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tences des adultes de l'OCDE (PIAAC)

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Ekaterina Kalugina,
Mouhamadou Moustapha Niang

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« Le Descartes »
29, promenade Michel Simon
93166 Noisy-Le-Grand CEDEX
Téléphone : (33) 01 45 92 68 00
Télécopie : (33) 01 49 31 02 44
www.cee-recherche.fr

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NATHALIE GREENAN

nathalie.greenan@lecnam.net

Cnam, Lirsa, CEET and TEPP

EKATERINA KALUGINA

ekaterina.kalugina@univ-evry.fr

EPEE, université Évry, Paris-Saclay, CEET and TEPP

MOUHAMADOU MOUSTAPHA NIANG

mouhamadou.niang2@lecnam.net

Cnam, Lirsa and CEET

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Work Organisation and Workforce Vulnerability to Non-Employment: Evidence from OECD's Survey on Adult Skills (PIAAC)¹

Nathalie Greenan, Ekaterina Kalugina, Mouhamadou Moustapha Niang

Abstract

*This working paper examines the relationship between forms of work organisation and vulnerability of the workforce to non-employment. It relies on the data from the first two rounds of the survey on adult skills (PIAAC) carried out by the Organisation for Economic Co-operation and Development (OECD) in 33 of its member or partner countries. Using hierarchical cluster analysis, we identify five forms of work organisation based on the description given by employees of the tasks they perform: Discretionary learning, Constrained learning, Independent, Simple and Taylorist. A multilevel logistic regression is then used to evaluate their impact on vulnerability to non-employment. **Vulnerability to non-employment is defined as the probability to make a transition from employment to non-employment over a one year period.** The results show indeed a significant impact of forms of work organisation on vulnerability to non-employment after controlling for a large number of relevant job and personal characteristics. In particular, employees in Discretionary learning forms of work organisation are the least vulnerable. We also identify labour market policies and institutions which are likely to influence the probability of making a transition to non-employment in relation with the different forms of work organisation. Our results suggest that active labour market policies such as training and employment and start-up incentives amplify the protective effect of Discretionary learning and Independent forms of work organisation as do passive labour market policies for Constrained learning and Simple forms of work organisation. To protect employees in Taylorist forms, expenditures on public employment service and administration, sheltered and supported employment and rehabilitation and direct job creation are to be promoted. A strict employment legislation against dismissals, unlike the strictness of the regulation regarding the use of temporary contract, tends to protect employees in Taylorist forms of work organisation while weakening the protective effect of Simple and Constrained learning forms. Finally, there is a non-monotonous relationship between the centralisation of wage bargaining and vulnerability. Vulnerability is lower for employees in Constrained learning, Discretionary learning and Independent forms of work organisation when bargaining takes place at an intermediate level, while it is higher for employees in Simple and Taylorist forms and decreasing in the degree of centralisation. It would seem, therefore, that the effectiveness of labor market policies and institutions should be examined in relation with the forms of work organisation prevailing within each country.*

Keywords: *Workforce vulnerability, Job insecurity, Work organisation, Labour market policies and institutions, PIAAC.*

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ORGANISATION DU TRAVAIL ET VULNÉRABILITÉ AU NON-EMPLOI : UNE ÉTUDE EMPIRIQUE À PARTIR DE L'ÉVALUATION DES COMPÉTENCES DES ADULTES DE L'OCDE (PIAAC)

RÉSUMÉ

Bousculée par la crise et les mutations du tissu économique, la vie des organisations au sein des pays de l'OCDE a été marquée cette dernière décennie par des changements fréquents en lien avec les évolutions technologiques, tandis que se développaient aussi bien le non-emploi que les formes non conventionnelles d'emploi. Dans un tel environnement, la capacité des salariés à se maintenir en emploi ne dépend pas seulement de leurs caractéristiques individuelles. Les formes d'organisation du travail, dans lesquelles ils sont insérés et accumulent de l'expérience, jouent également un rôle fondamental. Or, la plupart des études concernant la vulnérabilité sur le marché du travail s'intéressent aux facteurs du côté de l'offre de travail plutôt qu'à ceux qui prennent leur source au sein des organisations. De l'autre côté, les études qui s'intéressent aux organisations du travail analysent les enjeux de productivité, d'innovation, de conditions de travail et de bien-être des salariés, mais abordent rarement ceux liés aux transitions sur le marché du travail.

Ce document de travail examine **la relation entre les formes d'organisation du travail et la vulnérabilité de la main-d'œuvre au non-emploi. La vulnérabilité au non-emploi est définie comme la probabilité d'effectuer une transition de l'emploi vers le non-emploi au cours d'une période d'un an.** Il s'appuie sur les données des deux premières vagues de l'évaluation des compétences des adultes, pilotée par l'OCDE auprès de trente-trois de ses pays membres ou partenaires.

En utilisant une classification ascendante hiérarchique, nous identifions **cinq formes d'organisation du travail** en fonction des tâches effectuées par les salariés sur leur lieu de travail : **apprentissage autonome, apprentissage contraint, indépendante, simple et taylorienne.** *L'apprentissage autonome* décrit des formes d'organisation où les salariés bénéficient de marges de manœuvre importantes pour accomplir leurs tâches. Ils participent aussi fréquemment à des activités leur permettant d'apprendre des échanges avec leurs collègues et de résoudre des problèmes complexes. Les salariés dans des formes d'organisation à *apprentissage contraint* sont moins autonomes que le groupe précédent, mais ils sont plus impliqués dans des activités d'apprentissage sur le lieu de travail que ceux des trois autres formes d'organisation. Dans les formes d'organisation du travail *indépendantes* les salariés disposent d'une très grande autonomie, mais ils sont moins souvent impliqués dans des activités collectives. Les salariés des formes d'organisation dites *simples* ont peu de marge de manœuvre, ils sont moins impliqués dans les échanges avec d'autres et ils ont peu d'opportunités d'apprentissage. La forme *taylorienne* est comparable à la forme simple, mais les salariés sont dans des organisations plus structurées, notamment ils sont amenés à se coordonner avec leurs collègues.

Une modélisation logistique multiniveaux est ensuite utilisée pour évaluer l'impact de ces formes d'organisation du travail sur la vulnérabilité des salariés au non-emploi.

Les résultats montrent **un impact significatif de l'organisation du travail sur la vulnérabilité au non-emploi**, après avoir tenu compte d'un vaste ensemble de caractéristiques des emplois et des individus. En particulier, **les salariés dans des formes d'organisation à apprentissage autonome sont nettement moins vulnérables** au non-emploi.

Nous avons aussi identifié les politiques et institutions du marché du travail pouvant influencer la probabilité d'effectuer une transition vers le non-emploi en lien avec les différentes formes d'organisation du travail. Nos résultats suggèrent que **les politiques actives, telles que la formation et l'incitation au maintien de l'emploi ou à la création d'emploi ou de *start-up*, amplifient l'effet protecteur des formes d'organisation à apprentissage autonome et indépendantes**, tout comme les politiques dites passives pour les formes d'organisation à apprentissage contraint et simples. Pour protéger les salariés dans des formes d'organisation taylorienne, les dépenses en administration et service public de l'emploi, ainsi qu'en emplois aidés et en création d'emplois directs sont à privilégier. **Un encadrement légal strict des licenciements**, contrairement à une législation stricte sur l'utilisation des contrats temporaires, **contribue à protéger les salariés dans des organisations tayloriennes**, mais affaiblit l'effet protecteur des formes d'organisation à apprentissage contraint et simples.

Enfin, nous avons trouvé **une relation non monotone entre le degré de centralisation des négociations salariales et la vulnérabilité au non-emploi**. Pour les salariés dans les formes d'organisation à apprentissage autonome, apprentissage contraint et indépendantes, la vulnérabilité des salariés est moindre pour un niveau de centralisation intermédiaire, alors qu'elle est accrue pour les organisations simples et tayloriennes et qu'elle se réduit avec le degré de centralisation. Il semblerait donc que **l'efficacité de la politique et des institutions du marché du travail doit être examinée en lien avec les formes d'organisation du travail dominantes au sein de chaque pays**.

Mots-clefs : vulnérabilité au non-emploi, insécurité de l'emploi, organisation du travail, politiques du marché du travail, institutions du marché du travail, PIAAC.

INTRODUCTION

Organisational restructuring has been widely observed in workplaces since the 1980s (Osterman, 1994; Caroli and Van Reenen, 2001; Greenan, 2003). These changes often pursue an objective of productivity growth and innovation in an attempt to restore or strengthen competitiveness for business survival in the face of a more and more competitive international economy. Indeed, work organisation is often considered as a central element in fostering economic and business development in this new world. For example, Eurofound (2009) argues that more decentralised and empowering forms of work organisation are associated with a better quality of work and employment and that their promotion may help attaining the objectives set by Europe 2020 strategy and the *New Skills for New Jobs* initiative. However, from the employees' perspective, while these forms of work organisation may contribute to increased job satisfaction – through more autonomy and task complexity – they may also generate increased stress, work pressure and work intensity.

In this paper, we are going to study an area of impact of forms of work organisation which has seldom been considered: vulnerability to non-employment. It is defined as the probability to make a transition from employment to non-employment over a one year period. Indeed, we argue that employees' ability to secure their employment in changing work environments is partly due to the form of work organisation in which they are employed, either because it makes the organisation more resilient to business shocks or because it allows employees to better develop their skills and to adjust them to business needs. The acceptability for social partners of policies implemented to improve competitiveness depends on this relationship on which little is known. As a matter of fact, most studies on labour market vulnerability address supply side factors expected to influence labour market participation or the intensity of job search rather than demand side factors like working conditions or work organisation characteristics. Besides, the former are much better documented than the latter in labour force surveys. In this regard, the purpose of the present paper is to provide some insights into the linkage between forms of work organisation and vulnerability to non-employment within a number of countries that took part into rounds 1 and 2 of the survey of adult skills carried out by the Organisation for Economic Co-operation and Development (OECD) in the context of the Programme for the International Assessment of Adult Competencies (PIAAC).

Different strands of literature relate work organisation with economic outcomes. In the High-Performance Work Systems (HPWS) literature a distinction between the hierarchical and flexible forms of work organisation is made, assessing the impact of different organisational practices and work arrangements on efficiency improvements in production processes (Ichniowski et al., 1997; Osterman, 1994; Gittleman et al., 1998; Wood, 1999; Ramsay et al., 2000; Truss, 2001). The consequences of the diffusion of the Japanese lean production model associated with Toyota has also been scrutinised in this research field (Womack, Jones and Roos, 1990; MacDuffie and Pil, 1997). The literature on organisational design explores the relationship between work organisation and innovation and provides a more complex typology of forms of work organisation, notably the distinction between different adhocratic work systems based on learning, problem solving and discretion (Burns and Stalker, 1961; Mintzberg, 1979, 1983; Lam, 2005; Lam and Lundvall, 2006; Lorenz and Lundvall, 2010). Finally, in the literature on job quality, the emphasis is mostly on the contrasted effects of the forms of work organisation on different aspects of working

conditions (Karasek, 1979; Clark, 2005; and Green et al., 2015). Many dimensions of new forms of work organisation lead to increased job satisfaction and well-being, but some critical aspects like work intensity, lack of job control or poor physical work environment are sources of negative employee outcomes like stress, health impairments or work accidents.

The effects of work organisation on labour market outcomes are barely covered in these research strands except for wage rates. The job quality literature considers however the effects of job insecurity on workers' job satisfaction, on their well-being or their health (Esser and Olsen, 2011; De Witte, 2005; Green, 2015). The few studies which examine the determinants of job insecurity do not look at organisational aspects of work (Green et al., 2000). Furthermore, while these studies approach the question of job insecurity using subjective measures of the concept, the present study proposes an objective one, exploiting the information given in the PIAAC survey regarding the employment history of employees.

