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Work, Risk and Health: Differences between Immigrants and Natives in Spain

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ABSTRACT

Work, Risk and Health: Differences between Immigrants and Natives in Spain*

We analyze the impact of working and contractual conditions, particularly exposure to job risks, on the probability of acquiring a disability. We postulate a model in which this impact is mediated by the choice of occupation, with a level of risk associated to 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 use data from the Continuous Sample of Working Lives of the Spanish SS system. It contains individual, job and firm information of over a million workers, including a representative sample of immigrants. We find that risk exposure increases the probability of permanent disability by 5.3%; temporary employment also influences health. Migrant status – with differences among regions of origin – significantly affects both disability and the probability of being employed in a risky occupation. Most groups of immigrants work in riskier jobs, but have lower probability of becoming disabled. Nevertheless, our theoretical hypothesis that disability and risk are jointly determined is not valid for immigrants: i.e. for them working conditions is not a matter of choice in terms of health.

JEL Classification: J28, J61, J81

Keywords: disability, working conditions, immigration, Spain, MCVL

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1. Introduction

Numerous investigations have demonstrated that working conditions have an impact on health (Llena-Nozal et al, 2004; Robone et al, 2010; Bartley et al 2004; Benach et al 2004; Moden, 2005). In particular, the exposure to work related risk of injury and illness has an expected reflect on ill health (Berger and Leigh, 1989). Many of those investigations apply an equity lens to demonstrate a link between the unequal distribution of working conditions and inequalities in health (Artazcoz et al 2005; Warren et al, 2004, Borg and Kristensen, 2000; Power et al 1998; Lundberg, 1991). But not only material working conditions are likely to have an impact on health and permanent disability, psychological factors related to lack of autonomy at work, job dissatisfaction and contractual conditions that affect job stability have also appeared in several studies as strong determinants of general health or specific diseases (Gash et al 2007; Datta Gupta and Kristensen 2007; Marmot, 2005; Virtanen et al, 2005; Pikhart et al 2004; Smith et al 1995).

Conceiving health as a dynamic concept, it is plausible that working conditions and work environment affect both the gradual changes in health and the occurrence of events that have a sudden impact on individual's health, like work-related accidents. This approach is stressed in Kerkhofs and Lindeboom, 1997 and it stands at the basis of the present investigation. In their model, these authors assume that health status and labour market outcomes may be jointly determined. Individuals with low time discount rates may be more likely to invest in future labour market positions and health than those with higher discount rates.

Following this line, our starting notion is that the relationship between working conditions and health is mediated by the occupational choice in terms of risk. It is plausible to assume

that on choosing a job –with a level of risk associated to it- workers do not ignore the effects of working in a risky job on their health status[1]. The idea that individuals invest in their own health has an outstanding place in the literature since the publication of Grossman seminal work (1972), and the treatment of occupational choice as an investment in health can be found, for example, in Cropper (1977). On the other hand, the choice of work related risk level is partially determined by taste and economic circumstances. Among them, migrant status is supposed to strongly affect the occupational choice and, at the same time, contribute to determine health outcomes. Several researchers have documented differences in workplace risk exposures by country of origin or race within a broader discussion on the role of tastes and market opportunities in assuming a certain level of risk at work (Viscusi, 2003, Leeth and Ruser, 2006). Under a health investment framework, differences in health investments by migrant status are thus assumed.

This research uses a dataset containing ample information about working lives and disability status to explore two sets of issues. First, what is the contribution of working and contractual conditions, and particularly the exposure to health risks, to the probability of acquiring a disability, taking into account the endogeneity of risk level choices? Second, are immigrants and natives significantly different in terms of risk choices and in 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 itself a focus of interest of public policies. Possible differences in market opportunities by country of origin conducing immigrants to higher risk exposure or more precarious employment constitute an

[1] The importance of taking into account endogeneity has been illustrated in Haveman et al (1994) who use Grossman's framework to address the question of the interdependency of health status, work-time and wages where work-time beyond some norm is supposed to entail stress and other deleterious side effects. They demonstrate that the simultaneous GMM estimations differ substantially from those derived from simpler models with more restrictive assumptions commonly used in the literature.

additional source of inequality and are in the basis of the debate on the conditions in which a society integrates the new arrivals.

Due to the recent dramatic growth in the immigrant population in Spain[2], the above-mentioned issues stand out as a very important topic of public debate. Despite the magnitude of the immigration phenomenon and the political interest on it, the evidence about 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 by country of origin in workplace illness and injury rates. This paper seeks 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.

One would expect there to be differences in health investments related to occupational choice between immigrants and non-immigrants for different reasons. First, from the hedonic equilibrium framework perspective, differences in risk preferences fully explain discrepancies in workplace risk across demographic groups. Differences in wage-risk tradeoffs by country of origin may arise from unequal economic circumstances or from differences in tastes. For instance, inequalities in lifetime levels of wealth -supposed to be lower for immigrants- may explain differences in willingness to bear risk, i.e. immigrants or ethnic minorities would be more likely to be employed in risky jobs (Viscusi, 2003; Lucas, 1974; Robinson, 1984). Second, immigrant and non-immigrants might differ in terms of market opportunities. It is known that differences in market offer curve of wages as function of fatality risk by country

[2] In 2009, 13.8% of the population had been born abroad, while the percentage was only 3.13% in 1999.

of origin may arise from discrimination or from unmeasured productivity differences (Akhavan, 2006; Leeth and Ruser, 2006). In this respect, literature on market discrimination documents that immigrants are paid less for the same job (Viscusi, 2003). Other factors different from preferences may explain divergencies in risk levels between immigrants and non-immigrants if some hypotheses behind the hedonic equilibrium theory are unrealistic. Informational disadvantages or occupational crowding probably force immigrants to choose higher levels of risk than those arising from their preferences.

