On the Differential Impact of the Recent Economic Downturn on Work Safety by Nativity: The Spanish Experience[∗]

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Abstract

This paper explores differences in work injury and fatality rates between immigrants and natives and how they may have been impacted by the recent economic downturn. Our focus is on Spain over the 2001-2010 decade –a period of time during which Spain received one of the largest immigrant inflows of any developed economy and subsequently experienced a recession that has raised national unemployment rates above 20 percent. We find that immigrants worked in riskier jobs than natives during this high immigration period. Furthermore, the recession appears to have exclusively reduced job injury rates, but not fatality rates, among immigrants –hinting on immigrants' misreporting due to fear of dismissal as the primary cause for the observed decline. Overall, the figures are suggestive of work safety inequalities that may be important to address.

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1   Introduction

Migration across national borders provokes many spirited political and policy debates that are unlikely to diminish as the share of the world's population residing in a country other than their country of birth rises. For instance, it is frequently argued that immigrants take jobs that natives do not want, such as more dangerous jobs. This popular belief is consistent with stylized facts for many countries, as well as for Spain, where the immigrant work injury rate, 5.03 percent, is above the 4.20 percent rate of natives (see Table A.1 in the Appendix for details). Yet, it remains unclear how the most recent recession may have impacted differences in work injury and fatality rates by nativity when present. The latter could have widened if immigrants have endured, overall, worse job prospects than natives and/or accepted riskier jobs. Alternatively, the aforementioned gaps could have narrowed if: (a) fear of dismissal and unemployment have reduced immigrants' reporting behavior to a larger extent than that of natives, (b) workload reductions have been more prominent in sectors with a higher concentration of immigrants, or (c) selection of less accident-prone workers into employment has been more acute among immigrants than natives.

We examine work injury and work fatal accident rates among immigrants and natives in Spain over the 2001-2010 decade. We start by investigating whether, after accounting for a variety of factors potentially correlated to immigrants' higher work injury rates –such as educational attainment, language proficiency, assimilation to the host country or industry and occupation of employment, we observe significant differences in work injury and fatality rates by nativity and region of origin. Unlike previous studies, we include data on legal as well as undocumented immigrants during an interesting decade that encompasses the immigration boom experienced from 2000 through 2008, as well as the most recent recession. Subsequently, we

examine how the economic downturn has impacted work injury and fatality rates by nativity and region of origin, paying close attention at its likely determinants.

The focus on Spain is of special relevance given the purpose of the study and the time period being examined. During the 2001-2010 decade, Spain displayed one of the largest rates of immigration in the world –three to four times as large as the average immigration rate in the United States between 2000 and 2008. Just between 2003 and 2008, the foreign-born population four-folded and, by 2010, twelve percent of Spanish residents had a foreign nationality and 14 percent were foreign-born (Vasileva 2011).[1] The large and rapid inflow of immigrants may have resulted in significant disparities in work safety by nativity for numerous reasons –such as immigrants' lack of awareness of job risks, their need to get a job upon their immediate arrival, or their greater willingness to take on a riskier job (relative to natives) in exchange for a higher pay. Furthermore, Spain is one of the recent immigrant-receiving economies most hard hit by the latest recession. Unemployment rates have climbed to double-digits and currently hovered around 25 percent. Some risk prone industries with a higher concentration of immigrant workers, such as construction, have particularly suffered. Workload reductions, workforce composition biases and the pressure felt by more vulnerable and uninformed workers to misreport work injuries in order to avoid dismissal could have impacted work injury rates differently by nativity. Thus, Spain offers the ideal scenario to examine work injury and fatality gaps by nativity, as well as their evolution following the recent economic crisis.

This article is structured as follows. In the next section, we review the literature on work injuries and fatalities, focusing our attention on studies investigating differences by nativity or over the economic cycle. In section 3, we provide some background information on immigration

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[1] Even after the economic downturn, the foreign-born accounts for more than 12 percent of the population (Instituto Nacional de Estadística, 2012).

to Spain and on the regulation of work injury and fatality rates in the country. Section 4 discusses the data and provides some interesting descriptive statistics on the evolution of work injury and fatality rates by nativity in Spain over the past decade. We then describe the methodology and discuss our findings in sections 5 and 6, respectively. Finally, section 7 concludes the study with a summary of our findings and some closing remarks.

2   Work Injuries and Fatalities by Nativity and Over the Economic Cycle

The literature on differences in work injury and fatality rates by nativity is quite extensive. It is often argued that immigrants may hold riskier jobs than natives for a variety of reasons (*e.g.* Orrenius and Zavodny 2009). First, immigrants may have fewer job alternatives than natives. In that regard, Loh and Richardson (2004) argue that poor language ability and low educational attainment may limit many immigrants' employment options. Alternatively, immigrants might have different knowledge and perceptions of job risks than natives due their educational attainment, language proficiency or social capital (Marvasti 2010). For instance, immigrants may perceive work-related risks differently than natives if working conditions are generally better in the host country and do not perceive the job as particularly dangerous. In both cases, personal and human capital characteristics may account for differences in working conditions between immigrants and natives.

Second, from a compensating wage differentials framework in which riskier jobs pay more, immigrants might still occupy riskier jobs than natives because of differences in wealth or risk preferences. Immigrants may be more willing to take risky jobs if safety is considered a normal good and immigrants have lower incomes and wealth than natives. Alternatively, immigrants may be less risk averse than natives, as evidenced by the fact that they were willing

to take on the risk of migrating (Berger and Gabriel 1991).[2]   These two facts may imply that immigrants are more willing than natives to trade off work safety in exchange for a higher pay as it is assumed in the hedonic equilibrium framework (Rosen 1986, Viscusi 1993).

A third possibility might have to do with the "healthy immigrant effect". Immigrants tend to be healthier upon arrival than natives (Antecol and Bedard 2006). Therefore, it is conceivable that immigrants, particularly recent ones, might choose more physically strenuous jobs than natives.

Finally, immigrants and natives might have different safety-related productivities and abilities to benefit from safety training. Hersch and Viscusi (2010) suggest that immigrant workers as a group may impose higher safety-related costs because of language or cultural barriers. As a result, firms employing immigrants may have fewer incentives to invest in injury prevention (Bauer *et al*., 1998).

Despite all the aforementioned reasons for expecting higher work injury and fatality rates among immigrants, some studies provide conclusive evidence of natives having a higher work injury and/or fatality rate than immigrants, whereas others find no differences by nativity. For instance, in the United States –the country most widely studied (Ahonen *et al*. 2007), early studies found that immigrants generally endured lower work injury rates than natives (Berger and Gabriel 1991, Hamermesh 1998).   However, more recent studies suggest that immigrants, especially Hispanics, endure higher work injury rates than natives (Loh and Richardson 2004, Leeth and Ruser 2006, Orrenius and Zavodny 2009). The evidence for other nations is rather scarce and varies widely from country to country. For instance, in Germany, Bauer *et al*. (1998) report no significant differences in the unconditional probability of enduring a less severe

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[2]Note however that Bonin *et al*. (2009) find that, after controlling for age, education, and family characteristics, first-generation immigrants in Germany are more risk-averse than natives.

accident by nativity, but immigrants endure a higher probability of experiencing a severe work accident. In contrast, focusing on Spain and using data on legal immigrants who arrived to the country by 2001, Solé *et al*. (2010) conclude that, although legal immigrants are more likely to work in riskier jobs, they display a lower likelihood of becoming disabled. In that vein, Moral de Blas *et al*. (2009) use data for 2005 and report that native workers in Spain have a higher rate of soft tissue injuries –a finding that they attribute to the false reporting of injuries. Focusing on Cataluña –a region in Northeast Spain, Diaz-Serrano (2010) also concludes that African immigrants work in riskier jobs than natives. In contrast, Ahonen and Benavides (2008) find that immigrants enjoy a lower risk of work injury and fatality using data from a sample of immigrants collected between September 2006 and May 2007 in 5 Spanish cities.

Aside from the mixed findings regarding differences in work injury and fatality rates by nativity, it remains unclear whether such differences would be exacerbated or narrowed during an economic downturn. Previous research examining workplace safety during economic cycles finds that work injuries are pro-cyclical. The rationale behind the pro-cyclical nature of work injury rates is that higher production requirements and work hours might increase stress and tiredness among workers, resulting in an increased work injury rate (*e.g.* Kosssoris 1938, Shea 1990, Fairris 1998). Hence, during periods of high unemployment (or reduced economic activity), work injuries might decrease with the workload. Alternatively, injury and fatality rates may behave pro-cyclically due to changes in the composition of the workforce over the business cycle (Boone and van Ours 2006, Fahr and Frick 2007). Less accident-prone workers may be selected into the workforce when unemployment is high and, as such, fewer accidents may be recorded. The average workload may not have decreased, but the propensity to be involved in a work accident might have decreased. Finally, it is also possible for work injury rates to behave pro-cyclically and diminish during an economic downturn if workers are less likely to report

injuries for fear of dismissal. As noted by Boone and van Ours (2006) and Boone *et al*. (2011), such a fear appears to be the main reason behind the observed pro-cyclicality after comparing the performance of work injuries as opposed to work fatality rates, which are not likely to be misreported.

Yet, to our knowledge, no previous study has explored the differential effect that the economic downturn may have had on the job risks faced by immigrants and natives –particularly in countries characterized by a large and recent immigration inflow *and* severely hit by the recession. Did the economic downturn reduce injury and fatality rates among both immigrants and natives as would be expected from an even reduction in workload across all sectors? Or did it only lower injury rates solely among immigrants suggesting other potential causes, such as misreporting, uneven workload reductions, or workforce composition biases?

In what follows, we merge industry and occupation work injury and fatality rates with individual level data from the Spanish labor force survey (*i.e. Encuesta de Población Activa* or EPA) for the 2001-2010 decade to learn about immigrant job segregation into riskier or safer jobs, and about changes in such nativity segregation during the past recession. The first part of this study is close in spirit to previous work by Solé *et al*. (2010), who study differences in the probability of becoming disabled between immigrants and natives in Spain. The authors use cross-sectional data on severe work injuries and illnesses from the 2006 *Muestra Continua de Vidas Laborales* (MCVL) –a Social Security database that collects data on natives and legal immigrants. They also focus their attention on working age individuals who have contributed at least five years to the social security system –the minimum required to be eligible for a non-accident disability pension. Consequently, their study is informative of differences in permanent disability rates between natives and legal immigrants who arrived to the country prior to 2001.

