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Abstract: We analyse the impact of working and contractual conditions, particularly exposure to job risks, on the probability of acquiring a permanent disability, controlling for other personal and firm characteristics. We postulate a model in which this impact is mediated by the choice of occupation, with a level of risk associated with it. We assume this choice is endogenous, and that it depends on preferences and opportunities in the labour market, both of which may differ between immigrants and natives. To test this hypothesis we apply a bivariate probit model to data for 2006 from the Continuous Sample of Working Lives provided by the Spanish Social Security system, containing records for over a million workers. We find that risk exposure increases the probability of permanent disability - arising from any cause - by almost 5%. Temporary employment and low-skilled jobs also have a positive impact. Increases in education reduce the likelihood of disability, even after controlling for the impact of education on the choice of (lower) risk. Females have a greater probability of becoming disabled. Migrant status - with differences among regions of origin - significantly affects both disability and the probability of being employed in a high-risk occupation. In spite of immigrants' working conditions being objectively worse, they exhibit a lower probability of becoming disabled than natives because the impact of such conditions on disability is much smaller in their case. Time elapsed since first enrolment in the Social Security system increases the probability of disability in a proportion similar to that of natives, which is consistent with the immigrant assimilation hypothesis. We finally conclude that our theoretical hypothesis that disability and risk are jointly determined is only valid for natives and not valid for immigrants, in the sense that, for them, working conditions are not a matter of choice in terms of health.

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Research highlights

- Risk exposure, temporary employment and low-skill jobs have a substantial positive effect on the probability of disability.
- The presence of immigrants in the three unhealthy working conditions is relatively higher than that of natives.
- Immigrants are less likely to become disabled; in part because the impact of the work variables is smaller in their case.
- There are some differences among immigrants by region of origin, calling for caution to avoid over generalisation.

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Abstract

We analyse the impact of working and contractual conditions, particularly exposure to job risks, on the probability of acquiring a permanent disability, controlling for other personal and firm characteristics. We postulate a model in which this impact is mediated by the choice of occupation, with a level of risk associated with it. We assume this choice is endogenous, and that it depends on preferences and opportunities in the labour market, both of which may differ between immigrants and natives. To test this hypothesis we apply a bivariate probit model to data for 2006 from the Continuous Sample of Working Lives provided by the Spanish Social Security system, containing records for over a million workers. We find that risk exposure increases the probability of permanent disability – arising from any cause – by almost 5%. Temporary employment and low-skilled jobs also have a positive impact. Increases in education reduce the likelihood of disability, even after controlling for the impact of education on the choice of (lower) risk. Females have a greater probability of becoming disabled. Migrant status – with differences among regions of origin – significantly affects both disability and the probability of being employed in a high-risk occupation. In spite of immigrants' working conditions being objectively worse, they exhibit a lower probability of becoming disabled than natives because the impact of such conditions on disability is much smaller in their case. Time elapsed since first enrolment in the Social Security system increases the probability of disability in a proportion similar to that of natives, which is consistent with the immigrant assimilation hypothesis. We finally conclude that our theoretical hypothesis that disability and risk are jointly determined is only valid for natives

and not valid for immigrants, in the sense that, for them, working conditions are not a matter of choice in terms of health.

Introduction

Numerous investigations have demonstrated that working conditions, and in particular exposure to the risk of work-related injury and illness, have an impact on health (Llena-Nozal et al, 2004; Robone et al, 2010; Bartley et al, 2004; Benach et al, 2004; Monden, 2005, Berger and Leigh, 1989). Due to the increase of "flexible" employment and other forms of non-standard contractual conditions, a growing body of literature has emerged that shows that unstable employment is associated with bad health too (Gash et al, 2007; Rodriguez, 2002; Virtanen et al, 2005). Also, psychological factors related to lack of autonomy at work and job dissatisfaction have appeared in several studies as strong determinants of general health or specific diseases (Datta Gupta and Kristensen, 2007; Marmot, 2004; Plaisier et al, 2007).

As Kerkhofs and Lindeboom (1997) stress, working conditions and the working environment affect both gradual changes in health and the occurrence of events that have a sudden impact on an individual's health, like work-related accidents. These authors assume that health status and work history may be jointly determined (that is, they may be endogenous). The idea that individuals invest in their own health has had a prominent place in the health economics literature since the publication of Grossman's seminal work in 1972, and the treatment of occupational choice as an investment in health can be found, for example, in Cropper (1977).

Following this line of thought, our central notion is that the relationship between working conditions and health is mediated by occupational choice in terms of risk. It is plausible to assume that upon choosing a job – with its inherent level of risk – workers do not ignore the effects of working in a risky job on their health status. Nevertheless, the choice of work-

related risk level is partially determined by preferences and partially determined by social and economic circumstances. Among such circumstances, migrant status is thought to strongly affect occupational choice.

According to the hedonic equilibrium wage model, which relates wages to job characteristics including the relative attractiveness of a particular job, jobs with higher workplace risk receive a compensating wage premium. Nevertheless, wage-risk tradeoffs need not be equal. For instance, inequalities in lifetime levels of wealth – supposedly lower for immigrants – may explain differences in willingness to bear risk, i.e., immigrants or ethnic minorities would be more likely to accept and to be employed in high-risk jobs (Robinson, 1984; Viscusi, 2003; Leeth and Ruser, 2006). Immigrants and non-immigrants might also differ in terms of market opportunities. In several studies, it has been observed that the wages paid to compensate fatality risk differ among countries of origin, and that these variations may arise from discrimination, from unmeasured productivity differences (Akhavan, 2006; Leeth and Ruser, 2006) or from lower safety-related productivity arising from language barriers (Hersch and Viscusi 2010).

