The Effect of Human Capital on Occupational Health and Safety Investment: An Empirical Analysis of Spanish Firms

Human Capital and Occupational Health and Safety.

Abstract

This paper analyses how firms' human capital influences their investments in occupational health and safety (OHS). We argue that the incentive to protect workers by investing in OHS is a function of the stock of human capital. The empirical analysis was based on data from the official Working Conditions Spanish Survey on OHS management. Our sample was restricted to 1,472 firms from the manufacturing and construction industries. Our results show that firms which place more emphasis on training and have a multi-skilled and innovative workforce invest more in OHS. However, having technological and design skills have no impact on the investment in OHS, presumably because these skills are widely available in the labour market. Finally, the analysis suggests that some abilities such as problem solving may be affected by informational asymmetries and therefore firms may sub-optimally invest in protecting these capabilities.

Keywords: human capital; safety; workplace health promotion; management; advantage competitive.

1. Introduction

The relationship between skills, effort and workers' health have attracted the attention of the most prestigious economists from the very beginning of the discipline. Adam Smith (1776), for example, in the Wealth of Nations stressed that "*mutual emulation and the desire of greater gain frequently prompted them (workers) to overwork themselves, and to hurt their health by excessive labour*". To control the effect of work effort on health, the International Labour Organization (ILO) and the World Health Organisation (WHO) jointly established that the first and foremost objective of the Occupational Health and Safety (OHS) policies should be the "maintenance and promotion of workers' health and working capacity" (ILO, 2013). As firms and governments are responsible for OHS activities, they are obliged to protect workers and their human capital.

According to the Chicago School, human capital is the stock of knowledge, and some social and personal attributes (Becker, 1962). This stock determines workers' ability to work, and is expected to generate economic value for the organization. It follows that the value of a firm's human capital depends not only on the 'stock' variables belonging to each worker, but also on workers' actual capacity to generate economic value, which is determined by, amongst other factors, the health status of each worker. The professional sports industry illustrates this: expensive star players only contribute to a team's performance if their health is good enough to play. If they are injured or out of shape, their team's investment in human capital will not obtain the expected yield. This means that protecting and maintaining workers' (players') health is a human resources (HR) priority for professional sports teams; their competitive edge is strongly dependent on player health.

Despite the (allegedly) obvious, important relationship between human capital and OHS, the link between investment in OHS and the value of a firm's human capital has not been thoroughly analysed. Colbert (2004) claims that OHS activities have been systematically neglected in analysis of HR functions, which seriously hinders the development and implementation of effective OHS policies. Only some studies have analysed the relationship indirectly, and which estimated the effect of OHS activities on workers' productivity (Loeppke et al., 2009), or firms' performance (Fernandez-Muñiz, Montes-Peon, & Vazquez-Ordas, 2009). Others have analysed the relationship between organizations' work practices and occupational injuries directly (although without considering investment in OHS), including studies of high performance work systems (Barling, Kelloway, & Roderick, 2003; Zacharatos, Barling, & Iverson, 2005) quality management practices and technological and organisational innovations (Harrison & Legendre, 2003).

For the HRM field, the joint analysis of OHS investment and human capital has the potential to generate improved HR policies. MacIntosh, MacLean & Burns (2007), for example, stressed that the success in the implementation of some HR practices may be determined by workers' health status. Warr & Yearta (1995) analysed how the interaction between motivation and health affected absenteeism in workers. More recently, Van de Voorde & Beijer (2015) studied how high-performance work systems influenced employee's outcomes, including health. They observed that HR practices may improve work performance if they are associated with improvements in health-related variables. Ruiz & Corduras (2015) also investigated how certain HR practices contribute to the humanisation of the production process (one consequence of which is health improvements) and how these HR practices improve some performance indicators such as corporate entrepreneurship and productivity.

In this paper, we argue that the relationship described in the sport industry, between an organisation's human capital and the investment in OHS, may also be in force in other sectors and firms. Hence, firms with a strong human capital should be more interested in investing in OHS to "maintain and promote workers' health and working capacity" as defined by ILO/WHO. We focused our analysis on a sample of 1,474 Spanish manufacturing and construction firms, and where occupational risk is quite high in both industries. OHS activities and human capital were measured by responses to the VI Encuesta Nacional de Gestión de la Seguridad (ENGE) survey sponsored by the national body responsible for OHS in Spain, the Instituto Nacional de Seguridad e Higiene en el Trabajo (INSHT)[1].

2. Theoretical Conceptualization. Human Capital Investment in OHS.

The human capital of a firm can be analysed, fundamentally, at two levels: individual and organisational. At an individual level, human capital theory was the brainchild of Becker (1962), who recognised health and fitness as components of human capital. This perspective suggests that firms' investments in OHS may increase their stock of human capital, as does, for example, investment in workers' training. Individual health thus becomes an intangible asset of the firm.

