



## Employee Relations: The International Journal

Can e-learning improve job security? Evidence from 28 European countries  
Juan-Francisco Martínez-Cerdá, Joan Torrent-Sellens, Inés González-González,

### Article information:

To cite this document:

Juan-Francisco Martínez-Cerdá, Joan Torrent-Sellens, Inés González-González, "Can e-learning improve job security? Evidence from 28 European countries", *Employee Relations: The International Journal*, <https://doi.org/10.1108/ER-06-2016-0117>

Permanent link to this document:

<https://doi.org/10.1108/ER-06-2016-0117>

Downloaded on: 11 July 2017, At: 03:18 (PT)

References: this document contains references to 0 other documents.

To copy this document: [permissions@emeraldinsight.com](mailto:permissions@emeraldinsight.com)

The fulltext of this document has been downloaded 2 times since 2017\*

Access to this document was granted through an Emerald subscription provided by emerald-srm:333301 []

### For Authors

If you would like to write for this, or any other Emerald publication, then please use our Emerald for Authors service information about how to choose which publication to write for and submission guidelines are available for all. Please visit [www.emeraldinsight.com/authors](http://www.emeraldinsight.com/authors) for more information.

### About Emerald [www.emeraldinsight.com](http://www.emeraldinsight.com)

Emerald is a global publisher linking research and practice to the benefit of society. The company manages a portfolio of more than 290 journals and over 2,350 books and book series volumes, as well as providing an extensive range of online products and additional customer resources and services.

Emerald is both COUNTER 4 and TRANSFER compliant. The organization is a partner of the Committee on Publication Ethics (COPE) and also works with Portico and the LOCKSS initiative for digital archive preservation.

\*Related content and download information correct at time of download.

# Can e-learning improve job security? Evidence from 28 European countries

## Abstract

**Purpose-** The goal of this article is to prove that e-learning, in union with another variable, builds a statistically significant relationship for estimating improvements in employment security, i.e., transition to employment of the same or higher job security as the previous year.

**Design/methodology/approach-** Using data from Eurostat 2007-2013 in 28 European countries, and after carrying out analysis of 261 regression models between the e-learning variable, along with another variable related to working conditions, education, or e-skills levels of citizens.

**Findings-** This study provides evidence about: i) there is a statistically significant relationship ( $p\text{-value} < 0.05$ ) between employment security (dependent variable), e-learning and another variable (independent variables) in 60.7% of 28 European countries analyzed ( $p\text{-value} < 0.05$  for at least one of these two independent variables); and ii) there is a statistically significant relationship ( $p\text{-value} < 0.05$ ) in 75% of 28 countries ( $p\text{-value} < 0.1$  for at least one of these two independent variables). Consequently, a set with the minimum number of useful indicators for calculating the employment security is proposed: e-learning, labor transition, tertiary education, temporary employees, e-job search and e-skills.

**Implications-** Moreover, several similarities between studied countries are found, helping to formulate various recommendations based on complementarities between being an employee and using lifelong e-learning systems as a way for improving employment security.

**Originality/value-** This is one of the first studies to provide evidence of the relationship between e-learning and job security in Europe, in view of this, it should be considered as a key element and essential to any European policy related to work.

**Keywords** Employability security, e-learning, Employability Workers, Europe.

**Paper type** Research paper

## Introduction

Employment security is one of the most contemporary issues to study in the field of Human Resources Management (HRM) because of its relationship, *inter alia*, with business productivity (Michie and Sheehan, 1999). Thus, its importance in workers' behavior has been studied from various perspectives that consider employment security and its relationship with both unions and civil servants (Ferrie *et al.*, 1998) as well as existing international trends toward outsourcing (Geiskecker, 2008). Employment security has links with flexibility in several European countries (Muffels and Luijkx, 2008) and with job satisfaction (Wilczyńska *et al.*, 2015).

In the context related to employability, it is also crucial to highlight the growing need for realization of lifelong learning training. For example, in Europe this kind of training is an essential action because it helps to develop the employability of its citizens (Bădescu and Loi, 2010). Moreover, it is very useful for improving different levels of completion of compulsory secondary education and adult participation in educational initiatives (Boateng, 2009), which are unsatisfactory in most European countries: in 2004 only 9.1% of people between 25 and 64 years had done lifelong learning, in 2013 this figure was only 10.5%.

In relation to employment security and lifelong learning, it should be noted that both occur within a European context with socio-demographic, cultural, structural and economic barriers, such as those between countries in Northern, Southern and Eastern Europe (Zarifis, 2012), and with an increasing use of ICT by citizens (in 2013, Eurostat shows that 65% of the total European population had sent emails with attached files, 33% had made phone calls and 38% had done online purchases in the last 3 months) that can be exploited for education based on open and distance learning.

The objective of this research is to analyze the relationship between employment security and e-learning at a European level, as this analysis is set as within of the most noteworthy fields of research in contemporary usage of ICT by workers, especially after the detection of certain connections between these variables (Martínez-Cerdá and Torrent-Sellens, 2014b).

Section 2 presents various topics previously studied by authors in relation to employment security and education, as well as different approaches for calculating employment security, also raised by another set of investigations. Section 3 shows the research question and methodology of this research, and the characteristics of the data used. Then section 4 and section 5 discuss the results, accompanied by several recommendations and conclusions.

## Context and Background

### *Employment security and education*

When studying the relationship between employment security and e-learning, different aspects have to be considered both from the point of view of the current context in Europe in terms of employment and from the perspective of education as a way to develop useful skills for the employability of citizens and improve worker skills. In this regard, the linkages between employment security and education have been studied from the perspective of work-related learning (Kyndt and Baert, 2013) and the paradigm of studying the behavior of individuals (Sanders *et al.*, 2011) with the parameters of the theory of the reasoned action and its extension called the theory of planned behavior (Ajzen, 1991).

From a business point of view, Ordiz-Fuertes and Fernández-Sánchez (2005) also show a relationship between employment security and training, making the point that companies cannot invest resources in training their workers unless firms think about keeping workers on for a long period of time, after which enterprises will benefit of the investment made through such training.

Taking into account the growing social demand for skills and competences caused by the advance of the information society, different approaches have been studied on the issue of skills learned by students. These approaches range from computer literacy and its relationship with those skills useful for employability and lifelong learning to the analysis of digital educational games as a way for cultivating imagination and creativity abilities (Lin and Lin, 2014), to the use of wikis in educational environments for developing conflict resolution, leadership and working groups (Palomo-Duarte *et al.*, 2014), or to understand social networks usage by business students as a significant agents for professional purposes, knowledge and career (Benson and Filippaios, 2015).

Thus, in relation to competences required from the workforce (Bartel *et al.*, 2007), different European institutions have launched diverse initiatives. For example, the 21st Century Initiative launched in 2007 by the

European Commission, the Council, the European Parliament, the European Economic and Social Committee and the Committee of the Regions (European Commission, 2007). This initiative enables the learning and development of e-skills in citizens, since these abilities are assessed as insufficient (Hüsing and Korte, 2010), despite being very necessary for the development of employment (Pouliakas, 2013).

In relation to these e-skills, it seems that the application of methodologies based on e-learning helps to build information abilities that are valid in the current stage of the information society in Europe (Jun and Pow, 2011). Moreover, it should be noted that the development of e-skills helps to prepare for lifelong learning (Loureiro *et al.*, 2012) and that these e-skills are very useful for firms.

The research of employment security has ties to various scientific fields within the social sciences that have to be considered for the analysis of its relationship with e-learning: individual behavior, socio-economic context related to the labor market, skills and education.

### *Estimation of employment security*

With the goal to analyze the relationship between employment security and e-learning, a set of variables have been designed and used for calculating and estimating employment security by different authors, which are noted below. In this regard, there are two relevant points: i) most studies take into account employment security as a useful dimension for the calculation of other dimensions, such as those related to job quality (Díaz-Chao *et al.*, 2014) or job prospects (Green and Mostafa, 2012); ii) some authors have calculated employment security using linear models (Bassanini, 2006).

In this line of work, Morgan *et al.* (2001) conducted research that suggested estimating employment security through the use of variables associated with legal issues, unions, atypical employment and other institutions, and using a linear regression model with six independent variables that were applied to a set of 10 European countries, through three temporal observations separated by 4 or 5 years between them, and using the data of industrial and retail industries.