Finally, there is a rich literature on the effects of labour market policies and institutions on aggregate unemployment or on flows out of unemployment (Scarpetta, 1996; Nickell, 1997, 1998; Blanchard and Wolfers, 2000; Belot and Van Ours, 2001; Nickell, Nunziata and Ochel, 2005). In the current paper, we argue that these national labour market characteristics may also influence transitions from employment to non-employment and this impact may vary according to the form of work organisation experienced by employees.

We use hierarchical cluster analysis to define five forms of work organisation: *Discretionary learning*, *Constrained learning*, *Independent*, *Simple* and *Taylorist*. The clustering is based on the description given by employees of the tasks they perform. A multilevel logistic regression is then used to evaluate their impact on vulnerability to non-employment, controlling for relevant job and personal characteristics as well as for national labour market policies and institutions.

The paper is organised as follows. The next two sections explain the measurement frame of vulnerability to non-employment (section 1) and of the different forms of work organisation (section 2). Then section 3 presents the model and the variables used in our econometric analysis. Section 4 presents the empirical results before we conclude in section 5.

1. MEASURING VULNERABILITY TO NON-EMPLOYMENT

Several aspects of workforce vulnerability are described in the literature. It can be defined in terms of lack of employment security, low level of earnings or exposure to professional risks (Weil, 2009). In this paper, we focus on workforce vulnerability on the labour market², which is close to job insecurity. Employment security is an important aspect of the quality of a job and a source of job satisfaction (Gallie, 2003; Green, 2006; Doellgast et al., 2009). Job insecurity is usually defined objectively or in a subjective way.

The subjective definition refers mainly to the perceived fear of losing one's job (Anderson and Pontusson, 2007; De Witte, 2005; Esser and Olsen, 2011), or, more recently, to the fear of facing a downgraded job status, such as being transferred to a less interesting or less

² The concept of labour market vulnerability is quite large. It could include workers unable to access their statutory rights or lacking access to social protection (Saunders, 20003). Standard (full-time, indefinite) but low-paid work is also one of the forms of the labour market vulnerability. These kinds of vulnerabilities are out of the paper's scope.

challenging post with the same employer or losing a valued feature of the job (Gallie et al., 2017; Green, 2015). As it refers to the subjective fear of losing one's job or one's job status, it is dependent on individual interpretations. The same objective situation could provoke feelings of insecurity for some even if, objectively, their job continuity is not affected and vice versa (De Witte, 2005). Many studies found, however, a link between the subjective job insecurity and individual's objective chances and position on the labour market (Clark and Postel-Vinay, 2009; De Witte, 2005).

While subjective job insecurity is about the future, objective job insecurity refers to the precariousness of the current employment relationship: part-time, temporary work, employment through temporary agency and self-employment (Saunders, 2003). Indeed, these non standard employment characteristics are often associated with poor income and working conditions as well as with a greater exposure to economic risks. Temporary and part-time work have been on the rise in industrial countries since the late 1970s. Globalisation, technological change, as well as changes in patterns of family and working life are usually mentioned as the main explanations of such trends. However, not all precarious workers are vulnerable at every point of time. A dynamic perspective is usually necessary in order to better appraise the degree of individual objective vulnerability. A temporary contract, for example, could be a bridge to a job with higher quality, but also a trap into precarious, low quality, short-term jobs. The interaction with the level and duration of unemployment or inactivity is thus important. Vulnerable groups, such as young people, women, and low skilled workers, are often characterised by high incidence of unemployment rates as well as greater duration of unemployment spells.

Hence labour market vulnerability is also addressed through the analysis of worker flows among different labour market states: employment, unemployment, inactivity. After defining the transition rates (for example, employment-employment, employment-unemployment, employment-inactivity), the Markov transitions chains and Markov matrices are used for the descriptive analysis while regression analysis is usually applied in order to study the impact of main individual and institutional determinants of labour market transitions. From the theoretical standpoint search and matching models are referred to (Pissarides, 2000; Cahuc and Zylberberg, 2004). Two main data sources are generally used in this literature: the Labour Force Survey (LFS) and the European Union Statistics on Income and Living Conditions (EU-SILC). These databases allow defining different labour market transitions due to the panel data module and the detailed description of behaviours on the labour market. Based on this data, the European Commission (2014) provides in-depth analysis of labour market transitions in the European Union before and during the economic downturn which started in 2008. Compared with 2006, employment stability has declined significantly in 2010, with unemployment becoming the most frequent destination upon leaving employment. During this period, the transitions of men and young people were most strongly affected and temporary employment did not act any longer as a bridge to permanent employment (European Commission, 2014, p. 4).

Our measure of labour market vulnerability is based on an objective definition, namely the probability to make a transition from employment to non-employment over a one year period. Hence employees are considered as vulnerable when they cannot secure their employment in the near future. We choose this definition because we want to explore the sources of labour market vulnerability which are related to working conditions and employment history. Workers in employment are more vulnerable to non-employment when they are not able to develop their skills in order to adapt to technological and organisational changes in the workplace and maintain their employability or when their

working conditions do not allow them to remain in employment when they face personal challenges like family responsibility or health problems. Vulnerability to non-employment is also higher when the workplaces encounter problems that put their survival in jeopardy. For instance, when they are hit by an economic downturn or when they are not able to renew their strategy when new challengers enter their markets. This focus on employment history complements the perspective developed in the literature on unemployment history (Disney, 1979; Andress, 1989; Gay, 1989; Steiner, 1989; Stern, 1989; Winter-Ebmer and Zweimüller, 1992; Arulampalam et al., 2001; Niang, 2014) where recurrent unemployment is considered as part of the cycle of labour market disadvantage and poverty in work.

If EU-LFS and EU-SILC collect detailed information on employment status, transitions and socio-demographic characteristics, they do not describe, except for specific modules, the working conditions of people in employment. This is why we prefer to use another household data source, the OECD's survey of adult skills (PIAAC). While there are no questions about fear of job loss in the survey of adult skills, vulnerability in terms of objective employment security can be measured. The first and second rounds of the survey cover thirty-three countries member or partner of OECD. It gathers information on adults' skills proficiency and how those skills are used in the workplace and other environments, in addition to personal and job characteristics. Around 250,000 adult persons aged 16 to 65 were surveyed during the two rounds in the national languages of the thirty-three participating countries. The data collection took place between August 2011 and March 2012 for the first round and between April 2014 and March 2015 for the second round.

As the data for Australia and Indonesia are not available in the combined Public Use File (PUF), thirty-one countries are used in the descriptive part of our paper (sections 1 and 2). Due to missing data in Austria, Canada and United States of America³, we will ultimately use the data from twenty-eight countries in the econometric part of our study (sections 3 and 4): Belgium (Flanders), Chile, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Ireland, Israel, Italy, Japan, Korea, Lithuania, Netherlands, New Zealand, Norway, Poland, Russian Federation, Singapore, Slovak Republic, Slovenia, Spain, Sweden, Turkey and United Kingdom (England and Northern Ireland).

This survey is very appropriate for the implementation of the measure of vulnerability to non-employment presented above as it offers a unique retrospective view into the employees' employment situation over a year. We consider only individuals who are working or have worked in the last twelve months previous the survey. Those among them non-employed at the time of the survey, unless they are retired, are considered as vulnerable to non-employment compared to those who were able to keep their jobs. The resulting variable is our binary dependent variable. The original dataset has 200,588 observations, of which we keep only those individuals who declared having worked a paid job in the last twelve months preceding the survey (145,814). They represent roughly 72% of the initial number of observations in the survey as shown in Table 1 which synthesise the different steps in the construction of our vulnerability index.

We remove from the sample young persons aged 16-24 in their initial cycle of studies, who amount to 13,216 persons. Among the remaining 132,598 individuals, we keep only employees. This leaves us with a sample of 112,845 individuals of whom 9,657 (9.27%) are

³ For these three countries, information was not given regarding the employment history of individuals. The type of employment contract was also not available for Canada and the United States. Information regarding the gender was unavailable for Austria, as well as information on the number of hours worked per week. The latter is also not available for Canada.

non-employed at the time of the survey for diverse reasons: end of temporary contract (23.9%), dismissals (10.4%), redundancy (9.5%), family responsibilities or child care (8.6%), study (3.8%), bad health (8%), resignation (6.4%), retirement at or after state pension age (5.8%), early retirement (2.8%), others (18.9%). We remove from the sample the persons retired at or after state pension and consider all the remaining individuals as being vulnerable to non-employment. They represent 8.8% of the considered population.

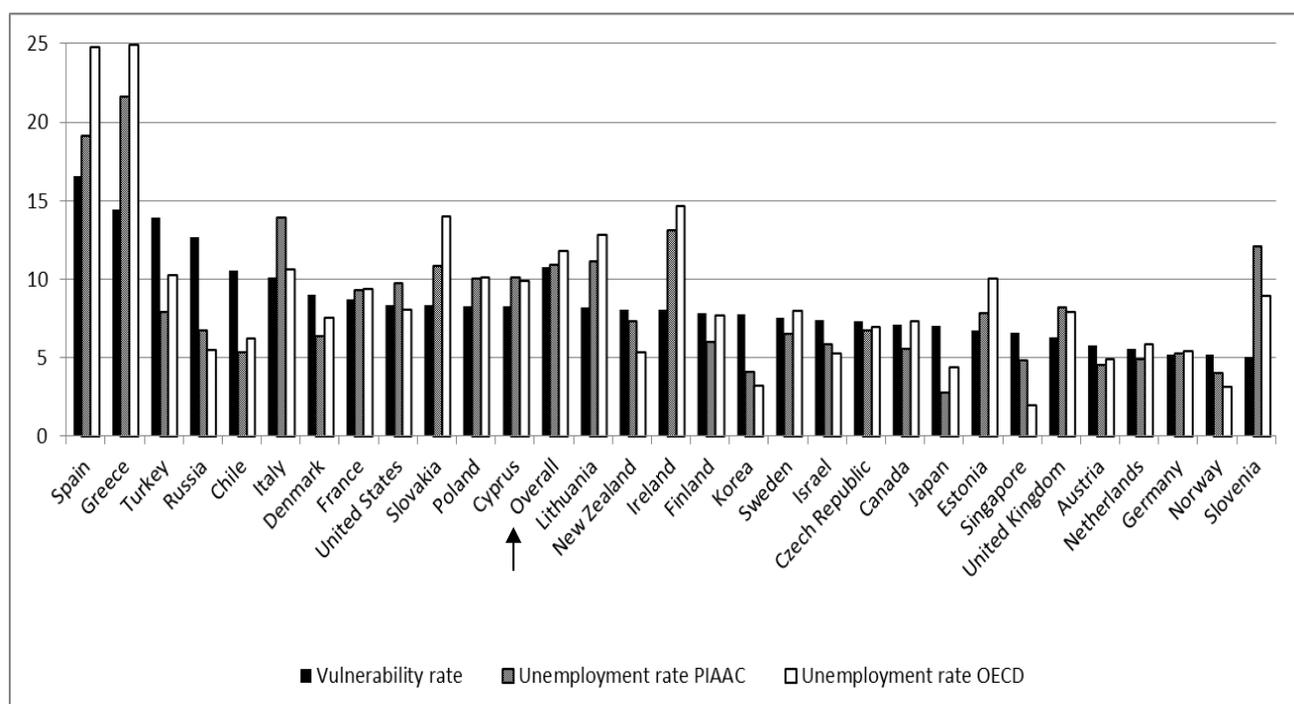
Table 1. **Sample and vulnerability index**

Variable	Frequency	Weighted percentage
Adults who have had paid work during the last 12 months	145814	72.0
Adults who have not had paid work during the last 12 months	51931	26.2
Not known	2843	1.8
Total	200588	100
Eligible for Adult Education/Training population (AET)	132598	92.1
youths 16-24 in initial cycle of studies	13216	7.9
Total	145814	100
Employee	112845	84.7
Self-employed	18667	14.3
Not known	1086	1.0
Total	132598	100
Employed	103188	90.7
Non-employed	9657	9.3
Total	112845	100
Could you tell me the main reason you stopped working		
Not known	83	1.9
I was dismissed	900	10.4
I was made redundant or took voluntary redundancy	1249	9.5
It was a temporary job which came to an end	2568	23.9
I resigned	757	6.4
I gave up work for health reasons	722	8.0
I took early retirement	362	2.8
I retired (at or after State Pension age)	580	5.8
I gave up work because of family responsibilities or child care	690	8.6
I gave up work in order to study	439	3.8
I left for some other reason	1307	18.9
Total	9657	100
Non-vulnerable	103188	91.2
Vulnerable	9657-580=9077	8.8
Total	112265	100

Source: First and second rounds PIAAC(2012 and 2015), OECD.

