

Abstract

Technological change and innovation affect many areas of society, in particular the labor market, by changing the relationship between employment and demand for certain skills. The aim of this work is to study the relationship between human capital and the duration of employment and how this relationship is influenced by the technology present in the sector, by using the Employment Survey data from 2011 to 2013, supplied by the Instituto Nacional de Estatística (INE). The econometric model proportional hazards (piecewise exponential) allowed us to make a deeper study and the results obtained revealed that the importance of technology together with human capital have a positive impact on duration of employment.

Key-Words: Skills; Technology; Duration of Employment; Human Capital; Duration Models.

1. Introduction

In a constantly changing and evolving society, a lifetime education is more and more important. In addition to the knowledge previously acquired, the renewal and the update are seen as valuable assets either at the personal or professional level. Although in the past people did not invest in complementary training other than the function they performed, this paradigm has undergone changes and currently, more updated and multi-purpose knowledge work almost as a pre-requisite, not only in the search for employment but also in their stay in the same. All this is due to the technological change which has affected the labour market and also to the relative demand for skills, requiring the professionals to have an increased knowledge in the field of several areas.

The main purpose of this work is to analyze the relationship between human capital and the duration of work. It also analyzes how this relationship is influenced by the technology and knowledge present in the sector. This study was based on the data collected through the Instituto Nacional de Estatística's employment survey from 2011 to 2013 with the purpose of evaluating the impact of the human capital together with the importance of technology and knowledge of the sector on the duration of employment. For this purpose, it has been used the econometric model proportional hazards (piecewise exponential), due to its adequacy to our data. The analysis thus focuses on seven determinants that can influence the duration of employment, which are, working time, age, gender, schooling, type of employment contract, technological intensity and knowledge of the sector and also the interaction between the latter co-variable and schooling. The present work also intends to give an overview on the panorama of living in Portugal in a period of crisis.

In fact, to analyze the dynamics of the labor market considering only employment and unemployment rates is insufficient thus being essential to consider several variables associated with the individual and the employment itself. The results obtained showed that people with more qualifications run a lower risk of being unemployed, putting at risk individuals with lower qualifications. When relating the level of schooling to technology, Castro Silva and Lima (2017) note that the workers with more qualifications and better skills run a lower risk of being unemployed and that the benefit of higher qualifications is mostly marked in companies with high levels of technology. In the same line of reasoning, Caselli (1999) concludes that in a labor market which is increasingly linked to the new technologies, the higher qualified workers enjoy an advantage by having specific skills related to the technology. This behavior is thus explained through Skill-Biased Technological Change (SBTC), a change in the skills demand, favoring qualified workers with more skills and competences. Lillard and Tan (1986) say, however, that more technology will require more specific human capital essentially in the form of on-the-job training.

Also, at the level of the wages, this positive relationship occurs when crossed with the technology of the company and with the level of qualification of the workers. Becker (1993) states that education, in addition to making workers more productive, encourages an increase in their wages. In this line of reasoning, Mincer (1958) highlights the existence of a positive relationship between the training of workers and their salaries.

A deeper analysis of the literature will be done in the next section. In section 3, a characterization of our sample will be performed, and the descriptive statistics associated with the sample will be presented. In section 4, the methodology that underlies the study, as well as the hypotheses to be tested will be presented. Section 5

is devoted to the discussion of the results obtained, and finally, section 6 includes the conclusions of all the work developed.

2. The human capital

Coined by the economist Adam Smith in 1776, the concept of human capital has been deepened in several studies and articles by Theodor Schultz and Gary Becker in 1960 (UNESCO, 2010) and this concept reinforces the advantage of individuals to invest, more and more, in their education. As a pioneer of this concept, Smith (1776/1963) was the first to relate the company incomes with the workers qualifications demonstrating that, from an early age, it has become aware that individuals have the skills and knowledge that can contribute to the performance and success of the organization they are part of.

