one-time lump-sum payment.
[4] Benefit=Regulatory Base * Percentage

The number of years included in the regulatory base depends on the source of the disability; for common illness the regulatory base is calculated by dividing by 112 the wage in the last 96 months (8 years) before becoming disabled. When the source of the disability is a work-unrelated accident, the regulatory base is calculated by dividing by 28 the wage in the last 24 months before becoming disabled. The individual can choose these 24 months from the last 7 years of work. For work-related accident or professional illness, the regulatory base is calculated by dividing by 12 the wage in the last 365 days before becoming disabled.[5]

Table 1. Summary of the parameters to calculate permanent disability pensions.

<table>
<tr><th></th><th>Ordinary Illness</th><th>Work-unrelated Accident</th><th>Work-related Accident or Professional Illness</th></tr>
<tr><td rowspan="2">Eligibility</td><td>Age >= 31:
Contributed 1/4 time between 20 years old and disabling condition. Minimum of 5 years</td><td rowspan="2">No minimum contributory period required</td><td rowspan="2">No minimum contributory period required</td></tr>
<tr><td>Age < 30:
Contributed 1/3 time between 16 years old and disabling condition. No minimum number of years required</td></tr>
<tr><td>Regulatory Base</td><td>Average wage last 8 years of work</td><td>Average annual wage of 24 months within the last 7 years of work</td><td>Average wage last year of work</td></tr>
<tr><td rowspan="3">Percentage applied to the regulatory base</td><td colspan="3">Partial Disability: 55%
Individuals older than 55 with difficulties to find a job due to lack of education or characteristics of the social and labor market of the region where they live: 75%</td></tr>
<tr><td colspan="3">Total Disability: 100%</td></tr>
<tr><td colspan="3">Severe Disability: 100%+50%</td></tr>
</table>

3. Database and Sample Selection

The study will use the Continuous Sample of Working Lives ("Muestra Continua de Vidas Laborales", MCVL) which is a microeconomic dataset based on administrative records provided by the Spanish Social Security Administration. It contains a random

[5] There was a reform in the calculation of the level of disability benefits for ordinary illness introduced in 2008. After the reform, there was a percentage that depended on the number of years contributed to the system that was multiplied by the regulatory base. As this change only affects individuals whose source of the disability is an ordinary illness, which could have an effect on the incentives to enter the DI system for this group of workers, in the robustness check section we will perform the same analysis but excluding the years after 2008 in order to have a sample period without any important reform of the DI system.

sample of 4% of all the individuals who, at some point during 2010, had contributed to the social security system (either by working or being on an unemployment scheme) or had received a contributory pension.[6] The random sample selected contains over one million people.

There is information available on the entire employment and pension history of the workers, including the exact duration of employment, unemployment and disability pension spells, and for each spell, several variables that describe the characteristics of the job or the unemployment/disability benefits spell. There is also some information on personal characteristics such as age, gender, nationality and level of education.

In our sample we select everybody that becomes disabled between 1996 and 2010 either partially or totally disabled and we follow them from the 10 years before becoming disabled until the year in which they enter the DI System. We also restrict the sample to include only individuals between the ages of 35 and 65 at the time of entering the DI system. We have chosen age 35 as we need to observe the labor market history of these workers 10 years before entering the DI System. We have chosen age 65 because individuals in the disability system are automatically transferred to the old-age system when they turn age 65. We select workers both in the partial and total disability system as we are interested in the earnings loss that these workers suffer before entering in the system (even if total disability individuals cannot work once they are accepted in the system). Therefore, by including both types of individuals, we will also distinguish between the earnings loss of these two types of disabled workers.

As our interest lies in estimating the earnings loss that disabled workers experience before being accepted into the DI System, we distinguish between individuals who become disabled due to a working accident (2.337 individuals) from individuals that become disabled due to an ordinary illness (30.865 individuals). This distinction allows us to use a matching technique to compare the wage growth pattern of two individuals with similar observable characteristics ten years before the onset of the disabling condition. We argue that the only important difference between these two workers is that one will become disabled by an accident (that is, by a sudden health shock) while the other will suffer from a progressive deterioration of his/her health condition until the

[6] This means that the only individuals that are missing from this database are those who were inactive in 2010and did not receive any kind of contributory benefit (such as disability, orphan, widow, etc…). Furthermore, the sample is representative for 2010 but, as exit from the disability system is extremely low, we belief that the sample is also representative for the other years included in the analysis.

moment of being accepted into the DI system. Therefore, we will attribute the observed differences in the wage growth path of these two similar workers to the progressivity of the disabling condition of one of the workers.