We focus, instead, on work injury and work fatality rates, as permanent disability rates exclude deaths and their recording is likely conditioned on the legal status of the migrant. Additionally, since the immigration boom in Spain took place between 2000 and 2008, we look at the entire 2001-2010 decade. To include both legal and undocumented immigrants –a non-trivial share of the immigrant population allegedly more likely to endure worse working conditions than their legal counterparts,[3] we use data from the Spanish labor force survey. The Spanish labor force survey is updated using the local population registers (*Padrón Municipal*). As noted by previous researchers (*e.g.* Gonzalez and Ortega 2011), because registration in the *Padrón* allows for free educational and medical services, undocumented immigrants have an incentive to register. Finally, we examine for the first time how the recent economic downturn has impacted any differences in work safety by nativity and the likely explanations for such an effect.

3   Institutional Framework

3.1.   Background on Immigration to Spain

Before proceeding any further, it is important to provide an overview of immigration to Spain and, in particular, its history and recent features. Until quite recently, Spain was a country of emigrants. However, the arrival of democracy in 1975, the entry of Spain in the European Union in the 1980s, the long-standing decline in Africa and the economic crises in several Latin American countries during the 1990s marked a sudden change. As noted in the Introduction, Spain has displayed one of the largest rates of immigration in the world since the year 2000. In 2001, the foreign-born population amounted to less than 1.4 million (Instituto Nacional de

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[3] According to the European Commission (2009), up to 1,232,000 irregular immigrants were present in Spain at the beginning of 2005. And, although this figure significantly declined with the 2005 amnesty, this number still stood at 354,000 in early 2008.

Estadística 2004). By 2008, it had five-folded, reaching 5.5 million (Instituto Nacional de Estadística 2012). In less than one decade, the foreign-born population had increased from 3.3 to approximately 14 percent of the population (Instituto Nacional de Estadística 2004, Vasileva 2011).

According to the official Spanish Statistical Institute, up to 52 percent of immigrants are male. On average, immigrants are younger than natives and have higher labor force participation rates (in the order of 73 percent compared to 57 percent in the case of natives) (*e.g.* Reher *et al*. 2008, Instituto Nacional de Estadística 2009). Fifty-nine percent of immigrants have secondary schooling and only 17 percent has tertiary education or a university degree. Available evidence also suggests that for 44.9 percent of immigrants Spanish is their native tongue, and 58.3 percent of those with a different native tongue consider themselves fluent in Spanish (Instituto Nacional de Estadística 2009). Only 14.5 percent of immigrants indicate not being able to speak the language. This new immigrant population is heavily concentrated in Madrid, the Mediterranean arc (*i.e.* Cataluña, Valencia, Murcia, and Andalucía), and the Balearic and Canary islands, and their origins are quite diverse. The vast majority of immigrants come from Latin America (39 percent), Europe (38 percent), and North Africa (17 percent) (Instituto Nacional de Estadística 2009). The most common countries of origin for immigrants are: Morocco, Romania, Ecuador, Colombia, the United Kingdom, and Colombia. Most Moroccans reside in Cataluña and Andalucía, Ecuadorians concentrate in Madrid, Cataluña and Murcia. People from the United Kingdom primarily reside in Alicante (Mediterranean arc) and Málaga (Andalucía), and half of Romanians reside in Madrid and Castellón (Mediterranean arc).

3.2.   The Spanish National System of Health and Safety at Work

The Law of Prevention of Labor Risks (November 31, 1995) regulates the *Spanish National System of Health and Safety at Work*, whose organizational structure is summarized in Figure A.1 in the Appendix (Sessé *et al*., 2002). The *Labor Administration* develops norms and legislation; trains and informs about risks; watches over the application of Spanish Safety Laws; applies sanctions; and processes official statistics on occupational accidents and diseases. The *Health Administration* focuses on the design of tools and systems that pursuit health at work, and trains sanitary personnel in health and safety in close collaboration with the Labor Administration.   Finally, *insurance organizations* provide the mandatory work accident insurance. Some of the most popular insurance organizations include the *Spanish Social Insurance Institute*, which generally covers diseases, and the *Mutual of Work Accidents*, which covers temporary disability.

Companies are obliged to have in place preventive services, which can range from internal services provided by designated workers, prevention delegates or a health and safety committee, to external services, depending on firm size. It is compulsory to declare occupational accidents and disease cases, and inspection agents examine all accidents in order to establish the causes and consequences, and to initiate prosecution in the case of criminal negligence. The system is harmonized at the European level and, as shown by Table 1, the statistical data on the relative performance of the Spanish system vis-à-vis those of other European countries indicate a clear recent amelioration.

[Insert Table 1 here]

4   Data

We use two sources of data in our analysis: (1) individual level data from the Spanish labor force survey (*Encuesta de Población Activa*, EPA) spanning from 2001 through 2010, and (2) data on work injury and fatality rates from the Workplace Accidents Statistics (*Estadística de Accidentes de Trabajo*, EAT) published by the Spanish Ministry of Labor and Immigration.

The EPA provides the most representative and frequent data on the Spanish workforce. As noted by Gonzalez and Ortega (2011), relative to other Spanish surveys with employment information, the EPA more accurately captures the demographics of the foreign-born population, including undocumented immigrants. This is because Spain keeps a continuously updated population registry at the local level, which plays an important role in the sampling design of the EPA. All residents, regardless of legal status, are required to register and simultaneously have a strong incentive to do so since it grants them access to health and educational services and provides them with an official proof of residency in the country –a document later on needed to apply for legalization.[4] As a result, the data on the foreign-born population in the EPA can be considered to be reasonably accurate and up-to-date. Our sample includes data from the second quarter of each year starting in 2001 and ending in 2010.[5] Of particular interest to us is the information on the occupation and industry of employment, given at the three-digit level, as well as individual level characteristics, such as place of birth and the length of time they have resided in Spain. We define immigrants as foreign-born individuals. The EPA does not provide information on language proficiency. Nevertheless, we use information on the country of origin to identify immigrants for whom Spanish is their native tongue. Finally, the EPA asks foreign-

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[4]Furthermore, the information cannot be used to locate undocumented workers.
[5] As noted by Alonso *et al*. (2010) or Amuedo-Dorantes and De la Rica (2011), among others, doing so minimizes any seasonal effects.

born individuals about the year they arrived to Spain. We use that information to construct a measure of the duration of the migration spell.

Table 2 displays a few characteristics of individuals in our sample. We focus on working immigrants and natives in the labor force survey. Immigrants account for approximately 13 percent of the sample, even though their rates vary from 5 percent in 2001 to over 16 percent in 2010 as the immigrant population rose during the decade. Relative to natives, employed immigrants are more likely to be female, young, and non-married. They are also less likely than natives to have a university degree and more likely to have less than a primary education. Immigrants also seem more likely to hold a temporary contract and overall display shorter tenures than natives. On average, they came to Spain eight years ago and Spanish is the native tongue of approximately half of them. Finally, the vast majority of immigrants in our sample originate from Latin America, followed by other European countries, Africa and, lastly, Asia.

[Insert Table 2 here]

Aggregate statistics on the number of work injuries and fatalities according to different classifications are published by the Spanish Ministry of Labor and Immigration. We use four different data series from the EAT: (1) the number of work injuries at the industry level, (2) the number of work injuries at the occupation level, (3) the number of fatalities at the industry level, and (4) the number of fatalities at the occupation level. Work injuries include trivial as well as severe accidents leading to at least one day of work absence and exclude commuting accidents. We merge the aggregate work injury and work fatality rate time series to the individual labor force survey data by industry and occupation. Industry is coded in both data sources using the Spanish version of the NACE (Rev. 1 and Rev. 2),[6] whereas occupation is coded using the

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[6] Statistical Classification of Economic Activities in the European Community.

Spanish version of ISCO-88 (COM).[7] The data are merged at the two-digit level industry and occupation level –the most detailed level at which data on work injury and fatality figures are made available.[8] We then calculate industry and occupation injury, as well as fatality, rates.

Table 3 summarizes the aforementioned rates. By industry, work injury rates are higher in mining, extractive industries and utilities, followed by construction, manufacturing and machinery/transportation equipment. Work fatality rates, however, are the highest in transportation and warehousing, followed by construction, mining and extractive industries, and agriculture. Of those industries, construction, followed by agriculture, are the ones exhibiting a higher concentration of immigrants.

[Insert Table 3 here]

A closer look by occupation reveals that work injury rates are the highest among unskilled non-service and transportation workers, as well as among skilled extraction and manufacturing workers. Work fatality rates are the largest among plant and machine operators and assemblers, followed by unskilled non-service transportation workers and by skilled construction workers. Of the aforementioned occupations, unskilled non-service and skilled construction jobs display a larger share of immigrant workers.[9]

Do work injury and fatality rates then significantly differ according to nativity? Sample means in Table 4 do not disclose a clear pattern. Immigrants appear to work in riskier occupations than natives, but in less risky industries. Because the figures in Table 4 only inform on the average work injury or fatality rate for the entire decade, we take a closer look at how those rates may have varied over time for both immigrants and natives.

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[7]International Standard Classification of Occupations for European Union purposes.
[8] We had to homogenize NACE Rev. 1, used for 2001-2008, and NACE Rev. 2, used for 2009 and 2010. We ended up with 44 different industry clusters and 61 occupation categories.
[9] Table A.2 in the Appendix further disaggregates the share of immigrants employed in the industry and occupation categories included in Table 3 by region of origin.

[Insert Table 4 here]

Figures 1A and 1B display industry and occupation work *injury* rates for immigrants and natives over the 2001-2010 period under examination. A couple of things are worth noting. First, work injury rates have been declining consistently throughout the entire time period, except between 2005-2007, when they stabilized among immigrants coinciding with increased immigration inflows and the housing boom. Later on, they dropped with the onset of the economic recession. Second, there are no significant differences in the work injury rate of immigrants and natives by industry; yet, immigrants appear to endure a consistently higher work injury rate than natives by occupation.