The compensating wage premium represents, in fact, any type of compensation that labour markets offer that is different for immigrants and natives. In an economy with a large underground sector the compensation could be, for instance, a legal contract giving rise to legal resident status and Social Security benefits. Additionally, informational disadvantages or occupational crowding – high competition for the same job, exacerbated by high unemployment rates – probably force immigrants to choose higher levels of risk than those

arising from their preferences. From a health investment perspective, we can thus assume that there will be differences in health investments owing to migrant status.

This research uses a dataset containing ample information about working lives and disability status to explore two sets of issues: Firstly, how do working and contractual conditions, and particularly exposure to health risks, contribute to the probability of acquiring a disability, taking into account the endogeneity of risk level choices? Secondly, are there socioeconomic inequalities between immigrants and natives in terms of risk choices and in terms of the effect of these choices on their health status? Moreover, are all immigrants the same?

The existence of socioeconomic health inequalities due to differences in working conditions constitutes, in itself, a point of interest for public policies and they have been highlighted by several authors, for example, Artazcoz et al, 2005; Warren et al, 2004, Borg and Kristensen, 2000; Power et al, 1998; Lundberg, 1991. Possible differences in market opportunities depending on migrants' country of origin, resulting in higher risk exposure or more precarious employment constitute an additional source of inequality and are at the core of the debate on the conditions in which a society integrates new arrivals.

Due to the recent dramatic growth in the immigrant population in Spain (in 2009, 13.8% of the population had been born abroad, whereas the percentage was only 3.13% in 1999), the above-mentioned issues stand out as a very important topic of public debate. However, evidence regarding health status and workplace conditions of immigrant populations in Spain and other developed countries is still scarce. Furthermore, the existing evidence is based on subjective perceptions of both working conditions and health status, or restricted to

differences in workplace illness and injury rates (Ahonen and Benavides, 2006; Parra et al, 2006). We seek to contribute to the quality of the discussion by applying a behavioural model using objective measures of working conditions and disability status obtained from the Social Security census of working lives. Moreover, we focus on disability arising from any cause, not just injuries or professional illnesses.

After this introduction, in the next section we discuss our conceptual and empirical frameworks. In section three we describe the institutional context and the data, and we present the variables and their descriptive statistics. Section four contains the results, and section five concludes with a discussion of the main results and some limitations.

2. Methodological framework

2.1. Conceptual framework

We aim to model the two hypothesis that form the basis of our analysis: health depends on working and contractual conditions, mainly through the exposure to work-related health risks; and the occupational choice that determines the level of risk depends on preferences and opportunities in the labour market that may differ between immigrants and natives.

Worker's i health stock (H_i) is governed by a health production function where the health stock depreciates at rate δ, and L represents a stochastic and permanent shock (an example of a health production function with a stochastic shock can be found in Vaness, 2003):

$$H_i = \overline{H}_i - \delta H_i - L_i \quad (1.1)$$

$$L_i = f(R_i, C, A_i, X_i) \quad (1.2)$$

L_i depends on R_i = the level of risk (injury and illness rate) associated with the job chosen, C = other working conditions, A_i= the individual's ability to work safely, and X_i = other individual variables shaping the acceptance of health risks. Permanent disability occurs when H_i falls below a critical level. Transitions to permanent disability are observed, by definition, once in an individual's lifetime.

According to the arguments presented in the introduction, immigrants and natives face different levels of risk and, likely, the determinants of risk level choices have a differential incidence between these two groups:

$$R_{1i} = \beta X_i + \varepsilon_i \quad (2.1)$$

$$R_{2i} = \alpha X_i + \mu_i \quad (2.2)$$

where 1=immigrant and 2=native and the vector X_i covers all personal characteristics affecting the choice of risk level. R_{1i} and R_{2i}, the risk level choices, are not only the result of individuals' acceptance of risk but are also related to supply conditions, that is, the compensation (wage premium or other, if existing) offered in exchange of risk. The formulation presented in equation (2.1) and (2.2) is appropriate to empirically account for the sorting of workers into levels of risk underlying personal characteristics.

2.2. Empirical framework

The model consists of a recursive system of equations for disability and risk exposure, where the random component of the disability equation is allowed to be freely correlated with the random component of the risk equation. This specification is able to take endogeneity into account, which may arise from simultaneity and unobservable heterogeneity influencing both disability and risk exposure. Simultaneity (joint determination) issues may emerge from the fact that individuals do not ignore the health consequences of their risk level choices. This consideration is consistent with our conceptual framework, where risk choice is inserted into a health production function.