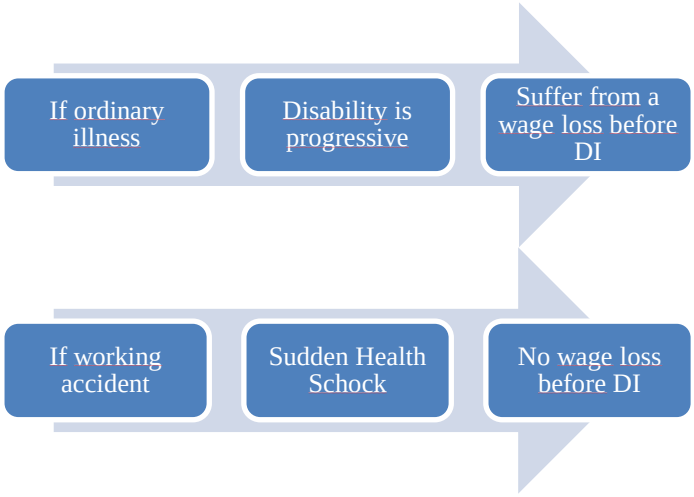
With respect to the labor market trajectory of these workers during the ten years preceding the entrance into the DI system, we have considered an individual as employed if he/she is observed as working on the 15th of each month.

The selected sample contains 33.202 individuals (351.958 person-year observations in total), 2.337 of them become disabled due to a working accident while 30.865 are disabled due to a working accident. As it can already be observed, most of the individuals that access the DI system do so due to an ordinary illness. We have selected such a large group of individuals in ordinary illness in order to ensure a good matching process and to make sure that we maximize the options of finding a similar individual in the ordinary illness group for each individual that we have in the working accident group.

4. Hypothesis and Descriptive Statistics

As explained above, our interest lies in the estimation of the earnings losses for individuals before becoming disabled. In order to do that, we will exploit the fact that our database allows us to distinguish between individuals that access the DI system due to an ordinary illness or due to a working accident to examine the differences in the wage growth pattern of these two groups of workers ten years before entering the DI system. Therefore, as showed in Figure 1 we assume that individuals suffering from a working accident suffer from a sudden health shock which gives them access to the DI system while individuals suffering from an ordinary illness suffer from a progressive deterioration of their health status which makes them spend some time before reaching the necessary health threshold to get access to the DI system. Therefore, as wages grow over time, by comparing the wage growth path of individuals who suffer from a working accident to individuals that suffer from an ordinary illness we will be able to identify how much wages failed to increase in the group of workers with an ordinary illness due to the progressivity of the disabling illness that deteriorates their productivity levels and, therefore, their wages.

Figure 1. Expected differences in wage growth between individuals with an ordinary illness and individuals with a working accident.



Looking at Figure 2 we can already get a first impression of the hypothesis developed above as we can observe that, even though individuals who will suffer from a working accident have a lower monthly wage ten years before the onset of the disabling condition, the rate of wage growth is higher for this group of workers. In fact, the figure shows that the group of individuals with a working accident end up with a considerably higher wage than the group of workers with an ordinary illness three years before being accepted into the DI system.