Employability security links are also observed with psychological issues such as perceived and objective job security (Dooley *et al.*, 1987) or satisfaction, desire and intention to search for another job (Barringer and Milkovich, 1995). On the other hand, studies have been done based on the work context in firms and measured through the use of variables related to competition among companies, the durability of the products developed or volatility of corporate profits (Ahmed *et al.*, 2006). Additionally, the estimation of employment security also finds close links with the reality of the labor market variables, focusing on the fact of being unemployed, being fired or having to find another job in a specific period of time (De Witte, 1999; Gracia *et al.*, 2011; Green and Leeves, 2013; Nisbet, 2007; Smith, 1999).

From another perspective, there are also estimations of employment security based on approaches that might be called more macroeconomic, such as those posed by Heckman and Pages (2000), authors that consider the legal issues that protect workers (tenure that a worker can attain in a firm, advance notice to a worker, mandated severance pay, payment to be awarded to a worker with tenure, etc.), as well as others related to the actual company context (for example, whether the economic difficulties of the firm are considered a justified cause for dismissal). In this macroeconomic perspective, Alemán (2009) has also taken into account variables such as wages, inflation, GDP and labor productivity. Specifically, the latter author also considers the factor of temporary contracts, something that is also noted by Ficapal-Cusi and Torrent-Sellens (2014).

From a microenterprise perspective, Daley *et al.* (2002) and Daley and Vasu (2005) carried out an estimate of employment security using variables related to the difficulty of firing workers, making use of Delery and Doty's (1996) approach. The same approach is used by Lee *et al.*, (2010), who also apply the same model. Botero *et al.* (2004) evaluate variables such as the costs of firing workers and their procedures, while Bonavia and Marin-Garcia (2011) take into account the percentage of production employees with a permanent employment contract. Caballero *et al.* (2013) also make use of indicators proposed by Heckman and Pages (2000) and Botero *et al.*, (2004).

Table 1 shows the characteristics of different variables that have been posed by authors regarding the calculation and estimation of employment and job security. Dasgupta (2001) describes the differences between job security and employment security: job security relates to the job of an employee and his/her security for maintaining it and to continue working in that job, while employment security involves more abstract aspects that have to do with the likelihood or ability of this employee to find a new job in the future, whether moving from a situation of unemployment or integration into the labor market, or because of a transition between two jobs, i.e. the possibility of continually working occurs, albeit in different jobs over time.

/Insert Table 1/

As noted previously, the study of the relationship between employment security and e-learning has implications for the field of human behavior, but it is also related to the socioeconomic context that exists, both economically and educational, the latter being one of the least considered by various researchers. The next section describes the methodological aspects that have been taken into account in establishing a relationship between employment security and e-learning.

## Research Question and Methodology

Given all the above, and the goal of this article, the research question is as follows: “Does e-learning help to obtain a significant approximation of employment security in Europe?”. This question is defined with its corresponding working hypothesis:

Hypothesis 1: There is a statistically significant relationship between employment security and e-learning in 60.7% of 28 European countries analyzed (in 17 countries) and according to the following regression model:

$$Y_{\text{Security}} = \alpha + \beta_{\text{e-Learning}} X_{\text{e-Learning}} + \beta_{\text{Variable(i)}} X_{\text{Variable(i)}} + \varepsilon \quad (1)$$

with the following constraints:

1. A global p-value for the regression model (1) lower than 0.05.
2. A significance level for at least one of the two independent variables ( $X_{\text{e-Learning}}$  or  $X_{\text{Variable(i)}}$ ) lower than 0.05 (95% confidence interval).

Where: i)  $Y_{\text{Security}}$  is a dependent variable for employment security; ii)  $X_{\text{e-Learning}}$  is the first and mandatory independent variable and is related to e-learning; iii)  $X_{\text{Variable(i)}}$  is the second independent variable according to the following set of variables:  $X(i) = \{\text{Temporary employees, Part time employment, Employment, Labor transition, Tertiary education, Lifelong Learning, e-Job search, e-Skills, Media Literacy}\}$ .

Hypothesis 2: There is a statistically significant relationship between employment security and e-learning in 75% of 28 European countries analyzed (in 21 countries) and according to the regression model (1) and the following constraints:

1. A global p-value for the regression model (1) lower than 0.05.
2. A significance level for at least one of the two independent variables ( $X_{\text{e-Learning}}$  or  $X_{\text{Variable(i)}}$ ) lower than 0.1 (90% confidence interval).

Hypothesis 3: There is a statistically significant relationship between employment security and e-learning in 85.7% of 28 European countries analyzed (in 24 countries) and according to the regression model (1) and the following constraints:

1. A global p-value for the regression model (1) lower than 0.1.
2. A significance level for at least one of the two independent variables ( $X_{\text{e-Learning}}$  or  $X_{\text{Variable(i)}}$ ) lower than 0.1 (90% confidence interval).

All these regression models have 4 degrees of freedom because the database has 7 years (2007-2013) and 3 variables.

For the selection of these variables the following five rules were applied: i) official data; ii) comparability and reliability of primary data sources; iii) wide geographical scope; iv) data existence over time, for longitudinal analysis; and v) existence of relationships with indicators previously used by researchers. In this regard, a database obtained from Eurostat of 28 European countries over the crisis period 2007-2013 was selected.

Consideration of this period of seven years is related to the availability and existence of some of the indicators used, which did not allow extending this time interval. Specifically, two indicators considered and related to e-learning ('Individuals who have used Internet, in the last 3 months, for doing an online course (of any subject)', and 'Individuals who have used Internet, in the last 3 months, for looking for information about education, training or course offers') began their time series in 2007. 2013 is the most recent year of data available in Eurostat for the indicators studied.

Considering the aspects listed above in section 2, the following dimensions and variables appear relevant for the study of the relationship between employment security and e-learning:

- i) Employment security: variable to be estimated
- ii) Working conditions: temporary employees, part time employment, employment, and labor transition.
- iii) Education: tertiary educational level, lifelong learning, and e-learning
- iv) e-Skills: e-job search, e-skills, and media literacy

These variables are shown in Table 2 according to their use in the regression model (1) and in relation to employment security and e-learning issues and estimation indicators commented in Table 1.

/Insert Table 2/

To prove the relationships between employment security and e-learning, Table 3 shows all models analyzed and tested in all 28 European countries. As can be observed, each of the nine independent variables taken into account, together with the mandatory e-learning variable, generates a regression model, which has to be analyzed to find out if the p-values are appropriate for the research hypotheses. In this way, the estimation process analyses these nine models -namely: model Temporary, model Part Time, model Employment, model Labor Transition, model Tertiary, model Lifelong, model e-Job Search, model e-Skills and model Media Literacy- in each country: 252 models in total. Moreover, 9 additional analyses have been done for all EU27 area data.

/Insert Table 3/

The selection of these valid p-values was made according to the following approach: selection of p-values for the regression model among those obtained with at least one of the significance levels of their dependent variables (e-learning or another one) lower than 0.05 or, if it is not possible, 0.1, according to the hypotheses. Finally, the minimum p-value of global regression model (1) in each country is selected. Thus the best linear model is defined and located the best variable, together with e-learning, to estimate the employment security variable. The results of the analysis are presented and discussed below.

## Results

All p-values,  $\Pr(>|t|)$  for the independent variables, and their significance codes for all the linear regressions analyzed in 28 countries were calculated (R Core Team, 2014; Revelle, 2015) and Table 4 below shows a ranking of countries according to the minimum p-values of their regression models (1) and  $\Pr(>|t|)$  for independent variables. As analyzed, 17 of a total of 28 countries have a p-value for the regression model lower than 0.05 (confidence interval greater than 95%) and with a significance level for at least one of the two independent variables ( $X_{e-Learning}$  or  $X_{Variable(i)}$ ) lower than 0.05.

Thus, hypothesis 1 is proved because there is a significant relationship between employment security and e-learning in 60.7% of 28 European countries analyzed and according to its constraints, i.e., in Greece, Germany, UK, Portugal, Belgium, Slovenia, Sweden, Luxembourg, Finland, Bulgaria, Austria, Estonia, Italy, Slovakia, Netherlands, Czech Republic and Hungary. Specifically, it is found that there is a p-value for the regression model lower than 0.01 (confidence interval greater than 99%) in 6 countries (21.4%), since the regression models found in these countries are even more valid in Greece, Germany, UK, Portugal, Belgium and Slovenia.

Furthermore, hypothesis 2 is proved too, since there are four countries with p-values lower than 0.05, but with a significance level for at least one of the two independent variables ( $X_{e-Learning}$  or  $X_{Variable(i)}$ ) lower than 0.1. These countries are: Spain, Lithuania, Cyprus and Latvia. Thus, 21 countries (seventeen from hypothesis 1 and four from hypothesis 2) have this situation.