[Insert Figures 1A and 1B here]

As shown by Figures 2A and 2B, work *fatality* rates by industry and by occupation also declined throughout the examined period for both immigrants and natives.[10] Nevertheless, unlike work injuries, fatality rates by occupation were not that different by nativity. Additionally, while immigrants display lower work fatality rates at the beginning of the period, immigrant fatality rates catch up with native fatality rates as the decade progresses and immigration rises.

[Insert Figures 2A and 2B here]

In sum, on average, only work occupation injury rates appear to significantly differ by nativity. These differences could, however, be explained by dissimilarities in personal and job characteristics. Therefore, in what follows, we turn to a more rigorous regression-based analysis to address such differences.

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[10] Benavides *et al.* (2009) examine whether the implementation of preventive measures by the regional governments were responsible for the declining trend in industry and job injuries and fatality rates from 2000 onwards. However, they do not find any significant results. The authors then propose alternative explanations, including: (a) increased safety inspections, (b) changes in workforce compositions from high-risk to low-risk industries, and (c) changes in reporting standards introduced by insurance companies.

5   Methodology

Our purpose is to learn about differences in the work injury and fatality rates experienced by workers according to nativity in Spain during the 2001-2010 decade, how the latter may have been impacted by the recession, and some of the potential explanations for the observed pattern. With that aim in mind, we estimate the following equation by ordinary least squares (OLS):

$$Rate_{ikt} = \alpha + \beta_1 Migrant_i + X_i \gamma + \eta_k + \phi_r + \varphi_t + t + \eta_k \times t + \varepsilon_{ikt} \tag{1}$$

where the dependent variable is the work injury or fatality rate in individual i's industry or occupation k in year t. The variable $Migrant$ is a dummy indicative of whether the respondent is foreign-born that, in alternative specifications, is substituted for a set of dummies indicative of the region of the world where the migrant is from. We also control for a variety of individual level personal and job characteristics included in the vector X known to be correlated to the likelihood of a work accident, such as age, gender, marital status, educational attainment, whether Spanish is their native tongue, time in Spain, job tenure, and contract type.[11]   Following Hamermesh (1998), we also include occupation fixed-effects when examining work injury and fatality rates at the industry level, and industry fixed-effects when assessing work injury and fatality rates at the occupation level. These are captured by η_k. Additionally, denoting by r the region of employment of individual i, regional ϕ_r and year φ_t fixed-effects account for a variety of macroeconomic factors possibly correlated to the work injury and fatality rate, such as differences in the distribution of occupations and industries across Spanish regions or specific economic shocks. Likewise, a time trend captures the progressive improvement in work injury and fatality rates exhibited by Figures 1A through 2B; whereas the interaction term $\eta_k \times t$ accounts for distinct trends in different industries (occupations). Finally, standard errors are

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[11] We include these characteristics sequentially to assess how the estimated coefficient changes as we include some variables that could be potentially considered endogenous, as is the case with contract type or job tenure.

clustered at either the occupation or industry level, depending on the level at which the dependent variable is aggregated at.

After gauging if there are any differences in work injury and fatality rates by nativity during this time period of intensive immigration, we look at how the recession may have impacted such differences by estimating a similar model by OLS. In addition to the previous regressors, the model includes a dummy indicative of the onset of the economic downturn in 2008 (*i.e. Crisis*), as well as an interaction term capturing any differential impact of the crisis on workers' injury and fatality rates by nativity:[12]

$$Rate_{ikt} = \alpha + \beta_1 Migrant_i + \beta_2 Crisis_t + \beta_3 Migrant_i \times Crisis_t + X_i\gamma + \eta_k + \phi_r + t + \eta_k \times t + \varepsilon_{ikt} \quad (2)$$

Equations (1) and (2) are estimated for all occupations and industries in our analysis.

6   Findings

6.1.   Differences in Work Injury and Fatality Rates by Nativity

Table 5 displays the results from estimating equation (1) for work injury rates computed at the occupation and industry levels. Columns (1) through (4) show the estimated gap in occupation injury rates by nativity. The gap drops from 156 injuries per 10,000 workers (specification 1) to 141 per 10,000 (specification 3) as we control for a variety of personal characteristics (such as educational attainment, having Spanish as the native tongue, and years lived in Spain, among other ones). It further drops to 123 per 10,000 workers (specification 4) once we account for a variety of job-related characteristics, such as contract type, job tenure and industry. These differences are all statistically different from zero at the 1 percent level as well as significant from an economic standpoint. For instance, the fact that immigrant workers endure

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[12] In this second specification, we do not include the full set of year fixed-effects since they are reported to be collinear to the crisis dummy. We are, however, able to include year dummies for the years 2001-2007 along with the crisis dummy and the results (available from the authors) do not change.

123 more injuries per 10,000 workers than native workers when the average occupation injury rate is 453 per 10,000 implies that, relative to natives, immigrants tend to work in jobs with work injury rates that are approximately 27 percent higher. However, immigrants and natives do not seem to display different work injury rates by industry (see columns (7) through (10) in Table 5). Likewise, the figures in Table 6 suggest that immigrants and natives do not display statistically different from zero work fatality rates at the industry level. Nevertheless, immigrants do seem to endure 0.49 more deaths per 100,000 workers than natives by occupation once job-related characteristics are taken into account.

[Insert Tables 5 and 6 here]

Columns (5)-(6) and (11)-(12) in Table 5 and Table 6 further document work safety differences according to immigrants' origin. Africans, followed by Europeans and, finally, Latin Americans, are all more likely to work in occupations with higher injury rates than natives. Likewise, Europeans are slightly more likely than their native counterparts to work in jobs with higher fatality rates. A quick look at Table A.2 further reveals how Africans are primarily concentrated in the agriculture sector and often occupy unskilled non-service and transportation jobs, whereas Latin Americans primarily concentrate in service jobs. Europeans are relatively concentrated in skilled construction, as well as in plant and machine operating jobs. In contrast, Asians are generally less likely to work in industries with higher injury or fatality rates, as well as in jobs with higher fatality rates, than natives. Specifically, as shown in Table A.2, they primarily work in wholesale and retail trade as managers, service workers, and sales workers.

Also worth discussing is the importance of the duration of the migration spell. Although not always statistically different from zero, the length of the migration spell is generally inversely related to work injury and fatality rates. As noted by Orrenius and Zavodny (2009), this coefficient could be capturing both assimilation and cohort effects. Nonetheless, given that we

are focusing on one decade, we are more likely to be capturing the former. Additionally, immigrants for whom Spanish is their native tongue appear less likely to work in risky jobs and, in particular, less risky industries.

The rest of the results in Tables 5 and 6 are the expected. For instance, women tend to work in safer occupations and industries, while older workers tend to work in occupations with lower injury rates –even though the difference disappears once we control for job characteristics such as contract type, job tenure, and industry. Marital status also matters, although not uniformly. Married employees appear more likely to work in occupations that exhibit lower injury rates. Yet, their industries of employment appear to be riskier than those of their single counterparts, and their occupations also display higher work fatality rates. Educational attainment exhibits its expected inverse relationship with injury and fatality rates, with the most highly educated working in safer jobs. Finally, as we would anticipate, employees with temporary contracts or with shorter tenures are more likely to work in riskier occupations than their counterparts with permanent work contracts or longer job tenures.

6.2. The Economic Downturn and Its Impact on Work Safety by Nativity

Did the crisis reduce work injury rates? And, if immigrants generally endure worse employment conditions than natives, did the economic downturn further raise their work injury and fatality rates and widen the work safety gap by nativity by pressuring immigrants into accepting riskier jobs? Or did the crisis actually reduce immigrant work injury and fatality rates relative to those experienced by natives due to a greater reduction in immigrant employment and/or an enhanced fear of misreporting?

Table 7 addresses these questions. Overall, the crisis appears to have been inversely related to industry and occupation injury and fatality rates, but the effect is never statistically

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different from zero.[13] Yet, the economic downturn seems to have impacted immigrant and native work injury rates differently.   According to the figures in Table 7, the economic downturn particularly lowered work injury rates among immigrants by 32 accidents per 10,000 workers.

[Insert Table 7 here]

Looking a bit more closely by immigrant origin, we find that African immigrants –usually experiencing worse employment prospects and a slower assimilation rate (Amuedo-Dorantes and de la Rica 2006), exhibit significant reductions in injury rates and, although to a much lesser extent, in job fatality rates. Similarly, Latin Americans experience reduced injury rates during the recession. However, their fatality rates, as in the case of all immigrants, remain unaltered – lending support to the hypothesis that most of the reduction in work injuries among immigrants in the midst of the recession might have resulted from misreporting (Boone *et al*. 2011).

6.2.1. Disentangling the Reasons for the Reduction in Immigrant Work Injury Rates

As noted above, the fact that, on average, only work injuries, but not fatalities, decrease among immigrants during the recession supports the notion that most of the reduction in accidents taking place following the onset of the recession might be due to misreporting on the part of immigrants. In other words, immigrants may fear to a greater extent than natives that, in the midst of the economic downturn, the firm might choose to lay off accident-prone workers first.   Perhaps immigrants are less aware of their rights than native, are more likely to be employed in the informal sector, or, in some instances, they may fear deportation (Orrenius and Zavodny forthcoming). Consistent with this hypothesis, we find that work injury rates among immigrants decrease after the onset of the economic crisis in 2008.   However, since fatal accidents are more difficult to misreport, there is not an observed decline in fatality rates.

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[13]In other specifications excluding job-related characteristics, the crisis contributed to a significant reduction in industry injury rates, thus evidencing the pro-cyclicality of accident rates, previously noted on the literature for other countries (*e.g.*Kossoris 1938, Fairris 1998 or, more recently, Boone *et al*. 2011).

The literature also notes alternative explanations for the observed decline in work injury rates (Boone and van Ours 2006). Changes in workload or in the composition of the labor force over the business cycle may explain the pro-cyclical behavior of accidents. In a boom period, there is a greater workload and also more new hires –often less experienced and more accident prone. During a recession, there are workload reductions and firms may dismiss the least productive and more accident-prone workers first. If immigrants are perceived to be less knowledgeable or proficient than natives by employers, they may be dismissed first and workload and workforce composition biases might explain the pro-cyclical pattern of immigrants' accident rates. The fact that the unemployment rate gap by nativity grew from 4 percentage points to approximately 12 percentages points between 2007 and 2010 suggests that, indeed, workforce composition biases may be one of the explanations for the pro-cyclical pattern (Instituto Nacional de Estadística 2012). Nevertheless, as Boone and van Ours (2006) indicate, if these two forces were the primary motive for the pro-cyclicality in work accident rates, both work injury and fatality rates should decline during the recession –not just work injuries as displayed in Table 7. Still, as a further robustness check, we re-estimate the model in equation (2) using a sample of both working and non-working individuals from the EPA. For non-working individuals, we use information on their last occupation/industry of employment. If selection of less accident-prone workers is the main cause for the observed reduction in work injuries among immigrant workers during the recession, we should no longer find evidence of a significant reduction for that group once non-working immigrants are also included in the analysis.