To properly account for endogeneity, and considering that both disability and risk are dichotomous variables, we specify the following bivariate probit model (Greene, 1998):

$$D_i^* = \beta_1 X_i + \lambda R_i + \varepsilon_i$$
$$D_i = 1 \qquad if \qquad D_i^* > 0 \tag{3.1}$$

$$R_i^* = \beta_2 X_i + \gamma Z_i + \mu_i$$
$$R_i = 1 \qquad if \qquad R_i^* > 0 \tag{3.2}$$

For individual i, D_i^* and R_i^* are unobserved latent variables indicating the individual's probability of acquiring a disability and the individual's propensity for choosing a high-risk job respectively. We observe D_i, a binary variable that takes the value 1 if the person moves to a permanent disability status and 0 otherwise. Similarly, the binary indicator R_i takes a value 1 if the individual is employed in a high-risk job and 0 otherwise. The vector X_i contains the explanatory variables of disability. Z_i is a vector of variables that influence current risk level choice but are uncorrelated with ε_i; the remaining terms in equations (3.1)

and (3.2) are the unknown parameters of interest that we wish to estimate, β_1, β_2, λ and γ, and the random error terms, ε_i and μ_i. The correlation between ε_i and μ_i -ρ- will be estimated, too, assuming that it follows a bivariate normal distribution.

The unobserved propensities D_i^* and R_i^* will be estimated first for the whole sample, with immigrants' region of origin as a dummy variable and interactions of these variables with risk. We then go on to estimate the bivariate probit separately for native-born Spaniards and immigrants, again distinguishing among immigrants' regions of origin with a set of dummy variables.

3. Institutional context, data and descriptive statistics

3.1 Institutional context

The employment-based Social Security (SS) system is mandatory for workers in Spain. Contributions are scaled according to occupational category. The SS funds the largest welfare programme: public benefits, allowances and pensions. Regarding permanent disability benefits, the law identifies four levels of disability, in increasing order of severity (the first two are compatible with employment): 1) *partial-permanent disability for the usual profession*, which refers to disability cases where a worker's ability to perform his/her usual tasks is decreased by 33% or more; 2) *total permanent disability for the usual profession*; 3) *absolute permanent disability*, which applies to cases were the individual is unable to undertake work of any kind; and 4) *severe disability*, where the person requires continued assistance from others in order to carry out basic daily activities (Jiménez-Martín et al, 2006).

To be eligible, the beneficiary must have contributed to the Social Security system for a minimum of five years if the disability is caused by an ordinary illness. There is no such requirement when the disability is caused by a work-related accident or a professional illness.

3.2. Data and Variables

We use the Continuous Sample of Working Lives, known as the MCVL in Spanish (from *Muestra Continua de Vidas Laborales*), 2006, an administrative dataset provided by the Social Security administration with information on individuals who had an active record at any time during 2006. The sample is a 4% non-stratified random draw from a reference population that includes employed workers (wage earners and self-employed) and those on unemployment and other benefits. It consists of nearly 1.1 million individuals. The MCVL contains information on the employment and SS contribution history of the selected individuals dating back to 1967, although for reliability reasons we have limited the period to 1980 onwards..

Individual variables include sex, date and place of birth, family status, benefits, degree of disability and the year of its commencement. Corporate characteristics comprise the number of employees, foundation date and geographical location. Job characteristics cover type of contract, the firm's sector of activity and the beginning and end dates of each contract. For each contractual relationship into which the worker enters, the characteristics of the job and the company are registered.

The MCVL has two features that are particularly relevant to our analysis: it contains a large and representative subsample of immigrants, and information regarding disabilities and the levels thereof. An immigrant is defined as someone who was born abroad. We work with cross section data: for active non-disabled population, the relationship with the Social Security prevailing in 2006 and, in the case of disabled people, data refer to the relationship applicable when the disability appeared. Since every contractual relation generates a new record, we can observe the actual working conditions prevailing when the disability occurred. From the original dataset, we have restricted our sample to working-age individuals (21 to 64 years old) who have contributed to the SS system for at least five years, making a total of 718,958 observations. A detailed description of the variables follows.

Disability

"Disability" takes the value 1 if the person moves to a permanent disability status (any of the four categories mentioned above) at any time of his/her active working life between 1980 and 2006 and 0 otherwise. For disabled individuals, we consider the working conditions applicable at the time of the transition to disability, and subsequent working relations are discarded.

Risk

We have constructed the risk measure using narrowly defined injury and illness rates by industry-occupation: i.e., the number of individuals receiving an allowance for non-fatal work-related injuries or professional illness in a certain industry-occupation divided by the

total number of individuals working in that industry-occupation. There are 44 industries and 10 occupations, which makes a total of 440 job-industry cells. The risk variable takes the value 1 if the individual's job-industry cell is in the top quartile in the illness/injury rate ranking, and 0 otherwise. We find our binary variable to be more suitable than the continuous one. The latter would imply that individuals have full information of the level of risk throughout its whole distribution by industry-occupation cells. Taking into account that we are modelling a choice, it seems more reasonable to think that individuals broadly know about the existence of "good" and "bad" jobs in terms of risk. Indeed, below the upper quartile of the ranking, illness/injury rates are low and quite similar across industry-occupation cells. The interested reader can check Table 4 in the supplementary material where we present the non-fatal injury and illness rates aggregating by major industry-occupation cells.

Explanatory variables

In the disability equation we include both individual characteristics – age, sex, education, number of family members, and marital status – and working conditions: risk exposure, days since first enrolment in the Social Security system, type of contract, and a dummy variable for low-skilled jobs. The "type of contract" variable takes the value 1 for temporary and fixed-term contracts, and 0 for the civil service and other kinds of open-ended employment. Following the classification of the Spanish Ministry of Labour, we consider "low-skilled" workers those employed in the subordinate and unskilled labourers occupations. This variable is used as a proxy for lack of autonomy on the job. Age is expected to have a positive effect on disability, while education is expected to have a negative one. It seems likely that the

greater the number of family members the more reluctant the worker will be to apply for disability benefits if that means losing income.