On the other hand, three countries, Romania, Denmark and Poland, have their p-values lower than 0.1 and a significance level for at least one of their two independent variables lower than 0.1, so 85.7% of countries have these acceptable values. Therefore, there are 24 countries where the hypothesis 3 is demonstrated.

Finally, France and Norway have the p-values of their regression models higher than 0.1 and a significance level for at least one of the two independent variables ( $X_{e-Learning}$  or  $X_{Variable(i)}$ ) lower than 0.1, and Iceland and Malta have the significance levels of their two independent variables ( $X_{e-Learning}$  or  $X_{Variable(i)}$ ) higher than 0.1, so they do not have any valid model according to the hypothesis and its constraints.

With regard to the four dimensions proposed above, Table 4 shows the importance of working conditions. In this sense, any of its variables, together with the mandatory e-learning variable, builds a best

regression model. And this model has a statistically significant relationship for estimating improvements in employment security, i.e., transition to employment of the same or higher job security as the previous year: i) having an employment contract helps in seven countries: Portugal, Slovenia, Luxembourg, Finland, Slovakia, Spain and Cyprus; ii) labor transition from unemployed to employed contributes in six countries: UK, Sweden, Bulgaria, Netherlands, Czech Republic and Lithuania; iii) part time contracts estimates the employment security in three countries: Belgium, Austria and Romania; and iv) temporary employees helps in all EU27 area and Norway. The dimension related to education is the second most important in the analysis: i) tertiary education is useful in four countries: Greece, Germany, Latvia and France; and ii) lifelong learning helps in Italy. Lastly, e-skills is the least important dimension for calculating improvements in job security: i) model related to e-skills is good in two countries: Estonia and Hungary; ii) media literacy is useful in Denmark; and iii) e-job search contributes in Poland.

/Insert Table 4/

Table 5 shows information about the coefficients of all the best linear regressions. With this information, it is possible to generalize findings related to all countries. In EU27, it is possible to estimate the employment security variable by using the e-learning ( $\beta_{eL}=-0.22855$ ,  $p<0.01$ ) and temporary variables ( $\beta_{TT}=-0.52704$ ), which is not the best one in any country, although it is also used in Norway. Austria, Belgium and Romania have the same situation: e-learning ( $\beta_{eL}=0.16249$ ,  $p<0.05$ ;  $\beta_{eL}=-1.4003$ ,  $p<0.01$ ;  $\beta_{eL}=-0.003946$ , respectively) and part time ( $\beta_{PT}=-0.86534$ ,  $p<0.01$ ;  $\beta_{PT}=1.6466$ ,  $p<0.05$ ;  $\beta_{PT}=0.876009$ ,  $p<0.05$ ; respectively) variables are estimators for employment security. Note the importance of part time variable in Belgium and its negative sign in Austria.

The importance of the labor transition variable can be seen in six countries: Bulgaria ( $\beta_{eL}=-0.03557$ ;  $\beta_{LT}=-0.14697$ ,  $p<0.05$ ), Czech Republic ( $\beta_{eL}=0.2935$ ;  $\beta_{LT}=0.1075$ ,  $p<0.05$ ), Lithuania ( $\beta_{eL}=-0.5778$ ;  $\beta_{LT}=0.2770$ ), Netherlands ( $\beta_{eL}=-0.70736$ ,  $p<0.05$ ;  $\beta_{LT}=0.04352$ ), Sweden ( $\beta_{eL}=-0.50992$ ,  $p<0.01$ ;  $\beta_{LT}=0.23871$ ,  $p<0.05$ ) and UK ( $\beta_{eL}=1.1993$ ,  $p<0.01$ ;  $\beta_{LT}=0.3530$ ,  $p<0.05$ ). Employment is the more useful variable for estimating employment security in the linear regression models analyzed, since is used in 7 countries: Cyprus ( $\beta_{EM}=0.82309$ ), Finland ( $\beta_{EM}=2.5593$ ,  $p<0.01$ ), Luxembourg ( $\beta_{EM}=-0.25049$ ), Portugal ( $\beta_{EM}=0.9887$ ,  $p<0.05$ ), Slovakia ( $\beta_{EM}=0.5654$ ), Slovenia ( $\beta_{EM}=1.16251$ ,  $p<0.05$ ) and Spain ( $\beta_{EM}=0.8453$ ). Note that employment has a positive influence in six countries (it is negative in Luxembourg), with very large coefficients in Finland and Slovenia. Regarding these countries, the e-learning variable has a very big negative influence in Finland ( $\beta_{eL}=-1.9173$ ,  $p<0.05$ ).

The e-skills variable is used with a negative sign in Estonia ( $\beta_{eS}=-1.1135$ ,  $p<0.05$ ) and Hungary ( $\beta_{eS}=-0.8560$ ,  $p<0.05$ ), and tertiary education variable is useful for regression models in France ( $\beta_{TE}=-0.45546$ ), Germany ( $\beta_{TE}=0.60871$ ,  $p<0.05$ ), Greece ( $\beta_{TE}=-0.412$ ) and Latvia ( $\beta_{TE}=-0.191$ ). Note that Greece and Germany have the best estimation, according to Table 4. Moreover, it seems that the e-learning variable is not important in Germany. Finally, Italy, Poland and Denmark use the lifelong learning ( $\beta_{LL}=2.0889$ ), e-job search ( $\beta_{eJ}=1.5183$ ) and media literacy ( $\beta_{ML}=-0.8048$ ) variables, respectively.

In the best models, the estimated coefficients related to e-learning are positive in ten countries over the period 2007-2013 (35,7% of 28 countries): Austria, Czech Republic, Denmark, Estonia, France, Germany, Hungary, Norway, Slovenia and UK. Note the large positive importance of this variable in UK ( $\beta_{eL}=1.1993$ ,  $p<0.01$ ), and its great negative influence in Finland, Greece and Belgium ( $\beta_{eL}<-1.4$ ,  $p<0.05$ ).

In general, the dimension related to working conditions has a clear positive effect on job security because the coefficients of its variables are positive in 50% of countries: i) employment in Cyprus, Finland, Portugal, Slovakia, Slovenia and Spain; ii) labor transition in Czech Republic, Lithuania, Netherlands, Sweden and UK; iii) part time in Belgium and Romania, and iv) temporary in Norway. In contrast, dimension of education has another situation: the coefficient of variable related to lifelong learning is positive in Italy, but the coefficients for tertiary education are negative in France, Greece and Latvia (only positive in Germany). Finally, the dimension related to e-skills has a mixed situation: e-skills and media literacy variables have negative coefficients in Estonia, Hungary and Denmark, while the coefficient of e-job search is positive in Poland. Note the great positive importance of employment in Finland and part time in Belgium ( $\beta_{EM}=2.5593$ ,  $p<0.01$ ; and  $\beta_{PT}=1.6466$ ,  $p<0.05$ , respectively). On the contrary, only the variable of e-skills in Estonia has a large negative coefficient ( $\beta_{eS}=-1.1135$ ,  $p<0.05$ ).

/Insert Table 5/

With data from p-values it is possible to find other relationships among countries and the analyzed variables. Thus, Table 6 shows the number of regression models found in all countries and their p-values: Greece (eight models), UK and Portugal (both with seven models) are the countries with more valid regression models according to the hypotheses, followed by countries with six valid models (Germany, Belgium, Lithuania, Slovenia, Estonia and Netherlands), and Spain and Luxembourg (both having five). The remaining countries have four or less valid models. Additionally, there is information about the significance levels of two variables used by linear regressions, both the e-learning variable and another one from the rest of independent variables in best regression models. As seen, the higher the number of regression models, the more significant the p-values.

Data about the number of uses of second variables shows that the working conditions variables are very useful for adding to e-learning variable to estimate employment security. Specifically, employment (7 times is the best model) and labor transition (6 times) are the most commonly used, and part time employment (3 times) is a good estimator too. Tertiary education is another useful variable, since it is used 4 times for defining the best regression models. Taking into account these results, it can be stated that to be working and having a college education, together with e-learning, are the most important variables for estimating transition to the same or higher job security as the previous year.