Table 8 displays the results from the aforementioned analysis. While immigrant work injury rates now drop by less than before (by 23 versus 32 per 10,000 workers), the reduction does not disappear when including non-working individuals. Likewise, for the most part, the remaining estimates are similar in sign, magnitude and statistical significant to those reported in

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Table 7. Therefore, while workforce composition biases might play some role, they do not seem to be the most prominent cause for the observed reduction in work injury rates among immigrants during the recession. This is also true if we examine work safety differences by immigrants' origin (see columns labeled 'Specification 2'). For the most part, the estimated coefficients remain statistically significant, have the same sign and are only slightly smaller in magnitude. The only exception is Latin American immigrants, for whom the previously marginally significant reduction in work injuries from Table 7 now disappears; thus suggesting that reductions in workload and workforce composition biases may have been primary causes for their experienced reduction in work injuries.

[Insert Table 8 here]

7 Summary and Concluding Remarks

We examine whether immigrants appear to have worked in riskier jobs –as captured by injury and fatality rates measured at the occupation and industry level– than natives during the 2001-2010 decade in Spain –a period of intensified immigration encompassing the most recent economic downturn. We further explore how any differences in work safety by nativity may have been exacerbated or narrowed by the recent economic downturn. Specifically, we examine if immigrants –who endure a higher risk of being unemployed than natives and a higher opportunity cost to being unemployed due to their lower likelihood of qualifying for some safety nets, such as unemployment benefits[14]– experienced a greater reduction in work injury and fatality rates associated to reductions in workload, workforce composition biases, or misreporting relative to natives.

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[14] Vazquez *et al*. (2009) note that, although the Spanish unemployment benefit scheme is one of the most generous in Europe, the fact that it requires 360 days of contribution over the past 6 years results in fewer benefit-entitled immigrants, especially among recent cohorts.

The results clearly indicate that immigrants –by origin: Africans, followed by Europeans and Latin Americans– work in more dangerous occupations than natives, even after accounting for observable characteristics, such as educational attainment, time in Spain or whether Spanish is their native language. Furthermore, the economic downturn appears to have contributed to a reduction of the overall immigrant job injury rate, but not the immigrant fatality rate –suggesting that workload reductions are unlikely to be the main explanation for the observed decline. Rather, greater fear of dismissal and, to a much lesser extent, workforce composition biases appear to be the main causes for the reduction in work injury rates for the vast majority of immigrants.

A couple of concluding remarks are worth making. First, to the extent that: (a) work injury and fatality rates by industry and by occupation combine immigrants and natives, and (b) informality, which is more common among immigrants, is more likely to result in misreporting, our estimates likely represent lower bounds. Second, we are unable to examine with the data at hand whether immigrants receive a compensating wage differential for working in riskier jobs than natives. If immigrants are taking these jobs due to misinformation or lack of alternative employment opportunities, they might not earn the same compensating wage differential as natives. In that case, corrective measures addressing these disparities in work safety dangerously concealed by the economic downturn might be warranted.

References

Ahonen, Emily Q. and Fernando G. Benavides. 2008. "Riesgo de lesión por accidente laboral en trabajadores extranjeros" *Gaceta Sanitaria*, 22(1): 44-47.

Amuedo-Dorantes, Catalina. 2002. "Work safety in the context of temporary employment: The Spanish experience" *Industrial and Labor Relations Review*, 55(2): 262-285.

Amuedo-Dorantes, Catalina and Sara De la Rica. 2010. "Immigrants' responsiveness to labor market conditions and their impact on regional employment disparities: evidence from Spain" *SERIEs*, 1(4): 387-407.

Antecol, Heather and Kelly Bedard. 2006. "Unhealthy Assimilation: Why Do Immigrants Converge to American Health Status Levels?"*Demography* 43:337-360.

Arocena, Pablo, Imanol Núñez and Mikel Villanueva.2008. "The Impact of Prevention Measures and Organisational Factors on Occupational Injuries" *Safety Science,* 46(9): 1369-1384.

Bauer, Thomas K., Andreas Million, Ralph Rotte, Klaus F. Zimmermann.1999. "Immigration Labor and Workplace Safety", IZA DP nº 16.

Benavides FG, Garcia AM, Lopez-Ruiz M, Gil J, Boix P, Martínez JM, Rodrigo F. 2009. "Effectiveness of occupational injury prevention policies in Spain". *Public Health Reports*, 124:180-187.

Berger, Mark C. and Paul E. Gabriel. 1991. "Risk Aversion and the Earnings of US Immigrants and Natives" *Applied Economics*, 23:311-318.

Bonin, Holger, Amelie Constant, Konstantinos Tatsiramos, and Klaus F. Zimmermann. 2009."Native-Migrant Differences in Risk Attitudes" *Applied Economics Letters*, 16(15): 1581-1586.

Boone, Jan and Jan C. van Ours. 2006. "Are Recessions Good for Workplace Safety?" *Journal of Health Economics*, 25: 1069-1093.

Boone, Jan, Jan C. van Ours, Jean-Philippe Wuellrich and Josef Zweimüller. 2011. "Recessions are bad for workplace safety" *Journal of Health Economics*, 30: 764-773.

Díaz-Serrano, Luis. 2010. "Do Legal Immigrants and Natives Compete in the Labour Market? Evidence from Catalonia." IZA Discussion Paper No. 4693.

European Commission. 2009. "Irregular Migration in Spain", Clandestino Research Project. Available at: http://clandestino.eliamep.gr

Fahr, René. and Bernd Frick 2007. "On the Inverse Relationship between Unemployment and Absenteeism: Evidence from Natural Experiments and Worker Heterogeneity," IZA Discussion Papers 3171.

Fairris, David. 1998. "Institutional change in shopfloor governance and the trajectory of postwar injury rates in the U.S. manufacturing, 1946-1970" *Industrial and Labor Relations Review*, 51: 187-203.

Gonzalez, Libertad and Francesc Ortega.2011. "How Do Very Open Economies Absorb Large Immigration Flows? Recent Evidence from Spanish Regions" *Labour Economics* 18: 57-70.

Geldart, Sybil, Christopher A. Smith, Harry S. Shannon and Lynne Lohfeld. 2010. "Organizational practices and workplace health and safety: A cross-sectional study in manufacturing companies" *Safety Science,* 48(5): 562-569.

Hamermesh, Dan S. 1998. "Immigration and the Quality of Jobs" in *Help or Hindrance? The Economic Implications of Immigration for African Americans*, edited by Dan S. Hamermesh and Frank D. Bean. New York: Russell Sage Foundation, pp. 75-106.

Hersch, Joni and Kip Viscusi. 2010. "Immigrant Status and the Value of Statistical Life" *Journal of Human Resources*, 45(3).

Hunt, H. Allan, and Rochelle V. Habeck. 1993. "The Michigan Disability Prevention Study: Research Highlights". Upjohn Institute Working Paper No. 93-18. Kalamazoo, MI: W.E. Upjohn Institute for Employment Research.

Instituto Nacional de Estadística (INE). 2004. "Extranjeros en España", *Cifras INE*, Madrid.

Instituto Nacional de Estadística (INE). 2008. *Encuesta de Población Activa Metodología 2005*, Madrid.

Instituto Nacional de Estadística (INE). 2009. *Encuesta Nacional de Inmigrantes 2007: Una Monografía,* Madrid.

Instituto Nacional de Estadística (INE). 2012. "Extranjeros en la UE y en España", *Cifras INE,* Madrid.

Kossoris, Max. 1938. "Industrial Injuries and the Business Cycle" *Monthly Labor Review*, 579-594.

Leeth, John and John Ruser. 2006. "Safety segregation: The importance of gender, race, and ethnicity on workplace risk" *Journal of Economic Inequality* 4(2):123-152.

Loh, Katherine and Scott Richardson. 2004. "Foreign-born Workers: Trends in Fatal Occupational Injuries, 1996-2001"*Monthly Labor Review* 127(6):42-53.

Marvasti, Akbar. 2010. "Occupational Safety and English Language Proficiency" *Journal of Labor Research,* 31(4): 332-347.

Ministerio de Trabajo e Inmigración. 2001-2010. *Estadística de Accidentes de Trabajo. Datos Anuales.* Published on line: http://www.mtin.es/estadisticas/eat/welcome.htm

Moral De Blas, Alfonso, Ángel Martín Román and Juan Carlos Rodríguez Caballero.2010. "La antigüedad y las diferencias de esfuerzo entre trabajadores de distintas zonas geográficas: un estudio de los accidentes de trabajo" *Estudios de Economía Aplicada*, 28: 201.

Orrenius, Pia M. and Madeline Zavodny. 2009. "Do immigrants work in riskier jobs" *Demography*, 46(3): 535-551.

Orrenius, Pia M. and Madeline Zavodny. Forthcoming. "Immigrants in risky occupations" in *International Handbook on the Economics of Migration* Amelie Constant and Klaus F. Zimmermann (editors), mimeo.

Reher, David Sven, Luis Cortés Alcalá, Fernando González Quiñones, Miguel Requena, Alberto Sanz Gimeno, María Sánchez Domínguez, Mikolaj Stanek. 2008. *Informe Encuesta Nacional de Inmigrantes (ENI – 2007)*, Madrid: Instituto Nacional de Estadística (INE).

Rosen, Sherwin. 1986. "The Theory of Equalizing Differences" in *Handbook of Labor Economics,* edited by O. Ashenfelter and R. Layard. Amsterdam: North Holland, pp. 641–92.

Sesé, Albert, Alfonso L. Palmer, Berta Cajal, Juan J. Montaño, Rafael Jiménez and Noelia Llorens. 2002. "Occupational safety and health in Spain" *Journal of Safety Research*, 33(4): 511-52.