Figure 1 presents, for each country, our vulnerability rate as well as the unemployment rate calculated using PIAAC⁴ and the OECD unemployment rate based on the International Labour Organization (ILO) definition. Our vulnerability measure differs from the unemployment rate in many regards. The unemployment rate is calculated at a given point in time and considers the proportion of the active labour force without a paid work while the rate of vulnerability considers loosely the rate of job loss over a period of time. Therefore, it considers only those who have worked in the last twelve months.

Figure 1. **Vulnerability to non-employment and unemployment rate**



Sources: First and second rounds PIAAC, weighted statistics, OECD database, 2012 and 2015.

The rate of unemployment is higher when the rate of job losses is higher even though all individuals leaving employment do not become unemployed. Indeed, leaving employment, individuals may transit toward inactivity. While the unemployment rate concerns individuals who are ready to return to work within two weeks, our measure of vulnerability includes those who do not qualify as unemployed for the many reasons given in Table 1. For instance, some people give up work, and for some of them, they do so in order to study. These persons are not considered as unemployed, while the training they receive is a concrete means of finding a new job. Others give up work for family responsibilities, for health reasons or for an early retirement. These people have been discouraged to remain in employment, although they could have remained employed with appropriate working conditions. Thus, the unemployment rate does not take into account all vulnerable persons on the labour market. On the other hand, the working age population who were unemployed or inactive during the previous twelve months is not taken into account in our indicator even though this population is certainly vulnerable in terms of income and well-being.

⁴ PIAAC unemployed is any person aged over 16 years old who is currently not employed, who has looked for a paid work at any time in the last 4 weeks, who has taken active steps to find a job and upon finding a job would have been able to start within 2 weeks or any person who will start a job within 3 months but is available to start a job within 2 weeks.

Spain is the country where all three measures of labour market vulnerability are the highest. Overall, the unemployment rate is greater than our vulnerability rate and this is also observed in fifteen countries out of twenty-eight. The thirteen remaining countries are Russia, Turkey, New Zealand, Israel, Singapore, Chile, Korea, Japan, the Nordic countries, the Netherlands and Austria. In these countries, exit from the labour force is more frequent for employees who have not been able to secure their jobs.

In what follows, we are going to analyse these differences using multilevel modelling with a particular attention to the influence of the form of work organisation and to its interaction with labour market institutions.

2. MEASURING FORMS OF WORK ORGANISATION

Work organisation is a multidimensional concept. Eurofound's European Observatory of Working life (EurWORK) defines it as follows: "*How work is planned, organised and managed – via production processes, job design, task allocation, rules, procedures, communication, responsibilities, management and supervisory styles, work scheduling, work pace, career development, decision-making processes, interpersonal and interdepartmental relationships.*"⁵

Accordingly, work organisation is a latent variable that can only be measured consistently with a set of questions. Data analysis is generally used to identify specific configurations of responses within this set, allowing to derive a taxonomy of organisational forms which mapping across countries can be analysed. The current study builds upon Lorenz and Valeyre (2005) and Arundel et al. (2007) who propose a mapping of forms of work organisation using the European Working Conditions Survey (EWCS). The survey of adult skills cover a larger set of countries, but it is less informative in terms of the variables needed for the measurement of work organisation. Both data sources are cross-sectional but PIAAC is a household survey when the EWCS covers people in employment only. Therefore, only subjective job insecurity or non-standard employment can be measured through the EWCS. Furthermore, compared with the two studies cited above, we apply hierarchical cluster analysis to the survey variables rather than to the scores of a factor analysis⁶, but the clustering is made using the same Ward's minimum variance hierarchical clustering method. Interviewed employees in PIAAC are asked to describe the task they perform because it is considered as an indirect and objective measure of their use of skills in the workplace. These questions also capture some of the dimensions of work organisation. We select those that are available both for the current job and for the last job when the person is not currently employed⁷. They cover the following dimensions:

⁵ Retrieved from: <https://www.eurofound.europa.eu/fr/observatories/eurwork/about-eurwork/work-organisation>

⁶ This choice is motivated first by the fact that we do not have that many variables, whereas the main reason factor analysis is used is to reduce the number of variables. Second, using the raw variables makes the interpretation easier than when using factor scores. In such a case, we have to interpret the result of the clustering based on the interpretation we have given to the results of the factor analysis. A third reason is related to the nature of our variables. They are ranked from the lowest frequency of skill use (never) to the highest (daily). Therefore the higher the frequency at which the task is performed, the higher the value assigned. This makes their assimilation to numerical variables acceptable, at least for a hierarchical cluster analysis.

⁷ There are some additional questions on work organisation in PIAAC's background questionnaire, but we cannot use them as they are only asked for the current job. This is the case for a set of questions on autonomy (D_Q11a, D_Q11b, D_Q11c, D_Q11d) and on informal learning (D_Q13a, D_Q13b, D-Q13c).

- Discretion/autonomy in the job: how often the worker plans his/her own activities, organises his/her own time.
- Collaboration in the workplace, team work: how often the worker shares work-related information with a co-worker, cooperates with co-workers.
- Influence in the workplace: how often the worker persuades or influences other people in the workplace.
- Problem solving: how often the worker solves complex problems at work – requiring more than thirty minutes to find a solution.
- Formalisation: how often the worker uses his/her literacy skills at work to read directions and instructions.
- Learning through on-the-job training: whether the worker has the possibility through his job to improve his/her abilities and/or acquire new skills.

Except for *on-the-job training*, each of these variables is rated as follows, depending on how often the task is performed: 1 never, 2 less than once a month, 3 less than once a week but at least once a month, 4 at least once a week but not every day, 5 every day. On-the-job training is a dummy variable indicating participation in organised sessions for on-the-job training by supervisors or co-workers. We use Ward's hierarchical clustering method to define a taxonomy of five forms of work organisation⁸ based on these variables: *Discretionary learning*, *Constrained learning*, *Independent*, *Simple* and *Taylorist*. Table 2 gives the mean value for each of the variables according to the form of the work organisation. The last column of the table (overall) contains the mean of variables in the overall population regardless of the form of work organisation. For each form of work organisation and for each variable, a test of equality with the overall mean was performed.

Table 2. Characteristics of the different forms of work organisation

	Discretionary learning	Constrained learning	Independent	Simple	Taylorism	Overall
	Mean	Mean	Mean	Mean	Mean	Mean
Planning own activities	4.63	1.71	4.69	2.61	1.63	3.58
Organising own time	4.77	4.62	4.78	3.03	1.22	3.95
Solving complex problems	3.77	2.50	2.70	1.94	2.10	2.84
Sharing work-related information	4.70	4.64	4.49	1.68	4.63	4.20
Cooperating or collaborating	3.77	3.77	3.36	1.89	4.07	3.45
Persuading or influencing people	4.25	2.49	2.78	1.72	2.12	2.99
Read directions or instructions	4.31	3.43	2.94	2.14	2.88	3.33
On-the-job training	0.76	0.45	0.08	0.13	0.29	0.39
Overall	33.96	10.47	25.57	14.02	15.98	100

Source: First and second rounds PIAAC (2012 and 2015), OECD, weighted statistics.

Coverage: These calculations include all participating countries and take into consideration those who have worked a paid job as employees during the last 12 months preceding the survey, excluding youths aged 16-24 in initial cycle of studies and retired people at State pension age.

Notes: Bold figures are significantly greater than the overall average, otherwise significantly lower.

⁸ The choice of the number of clusters has been made following Ward's minimum variance hierarchical clustering. A histogram of information losses resulting from regrouping clusters of the last merging steps of the hierarchy as well as a dendrogram to search for distinctive breaks (elbow) guides the choice of cluster numbers. We retained a parsimonious number of clusters after a thorough review based on their mapping across countries. Individuals for whom some of the variables used in the clustering are missing are assigned afterwards to the classes they are the closest based on available information, maximising the interclass variance and minimising the intraclass variance.

The bold figures indicate that the mean of the variable is significantly higher than the overall mean. The non-bold figures indicate a lower mean value than the overall mean. For instance, in terms of how often employees solve complex problems at work, employees working in a *Discretionary learning* form of work organisation have a mean value of 3.77, which means (rounding up) that they perform this activity every week, while an average employee in the overall population performs it only monthly, with a mean of 2.84. The bottom line of Table 2 shows the distribution of the different forms of work organisation in the overall population, which is representative of employees who have worked a paid job in the last twelve months and are neither in the initial cycle of studies nor retired.

The *Discretionary learning* form account for roughly 34% of this population. It is characterised by the more frequent performance of all the tasks identified to map work organisation than in the overall population and in the other forms of work organisation, except in rare few cases. In this form of work organisation employees have a higher degree of autonomy in the way they do their job. They plan their own activities and organise their own time on a daily basis. They are also more frequently involved in solving complex problems at work: at least once a week, compared to once a month in the average population. Except for the *Taylorist* form of work organisation, they are more involved in team work than employees in the other forms of work organisation. As a matter of fact, they share work related information on a daily basis and cooperate or collaborate with co-workers at least every week. They are also more involved in taking initiative as they persuade or influence people at work on a weekly basis. They read directions or instructions at least every week. Finally, they are more involved in learning activities. Nearly 80% of them receive on-the-job training. This form of work organisation resembles the one of the same name in Arundel et al. (2007) and the operating adhocracy in Lam (2005).