According to Becker (1993), human capital can be defined as the set of capacities that the individual can acquire, through the accumulation of general or specific knowledge, that can benefit the company in its process of evolution. According to this author, human capital is replaceable, but it can never be transferred. This type of capital may exist in the individual from birth, through the so-called innate capacity, or can be developed through different forms at any point in his life, through education and training at work (Schultz, 1964; Giménez, 2005), and may determine the ability of the individual to perform a task (Giménez, 2005).

Having carried out more in-depth studies on this subject, Becker distinguished two types of human capital, as being, the general human capital and the specific human capital. General human capital is understood here as the individual's knowledge, skills and abilities that can be applied outside the organization to which they belong, that is to say, knowledge and skills that can be easily transferred from organization to organization. The specific human capital, in turn, corresponds to the individual's knowledge and skills that are only useful to the organization in which they are integrated, thus having a very limited application outside of it. Thus, according to Kiefer (1985), the most qualified individuals present higher levels of specific human capital of the company, since education and specific experience are taken as complements. For Mincer (1991), the most skilled workers are also more likely to receive on-the-job training and to remain in the company for a long period of time.

In a constantly evolving society, according to Kettunen (1997), employment opportunities increase with the number of years invested in education, whether formal (which occurs in educational systems such as schools, universities or polytechnic institutes), non-formal (which occurs outside of educational systems, being sought on a voluntary basis by the trainees, for example, vocational training or adult training) or informal (acquired throughout life, this being a process by which people acquire and accumulate knowledge, attitudes and behaviors through their daily experiences).

Workers who invest in their human capital and who, consequently, are more qualified, have more capacities,

thus presenting a greater advantage in the world of technology (Nelson & Phelps, 1996; Welch, 1970; Bartel & Lichtenberg, 1987).

It is also important to emphasize the importance of human capital in workers' wages. One fact that stands out from the theory of human capital is that education, in addition to making workers more productive, also promotes an increase in their wages (Becker, 1993). For Berman, Bound and Machin (1997), the demand for less qualified workers has declined dramatically in the United States and in several developed countries over the last decades. For these authors, the main explanation for this paradigm shift is related to the known Skill-Biased Technological Change (SBTC), that is to say, a change in the demand for skills caused by technological progress, which favors the most qualified workers (Berman, Bound & Machin 1997).

2.1. Technology and employment

As we become more and more connected and familiar with technology, job vacancies are geared towards more qualified and multi-skilled people who update and refresh their knowledge and skills. The debate about the influence of technology on the market dates back to the nineteenth century and, although there is no consensus among this relationship, many studies point to an increase in employment resulting from the product invasion that is registered in companies. Focusing on the impact that new technologies and technological change have on older workers, Friedberg (2003) asserts that these workers are the most disadvantaged by all this evolution, since, having fewer qualifications, they end up performing less complex functions that can be replaced by new technologies.

In this way, although technological innovation creates numerous opportunities, it also has consequences. One of these consequences is related to the possible increase in technological unemployment, since there will be less demand for less trained or less able workers. This may lead to less skilled workers being exposed to a period of high-unemployment or a low-paid job stream. Another consequence, as previously mentioned, is the search for new skills in the labor market.

Before this paradigm, Griliches (1969) has advanced that capital and qualified labor are relatively more complementary than capital and unskilled labor. This hypothesis, dubbed capital-skill complementarity, aims to show that, although capital can be complementary to all skill levels, the level of complementarity tends to be higher in skilled work. Under the hypothesis presented by Griliches, a higher valuation of specific human capital is expected in industries with a high level of technology, which could lead to a lower risk of unemployment. As emphasized by Vivarelli (2014), innovation is influenced by skills and thus the substitution of tasks carried out by low-skilled workers by tasks requiring more skilled workers is visible.

2.2. Human capital and the duration of employment

Empirical studies already performed point to another factor that can influence the duration of employment, being this, the characteristics of the worker and the company (Castro Silva & Lima, 2014). For Farber (1994), the risk of termination of employment decreases after the initial period, as the worker acquires company-specific human capital. According to Becker (1993), during working time, both the company and the worker invest in specific human capital, which causes an increase of the worker's productivity in the company in question, acting as an incentive for him to remain in the same company.