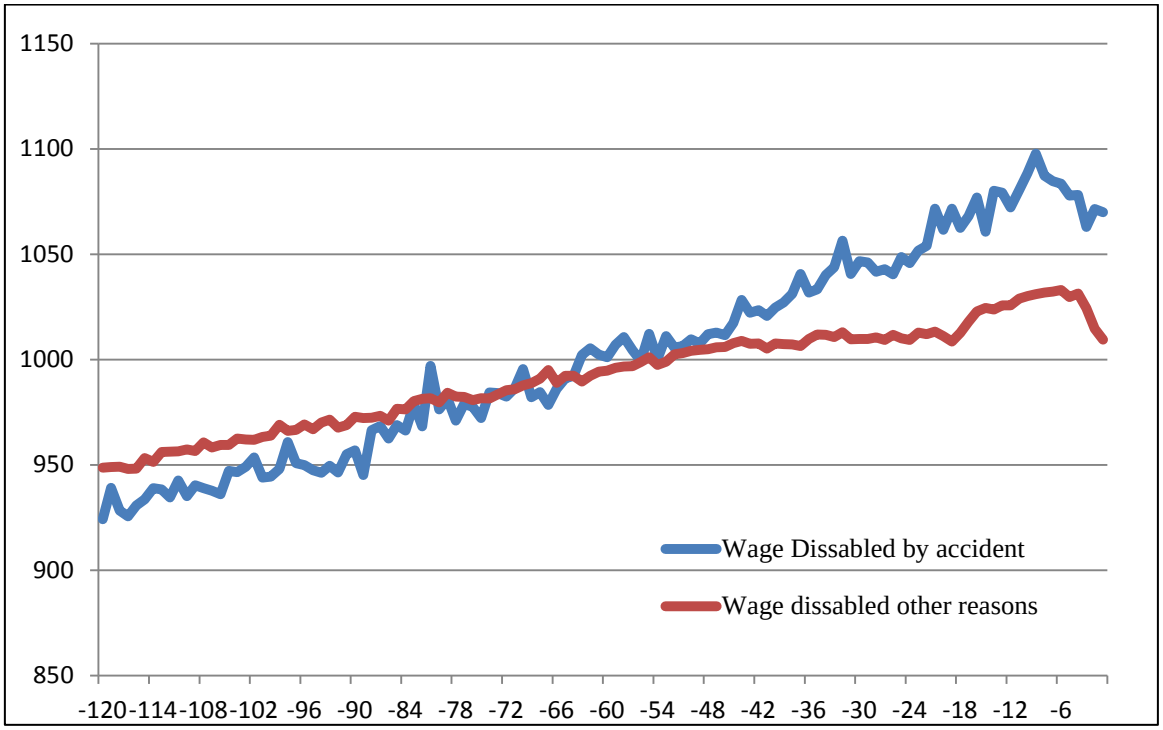
Of course, by looking only at this graph we cannot automatically attribute these differences in the wage growth path of these two groups of workers to the different source of the disabling condition.

In fact, there are mainly two potential explanations of this different evolution. First, there is the explanation that we have been suggesting until now, which is that the difference in the wage growth pattern between these two groups of workers can be due to the different source of the disabling condition and the fact that the disabled due to an ordinary illness are already disabled (and thus, incurring in an earnings loss) before entering the DI system whereas individuals that become disabled due to an accident are not disabled (and thus, do not incur in an earnings loss) before entering the DI system. Alternatively, the differences in growth rate of wages can be due to the fact that the source of the disability is also capturing two different types of individuals which have a different pattern of wage growth due to other reasons. For example, the differences could be caused by different education levels, different ages, different sectors of the

economy (with a different pattern of wage growth), different incidence of the economic crisis in these two groups of workers, etc.

As far as these differences between individuals in the two groups are observable, we can control for all these other potential sources of wage growth variation so that we are able to isolate the variation that is due to the fact of suffering from a disabling condition before being able to enter the DI system.

Figure 2. Monthly real wages before disability by source of the disability.



In that sense, to get a first impression of the similarity of the workers in these two groups, Table 2 presents the descriptive statistics of a number of variables according to the source of the disabling condition.

Table 2. Descriptive statistics of the variables included in the model.

Characteristic	Disabled by accident	Disabled other reasons
Age disability (mean)	48,97	51,86
Sex (%)		
Men	86,99	67,23
Women	13,01	32,77
Nationality (%)		
Spanish workers	97	98,89
Education (%)		

Primary	47,41	47,44
Secondary	38,28	34,99
Tertiary	12,92	15,55
Post-graduate	1,39	2,02
Professional Category (%)		
Unskilled laborers	78,98	66
Other semi-skilled workers, skilled and semi-skilled clerks	15,24	24,84
Engineers and graduates, chief and departmental heads	5,78	9,16
Sector of Activity (%)		
Agriculture	7.79	9.43
Industry	54.41	36.07
Construction	16.23	18.36
Trade, Transport and Hotels	5.35	7.61
Public Administration	15.48	25.94
Finance	0.75	2.55
Type of Contract (%)		
Part-time	4.53	8.5

As we can see in the Table 2, we cannot spot any important difference between the two groups although for some of the variables the means in the two groups are somehow not exactly the same. Therefore, in order to be sure that we are comparing pairs of individuals that are as similar as possible, we will estimate not only a regression model but also matching models that will allow us to form pairs of individuals as similar as possible before proceeding to the estimation of the effects of interest.