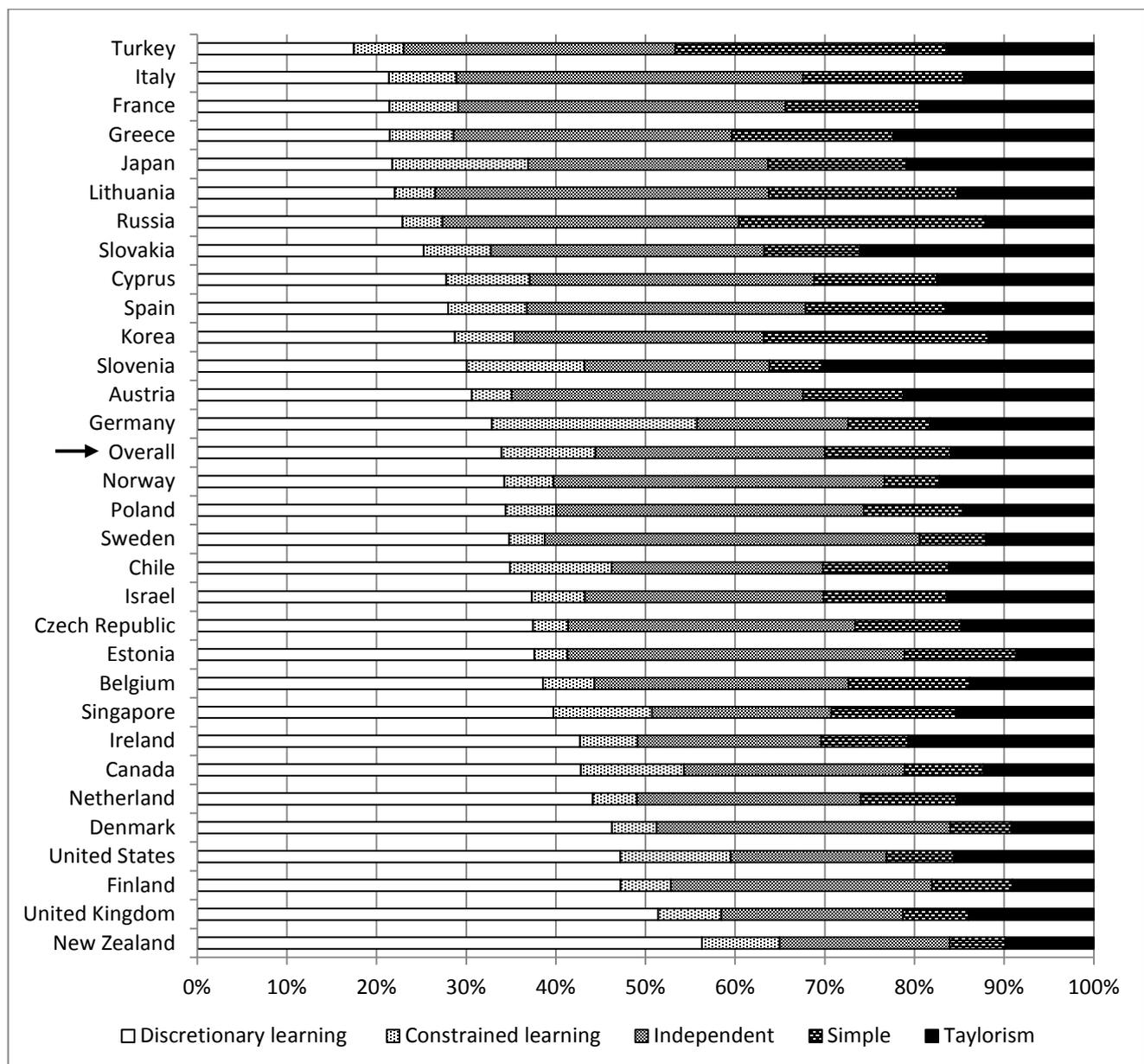
The clustering identifies another learning form of work organisation referred to as *Constrained learning* because more constraints weigh on the organisation of work. Unlike in the *Discretionary learning* form of work organisation, employees in the *Constrained learning* form experience below average frequencies for planning their own activities (less than once a month), solving complex problems (less than once a week, but at least once a month) and persuading or influencing people (less than once a week but at least once a month). However, they organise their own time weekly, share work-related information daily, cooperate or collaborate with co-workers weekly, read directions or instructions weekly and 45 % of them are involved in on-the-job training. So, this form of work organisation differs from the *Discretionary learning* in term of discretion, problem solving and influence at work, but employees have more learning opportunities than in other forms of work organisation through collaborations and sharing of information as well as through on-the-job training.

The *Independent* form of work organisation is below the overall mean for the following activities: reading directions or instructions, on-the-job training, solving complex problem, cooperating or collaborating with co-workers and persuading or influencing people at work. They perform these activities less than once a week, but at least once a month. They are situated above the overall mean for the other variables. They plan their own activities and organise their own time daily; they share work-related information daily. This form of work organisation differs from the *Discretionary learning* form in terms of formalisation of work, team work, problem solving and learning opportunities. Employees in this form of organisation have a lot of discretion and many opportunities to exchange with other people in professional networks but their organisation is more informal.

The *Simple form* of work organisation is opposite to the *Discretionary learning* form as employees perform less frequently than in the average population all the listed tasks. Thus, they perform more simple jobs in simpler organisations. However, in this form of work organisation, 13% of employees receive on the job training, which is more than in the *Independent* form.

The last form of work organisation is *Taylorism*. It is characterised by below average frequency for all listed tasks except for two of them: cooperating or collaborating and sharing work-related information. 29% of employees in this form receive on-the-job training, which is more than in the *Independent* and *Simple* forms, but less than in the *Learning* forms of work organisation. Thus, employees perform simple tasks in more structured organisations than in the *Simple* form. This is why we identify this last form as the *Taylorist* form of work organisation.

Figure 2. National differences in forms of work organisation



Source: First and second rounds PIAAC (2012 and 2015), OECD, weighted statistics.

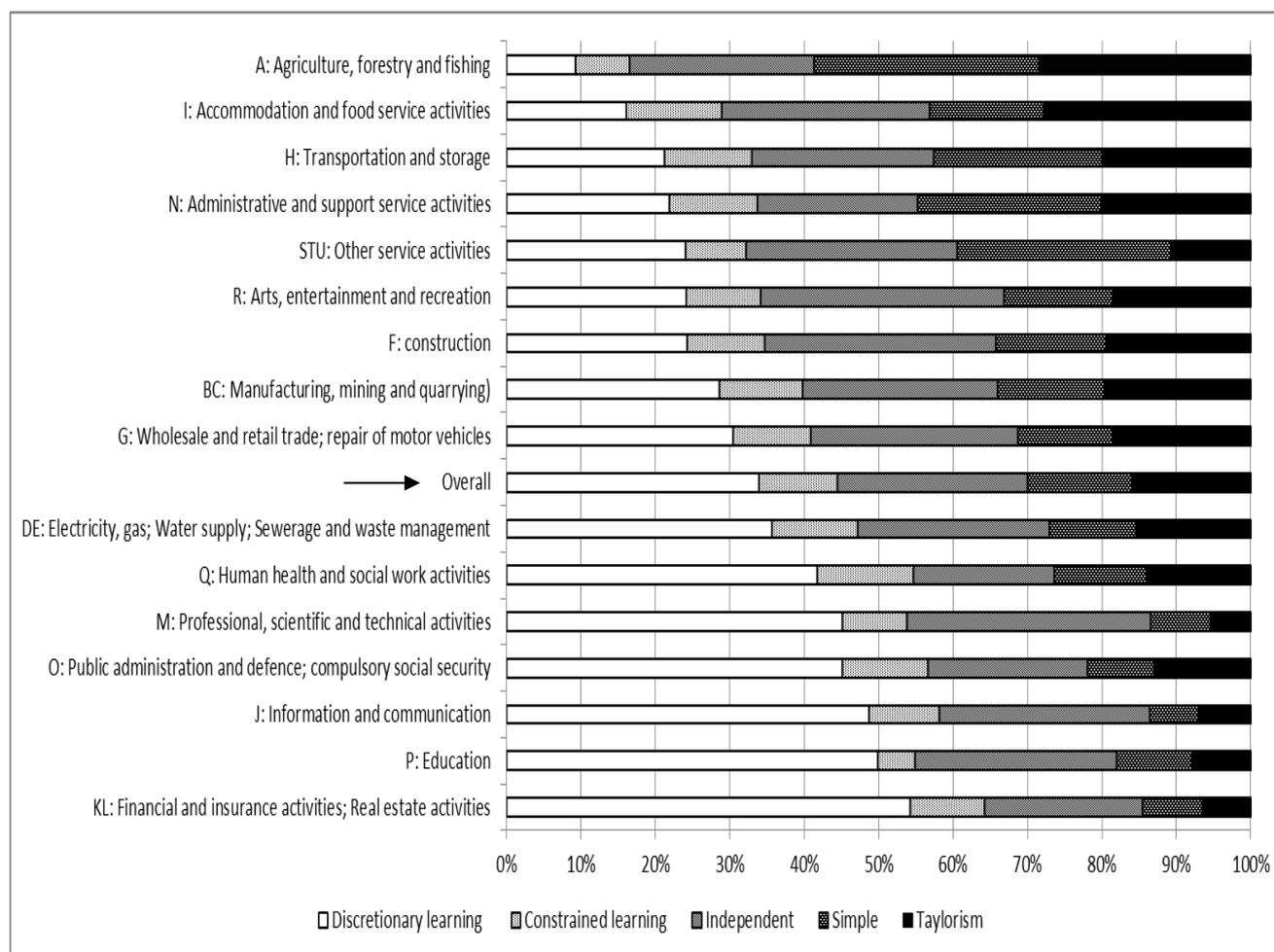
Coverage: These calculations include all participating countries and take into consideration those who have worked a paid job as employees during the last 12 months preceding the survey, excluding youths aged 16-24 in initial cycle of studies and retired people at State pension age.

Figure 2 gives the mapping of these five organisational forms in countries covered in rounds 1 and 2 of PIAAC. The *Discretionary learning* model is more frequent in Anglo-saxon and Nordic countries as well as in the Netherlands: more than 40% of the covered employees are concerned in these countries. The *Constrained learning* model represents more than 13% of the workforce in Slovenia (13%), Japan (15%) and Germany (23%). The countries with the higher shares of *Independent* forms (37% and more) are Sweden, Italy, Estonia, Lithuania, Norway and France. The four countries with the top share of *Simple* forms are Turkey (30%), Russia (28%), Korea (25%) and Lithuania. For the *Taylorist* form, Slovenia (30%), Slovakia (26%), Greece (22%) and Austria (21%) are ranking the highest.

We can distinguish at least six clusters of countries according to the observed mix of forms of work organisation. In a first group, composed of Denmark, Finland, New Zealand and the United Kingdom, the *Discretionary learning* forms of work organisation are more widespread when all the other forms are less so. A second cluster is characterised by more prevalent *Discretionary learning* or *Constrained learning* forms while the spread of *Independent* forms is limited: USA, Canada, Ireland, the Netherlands, Belgium, Israel, Singapore and Chile are in this group. Germany and Slovenia come together, with a high share of *Constrained learning* form and more prevailing *Taylorist* forms. Two nordic countries (Norway, Sweden) and three eastern and central European countries (Czech Republic, Estonia, Poland) are characterised by more frequent *Independent* forms, with *Discretionary learning* forms close to average and less widespread other forms. In a fifth cluster mediterranean countries (Cyprus, Spain, France, Greece and Italy) come together with Austria, Slovak Republic and Japan. These countries are characterised by more pervasive *Taylorist* and *Independent* forms and under-represented *Discretionary learning* forms. Finally Russia, Korea, Lithuania and Turkey are characterised by the highest share of *Simple* forms, more frequent *Independent* forms and less *learning* forms.

Figure 3 shows the differences in forms of work organisation across industries. Following Wren et al. (2013), we can distinguish between the dynamic services (financial, insurance and real estate activities; information and communication), the welfare services (education, health and social work and public administration) and the non-dynamic services (hotels and restaurants; wholesale and retail trade; and other community, social, and personal services). Compared with the two other groups, the first group is characterised by high level of ICT intensity, productivity growth and international trade. We observe a marked contrast between the *Discretionary learning* form of work organisation and the *Taylorist* and *Simple* forms. The *Discretionary learning* form of work organisation is more widespread in dynamic and welfare services where the *Taylorist* and *Simple* forms of work organisation are less prevalent. *Simple* and *Taylorist* forms are both more frequent in agriculture, administrative and support services, transportation. The *Simple* form is also emblematic of other community, social and personal services while the *Taylorist* form is more typical in accomodation and food service activities and in manufacturing. The *Constrained learning* and *Independent* forms of work organisation are more evenly widespread across sectors. The former just seems to be more typical of human health and social work activities and the latter of arts, entertainment and recreation, professional, scientific and technical activities and construction. Furthermore, the *Discretionary learning* form of work organisation is more frequent in large-sized firms, whereas the *Simple* and *Independent* forms are predominant in small-sized establishments. The *Simple* form can be seen as a traditional forms of work organisation in small establishments when the *Independent* form would be more typical of start-ups.