There is, however, another theory to explain the reduction of separation rates, with the possession of specific human capital by the worker. According to the matching theory (Jovanovic, 1979), the quality of the matching (match) between worker and employer is considered a good of experience, because as the stability of the job increases, both parties learn from each other.

When analyzing the risk of separation from work, it is possible to conclude that separation rates are lower for highly skilled workers working in high technology industries because of the relationship between training and skills and the use of technology (Castro Silva & Lima, 2017). Becker (1993) also shows that unemployment rates are inversely related to the level of schooling. Also, Castro Silva and Lima (2017) follow the same line of thinking, stating that more educated workers present better and more up-to-date qualifications and abilities, running, therefore, less risk of separation of employment in companies with high technology level.

3. Data

For our study on the duration of employment we used the Employment Survey conducted by the Instituto Nacional de Estatística (INE). This survey aims to characterize the labor market in Portugal, focusing, specifically, on the behavior of employment and unemployment at the national level (Correia & Lima, 2006). Starting in the 1970s, this survey aims to obtain periodic estimates on the active (employed and unemployed) and inactive population (students, retirees, etc.) (INE, 2014).

During this survey, each family has a unique identification number (ID) and is interviewed every three months for a maximum period of six consecutive quarters. The survey consists of several questions about employment and unemployment, as well as personal characteristics. Of all the questions included in the research, those of our interest are related to gender, age, type of contract, level of schooling, sector of technological intensity / knowledge and duration of employment. We use data for the years 2011 to 2013, counting x observations, of a total of z individuals. The data we used were for the period from 2011 to 2013, having been counted 479 326 observations, out of a total of 134 956 individuals. Contradictory or incomplete answers were

found, which led to its elimination and non-accounting for the study in question.

3.1. Sample

For our study, we considered only the last quarter in which the individual is employed, because these are the most recent data. We excluded from our sample individuals under the age of 16 and over 64 years of age and, as to their status with regard to work, we considered only civilian jobs and a professional status as an employee. Since our data refer to the years 2011-2013, we were not provided information on the first quarter of 2014 and, as such, were therefore excluded all the observations related to the fourth quarter of 2013, after identifying whether unemployment has been recorded for this quarter or not.

Our sample is thus reduced to 10 341 observations of 10 341 individuals. The number of observations presented is compatible with the number of individuals, since, as previously mentioned, we have only analyzed the data of the last quarter in which they were employed.

With regard to the classification of enterprises in manufacturing technology or intensive knowledge of services, the OECD definition was used, using the Eurostat version with NACE codes, Revision 2 at the 2-digit level. This variable is thus divided into two categories: knowledge and technology intensive sectors (KTIS), which encompass high- and medium-high technology companies and knowledge-intensive services; and less knowledge and technology intensive sectors (LKTIS) that encompass low- and medium-low-tech enterprises and less knowledge-intensive services.

3.2. Co-variables and descriptive statistics

The following table presents the descriptive statistics of the main co-variables used. As mentioned previously, our sample is composed of 10 341 observations, corresponding to 10 341 individuals. With regard to the average duration of employment, this corresponds to 8,61 years, knowing that the maximum value is 52 years, and most of the observations are within the first 3 years of service.