A relevant variable in our analysis is education. One might expect the impact of education on the probability of disability to be reduced since some of its effect is mediated by the role of education in relation to risk: i.e. increases in education lessen the probability of accepting riskier jobs, which in turn, reduces the chance of disability (Warren et al, 2004).

The risk equation contains mostly the same variables plus a dummy that takes the value 1 for workers whose previous working status was "unemployed". Crowded occupations or lack of employee bargaining power are natural correlates of unemployment status and constrain the worker's range of opportunities in the job market. Therefore, it is reasonable to expect that shifts from unemployment to high-risk jobs are more likely than transitions from other jobs to high-risk occupations, everything else being equal.

Number of family members and marital status have been used in some studies as proxies for risk preferences (Leeth and Ruser, 2006; DeLeire and Levy, 2004). Size of the family and risk are expected to be negatively correlated. In the case of unmarried persons the expected sign is less clear but we tend to think that it is also negative because these individuals don't need so much the (possible) wage compensation for risk and they cannot count so much on others to look after them in case of injury. Consistently with other literature which shows that women are more risk averse than men in their financial decisions (Jianakoplos and Bernasek, 1998) and gambling (Hershey and Schoemaker, 1980), we expect women to engage in less risky jobs.

Control variables for corporate characteristics are also considered in the risk equation: number of employees and number of years since foundation. Findings from industrial safety literature indicate that firm size and accident rates are strongly correlated (Oi, 1974). The number of employees appears positively related to safety practices in Thomason (2002).

3.3 Descriptive statistics

Table 1 shows that the proportion of immigrants that have made the transition to a permanent disability (1.6%) is lower than that of natives (4.86%). Figure 1 (see supplementary material) depicts the non adjusted odd-ratios of disability associated with each of the three working and contractual conditions by country/region of origin. The odds-ratios are always higher for natives than for immigrants when these are taken altogether, but it is evident that the nature of the association varies widely among immigrants themselves.

We also observe that on average, immigrants exhibit a higher educational attainment than natives. The percentages of immigrants with secondary (33.8%) or university (8.4%) studies are larger than those for natives (29.3% and 5.9%). The same result has also been found in Fernández and Ortega (2008) and Díaz-Serrano (2012).

INSERT TABLE 1

The proportion of immigrants on temporary contracts or low-skilled jobs is much higher than that of natives. Immigrants are also more likely to be employed in high-risk jobs. The

difference is not large (27.4% versus 26.8%), but it is statistically significant. However, disaggregation of immigrants by region/country of origin shows this general assertion to be over-simplistic. Only foreigners born in Africa and European non-EU15 countries are found in risky occupations in proportions higher than natives. Individuals born in Asia, the US, Canada, the EU15 and Latin America are actually less likely to engage in high-risk occupations. All groups, though (except EU15, USA and Canada), have more unstable contracts than natives. When the three potentially "unhealthy" working conditions are jointly considered, the proportion of immigrants employed in temporary, low-skilled or high-risk positions is nearly twice that of native-born Spaniards. This finding contradicts the expected positive relation between high academic attainment and good working conditions.

As a summary, and as far as the comparison between immigrants and native-born Spaniards is concerned, three insights can be obtained from our preliminary analysis: immigrants are better educated, work in worse risk and contractual conditions which, in general, seem to be associated with higher disability rates, but are, in fact, less likely to become disabled. In the econometric analysis we will try to unscramble this apparent puzzle by controlling for all the determinants of occupational choice and disability and their differential effects.

4. Results

Table 2 summarises the estimation results using the full sample. The first four columns present the variables and estimated coefficients of the bivariate probit model . In order to assess the magnitude of the bias due to the endogeneity of risk choices, we also report the results of the univariate probit estimation of the probability of disability. These two models

include several regional dummies and their interactions with the risk variable. These interactions allow us to test for the potential existence of a differential effect of the level of risk on the probability of disability by birthplace. Selected results of the model in which immigrant status is captured by a single dummy variable are also included in two separate rows (model 3).

In order to facilitate comparisons, we report the marginal effects instead of the estimated coefficients. For variables appearing in both the disability and the risk equations we report the total marginal effects. These are the sum of the direct effect of the variable (column 2) on the probability of disability plus the indirect effect. The indirect marginal effects capture the effect of the variable on the probability of disability coming through its impact on the probability of choosing a risky job. Marginal effects are computed based on Greene, 1998.

It is interesting to note that the correlation (rho) between the unobservable factors affecting the probability of choosing a risky job and the probability of being disabled is negative and significant (-0.21). This result suggests that such unobservable factors tend to reduce the choice of risk but to increase the probability of being disabled, and vice versa. To formally test the null hypothesis of exogenous risk choice, we performed the Hausman-Wu test (Hausman, 1978). The exogeneity of risk choice was rejected ($p < 0.05$) in all models. Therefore, our comments are based on the estimates of the bivariate probit model.

The impact of risk exposure on disability is strong and significant when the whole sample is considered. Workers employed in high-risk jobs increase their probability of becoming disabled by 4.7%. Moreover, all the marginal effects associated with working conditions are

significant and large. Being employed in a temporary job, as opposed to an open-ended contract, increases that probability by 2.2%.