For Spain, Ahonen and Benavides (2006) not only find that immigrants are employed in riskier jobs than native-born Spaniards, they also show that they experiment more work related injuries and diseases than do natives. A similar finding appears in Parra et al (2006) for the region of Navarra. Finally, immigrants' rate of accidents has been reported to be about twice that of natives in Germany, France and the Netherlands (Bollini and Siem, 1995).

After this introduction, in the next section we discuss the 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 econometric 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 two simple facts that are in 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.

The worker health stock (H) is governed by a health production function where the health stock depreciates at rate δ, and L represents a stochastic and permanent shock[3]:

$$H_i = \overline{H}_i - \delta H_i - L_i$$
$$L_i = f(R_i, C, A_i, X_i)$$

where R_i = the level of risk associated to a job (injury and illness rate) chosen by worker i, C = other working conditions, A_i = worker's ability to produce safety at work, and X_i = other individual's variables shaping the adoption of health risks.

Let W_{Ri} be the expected wage of worker i in a job with risk R and W_{Gi} the corresponding wage in a job without risk. The worker will choose a job with risk if:

$$W_i = \frac{W_{Ri} - W_{Gi}}{W_{Gi}} > M_i$$

[3] An example of a health production function with a stochastic shock can be found in Vaness (2003).

Following previous studies (Daniel and Sofer, 1998) M_i can be interpreted as i´s reservation relative wage or as the relative shadow prize for risky working conditions, and therefore related to individual's risk preferences. In other words, in a utility function that depends on health and wages, M_i is the MRS between safety and salary. W_i represents the expected wage premium for risk (if existing), or simply the difference, in terms of wage, between working in a risky job and i´s alternative in the labour market. Particularly, our model allows for W_{Gi} to be 0 in the presence of unemployment. Being an immigrant may affect both M_i and W_i. Migrant decision might reflect itself certain risk tolerance, so that M_i can be smaller for immigrants than for natives. Leigh (1989) argues that blacks and others who have been reared in relative poverty have less aversion to risk than whites that come from predominantly middle to upper-income families. With respect to W_i, our hypothesis is that the probability of choosing a better job without risk (W_{Gi} not being 0) and the compensating wage premium for risk is lower for immigrants[4]. They face different hedonic wages than natives and, therefore, might choose different levels of risk. This leads to a situation in which immigrants and natives face different levels of risk and the determinants of risk level choices have a differential incidence between these two groups:

$$R_{1i} = \beta X_i + \varepsilon_i$$
$$R_{2i} = \alpha X_i + \mu_i$$

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

[4] 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.

individuals' acceptance of risk (M_i) but are also related to W_i , the wage premium for risk. In this respect, the components of vectors R_{1i} and R_{2i} express each level of risk associated to a marginal price that results from the intersections of demand and supply functions of workers and firms choosing those particular job risks[5]. The formulation presented in equation (3.1) and (3.2) is appropriate to empirically account for the sorting of workers into levels of risk underlying personal characteristics.

2.2. Empirical framework

Our 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 into account endogeneity, which may arise from both simultaneity and unobservable heterogeneity influencing both disability and risk exposure. Simultaneity issues may emerge from the fact that individuals do not ignore the consequences in terms of health of their risk level choices. This consideration is fully consistent with our conceptual framework, where risk choice is inserted in a health production function.

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

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(4.

[5] See Thaler and Rosen (1976) for a theoretical analysis of the effect of personal characteristics on risk level choices.

$$D_i^* = \beta_1 X_i + \delta R_i + \varepsilon_i$$
$$D_i = 1 \quad if \quad D_i^* > 0$$

$$R_i^* = \beta_2 X_i + \gamma Z_i + \mu_i \qquad (5.$$
$$R_i = 1 \quad if \quad R_i^* > 0 \qquad (5.$$

for individual i, the D_i^* and R_i^* are unobserved latent variables indicating individual's probability of acquiring a disability and individual's propensity to choose a risky job, respectively. 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 (4.1) and (4.2) are the unknown parameters of interest that we wish to estimate, β_1, β_2 δ and γ, the random error terms, ε_i and μ_i.The correlation between ε_i and μ_i , ρ , will be also estimated, assuming that it follows a bivarate normal distribution.

The unobserved propensities D_i^* and R_i^* specified in the system of equations will be estimated first for the whole sample, with migrant status as a dummy variable; we then introduce some interactions taking into account the region of origin and, finally, we estimate the bivariate probit separately for native-born Spaniards and immigrants distinguishing among different regions of origin of those immigrants.

3. Institutional Framework and Data

3.1 Institutional context

The labour market based social security is mandatory for workers in Spain. Contributions (around 37% of calculated monthly earnings) are scaled according to occupational category.

Employers contribute approximately 85% of the total amount and employees the remaining 15%. The Social Security system provides the most important welfare program in Spain: public pensions. As far as permanent disability pensions are concerned, the law distinguishes four levels characterized by increasing severity (the first two are compatible with holding a job): 1) *partial-permanent disability for the usual profession*, refers to disability cases where 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*, applies to cases were the individual is unable to do any kind of job and 4) *severe disability*, the person requires continued attendance by other persons in order to carry out the basic daily activities (Jiménez-Martín et al, 2006). In terms of requirements, when the disability is caused by an ordinary illness, eligibility to a pension requires a minimum of five years of contributions. There is no requirement when the disability is caused by an accident,-whether work-related or not- or a professional illness.

3.2. Data and Variables

We use the Muestra Continua de Vidas Laborales (MCVL), 2006, *(Continuous Sample of Working Lives)*, an administrative data set provided by the Social Security Administration with information on individuals who had an active record with the Social Security system 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), unemployment benefits recipients and pensioners. It consists of nearly 1.1 million individuals. The MCVL contains information on the employment and contribution history (dating back to 1967) of the selected individuals.

Individual variables include sex, date and place of birth, family status, monthly earnings, pension benefits, disability degree and the year of its commencement. Firm characteristics comprise number of employees, foundation date and geographical location. Job characteristics cover type of contract, tenure, social security scheme, firm's sector of activity and dates of beginning and end of each contract. Job and firm characteristics are registered for each contractual relation the worker has been involved in.