Shea, John. 1990. "Accident rates, labor effort, and the business cycle", SSRI Working Paper 9028, University of Wisconsin, Madison.

Solé, Meritxell, Luis Díaz-Serrano and Marisol Rodriguez Martínez. 2010. "Work, Risk and Health: Differences between Immigrants and Natives in Spain," IZA Discussion Papers 5338.

Vasileva, Katya. 2011. "6.5% of the EU population are foreigners and 9.4% are born abroad". *Eurostat: Statistics in Focus* 34/2011.

Vázquez, Pablo, Mario Alloza, Raquel Vegas and Stefano Bertozzi. 2009. "Impact of the Rise in Immigrant Unemployment on Public Finances" FEDEA Working Paper No. 2009-15.

Viscusi, W. Kip. 1993. "The Value of Risks to Life and Health" *Journal of Economic Literature*, 31:1912–46.

Table 1
Standardized Incidence Rate of Fatal Accidents at Work by Member State

Country	2000	2001	2002	2003	2004	2005	2006	2007	2008
EU15	2.8	2.7	2.5	2.5	2.4	2.3	2.4	2.1	:
Euro Area	3.2	3.1	2.9	2.9	2.7	2.5	2.8	0.5	:
Belgium	3.1	3.8	2.6	2.4	2.9	2.6	2.6	2.5	3.6
Denmark	1.9	1.7	2	1.8	1.1	2.2	2.7	2	1.7
Germany	2.1	2	2.5	2.3	2.2	1.8	2.1	1.8	1.6
Ireland	2.3	2.6	2.6	3.2	2.2	3.1	2.1	1.7	2.4
Greece	2.7	2.9	3.8	3	2.5	1.6	3.8	:	:
Spain	**4.7**	**4.4**	**4.3**	**3.7**	**3.2**	**3.5**	**3.5**	**2.3**	**3.3**
France	3.4	3.2	2.6	2.8	2.7	2	3.4	2.2	1.5
Italy	3.3	3.1	2.1	2.8	2.5	2.6	2.9	2.5	3.4
Luxembourg	6.8	1.7	2.4	3.2	:	2.6	1.7	:	2.8
Netherlands	2.3	1.7	1.9	2	1.8	1.6	1.7	:	1.6
Austria	5.1	4.8	5.1	4.8	5.4	4.8	4.2	3.8	4.2
Portugal	8	9	7.6	6.7	6.3	6.5	5.2	6.3	5.3
Finland	2.1	2.4	2	1.9	2.5	2	1.5	1.3	1.4
Sweden	1.1	1.4	1.2	1.2	1.1	1.7	1.5	1.4	1.5
Great Britain	1.7	1.5	1.4	1.1	1.4	1.4	1.3	1.3	0.6

Notes: Number of accidents which leads to the death of a victim within one year of the accident relative to the number of persons in employment in the reference population times 100,000.
Source: Eurostat.

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Table 2
Immigrant and Native Characteristics in the sample

Characteristics	Natives		Foreign-born	
	Mean	**S.D.**	**Mean**	**S.D.**
Male	0.60	0.49	0.56	0.50
Age	39.59	11.60	35.99	9.83
Married	0.60	0.49	0.55	0.50
Less than Primary	0.03	0.17	0.05	0.23
Primary	0.17	0.38	0.17	0.38
Secondary	0.47	0.50	0.52	0.50
University Degree	0.33	0.47	0.26	0.44
Temporary Contract	0.22	0.42	0.43	0.50
Job Tenure	121.54	124.21	42.50	62.74
Years in Spain	0.00	0.00	7.79	7.98
Spanish as Native Tongue	1.00	0.00	0.46	0.50
Africa	0.00	0.00	0.14	0.35
Asia	0.00	0.00	0.03	0.18
Europe	0.00	0.00	0.34	0.47
Latin America	0.00	0.00	0.48	0.50
Other Origin	0.00	0.00	0.01	0.07

Notes: Observations are weighted using the individual weights in the EPA. The sample includes only individuals aged 16 and older who are employed in the private or public sector, except for military personnel, and not self-employed.
Source: EPA (2001-2010).

By Industry/Occupation Categories	Injury Rate (per 10,000)		Fatality Rate (per 100,000)		Share of Foreign-born (%)
	Mean	Std. Dev.	Mean	Std. Dev.	
Major Industry Categories					
Agriculture, forestry, fishing, and hunting	361.29	112.80	7.85	9.64	15.12
Nondurable goods and wood products manufacturing	590.85	267.72	3.96	2.09	10.64
Mining and oil and gas extraction, utilities, and metal products	954.11	549.99	9.35	6.87	8.50
Machinery, electronic products, and electrical and transportation manufacturing	548.08	185.59	3.53	2.64	7.59
Construction	959.74	218.45	11.72	2.30	19.36
Wholesale and retail trade, accommodation and food services	390.98	120.24	2.31	2.24	15.42
Transportation and warehousing and Information	429.11	187.79	12.27	9.79	10.47
Financial activities, professional and business services	249.71	188.86	2.45	1.64	9.58
Education and health services and public administration	232.82	132.89	1.66	1.49	6.23
Other services	193.84	260.96	1.83	3.10	29.21
All industries	454.54	340.47	4.81	5.79	13.13
Major Occupation Categories					
Managers	18.23	29.54	1.02	1.49	8.71
Professionals	48.67	35.18	0.98	1.16	6.67
Technicians and associate professionals	97.61	78.81	2.40	2.13	6.78
Clerical support workers	148.38	97.91	1.44	1.36	6.97
Service workers	396.70	89.70	1.82	1.95	19.59
Sales workers	407.86	81.81	1.35	0.46	10.59
Skilled agricultural, forestry and fishery workers	301.60	179.40	7.59	10.40	7.15
Skilled construction workers	931.43	369.79	10.66	4.31	17.68
Skilled extraction and manufacturing workers	988.84	554.24	8.30	5.09	10.00
Craft and related trades workers	920.72	161.05	4.18	1.77	12.12
Plant and machine operators, and assemblers	694.77	377.93	13.96	9.97	9.13
Unskilled service workers except transportation	472.17	361.80	2.89	4.24	29.53
Unskilled non-service and transportation workers	1423.98	640.53	11.19	5.75	26.99
All occupations	453.39	496.33	4.81	5.79	13.13

Source: Estadística de Accidentes de Trabajo (EAT) (2001-2010) and EPA (2001-2010).

Table 4
Immigrant and Native Injury and Fatality Rates by Occupation and Industry

Work Injury and Fatality Rates	Natives		Foreign-born	
	Mean	S.D.	Mean	S.D.
Occupation Injury Rate per 10,000 Workers	438.26	492.41	553.46	510.32
Industry Injury Rate per 10,000 Workers	457.78	340.89	433.11	336.95
Occupation Fatality Rate per 100,000 Workers	4.79	6.51	4.89	5.93
Industry Fatality Rate per 100,000 Workers	4.86	5.87	4.43	5.18
Observations	618501		44990	

Note: Observations are weighted using the individual weights in the EPA. The sample includes only individuals aged 16 and older who are employed in the private or public sector, except for military personnel, and not self-employed.
Source: Estadística de Accidentes de Trabajo (EAT) (2001-2010) and EPA (2001-2010).

Table 5
Effects of Immigrant Status and Region of Origin on Occupation and Industry Injury Rates

Independent Variables	Occupation Injury Rate						Industry Injury Rate					
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	Spec.1	Spec.2	Spec.3	Spec.4	Spec.5	Spec.6	Spec.1	Spec.2	Spec.3	Spec.4	Spec.5	Spec.6
Foreign-born	156.70***	220.09**	140.61**	122.95***			10.11	-13.13	-32.46	-29.24		
	(58.597)	(90.106)	(57.171)	(31.897)			(60.539)	(98.861)	(67.930)	(25.146)		
Years in Spain		-8.99***	-4.87***	-3.88***	-4.90**	-3.90***		-0.92	0.78	0.84	0.80	0.82
		(3.186)	(1.831)	(0.904)	(1.844)	(0.921)		(2.954)	(2.019)	(0.745)	(1.989)	(0.731)
Spanish Native Tongue		-46.24*	-18.93	-2.54				-66.10**	-38.66*	-19.97**		
		(27.175)	(19.705)	(12.050)				(31.345)	(21.925)	(9.513)		
Africa					201.33**	157.50***					11.06	-0.24
					(76.882)	(46.989)					(41.200)	(14.489)
Asia					-40.67	27.11					-105.16**	-38.26*
					(44.326)	(34.095)					(42.148)	(20.164)
Europe					171.41***	127.39***					19.86	-7.97
					(53.472)	(26.405)					(56.162)	(19.114)
Latin America					137.54**	120.87***					-33.47	-29.33
					(56.481)	(31.579)					(67.520)	(25.103)
Other Origin					8.30	16.10					-64.58	-29.68
					(49.361)	(33.961)					(40.910)	(21.904)
Male			228.05***	93.41**	227.66***	93.43**			220.81***	58.02***	220.85***	58.02***
			(61.974)	(37.085)	(61.926)	(37.174)			(72.632)	(13.197)	(72.500)	(13.188)
Age			-8.98**	-3.31	-9.02**	-3.36			-2.98	-0.96	-2.98	-0.97
			(4.455)	(2.690)	(4.469)	(2.700)			(2.306)	(1.131)	(2.308)	(1.130)
Age Squared			0.03	0.01	0.03	0.01			-0.01	0.01	-0.01	0.01
			(0.042)	(0.026)	(0.042)	(0.026)			(0.023)	(0.013)	(0.023)	(0.013)
Married			-3.20	-15.15*	-2.99	-15.03*			28.79***	12.86***	28.92***	12.87***
			(11.958)	(8.948)	(11.901)	(8.937)			(7.960)	(2.657)	(7.839)	(2.622)
Less than Primary			229.99***	181.12***	226.92***	178.07***			45.36	6.61	46.27	5.91
			(65.824)	(42.673)	(64.124)	(40.926)			(46.200)	(7.200)	(47.153)	(7.551)
Primary			163.08***	117.09***	162.72***	116.62***			51.07*	7.79*	51.45*	7.73*
			(40.808)	(26.993)	(40.487)	(26.714)			(27.941)	(4.449)	(28.120)	(4.491)
University			-290.27***	-228.21***	-290.21***	-227.97***			-113.81***	-24.59***	-113.94***	-24.59***
			(47.156)	(34.538)	(47.145)	(34.522)			(41.488)	(7.847)	(41.456)	(7.860)
Temporary Contract				128.18***		127.63***				-4.68		-4.78
				(35.132)		(34.908)				(6.034)		(6.028)
Job Tenure				-0.15**		-0.15**				-0.07		-0.07
				(0.056)		(0.056)				(0.048)		(0.048)