Table 1. Descriptive statistics

	Average	St. Deviation
Duration of employment (years)	8,61	0,102
Dur. of employment: 1	0,17	0,004
Dur. of employment: 2	0,15	0,004
Dur. of employment: 3-5	0,21	0,005
Dur. of employment: 6-10	0,17	0,005
Dur. of employment: 11-30	0,25	0,005
Dur. of employment: 31-52	0,05	0,002
Age (years)	37,36	0,127
Age: 16-24	0,13	0,004
Age: 25-34	0,35	0,006
Age: 35-44	0,24	0,005
Age: 45-54	0,18	0,004
Age: 55-64	0,10	0,003
Gender		
Female	0,56	0,006
Male	0,44	0,006
Residence		
Lisbon	0,32	0,006
Another Region of Portugal	0,68	0,006
Educational level		
Secondary or lower	0,81	0,005
Higher education	0,19	0,005
Type of contract		
Contract without term	0,64	0,006
Contract with term	0,36	0,006
Sector technological/knowledge intensity		
KTIS	0,39	0,006
LKTIS	0,61	0,006
Number of observations	10 341	
Number of individuals	10 341	
Number os failures	2 009	
Proportion of failures	19,43%	

In categorical variables, the average represents the proportion of observations in each category.

When analyzing the age of our individuals, the average age of our sample is 37, 36 years, we have verified a greater number of observations in the age group from 25 to 34 years. Regarding gender, 56% of our sample belongs to the female gender. The place of residence is important to our study due to the analysis of more technological companies / sectors and jobs. Most of the individuals in our sample live in another region of Portugal than Lisbon, where only 32% of the individuals live. It should be noted that, for another region of Portugal, the NUTS II division should be considered, the other regions being: North, Center, Alentejo, Algarve, the Autonomous Region of Azores and the Autonomous Region of Madeira.

When we approach the subject of educational level, we conclude that our sample presents, mainly, a little in-depth training, evidencing only basic / secondary education, data that are in line with the Portuguese population, that is, 81% of individuals have only secondary education or a lower qualification and 19% have an equivalent qualification to higher education. In terms of employment, about two-thirds of our sample has a no term contract and 61% of the individuals work in sectors less intensive in technology and knowledge (LKTIS).

Finally, about 19% of the respondents presented a failure until the end of the observation period, corresponding to a total of 2009 individuals. This failure refers to the number of individuals who in the next quarter are unemployed.

4. Methodology

We estimated models of employment duration with the purpose of determining how this is influenced by an individual's human capital and by the technological intensity of a company/industry. This will allow us to understand how the role of human capital varies with the different levels of technological intensity existing in the company. We thus introduce the principles of duration analysis.

Whether T is a continuous random variable, also known as the duration of a period, whether T is the "survival time" (in the present case, the duration of employment), with a cumulative distribution function, F (t):

$$\Pr(T \leq t) = F(t) \quad (4.1)$$

For the study on the duration of employment, the risk function (hazard) h indicates the conditional probability of an individual going from a certain state (becoming unemployed) at time t, since he remained employed until t. Assuming T as a continuous random variable, with the probability density function f (t), the cumulative distribution function F (t) and the survival function S (t), the risk function is given by the equation:

$$h(t) = \frac{f(t)}{1-F(t)} = \frac{f(t)}{S(t)} \quad (4.2)$$

The probability density function $f(t)$ represents the concentration of duration at each time point along its axis. In this case, the time the individual is employed.

Given that the primary objective of this work is to study the survival (or duration) of employment, we used models aimed at studying the probability of the individual leaving the job, that is, the hazard, as mentioned in the previous section. The econometric model used was the exponential proportional hazard, a parametric model, due to its simplicity and adequacy to our data. The parametric approach allows an estimate of the co-variables parameters but requires the investigator to make an assumption about the form of the baseline risk. These types of models fit a specified distribution in terms of unknown parameters to calculate the survival function. The use of these representations provides estimators that are easier to compute and more efficient when compared to non-parametric representations, including parametric procedures that require a specific functional form for baseline risk $h_0(t)$.

With the aim of facilitating the probabilistic analysis of duration dependence, Weibull model is the most used and defines the baseline risk function as follows:

$$h(t) = \rho t^{\rho-1} \exp(\beta_0 + x\beta_x) \quad (4.3)$$

in which ρ is the shape parameter, estimated through our data.

In this case, the hazard ratio increases steadily with time ($\rho > 1$), and a dependence of positive duration is observed; decreases in a constant way with time ($\rho < 1$), and we observe a dependence of negative duration or it remains constant ($\rho = 1$), an exponential risk function occurring. This latter case ($\rho = 1$), is the special case of the model of Weibull known as Exponential Model.