Education behaves as expected. The probability of disability decreases by 1.5% and 1.2% for college graduates and workers with secondary education respectively. Education is significant even after controlling for the effect of education on risk. . For instance, holding risk constant, having a university education reduces the chance of a disability by 1.32 percent; but education also reduces occupational risk so that the total impact of a university education on the chance of a disability allowing risk to vary is 1.50%. The 17.9% lower likelihood of accepting a high-risk job (see the risk equation in table 2) reduces the chance of becoming disabled by 0.18 percentage points, or 13.6 percent. We also estimated the bivariate probit model without education in the disability equation in order to observe changes in the risk coefficient. The results (not shown) indicate that the marginal effect of risk on disability would jump to 0.074, in contrast with the marginal effect of 0.047 that we obtain when education is included, as in Table 2. That is, education would pick up part of the effect of risk.

INSERT TABLE 2

The interactions of risk with the birthplace dummies are all negative, except for Asians and citizens from EU15, the US and Canada. Nevertheless, only the coefficient for non-EU15 Europeans is significant, implying no differences with natives for the rest of groups. By contrast, regional dummies are all significant and negative except precisely for those born in non-EU15 Europe. These results suggest that differences in disability between natives and

immigrants are related to conditions associated with origin rather than being the result of a differential effect of risk by birthplace. Only for non-EU15 Europeans (Romanians, Poles, Ukrainians, etc.) differences in disability actually originate from a differential (lower) impact of risk on disability.

When we do not distinguish by region of origin and estimate the bivariate model including a single variable for immigrants, the results show that being an immigrant reduces the probability of disability by nearly 0.9% (model 3), but the effect of this variable when interacted with risk is not significant. This reinforces the idea that differences in disability are more associated with region of origin itself than with a differential impact of risk by birthplace.

The case of females is interesting. Holding risk constant, the direct marginal effect is to increase disability by 0.39 per cent, but since being a female actually reduces the acceptance of risk by 22.5%, the total marginal effect is just 0.16%. That is, the total probability of a female becoming disabled appears to be only slightly higher than that of men, but that is mainly due to the indirect effect working through risk, which reduces that probability by 0.23 percentage points, or 59 percent.

Most of the other estimates in the univariate probit do not differ much from those of the bivariate one, except for risk. Given its endogenous nature, the effect of risk in the univariate model turns out to have a strong downward bias (marginal effects: 0.021 vs. 0.047).

The estimates regarding the determinants of risk (lower part of Table 2) show that immigrants, taken as a whole, are more likely to be found in risky jobs (marginal effect equals 0.0388 in model 3). However, there are differences by birthplace. Africans, Latin Americans and non-EU15 Europeans are the groups most prone to be engaged in risky jobs. People coming from China and other Asian countries are actually less likely to be exposed to work-related risks than natives, and those born in the EU15, the US and Canada are not significantly different from natives.

Table 3 allows for a more thorough analysis of disparities between natives and immigrants. First of all, we note that most of the estimated marginal effects in the disability equation are notably larger for natives than for immigrants, particularly so in the case of risk, age, university education and temporary contract. Moreover, female and primary education are not significant in the immigrants model. This suggests that in their case there are more unobserved factors that determine the probability of being disabled that we are not controlling for.

The results for the regional dummies in the sample of immigrants indicate that differences among immigrants in terms of disability are not marked. Only Europeans from non-EU15 countries have a greater probability of disability than the base category (Latin America) at 10% significance, which is consistent with their significantly greater tendency to work in risky jobs (see the risk equation) and with the results of the univariate probit. The interaction of risk with the regional dummies shows that risk exposure has a differential (positive) impact on disability only for people born in Asia. Finally, it is noteworthy to mention that again the univariate probit tends to underestimate the effect of risk on disability. This result holds for

both natives and immigrants, even though for immigrants rho is not statistically different from zero.

INSERT TABLE 3

Generally, the variables included in the risk equation are highly significant and have the expected sign for both sociodemographic groups, with less difference between them in the size of the marginal effects than in the disability equation. Yet there are some peculiarities that deserve attention. The effect of age in the case of natives corresponds to a U-shape (negative and increasing), while the effect of years since first enrolment in the Social Security system follows an inverted U-shape (positive and decreasing), just the opposite to the pattern of immigrants. This implies that older immigrants are willing to accept more risk, although at a decreasing rate, whereas the longer immigrants stay in the legal labour market, the less risk they are willing to undertake. The negative effect of being unmarried is not significant for immigrants and the number of family members has a positive effect on risk in their case, while the reverse is true for natives. Finally, as anticipated, the transit from unemployment to high-risk work is more likely than the transit from a safer job to a high-risk one for both groups, the size of the effect being greater for immigrants.

5. Discussion

Our study constitutes an effort to assess disparities between immigrants and natives in the role played by working and contractual conditions, particularly risk exposure, in determining the occurrence of disability, an indication of poor health. Our paper differs from previous studies

in one or several of the following ways. First, we focus on disability arising from any cause, and not just from injuries and professional illness. Secondly, our indicator of health is based on an objective measure, rather than the commonly used scales of self-perceived health. Thirdly, we analyse differences by region of origin in order to avoid inappropriate generalisations to all immigrants. Lastly, but most importantly, we account for possible endogeneity of risk exposure on the disability equation. We aim to capture the determinants of the occupational choice so as to better understand the factors behind discrepancies in health outcomes.