Figure 3. Differences in forms of work organisation across industries

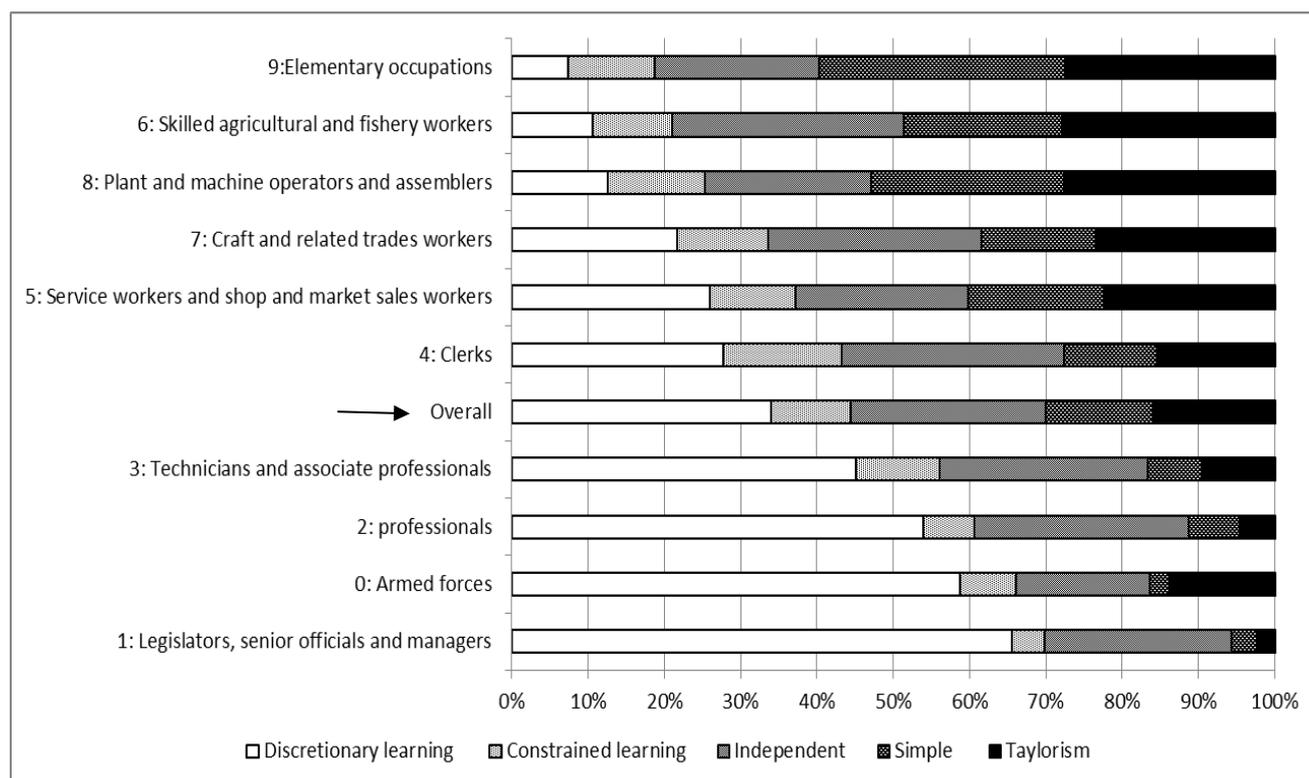


Source: First and second rounds PIAAC (2012 and 2015), OECD, weighted statistics. Coverage: These calculations include all participating countries and take into consideration those who have worked a paid job as employees during the last 12 months preceding the survey, excluding youths aged 16-24 in initial cycle of studies and retired people at State pension age.

Figure 4 shows the differences in forms of work organisation across occupations. The contrast between the *Taylorist* and *Simple* forms and the *Discretionary learning* forms of work organisation also stand out in this figure. The *Discretionary learning* form is more frequent in occupations such as: legislators, senior officials and managers; professionals; technicians and associate professionals and armed forces. The *Taylorist* and *Simple* forms are more widespread in the following occupations: elementary occupations; skilled agricultural and fishery workers; plant and machine operators and assemblers; craft and related trades workers; service workers and shop and market sales workers. The *Constrained learning* and *Independent* form of work organisation are less strongly associated with occupations. The former is just a little more frequent for clerks and plant and machine operators and assemblers, the latter for skilled agricultural and fishery workers, clerks and professionals.

The aim of the current paper is to analyse the relationship between forms of work organisation and vulnerability to non-employment. In this regard, Table 3 gives the distribution of the forms of work organisation for both the vulnerable and non-vulnerable employees. The form of work organisation characterises the current work for non-vulnerable employees and tasks performed in the last work for vulnerable employees.

Figure 4. Differences in forms of work organisation across occupations



Source: First and second rounds PIAAC (2012 and 2015), OECD, weighted statistics.

Coverage: These calculations include all participating countries and take into consideration those who have worked a paid job as employees during the last 12 months preceding the survey, excluding youths aged 16-24 in initial cycle of studies and retired people at State pension age.

Table 3. Forms of work organisation by vulnerability status

	Overall	Vulnerable	Non-vulnerable
Work organisation	(%)	(%)	(%)
Discretionary learning	33.96	20.99	35.21
Constrained learning	10.47	11.03	10.41
Independent	25.57	27.35	25.40
Simple	14.02	17.80	13.66
Taylorism	15.98	22.83	15.32
Total	100	100	100

Source: First and second rounds PIAAC (2012 and 2015), OECD, weighted statistics.

Coverage: These calculations include all participating countries and take into consideration those who have worked a paid job as employees during the last 12 months preceding the survey, excluding youths aged 16-24 in initial cycle of studies and retired people at State pension age.

Again, a strong contrast between the *Discretionary Learning* and the *Taylorist* forms of work organisation appears. The vulnerable employees are relatively more present in the *Taylorist* forms of work organisation (23% versus 15% for non-vulnerable employees), whereas the *Discretionary Learning* form is predominant among the non-vulnerable employees (35% versus 21% for vulnerable employees). Vulnerable employees are also slightly more frequent in the *Independent* and *Simple* forms of work organisation (respectively 27% and 18% against 25% and 14% for non-vulnerable employees).

3. MODEL AND VARIABLES

This section presents the (multilevel) logistic model and both individual- and country-level variables. Researchers in social sciences are more and more interested in research questions concerning how outcomes at the individual level can be seen as the result of the interplay between individual and contextual factors. Indeed, differences in individual outcomes could reflect differences in the effects of country-specific characteristics such as labour markets or other socioeconomic institutions. As a result, the studies based on multilevel models have proliferated during the last two decades and focus on different topics such as educational outcomes (O'Connell and McCoach, 2008), in-work poverty (Andress and Lohmann, 2008) or quality of working life (Greenan et al., 2014). Regarding the current study, it is our view that the incidence for employees of vulnerability on the labour market cannot be thoroughly analysed without taking into account not only the individual and employer characteristics but also the institutional context. In this section, after describing the empirical model we define the variables used in estimations.

3.1. Model

We use data from the first and second rounds of PIAAC in the twenty-eight OECD countries where all the information needed for our econometric analysis are available. This kind of multi-country data set offers the possibility to quantify the extent to which differences in individual outcomes (here vulnerability) reflect differences in the effects of country-specific characteristics, which are separate from those associated with variations in the characteristics of the individuals themselves (Bryan and Jenkins, 2016). How to “uncover” these country effects?

Let us consider V the dependent variable, vulnerability to non-employment. It is a latent continuous variable which is non observable. However, when V become higher than a given threshold, we observe that the employee makes a transition to non-employment. v is the binary variable that we observe, equal to one if the employee moves out of employment during the reference period, to 0 otherwise. p , denotes the probability of making a transition out of employment ($p = Prob(v = 1)$). c_k represents a k form of work organisation, k ranging from 1 to 5, for our five forms of work organisation defined above. It takes the value 1 if the employee works or has worked in a k form of work organisation. Finally, we consider that x contains all the other socioeconomic and job characteristics that we use as controls and z all the country-level variables.

The standard logistic regression model with country fixed effects is expressed as follows:

$$\pi_{ij} = \log\left(\frac{p_{ij}}{1 - p_{ij}}\right) = \beta_1 + \sum_{k=2}^5 \beta_k c_{kij} + \beta_6 x_{ij} + F_j \quad (1)$$

where π_{ij} is the odds ratio of individual i in country j , F_j is the country fixed effects which represents the effects of unobserved factors that are shared within each country. β_1 and the β_k are scalars, while β_6 is a vector containing the coefficient attached to the control variables in x .

A major drawback of this method is that the country institutional contexts cannot be explicitly introduced (Bryan and Jenkins, 2016). Country effects are considered fixed and therefore only available for countries in the sample. The results of the estimates cannot be

extended to other countries. Moreover, if institutional contexts shape the individual behaviours, outcomes are likely to be correlated within countries and the standard error estimates are downwardly biased as a result (Hox, 2010; Bryan and Jenkins, 2016).

Our dataset is hierarchical, with a level 1 (the individual, indexed by i) nested in a level 2 (the country, indexed by j). This hierarchical structure as well as possible correlations across observations within the countries can be taken into account in a multilevel model which enables to obtain statistically efficient estimates of regression coefficients and correct standard errors (Hox, 2010). We are going to estimate two models using this more appropriate multilevel modelling frame.

The first model is a multilevel logistic model with country random effects in the constant term (random intercept) as well as in four individual-level fixed effects representing the different forms of work organisation (random slopes model). We suppose that belonging to one of the form of work organisation does not have the same effect according to national contexts. The random slope model allows the effect of indicators of form of work organisation to vary randomly across countries. In this first model, we assume that country effects are distributed randomly (usually normally) across countries. This makes it possible to extend our results to other countries. Assuming that the different random terms are not correlated, the model can be expressed as follows:

$$\pi_{ij} = \log\left(\frac{p_{ij}}{1-p_{ij}}\right) = \beta_{1j} + \sum_{k=2}^5 \beta_{kj}c_{kij} + \beta_6x_{ij} \quad (2)$$

where

$$\begin{aligned} \beta_{1j} &= \gamma_1 + r_{1j} \\ \beta_{kj} &= \gamma_k + r_{kj} \end{aligned}$$

with $r_{1j} \rightarrow N(0, \sigma_1^2)$ and $r_{kj} \rightarrow N(0, \sigma_k^2)$ for $k = 2, 3, 4, 5$ (the first form, *Taylorism* is taken as the reference form of work organisation). The slope of the linear relationship between the form of work organisation indicator and the log-odds of being vulnerable is thus $\gamma_k + r_{kj}$ for country j .

A particular advantage of multilevel modelling is the ability to explore the effects of group-level predictors, i.e. to introduce explicitly the country-level explanatory factors in the model. It allows to identify the contextual effects as well as cross-level interactions. Therefore, the second multilevel logistic model we estimate goes further as it introduces country-level variables and their interactions with the different forms of work organisation so that the four individual-level predictors vary with the size of country-level fixed effects (cross-level interaction). The interaction effects allow the effect of one explanatory variable on the outcome to depend on the value of another explanatory variable. We suppose, for example, that the effect of belonging to one of the forms of work organisation on the probability of making a transition to non-employment depends on the mix of the country-level labour market policies and wage bargaining practices. In order to do so, we extend the model in equation 2 to take into consideration country-level variables in z . This version of the multilevel logistic model considers that the contextual variables in z can explain the national differences mentioned earlier. It can be written as follows:

$$\pi_{ij} = \log\left(\frac{p_{ij}}{1-p_{ij}}\right) = \beta_{1j} + \sum_{k=2}^5 \beta_{kj}c_{kij} + \beta_6x_{ij} \quad (3)$$

where

$$\beta_{1j} = \gamma_1 + \gamma_{11}z_j + r_{1j}$$

$$\beta_{kj} = \gamma_k + \gamma_{k1}z_j + r_{kj}$$

with $r_{1j} \rightarrow N(0, \sigma_1^2)$ and $r_{kj} \rightarrow N(0, \sigma_k^2)$ for $k = 2, 3, 4, 5$. γ_{11} and γ_{k1} are vectors of parameters attached to the country-level variables. Country level variables are centred so that the intercept gives the odds of the reference individual when the macro variables are at their mean value⁹.