At the organisational level, which is the focus of our analysis, human capital is the sum of the skills and capabilities that a firm employs in the production process (Wright, Coff, & Moliterno, 2014). Ployhart and Moliterno (2011) stressed that human capital in this sense is an asset that belongs to the firm. Furthermore, as human capital is a productive asset, it should contribute to the firms' production and value, and therefore, enhance its competitive advantage (Barney & Wright, 1998). At an organisational level, workers' health is not usually considered a component of human capital. With the exception of a small number of sectors which make very specific demands of workers, such as professional sport, it seems unreasonable to suggest that the workers' physical condition can generate a competitive advantage for a normal firm. On the contrary, it is quite clear that poor health or accidents and injuries may hinder the effective use of workers' *productive* skills and capabilities.

Our theoretical proposition is not that firms invest in OHS to increase their human capital, but that they do so to protect it and make it available. In a recent article, Ployhart,

[1] National Institute of Occupational Health and Safety.

Nyberg, Reilly, & Maltarich (2014) discussed the difference between human capital and human capital resources; they stressed that the difference between the constructs is in firms' level of access to their stock of human capital. They argue that traditional human capital components, such as knowledge or skills are only significant if they are accessible for a firm relevant purposes. On the basis of this distinction we understand firms' investment in OHS as an organisational mechanism by which the stock of human capital embodied in workers is made available to firms' production processes; in other words, investment in OHS may transform unproductive human capital into a source of competitive advantage for a firm.

If this conceptual approach is accepted, then investments in OHS and, for example, training, do not contribute equally to a firm's human capital. Investment in training may increase a firm's stock of human capital but if the trained workers are not fit for work due to accidents or sickness it will not yield any competitive advantage. Firms with large stocks of human capital thus have a particularly strong incentive to minimise accidents and sickness among their workforce by investing in OHS.

The formalisation of the market of OHS first developed by Henderson (1983) may help to illustrate the relationship we have proposed. Henderson (1983) assumes that the investment in OHS is no different to other decisions made by firms and workers, and therefore is informed by cost and benefits functions. Rational firms in a competitive market will therefore invest in OHS to the point where marginal costs and revenues are equal. From that starting point, economists have tried to identify the components of these functions, with particular interest in wage differentials (Viscusi, 1993), inspections and sanctions (Shapiro, 1999) or incentives linked to the insurance system (Ruser & Butler, 2010). In this paper, we argue that human capital will depict the form of the OHS benefit function and consequently it will determine the level of optimum OHS investment.

Accordingly, we posit that:

Hypothesis 1: Investment in safety (OHS) is positively related to human capital stock.

Based on Ployhart and Moliterno's (2011) definition of human capital as an organisational resource that emerges from individuals' knowledge, skills, abilities and other characteristics (KSAO) we operationalised Hypothesis 1 as a series of sub-hypotheses:

Hypothesis 1a: Firms where the workforce is highly knowledgeable will invest more in OHS.

Hypothesis 1b: Firms where the workforce is highly skilled will invest more in OHS.

Hypothesis 1c: Investment in OHS is positively related to workers' abilities.

3. Method.

3.1 Data and Sample

The sample is based on the IX Encuesta Nacional de Gestion de la Seguridad y Salud en el Trabajo (ENGE 2009)[i], conducted by the Spanish National Institute for Safety and Health at Work. The unit of analysis is the firm and the survey collected a unique set of data on OHS indicators, management practices and job design parameters. The survey was targeted at managers or company owners with at least one registered worker in the social security system. The population comprises 1,120,276 units and comprises companies in all sectors throughout Spain (except Ceuta and Melilla). The random sample survey included a total of 5,147 firms.

In our analysis we limited the sample to the construction and manufacturing industries, where the level of occupational risk is higher and easier to measure. We excluded the service industries because the occupational risk in this sector is close to $p \approx 0$, and in such cases the influence of the quantity of human capital on investment in OHS will be very small, and therefore difficult to estimate empirically. Finally, we restricted the sample to firms with ten or more employees to ensure that we only considered firms with a developed HR function and OHS management system. The resulting sample consisted of 1,472 firms; descriptive statistics for the sample are listed in Table 1.

[Insert Table 1]

3.2. Dependent Variable

We measured investment in OHS using a specially developed additive index of nine measures which have been or have not been implemented by a firm. The index is an ordinal measure of overall investment in OHS, which would, ideally, be measured in monetary units; however this information was not available from this survey. Furthermore, the lack of accounting standards for the costs and revenues of OHS is a widespread problem which affects not only surveys, but more importantly, OHS practitioners and firms. In most national accounting systems, OHS costs and revenues are reported under different accounting items, which dramatically reduces the visibility of OHS performance (Rikhardsson & Impgaard, 2004).

We opted to construct an ordinal index of OHS investment as an alternative to a direct monetary indicator based on the assumption that firms implementing a given OHS measure are investing more in OHS than they would if they did not implement that measure. It is important to note that because we used an ordinal construct we cannot compare OHS investment between firms. For example, if firms A and B both score 2 this does not mean that they are investing the same amount of resources in OHS. This limitation is particularly important when, as is the case in practice, there are differences in the resources needed to implement particular OHS measures. For example, it may be more expensive to ensure that all employees undergo a specific medical examination than assigning OHS responsibilities.