We explicitly determine that working conditions have an impact on health for natives and immigrants. Risk exposure is, as expected, a decisive factor in accounting for differences in disability. The considerable magnitude of its effect is one of our most important results. The findings regarding the strong impact of temporary employment on disability are also noteworthy and deserve further comment. The experience of job insecurity has already been associated with ill health in studies such as Robone et al, 2010 and Rodríguez, 2002. Nevertheless, previous evidence of this association for Spain is scarce and somewhat ambiguous (Amuedo-Dorantes, 2002). The present study shows that the negative effect of temporary employment on health is unambiguous when its impact is measured using an overall health status indicator, such as permanent disability, rather than considering only work related injuries and illness rates.

As to disparities between immigrants and natives, we find, first of all, that the probability of becoming disabled is higher for natives. We must also conclude that our theoretical hypothesis that disability and risk are jointly determined is only valid for natives and not valid

for immigrants. Such is the interpretation of the non-significance of the rho parameter in the model for immigrants in Table 3. This is consistent with earlier studies that confirm the weak role played by risk in occupational choices in the case of immigrants (Díaz-Serrano, 2012).

Our results are in agreement with previous studies of the immigrant assimilation hypothesis in Spain (Amuedo-Dorantes and de la Rica, 2007), as time elapsed since first enrolment in the Social Security system increases the probability of disability similarly to natives. The transit from unemployment increases the probability that risks will be accepted slightly more in the case of immigrants. These findings can be interpreted as a confirmation that immigrants (at least, some of them) are affected more than natives by lack of opportunities in the labour market. In addition, the significance of most of the regions of origin in the risk equation suggests a heterogeneous pattern of occupational choice among the various communities of immigrants.

A principal corollary is that an effective and equitable health policy should incorporate a full understanding of the role of working conditions on determining health disparities. Furthermore, a better knowledge of the conditions in which vulnerable groups – like immigrants – access safe working conditions may help avoid future health inequalities. The strong effect on disability of risk exposure and other forms of precarious employment – such as temporary jobs – suggests that the actions involved in these policies probably need to go beyond traditional occupational health policies.

One important limitation of our analysis is the lack of the individual's baseline health in our data. This variable is expected to have an influence on both the likelihood of accepting risks

and the advent of disability. Its omission might bias the marginal effect of the other variables. For example, a better initial health status could explain the smaller impact of working conditions on disability in the case of immigrants, in spite of their working conditions being objectively worse than those of natives. This interpretation is consistent with other studies indicating that healthy people are the more likely ones to migrate; the so-called "healthy migrant effect" (Esteban-Vasallo, 2009; Akhavan, 2006; Swerdlow, 1991). Nevertheless, the fact that we account for some of the determinants of health (age, gender, education) may mitigate the size of the bias. We also do not know what were the economic circumstances in the home country, which could affect the willingness to accept risk.

Another limitation is that our data include only insured workers. This excludes irregular labour practices, which are more likely to occur among foreign workers. Also, institutional and bureaucratic requirements to obtain a disability pension may affect natives and immigrants differently. The latter may be less likely to apply for disability benefits due to lack of information or specific capabilities. Nevertheless, all individuals in our sample – including immigrants – had been working and living in Spain for at least five years, a factor that probably lessens the differences.

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Table 1. Descriptive Statistics

VARIABLE		TOTAL	NATIVE-BORN SPANIARDS	IMMIGRANTS (ALL)	TEST OF INDEPENDENCE	IMMIGRANTS BY COUNTRY/REGION OF ORIGIN: AFRICA	LATIN AMERICA	EUROPE NON-EU 15	EU-15[&], USA AND CANADA	ASIA
		%	%	%	χ^2/t	%	%	%	%	%
N		718,958	681,078	37,880		8,632	12,830	3,281	10,744	2,393
%		100	94.73	5.27		1.20	1.78	0.46	1.49	0.33
DEPENDENT VARIABLES										
	Disability	4.69	4.86	1.60	29.20**	1.90	1.02	1.00	2.34	1.10
	Risk	26.87	26.84	27.36	4.61**	39.52	24.66	36.18	21.30	13.04
PERSONAL CHARACTERISTICS										
	Age (mean)	41.68	41.78	39.83	6.29**	39.92	40.21	37.62	39.81	40.49
	Gender: Female	41.50	41.58	39.95	33.65**	21.17	49.66	40.11	44.91	33.14
	Education									
	Without studies	26.79	26.76	27.57	10.65**	58.29	17.66	22.73	17.42	39.44
	Primary	37.75	38.06	30.32		22.59	31.58	33.96	34.89	29.11
	Secondary	29.51	29.33	33.75		15.59	40.21	35.35	37.64	25.52
	University	5.95	5.85	8.37		3.53	10.55	7.96	10.06	5.93
	Family members (mean)	3.16	3.14	3.59	58.45**	4.01	3.74	3.46	2.96	4.32
	Unmarried	12.95	12.81	15.52	15.24**	16.93	12.52	14.17	18.17	16.21
WORKING CONDITIONS										
	Temporary contract	37.88	37.31	47.73	33.36**	61.14	48.57	43.42	37.81	40.20
	Self-employed	16.29	16.31	16.04	1.38	9.97	13.05	13.01	21.06	35.60
	Low-skilled job	28.51	28.14	35.19	29.62**	53.71	35.14	33.98	22.65	26.79
	Years since 1st enrolment in the SS system	16.88	20.65	12.31	157.56**	12.32	10.71	9.66	15.18	11.25
	Previous working status: unemployed	17.04	17.15	14.89	11.44**	16.62	13.86	14.69	16.58	6.81
FIRM CHARACTERISTICS[$]										
	Nr. Employees (mean)	314.56	320.9	236.86	1.36	196.08	310.07	193.10	228.77	94.11
	Years since foundation (mean)	17.53	17.68	14.75	30.02**	14.02	15.09	13.92	15.76	11.73

& The EU-15 includes the following countries: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxemburg, Netherlands, Portugal, Spain, Sweden and UK. Here and throughout the text, reference to EU15 means all previous countries except Spain.