Table 5 – Continued

Independent Variables	Occupation Injury Rate						Industry Injury Rate					
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	Spec.1	Spec.2	Spec.3	Spec.4	Spec.5	Spec.6	Spec.1	Spec.2	Spec.3	Spec.4	Spec.5	Spec.6
Regional FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time Trend	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry/Occupation FE	No	No	No	Yes	No	Yes	No	No	No	Yes	No	Yes
Ind/Occ. Time Trend	No	No	No	Yes	No	Yes	No	No	No	Yes	No	Yes
Observations	663,490	663,490	663,490	663,490	663,491	663,490	663,490	663,490	663,490	663,490	663,490	663,490
R-squared	0.049	0.054	0.239	0.417	0.240	0.417	0.072	0.074	0.222	0.525	0.222	0.525

Notes: Injury rates calculated per 10,000 workers. The sample includes only individuals aged 16 and older who are employed in the private or public sector, except for military personnel, and not self-employed. Regressions also include a constant term. Observations are weighted using the individual weights in the EPA. Standard errors are clustered on industry or occupation. Standard errors in parentheses. * significant at 10% ** significant at 5%; *** significant at 1%.

Table 6
Effects of Immigrant Status and Region of Origin on Occupation and Industry Fatality Rates

Independent Variables	Occupation Fatality Rate						Industry Fatality Rate					
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	Spec.1	Spec.2	Spec.3	Spec.4	Spec.5	Spec.6	Spec.1	Spec.2	Spec.3	Spec.4	Spec.5	Spec.6
Foreign-born	0.64	0.69	0.39	0.49*			0.07	-0.24	-0.29	-0.10		
	(0.815)	(1.220)	(0.671)	(0.249)			(0.782)	(1.173)	(0.687)	(0.168)		
Years in Spain		-0.05	-0.02	-0.02**	-0.02	-0.02**		-0.02	-0.00	-0.00	-0.00	-0.00
		(0.039)	(0.021)	(0.007)	(0.022)	(0.008)		(0.036)	(0.020)	(0.006)	(0.020)	(0.006)
Spanish Native Tongue		-0.91***	-0.31	-0.02				-1.02***	-0.54**	-0.25**		
		(0.335)	(0.193)	(0.109)				(0.318)	(0.202)	(0.105)		
Africa					0.68	0.49					0.17	0.19
					(1.003)	(0.460)					(0.677)	(0.156)
Asia					-2.37***	-0.88*					-2.08***	-0.40**
					(0.826)	(0.456)					(0.769)	(0.190)
Europe					1.09*	0.68***					0.58	0.21
					(0.630)	(0.230)					(0.618)	(0.162)
Latin America					0.35	0.47*					-0.32	-0.10
					(0.668)	(0.247)					(0.685)	(0.168)
Other Origin					-0.19	-0.09					-0.15	0.17
					(0.524)	(0.388)					(0.555)	(0.344)
Male			4.58***	2.37***	4.59***	2.38***			3.62***	0.80***	3.63***	0.80***
			(1.108)	(0.615)	(1.111)	(0.617)			(1.047)	(0.181)	(1.047)	(0.182)
Age			0.03	0.02	0.03	0.02			0.05	0.02	0.05	0.02
			(0.064)	(0.022)	(0.064)	(0.022)			(0.050)	(0.016)	(0.050)	(0.016)
Age Squared			-0.00	-0.00	-0.00	-0.00			-0.00*	-0.00	-0.00*	-0.00
			(0.001)	(0.000)	(0.001)	(0.000)			(0.001)	(0.000)	(0.001)	(0.000)
Married			0.32*	0.08	0.33*	0.08			0.46***	0.19***	0.47***	0.19***
			(0.167)	(0.079)	(0.167)	(0.080)			(0.152)	(0.043)	(0.151)	(0.043)
Less than Primary			2.17***	1.36***	2.22***	1.39***			1.10**	0.16*	1.14**	0.17*
			(0.677)	(0.365)	(0.660)	(0.355)			(0.497)	(0.094)	(0.487)	(0.092)
Primary			1.59***	0.97***	1.61***	0.98***			0.91***	0.14**	0.92***	0.14**
			(0.431)	(0.255)	(0.432)	(0.255)			(0.315)	(0.066)	(0.314)	(0.066)
University			-2.39***	-1.72***	-2.40***	-1.72***			-1.36**	-0.20*	-1.37**	-0.20**
			(0.741)	(0.426)	(0.743)	(0.427)			(0.596)	(0.099)	(0.596)	(0.099)
Temporary Contract				0.76***		0.76***				-0.00		-0.00
				(0.264)		(0.262)				(0.077)		(0.077)
Job Tenure				-0.00***		-0.00***				-0.00		-0.00
				(0.001)		(0.001)				(0.001)		(0.001)

Table 6 – Continued

Independent Variables	Occupation Fatality Rate						Industry Fatality Rate					
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**	**(9)**	**(10)**	**(11)**	**(12)**
	Spec.1	**Spec.2**	**Spec.3**	**Spec.4**	**Spec.5**	**Spec.6**	**Spec.1**	**Spec.2**	**Spec.3**	**Spec.4**	**Spec.5**	**Spec.6**
Regional FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time Trend	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry/Occupation FE	No	No	No	Yes	No	Yes	No	No	No	Yes	No	Yes
Ind/Occ. Time Trend	No	No	No	Yes	No	Yes	No	No	No	Yes	No	Yes
Observations	663,490	663,490	663,490	663,490	663,490	663,490	663,490	663,490	663,490	663,490	663,490	663,490
R-squared	0.041	0.042	0.229	0.507	0.230	0.507	0.047	0.048	0.171	0.526	0.172	0.526

Notes: Fatality rates are per 100,000 workers. The sample includes only individuals aged 16 and older who are employed in the private or public sector, except for military personnel, and not self-employed. Regressions also include a constant term. Observations are weighted using the individual weights in the EPA. Standard errors are clustered on industry or occupation. Standard errors in parentheses. * significant at 10% ** significant at 5%; *** significant at 1%.

Table 7
The Economic Downturn and Work Injury and Fatality Rates by Nativity

Independent Variables	Injury Rates				Fatality Rates			
	Occupation Rate		Industry Rate		Occupation Rate		Industry Rate	
	Spec.1	Spec.2	Spec.1	Spec.2	Spec.1	Spec.2	Spec.1	Spec.2
Migration variables:								
Foreign-born	134.45***		-26.44		0.55*		-0.09	
	(36.165)		(28.125)		(0.280)		(0.193)	
Years in Spain	-3.43***	-3.49***	1.00	1.00	-0.02**	-0.02**	-0.00	-0.00
	(0.783)	(0.822)	(0.678)	(0.670)	(0.007)	(0.007)	(0.005)	(0.005)
Spanish Native Tongue	-1.18		-19.48*		-0.01		-0.25**	
	(12.365)		(9.887)		(0.108)		(0.106)	
Africa		179.03***		7.35		0.65		0.22
		(49.373)		(14.669)		(0.483)		(0.166)
Asia		49.00		-40.61		-0.75		-0.49*
		(40.851)		(26.664)		(0.529)		(0.258)
Europe		127.31***		-3.63		0.63**		0.24
		(27.918)		(20.877)		(0.255)		(0.184)
Latin America		133.76***		-30.19		0.56*		-0.12
		(37.207)		(29.579)		(0.283)		(0.207)
Other Origin		-11.22		-35.76		-0.16		0.31
		(40.368)		(23.923)		(0.515)		(0.488)
Crisis effect:								
Post-crisis	-17.52	-17.53	-34.24	-34.28	0.28	0.28	0.18	0.18
	(22.926)	(22.927)	(21.630)	(21.620)	(0.253)	(0.253)	(0.215)	(0.215)
Interaction terms:								
Post-crisis* Foreign-born	-32.48**		-7.16		-0.17		-0.02	
	(15.448)		(9.719)		(0.127)		(0.092)	
Post-crisis*Africa		-67.46***		-22.87**		-0.48***		-0.08
		(19.792)		(10.359)		(0.176)		(0.098)
Post-crisis*Asia		-52.38		3.00		-0.31		0.17
		(31.956)		(18.951)		(0.320)		(0.297)
Post-crisis*Europe		-6.10		-12.65		0.09		-0.08
		(11.540)		(7.883)		(0.145)		(0.089)
Post-crisis*Latin America		-35.55*		1.46		-0.22		0.04
		(18.825)		(13.369)		(0.134)		(0.131)
Post-crisis*Other Origin		71.83*		15.16		0.21		-0.38
		(37.846)		(22.410)		(0.566)		(0.567)
Personal/Job Characteristics	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Regional FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	No	No	No	No	No	No	No	No
Time Trend	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry/Occupation FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Ind./Occ. Time Trend	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	663,490	663,490	663,490	663,490	663,490	663,490	663,490	663,490
R-squared	0.416	0.416	0.523	0.523	0.506	0.506	0.526	0.526

Notes: Injury rates are per 10,000 workers and fatality rates are per 100,000 workers. The sample includes only individuals aged 16 and older who are employed in the private or public sector, except for military personnel, and not self-employed. Regressions include a constant term and the personal and job characteristics shown in Tables 5 and 6. Observations are weighted using the individual weights in the EPA. Standard errors (in parentheses) are clustered on industry or occupation. * significant at 10% ** significant at 5%; *** significant at 1%.

