

An analysis of occupational accidents on the basis of annual accident severity rates, over the period 1990- 2013 in Spain

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Abstract: The improvement of working conditions is one of the great objectives of the present-day productive society. In this investigative study, an analysis is therefore undertaken of accident severity rates in Spain between 1990 and 2013, based on data supplied by Government Agencies such as the Ministry of Employment and Social Security. The results of the study demonstrate the significant drop in the annual rate of severe accidents, above all in the last half of the time-span of this study; observing that this notable improvement coincides with the introduction of the Law on Occupational Risks Prevention. This Law has fostered a new culture of risk prevention management in Spanish firms, promoting greater health and safety at work.

Keywords: Occupational Accidents, Occupational Health & Safety, Prevention of Occupational Hazards.

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1 Introduction

Among the different variables used to record Occupational Accident Rates, some of them supply highly relevant data for analysis: age, sex, sector, and site of the accident. The availability of official data on a number of those variables at the *Ministerio de Empleo y Seguridad Social* [Ministry of Employment and Social Security] (MEYSS) means that we can analyze them across a broad time-span and thereby calculate the Accident Rate (A_r) with regard to accident severity.

Thus, after presenting the theoretical framework of the results obtained by other researchers over shorter time-spans, in this study, occupational accident rates are analyzed over twenty-four years, from 1990 to 2013.

The objective of this work is therefore to investigate the severity of different types of accidents as a variable, to establish their patterns and to find the causes that have led to the present situation; in such a way that firms can take efficient decisions that imply working to identify those actions that improve health, safety, and the quality of life of all workers in the firm.

2 Theoretical framework

Through the classification of an accident by its severity, we may categorize accidents as slight, severe, or fatal; a slight accident being very different from a fatal one, with regard to its costs and its consequences, both personal and entrepreneurial as much as family-related and even social.

There are abundant investigations and studies that have been developed on the severity of accidents, which have related this aspect to other very different ones, which might be related with the workplace, contractual conditions, different economic determinants, etc.

The severity of the accident offers us information of great relevance on this matter, as it points to certain patterns, depending on the activity carried out by the workers, the sectors to which they belong, the region in which they work, etc.

Some researchers have sought a better understanding of this relevant variable; its analysis may help us in this investigation, which has the objective of reducing the number of accidents as well as their severity.

In their work, Tomás et al. (2005) compared slight accidents with severe and fatal ones, to conclude that slight accidents are easily predictable through physical variables such as risks and environmental conditions present at the routine place of work, while the slight and mortal accidents are caused to a greater extent by organizational and social factors.

Boix et al. (1997) analyzed fluctuations in accident rates between 1988 and 1995 in terms of different variables, among which, accident severity. They pointed out that serious and fatal accident rates diminished notably, while slight accident rates increased.

Narocki C (1997) pointed out that when accidents were analyzed by severity, the most remarkable difference, in terms of firm size, was for severe accidents, but also for the total of all accidents and for slight accidents. They found that the pat-

tern of fatal accidents was different, so it would be interesting to investigate it further.

The study by Santamaría et al. (2006) analyzed the patterns of fatal accidents that occurred in the working day in Spain, between the years 1992 and 2002, in relation to economic activity, contractual obligations, age, and sex. They concluded that, on average, the rate in this type of accident fell annually by 4.3%, which represented a global drop of 38%. They also pointed out that the falling trend observed in fatal accidents in the working day was similar to that observed in other developed countries.

García and Montuenga (2009) investigated some characteristics relating to both employees and the jobs they occupy, and occupational accident rates according to their severity. They underlined that workers with greater work experience presented less risk of experiencing a severe or fatal accident, while extra hours increased that risk. They added that to reduce the impact of fatal accidents, the number of hours worked would have to be limited, especially in cases in which work experience can not be taken into account.

The investigations of Bande and Fernández (2007) centred on the Galician community over the period 1996-2002. They affirmed that both the individual variables and certain economic variables, such as the type of contract, length of service in the firm and the occupational group, played a decisive role in whether an accident is severe.

The study of the severity of injuries by occupational accident is key to the establishment of prevention plans according to Bolívar et al. (2009). In their study, solely involving data on the autonomous region of Andalusia, they affirmed that the severity of injuries was related to sex, age, and type of injury. Among men, it was also associated with professional standing, social class, the site of the accident, the staff, and performing tasks other than the routine ones. While among women, it was associated with the sector of activity. In addition, men presented a greater probability of suffering accidents of a severe nature.