5. Empirical Model

Using the MCVL we apply two methods in order to distinguish the difference in the wage path for two types of disabled workers, those who become disabled by a working accident and those who become disabled by an ordinary illness.

First of all, we estimate the following regression:

$$W_{it}=\alpha_i +\beta X_{it}+\tau DA_{it}\, d_{it}+\vartheta DNA_{it}\, d_{it}+\varepsilon_{it}$$

where: W_{it} represents the log of averaged monthly earnings of persons i in year t, X_{it} are the control variables: education, professional category, age of disability, sector of activity, gender, nationality and degree of partiality. The most important variables are the two binary variables: DA_{it} and DNA_{it}. In particular, DA_{it} takes value 1 if the

individual becomes disabled by an accident and DNA_{it} takes value 1 if the individual becomes disabled by other reasons. Both variables are multiplied by d_{it} that measure the distance before the date of onset and can be -10, -9, -8…and 0.

With this regression we can compare the path of earning for both types of workers with a different disabling condition.

Although we control for several personal and professional variables in the regression model showed above, it could still be the case that working accidents are more typical in some types of activities than in others or for some types of workers.

Therefore, the second method we apply is the propensity score matching. With this method we want to estimate how much wages change, on average, for those individuals who will become disabled due to an accident compared to the hypothetical state of becoming disabled for other reasons. One of the main problems in measuring this change is that each individual will only experience one type of disability. Therefore, we make use of matching methods to allow for the counterfactual approach associated with treatment effects techniques for program evaluation.

Formally, let $D = 1, 0$ indicate if the individual is actually treated or not. In our case, if the individual becomes disabled by an accident or not. Let X be the set of observed characteristics and W_{1i} and W_{0i} be the potential salaries of interest if the individual is treated or non-treated, respectively. The notion of "potential" is used to emphasize that only one of W_{1i} or W_{0i} is observed for every individual in the sample.

In this context we want to measure the Average Treatment Effect on the Treated (ATET), that is given by the following expression:

$$ATET = \vartheta = E\lfloor W_{1i} - W_{0i} | \, D_i = 1 \rfloor = E\lfloor W_{1i} | \, X, D_i = 1 \rfloor - E\lfloor W_{0i} | \, X, D_i = 1 \rfloor$$

Clearly ϑ is not identified by the data, since we observe each individual in one of the possible states in each moment in time. Therefore, we do not observe the counterfactual. If we assume that the probability of becoming disabled by an accident is random, we could solve this problem by using the control group, those who become disabled by other reasons, as a counterfactual. However, it could happen that those types of working accidents would have a higher occurrence in certain professions or sectors more than in others. If that is the case, workers that become disabled due to a working accident may

be concentrated in some professions more than others and may have different characteristics than the disabled due to an ordinary illness.

Therefore, our empirical strategy relies on the fact that we have sufficient information on the characteristics of the individual and the type of job that he/she had before the disabling condition occurs. In this context, we use the Propensity Score Matching to create subgroups where the treated and control individuals do not differ before the shock and then we use different matching techniques to compare the individual in the treated group that is most similar to an individual in the control group.[7]

In particular, our conditional independence assumption is:

$$(W_{1i}, W_{0i}) \perp D|X$$

This assumption is known as selection on observables and was introduced by Rubin (1973, 1974) and Rosenbaum and Rubin (1983, 1984).

In order to construct the treatment and control groups we use the MCVL. In particular, our treated group is formed by individuals who were non-disabled in *t=-10, t=-9, t=-8, ... , t=-1,* and become disabled by an exogenous disability shock (accident) in *t=0*.

As a control group or comparison group we want similar individuals in *t=-10*, the moment that we construct the propensity score. Those individuals continue being non disabled in *t=-9, t=-8, ..., t=-1,* however they become disabled for other reasons.