The MCVL has two characteristics especially relevant for our analysis: it contains a large and representative subsample of immigrants and information about disability and its degree. An immigrant is defined as someone who was born abroad. We work with cross section data: any relation with the Social Security prevailing in 2006 in the case of the active non-disable population and the relationship applicable when the disability appeared in the case of disabled people receiving a pension. Since every labour relation generates a new record that means we can observe the actual working conditions prevailing when the disability occurred. From the original data set, we have restricted our sample to working age (16 to 64) individuals who have contributed at least five years to the social security system, the minimum required to be eligible for a non-accident caused disability pension. A detailed description of the variables follows.

Disability

The first endogeneous variable is "Disability", a binary variable that 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 and 0 otherwise. The information comes from the

administrative records contained in the MCVL. Our data allows identifying transitions to disability in two ways: if the individual starts receiving a disability benefit from the Social Security System or if the employer starts declaring workers disability (there are incentives – reduced contributions to the Social Security- to declare the disability). Both can occur simultaneously. For disabled individuals, the working conditions considered are those applicable in the moment of the transition to disability, and further working relations are eliminated.

Risk

We have constructed the risk measure using injury and illness rates by industry-occupation: i.e. number of individuals receiving a pension for non-fatal [6] 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 provides a total of 440 job-industry cells. The risk variable takes the value 1 if the job-industry cell the individual belongs to is in the top quartile in the illness/injury rate ranking, and 0 otherwise.

Our risk measure satisfies two important conditions. First, it is narrowly defined in order to capture the variation in risk by both occupation and industry at a high level of detail. Second, it is elaborated following the same classification of industries and occupations used to define the rest of working conditions -both based on the MCVL-, what guaranties coherence. Other sources of information that directly provide work-related injury and illness rates not requiring

[6] Our investigation excludes fatal injury rates as measure of risk. Since we investigate disability status -our sample only contains individuals who are alive- nonfatal rates are more suitable to capture the effects of risk on disability status.

further elaborations (for example, the statistics published by the Ministry of Labour and Migrations) do not use the same occupational categories as those considered in the MCVL.

Table 1 presents the non-fatal injury and illness rates by major industry-occupation cells. Studies that employ simultaneously occupation and industry to estimate risks are rare in the Spanish context. Riera and Font (2007) used 8 industries and 9 occupations to estimate a hedonic wage function. Lopez-Jacob et al (2008) in comparing immigrants and autochthones injury and illness rates used 10 industries (occupations were not considered). Nevertheless, our results are consistent with theirs, despite the fact that the terms of comparison are not exact. Higher skilled occupations –engineers and university degree graduates, senior managers and engineering technicians and assistants with a university degree- have the lowest injury and illness rates[7]. The highest incidence of work related injuries and illness is found among workers in low-skilled job categories of mining and quarrying (25,675 disabled per 100,000 workers). It is worth mentioning that we consider risk level as a characteristic intrinsic to the job and as such it is observed by the worker.

INSERT TABLE 1

Explanatory variables

In the disability equation we include both individual characteristics -age, sex, education, number of family members, and marital status- and working conditions: days since the first affiliation, type of contract, a dummy variable for low skilled jobs, and risk exposure. The

[7] Although a university degree is necessary to belong to these two occupational groups, there can be people with a university degree in other categories. Occupation is not a worker's attribute but reflect the contractual relation with the employer, contributing to define the tasks involved.

variable "type of contract" takes the value 1 for temporary and fixed-term contracts, and 0 for civil servants and other kinds of permanent workers. Following the classification published by the Spanish Ministry of Labour we consider "low skilled" workers employed as subordinated and low skilled labourers. This variable is used as a proxy for lack of autonomy on the job.

We believe that individual's characteristics also influence the choice of risk level; in particular, "number of family members" and "marital status" have been used in some studies as proxies for risk preferences (Leeth and Ruser, 2006). The risk equation also contains a dummy variable that takes the value 1 for workers whose previous working status was "unemployed", and therefore moved from unemployment to the *current* job[8]. Being unemployed when the occupational decision takes place may influence the choice of job characteristics, and particularly the level of risk. Crowded occupations or lack of worker's bargaining power are natural correlates of unemployment status and delimit worker's set of opportunities in the job market. Therefore, it is reasonable to expect shifts from unemployment to risky jobs to be more likely than transitions from other jobs to risky occupations, everything else equal. On the other hand, if risk preferences fully account for differences in risk level choices -as predicted by the hedonic equilibrium theory-, workers in a disadvantaged situation (as unemployment) would not be more likely than others to be employed in risky occupations. Control variables for firm characteristics are also considered in the risk equation: size (number of employees), and years since foundation. Findings from industrial safety literature indicate that firm size and accident rates are strongly correlated. Oi (1974) found an inverted U shape with its peak accident rate for firms with 160 workers. The number of employees appears positively related to safety practices in Thomason (2002).

[8] The job performed in 2006 or, in the case of disable people, the job held in the moment of the transition to disability.

Descriptive statistics

Table 2 shows that the proportion of immigrants that have made the transition to a permanent disability (2.4%) is lower than that of natives (5.5%). On average, immigrants exhibit a higher educational attainment than natives. The percentages of immigrants with secondary (33.8%) or university (8.9%) studies are larger than those for natives (29.3% and 5.9%), what seems to be contradictory with the higher representation of immigrants in the worst working conditions.[9] Immigrants have higher rates of unemployment and temporary employment, and are found more often than natives in low-skilled jobs. More telling for our analysis is the fact that immigrants are more likely to be employed in risky jobs: 36 % of immigrants are exposed to work related risks, while this proportion is 26% for natives. When the three potentially "unhealthy" working conditions – temporary employment, risk, and lack of autonomy at work (low-skilled jobs)- are jointly considered, the proportion of immigrants employed in temporary, low skilled and risky jobs is nearly three times that of native-born Spaniards. This finding reinforces the violation of the expected positive relation between high education attainment and good working conditions and is consistent with previous studies that show a higher incidence of overeducation among immigrant population in Spain (Fernández and Ortega 2008; Díaz-Serrano 2010).