Portolés et al. (2007), in their study, concluded that traffic was the principal cause of fatal accident injury rates in Catalonia, and that the administrations responsible for health and safety, labour, and traffic should coordinate efforts to prevent this significant public-health problem.

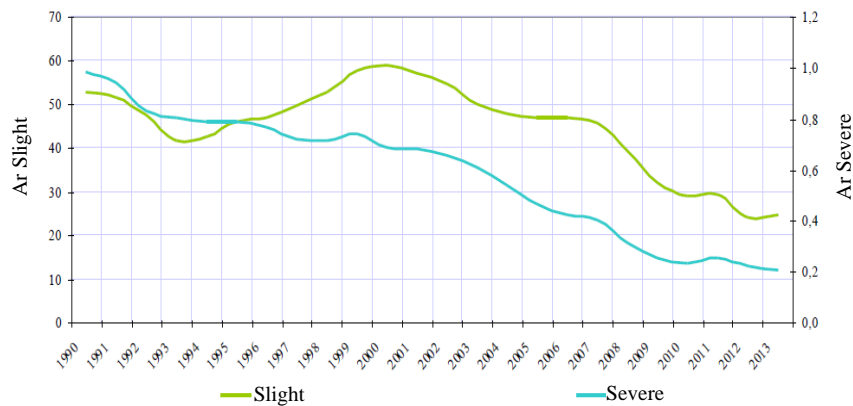
In an analysis on the severity of accidents in Singapore (Ng et al., 2010), the relation between severe accidents and the workplace was studied, concluding that a high number of cases of severe accidents were linked to the workplace: that the average age of victims was 37 years with a high percentage of men (95.4%) and non-residents (57.1%), as the most frequent ethnic group was Chinese (53.1%), followed by nationals (23.5%). The most common cause of these accidents was falls from height (66.3%), followed by injuries as a consequence of falling objects at work (21.9%). Patients admitted because of severe occupational accidents had an average admission stay of 5 days in the hospital, with an average of 24 days sick leave, with an average patient admission-to-discharge cost of around eleven thousand US dollars. They concluded by affirming that a better understanding of the epidemiology and the socio-economic impact of workplace-related accidents in Singapore was possible thanks to their study.

Therefore, from the analysis of the above investigations, it may be concluded that there is a need for studies that cover longer time-spans than have been done to date in Spain, in view of the great importance that accident severity assumes in relation to occupational accident rates. A conclusion that justifies this lengthier study of accident severity patterns over the past twenty-four years, through data facilitated by Spanish Government Agencies.

3 Empirical research and results

Accident rates by their degree of severity over the 24 years of this study (Graph 1 and Graph 2) show that slight accident rates were very much higher than serious and fatal accident rates. The annual average number of slight accident rates between 1990 and 2013 was 44.8, while the annual average value of severe accidents was 0.58 and of fatal accidents, 0.058. These figures allow us to affirm that the probability of suffering a slight accident was much higher than the probability of suffering a severe or fatal accident.

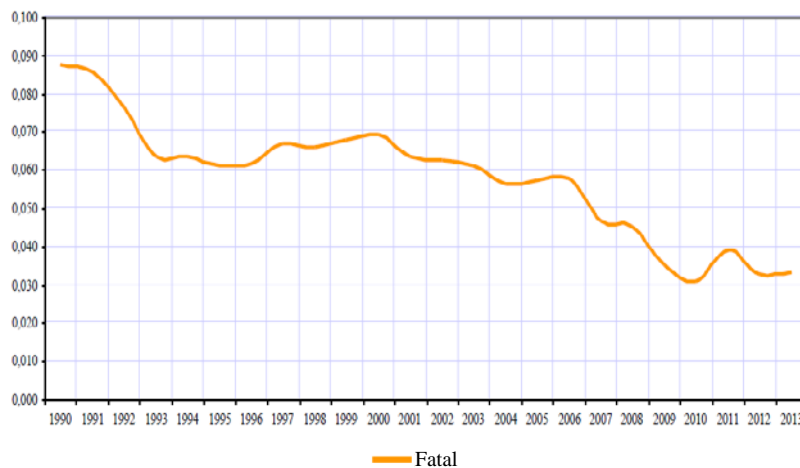
Analyzing the accident rates by accident severity in the first and second half of the time-span of this study, we can confirm that the average probability of suffering an accident varied in different ways according to its severity. Thus, while the average probability of suffering slight accidents fell by only 7% from 1990 to 2001 (the first half of the period selected), it fell by 55% in the second half (2002 to 2013). With regard to serious accidents, the figure was 31% in the first half and 68% in the second half. As for fatal accidents, a reduction of 27% was observed in the first half and 47% in the second half. Therefore, the probability of suffering a severe accident in the second half was practically halved in comparison with the first half; and something similar occurred for fatal accidents, although to lesser extent.