3.2. Variables

What are the main driving forces behind the individual and country differences in vulnerability to non-employment? We combine micro data on individuals coming from PIAAC with macro data describing the institutional context.

As stressed in the introduction, the relationship between work organisation at the last employer and labour market vulnerability of employees has never been investigated with a large cross-country dataset. It is a main contribution of this paper to document this issue. Apart from work organisation, the background questionnaire of PIAAC provides detailed information at the individual level on job and personal characteristics. We are thus able to take into account controls that remain most of the time unobserved in studies of labour market transition. For instance, we know about the social background of the employee, his immigration status and the education level of his parents. For each control, we create a missing value category in order to keep the largest sample. The distributions of individual and job characteristics variables across vulnerable and non-vulnerable individuals are presented in Table A1 in the Appendix.

At the country level, we consider labour market institution variables, describing labour market policies, employment protection legislations and wage bargaining systems as well as macroeconomic background variables.

3.2.1. Job and employer characteristics

As for the job and employer characteristics, we are able to measure:

- Institutional sector: private, public and nonprofit.
- Establishment size: lower or equal to 10, between 11 and 50, between 51 and 250, between 251 and 1000, more than 1000.
- Industry classification: 16 categories of industry based on the International Standard Industrial Classification (ISIC) of all economic activities, rev. 4.
- Occupational classification: 10 categories based on the International Standard Classification of Occupations, ISCO-88, 1-digit level.
- Number of hours worked per week as a continuous variable.
- Type of employment contract: indefinite versus temporary and other types of employment contracts.

⁹ One needs to be very cautious when interpreting the results from the model in equation 3. Indeed, there is an issue regarding the reliability of estimates from a multilevel logistic regression in relation to the number of subjects at level 2 (see e.g. Austin, 2010; Moineddin et al., 2011; Stegmüller, 2013; and Bryan and Jenkins, 2016). Bryan and Jenkins (2016) conclude that when this number is lower than 30, the estimates of the variance component and their standard errors are biased downward, and we need more than 30 when cross-level interactions are included. This issue is further discussed in the empirical analysis.

- Use of Information and Communication technologies (ICT) in the workplace: use of a mainframe, desktop or laptop computer, or any other device that can be used to do such things as sending or receiving e-mail messages, processing data or text, or finding things on the internet.

Table A1 shows that private sector employees are more vulnerable than those in public and non-profit organisations, that individuals in small-sized firms are more likely to make a transition to non-employment (1-50 employees), that there are minor differences in the distribution of the two groups across industries. There is a relatively higher vulnerability in elementary and semi-skilled occupations in the service sector and agriculture (ISCO 9, 5, 6). As expected, there is more vulnerability to non-employment for persons with precarious employment contract (temporary contract, temporary employment agency contract, apprenticeship or other training scheme, no contract, other employment relation). Finally, employees who do not use computers at work are more vulnerable to non-employment.

3.2.2. Sociodemographic characteristics

Based on the results of a pre-analysis of the personal determinants of vulnerability to non-employment, we retain the following variables among those characterising the individuals before their entry in the labour market:

- Age: ten year bands for under 24, 25-34, 35-44, 45-54, over 55.
- Education: using the International Standard Classification of Education (ISCED), we consider three levels: primary or less (ISCED level 1 or less: early childhood and primary education), secondary (ISCED level 2 to 4: lower, upper and post-secondary non-tertiary education) and university education (ISCED level 5 to 8: doctoral, master, bachelor and short cycle tertiary education).
- Gender: female or male.
- Marital status: single or living with a spouse or partner.
- Family responsibilities: no children, 1 child, 2 children and 3 children and more.
- Social background:
 - o Immigration status: first generation immigrants, second generation immigrants, and non 1st or 2nd generation immigrant. A first generation immigrant is a person who is foreign-born and whose parents (or at least one parent) are foreign-born. A second generation immigrant is a native-born person with foreign-born parents.
 - o Education level of the parents: uneducated parents, at least one educated parent.

Table A1 shows that vulnerable individuals are more often single, young females with secondary education or less. They more often have either no children or three children or more, are first or second generation immigrants and have uneducated parents.

3.2.3. Institutional and economic factors

Different institutional factors are likely to influence the individual probability of being vulnerable to non-employment. What are the national characteristics potentially important in the explanation of the national differences in countries' vulnerability profile?

It is usually considered that institutional features, such as unemployment benefits, degree of employment protection, as well as active labour market policies are important in order to explain labour market transitions (Bassanini and Duval, 2006, 2009). However, theoretical considerations about the effects of labour market institutions on labour market transitions generally concern the discussion about the impact of labour market institutions on incentives to supply labour at any given market wage (European Commission, 2014). So it is most of

the time the transition out of unemployment to employment which is implicitly considered¹⁰. In particular, active labour market policies (active LMP) are generally defined as measures which assist the inactive and unemployed to find a job with the objective to bring more people into the labour force and into jobs. However, the active LMP also favour the general employability of individuals. For instance, workplace training programs are integral part of active policies as defined by the OECD. They also contribute to stabilising employment: while employment maintenance incentives aim to facilitate continuing employment in situations of restructuring, start-up incentives programmes, through the promotion entrepreneurship, could foster the creation of more sustainable start-ups.

We have retained the following variables characterising national labour market policies¹¹:

- Expenditures on active labour market policies in percentage of the Gross Domestic Product (GDP):
 - o Public employment services and administration
 - o Training
 - o Employment and start-up incentives
 - o Sheltered and supported employment and rehabilitation and direct job creation
- Expenditures on passive labour market policies in percentage of the GDP.

In addition to expenditures on labour market policies, we also take into account the degree of strictness of employment protection legislation and the centralisation of the wage bargaining system. More precisely, we introduce OECD indicators on the strictness of employment protection legislation concerning individual and collective dismissals of employees in regular employment as well as the use of temporary employment. Two indicators are used. They measure respectively the procedures and costs involved in dismissing individuals or groups of workers and the procedures involved in hiring workers on fixed-term or temporary work agency contracts. For each year, indicators refer to the regulation in force on the 1st of January. The data range from 0 to 6 with higher scores representing stricter regulation. It is usually considered that higher costs and more complex procedures in dismissing individuals favour job stability (OECD, 2004; Bassanini and Garnero, 2013).

The centralisation of wage bargaining is reflected by a summary measure taking into account both union density and bargaining coverage at multiple levels. According to Calmfors and Driffill (1988) countries with highly centralised and highly decentralised wage bargaining systems have lower unemployment than countries with an intermediate degree of centralisation. Recent empirical evidence has shown that this relationship has become weaker together with the loss of union influence and stresses the need to take into account the diversity

¹⁰ For some kinds of labour market policies such as unemployment insurance benefits the transitions out of non-participation are also considered. For example, with higher unemployment benefits the “non actives” would increase their labour market participation in order to become eligible for unemployment benefits.

¹¹ The total expenditures on labour market policies is partitioned into expenditures in two types of labour market policies: active and passive. There are 6 active policies: public employment services and administration; training; employment incentives; sheltered and supported employment and rehabilitation; direct job creation; start-up incentives. The passive policies are of two types: out-of-income maintenance and support and early retirement. The reader can refer to the OECD database for more details about these elements of the expenditures on labour market policies. We have grouped employment incentives policies and start up incentive policies together as well as direct job creation and sheltered and supported employment and rehabilitation. We obtain 5 variables describing LMPs as a percentage of GDP. This choice has been made to reduce the number of country-level variables in the multilevel model in order to have more reliable estimates. However, a thorough analysis of the data has been performed (using correlation analysis and principal component analysis) regarding all country-level variables to select the ones presented here. These variables turn out to summarize the essential aspects of the different institutions and economies across OECD countries relevant to the current analysis, avoiding information redundancies.

of labour market institutions (Aidt and Tzannatos, 2002). However, in the current study, we consider a quadratic relationship between individual vulnerability and centralisation of wage bargaining system (WBS) to account for the possibility of it being hump-shaped.

Finally, the sectoral structure, the country innovation performance as well as the macroeconomic conditions are reflected in the share of employment in services, R&D expenditure as a percentage of GDP and GDP growth rate.

The variables retained come from either the OECD database or the database on institutional characteristics of trade unions, wage settings, state interventions and social pacts 1960-2014 (ICTWSS) from Jelle Visser of Amsterdam Institute for Advanced Labour Studies. They are displayed in Table A2 in the Appendix.

4. RESULTS

4.1. Fixed and random effects

All models estimate a weighted multilevel logistic regression of the probability of being vulnerable to non-employment, using the survey sample weights. We estimate four multilevel models. Model 1 (see Equation 2) is a random slope logit regression in which we allow the constant term of the model and the effects of working in other forms of work organisation than *Taylorism*, which is the reference form of work organisation in the regressions, to vary randomly across countries. It is estimated for the largest group of twenty-eight countries. All remaining three models are based on the specification given in Equation 3. They include country level variables on the share of services in employment, GDP growth rate and R&D investments. In addition to these three variables, Model 2 includes labour market policies variables, Model 3 employment protection legislation variables and Model 4 wage bargaining variables. As the labour market institution variables are not available in the same group of countries (see Table A2 in the Appendix) estimations in Models 2 to 4 cover different sets of countries. All three models also consider, in addition to country-level variables, their interactions with the different forms of work organisation. This allows us to account for observed differences between countries in the response variable and in the effects of work organisation.

The results are given in Tables 4, 5 and Table A3 in the Appendix. Table 4 shows the results of the estimation of the four different models for our variables of interest, the indicators of forms of work organisation, and the random parts of the multilevel models. Table 5 reports the estimates for country-level variables and cross-level interactions. Finally, Table A3 in the Appendix shows the estimation of individual fixed effects.

The estimates of the variance of the random terms, given in the lower part of Table 4, show considerable variation of the estimates of the constant term and the coefficient attached to the different forms of work organisation across countries. The intercept variance of 0.141 in Model 1 is interpreted as the between-country variance in the log-odds of being vulnerable for a reference individual living in an average OECD country, while the slope variation of *Discretionary Learning* of 0.096, for example, is the between-country variance in the effect of *Discretionary Learning* on the probability of being vulnerable. We note that the slope coefficients with the largest variance are associated with the learning forms of work organisation. Across countries, the relationships between the *Constrained learning* and the *Discretionary learning* forms of work organisation and vulnerability to non-employment differs significantly.

Table 4. **Fixed and random effects estimates**

	Multilevel logistic regression			
	Model 1	Model 2	Model 3	Model 4
Fixed Effects estimates				
Intercept	-1.574***	-1.938***	-1.867***	-1.897***
Work organisation (ref. Taylorism)				
Discretionary learning	-0.571***	-0.559***	-0.543***	-0.636***
Independent	-0.141**	-0.125**	-0.114*	-0.172***
Simple	-0.220***	-0.186**	-0.202***	-0.256**
Constrained learning	-0.200**	-0.217***	-0.200**	-0.391***
Random effects estimates				
Intercept	0.141 (0.037)	0.048 (0.014)	0.091 (0.026)	0.087 (0.025)
Discretionary learning	0.096 (0.026)	0.035 (0.010)	0.093 (0.027)	0.064 (0.018)
Independent	0.061 (0.016)	0.023 (0.007)	0.041 (0.012)	0.035 (0.010)
Simple	0.084 (0.023)	0.043 (0.013)	0.051 (0.015)	0.060 (0.017)
Constrained learning	0.147 (0.039)	0.088 (0.026)	0.109 (0.031)	0.055 (0.016)
Number of individuals	89705	78439	78985	80317
Number of countries	28	23	24	24
-2 Log Pseudo-Likelihood	3.0089E8	2.3121E8	2.4958E8	2.2601E8

Notes: Significant at **** 1%, ** 5%, * 10%. Standard errors are into parenthesis for the estimates of the random terms variances. All models control for personal and job. Table A3 in the Appendix shows estimates of coefficients attached to the control variables. Model 1 does not include any country-level variables. Model 2 to 4 include economic factors and their interactions to the different types of work organisation. In addition to these variables, Model 2 considers labour market policy variables, while Model 3 includes employment protection legislation variables and Model 4 takes into account the wage bargaining system. We also use sample weight in these estimations.