With regard to the four dimensions, two variables related to working conditions (part time and labor transition) have significant p-values and coefficients in two of their best models: labor transition in UK ( $p < 0.01$ ;  $p_{eL} < 0.01$ ,  $p_{LT} < 0.05$ ) and Sweden ( $p < 0.05$ ,  $p_{eL} < 0.01$ ,  $p_{LT} < 0.05$ ), and part time in Belgium ( $p < 0.01$ ,  $p_{eL} < 0.01$ ,  $p_{PT} < 0.05$ ) and Austria ( $p < 0.05$ ,  $p_{eL} < 0.05$ ,  $p_{PT} < 0.01$ ). Moreover, the employment variable has significant p-values and coefficients in its best model in Finland ( $p < 0.05$ ,  $p_{eL} < 0.05$ ,  $p_{EM} < 0.01$ ). This situation does not happen in other dimensions except for e-skills variable in Hungary ( $p < 0.05$ ,  $p_{eL} < 0.05$ ,  $p_{eS} < 0.05$ ).

/Insert Table 6/

Since the number of regression models in each country have been taken into account, it is important to note that the second variable chosen is the best one between the others also analyzed. In this sense, Table 6 shows that there are two groups of variables taking into account to the number of times that they are used for finding regression models according to minimum conditions of hypotheses (p-value  $< 0.1$  for global regression model, and p-values  $< 0.1$  for at least one of the two independent variables): variables that are used 6 times, e-skills and media literacy, and the rest of variables, which are used more than 10 times. Specifically, it is interesting to note that e-job search variable is used more times than the other two variables from its same dimension e-skills (14 versus 6 times).

These data have helped to calculate the ratio of the more efficient variables, i.e., those that have more uses in the best models in relation to their total uses in all regression models. In this way, employment, labor transition, tertiary education, e-skills and part time are the more efficient variables for estimating employment security and use the e-learning variable as a complementary independent variable: their efficient ratios are higher than 0.25. Thus, the dimension related to working conditions is more efficient than others. Figure 1 shows that.

/Insert Figure 1/

### **Figure 1. Efficient variables**

The analysis also shows countries that have only one-second variable for estimating their regression model (1): Bulgaria, France, Latvia, Norway and Poland. With this information it is possible to determine whether these variables are the best models in other countries. As shown in Table 7, the four second independent variables of these four countries -labor transition, tertiary education, temporary employees and e-job search- are useful for estimating the best regression models in 7 other countries -Czech Republic, Lithuania, Netherlands, Sweden, UK, Germany, Greece- and EU27 region. So, with these models is possible to have a good estimation for 12 countries. Moreover, these four variables are useful for the other 14 countries. Additionally, if e-skills are added to this list of four variables used only one time in five countries, they are found to improve models for Austria and Hungary.



In this way, the dimension of working conditions, specifically its variables related to labor transition and temporary employees, is the most important dimension for estimating, together with e-learning, transition to the same or higher job security as the previous year: it could be useful in 12 countries ( $p < 0.05$ ). The variable of tertiary education makes that education is the second most important dimension because it could be used in six countries ( $p < 0.05$ ). The other variables and dimensions are very difficult to combine among countries.

/Insert Table 7/

After the explanation of the results, the next section discusses and comments on various aspects related to these findings.

## Implications and Conclusions

The article has studied the relationship between the e-learning variable and different variables associated with working conditions, education and skills to use ICT, in their complementarity for calculating and estimating improvements in employment security. Employment security is understood as a transition to the same or higher job security as the previous year. The data analysis has demonstrated that this complementarity exists in most of the European countries analyzed, so employment security can be calculated with high levels of statistical significance.

In the sense of being able to analyze in more detail the situations observed here, it is important to note the differences between various concepts related to worker security in his/her workplace: thus, employment security/insecurity, job security/insecurity, labor market security/insecurity are intrinsically related concepts. Moreover, aspects related to the specific trends in labor markets and their influence on the security of maintaining jobs, as well as the security of working conditions of jobs, must be also taken into account.

From this perspective, the research undertaken has considered employment security closely linked to the field of employment or labor market security, in which different personal skills for finding and obtaining alternative employment to existing or to non-existent are key (Anderson and Pontusson, 2007). The availability of official, comparable and linear data for statistics through Eurostat has been the determining factor throughout the research.

Another complementary view to this is posed through approaches that deal with realities closely linked to the security of a particular job: the possibility that the vacancy is to be maintained in the future for a particular type of worker (Esser and Olsen, 2012). As has been mentioned (Dasgupta, 2001), different ideas and approaches to the concept of employment security is one of the most important aspects to research.

In this sense, another approach relates employment security with the institutional framework (favorable conditions for dismissal, for contracting without guarantees for the worker in relation to continuity, etc.). This approach has been developed by Lloyd (1999), as well as others authors discussed hereinabove (Morgan *et al.*, 2001), and it presents numerous problems, mostly related to the international comparability due to the large number of existing legislative changes in the field of hiring and employment.

At a much more macro level, the estimation of employment security must also take into account aspects related to the dynamic evolution of jobs, often subject to the dynamic of creative destruction as a result of the development and emergence of technological innovations (Schumpeter, 2003). Technological innovations cause business cycles that gradually expand globally as concentric waves from the countries that initiated these innovations to others (Calzada, 2005).

Notably, two aspects are presented as very important to keep in mind for future research and may can be considered as recommendations for researchers in this field: i) researchers must consider the meanings and concepts related to employment security, going beyond the capabilities related to search for an alternative job; and ii) it is necessary to establish mechanisms to relate employment security with the degree of implementation of technological innovations at the country level, which will occur gradually over time.

In few words, the most obvious conclusion and recommendation after the data analysis is to note that e-learning has a relationship of complementarity with other factors related to the labor market, in pursuit of employment security at European level. Specifically, the dimension of working conditions is the most important dimension for estimating, along with e-learning, transition to the same or higher job security as the previous year over the crisis period 2007-2013. The dimension of education is the second one. In view of this, it is logical that e-learning should be considered as a key element and essential to any European policy related to work.

## **Acknowledgments**

Juan-Francisco Martínez-Cerdá would like to acknowledge the support of a doctoral grant from the UOC. The authors would like to thank Greig Krull for his help in the English revision of the manuscript.

## References

1. Ahmed, A. S., Zhou, J. and Lobo, G. J. (2006), "Job Security and Income Smoothing: An Empirical Test of the Fudenberg and Tirole (1995) Model", *SSRN Scholarly Paper* [No. ID 248288], Social Science Research Network, Rochester, NY. <https://doi.org/10.2139/ssrn.248288>
2. Ajzen, I. (1991), "The theory of planned behavior", *Organizational Behavior and Human Decision Processes*, Vol. 50 No. 2, pp. 179–211. [https://doi.org/10.1016/0749-5978\(91\)90020-T](https://doi.org/10.1016/0749-5978(91)90020-T)
3. Alemán, J. (2009), "Labour market dualism and industrial relations in Europe", *Industrial Relations Journal*, Vol. 40 No. 3, pp. 252–272. <https://doi.org/10.1111/j.1468-2338.2009.00524.x>
4. Anderson, C. J. and Pontusson, J. (2007), "Workers, worries and welfare states: Social protection and job insecurity in 15 OECD countries", *European Journal of Political Research*, Vol. 46 No. 2, pp. 211–235. <https://doi.org/10.1111/j.1475-6765.2007.00692.x>
5. Bădescu, M. and Loi, M. (2010), "Participation in training of adult workers in European countries evidences from recent surveys", *JRC Scientific and Technical Reports* [No. EUR 24563 EN], Publications Office of the European Union, Luxembourg. Retrieved from <http://dx.publications.europa.eu/10.2788/3263>
6. Barringer, M. and Milkovich, G. (1995), "Changing Employment Contracts: The Relative Effects of Proposed Changes in Compensation, Benefits and Job Security on Employee Outcomes", *CAHRS Working Paper Series*, Vol. 95 No. 14, pp. 1–25. Retrieved from <http://digitalcommons.ilr.cornell.edu/cahrswp/204>
7. Bartel, A., Ichniowski, C. and Shaw, K. (2007), "How Does Information Technology Affect Productivity? Plant-Level Comparisons of Product Innovation, Process Improvement, and Worker Skills". *The Quarterly Journal of Economics*, Vol. 122 No. 4, pp. 1721–1758. <https://doi.org/10.1162/qjec.2007.122.4.1721>
8. Bassanini, A. (2006), "Training, wages and employment security: an empirical analysis on European data". *Applied Economics Letters*, Vol. 13 No. 8, pp. 523–527. <https://doi.org/10.1080/13504850500400447>
9. Benson, V. and Filippaios, F. (2015), "Collaborative competencies in professional social networking: Are students short changed by curriculum in business education?", *Computers in Human Behavior*, Vol. 51, Part B, pp. 1331–1339. <https://doi.org/10.1016/j.chb.2014.11.031>
10. Boateng, S. K. (2009), "Significant country differences in adult learning". *Eurostat: Statistics in Focus*, No 44, pp. 1–12. Retrieved from <http://www.uni-mannheim.de/edz/pdf/statinf/09/KS-SF-09-044-EN.pdf>
11. Bonavia, T. and Marin-Garcia, J. A. (2011), "Integrating human resource management into lean production and their impact on organizational performance". *International Journal of Manpower*, Vol. 32 No. 8, pp. 923–938. <https://doi.org/10.1108/01437721111181679>
12. Botero, J. C., Djankov, S., La Porta, R., Lopez-De-Silanes, F. and Shleifer, A. (2004), "The Regulation of Labor". *Quarterly Journal of Economics*, Vol. 119 No. 4, pp. 1339–1382. <https://doi.org/10.1162/0033553042476215>
13. Bresnahan, T. F., Brynjolfsson, E. and Hitt, L. M. (2002), "Information Technology, Workplace Organization, and the Demand for Skilled Labor: Firm-Level Evidence", *Quarterly Journal of Economics*, Vol. 117 No. 1, pp. 339–376. <https://doi.org/10.1162/003355302753399526>
14. Caballero, R. J., Cowan, K. N., Engel, E. M. R. A. and Micco, A. (2013), "Effective Labor Regulation and Microeconomic Flexibility", *Journal of Development Economics*, Vol. 101, pp. 92–104. <https://doi.org/10.1016/j.jdeveco.2012.08.009>
15. Calzada, I. (2005), *Futuro del trabajo. Trabajo del futuro*, MIK, Arrasate, Gipuzkoa.
16. Daley, D. M. and Vasu, M. L. (2005), "Supervisory Perceptions of the Impact of Public Sector Personnel Practices on the Achievement of Multiple Goals Putting the Strategic into Human Resource Management", *The American Review of Public Administration*, Vol. 35 No. 2, pp. 157–167. <https://doi.org/10.1177/0275074004272846>
17. Daley, D. M., Vasu, M. L. and Weinstein, M. B. (2002), "Strategic human resource management: Perceptions among North Carolina county social service professionals", *Public Personnel Management*, Vol. 31 No. 3, pp. 359–375. <https://doi.org/10.1177/009102600203100308>
18. Dasgupta, S. (2001), *Employment security: conceptual and statistical issues*, International Labour Office, Geneva. Retrieved from <http://www.ilo.int/public/english/protection/ses/download/docs/employ.pdf>