We match individuals in the treated and control groups with the propensity score in *t=-10,* where both individuals were non-disabled. We use: age of disability, education, professional category, sector of activity, gender, degree of partiality, nationality and wages at *t=-10* as explanatory variables.

6. Results

6.1 Regressions

Table 3 shows the results of the estimation of equation (1), i.e the wages' path for both types of disabled workers during the 10 years before they become disabled. Here we only present the coefficient of the interaction between the two main dummies (the type

[7] See Heckman and Horz (1989), Heckman, Ichimura and Todd (1997) and Blundell and Costa Dias (2002) are some of the articles that explain how to evaluate certain treatments using matching procedures.

of disability they have at t = 0) and the distance. The results of the full regression are presented in table A1 in the Appendix.

The reference year is -10 (10 years before the individual becomes disabled). From the data section we can see that this distance is a good reference as, at that point, we still do not observe differences in wage levels when we control for characteristics.

Table 3: Wage paths for both disability types in the 10 years before the disability

Years since onset	Disabled by accident	Disabled other resons
-9	0.020	0.017 ***
	(0.013)	(0.004)
-8	0.030 *	0.037 ***
	(0.012)	(0.004)
-7	0.055 ***	0.055 ***
	(0.012)	(0.004)
-6	0.076 ***	0.072 ***
	(0.012)	(0.004)
-5	0.119 ***	0.094 ***
	(0.012)	(0.004)
-4	0.135 ***	0.112 ***
	(0.012)	(0.003)
-3	**0.172** ***	**0.125** ***
	(0.011)	(0.003)
-2	**0.199** ***	**0.135** ***
	(0.011)	(0.003)
-1	**0.180** ***	**0.109** ***
	(0.012)	(0.004)

Note: Dependent variable: log of monthly earnings. Standard errors in parentheses.

As we can see in the Table 3, the real wages for both types of disabled increase every year compared to the reference year. However, wages of disabled workers by accident grow faster than wages of disabled due to an ordinary illness. Somehow individuals that become disabled due to an ordinary illness have a disadvantage in the labor market and their position is worse before the onset of the disabling condition than disabled workers due to an accident.

For example, in *t=-3*, i.e. three years before individuals become disabled, compared with the situation at *t=-10*, the wages of workers who will become disabled by accident are, on average, 33.4 euros higher than wages of individuals who will become disabled

for other reasons (controlling for characteristics).[8] One year before entering the DI system the difference in wages is estimated to be of the order of 62 euros between individuals suffering from a working accident vis-à-vis individuals with an ordinary illness.

6.2. Propensity score matching

In this subsection we compare the impact on wages before becoming disabled for the two types of disabled (those who become disabled by an accident and those who become disabled by other reasons) using matching models. We try to answer the same question than in the previous section (whether there is an earnings loss before becoming disabled for individuals that suffer from on ordinary illness) but using a propensity score model to compare pairs of individuals as similar as possible in personal and job characteristics.

We estimate ATET effects following Becker and Ichino (2002), Abadie and Imbens (2002) and Abadie et al. (2004). First, we estimate the propensity score (the probability of being in the treatment group) by a probit specification due to the fact that we have two possible states (individuals who will become disable by an accident versus individuals who will become disabled due to an ordinary illness). As we have explained before, we match individuals in the treated and control groups with the propensity score in *t=-10*, where both individuals were non-disabled. We use: age of disability, education, professional category, sector of activity, gender, degree of partiality, nationality and wages at *t=-10* as explanatory variables. The specification passes the "balancing hypothesis".[9] This means that there are no systematic differences in observable characteristics between the treated and control groups once we condition on the propensity score. After that, we match treated and control individuals using nearest neighbor matching. In the next section we use other methods to match the individuals as robustness check.

---

[8] On average wages at *t=-10* were about 878 euros per month for those individuals who after will become disabled by an accident and 885 euros per month for the other disabled. If the wages of workers who become disabled by accident, had increased by 17.2% this gives an average wage of 1029 euros per month. On the other hand, the increase of wages for those disabled from other reasons is 12% which gives an average wage of 995.6 euros in *t=-3*. Therefore, that gives us a difference of 33.4 euros. This difference amounts to 62 euros at *t=1*.

[9] We also have tried with other variables like education, sector of activity, but at the end we have selected those who generate a better match.