To measure the internal robustness of the additive index, we used Cronbach's Alpha. We used the usual threshold of values over (λ=.70) to accept that the additive index is measuring the same construct. The internal robustness of the index was very good (λ=.83), and we found that, on average, firms implement 6.29 measures out of 9. As expected, basic measures such as development of an OHS plan (86.4%) or planning OHS activities (81.4%) are more widely implemented than more specific measures such as medical examinations (42.7%) or simulated emergencies (52.3%). It is important to note, however, that firms have a legal duty to implement most of these measures, and so what appears to be high implementation frequencies actually indicates that firms are not complying with the law quite frequently. We deliberately excluded OHS training activities from our OHS investment index as some human capital variables include training and we wanted to avoid the risk that we would be measuring the same factor as a dependent and independent variable.

3.3. Independent Variables.

As explained above, we determined firms' stock of human capital by measuring the KSAO embedded in their workforce. In this analysis, we will focus on the stock of Knowledge, Skills and Abilities, as it is difficult to define and measure what is embedded in the more generic Other dimension. The unit of analysis is the firm, and therefore frequencies in Table 1 show the percentage of firms implementing each preventive or organizational practice.

First, we tested *Hypothesis 1a*, by estimating *knowledge* based on the scope and content of firms' training activities. We simply assumed that the stock of knowledge is higher in firms where more workers receive training (greater scope) and where training is delivered more frequently, because "knowledge contained in any given process is proportionate to the time it takes to learn it" (Pavlou et al., 2005). We observed that on average firms provide training for 3.06 out of 5 worker categories and the category least likely to receive training was outsourced staff, as only 28.0% of the firms in the sample provide training to this group. Inspection of data on training frequency also showed that firms are most likely to provide training when hiring new staff (50.7%) and when improvement programmes are introduced (64.3%). Finally, to control for the source of training, distinguishing between internal and more specific training, and external and more generic training, we include a dummy variable that identifies firms

(30,6%) that provide training by using external institutions such as universities, unions or consulting firms.

To test the next two sub-hypotheses we introduced a set of variables measuring skills and abilities. Unfortunately, it is not always easy to distinguish and separately measure workers' skills and abilities. This is even more complicated when the unit of measure is the firm and not the individual worker, as in our case, and also the case of many of previous studies on human capital (Wright & McMahan, 2011).

The following measures are therefore proposed in order to approach the stock of skills and abilities embedded in the firm, but do not attempt to provide a clear cut differentiation between skills and abilities. As we are aware that some readers may understand skills and abilities differently in the proposed classification. Nevertheless, we understand that they are adequate measures for our analysis, as they are clearly and positively related to firms' average stock of human capital.

To test *Hypothesis 1b*, we used a set of variables measuring the skill mix of firms: frequency of multi-skilling (58.6%) and the percentage (12.8%) of firms that are strong in new technologies. We assumed that firms where workers have multiple skills and firms where new technologies are introduced have a richer skill mix among their workforce and therefore have more incentive to protect their workers by investing more resources in OHS. We also include a dichotomic variable identifying firms where the design of new products is among the two major strategic goals (20,8%). Leornard-Barton (1992) identifies some core technical and managerial skills or capabilities that are key to the development of new products. In our analysis, we simply expect that these design-oriented firms will need to incorporate these skills and, as a result, their stock of human capital will be larger.

Third, to test *Hypothesis 1c*, we introduced two variables, workforce ability to solve problems (45.1%) and a dichotomic variable that identifies firms (5.4%) where innovation is among their strategic priorities. Sullivan and Ford (2010) stress that innovation is linked to some personal abilities or attributes broadly embodied in the concept of creativity. We expect that these innovative firms will also have a more creative workforce, making their stock of human capital higher.

Finally, we included some control variables in order to gauge the level of occupational risk in firms. First, we created a risk index based on respondents' assessments of firms' OHS risk. In particular, the respondents assessed the risk of accidents, occupational diseases and special activities that involve high risk. We also included the industry and size of the firm in order to control structural and institutional characteristics of the firm. This sample was mainly composed of firms in the manufacturing industry (81.5%) and medium sized firms (133.70 employees). Finally, we included past administrative sanctions (15.1%) and surcharges in the social security fees (7.3%) paid by firms in order to control the effect of the enforcement of OHS regulations.

4. Results

4.1. The Ordered Probit Model.

Human capital variables are usually correlated and therefore multicollinearity becomes an important methodological issue when their relationship is econometrically analysed (Heckman & Vytlacil, 1998). Lack of independence between human capital variables is quite common as, for example, individual knowledge may be the origin of personal skills, or the result of the ability to learn. First, in order to identify possible multicollinearity problems, in Table 2, we computed the pairwise Pearson's correlation coefficients for the explanatory variables.