19. De Witte, H. (1999), "Job insecurity and psychological well-being: Review of the literature and exploration of some unresolved issues", *European Journal of Work and Organizational Psychology*, Vol. 8 No. 2, pp. 155–177. <https://doi.org/10.1080/135943299398302>
20. Delery, J. E. and Doty, D. H. (1996), "Modes of theorizing in strategic human resource management: Tests of universalistic, contingency, and configurational performance predictions", *Academy of Management Journal*, Vol. 39 No. 4, pp. 802–835. <https://doi.org/10.2307/256713>
21. Desjardins, R. and Rubenson, K. (2011), "An Analysis of Skill Mismatch Using Direct Measures of Skills", *OECD Education Working Papers*, No. 63, pp. 1–87. Retrieved from <https://doi.org/10.1787/5kg3nh9h52g5-en>
22. Díaz-Chao, Á., Ficapal-Cusí, P. and Torrent-Sellens, J. (2014), "Economic Crisis and Job Quality in Spain: A Multi-dimensional and Micro-data Empirical Approach", *Social Indicators Research*, Vol. 125 No. 2, pp. 613–633. <https://doi.org/10.1007/s11205-014-0850-0>
23. Dooley, D., Rook, K. and Catalano, R. (1987), "Job and non-job stressors and their moderators", *Journal of Occupational Psychology*, Vol. 60 No. 2, pp. 115–132. <https://doi.org/10.1111/j.2044-8325.1987.tb00245.x>
24. Elman, C. and O'Rand, A. M. (2002), "Perceived Job Insecurity and Entry into Work-Related Education and Training among Adult Workers", *Social Science Research*, Vol. 31 No. 1, pp. 49–76. <https://doi.org/10.1006/ssre.2001.0718>
25. Esser, I. and Olsen, K. M. (2012), "Perceived Job Quality: Autonomy and Job Security within a Multi-Level Framework", *European Sociological Review*, Vol. 28 No. 4, pp. 443–454. <https://doi.org/10.1093/esr/jcr009>
26. European Commission (2007), "E-skills for the 21st century: fostering competitiveness, growth and jobs", *Communication from the Commission to the Council, the European Parliament, the European Economic and Social Committee and the Committee of the Regions* [Pub. L. No. COM(2007) 496 final, 52007DC0496 10]. Retrieved from <http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex:52007DC0496>
27. Ferrie, J. E., Shipley, M. J., Marmot, M. G., Stansfeld, S. A. and Smith, G. D. (1998), "An uncertain future: the health effects of threats to employment security in white-collar men and women", *American Journal of Public Health*, Vol. 88 No. 7, pp. 1030–1036. <https://doi.org/10.2105/ajph.88.7.1030>
28. Ficapal-Cusí, P. and Torrent-Sellens, J. (2014), "New Human Resource Management Systems in Non-Based-Knowledge Firms: Applications for Decision Making on the Business Performance", *Modern Economy*, Vol. 5 No. 2, pp. 139–151. <https://doi.org/10.4236/me.2014.52016>
29. Geishecker, I. (2008), "The impact of international outsourcing on individual employment security: A micro-level analysis", *Labour Economics*, Vol. 15 No. 3, pp. 291–314. <https://doi.org/10.1016/j.labeco.2007.06.015>
30. Gracia, F. J., Ramos, J., Peiró, J. M., Caballer, A. and Sora, B. (2011), "Job attitudes, behaviours and well-being among different types of temporary workers in Europe and Israel", *International Labour Review*, Vol. 150 No. 3–4, pp. 235–254. <https://doi.org/10.1111/j.1564-913X.2011.00115.x>
31. Green, C. P. and Leeves, G. D. (2013), "Job Security, Financial Security and Worker Well-Being: New Evidence on the Effects of Flexible Employment", *Scottish Journal of Political Economy*, Vol. 60 No. 2, pp. 121–138. <https://doi.org/10.1111/sjpe.12005>
32. Green, F. and Mostafa, T. (2012), *Trends in job quality in Europe: a report based on the fifth European Working Conditions Survey*, European Foundation for the Improvement of Living and Working Conditions – Publications Office of the European Union, European Foundation for the Improvement of Living and Working Conditions, Dublin, Ireland – Luxembourg. Retrieved from <https://www.eurofound.europa.eu/publications/report/2012/working-conditions/trends-in-job-quality-in-europe>
33. Heckman, J. J. and Pages, C. (2000), "The Cost of Job Security Regulation: Evidence from Latin American Labor Markets", *NBER Working Paper* [No. 7773], National Bureau of Economic Research, Cambridge, MA. <https://dx.doi.org/10.2139/ssrn.1817230>
34. Hüsing, T. and Korte, W. B. (2010), *E-Skills 21: evaluation of the implementation of the communication of the European Commission: e-skills for the 21st Century*, European Commission, Directorate-General for Enterprise and Industry, & Empirica GmbH, Bonn.
35. Jun, F. and Pow, J. (2011), "Fostering Digital Literacy through Web-Based Collaborative Inquiry Learning – A Case Study", *Journal of Information Technology Education*, Vol. 10, pp. 57–71. Retrieved from <http://www.jite.org/documents/Vol10/JITEv10IIPp057-071Jun930.pdf>