The exponential model, known as the simplest of parametric survival models, assumes that baseline risk is constant,

$$\begin{aligned} h(t|x_j) &= h_0(t) \exp(x_j\beta_x) \\ &= \exp(\beta_0) \exp(x_j\beta_x) \end{aligned} \quad (4.4)$$

for any constant β_0 . We use the notation β_0 to emphasize that the constant can also be considered as an intercept term of the linear predictor.

Our focus thus falls on a parametric continuous model in which baseline risk is modeled as a constant exponential by parts (piecewise-constant exponential) (Meyer, 1990) where we assume a constant risk rate within each interval, but we can vary between intervals. By allowing the baseline to take any configuration, we can get more consistent estimates of the parameters. Because this specification is so flexible, it allows a very weak assumption to be made about the form of the baseline risk and, since it may vary between ranges, it will be the data rather than the assumptions that will determine that same baseline risk. Although an erroneous specification of the risk function may somehow skew the estimates, Dolton and van der Klaauw (1995) conclude that the flexible modeling we have adopted addresses this issue. For reasons of robustness, we have

tested other types of models, such as the Weibull model, however, we have concluded that the constant exponential, by parts, is our best choice. We note, however, that we are ignoring unobserved heterogeneity and, according to Dolton and van der Klaauw (1995), our flexible specification greatly diminishes the effect of disregarding such homogeneity.

4.1. Hypotheses

The hypotheses considered in this study are as follows:

H₁. Workers with a long-term job run a lower hazard of unemployment.

As emphasized by Addison and Teixeira (2001), a longer working relationship will allow workers to accumulate an authentic and essential set of knowledge and skills in the (as well as for) the organization, in which they are inserted, that is, it allows the accumulation of human capital. Farber (1994) reinforces this idea by showing that the risk of termination of employment decreases after the initial period of work, as the worker acquires specific human capital of the company.

H₂. Individuals with a higher qualification have a lower hazard of unemployment.

According to Caselli (1999), more skilled workers have a greater advantage because they have specific skills related to technology. Thus, and as Becker (1993) concludes, unemployment rates are inversely related to the level of education of the worker.

H₃. Individuals working in technology and knowledge intensive sectors have a lower hazard of unemployment.

According to the capital-skill complementarity hypothesis from Griliches (1969), stating that capital and skilled labor are relatively more complementary than capital and unskilled labor, a higher valuation of specific human capital is expected in industries with a high level of technology, which can lead to a lower risk of unemployment.

H₄. Individuals with term employment contracts run a higher hazard of unemployment.

The results suggest that individuals with a type of permanent contract have a lower risk of becoming unemployed.

H₅. Male individuals run a lower hazard of unemployment.

Gender inequalities in the labor market are one of the greatest social challenges faced by the community, over time. No matter how much one wants to regularize and match, not only the opportunities for entry, but also the permanence in employment and even wages, the fact is that women are less likely to participate in the labor market when compared to men (International Labour Office, 2017).

H₆. Workers with higher qualifications working in technology and knowledge intensive sectors have a lower hazard of unemployment.

According to Vivarelli (2014), innovation is influenced by skills, being visible the replacement of tasks performed by low-skilled workers, by tasks requiring more skilled workers. It can, thus, be verified that the separation rates are lower for highly qualified workers who work in a high technology company (Morrison & Siegel, 2001; Castro Silva & Lima, 2007).

5. Results

All the models in table 2 analyze our variables of interest, such as, duration of employment, age, gender, type of employment contract, educational level, technological intensity of the current sector, as well as the relationship between these last two variables. To test our hypotheses, we have estimated several models that include different combinations of variables already analyzed with the purpose of seeing the impact of these co-variables.