Persons born in the US, Canada, China and EU-15 are the least likely to be found in risky occupations. At the other extreme, Latin America, Portugal, Eastern Europe and Africa are the countries/regions of origin associated to higher percentages of risky jobs. This preliminary

[9] However, this finding is also observed in Diaz-Serrano (2010), who used a health survey from Catalonia.

analysis suggests an opposite relation between country's level of wealth and risk exposure. However, two observations break this link: Portugal is associated to high levels of risk contrasting to other EU-15 members, and citizens born in China and other Asian countries hardly participate in risky occupations.

Summarizing, and as far as the comparison between immigrants and native-born Spaniards is concerned, three intuitions can be obtained from this preliminary analysis: immigrants have better education and are less likely to be disabled; however, they are more likely to be employed in risky jobs, and risky jobs seem to be associated to higher disability rates[10]. In the econometric analysis we will try to disentangle this puzzle by exploring the effect of working conditions on disability for both immigrants and native-born Spaniards.

INSERT TABLE 2

4. Econometric results

Table 3 contains two models with the estimation results of the recursive bivariate probit for the whole sample. In the first model, immigrant status is captured by single dummy variable; in the second model we include several regional dummies and their interactions with the risk variable. Separate estimations by region of origin are shown in table 4. In order to allow for comparisons we report the marginal effects instead of the estimated coefficients.

[10] In our data, workers employed in risky jobs represent 29% of all workers and accumulate 40% of all cases of disability, which suggests that exposure to work related health risks strongly influences the probability of becoming disabled.

To formally test the null hypothesis of exogenous risk choice, we employed the Hausman-Wu test (Hausman, 1978). This test entails a χ^2 test of the explanatory power of the residuals from the first-stage risk choice equation when added to the second-stage disability equation. The exogeneity of risk choice was rejected ($p < 0.05$) in all models.

Migrant status significantly affects both disability status and the probability of being employed in a risky occupation. Immigrants have better health –measured by permanent disability -but are employed more likely than natives in risky jobs. The impact of our key variable, risk exposure, is strong and significant when the whole sample is considered. Workers employed in risky jobs increase their probability of becoming disabled by 5.3%. Moreover, all the marginal effects associated to working conditions are significant and large, in fact, larger than those of other relevant variables such as education. University studies reduce the probability of becoming disabled by 1.3% with respect to a person without studies, while being employed in a temporary job compared to an indefinite contract increases that probability by 2.4%.

The second model highlights the differential effect of risk on disability depending on the region of origin. The interactions of risk exposure with the regional dummies are all negative; this implies that with respect to natives, immigrants exposed to risky working conditions are, on average, less likely to become permanently disabled. Nevertheless, the coefficients are not significant for those born in EU-15, the US, Canada and Asia, implying no differences with natives.

The estimations regarding the determinants of risk also provide interesting results. We can distinguish three groups of countries. The first and most numerous is composed of African, Latin American and European non-EU countries, with positive and large marginal effects. European non-EU countries show the highest marginal effect (0.16, in absolute value). The second group is made up of people from China and other Asian countries, actually less likely to be exposed to work-related risks than natives. Finally, those born in the EU-15, the US and Canada are not significantly different from natives with regard to work related risk choices.

Table 4, which contains the results of the model estimated separately for each region of origin, shows that ρ is significantly different from 0 only for Spain. This result may arise from two possible sources of endogeneity: unobserved factor(s) that influences both the probability of becoming disabled and the probability of work risk exposure, or the joint determination of disability and risk. As a consequence, a univariate probit will produce biased estimates of the impact of risk exposure. For the rest of countries, the non- significance of ρ, indicates that both univaritate probit and bivariate probit estimations will yield the same empirical results.

Examination of the determinants of risk suggests a number of comments. For all the regions of origin, almost all the variables exert a significant effect. Age presents mixed results. It appears to be significant only for natives, Latin American and European non-EU15, with opposite effects for natives and immigrants. Older natives are less likely to be employed in risky jobs while the reverse is true for immigrants. It may reflect that immigrants are less likely to shift to better working conditions than natives, and consequently remain in risky jobs for a longer time. On the other hand, women are less likely to assume work related risks than

men in all of the regions, but this difference is higher in the case of the African and the non-EU15 immigrants.

INSERT TABLE 3

The probability of working in a risky job decreases in general as educational attainment increases. The negative effect of secondary education is bigger for natives than for immigrants. To have university studies implies a big decline in the probability of working in a risky job (between 10% and 20%) with the highest effect being that of African immigrants.

Time since the first affiliation exerts a negative and significant effect on the probability of being employed in a risky job for all the groups of immigrants, except for Africans and for the group of EU-15, American and Canadian immigrants. By contrast, risky jobs are more likely found among natives with longer work trajectories. The reasons that explain the lack of effect of this variable may not be the same for Africans as for those born in the richer countries. For African immigrants it may indicate that they do not tend to assimilate to natives, which could be linked to reasons of skill transferability, language proficiency and/or labour market discrimination. The existence of an occupational attainment gap and the lack of an assimilation pattern for Africans are documented in previous studies (Amuedo and de la Rica, 2007). Immigrants born in rich countries do not differ from natives in terms of risk level choices (see table 3) and the non-significance of the time since first affiliation may simply indicate that the likeness to natives remains.

Marital status reduces native's probability of being employed in a risky job and has no effect on immigrants, except for a slight increase in the case of Asians. The results regarding the number of family members differ more: it shows a negative impact for natives and a positive one for the rest of regions, except for Africans and Asians. Since these variables are plausible indicators of risk preferences (as in Leeth and Ruser, 2006), this result may reflect that tastes play a less important role on determining risk level choices in the case of immigrants. Finally, the transit from unemployment to a risky job is more likely than the transit from a safer job to a risky job for all the groups except for Asian and European non-EU15. The impact is especially large for people coming from Africa and Latin America.