$ Only includes private sector

** Indicates that the means are significantly different

Table 2. Bivariate probit and univariate probit estimations for the whole sample. Immigrants represented with dummmies by region of origin or taken as a whole (model 3). Marginal effects.

		Model 1. Bivariate Probit				Model 2. Univariate Probit		
		Total Mg. Effects	Mg. Effects (direct effect)	*z*		Mg. Effects	*z*	
	Dependent Variable: Permanent disability							
	Age	0.0019	0.0019	*84.67*	**	0.0018	*81.9*	**
	Female	0.0016	0.0039	*4.07*	**	-0.0027	*-8.03*	**
	Primary education[$]	-0.0055	-0.0046	*-16.02*	**	-0.0062	*-18.84*	**
	Secondary education[$]	-0.0122	-0.0097	*-28.24*	**	-0.0139	*-36.24*	**
	University education[$]	-0.0150	-0.0132	*-22.38*	**	-0.0158	*-26.28*	**
	Unmarried	0.0024	0.0023	*4.18*	**	0.0022	*3.78*	**
	Family members	-0.0020	-0.0018	*-13.96*	**	-0.0020	*-14.77*	**
	Years since 1st enrolment in SS	0.0019	0.0016	*19.85*	**	0.0018	*19.53*	**
	Years since 1st enrolment in SS Sq	0.0000	0.0000	*-16.31*	**	0.0000	*-15.32*	**
	Temporary contract	0.0219		*63.58*	**	0.0197	*59.29*	**
	Low skilled job	0.0097		*24.98*	**	0.0104	*27.91*	**
	Risk	0.0470		*39.27*	**	0.0209	*49.28*	**
	Risk*African	-0.0044		*-1.32*		-0.0039	*-1.23*	
	Risk*Latin American	-0.0056		*-1.45*		-0.0071	*-2.02*	**
	Risk* Europe non-EU15	-0.0131		*-2.54*	**	-0.0129	*-2.58*	**
	Risk* EU15, USA, Canada	0.0019		*0.56*		0.0013	*0.42*	
	Risk*Asia	0.0167		*1.33*		0.0090	*0.83*	
	Africa	-0.0097	-0.0092	*-5.03*	**	-0.0096	*-5.24*	**
	Latin America	-0.0104	-0.0099	*-5.67*	**	-0.0102	*-5.8*	**
	Europe non-EU15	-0.0036	-0.0050	*-0.86*		-0.0032	*-0.79*	
	EU15, USA, Canada	-0.0042	-0.0039	*-2.47*	**	-0.0045	*-2.79*	**
	Asia	-0.0134	-0.0121	*-3.97*	**	-0.0133	*-4.3*	**
MODEL 3	Immigrant	-0.0088		*-8.74*	**	-0.0081	*-8.31*	**
	Risk*Immigrant	-0.0021		*-1.12*		-0.0037	*-2.13*	**
	Dependent Variable: Risk							
	Age	-0.0150		*-27.71*	**			
	Age squared	0.0001		*22.11*	**			
	Female	-0.2251		*-208.56*	**			
	Primary education[$]	-0.0417		*-34.06*	**			
	Secondary education[$]	-0.1661		*-130.09*	**			
	University education[$]	-0.1794		*-101.26*	**			
	Unmarried	-0.0093		*-5.06*	**			
	Family members	-0.0013		*-3.14*	**			
	Years since 1st enrolment in SS	0.0104		*26.78*	**			
	Years since 1st enrolment in SS Sq	-0.0001		*-14.34*	**			
	Unemployed last relation	0.0370		*25.06*	**			
	Africa	0.0596		*11.91*	**			
	Latin America	0.0656		*13.54*	**			
	Europe non-EU15	0.1659		*18.83*	**			
	EU15, USA, Canada	0.0066		*1.51*				
	Asia	-0.0885		*-9.61*	**			
	Years since firm´s foundation	0.0000		*-206.79*	**			
	Nr. of employees	0.0000		*-42.76*	**			
MODEL 3	Immigrant	0.0388		*14.68*	**			
	Rho -0.21					No. Observations		648547
	Likelihood-ratio test of rho=0: chi2(1) = 352.90					Log pseudolikelihood = -94180.80		
	No. Observations	629700				Wald chi2(12) =26657,85		
	Log pseudolikelihood	-363972.67				Prob > chi2 0.0000		

Prob > chi2	0.0000	Pseudo R2	0.1835

** Significant at 5% level ; * Significant at 10% level

$ Excluded category: no studies

The marginal effects of the binary variables are calculated as the difference in the average predicted probability of a positive outcome for the variable when:(1) variable values are set to zero; and (2) variable values are set to one

z-statistics refer to the estimated coefficients

Table 3. Bivariate probit and univariate probit for native-born Spaniards and for immigrants (Marginal Effects)