The results are presented in the form of marginal effects in the hazard, to allow a clear and simple interpretation, when compared to the coefficients. Starting from the values, it is possible to observe if a variable provides an advantage or a disadvantage for the individuals. A marginal effect on the hazard with negative values, that is, values lower than 0, is associated to a lower hazard and to a longer survival time. In our case, this means that the individual has a lower hazard of going to unemployment and a longer duration in the current job. In turn, a marginal effect on the hazard with positive values, that is, values above 0 is associated with a higher hazard and a shorter survival time. In our case, it means that the individual has a greater risk of going to unemployment and a shorter duration in the current job.

Our study portrays the Portuguese population and, as presented in the descriptive statistics, each model records 10 341 observations in total, with a total of 2 009 leaving for unemployment.

Starting the analysis of the duration of employment, the results obtained reveal a level of significance of 1% in all models, showing that, as the time in employment increases, the risk of being unemployed in the following quarter decreases. In fact, although there is a greater risk in the initial period (1.5 p.p. in model 4), this risk is re-

gressing as time passes, due essentially to the accumulation of knowledge and specific human capital they acquire. Given this, we can conclude that our estimates can corroborate hypothesis 1.

The level of schooling is one of the topics that is currently most addressed when discussing the problem of employment duration, and the literature points to a positive relationship between the level of qualification and the risk of employment. When analyzing the level of education and the intensity of technology and knowledge of each sector (Model 3), and even these two variables and the interaction between both (Model 4), the variable of schooling ends up losing its level of significance from 1% to 10%. An explanation for this loss of significance is related to the small number of individuals in our sample who invest in a higher education level and further observations would be needed to increase the accuracy of our results. The results obtained in Model 1 allow us to conclude, with a significance of 1%, that workers with a higher education qualification have a lower risk of going to unemployment (1,2 p.p.) in the following quarter. The results obtained support hypothesis 2, by showing that the most educated individuals have a lower risk of being unemployed, due not only to their more current and multipurpose knowledge, but also because of their ease in working with new technologies and new communication tools.

In terms of technology intensity and current industry knowledge, estimates show a significance level of 1% in the three models where this variable is present. Thus, as evidenced throughout the literature review, individuals engaging in technology- and knowledge-intensive sectors have a lower risk (less than 1.4 percentage points than LKTIS workers) of going to unemployment in the following quarter (Model 3). These values are justified for two reasons. The first reason is because, when a worker is hired, he is already hired with a high level of knowledge and, as such, it will be more difficult for him to leave the company. The second reason is that the company wants to invest in human capital and, therefore, will keep the worker, so as not to lose the investment already made. With this, we can conclude that our estimates can corroborate hypothesis 3.

Table 2. Average marginal effects on the hazard

	Model 1	Model 2	Model 3	Model 4
Dur. of employment: 2 years	-0,152*** (0,014)	-0,151*** (0,014)	-0,150*** (0,014)	-0,150*** (0,014)
Dur. of employment: 3-5 years	-0,236*** (0,015)	-0,234*** (0,015)	-0,233*** (0,015)	-0,233*** (0,015)
Dur. of employment: 6-10 years	-0,265*** (0,015)	-0,263*** (0,015)	-0,262*** (0,015)	-0,262*** (0,015)
Dur. of employment: 11-30 years	-0,277*** (0,015)	-0,275*** (0,014)	-0,274*** (0,014)	-0,274*** (0,014)
Dur. of employment: 31-38 years	-0,281*** (0,014)	-0,279*** (0,014)	-0,278*** (0,014)	-0,279*** (0,014)
Higher education	-0,017*** (0,006)		-0,012* (0,007)	-0,014* (0,007)
Sector technological/knowledge intensity: KTIS		-0,017*** (0,005)	-0,014*** (0,005)	-0,014*** (0,005)
Contract With term	0,057*** (0,005)	0,058*** (0,005)	0,059*** (0,005)	0,059*** (0,005)
Female	0,011** (0,005)	0,011** (0,005)	0,011** (0,005)	0,011** (0,005)
Higher education X KTIS				-0,008 (0,007)
Higher education X LKTIS				-0,017 (0,011)
Age: 25-34 years	0,020*** (0,006)	0,019*** (0,006)	0,021*** (0,006)	0,021*** (0,006)
Age: 35-44 years	0,040*** (0,007)	0,040*** (0,007)	0,040*** (0,007)	0,040*** (0,007)
Age: 45-54 years	0,047*** (0,008)	0,049*** (0,008)	0,048*** (0,008)	0,048*** (0,008)
Age: 55-64 years	0,038*** (0,011)	0,039*** (0,011)	0,038*** (0,011)	0,038*** (0,011)
Number os observations	10 341	10 341	10 341	10 341
Number of failures	2 009	2 009	2 009	2 009