Regarding the disability equation, we observe that risk exposure notably increases the probability of becoming disabled in the case of natives, Africa, Latin America and the group of rich countries (EU-15, US and Canada): a 5% increase for natives and increases of around 1% for the rest are found. The rest of variables defining working conditions exhibit similar results: are irrelevant for Asian and European non-EU15 and have a strong effect on disability in the rest of countries. Interestingly, the effects of working conditions are, in general, higher for native-born Spaniards than for immigrants.

Educational attainment has the expected negative effect on the probability of becoming disabled for native-born Spaniards and those born in EU-15, the US and Canada. However, it has turned out to be statistically non-significant for immigrants (except secondary education for Africans). This finding is consistent with investigations indicating that, compared to natives, immigrants face a higher incidence of overeducation (Fernández and Ortega, 2007). Another interesting finding is the smaller magnitude of the effect compared to working

conditions. Holding a temporary contract has twice the effect of having a university degree. This ratio is 5 to 1 when risk exposure and university education are compared.

Age exerts the expected effect for all the groups: it significantly increases the probability of acquiring a permanent disability, especially among natives. Women have higher probabilities of disability only in the case natives and African, these with a 10% level of significance. Being married increases the probability of disability only for Africans, but decreases this probability in the case of natives.

Some of the most telling results are those related to years since the first affiliation. Being this a *proxy* for time since arrival in Spain, its behaviour helps to understand the assimilation patterns of immigrants. For all the regions of origin except for Asian and European non-EU15, this variable appears to be relevant to explain (increase) the probability of becoming disabled. This result is coherent with the "healthy migrant effect": those more likely to migrate are the healthier, but immigrants' health tends to assimilate to that of natives if they are exposed to similar or worst conditions, everything else equal.

INSERT TABLE 4

5. Discussion

Our study is an effort to assess the different role of working and contractual conditions, particularly risk exposure, on determining the probability of acquiring a permanent disability for immigrants and natives. Our paper differs from previous literature in various ways. First, it is based on an objective measure of health rather than the commonly used indicators of self-perceived health. Second, we analyse differences by region of origin, what is uncommon for

Spanish studies. Third, our investigation tries to capture the determinants of the occupational choice to better understand the factors behind differences in health outcomes. In our estimations, we account for possible endogeneity of risk exposure on the disability equation.

We unambiguously determine that working conditions have an impact on health for natives and the most numerous communities of immigrants. Risk exposure is, as expected, an important factor to account for differences in disability. The big magnitude of its effect compared to other traditional determinants of health such as education is one of our most interesting findings. Moreover, the results regarding the strong impact of temporary employment on disability deserve further comments. As we mentioned in the introduction, the experience of job insecurity has been associated with ill health. Nevertheless, the previous evidence of this association for Spain is scarce and ambiguous. The present investigation shows that the conclusions regarding the negative effect of temporary employment on health are unambiguous when its impact is measured on an indicator of overall health status, as permanent disability, and not restricted to differences in workplace safety.

Regarding differences between immigrants and natives, we find, first of all, that our theoretical hypothesis that disability and risk are jointly determined is not valid for immigrants. Such is the econometric explanation of the non-significance of the ρ parameter for the immigrant population. The conceptual implication is that health considerations play no role on determining occupational choice for immigrants. Neither is unmeasured heterogeneity –e.g. in time discount rates- simultaneously affecting the risk level choice and the probability of disability. A theoretical model in which working conditions have an important role on determining health status is obviously valid for immigrants. Nevertheless, the occupational

choice cannot be interpreted as an investment in health simply because working conditions are not a matter of choice in terms of health.

Moreover, occupational choice seems to mediate the effect of education on disability propensities in the case of immigrants[11]. While education exerts a significant effect on risk level choices for all the groups, its impact on disability is restricted to natives and EU-15, American and Canadian immigrants. Education is one of the classical determinants socioeconomic inequalities in health. The absence of effect of this variable in the case of immigrants when working conditions are included in the model suggests that the relative role of education and working conditions in explaining health inequalities may have not being properly measured yet, or it is changing, and that it requires further investigations.

We have also shown that the impact of working conditions on disability is dissimilar between immigrants and natives. This may arise from unmeasured differences in their ability to produce safety at work or from unmeasured differences in initial heath status. The lower probability of disability in the case of immigrants is coherent with previous findings indicating that the healthier are the most likely to migrate. But our results also confirm the assimilation hypothesis since for all the groups of immigrants time since the first affiliation increases the probability of disability.

Both Table 3 and Table 4 reveal that immigrants are far from homogeneous. Region of origin and not only migrant status is fundamental to explain risk choice. We have seen that marital status and family members, commonly used in the literature as indicators of risk preferences,

[11] This result is supported by the fact that estimations of the model without including risk as determinant of disability show a significant effect of education on disability.

have less effect on the probability of choosing risky jobs for immigrants. Moreover, transit from unemployment increases the probability to bear risks more in the case of Africans and Latin Americans than for native-born Spaniards. These findings can be interpreted as confirming that, regarding occupational choices, immigrants are more affected than natives by lack of opportunities in the labour market. In addition, the differential effect of the region of origin suggests a heterogeneous pattern of occupational choice among the different communities of immigrants. We postulate an integration model of immigrants in the local labour markets with specialization by country; that is to say, with networks of people from the same country playing a central role. It is also reasonable to suppose differences in reservations wages among groups. Immigrants that originate from richer countries and enjoy a greater degree of skill transferability –EU-15, American and Canadian immigrants- may have higher reservation wages. Therefore, everything else equal, they may be less prone to accept workplace risks.