	Native-born Spaniards						Immigrants, with regional dummies and interactions					
	Bivariate Probit				Univariate Probit		Bivariate Probit				Univariate Probit	
Dependent Variable: Permanent disability												
	Total Mg. Effects	**Mg. Effects (direct effect)**	***z***		**Total Mg. Effects**	***z***	**Total Mg. Effects**	**Mg. Effects (direct effect)**	***z***		**Total Mg. Effects**	***z***
Age	0.0021	0.0021	85.22	**	0.0019	82.72 **	0.0005	0.0004	9.43	**	0.0005	9.23 **
Female	0.0016	0.0040	3.86	**	-0.0031	-8.55 **	-0.0004	0.0010	-0.45		-0.0008	-0.99
Primary education[$]	-0.0058	-0.0049	-15.84	**	-0.0065	-18.77 **	-0.0011	-0.0009	-1.17		-0.0012	-1.26
Secondary education[$]	-0.0127	-0.0101	-27.74	**	-0.0147	-35.85 **	-0.0047	-0.0036	-4.48	**	-0.0045	-4.64 **
University education[$]	-0.0161	-0.0142	-22.37	**	-0.0169	-26.31 **	-0.0035	-0.0026	-2.46	**	-0.0034	-2.57 **
Unmarried	0.0031	0.0030	5.06	**	0.0028	4.78 *	-0.0033	-0.0029	-2.94	**	-0.0032	-3.01 **
Family members	-0.0019	-0.0018	-12.72	**	-0.0020	-13.39 **	-0.0014	-0.0013	-4.99	**	-0.0013	-4.92 **
Years since 1st enrolment in SS	0.0017	0.0014	16.87	**	0.0016	16.25 **	0.0017	0.0016	8.67	**	0.0016	8.39 **
Years since 1st enrolment in SS Sq.	0.0000	0.0000	-14.02	**	0.0000	-12.82 **	0.0000	0.0000	-5.25	**	0.0000	-4.88 **
Temporary contract	0.0233		63.58	**	0.0209	59.14 **	0.0050		5.89	**	0.0046	5.76 **
Low-skilled job	0.0101		24.65	**	0.0109	27.69 **	0.0049		4.76	**	0.0046	4.84 **
Risk	0.0502		39.64	**	0.0219	49.2 **	0.0080		2.41	**	0.0050	2.36 **
Risk*African							0.0015		0.59		0.0022	0.87
Risk* European							-0.0032		-1.11		-0.0028	-0.97
Risk* EU15, USA, Canada							0.0014		0.59		0.0021	0.85
Risk*Asia							0.0132		1.87	*	0.0113	1.74 *
Africa[&]							0.0003	0.0002	0.24		0.0004	0.28
Europe non-EU15[&]							0.0050	0.0036	1.93	*	0.0048	1.94 *
EU15, USA, Canada[&]							0.0020	0.0018	1.53		0.0020	1.64
Asia[&]							-0.0022	-0.0015	-1.05		-0.0018	-0.9

Table 3. Continued

Dependent Variable: Risk

	Native-born Spaniards			Immigrants		
	Total Mg. Effects	***z***		**Total Mg. Effects**	***z***	
Age	-0.0204	-33.36	**	0.0102	5.4	**
Age squared	0.0001	27.98	**	-0.0001	-5.87	**
Female	-0.2223	-200.26	**	-0.2316	-52.41	**
Primary education	-0.0424	-33.69	**	-0.0188	-3.63	**
Secondary education	-0.1661	-125.28	**	-0.1071	-20.5	**
University education	-0.1798	-96.92	**	-0.1363	-20.4	**
Unmarried	-0.0108	33.38	**	-0.0066	-0.96	
Family members	-0.0025	-21.63	**	0.0053	4.4	**
Years since 1st enrolment in SS	0.0148	-5.7	**	-0.0103	-8.58	**
Years since 1st enrolment in SS Sq.	-0.0002	-5.58	**	0.0003	8.53	**
Unemployed last relation	0.0363	23.98	**	0.0406	6.46	**
Years since firm´s foundation	0.0000	-202.27	**	0.0000	-36.54	**
Nr. of employees	0.0000	-42.07	**	0.0000	-7.23	**
Africa				0.0116	1.94	*
Europe non-EU15				0.0799	9.6	**
EU15, USA, Canada				-0.0019	-0.34	
Asia				-0.1072	-12.98	**

Rho	-0.21		No. Observations	614452	Rho	-0.05	No. Observations	33595
Likelihood-ratio test of rho=0: chi2(1) =	370.70		Log pseudolikelihood	-91862.33	Likelihood-ratio test of rho=0: chi2(1) =	0.77	Log pseudolikelihood	-2235.62
No. Observations	598299		Wald chi2(12)	26657.85	No. Observations	31401	Wald chi2(20)	626.27
Log pseudolikelihood	-348258.77		Prob > chi2	0.0000	Log	-15111.97	Prob > chi2	0.0000

				pseudolikelihood			
Prob > chi2	0.0000	Pseudo R2	0.1835	Prob > chi2	0.0000	Pseudo R2	0.1578

** Significant at 5% level

* Significant at 10% level

$ Excluded category: no studies

&Excluded category: Latin America

Marginal effects calculated as in Table 2

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