Standard errors (in brackets). The marginal effects are calculated through the whole sample. Models are estimated with sample weights and control for year, quarter, and region of residence effects. The base level of each categorical variable is omitted (duration of employment: 1 year age: 16-24 years; contract: No term; gender: M; educational level: secondary or lower; Intensity of the sector: LKTIS; For their interactions the base levels remain) - *significant to 10%; **significant to 5%; ***significant to 1%.

Regarding the type of employment contract, the results show, with a significance of 1%, that having a term contract increases the risk of unemployment by 5,9 p.p. (Model 4), when compared to the permanent contract. These results support the hypothesis 4.

The gender variable has a significance of 5% in all four models, and it is possible to conclude that men have a slight advantage, since women have a higher risk of unemployment in the next quarter. The results obtained are in accordance with our hypothesis 5.

Age-related estimates reveal that the older the individual is, the greater the risk of going to unemployment, and the less likely they are to remain employed. The values show that the age group between 45 and 54 years is the one that presents a greater risk in relation to the rest (4,8 p.p. in Model 3 and Model 4). It is also verified that in the age group between 16-24 years and 25-34 years the individual is less likely to become unemployed. In this way, younger individuals with a more up-to-date qualification and more qualified in the new technologies present, mostly, a greater advantage in the permanence in the labor market. It would, however, be expected that individuals with a higher age group would have a lower risk of going to unemployment because of the experience they already have.

Model 4 estimates the results of the interaction between the level of schooling and the intensity of technology and knowledge of the current sector, in order to know the behavior that the marginal effect in hazard has when these two variables interact with each other. This presents the marginal effects of higher education in both sectors, compared to the other level of education. The results obtained with regard to the relationship between these two variables are not conclusive, since they are not statistically significant, they can assume any value, that is, both can assume the same value, as one of the values may be better than the other. This is due to the few observations made in higher education.

In general, the results obtained support the hypotheses presented in their totality. With regard to hypothesis 1, it has been found that workers with a long-term job have a lower risk of falling into unemployment. As Farber (1994) points out, as the years of work in a company move forward, the worker begins to acquire specific human capital. The matching theory of Jovanovic (1979b) also helps to explain this evolution over the years. According to this theory, as the duration of employment increases, both the worker and the employer learn about the match. This hypothesis is thus corroborated by the results obtained.

Hypotheses 2 and 3 represent the main focus of analysis of our study and were corroborated by our estimates. In fact, human capital has become an increasingly important variable in the duration and stability of employment. More qualified workers have more advantages, in various branches and areas, due to the skills, abilities and knowledge they possess (Caselli, 1999; Castro Silva & Lima, 2017). The qualification of

the individual and the investment he makes in updating his knowledge and skills has proved to be of extreme importance in his professional life and in the progress of his career. The more up-to-date the worker stays, the more chances he has to keep the same job for a longer period. As emphasized by the hypothesis presented by Griliches (1969) – capital-skill complementary – human capital and skilled labor are more complementary than capital and unskilled labor. We thus affirm that these two hypotheses were corroborated by the estimates presented. According to Hypothesis 2, individuals with higher qualifications have a lower risk of going to unemployment than individuals with a secondary or lower qualification. Although it loses its level of significance from 1% (model 1) to 10% (model 3 and 4), it allows for a meaningful conclusion. On the other hand, hypothesis 3, with respect to the technology and knowledge intensive sectors, was also corroborated by our results, presenting a level of significance of 1% in all models.