Policies aiming at reducing health inequalities among sociodemographic groups are in the agenda of most of developed countries. Our results indicate that effective and equitable health policies must comprise a full understanding of the role of working conditions on determining health differences. Also, a better knowledge of the conditions in which vulnerable groups -like immigrants- access to safe working conditions may contribute to avoid future health inequalities. The strong effect on disability of risk exposure and other forms of precarious employment –like temporary jobs- suggest that the actions involved in these policies probably must exceed the frame of the traditional occupational health policies.

Finally, it is necessary to mention the limitations of our investigation. First, our data include only insured workers, which exclude irregular labour relations, more likely to happen among foreign workers. Second, institutional and bureaucratic requirements to obtain a disability pension may affect differently natives and immigrants. The latter may be more likely dissuaded to apply for a pension, due to lack of information or specific capabilities. Nevertheless, the individuals –also immigrants- included in our sample have been working and living in Spain at least for five years, so that the above mentioned limitation is supposed to be mitigated.

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TABLES

Table 1. Non Fatal Injury and Illness Rates by Industry and Occupation (per 100,000 workers)

MAJOR OCCUPATION GROUP / INDUSTRY	Engineers and University Graduates. Senior managemen t personnel	Engineering Technicians. Experts and Assistants with a University Degree	Administrative and workshop managers	Unqualified Assistants	Administrative Officials	Subordinates	Administrative Assistants	First and second degree skilled workers	Third degree skilled workers and Specialists	Unskilled labourers	**Industry Total**
Agriculture. Forestry and Fishing	335.57	0.00	687.55	471.70	800.00	0.00	874.64	1031.81	1308.14	424.27	**607.36**
Mining and Quarrying	0.00	0.00	6250.00	3508.77	2739.73	9090.91	0.00	8888.89	11009.17	5050.51	**7161.35**
Manufacturing	166.70	116.50	395.55	781.86	517.11	2263.20	406.50	1289.69	1296.58	1252.11	**1053.89**
Electricity, gas, steam and air conditioning supply	0.00	259.07	423.73	936.77	1346.80	1470.59	444.44	1884.42	1685.39	1754.39	**1092.74**
Construction	195.77	47.19	462.25	1057.08	642.17	1264.04	512.58	1136.59	1054.27	965.36	**979.34**
Wholesale and retail trade, repair of motor vehicles	378,07	0	135,69	0	193,14	2166,06	127,23	575,93	1220,79	992,15	**647,85**
Wholesale and retail trade, repair of motor vehicles	72,25	196,66	82,3	245,1	333,07	539,81	336,38	929,22	718,42	772,25	**524,55**
Wholesale and retail trade, repair of motor vehicles	177,62	0	126,58	185,32	261,47	405,41	228	538,82	427,85	402,41	**316,01**
Wholesale and retail trade, repair of motor vehicles	229.06	189.30	288.97	829.51	347.85	1040.83	339.13	3149.72	1373.18	2060.92	**1203.53**
Accommodation and food service activities	0.00	500.00	416.88	273.82	247.26	224.72	447.57	457.31	458.50	875.03	**496.34**
Transportation and storage	250.84	292.11	747.76	730.82	342.90	710.48	541.01	1309.48	2959.03	3332.47	**1330.05**
Financial and insurance activities	0.00	0.00	77.54	193.30	246.83	297.62	169.08	1702.13	1526.72	1436.78	**206.43**
Real state activities	89.53	0.00	151.98	0.00	180.59	193.05	178.66	821.92	653.59	768.74	**361.57**

Information and communication	0.00	127.23	72.67	0.00	141.94	833.33	232.56	255.75	450.45	0.00	**124.44**
Professional,scientific technical activities	31.46	96.96	71.07	413.47	244.17	528.75	192.95	1216.74	1212.44	788.74	**543.54**
Public Administration and Defense	225.04	302.07	617.92	1324.81	682.77	1409.67	421.12	6672.03	6074.28	2317.00	**1744.55**
Education	136.61	175.70	387.35	217.39	328.95	732.22	361.16	1161.44	1219.51	1120.73	**373.00**
Human health and Social work activities	181.46	274.33	430.57	463.32	655.90	535.23	422.11	1587.82	1423.71	1412.11	**634.60**
Arts, Entertainment and Recreation	426.44	387.60	298.86	0.00	180.10	111.36	410.17	994.04	819.67	738.40	**479.51**
Other service activities	0.00	680.27	0.00	458.72	132.10	665.56	507.19	426.23	764.59	797.17	**568.44**
Activ. of households	0.00	0.00	0.00	0.00	0.00	626.96	0.00	4724.41	7894.74	3076.92	**1561.69**
Occupation total	**163.07**	**214.25**	**353.72**	**619.54**	**371.19**	**752.63**	**335.11**	**1476.15**	**1310.53**	**1229.62**	**884.93**