Table 8
The Economic Downturn and Work Injury/Fatality Rates by Nativity: Working and Non-Working Individuals

| Independent Variables	Injury Rates				Fatality Rates			
	Occupation Rate		Industry Rate		Occupation Rate		Industry Rate	
	Spec. 1	Spec. 2	Spec. 1	Spec. 2	Spec. 1	Spec. 2	Spec. 1	Spec. 2
Migration variables:								
Foreign-born	163.23***		-21.87		0.82**		0.03	
	(43.679)		(30.586)		(0.327)		(0.221)	
Years in Spain	-4.22***	-4.28***	0.98	0.99	-0.02***	-0.02**	-0.01	-0.01
	(0.985)	(1.025)	(0.673)	(0.664)	(0.008)	(0.009)	(0.005)	(0.005)
Spanish native tongue	1.29		-18.42*		0.05		-0.26**	
	(12.879)		(10.251)		(0.122)		(0.114)	
Africa		210.03***		9.27		0.84		0.42*
		(57.394)		(17.406)		(0.526)		(0.215)
Asia		74.54		-31.04		-0.55		-0.40
		(53.243)		(26.108)		(0.497)		(0.256)
Europe		148.41***		0.54		0.83***		0.35*
		(32.231)		(22.170)		(0.272)		(0.204)
Latin America		163.38***		-26.41		0.83**		-0.02
		(45.090)		(31.915)		(0.335)		(0.233)
Other origin		17.71		-35.60		0.03		0.33
		(41.158)		(27.038)		(0.501)		(0.492)
Crisis effect:								
Post-crisis	-26.22	-26.22	-41.03*	-41.08*	0.19	0.20	0.15	0.15
	(27.208)	(27.217)	(22.910)	(22.895)	(0.269)	(0.268)	(0.230)	(0.230)
Interaction terms:								
Post-crisis* Foreign-born	-23.47*		-6.78		-0.09		-0.05	
	(13.595)		(10.503)		(0.126)		(0.098)	
Post-crisis*Africa		-58.93***		-22.60*		-0.32*		-0.21*
		(15.856)		(11.213)		(0.187)		(0.112)
Post-crisis*Asia		-36.04		-7.25		-0.17		0.14
		(45.952)		(17.729)		(0.333)		(0.289)
Post-crisis*Europe		7.76		-13.08		0.17		-0.10
		(11.183)		(7.986)		(0.151)		(0.092)
Post-crisis*Latin-Am.		-29.97		3.33		-0.17		0.04
		(18.057)		(13.961)		(0.134)		(0.137)
Post-crisis*Other Origin		55.90		12.82		0.11		-0.44
		(37.220)		(22.600)		(0.512)		(0.535)
Personal characteristics	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Regional FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	No	No	No	No	No	No	No	No
Time trend	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Ind./Occ. FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Ind./Occ. Time trend	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	835.737	835.737	835.737	835.737	835.737	835.737	835.737	835.737
R-squared	0.391	0.392	0.516	0.516	0.500	0.501	0.524	0.525

Notes: Injury rates are per 10,000 workers and fatality rates are per 100,000 workers. The sample includes only individuals aged 16 and older who are employed or unemployed, except for military personnel. Regressions include a constant term and the personal characteristics shown in Tables 5 and 6. Observations are weighted using the individual weights in the EPA. Standard errors (in parentheses) are clustered on industry or occupation. * significant at 10% ** significant at 5%; *** significant at 1%.

Figures 1A and 1B:
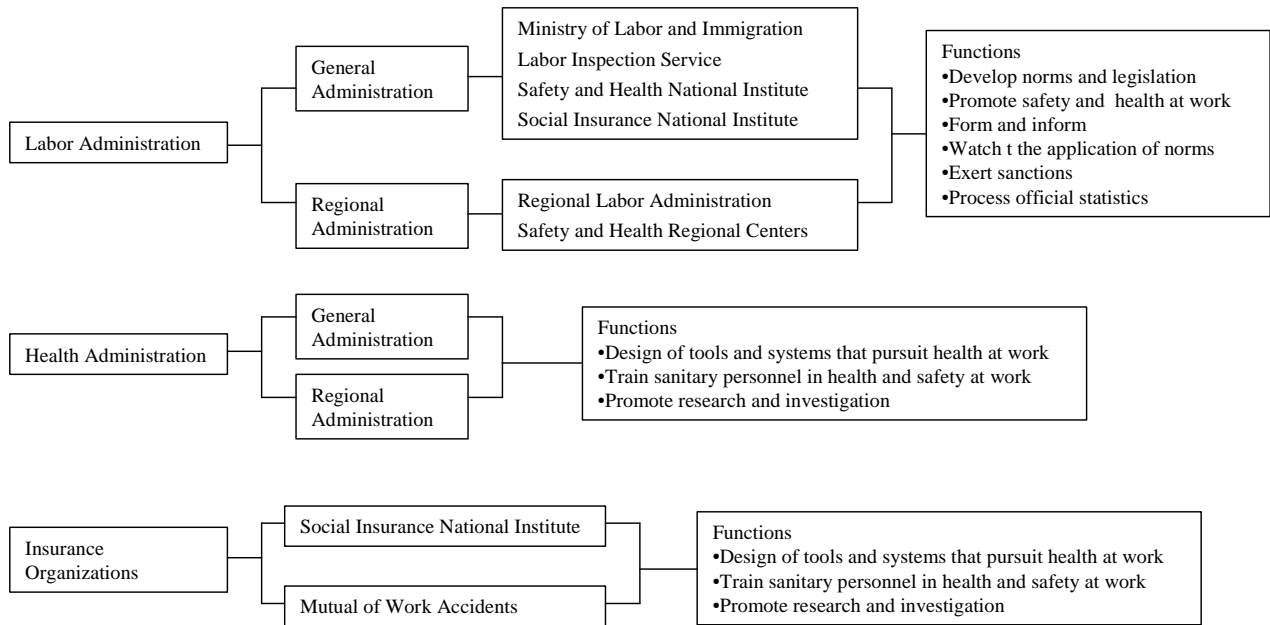**Work Injury Rates by Industry and Occupation**
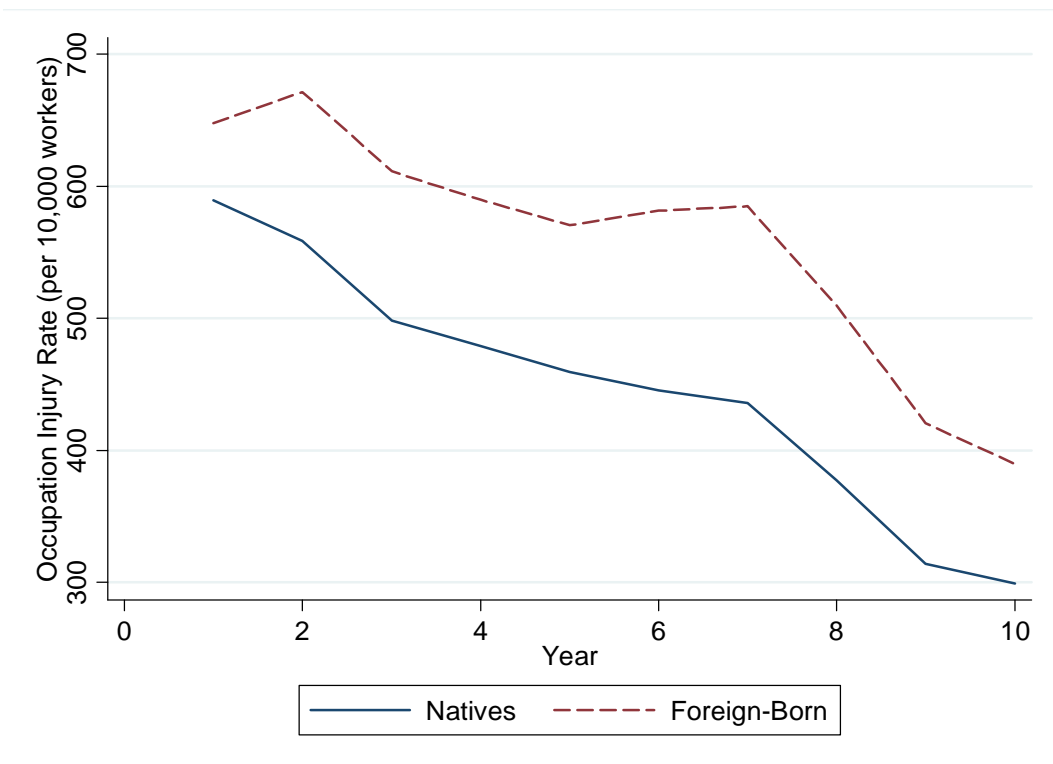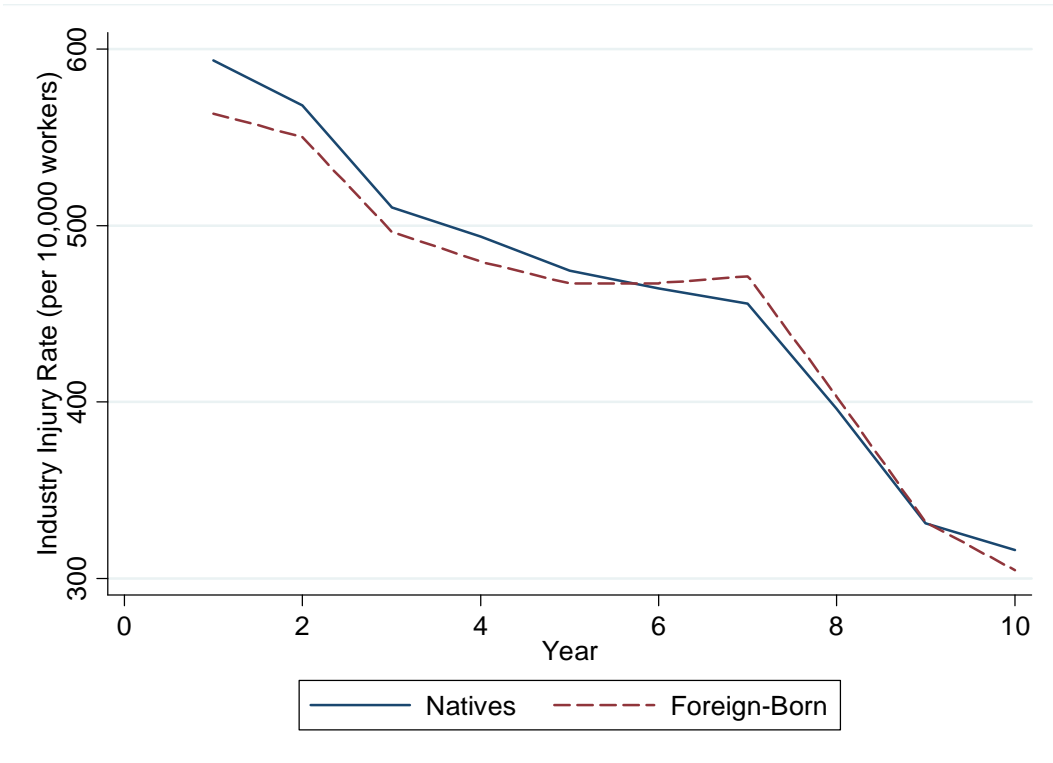
Figures 2A and 2B:
Work Fatality Rates by Industry and Occupation
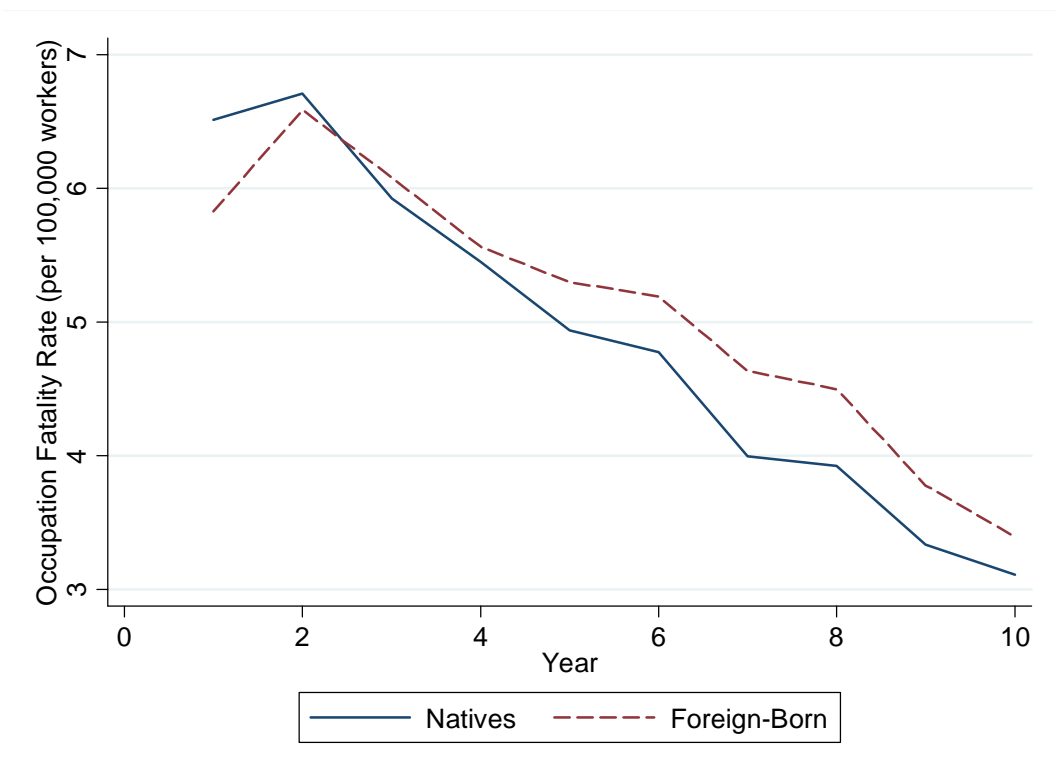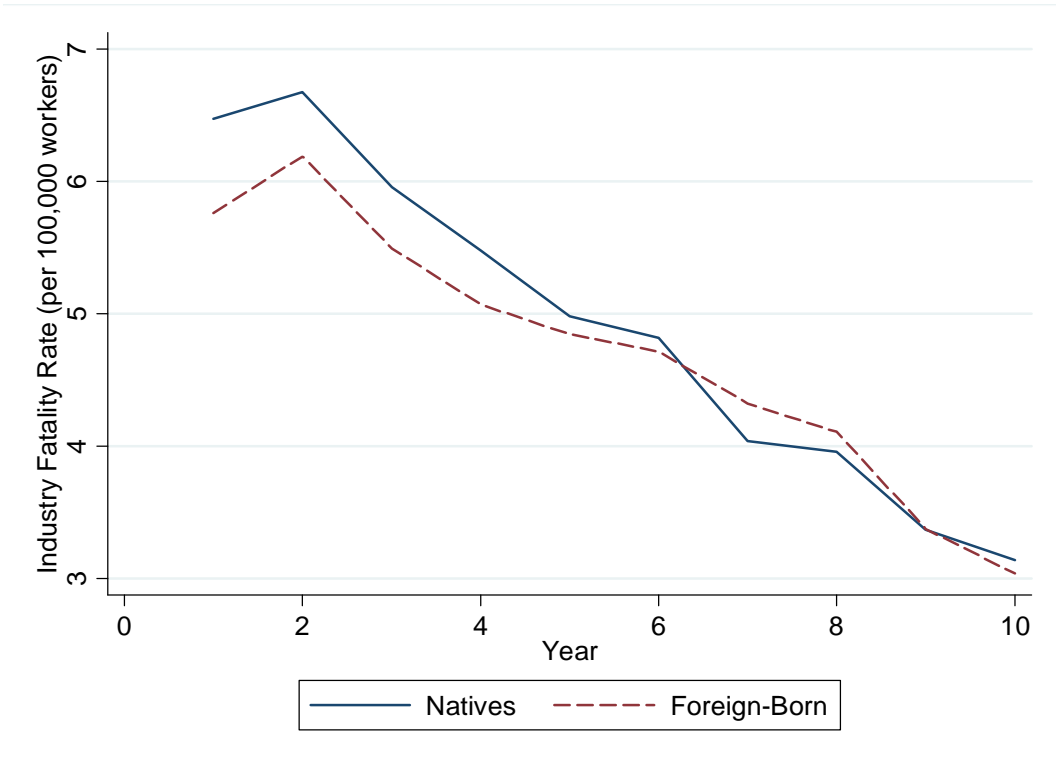
Appendix
Figure A.1 Organizational Structure of the Spanish National System of Safety and Health at Work