[Insert Table 2 around here]

As expected, this revealed that most variables were positively related. However, in most cases the level of correlation was reasonably low. Some additional tests such as the Variance

Inflation Factor (VIF) confirm that the multicollinearity problem was not grave enough to bias the estimations.

We defined the following model to estimate the relationship between investment in OHS and the stock of human capital. The first model is specified in Equation [1] and is estimated by means of an Ordered Probit regression. In order to avoid possible heteroscedasticity bias, we used the robust errors option available in STATA 14.

Model 1

$$y_1 = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \beta_4 x_4 + \beta_5 x_5 + \beta_6 x_6 + \beta_7 x_7 + \beta_8 x_8 + \beta_9 x_9 + \beta_{10} x_{10} + \beta_{11} x_{11} + \beta_{12} x_{12} + \beta_{13} x_{13} + \varepsilon_j \qquad [1]$$

The direct effects are listed in Table 3.

[Insert Table 3 around here]

The results provide strong support for *Hypothesis 1*. There is an association between human capital stock and investment in OHS. In particular, *Hypothesis 1a* is supported by the coefficients of training scope (β=.177, ρ=.000) and frequency (β=.126, ρ=.000), both strongly significant coefficients. In line with our theoretical proposal, the results show that when firms have enhanced their human capital through training, they protect it by devoting more resources to OHS. The results also reveal that the external source of training does not affect the investment in OHS. In other words, both specific and generic human capital gains are equally protected by firms' investment in OHS.

The results also provide support for *Hypothesis 1b:* there was strong evidence that the multi-skilling dimension of human capital (β=.276, ρ=.000) influenced investment in OHS. However, we find no evidence that investment in OHS was related to the need for technological skills, or to design skills. As we will discuss further, these results may indicate that firms in the sample do not consider these skills of strategic value or, alternatively, they find it easy to replace these types of skills using external markets.

We also found support for *Hypothesis 1c,* as coefficients for abilities linked to innovation (β=.220, ρ=.052) and problem-solving (β=.235, ρ=.000) were positive and significant. The results reveal that firms find it necessary to protect their workforce more intensely when their employees have these particular and quite rare abilities. Finally, we obtained the expected results for the control variables; all coefficients were positive and significant: risk index (β=.083, ρ=.001), industry dummy (β=.252, ρ=.001), company size (β=.087,ρ=.001) and administrative sanctions (β=.384, ρ=.000).

4.2. Analysing the endogeneity problem.

The rigorousness of the results presented above are based on the assumption of a unidirectional relationship between human capital stock and investment in OHS. However, this relationship may work the other way around leading to a classical endogeneity problem where the stock of human capital may be explained by the OHS investment. In particular, it can be argued that skilled workers may prefer safer firms as suffering an accident or illness may be more costly for them in terms of the loss of the opportunity to develop their (more optimistic) careers. The wage premium theory precisely stresses that workers will be sorted in firms according to their preferences between risk or wage (Viscusi, 1993), and therefore it is likely that the workforce of safer firms will be composed of workers with better career prospects or, in other words, workers with higher human capital stock.

The Instrumental Variable (IV) estimation models are the common solution to endogeneity problems. The IV models are estimated in two stages. In the first-stage, the endogenous variables (human capital variables) are used as dependent variables and the Instrumental Variables are used as explanatory variables. In the second stage, the dependent variable (OHS investment) is regressed against the predicted values of the endogenous variables estimated in the first-stage regression. IV models have to comply with two conditions in order to become valid and robust estimators. First, IV variables have to significantly relate to the endogenous variables and, as a second condition, they should remain unrelated to the dependent variable (Angrist and Pischke, 2009).

Finding adequate instruments is a difficult task, particularly when the model contains multiple endogenous variables. In our case, we needed eight instruments for the equivalent number of endogenous variables. In order to estimate our model, we used several *official regional educational and health indicators* listed in Table 4 as instrumental variables. The relationship of early education and health with future human capital is straightforward and well documented in the literature (Schulz, 1961) and therefore these variables will observe the first condition. Regarding the second condition, it seems quite reasonable to think that variables such as the number of students per teacher or the per capita expenditure on education will not inform a firm's private decision to invest in OHS. Hence, only through the effect of human capital, may these educational variables affect OHS.

It is also worth to stating that the educational and health variables are obtained for each Spanish autonomous region and not for each firm. We understand that this is not a problem as the education in Spain is a fully decentralized system where each autonomous region decides key variables such as investment in education, per teacher ratios or teaching methodologies. This decentralized system does create strong differences in the performance of the educational system, and indicators such as the PISA scores by region, for example, are notably different (Economic and Social Council of Spain, 2009). Furthermore, the Spanish labour market is also characterized by its geographical rigidity (Huber, 2004) and therefore is very likely that workers educated (differently) in each regional system will also be employed in the same region. We believe that these two characteristic of the Spanish case reinforce the validity of our instruments.

In Table 4 we list the coefficients obtained for the IV models in each of the eight first stage equations.