Table 2. Descriptive Statistics

	TOTAL		NATIVE-BORN SPANIARDS		IMMIGRANTS (ALL)		AFRICA		LATIN AMERICAN		EUROPE NON-EU 15		EU-15, USA AND CANADA		ASIA	
							DISAGREGGATION OF "IMMIGRANTS" BY REGION/COUNTRY OF ORIGIN									
VARIABLE	%	S.D.	%	S.D.	%	S.D.	%	S.D.	%	S.D.	%	S.D.	%	S.D.	%	S.D.
N	748.423		710.344		38.079		8.647		12.838		3282		10765		2393	
%	100		94,92		5,08		1.09		1.48		0.45		1.63		0.34	
DEPENDENT VARIABLES																
Disability	5,36	0.21	5,48	0.21	2,41	0.21	1.90	13.68	1.02	0.10	1.00	0.10	2.34	0.15	1.10	0.1
Risk	30,01	0.44	25,6	0.44	36,1	36.1	37.64	48.45	23.06	0.42	35.27	47.79	19.33	0.39	11.37	31.75
PERSONAL CHARACTERISTICS																
Age (mean)	41,73	11.21	41,84	11.13	40,04	9.10	39.96	9.31	40.22	9.27	37.62	8.17	39.86	8.81	40.49	9.48
Gender, Female	39.8	0.49	40,89	0.49	40,54	0.44	21.17	0.40	49.64	0.50	40.13	49.02	44.86	0.50	33.14	0.47
Education		0.89		0.89		0.95		0.86		0.90		0.90		0.88		0.94
Without studies	26.79		26,76		27,57		58.25		17.66		22.73		17.46		39.44	
Primary	37.75		38,06		30,32		22.62		31.57		33.95		34.89		29.11	
Secondary	29.51		29,33		33,75		15.61		40.20		35.34		37.61		25.52	
University	5.95		5,85		8,37		3.52		10.57		7.99		10.04		5.93	
Family members (mean)	1.48	2.37	3.13	1.44	3.59	2.05	4.01	2.38	3.74	2.00						
Unmarried	12.95	0.34	12.81	0.33	15.52	0.36	16.93	0.37	12.53	0.33	14.20	0.35	18.18	0.38	16.21	36.86
WORKING CONDITIONS																
Temporary contract*	38.05	0.49	37.28	0.48	47.73	0.49	61.13	0.49	48.57	0.50	43.42	0.49	37.81	0.48	40.20	0.49
Unemployed	15.66	0.30	15,45	0.30	15,36	0.31	13.75	0.34	9.86	0.30	9.65	0.29	10.12	0.30	4.80	0.21
Self-employed	15.80	0.37	16,30	0.37	11,01	0.37	9.97	0.29	13.40	0.34	13.01	0.33	21.02	40.75	35.60	0.48
Low-skilled job	30.00	0.45	28,20	0.45	35,10	0.48	53.67	0.50	35.12	0.47	0.34	0.47	22.69	0.41	26.79	0.44
Years since 1st affiliation	16.88	3.68	20.65	10.08	12.31	7.52	12.35	8.18	10.72	7.05	9.67	5.69	15.21	7.27	11.25	6.49
Previous working status (%)																
Unemployed	21.82	0.38	21,74	0.38	14.92	0.36	16.64	0.37	13.86	0.35	14.69	0.35	16.65	0.37	6.81	0.25
Firm characteristics**																
Nr. Employers (mean)	314.56	1312	320,9	1332	236.86	1005	196.08	793,18	310.07	1191	193.10	881	228.77	1026	94.11	518
Years since foundation (mean)	15,7	16,22	11.78	13.13	15.97	16.37	10.41	11.99	12.00	13.50	11.25	11.96	13.30	13.95	9.75	12.28

*Includes civil servants

**Only private sector is considered

Table 3. Bivariate Probit Estimation for the whole sample (M1) and with variable interactions (M2).

Variable	*M1*			*M2*		
Permanent disability	**Mg. Effects**	***z***		**Mg. Effects**	***z***	
Age	0.0019	*85.06*	**	0.0019	*83.56*	***
Female	0.0035	*8.70*	**	0.0017	*4.24*	***
Primary education[$]	-0.0048	*-13.77*	**	-0.0055	*-16.07*	***
Secondary education[$]	-0.0094	*-21.04*	**	-0.0123	*-28.69*	***
University education[$]	-0.0127	*-17.21*	**	-0.0151	*-22.93*	***
Unmarried	0.0026	*4.59*	**	0.0022	*3.94*	***
Family members	-0.0020	*-14.06*	**	-0.0020	*-15.32*	***
Years since 1st affiliation	0.0430	*21.53*	**	0.0325	*21.22*	***
Years since 1st affiliation Sq	-0.0006	*-17.63*	**	0.0005	*-17.39*	***
Temporary contract	0.0244	*70.33*	**	0.0219	*66.12*	***
Low skilled job	0.0101	*26.17*	**	0.0096	*25.71*	***
Risk	0.0525	*41.62*	**	0.0470	*39.00*	***
Immigrant	-0.0093	*-11.29*	**	-	-	
Risk*African				-0.0118	*-6.12*	***
Risk*Latin American				-0.0130	*-5.15*	***
Risk* European				-0.0142	*-3.59*	***
Risk* EU15, USA, Canada				-0.0025	*-0.98*	
Risk*Asia				-0.0060	*-0.79*	
Risk[&]						
Age	-0.0135	*25.78*	**	-0.0150	*-28.69*	***
Age squared	0.0001	*20.33*	**	0.0001	*22.85*	***
Female	-0.2261	*-212.33*	**	-0.2252	*-217.65*	***
Primary education[$]	-0.0379	*-31.73*	**	-0.0417	*-33.74*	***
Secondary education[$]	-0.1565	*-125.18*	**	-0.1662	*-131.88*	***
University education[$]	-0.1714	*-97.87*	**	-0.1794	*-107.14*	***
Unmarried	-0.0091	*-5.08*	**	-0.0093	*-5.09*	***
Family members	-0.0015	*-3.66*	**	-0.0013	*-3.09*	***
Unemployed last relation	0.0307	*21.29*	**	0.0370	*25.38*	***
Years since 1st affiliation	0.0550	*25.03*	**	0.0033	*27.77*	***
Years since 1st affiliation Sq	-0.0006	*-12.45*	**	0.0007	*-14.79*	***
Immigrant	0.0387	*14.65*	**	-	-	
Africa				0.0587	*11.72*	***
Latin America				0.0648	*13.29*	***
Europe non-EU15				0.1655	*18.75*	***
EU-15, USA, Canada				0.0063	*1.45*	
Asia				-0.0891	*-10.08*	***
Rho -0.24				rho -0.2032		
Likelihood-ratio test of rho=0: chi2(1) = 477.25				*Likelihood-ratio test of rho=0: chi2(1) =380.047*		
& We have controlled for firm characteristics (size, years since foundation)						
N Observations	629.863					
Log Likelihood	-360927.9					
Prob > chi2	0.0000					

$ Base category: no studies

*** Significant at 1% level

** Significant at 5% level

* Significant at 10% level

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
The second column in each model contains the z-statistics refering to the estimated coefficients