Hypothesis 4 was also corroborated by the estimates presented. Although there is not much theoretical support in the literature for the relationship between the type of employment contract and the duration of employment, the results show that a permanent contract of employment provides better job stability.

Regarding hypothesis 5, it was found that men present a lower risk of going to unemployment when compared to women, although there is not much discrepancy between values.

Finally, hypothesis 6: the existence of a positive relationship between the level of schooling and the intensity of the technology and knowledge sectors was the only hypothesis that was not corroborated by our results, since these were not statistically significant.

6. Conclusions

The study developed in this study allowed to understand not only the dynamics developed in the current labor market, but also to understand the situation that Portugal experiences in relation to employment and the duration of the same, taking into account the qualification of the workers and the technology experienced by the company, providing databases and data for future investigations that may arise. The data characterization describes the duration of employment at national level and the sample used was constructed from the data obtained in the Employment Survey 2011-2013 (Labour Force Survey) made available by INE, which is the main source of data of the study presented. The descriptive analysis focuses on seven determinants that can influence the duration of employment, such as: years of work, age, gender, region of residence, schooling, type of employment contract and intensity of technology and knowledge of the sector and provides an insight into the panorama of life in Portugal. Between 2011 and 2013 there has been a decrease in the employment rate due to the Portuguese financial crisis. It is not only the workers struggling to keep up with these technological ad-

vances, several companies are also forced to do so otherwise they are not able to survive in this era and end up having to close doors, causing numerous redundancies.

In order to obtain more accurate data, an econometric analysis was performed on the duration of employment in Portugal, using a proportional risk model. This analysis explored the impact of the seven determinants analyzed in this study on the duration of employment. We have found that, in relation to the duration of employment, the risk decreases as the number of years of service of the individual increases. As for age, it has a negative impact on the duration of employment, that is, the older the individual is, the lower the probability of remaining employed. Regarding the type of contract, the data showed that contracts of permanent employment are those which offer a lower risk of unemployment. As for the data of the gender variable, men are who benefit from greater job stability. In terms of schooling, a higher qualification has shown a greater advantage, both in entering the labor market and in staying in it. The analysis of the intensity of the sector has shown that the sectors that are intensive in technology and knowledge have a positive impact on the duration of employment. Finally, when the study of the interaction between schooling and the intensity of the sector was carried out, the results obtained were not significant, so it was not possible to obtain any conclusions.

The results we obtained will confirm the literature analyzed and the panorama in Portugal. The bet on education, on a wider range of knowledge, on the development of new skills and abilities will always be an asset for the individual, whether already employed or looking for a job. The level of schooling is valued and seen as a necessity for individuals, in order to be able to keep up with all the advances that have been made and will still be made in various sectors of our society. The development and improvement of certain skills, either through workshops or through training or complementary courses, are also extremely important as they provide better professional and career performance. It is necessary to give young workers the opportunity to develop their skills, but it is also necessary to keep older workers who have so much to transmit.

This study presents, however, some limitations, namely the treatment of non-updated data, reminiscent of the financial crisis in Portugal, not representing the reality in which we currently live. Another of the limitations is related to the contradictory or incomplete answers that were found and, as such, they were eliminated or not counted, which could have compromised the results obtained.

In future studies, it would be interesting to obtain more information about the individual, namely on the specific human capital acquired in the work context, or on his own initiative, in order to analyze the duration of the same and to study how certain skills influence this relation. The bet on these studies would have to be made

through access to the complete information of an individual and, if associated with a technology, it would allow a monitoring in real time centralizing in this way, the information and simplifying eventual management processes. It is therefore imperative that society continue to invest in training projects, which are strongly targeted at the labor market. It is well known that the development of a country can only be based on lifelong learning, because it is an investment in personal development, innovation and quality.

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