36. Kocanova (Coordination), D., Paolini, G. and Borodankova, O. (2011), *Adults in formal education: policies and practice in Europe*, EURYDICE (Organization), Audiovisual & Culture Executive Agency Education, & European Commission, Brussels. <https://doi.org/10.2797/51592>
37. Kyndt, E. and Baert, H. (2013), "Antecedents of Employees' Involvement in Work-Related Learning: A Systematic Review", *Review of Educational Research*, Vol. 83 No. 2, pp. 273–313. <https://doi.org/10.3102/0034654313478021>
38. Lee, F.-H., Lee, T.-Z. and Wu, W.-Y. (2010), "The relationship between human resource management practices, business strategy and firm performance: evidence from steel industry in Taiwan", *International Journal of Human Resource Management*, Vol. 21 No. 9, pp. 1351–1372. <https://doi.org/10.1080/09585192.2010.488428>
39. Lin, H.-W. and Lin, Y.-L. (2014), "Digital educational game value hierarchy from a learners' perspective", *Computers in Human Behavior*, Vol. 30, pp. 1–12. <https://doi.org/10.1016/j.chb.2013.07.034>
40. Lloyd, C. (1999), "Regulating Employment: Implications for Skill Development in the Aerospace Industry", *European Journal of Industrial Relations*, Vol. 5 No. 2, pp. 163–185. <https://doi.org/10.1177/095968019952004>
41. Loureiro, A., Messias, I. and Barbas, M. (2012), "Embracing Web 2.0 & 3.0 Tools to Support Lifelong Learning - Let Learners Connect", *Procedia - Social and Behavioral Sciences*, Vol. 46, pp. 532–537. <https://doi.org/10.1016/j.sbspro.2012.05.155>
42. Martínez-Cerdá, J.-F. and Torrent-Sellens, J. (2014a), "Alfabetización mediática y co-innovación en la microempresa: primeras evidencias para España", *El Profesional de La Informacion*, Vol. 23 No. 3, pp. 288–299. <https://doi.org/10.3145/epi.2014.may.09>
43. Martínez-Cerdá, J.-F. and Torrent-Sellens, J. (2014b), "e-Learning, e-skills and employability: First evidence in European countries", *eLC Research Paper Series*, No. 9, pp. 6–14. Retrieved from <http://elcrps.uoc.edu/index.php/elcrps/article/view/2481>
44. Michie, J. and Sheehan, M. (1999), "HRM Practices, R&D Expenditure and Innovative Investment: Evidence from the UK's 1990 Workplace Industrial Relations Survey (WIRS)", *Industrial and Corporate Change*, Vol. 8 No. 2, pp. 211–234. <https://doi.org/10.1093/icc/8.2.211>
45. Morgan, J., Genre, V. and Wilson, C. (2001), "Measuring Employment Security in Europe Using Surveys of Employers", *Industrial Relations*, Vol. 40 No. 1, pp. 54–72. <https://doi.org/10.1111/0019-8676.00195>
46. Muffels, R. and Luijkx, R. (2008), "Labour market mobility and employment security of male employees in Europe: 'trade-off' or 'flexicurity'?", *Work, Employment & Society*, Vol. 22 No. 2, pp. 221–242. <https://doi.org/10.1177/0950017008089102>
47. Nisbet, P. (2007), "Human capital vs social capital: Employment security and self-employment in the UK construction industry", *International Journal of Social Economics*, Vol. 34 No. 8, pp. 525–537. <https://doi.org/10.1108/03068290710763044>
48. Ordiz-Fuertes, M. and Fernández-Sánchez, E. (2005), "Influence of the sector and the environment on human resource practices' effectiveness", *International Journal of Human Resource Management*, Vol. 16 No. 8, pp. 1349–1373. <https://doi.org/10.1080/09585190500220242>
49. Palomo-Duarte, M., Dodero, J. M., García-Domínguez, A., Neira-Ayuso, P., Sales-Montes, N., Medina-Bulo, I., ... Balderas, A. (2014), "Scalability of assessments of wiki-based learning experiences in higher education", *Computers in Human Behavior*, Vol. 31, pp. 638–650. <https://doi.org/10.1016/j.chb.2013.07.033>
50. Pérez Tornero (Director and Scientific Coordinator), J. M., Martínez-Cerdá, J.-F., Pegurer Caprino, M. and Othman, D.-A. (2013), *Midiendo la Alfabetización Mediática en Europa 2005-2010*, Gabinete de Comunicación y Educación. Universitat Autònoma de Barcelona (UAB), Barcelona. Retrieved from [http://www.gabinetecomunicacionyeducacion.com/sites/default/files/field/adjuntos/yearbook\\_2005-2010.pdf](http://www.gabinetecomunicacionyeducacion.com/sites/default/files/field/adjuntos/yearbook_2005-2010.pdf)
51. Pérez Tornero, J. M. and Martínez-Cerdá, J.-F. (2011), "Hacia un sistema supranacional de indicadores mediáticos. Políticas de alfabetización en la Unión Europea", *Infoamérica: Iberoamerican Communication Review*, No. 5, pp. 39–57. Retrieved from <http://dialnet.unirioja.es/servlet/articulo?codigo=4278812>
52. Poulidakas, K. (2012), "The skill mismatch challenge in Europe", in *Employment and Social Developments in Europe 2012*, European Commission, Brussels, pp. 351–394. <https://doi.org/10.2767/86080>

53. R Core Team. (2016), *R: A language and environment for statistical computing*, R Foundation for Statistical Computing, Vienna, Austria. Retrieved from <http://www.R-project.org/>
54. Revelle, W. (2015), *psych: Procedures for Personality and Psychological Research*, Northwestern University, Evanston, Illinois, USA. Retrieved from <http://cran.r-project.org/web/packages/psych/>
55. Sanders, J., Oomens, S., Blonk, R. W. . and Hazelzet, A. (2011), “Explaining lower educated workers’ training intentions”, *Journal of Workplace Learning*, Vol. 23 No. 6, pp. 402–416. <https://doi.org/10.1108/13665621111154412>
56. Schumpeter, J. A. (2003), *Capitalism, Socialism and Democracy*, Routledge, New York.
57. Smith, M. R. (1999), “The Production of Flexible Attitudes in the Canadian Pulp and Paper Industry”, *Relations Industrielles / Industrial Relations*, Vol. 54 No. 3, pp. 581–608. <https://doi.org/10.7202/051255ar>
58. Van de Vord, R. (2010), “Distance students and online research: Promoting information literacy through media literacy”, *The Internet and Higher Education*, Vol. 13 No. 3, pp. 170–175. <https://doi.org/10.1016/j.iheduc.2010.03.001>
59. Wilczyńska, A., Batorski, D. and Torrent-Sellens, J. (2015), “Employment Flexibility and Job Security as Determinants of Job Satisfaction: The Case of Polish Knowledge Workers”, *Social Indicators Research*, Vol. 126 No. 2, pp. 1–24. <https://doi.org/10.1007/s11205-015-0909-6>
60. Zarifis, G. (2012), “Adult participation in education in south-eastern Europe: An elaboration on the study report for the assessment of the impact of ongoing reforms in education and training on the adult learning sector”, *Journal of Adult and Continuing Education*, Vol. 18 No. 1, pp. 27–42. <https://doi.org/10.7227/JACE.18.1.4>

**Table 1**

Variables related to employment and job security estimation in literature.

Variables related to employment and job security estimation	References
Perceived job security	Dooley <i>et al.</i> (1987)
Objective job security	
Competition	Ahmed <i>et al.</i> (2006)
Product durability	
Revenue volatility	
Job satisfaction	Barringer and Milkovich (1995)
Willingness to accept an offer from another company that provides much security.	
Intentions to search for another job	
Expect to stay in the organization for as long as wishing	Delery and Doty (1996)
Difficult to dismiss an employee	Daley <i>et al.</i> (2002)
Employees in a job would be the last to get cut	Daley and Vasu (2005)
	Lee <i>et al.</i> (2010)
Probability to be unemployed in the near future	De Witte (1999)
Probability of being laid off	Smith (1999)
Probability of finding another job if the first one is lost	
Probability of remaining in a job	Heckman and Pages (2000)
Discount factor	
Maximum tenure that a worker can attain in a firm	
Advance notice to a worker that has been <i>i</i> years at a firm	
Probability that the economic difficulties of the firm are considered a justified cause of dismissal.	
Mandated severance pay in such event to a worker that has been <i>i</i> years at the firm.	
Payment to be awarded to a worker with tenure <i>i</i> in case of unjustified dismissal.	
Legal restrictions	
Trade unions	Morgan <i>et al.</i> (2001)
Prevalence of atypical employment	
Influence of other institutions	
Alternative employment contracts	Botero <i>et al.</i> (2004)
Cost of increasing hours worked	
Cost of firing workers	
Dismissal procedures	
Time necessary to find comparable work in both self-employment and direct employment.	Nisbet (2007)
Real wages	Alemán (2009)
Employment indices	
Firing costs	
Dualism index	
Temporary employment	
Unemployment	
Inflation	
GDP growth	
Industry	
Services	
Labour productivity	
Polity durability	
Percentage of production employees with a permanent employment contract.	
Perceived likelihood of losing one's present job	Gracia <i>et al.</i> (2011)
Job security index constructed by Heckman and Pages (2000)	Caballero <i>et al.</i> (2013)
Job security index constructed by Botero <i>et al.</i> (2004)	
Chance of getting sacked	Green and Leeves (2013)
Change of quitting	
A job contract with a permanent or temporary nature	Ficapal-Cusí and Torrent-Sellens (2014)

**Table 2**

Indicators used from Eurostat related to employment security, e-learning and other research.