As mentioned in the previous section, the multilevel model allows not only to identify the country-effect, but also to account for it through the country level variables. It is indeed important not only to know whether there are differences between countries, but also to know the factors behind these differences. In order to answer such questions, we extend Model 1 to include country-level variables that can explain these differences as well as their interaction with the different forms of work organisation: this leads to Models 2 to 4. By introducing the cross-level interaction terms between the forms of work organisation indicators and macroeconomic variables, we analyse if institutional contexts reinforce or, on the contrary, lessen the impact of the forms of work organisation on individuals' vulnerability to non-employment.

We note that the unobserved variations of the random terms in Models 2 to 4 reduces considerably compared to Model 1 (cf. Table 4). Therefore, we may say that our country-level variables explain an important part of the inobserved heterogeneity between countries in the probability of being vulnerable and the effect of forms of work organisation.

4.2. The impact of forms of work organisation

The top panel of Table 4 gives the coefficients associated with the intercept and the four forms of work organisation, *Taylorism* being the reference category. The intercept in Model 1 gives the probability of being vulnerable to non-employment for the reference individual, a young male worker (under 24 years old) with primary education or less, no children, native since two generations, with educated parents, working in the private sector with an indefinite contract,

performing an elementary occupation in a *Taylorist* form of work organisation implying no use of ICT in a manufacturing establishment with less than 10 employees, working an average number of hours per week. His chances of making a transition to non-employment is 17%¹², about twice the average vulnerability in the overall population (cf. Table 1 in section 1). But if this reference employee had experienced a *Discretionary learning* form of work organisation, his odds of being non-employed would be much lower, amounting to 10%¹³ which is close to average vulnerability. In an *Independent* form, it would be 15%, and 14% in a *Constrained learning* or *Simple* form. In Models 2 to 4, the reference situation changes slightly as our reference employee is now part of an average country in the sense that the country level variables entered in each model are at their mean value. The results associated with the different forms of work organisation remain close to those found in Model 1, except for the coefficient associated with the *Constrained learning* form of work organisation which becomes higher in absolute value than that of the *Simple* form (except Model 3), implying that the odds of being non-employed are lower for employees in *Constrained learning* form of work organisation. The hierarchy in the impact of forms of work organisation remains unchanged in these models: The *Discretionary learning* form is the form of work organisation where vulnerability to non-employment is the lowest, followed by the *Constrained learning* form, the *Simple* form and the *Independent* form. More precisely a person working in a *Discretionary Learning* organisation reduces nearly by a half his/her chance of being vulnerable to non-employment, compared to another person working in a *Taylorist* organisation. The same can be said regarding persons working in *Constrained learning* or *Simple* or *Independent* forms of work organisation, but to a lesser extent¹⁴.

Our findings show that some forms of work organisation are more efficient than others for maintaining employability and securing employment. We have to keep in mind that although the regressions are cross-sectional they implicitly compare two points in time (now and sometime in the last twelve months) and they are obtained using a very large set of controls taking into account sociodemographic characteristics including social background, employment relations characteristics and detailed occupations and industry (cf. Table A3 in the Appendix). We thus hope to be the closest possible to a pure work organisation effect¹⁵. We find that the *Discretionary Learning* and the *Constrained Learning* forms of work organisation that favour skills development through on-the-job training, knowledge sharing, problem solving and job discretion are more efficient at securing employment than forms of work organisation where employees perform simple tasks and lack discretion that would allow them to take advantage of learning opportunities like in *Taylorist* organisations or lack access to organised on-the-job training like in the *Independent* organisations or, finally, lack opportunities to share knowledge with their co-workers like in *Simple* organisations.

As for individual fixed effects, the great majority of significant results (cf. Table A3 in the Appendix) are in line with those found in the literature on labour market insecurity measured by the transition rate between employment and unemployment (for example, Duhautois et al., 2014). Women are significantly more vulnerable to non-employment than men. Vulnerability

¹² This predicted probability is calculated using the following formula : $1/(1+\exp(1.574))$

¹³ $1/(1+\exp(1.574+0.571))$

¹⁴ In order to obtain the percentage of variation in the odds of being vulnerable for one unit change in explanatory variable we use the following formula: $100 \times \{\exp(\beta_k) - 1\}$

¹⁵ We cannot rule out however that individuals self select or are selected into different forms of work organisation according to unobserved characteristics that also contribute to explaining their vulnerability to non-employment.

to non-employment is significantly higher for very young workers (aged under 24 years old) while individuals aged between 35 and 54 have the lowest probability to make a transition. More educated workers are more protected against vulnerability to non-employment. Indeed, higher education generally implies higher job stability (Charlot and Malherbet, 2013). Precarious employment contracts (temporary versus indefinite) are associated with a higher probability of making a transition out of employment. An important number of temporary jobs in an economy leads to both a higher level of job creation and of job destruction. Job destruction of temporary employment is particularly important during economic recessions. The end of a temporary contract which is not renewed is an important factor of vulnerability to non-employment. Controlling for education, the use of ICT at work is associated for employees with lower levels of labour market vulnerability. Vulnerability is also lower in bigger establishments. Finally, compared to elementary occupations, *white-collar* occupations like legislators, professionals and technicians, but also *blue collar* occupations like plant and machine operators experience lower levels of vulnerability.

4.3. Country level heterogeneity

Table 5 reports the estimated effects in Models 2 to 4 of the country-level and cross-level interactions¹⁶ on the probability of being vulnerable to non-employment. By construction, the direct effects of the macroeconomic indicators (column 1 of each model) reflect the impact of institutional contexts on the reference individual who is working in the *Taylorist* form of work organisation. In growing countries and in countries with high R&D investments, employees working in *Taylorist* forms of work organisation tend to be less vulnerable to non-employment. However, these negative coefficients are significant in Model 3 only for GDP growth, in Models 2 and 4 for R&D investments. Model 2 includes expenditures in labour market policy along with economic factors. According to their target, active labour market policies have contrasted impacts on the vulnerability of employees in *Taylorist* forms of work organisation. When they target public employment services and administration, sheltered and supported employment and rehabilitation or direct job creation, they have a protective effect, but when they target training, employment incentives or start-up incentives, employees in *Taylorist* forms of work organisation are more vulnerable to non-employment. Model 3 considers the strictness of employment protection legislation. The results associated with *Taylorist* forms of work organisation show that strict employment protection legislation regarding dismissals is associated with lower vulnerability when strict employment protection legislation regarding the use of temporary contracts is associated with higher vulnerability. Moreover, it is in this model that the coefficient on GDP growth rate comes out significantly negative. Thus, the story here could be the following. The economic recession led to job destructions especially for the simple jobs found in *Taylorist* organisations. As they have not invested in skills building or organisational learning, their labour force is mainly substitutable. Facing adverse shocks, they reduce their hiring activities and increase dismissals, generating flows from employment to unemployment or to inactivity. On the

¹⁶ A critical aspect of these models is the number of subjects at level 2. Studies investigating the reliability of multilevel model estimates in relation to the number of subjects in level 2 suggest using at least 30 subjects when level 2 variables and cross-level interactions are introduced. In the current study, we have 12 country-level variables with varying availability across countries, except for economic factors. In order to run estimations on the largest possible country set, we prefer to introduce one group of country-level variable at a time, using economic factors as control. This leads to using 23 or 24 countries in estimations, thus facing possible asymptotic issues. However, we tested the stability of the results when country level variables were introduced one at a time.

contrary, as soon as the recovery is back, they hire new workers on temporary short-term contracts. Finally in Model 4, the degree of centralisation of the wage bargaining system is taken into account. We find that the highest the degree of centralisation, the lowest the vulnerability to non-employment of employees in *Taylorist* forms of work organisation.

The interpretation of the estimated parameters of the cross-level interactions (columns 2 to 5 of each model) is different from that of the direct effect on column 1. Here, the country-level variables are moderating the effects of the variables they are interacted with. Starting with the *Discretionary learning* form of work organisation, given the negative direct effect of this form of work organisation (Table 4) on vulnerability, a positive estimate on the interaction term means that the country-level variable in question reduces the protective effect of *Discretionary learning* compared with *Taylorism* while a negative sign of the interaction term would mean that the given policy amplifies its beneficial effect. As an illustration, we can calculate the effect of *Discretionary learning* on the log-odds of being vulnerable for different values of macroeconomic variables. For example, in France only 0.07% of the GDP go to employment and start-up incentives while this indicator is 0.65% in Sweden (Table A2). For France the effect of *Discretionary learning* compared with *Taylorism* is: $-0.559 - (1.737 * (0.07 - 0.126)) = -0.46$; while in Sweden it is: $-0.559 - (1.737 * (0.65 - 0.126)) = -1.47$ ¹⁷.

Economic factors have the same influence on employees in the *Discretionary learning* model as on those in the *Taylorist* model (cross-level interactions are not significant or they have the same sign), except in Model 2 where the share of services in employment is associated with a significant positive coefficient. Hence, employees in *Discretionary learning* organisations are less protected against transitions out of employment in countries with a larger services sector. Furthermore, we find that expenditures in sheltered and supported employment and rehabilitation and in direct job creation reduce the protective effect of the *Discretionary learning* form of work organisation compared with *Taylorism*, while employment incentives and start-up incentives have the opposite moderating effect. Hence employment is not secured by the same active labour market policies in *Taylorist* and *Discretionary learning* forms of work organisation. We do not find any further results for the *Discretionary learning* in Model 3 when we take into account the strictness of employment protection legislation, but we identify in Model 4 a specific impact of the centralisation of the wage bargaining system. This effect is non-monotonous (the direct effect is negative and the squared term is positive and significant), showing that compared with *Taylorism*, the *Discretionary Learning* form is more efficient in protecting from vulnerability to non-employment when there is an intermediate level of centralisation of wage bargaining.

Compared with *Taylorism*, employees in the *Independent* forms of work organisation are more vulnerable to non-employment when R&D investments are high, but in Model 4, employees in these forms of work organisation are also less vulnerable in countries where the services sector represents a higher share of employment. Apart from these effects, the *Independent* form of work organisation appears quite close to the *Discretionary learning* form. The main difference between the two forms is the significant protective impact of training expenditures that complement that of employment and start up incentives. As active LMP, training expenditures could be particularly efficient in *Independent* forms of work organisation because these organisations offer very little on-the-job training to their employees (see Table 2).

¹⁷ Taking the exponential of -0.46 and -1.47, we obtain that the odds of being vulnerable is 0.63 in France and 0.23 in Sweden while it is 0.71 in a country with zero expenditures on employment and start-up incentives (Chile, for example).