[Insert Table 4 around here]

Briefly, we observe that IV are, in general, significantly related to the endogenous variables. We also find a better fit with knowledge and skills variables where most of the instruments are positively and significantly related. Not surprisingly, the fit of the instrumental variables with the abilities variables is not that good, as these are understood to be more innate (less educational) attributes. In any case, the PISA score in science is related for the case of problem solving and innovation and, for the former, some other good instruments are also found. The results of the first-stage equation suggest that the proposed IV model provides a reasonable control for the alleged endogeneity bias.

As we explained above, our dependent variable is an Ordinal variable with nine possible levels of OHS investment. The estimation of Ordered Probit models with eight instrumental variables is an econometric challenge, as the main econometric packages do not offer the option to estimate Instrumental Variables in non-linear models. In order to provide some robust estimates, in the first column of Table 5, we list the results obtained with STATA 14, assuming that our dependent variable is normally distributed. It is important to acknowledge that our dependent Ordinal variable has nine categories and therefore it quite closely represents the continuous and normally distributed latent variable (i.e OHS investment in euros).

In order to improve the robustness of our results, we also applied a two-step procedure proposed by Sajaia (2008) in which we estimate the eight predicted values of the instrumental variables listed in Table 4, and then, we use these variables as independent variables in the structural Ordered Probit model. Results are shown in the second column of Table 5, and they are quite similar to results obtained assuming normality. In any case, in order to ensure that our

Hypothesis are empirically supported, we have only considered the coefficients that are significant in both models.

Table 5 shows the results for the structural equation where coefficients are estimated once the endogeneity is controlled by the IV model in the first-stage regression. Results in Table 5 will therefore capture the unidirectional relationship between human capital and firms' decision to invest in OHS.

[Insert Table 5 around here]

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We find that results for training scope (β=1.29,ρ=.010), multi-skilling (β=10.5,ρ=.053) and innovation (β=3.72,ρ=.048) are positive and significant and therefore we can confirm the hypothesis above. These results suggest that, regardless of the preferences and behaviours of skilled workers, firms do increase their investment in OHS when training is extended to more types of workers, when the workforce provide a multiple and diverse of set of skills and, finally, when workers provide some abilities and attitudes linked to innovation.

The main difference between the Ordered probit model Table 3 and the IV models in Table 5 is the results obtained for the problem solving ability. In Table 3, the coefficient was positive and significant while, once endogenity is controlled, the problem-solving ability becomes non-significant. The problem-solving ability is a mainly innate characteristic and therefore may be easier to be observed by the worker than by the firm. In the case of un-observability or asymmetric information, firms will not be able to incorporate the information regarding the value of their problem-solving asset to the decision on OHS investment. The results obtained in the linear model will therefore be clearly endogenous, as only the preference of workers with this ability for safer firms may explain the estimated positive relationship.

We also found some differences between the Ordered Probit model and the IV models regarding training frequency. In particular, the coefficient changes from significant (β=.126, ρ=.000) to non-significant (β=.241, ρ=.812). This result may suggest that, as stressed by Acemoglu and Pischke, (1999), highly skilled workers may select jobs offering intensive training programs. The positive relationship between human capital and safety investment estimated in the Ordered Logit model may not be related to firms' decision to invest in OHS, and therefore disappears when endogeneity is controlled.

5. Discussion and Conclusions.

In this paper we have shown that firms' human capital stock and their decisions about investment in OHS are positively related. We argued and demonstrated empirically that firms protect their human capital by investing in OHS resources. We believe that this analysis opens up some interesting avenues for further research into HR management, particularly in relation to clarifying what the core HR activities should be and for the better integration of the OHS management in the firms' decision making process.

This paper broadly contributes to the human capital field of study in the following form: First, it shows that firms are not only devoted to hiring or creating human capital, as previous literature has extensively studied, but are also worried about protecting human capital assets. Our empirical analysis, therefore, reinforces the idea of human capital resources stressed by Ployhart et al (2014) where the emphasis is made in the level of access (or availability) to human capital, rather than in the stock. Second, our paper also shows that firms do not protect the components of human capital equally, suggesting that human capital is also managed strategically. In particular, we find that firms are mostly interested in protecting the human capital components that are rare (innovation) or difficult to replace (multi-skilling). Finally, our analysis on endogeneity suggests that some informational asymmetries between firms and workers may lead to some non-efficient investment decisions. It may be the case of innate abilities such as problem-solving that appears to be correlated to OHS investment only by workers' choice of safe firms.

We draw the following conclusions from our results. First, there is a clear relationship between firms' investment in the internal creation of human capital (training) and their investment in OHS. This is particularly important given that training is part of the HR function and therefore is specifically and internally designed by firms. Other HR factors such as skills or abilities, for example, can be obtained by hiring from the external market and are therefore affected by informational asymmetries (Lazear and Gibbs, 2015). Furthermore, our analysis of endogeneity reveals that some valuable abilities such as problem-solving may be observed by workers but remain unnoticed by the firm. This evidence gives even more relevance to the long-term issue of human capital signalling. Our study suggests that skills that are easier to be signalled such as formal education or training may induce firms to over-invest in safety. On the contrary, less visible abilities such as problem-solving or creativity may not be optimally protected.