Labor Administration

General Administration
- Ministry of Labor and Immigration
- Labor Inspection Service
- Safety and Health National Institute
- Social Insurance National Institute

Regional Administration
- Regional Labor Administration
- Safety and Health Regional Centers

Functions
- Develop norms and legislation
- Promote safety and health at work
- Form and inform
- Watch t the application of norms
- Exert sanctions
- Process official statistics

Health Administration

General Administration

Regional Administration

Functions
- Design of tools and systems that pursuit health at work
- Train sanitary personnel in health and safety at work
- Promote research and investigation

Insurance Organizations

Social Insurance National Institute

Mutual of Work Accidents

Functions
- Design of tools and systems that pursuit health at work
- Train sanitary personnel in health and safety at work
- Promote research and investigation

Source: Adapted from Sesse *et al.* (2002).

Table A.1: Accident rates in Spain, 2009

	Accidents	Affiliates	Accident Rate
BOTH SEXES	**617.440**	**14.414.900**	**4,28**
Natives	541.996	12.914.738	4,20
Foreign-born	75.444	1.500.162	5,03
MALE	**453.762**	**7.855.400**	**5,78**
Natives	397.702	6.937.844	5,73
Foreign-born	56.060	917.556	6,11
FEMALE	**194.163**	**6.559.500**	**2,96**
Natives	168.866	5.976.904	2,83
Foreign-born	25.297	582.596	4,34

Notes: This table shows Accident rates by sex and immigrant status with information from the *Estadística de Accidentes y Enfermedades Profesionales*(MITIN, 2009) and the Social Security Affiliation Registry (MITIN, 2009)

Table A.2:
Share of Immigrants by Major Industry and Occupation Groups

By Industry/Occupation Categories	All Foreign-born	Africans	Asians	Europeans	Latin Americans	Other Regions
Major Industry Categories						
Agriculture, forestry, fishing, and hunting	15.12	4.54	0.24	4.92	5.42	0.01
Nondurable goods and wood products manufacturing	10.64	2.12	0.35	4.04	4.07	0.06
Mining and oil and gas extraction, utilities, and metal products	8.50	1.99	0.21	3.29	2.98	0.03
Machinery, electronic products, and electrical and transportation manufacturing	7.59	1.01	0.15	3.37	3.03	0.03
Construction	19.36	3.91	0.20	6.60	8.60	0.04
Wholesale and retail trade, accommodation and food services	15.42	2.12	1.17	4.58	7.49	0.06
Transportation and warehousing and Information	10.47	1.08	0.26	4.49	4.57	0.07
Financial activities, professional and business services	9.58	0.79	0.12	3.59	4.93	0.14
Education and health services and public administration	6.23	0.63	0.15	2.52	2.82	0.11
Other services	29.21	1.85	0.71	7.80	18.74	0.11
All industries	13.13	1.89	0.45	4.41	6.32	0.07
Major Occupation Categories						
Managers	8.71	1.03	1.14	3.87	2.52	0.15
Professionals	6.67	0.47	0.19	3.19	2.60	0.22
Technicians and associate professionals	6.78	0.44	0.18	3.18	2.86	0.12
Clerical support workers	6.97	0.55	0.17	2.82	3.37	0.06
Service workers	19.59	2.13	1.10	5.30	11.04	0.01
Sales workers	10.59	1.04	1.03	2.69	5.74	0.09
Skilled agricultural, forestry and fishery workers	7.15	2.14	0.20	2.65	2.15	0.01
Skilled construction workers	17.68	3.23	0.17	6.68	7.57	0.03
Skilled extraction and manufacturing workers	10.00	1.59	0.12	3.82	4.46	0.01
Craft and related trades workers	12.12	2.55	0.33	4.13	5.08	0.03
Plant and machine operators, and assemblers	9.13	1.63	0.15	3.55	3.77	0.02
Unskilled service workers except transportation	29.53	3.02	0.71	7.55	18.25	0.01
Unskilled non-service and transportation workers	26.99	7.44	0.47	7.32	11.74	0.01
All occupations	13.13	1.89	0.45	4.41	6.32	0.07

Note: Observations are weighted using the individual weights in the EPA. The sample includes only individuals aged 16 and older who are employed in the private or public sector, except for military personnel, and not self-employed.
Source: EPA (2001-2010).