Dimension	Variable	Indicators	Reference
Dependent variable:			
Employment security	Employment security	Transition to the same or higher job security as previous year.	Barringer and Milkovich (1995) Nisbet (2007)
First independent variable (required):			
e-Learning	e-Learning	Individuals who have used Internet, in the last 3 months, for doing an online course (of any subject).	Van de Vord (2010)
		Individuals who have used Internet, in the last 3 months, for looking for information about education, training or course offers.	Desjardins and Rubenson (2011) Jun and Pow (2011) Kocanova <i>et al.</i> (2011)
Second independent variables, of which only one will be used in regression model (1):			
Working conditions	Temporary employees	Temporary employees as a percentage of the total number of employees.	Morgan <i>et al.</i> (2001) Alemán (2009) Ficapal-Cusí and Torrent-Sellens (2014)
	Part time employment	Part-time employment as a percentage of the total employment.	Botero <i>et al.</i> (2004) Alemán (2009)
	Employment	Employment (15 to 64 years)	Alemán (2009) Bonavia and Marin-Garcia (2011)
	Labour transition	Transition from unemployed persons to employed persons.	Smith (1999)
Education	Tertiary education	Percentage of the population aged 30-34 who have successfully completed tertiary studies (e.g. university, higher technical institution, etc.).	Geishecker (2008) Boateng (2009)
	Lifelong Learning	Participation rate in education and training (last 4 weeks) (25 to 64 years).	Elman and O'Rand (2002) Desjardins and Rubenson (2011) Sanders <i>et al.</i> (2011) Loureiro <i>et al.</i> (2012) Kyndt and Baert (2013)
e-Skills	e-Job search	Internet use: job search or sending an application.	Barringer and Milkovich (1995) Nisbet (2007)
	e-Skills (Internet use)	Sending/receiving e-mails Finding information about goods and services Seeking health information Travel and accommodation services Internet banking Last online purchase: in the last 3 months Selling goods or services Telephoning or video calls Playing/downloading games, images, films or music. Downloading software Reading/downloading online newspapers/news Listening to web radios and/or watching web TV Obtaining information from public authorities web sites (last 12 months). Downloading official forms (last 12 months). Sending filled forms (last 12 months). Interaction with public authorities (last 12 months). Uploading self-created content to any website to be shared.	Bresnahan <i>et al.</i> (2002) Bartel <i>et al.</i> (2007) European Commission (2007) Hüsing and Korte (2010) Pouliakas (2013) Martínez-Cerdá and Torrent-Sellens (2014b)
	Media Literacy	General Media Literacy Assessment (*)	Martínez-Cerdá and Torrent-Sellens (2014a, 2014b)

(\*) Following methodology from Pérez Tornero and Martínez-Cerdá (2011) and Pérez Tornero *et al.* (2013) with data from Eurostat



**Table 3**

Regression models analysed in all countries to proving the relationships between employment security and e-learning.

Dimension	Model	Linear regression
Working conditions	Model Temporary	$Y_{ES} = \alpha + \beta_{eL} X_{eL} + \beta_{TT} X_{TT} + \epsilon$
	Model Part Time	$Y_{ES} = \alpha + \beta_{eL} X_{eL} + \beta_{PT} X_{PT} + \epsilon$
	Model Employment	$Y_{ES} = \alpha + \beta_{eL} X_{eL} + \beta_E X_{EM} + \epsilon$
	Model Labour Transition	$Y_{ES} = \alpha + \beta_{eL} X_{eL} + \beta_{LT} X_{LT} + \epsilon$
Education	Model Tertiary	$Y_{ES} = \alpha + \beta_{eL} X_{eL} + \beta_{TE} X_{TE} + \epsilon$
	Model Lifelong	$Y_{ES} = \alpha + \beta_{eL} X_{eL} + \beta_{LL} X_{LL} + \epsilon$
e-Skills	Model e-Job Search	$Y_{ES} = \alpha + \beta_{eL} X_{eL} + \beta_{eJ} X_{eJ} + \epsilon$
	Model e-Skills	$Y_{ES} = \alpha + \beta_{eL} X_{eL} + \beta_{eS} X_{eS} + \epsilon$
	Model Media Literacy	$Y_{ES} = \alpha + \beta_{eL} X_{eL} + \beta_{ML} X_{ML} + \epsilon$

$X_{ii}$  is the second independent variable:  
 TT = Temporary Employees  
 PT = Part Time Employment  
 EM = Employment  
 LT = Labour Transition  
 TE = Tertiary Education  
 LL = Lifelong Learning  
 eJ = e-Job Search  
 eS = e-Skills  
 ML = Media Literacy

Employment security is the dependent variable ( $Y_{ES}$ )  
 e-Learning is the first independent variable ( $X_{eL}$ )

**Table 4**

Ranking of countries according to their minimum p-values for regression model (1) and significance levels of their independent variables.

Country	Minimum p-value	Pr(> t ) of its independent variables		
		E-learning	Second variable of best regression model	
A p-value for the regression model lower than 0.05 and a significance level for at least one of the two independent variables ( $X_{e-Learning}$ or $X_{Variable(i)}$ ) lower than 0.05.				
Greece	0.00037 ***	0.00291 **	0.12387	Tertiary
Germany	0.00080 ***	0.39500	0.015 *	Tertiary
UK	0.00109 **	0.00221 **	0.03370 *	Labour Transition
Portugal	0.00116 **	0.22920	0.0172 *	Employment
EU27	0.00303 **	0.0016 **	0.10420	Temporary
Belgium	0.00473 **	0.004937 **	0.014339 *	Part Time
Slovenia	0.00848 **	0.73900	0.0478 *	Employment
Sweden	0.01085 *	0.00423 **	0.02540 *	Labour Transition
Luxembourg	0.01310 *	0.02783 *	0.44734	Employment
Finland	0.01639 *	0.02267 *	0.00653 **	Employment
Bulgaria	0.01921 *	0.84780	0.0237 *	Labour Transition
Austria	0.02099 *	0.03737 *	0.00917 **	Part Time
Estonia	0.02687 *	0.0876 .	0.0190 *	e-Skills
Italy	0.02865 *	0.01199 *	0.36827	Lifelong Learning
Slovakia	0.03406 *	0.0476 *	0.17980	Employment
Netherlands	0.03568 *	0.0144 *	0.21850	Labour Transition
Czech Republic	0.04465 *	0.0902 .	0.0379 *	Labour Transition
Hungary	0.04795 *	0.0312 *	0.0201 *	e-Skills
A p-value for the regression model lower to 0.05 and a significance level for at least one of the two independent variables ( $X_{e-Learning}$ or $X_{Variable(i)}$ ) lower to 0.1.				
Spain	0.00112 **	0.56040	0.0981 .	Employment
Lithuania	0.00558 **	0.14266	0.074386 .	Labour Transition
Cyprus	0.00786 **	0.86380	0.0938 .	Employment
Latvia	0.03609 *	0.0595 .	0.76500	Tertiary
A p-value for the regression model lower than 0.1 and a significance level for at least one of the two independent variables ( $X_{e-Learning}$ or $X_{Variable(i)}$ ) lower than 0.1.				
Romania	0.05758 .	0.91390	0.0383 *	Part Time
Denmark	0.08087 .	0.51188	0.07096 .	Media Literacy
Poland	0.09910 .	0.36400	0.093 .	e-Job Search
A p-value for the regression model higher than 0.1 and a significance level for at least one of the two independent variables ( $X_{e-Learning}$ or $X_{Variable(i)}$ ) lower than 0.1.				
France	0.11160	0.38340	0.0598 .	Tertiary
Norway	0.19380	0.0875 .	0.51680	Temporary
A significance level for the two independent variables ( $X_{e-Learning}$ or $X_{Variable(i)}$ ) higher than 0.1.				
Iceland				
Malta				

Signif. Codes: \*\*\* p<0.001; \*\* p<0.01; \* p<0.05; . p<0.1

**Table 5**

Coefficients of all the best linear regressions models and significance levels of their coefficients.