Second, our results show that the flexibility and adaptability associated with multi-skilling are valued more than purely technical skills. It should be noted that this finding may only apply to the Spanish labour market, whose rigidity and low mobility are partly responsible for the high rates of unemployment (Dolado & Jimeno, 1997). Workers in Spain tend to spend long periods of their working life working for a single firm and to specialise in certain roles and tasks. This ability is dependent on the versatility of the workforce; having workers who can perform tasks in several different production processes reduces the costs of direct and indirect recruitment (Gomar, Haas, & Morton, 2002). In short, workers who offer a variety of skills are difficult to replace, and therefore valuable to the firms.

In this sense, besides traditional human capital variables (i.e. knowledge and training), our results are in line with some authors that claim that the true competitive advantage lies in some social and organisational competences such as the autonomy to take decisions and the capability of sharing such decisions with the organisations (Wright, Dunford, & Snell, 2001). Ployhart et al (2014) stress that competitive advantage depends precisely on human capital resources at the unit level. This capital is formed by a unique and complex combination or interrelation of individual skills and capabilities that are observed at firm or departmental level. For a normal firm, incentives will therefore lie in the protection of the "*workforce*" rather than the protection of "*star workers*". Furthermore, these organisational and social capabilities are, in general, specific to a particular organisational context as they depend on mutual trust and organisational compromise (McKnight, Cummings, & Chervany, 1998); they may not be available in external labour markets and, therefore strong incentives to protect this intangible asset will arise.

In contrast, we found that some elements of KSAO are not rewarded with increased investment in OHS, for example, neither technical nor technological skills were positively related to the OHS index. There are two possible reasons for this, which are consistent with our theoretical perspective: (i) technical skills do not have a strategic value for firms and (ii) workers with these skills are easy to replace from external labour markets. Although we do not rule out the first possibility, the second seems more plausible if the particularities of the Spanish labour market are taken into consideration. In the recent decades, the number of moderately and highly educated workers in Spain has increased; however, despite this strong transformation, changes towards an economy based on advanced technologies are slow. Traditional industries, such as the construction industry, are still reliant on physical and manual work. In some senses Spain has become a paradigmatic example of what happens when the workforce is overeducated (Garcia-Mainar, Garcia-Martin, & Montuenga, 2014): many educated workers are driven to accept low-skill jobs in order to avoid unemployment or even emigration.

As explained above, one of the most important objectives of our paper is to show that firms' investment in OHS do respond to incentives, and therefore, in some circumstances, the administration may not need to spend vast public resources on the enforcement of occupational safety legislation. However, our results also show that, sometimes, firms fail to observe the real value of their human capital and therefore their investment in OSH may be suboptimal. Furthermore, some firms may not possess or need a large stock of human capital and therefore their incentives to invest in OSH may be weak. This is the case of firms where workers perform simple and routine tasks, and therefore their workforce is low skilled and easy to replace. In these firms, incentives to protect workers will be lower and the administration should intervene to guarantee workers' safety.

The results of this study also offer insights which may be of interest to those seeking to improve the management of OHS. First, our findings are consistent with a statement by the European Commission-funded European Network for Workplace Health Promotion in the Luxemburg Declaration (ENWHP,1997, p. 3) that "the future success of organisations is dependent on having well-qualified, motivated and healthy employees", and its efforts to encourage firms' to include OHS policy in their corporate strategy. The strategic importance of OHS was also emphasised in the Barcelona Declaration (ENWHP, 2002, p. 2) which stated that "good workplace health practice is a driver for social and economic success in Europe. The 'business case' for investment in workplace health promotion has been understood by successful organisations". .New models of management based on the principle that 'healthy companies are made up of healthy workers' are gaining traction in the current economic climate, in which different norms, standards and certification schemes are being developed and promoted by different organisations in different parts of the world".

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[i] National Survey on Health and Safety Management

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Table 1.

Variable description.