Table 4 presents the estimates of the ATET on earnings at *t=-9, t=-8,…,t=-1*. We use monthly average wages as a measure of earnings. In particular, we sum the wage received in all the months worked and then we divide this wage by the total number of months worked to obtain a monthly measure of the wage.

In fact, what we don't use wages as such but a proxy for wages, the contributory base over which the contributions to the Social Security administration are calculated and paid. As it often occurs with Social Security records, wages in the MCVL are top- and bottom-coded, that is, they are censored. Although for the entire MCVL this fact may potentially be a problem, as Bonhomme and Hospido (2009) mention, such an issue is not empirically relevant in our case as wages are censored for very few observations.

Table 4: Difference of wages between disabled by accident and disabled other reasons before onset

Years before onset	Average difference of wages (in euros per month)
-9	2.426 (15.29)
-8	-7.725 (15.69)
-7	-3.188 (15.99)
-6	3.222 (16.09)
-5	15.036 (16.26)
-4	**10.312*** (16.90)
-3	**30.03**** (17.34)
-2	**37.56**** (17.36)
-1	**47.26***** (18.27)

Note: Money figures are expressed in 2010 euros. Bootstrapped standard errors in parentheses.

As shown previously in the descriptive statistics presented in Table 2 of the previous section, once we control for characteristics, the differences in earnings between individuals who will become disabled for one of the two cases were very small and insignificant ten years before entering the DI system. However once we get closer to the

moment they become disabled we begin to observe an increased wage gap. More specifically, for *t=-1*, using the nearest neighbor matching method, the gap is 47.26 euros a month on average. This result is very close to the 62 euros wage gap that we obtained in the previous section using a separate regression for both groups of disabled workers. Nonetheless, even if the results of the two techniques are very similar, we prefer the results of the matching model as it allows us to compare two individuals that are more similar in observed characteristics and, therefore, we make sure that the potential differences in the two groups are accounted for in the estimation.

7. Conclusions

Even if quite a large number of authors have demonstrate that disabled individuals suffer from wage and employment losses with respect to non-disabled workers (with some countries being an exception and showing no losses for the disabled), not much is known in the literature with respect to what happens to these workers before entering the disability system. For instance, for some people suffering from a common illness, the disabling condition may have appeared well before they are actually accepted into the DI System. If that is the case, these workers may already be impaired and, thus, suffering from earnings and/or employment losses before they are actually accepted into DI. As the level of disability benefits is set as a percentage of previous earnings, if the earnings of these impaired workers are already showing the productivity losses resulting from the disabling condition, the benefits will be set at a lower level than if the disabling condition would have appeared as a shock. This may entail an economic disadvantage for individuals suffering from a more progressive common illness.

Therefore, in this paper we try to quantify whether there are earnings losses for some disabled workers even before they are accepted into the disability System. In order to do so, we compare the wage growth patterns of individuals that become disabled due to a working accident to the wage growth pattern of individuals that are disabled due to a common illness. As working accidents represent a sudden health shock we should not expect any wage lost for this group of workers before entering DI.

We estimate separate regressions for the two groups of workers from ten years before the onset of the disabling condition and find that the wage gap between the two groups of workers one year before onset amounts to 62 euros/month. In order to make sure that we are comparing pairs of workers that are as similar as possible in terms of personal as

well as job characteristics, we further estimate a matching model. The results of this model are in line with the regression results and show a highly statistically significant difference of 47 euros in the wages of the two groups of workers in the year before onset.

Our results reinforce the findings of Kofi Charles (2003) as they show that the wage differential begins four years before onset but it starts accelerating from the third year preceding the entrance into the DI system. As far as we are aware of our results present the first empirical evidence of the wage losses of certain disabled workers well before they can enter the DI system. In terms of policy implications, we believe that this evidence should be taken into account when designing any legislative change of the Social Security disability benefits.