Table 4. Bivariate probit for native-born Spaniards and Immigrants by region og origin (Marginal Effects)

	Spain		Africa		Latin America		Europe non-EU15		EU15, USA and Canda		Asia	
Permanent disability												
Age	0.0021	***	0.0005	***	0.0004	***	0.0003	**	0.0006	**	0.0002	*
	85,09		*3.74*		*4.72*		*3.32*		*6.42*		*1.90*	
Famele	0.0032	***	0.0057	*	0.0013		-0.0035		-0.0025		-0.0018	
	7,59		*1.93*		*0.80*		*-1.40*		*-1.40*		*-0.87*	
Primary education	-0.0050	***	-0.0020		-0.0015		0.0053		-0.0030	*	0.0009	
	-13.39		*-0.93*		*-0.83*		*1.59*		*-1.68*		*0.40*	
Secondary education	-0.0097	***	-0.0069	***	-0.0018		0.0023		-0.0089	**	0.0011	
	-20.32		*-2.99*		*-1.04*		*0.69*		*-4.19*	.	*0.44*	
University education	-0.0136	***	-0.0025		-0.0012		0.0006		-0.0063	**	-0.0019	
	-17.31		*-0.55*		*-0.51*		*0.10*		*-2.40*		*-0.71*	
Unmarried	0.0035	***	-0.0017	**	-0.0014		-0.0039		-0.0039	*	0.0030	
	5,76		*-2.27*		*-0.76*		*-1.54*		*-1.75*		*0.79*	
Family members	-0.0019	***	-0.0017	***	-0.0010	**	-0.0002		-0.0025	**	0.0002	
	-13.40		*-2.97*		*-2.17*		*-0.40*		*-3.64*	.	*0.44*	
Years since 1st afiliation	0.0019	***	0.0019	***	0.0019	***	0.0003		0.0022	**	0.0004	
	17.62		*4.04*		*5.73*		*0.68*		*5.14*	.	*0.92*	
Years since 1st afiliation Sq.	0.0001	***	0.0001	**	0.0000	***	0.0000		0.0001	**	0.0000	
	-14.81		*-2.27*		*-4.59*		*0.82*		*-3.42*	.	*0.10*	
Temporary contract	0.0259	***	0.0044	**	0.0043	***	0.0033		0.0083	**	0.0012	
	71.85		*2.69*		*3.33*		*1.56*		*4.80*	.	*0.69*	
Low-skilled job	0.0102	***	0.0046	**	-0.0007		0.0098	***	0.0108	**	0.0033	
	25.44		*2.39*		*-0.47*		*3.25*		*4.76*	.	*1.15*	
Risk	0.0542	***	0.0121	**	0.0172	**	0.0018		0.0140	**	0.0046	
	41.45		*2.03*		*2.26*		*0.36*		*2.73*	.	*0.35*	

Table 4. Continued

Risk	Spain		Africa		Latin America		Europe non-EU15		EU15, USA and Canda		Asia	
Age	-0.0204	***	0.0059		0.0100	***	0.0185	**	0.0017		0.0017	
	-35.90		*1.39*		*3.33*		*2.35*		*0.60*		*1.46*	
Age squared	0.0002	***	-0.0001		-0.0001	***	-0.0002	**	0.0000		0.0000	
	29,91		*-1.66*		*-1.00*		*-2.30*		*-1.28*		*-1.21*	
Female	-0.2224	***	-0.3197	***	-0.2659	***	-0.3471	***	-0.1686	**	-0.0183	**
	208.55		*-22.81*		*-3.38*		*-21.17*		*-26.82*		*-5.74*	
Primary education[$]	-0.0423	***	-0.0079		-0.0215	**	0.0211		-0.0218	**	-0.0020	
	-33.34		*-21.07*		*-33.46*		*0.95*		*-2.92*		*-0.56*	
Secondary education	-0.1661	***	-0.1340	***	-0.0736	***	-0.0563	**	-0.1138	**	-0.0088	**
	-127.49		*-0.51*		*-2.47*		*-2.55*		*-14.88*		*-2.42*	
University education	-0.1799	***	-0.1975	***	-0.1073	***	-0.1390	***	-0.1100	**	-0.0131	**
	-102.90		*-7.42*		*-8.28*		*-4.47*		*-13.73*		*-2.32*	
Years since 1st afiliation	0.0148	***	-0.0061	*	0.0150	***	-0.0001	***	0.0006		0.0031	**
	35.88		*-1.81*		*-7.77*		*-3.67*		*0.39*		*-2.99*	
Years since 1st afiliation Sq.	0.0002	***	0.0001	*	0.0003	***	-0.0245	***	0.0000	*	0.0001	**
	-22.88		*1.71*		*6.64*		*-4.10*		*1.91*		*2.66*	
Unmarried	-0.0108	***	-0.0310		-0.0118		0.0237	***	-0.0014		0.0207	**
	-5.76		*1.14*		*5.79*		*2.9*		*-0.14*		*3.11*	
Family members	-0.0025	***	0.0015		0.0051	***	0.0141	**	0.0063	**	0.0008	
	-5.53		*3.97*		*3.93*		*2.57*		*2.86*		*1.05*	
Unemployed last relation	0.0360	***	0.0681	***	0.0425	***	0.0059		0.0222	**	-0.0060	
	24.05		*0.47*		*2.66*		*0.23*		*2.56*		*-1.08*	
Likelihood-ratio test of rho=0: chi2(1) =	491.62		0.0290		1.5578		0.6750		1.2218		0.0389	
	-0.25		-0.02		-0.21		-0.17		-0.10		0.12	
N Observations	598299		6894		9311		2815		10269		2115	
Log Likelihood	-347910.64		-4241.46		-3991.30		-1349.91		-4577.93		-623.57	
Wald chi2 (26)			1229.14		1393.22		707.02		1675.15		560.75	

$ Base category: no studies

& We have controlled for firm characteristics (size, years since foundation)

*** Significant at 1% level

** Significant at 5% level

* Significant at 10% level