	Frequency/mean (Cronbach´s Alpha)	*σ*	*ENGE Question*
Sample	1.472		
Dependent Variable.			
OHS Index. (y_1)	6.29 (.8354)	2.586	*ENGE 39. Indicate if these OHS activities have been carried out in your firm:*
Development	86.4%		*Development of an OHS plan.*
Planning	81.4%		*Planning of the OHS activities.*
Control	67.7%		*OHS control activities.*
Emergency	74.9%		*Definition of emergency measures.*
Simulacrum	52.3%		*Dealing with simulated emergencies*
Information	83.4%		*Provision of OHS information*
Investigation	75.0%		*Accident investigation and analysis*
Responsibilities	65.8%		*Assignment of OHS responsibilities*
Specific medical examination	42.7%		*ENGE 36. Indicate if your company has offered workers the opportunity to undergo medical examinations in the last year*
Independent Variable			
Knowledge			
Training Scope (X_1)	3.06 (.7934)	1.678	*ENGE 42. Indicate the groups have received training*
Workers with OHS-related duties	70.2%		Workers with specific OHS-related duties
Directors	59.9%		Senior management or directors
Middle managers	67.9%		Direct and intermediate line managers
Other workers	80.0%		Other employees
Out-sourced staff	28.0%		External employees
Training Frequency (X_2)	2.75 (.7805)	2.350	*ENGE 43. Indicate the reasons for training*
New workers	50.7%		Hiring new workers
OHS functions	29.4%		Assigning OHS functions to certain workers
Changing roles	21.9%		The change in the functions performed by the worker
New technologies	19.3%		The introduction of new technologies
Work equipment	18.9%		A change in work equipment
Demands	16.2%		Demands for workers or their representatives
Identification of hazards	34.8%		Hazard identification and risk assessment
Investigation	20.2%		*Investigation of occupational accidents and diseases*
Improvement	64.3%		The general improvement in OHS training
External Training (X_3)	30.6%		*ENGE 44. Entity that has dispensed the training*

Skills			
Multi-skilling (x_4)	58.6%		ENGE 13. Indicate if these management tools have been used in your firm
High-Technology (x_5) (Over 71%)	12.8%		ENGE 45. Indicate what percentage of your companies purchases of machinery (excluding computers) have been new machinery during the past two years.
Design (x_6)	20.8%		ENGE 12. Sort these factors according to your company´s business strategy.
Abilities			
Innovation (x_7)	5.4%		ENGE 12. Sort these factors according to your company´s business strategy.
Problem-solving (x_8)	45.1%		ENGE 13. Indicate if these management tools have been used in your firm
Control Variables			
Risk Index (x_9)	0.85 (.776)	1.215	*ENGE 11 Indicate if your firm carries out particularly dangerous activities* *ENGE 15. Indicate if there is a risk of workplace accidents, occupational diseases, or other diseases or disorders related to work*
Industry (x_{10})	81.5%		ENGE 4. The main economic activity of the company in the workplace. [Manufacturing]
Company size (x_{11})	133.70	1.335	*ENGE 6. Indicate the number of people your firm employs at present*
Administrative Sanctions (x_{12})	15.1%		*ENGE 16. Indicate if your company has had any:*
Social Security Surcharges (x_{13})	7.3%		*ENGE 16. Indicate if your company has had any:*

Table 2.

Pairwise Pearson's correlations for explanatory variables.

Variables	Correlations (Significance level) 1	2	3	4	5	6	7	8	9	10	11	12	13
1. Training Scope	1.000												
2. Training Frequency	.559**	1.000											
	(.000)												
3. External Training	.299**	.503**	1.000										
	(.000)	(.000)											
4. Multi-skilling	.169**	.160**	.097**	1.000									
	(.000)	(.000)	(.000)										
5. High technology	.098**	.169**	.153**	.095**	1.000								
	(.000)	(.000)	(.000)	(.000)									
6. Design	-.074**	.090**	-0.027	-.035	-.010	1.000							
	(.004)	(.001)	(.293)	(.184)	(.689)								
7. Innovation	.079**	.062*	.025	.060*	.017	.034	1.000						
	(.002)	(.018)	(.334)	(.022)	(.508)	(.192)							
8. Problem-solving	.157**	.154**	.059*	.325**	.013	-.040	.057*	1.000					
	(.000)	(.000)	(.023)	(.000)	(.616)	(.121)	(.030)						
9. Risk Index	.221**	.300**	.191**	.088**	.106**	.118**	.031	.084**	1.000				
	(.000)	(.000)	(.000)	(.001)	(.000)	(.000)	(.236)	(.001)					
10. Industry	-.041	-.018	-.041	.083**	.004	.037	.059*	.087**	206**	1.000			
	(.114)	(.494)	(.114)	(.001)	(.882)	(.087)	(.024)	(.001)	(.000)				
11. Ln Company Size	.354**	.477**	.336**	.170**	.111**	.014	.058*	.233**	.188**	.091**	1.000		
	(.000)	(.000)	(.000)	(.000)	(.000)	(.591)	(.026)	(.000)	(.000)	(.000)			
12. Administrative sanctions	.176**	.301**	.238**	.113**	.105**	-.058*	.000	0.051	.158**	-.058*	.231**	1.000	
	(.000)	(.000)	(.000)	(.000)	(.000)	(.027)	(.992)	(.050)	(.000)	(.027)	(.000)		
13. Surcharges	.166**	.250**	.189**	.119**	.120**	-.066*	-.009	.093**	.150**	-.015	.204**	.378**	1.000
	(.000)	(.000)	(.000)	(.000)	(.000)	(.011)	(.741)	(.000)	(.000)	(.565)	(.000)	(.000)	

**. The correlation is significant at the .01 level (bilateral).

*. The correlation is significant at the .05 level (bilateral).