Appendix

Table A1: Wages path for both disability types in the years before the disability (full estimation)

Variable		Coefficient	Standard error
Sex	Men	0.368	0.009
Age that became disabled		0.007	0.0005
Eduacation	Secondary	0.141	0.008
	Tercery	0.338	0.012
	Post-graduate	0.466	0.032
Professional category	Other semi-skilled workers, skilled and semi-skilled clerks	0.111	0.005
	Engineers and graduates, chief and departmental heads	0.247	0.008
Activity	Industry	0.215	0.010
	Construction	0.162	0.012
	Trade, Transport and Hotels	0.211	0.013
	Public Administration	0.215	0.025
	Finance	0.166	0.024
Part-time		0.558	0.006
Spanish		0.179	0.033
Years since onset	-9	0.020	0.013
(Disabled by accident)	-8	0.030	0.012
	-7	0.055	0.012
	-6	0.076	0.012
	-5	0.119	0.012
	-4	0.135	0.012
	-3	0.172	0.011
	-2	0.199	0.011
	-1	0.180	0.012
Years since onset	-9	0.017	0.004
(Disabled other resons)	-8	0.037	0.004
	-7	0.055	0.004
	-6	0.072	0.004
	-5	0.094	0.004
	-4	0.112	0.003
	-3	0.125	0.003
	-2	0.135	0.003
	-1	0.109	0.004

References

Abadie A, Drukker D, Herr H, Imbens G. 2004. Implementing matching estimators for average treatment effects in Stata. Stata Journal 4: 290-311.

Abadie A, Imbens G. 2002. Simple and bias-corrected matching estimators for average treatmen efects in STATA. Stata Journal 1 (1): 1-18.

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

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

Bonhomme, S., and L. Hospido (2009): "Using Social Security Data to Estimate Earnings Inequality," Mimeo.

Charles, K. K. 2003. The Longitudinal Structure of Earnings Losses among Work-Limited Disabled Workers, Journal of Human Resources, 38(3), 618-46.

Cervini M, Silva J.I, Vall Castello J. 2012. Estimating the Income Loss of Disabled Individuals: The Case of Spain. IZA Discussion Papers 6752.

Contoyannis P, Rice N. 2001. The impact of health on wages: Evidence from the British Household Panel Study. Empirical Economics 26 (4): 599-622.

Garcia Gomez P, López Nicolás A. 2006. Health Shocks, Employment and Income in the Spanish Labour Market. Health Economics 15: 997-1009.

Halla M, Zweimüller M. 2013. The Effect of Health on Earnings: Quasi-Experimental Evidence from Commuting Accidents. Labour Economics 24: 23-38.

Heckman J, Hotz J. 1989. Choosing among alternative methods for estimating the impact of social programs: The case of manpower training. Journal of the American Statistical Association 84: 862-874.

Heckman J, Ichimura H, Todd P. 1997. Matching as an econometric evaluation estimator: evidence from evaluating a job training program. Review of Economics Studies 64: 605-654.

Jolly N.A. 2013. The Impact of Work-Limiting Disabilities on Earnings and Income

Mobility. Applied Economics 45(36): 5104-5118.

Kidd M, Sloane P, Ferko I. 2000. Disability and labour market: an analysis of British males. Journal of Health Economics 19: 961-981.

Lechner M, Vazquez-Alvarez R. 2011. The Effect of Disability on Labour Market Outcomes in Germany. Applied Economics 43: 389-412.

Lundborg P, Nilsson M, Vikström J. 2011. Socioeconomic Heterogeneity in the Effect of Health Shocks on Earnings: Evidence from Population-Wide Data on Swedish Workers. IZA Working Papers No.6121.

Malo, M.A. and Pagán, R. (2012): "Wage differentials and disability across Europe: Discrimination and/or lower productivity", *International Labour Review*, 151(1-2): 43-60.

Mok, W. K.C., Meyer, B. D., Charles, K. K. and Achen, A. C. 2008. A Note on the Longitudinal Structure of Earnings Losses among Work-Limited Disabled Workers. Journal of Human Resources, 43(3), 721-8.

OECD. 2009. Sickness, Disability and Work: Keeping on Track in the Economic Downturn: Background Paper.

Rubin DB. 1973. Matching to remove bias in observational studies. Biometrics 29: 159-183.

Rubin DB. 1974. Estimating casual effects of treatments in randomised and non-randomised studies. Journal of Educational Psychology 66: 688-701.

Rosenbaum P, Rubin DB. 1983. The central role of the propensity score in observational studies for causal effects. Biometrika 70: 41-55.

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

Walker I, Thompson A. 1996. Disability, wages and labour force participation: Evidence from UK panel data. Keele Department of Economics Working Paper No. 96/14.