Graph 1. Severe Accident rates (Slight and Severe) and Year (per 1,000 workers). Source: Authors' own presentation of data from MEYSS

If we compare the variations in accident severity rates between 1990 and 2013, we see that rates were also reduced for all types of accident, although not in the same proportion, as the rate of slight accidents fell by 54%, the rate of severe accidents by 79%, and of fatal accidents 62%. Analyzing the whole period, it may be concluded that the greatest fall in the probability of suffering an accident (severe/fatal) was for the most severe accidents, as although that probability is reduced for slight accidents, it does so to a lesser extent.

The descriptive analysis therefore indicates to us that as the years passed by the general probability of suffering an accident, whether slight, severe, or fatal, was reduced by the same proportion, as it is the most severe accidents that have lowered that probability, which might be due to the intensification of training and health and safety prevention routines at a working level that have been implemented, above all since the entry into force of the Law on Occupational Risk Prevention.



Graph. 2. Accident severity rate (fatal accidents) and year (per 100,000 workers). Source: Author's own presentation of data from the MEYSS

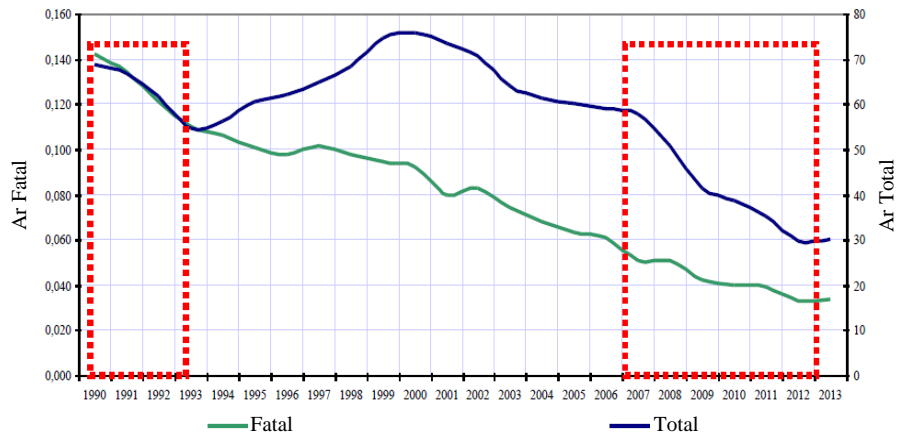
Looking at this analysis in greater depth and taking the contingency table of the variable *severity* with regard to the variable *year*, it is demonstrated that both variables share a relation of dependency with a significance level of over 99%. It confirms that such a relation is not by chance, as both the *chi-squared* value and the *standardized fitted residuals* (SFR) are within the intervals that guarantee causal relations.

Likewise, analyzing accidents at work through the *chi-squared* and SFR, we can confirm that the majority of accidents that took place were slight, as they represented 98.51% of the total, while accidents of a severe nature represented 1.36%, and fatal accidents, 0.13%. In other words, of the totality of accidents that occurred in this period, serious accidents and fatal accidents were no higher than 2% of the total.

4 Discussion and conclusions

In the twenty-four years that ran from 1990 to 2013, the probability of suffering a fatal accident at work has been considerably and progressively falling. So much so that this probability has fallen by 77%, while the probability of suffering an accident in general has fallen by 56%. Thus, the impact of fatal accidents reached its lowest value throughout the whole period in 2012.

As can be seen in Graph 3, the identical shape of the curve of General accident rates and Fatal accident rates stands out between the years 1991 and 1993. However, as from 1994, both lines described different trajectories.



Graph 3. General accident rate and fatal accident rate. Source: Authors' own preparation with data from MEYSS

Having analyzed the legislative developments and the measures implemented by businesses in the second half of the period under analysis, we may conclude that the application of the Law on Occupational Risk Prevention to the productive sector has created a new safety management culture in the workplace in Spain; the significant results of which may be seen in the results of the analysis conducted in this investigation.

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