Table 3.

Ordered Probit regression analysis on OHS investment index.

Independent Variable	Beta	Robust Standard Errors	
		Errors	*p*
Knowledge			
Training Scope	.177	.020	.000
Training Frequency	.126	.017	.000
External Training	.039	.071	.577
Skills			
Multi-skilling	.276	.059	.000
High technology	.018	.083	.827
Design	-.039	.069	.573
Abilities			
Innovation	.220	.113	.052
Problem-solving	.235	.058	.000
Risk Index	.083	.024	.001
Industry	.252	.074	..001
Ln Company size	.087	.025	.001
Administrative sanctions	.384	.090	.000
Surchages	-.101	.122	.405
Cut (0)	*-1.205*	*.296*	*.000*
Cut (1)	*-.609*	*.289*	*.035*
Cut (2)	*-.119*	*.286*	*.172*
Cut (3)	*.209*	*.285*	*.535*
Cut (4)	*.656*	*.285*	*.021*
Cut (5)	*1.201*	*.286*	*.000*
Cut (6)	*1.792*	*.286*	*.000*
Cut (7)	*2.627*	*.286*	*.000*
Cut (8)	*4.329*	*.286*	*.000*

Table 4.

First Stage Regression for Endogenous Covariates

Instruments [regional data]	Mean [dev]	Endogenous Covariate: Training Scope	Training Frequency	External Training	Multi-Skilling	High Technology	Design	Innovation	Problem Solving
Education Spending per capita	1.00	.006**	.005**	.025**	.017**	.048*	.021**	.058**	-.154
	[0.107]	[.002]	[.003]	[.005]	[.008]	[.042]	[.005]	[.001]	[.142]
Primary Schooling rate	85.23	-.003*	-.012**	-.001**	-.003**	-.003**	-.005**	-.001**	-.001**
	[6.97]	[.012]	[.004]	[.002]	[.002]	[.000]	[.000]	[.001]	[.001]
Higher education rate	24.04	.011**	.042*	-.004**	.005**	.009**	.004**	.004**	.007**
	[6.41]	[.005]	[.013]	[.004]	[.002]	[.001]	[.001]	[.000]	[.006]
Early school leaving rate	28.77	-.046**	.016*	-.010**	.010**	-.007**	-.003**	-.003**	.008**
	[5.958]	[.006]	[.015]	[.004]	[.003]	[.002]	[.002]	[.002]	[.007]
Pisa Score Science	500.03	.009**	.003**	.003**	-.001**	.001**	.005**	.005**	.002**
	[15.429]	[.001]	[.002]	[.004]	[.003]	[.000]	[.003]	[.000]	[.000]
Students per teacher	11.00	-.019*	-.196	-.078*	-.064*	-.049*	.015*	-.012**	-.006*
	[.940]	[.041]	[.051]	[.010]	[.022]	[.011]	[.010]	[.004]	[.014]
Universities per habitant	0.16	.054*	-.001*	-.003**	.009**	.003**	.012**	.002**	.001**
	[.069]	[.011]	[.014]	[.004]	[.002]	[.001]	[.001]	[.002]	[.002]
Child mortality rate	2.04	-.280	.132	.064*	-.034*	-.068*	.050*	-.002**	-.016*
	[.462]	[.075]	[.086]	[.022]	[.036]	[.021]	[.011]	[.008]	[.021]

**. The correlation is significant at the .01 level.
*. The correlation is significant at the .05 level.

Table 5.Structural equation of the analysis of OHS investment with endogenous covariates.

Independent Variable	Normal distribution	Ordinal Distribution
Knowledge		
Training Scope	1.29**	.411***
	[.505]	[.053]
Training Frequency	.241	.409***
	[2.00]	[.057]
External Training	-2.93	.007
	[12.3]	[.051]
Skills		
Multi-skilling	10.5*	.172***
	[5.22]	[.049]
High technology	-11.4	-.005
	[8.26]	[.048]
Design	-4.70	-.017
	[3.24]	[.047]
Abilities		
Innovation	3.72**	.193***
	[1.68]	[.049]
Problem-solving	-15.01	.054
	[19.7]	[.048]
Risk Index	.634***	.302***
	[.016]	[.042]
Industry	.315***	.463***
	[.074]	[.124]
Ln Company size	.738***	.466***
	[.025]	[.039]
Administrative sanctions	.180	.945***
	[.326]	[.150]
Surchages	1.61	-.166
	[3.34]	[.205]
Constant	*.878*	
	[.028]	
Cut (0)		*-2.418****
		[.288]
Cut (1)		*-1.835****
		[.279]
Cut (2)		*-1.358****
		[.275]
Cut (3)		*-.604***
		[.272]
Cut (4)		*-.077*
		[.272]
Cut (5)		*.491**
		[.272]
Cut (6)		*1.300****
		[.274]
Cut(7)		*2.964****
		[.282]
Cut (8)		*4.321*
		[.286]