Model	Best model	Adjusted R-squared	Linear regression coefficients			
			$\alpha$	$\beta_{eL}$	$B_{Variable}$	$\varepsilon$
EU27	Temporary **	0.9174	97.86800	-0.22855 **	-0.52704	0.1774
Austria	Part Time *	0.7827	107.03159	0.16249 *	-0.86534 **	0.3763
Belgium	Part Time **	0.8968	63.2169	-1.4003 **	1.6466 *	0.292
Bulgaria	Labour Transition *	0.7921	86.12899	-0.03557	-0.14697 *	0.9648
Cyprus	Employment **	0.867	34.94922	-0.09532	0.82309 .	1.157
Czech Republic	Labour Transition *	0.683	84.9674	0.2935 .	0.1075 *	0.4726
Denmark	Media Literacy .	0.5734	140.4852	0.1870	-0.8048 .	1.536
Estonia	e-Skills *	0.7541	109.1193	1.1894 .	-1.1135 *	1.732
Finland	Employment *	0.808	-46.8141	-1.9173 *	2.5593 **	0.8111
France	Tertiary -	0.4989	107.92862	0.07621	-0.45546 .	0.3413
Germany	Tertiary ***	0.9575	66.73515	0.09838	0.60871 *	0.3567
Greece	Tertiary ***	0.9711	110.933	-1.583 **	-0.412	0.9428
Hungary	e-Skills *	0.6715	98.3712	0.8631 *	-0.8560 *	1.156
Iceland	No model					
Italy	Lifelong Learning *	0.7461	83.5190	-0.9473 *	2.0889	1.387
Latvia	Tertiary *	0.7151	106.600	-1.062 .	-0.191	1.693
Lithuania	Labour Transition **	0.8879	87.6396	-0.5778	0.2770 .	1.161
Luxembourg	Employment *	0.8283	114.96574	-0.25652 *	-0.25049	0.4525
Malta	No model					
Netherlands	Labour Transition *	0.7167	103.19089	-0.70736 *	0.04352	0.4534
Norway	Temporary -	0.3396	88.25855	0.11426 .	0.30645	0.3912
Poland	e-Job Search .	0.5278	79.6584	-0.6814	1.5183 .	1.279
Portugal	Employment **	0.9489	23.6255	-0.2522	0.9887	0.8379
Romania	Part Time .	0.64	86.472179	-0.003946	0.876009 *	0.285
Slovakia	Employment *	0.7232	56.8099	-0.2147 *	0.5654	0.8771
Slovenia	Employment **	0.8618	8.57116	0.08472	1.16251 *	0.8317
Spain	Employment **	0.9499	34.3604	-0.1859	0.8453 .	1.028
Sweden	Labour Transition *	0.8437	87.63182	-0.50992 **	0.23871 *	0.5632
UK	Labour Transition **	0.9504	53.8729	1.1993 **	0.3530 *	0.9458

Signif. Codes: \*\*\* p&lt;0.001; \*\* p&lt;0.01; \* p&lt;0.05; . p&lt;0.1; - p&gt;0.1

**Table 6**

Ranking of countries according to their number of regression models analysed, and their minimum p-values.

Country	Number of regression models	Minimum p-value	First variable of regression model: e-Learning	Second variable of best regression model								
				Working conditions			Education			e-Skills		
				TT	PT	EM	LT	TE	LL	eJ	eS	ML
Greece	8	0.00037 ***	**	1	1	1	1	-	1		1	1
UK	7	0.00109 **	**	1	1	1	*		1	1		1
Portugal		0.00116 **	-	1	1	*	1		1	1	1	
Germany	6	0.00080 ***	-	1			1	*	1	1		1
EU27		0.00303 **	**	-		1	1		1	1		1
Belgium		0.00473 **	**	1	*	1	1	1	1			
Lithuania		0.00558 **	-	1	1	1			1	1		
Slovenia		0.00848 **	-	1	1	*	1	1	1			
Estonia		0.02687 *	.		1	1	1	1		1	*	
Netherlands	5	0.03568 *	*	1			-	1	1	1		1
Spain		0.00112 **	-	1			1	1	1			
Luxembourg		0.01310 *	*	1	1	-	1			1		
Sweden		0.01085 *	**	1	1	1	1	*				
Finland		0.01639 *	*	1		**	1			1		
Austria	3	0.02099 *	*		**			1			1	
Slovakia		0.03406 *	*			-			1	1		
Hungary		0.04795 *	*				1			1	*	
Denmark	4	0.08087 .	-					1		1		
Cyprus		0.00786 **	-					1				
Italy		0.02865 *	*	1						-		
Czech Republic		0.04465 *	.				*					1
Romania	2	0.05758 .	-		*					1		
Bulgaria		0.01921 *	-				*					
Latvia	1	0.03609 *	.					-				
Poland		0.09910 .	-									
France		0.11160 -	-									
Norway	0	0.19380 -	.	-								
Iceland												
Malta												
		Total uses of variable in best models (A)	27	2	3	7	6	4	1	1	2	1
		Total uses of variable (B)	27	15	11	14	17	12	12	14	6	6
		Ratio (A/B)		0.13	0.27	0.50	0.35	0.33	0.08	0.07	0.33	0.17

Signif. Codes: \*\*\* p<0.001; \*\* p<0.01; \* p<0.05; . p<0.1; - p>0.1

1=useful second variable, too

X<sub>ii</sub> is the second independent variable:

TT = Temporary Employees

PT = Part Time Employment

EM = Employment

LT = Labour Transition

TE = Tertiary Education

LL = Lifelong Learning

eJ = e-Job Search

eS = e-Skills

ML = Media Literacy

Employment security is the dependent variable (Y<sub>ES</sub>)

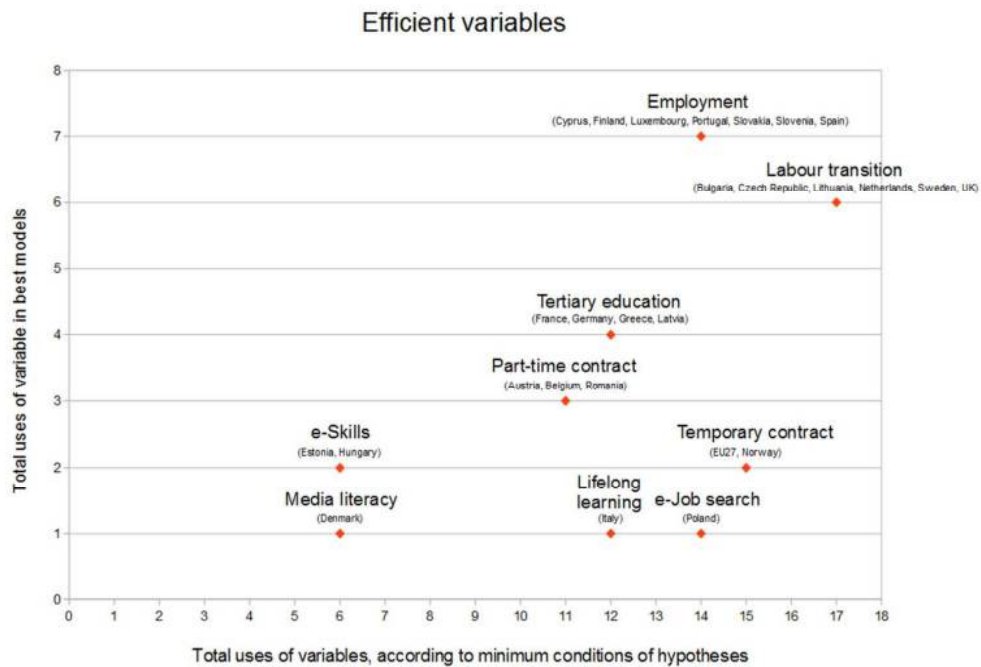
e-Learning is the first independent variable (X<sub>eL</sub>)

**Table 7**

Countries with only one model and other countries using this model.

Variable	Country where this is the unique variable	This variable is the best one in other countries	This variable is also useful in other countries
Labour Transition	Bulgaria *	Czech Republic * Lithuania ** Netherlands * Sweden * UK **	Belgium * Luxembourg * Portugal ** Spain **
Tertiary Education	France - Latvia *	Germany *** Greece ***	Austria - Cyprus * Estonia * Slovenia *
Temporary employees	Norway -	EU27 **	Finland * Italy *
e-Job Search	Poland .		Denmark . Hungary - Romania . Slovakia .
e-Skills (variable added to other four ones)			Austria . Hungary *

Signif. Codes: \*\*\* p&lt;0.001; \*\* p&lt;0.01; \* p&lt;0.05; . p&lt;0.1; - p&gt;0.1



159x109mm (300 x 300 DPI)