Table 5. Estimates for the coefficients attached to the country- and cross-levels interactions variables in Models 2, 3 and 4

Country-level variable * Work organisation	Model 2: Labour market policies					Model 3: Employment protection legislation					Model 4: Centralisation of wage bargaining system				
	Intercept	Forms of work organisation				Intercept	Forms of work organisation				Intercept	Forms of work organisation			
	Taylorism (reference)	Discretionary learning	Independent	Simple	Constrained learning	Taylorism (reference)	Discretionary learning	Independent	Simple	Constrained learning	Taylorism (reference)	Discretionary learning	Independent	Simple	Constrained learning
Economic factors															
Share of services in employment	-0.648	2.007***	0.010	1.275	-0.079	-0.317	0.342	-0.955	1.213	-0.705	1.267	0.575	-1.125**	-0.979	-3.160***
GDP growth rate	-0.009	-0.078**	-0.041	-0.025	-0.169***	-0.110***	0.013	0.029	0.085***	-0.011	-0.051	-0.027	0.001	0.022	-0.123***
Research & Development (% GDP)	-0.180***	0.036	0.134***	-0.035	-0.018	-0.056	-0.012	0.099*	-0.038	-0.078	-0.127*	0.002	0.124***	0.088	0.035
Labour Market Institutions															
<i>Expenditures on labour market policies (% GDP)</i>															
Public employment services and administration	-0.818*	-0.271	-0.065	-0.302	-0.410	.	.	.	.	.	.	.	.	.	.
Training	1.421**	-0.392	-0.453*	-0.075	-0.393	.	.	.	.	.	.	.	.	.	.
Employment and start-up incentives	1.756***	-1.737***	-1.029***	-0.175	-0.387	.	.	.	.	.	.	.	.	.	.
Sheltered and supported employment and rehabilitation and direct job creation	-0.540*	0.616**	0.411*	0.401	0.510	.	.	.	.	.	.	.	.	.	.
Passive labour market policies	0.015	-0.132	-0.100	-0.253**	-0.369***	.	.	.	.	.	.	.	.	.	.
<i>Strictness of employment protection legislation</i>															
Individual and collective dismissals	.	.	.	.	.	-0.270*	0.010	0.051	0.321***	0.342**	.	.	.	.	.
Use of temporary contract	.	.	.	.	.	0.118*	0.038	0.009	-0.036	-0.114	.	.	.	.	.
<i>Trade union and wage setting</i>															
Measure of the Centralisation of wage bargaining	.	.	.	.	.	.	.	.	.	.	-0.234	-0.646	-0.244	0.197	-0.639**
Measure of the Centralisation of wage bargaining squared	.	.	.	.	.	.	.	.	.	.	-4.120***	4.856***	3.254***	1.363	6.467***
Number of individuals			78439					78985					80317		
Number of countries			23					24					24		
-2 Log Pseudo-Likelihood			2.3121E8					2.4958E8					2.2601E8		

Note: Significant level at * 10%, **5%, ***1%. This table is not presenting the regression of the different forms of work organisation. It shows the estimates from the part of our random effect model with country level variables and their interactions with the different forms of work organisation. This way of presenting these results improve the readability. It clearly shows how differences between countries affect the relationship between work organisation and vulnerability to non-employment. The first column of each block shows the direct effects of the country-level variables (estimates of the coefficients attached to them). It can also be considered the effect of the interaction with the form of work organisation of the reference individual (Taylorism). The other columns represent the estimates of the coefficients attached to the interaction between the country-level variables and the different forms of work organisation.

No economic factors or labour market policy significantly amplify the negative direct effect of the *Simple* form of work organisation on the probability of being vulnerable, except expenditures on passive labour market policies. Dedicated mainly to out of income maintenance and support these expenditures increase the protective effect of *Simple* forms of work organisation compared with *Taylorist* ones. Two further country level effects are identified in Model 3, but they reduce the protective effect of *Simple* forms compared with *Taylorist* forms: GDP growth rate and strictness of employment protection legislation on dismissals.

Finally, vulnerability to non-employment in the *Constrained learning* forms of work organisation compared with *Taylorist* ones is further reduced by GDP growth (Models 2 and 4) and by the development of the services sector. If we consider labour market policies (Model 2) and employment protection legislation (Model 3), country level impacts for the *Constrained learning* form and for the *Simple* form are close to one another: passive LMPs are associated with lower vulnerability and strictness of employment legislation on dismissals have the opposite effect. However, Model 4 shows a specific and strong effect with the *Constrained learning* form, which is also found albeit weaker with the *Discretionary learning* and the *Independent* forms of work organisation: the impact of the degree of centralisation of the wage bargaining system is clearly hump-shaped, implying that intermediate levels of bargaining are the most efficient to protect employees from transitions out of employment.

CONCLUSIONS

Work organisation is often considered as a central element in fostering economic and business development. In recent years, restructuring of organisations have been widely observed in many OECD countries. At the same time nonstandard work, as well as unemployment, has been on the rise. We argue that the capacity of workers to secure their employment in a changing work environment is related to the form of work organisation in which they are employed.

Most studies on labour market vulnerability rely on the study of supply side factors while the literature dealing with the concept of work organisation usually analyses it in terms of its relationship with productivity, innovation and working conditions rather than with labour market outcomes. This paper examines the relationship between the different forms of work organisation in workplaces and the vulnerability to non-employment within countries taking part in rounds 1 and 2 of the Programme for the Assessment of Adults Competencies (PIAAC) – a cross-country survey carried out by the Organisation for Economic Co-operation and Development (OECD). Using hierarchical cluster analysis, we define five forms of work organisation based on the description given by employees of the tasks they perform: *Discretionary Learning*, *Constrained Learning*, *Independent*, *Simple* and *Taylorist*. Workers in *Discretionary learning* forms of work organisation have a higher degree of autonomy in the way they do their job, they plan their own activities and organise their own time on a daily basis. They are also more frequently involved in learning activities and in solving complex problems at work. The *Constrained Learning* form of work organisation differs from the *Discretionary Learning* in terms of discretion, problem solving and influence at work, but employees have more learning opportunities than in the other three forms of work organisation through collaborations and sharing of information as well as through on the job training. The *Independent* form of work organisation is above

the overall mean regarding discretion at work and in sharing work-related information. The *Simple form* of work organisation is opposite to the *Discretionary learning* form as employees perform less frequently than in the overall population all the listed tasks. Thus, they perform more simple jobs in simpler organisations. However, in this form of work organisation, compared with the *Independent* form, employees receive more on-the-job training. Finally, the *Taylorist* form of work organisation is characterised by below average frequency for all listed tasks except for two of them: cooperating or collaborating and sharing work-related information. The employees perform simple tasks in more structured organisations than in the *Simple* forms.

Then multilevel logistic regression is used to evaluate the impact of forms of work organisation on vulnerability to non-employment. The latter is defined as the probability to make a transition from employment to non-employment over a one year time period. An advantage of multilevel modelling is that it allows to analyse variables from different levels simultaneously, using a statistical model that properly organises these various dependencies. National factors, including economic factors or labour market institutions could influence the probability of being vulnerable to non-employment. Our results thus identify both the most protective forms of work organisation and the national policies which moderate their effects.

The results show indeed a significant impact of work organisation on vulnerability to non-employment after controlling for relevant job and personal characteristics. However, its size depends on the type of work organisation. Compared to *Taylorism* all other forms of work organisation decrease the employees' probability of making a transition out of employment. In particular, employees in *Learning* forms of work organisation, where they have a certain degree of discretion in the planning of their activities and time, are the least vulnerable.

The results also show that employment policies need to take into account the structure of the economy in terms of forms of work organisation. Active labour market policies such as training and employment and start-up incentives are efficient at protecting employment in countries where the *Discretionary Learning* and the *Independent* forms of work organisation are widespread. This is because they tend to lower the probability of making a transition out of employment for employees in these two forms of work organisation. These active LMPs are much less efficient in countries where *Taylorist*, *Simple* or *Constrained learning* forms of work organisation are predominant. In such countries, expenditures in public employment services and administration, sheltered and supported employment and rehabilitation and direct job creation provide better shields against workers' flows out of employment. In addition for employees in *Simple* and *Constrained learning* forms, passive LMPs have a protective role. Employment protection legislation also moderate the impact of forms of work organisation on vulnerability to non-employment. Stricter legislation on dismissal reduce the probability of making a transition out of employment in *Taylorist* forms of work organisation while the opposite result is observed for stricter legislation on use of temporary contract. From this point of view, the *Discretionary learning* and *Independent* forms of work organisation behave like the *Taylorist* form. However, in the *Simple* and *Constrained learning* forms, we do not observe any protective effect of stricter employment protection legislation on dismissals. Furthermore, an intermediate level of centralisation of wage bargaining favours the capacity of the *Constrained learning* form of work organisation to secure employment. The same conclusion holds in countries with large shares of *Discretionary learning* and *Independent* forms of work organisation, unlike in countries with a predominant *Taylorist* work organisation where a high level of centralisation of the wage bargaining system secures for employees lower levels of labour market vulnerability.

Finally, our results should stimulate reflections and further research on national policies that encourage firms' organisational choices in order to adapt the forms of work organisation (especially *Discretionary Learning*) which protect individuals from vulnerability to non-employment.

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APPENDIX

Table A1. Job and sociodemographic characteristics by vulnerability status

Variables	Overall (%)	Vulnerable (%)	Non-vulnerable (%)
Characteristics of the employer			
Economic sector			
Private	72.4	75.5	72.1
Public	24.9	21.9	25.2
Nonprofit	2.5	2.1	2.49
Missing values	0.2	0.5	0.2
Establishment size			
<10 employees	26.1	35.2	25.2
11-50 employees	30.2	32.5	30
51-250 employees	23.1	18.6	23.6
251-1000 employees	11.4	6.8	11.9
>1000 employees	8	4.7	8.4
Missing values (mostly self-employed without employees)	1.2	2.2	0.9
Industry classification ISIC Rev 4			
A: Agriculture, forestry and fishing	1.8	3.6	1.7
BC: Manufacturing, mining and quarrying)	19	14.3	19.5
DE: Electricity, gas and Water supply; sewerage and waste management	1.9	2.9	1.8
F: construction	7	8.6	6.8
G: Wholesale and retail trade; repair of motor vehicles and motorcycles	13.3	13.8	13.2
H: Transportation and storage	6.1	5	6.2
I: Accommodation and food service activities	4.5	8.2	4.2
J: Information and communication	3.1	1.9	3.2
KL: Financial and insurance activities; Real estate activities	3.5	2.9	3.6
M: Professional, scientific and technical activities	3.9	4.3	3.8
N: Administrative and support service activities	4.7	6.3	4.5
O: Public administration and defence; compulsory social security	7.2	4.9	7.4
P: Education	8.5	7.3	8.6
Q: Human health and social work activities	10.6	8.3	10.8
R: Arts, entertainment and recreation	1.5	2.4	1.4
STU: Other service activities	2.6	2.3	2.7
Missing values	0.8	3	0.6
Characteristics of the job			
Occupational classification ISCO 1 digit			
0: Armed forces	0.6	0.4	0.6
1: Legislators, senior officials and managers	6.3	3.7	6.6
2: professionals	16.9	13.2	17.3
3: Technicians and associate professionals	14.3	8.8	14.9
4: Clerks	11.2	11	11.2
5: Service workers and shop and market sales workers	18.7	23.5	18.3
6: Skilled agricultural and fishery workers	1	1.8	0.9
7: Craft and related trades workers	11.9	12.7	11.8
8: Plant and machine operators and assemblers	9.5	8.3	9.6
9:Elementary occupations	8.9	15.7	8.2
Missing values	0.7	0.9	0.6
Type of employment contract			
Indefinite	70.8	42.9	73.6
Temporary	16.8	33.3	15.1
Others: temporary employment agency contract; apprenticeship or other	12.2	23.4	11.1
Missing values (for Austria, United States and Canada)	0.2	0.4	0.2
Average number of hours worked per week (mean)	39.6	37.9	39.8
Experience with computer at work			
Use ICT at work	62.1	44.3	63.9
Do not use ICT at work	37.8	55.6	36.1
Missing values	0.1	0.1	0

Table A1 (continued). **Job and sociodemographic characteristics by vulnerability status**

Variables	Overall (%)	Vulnerable (%)	Non-vulnerable (%)
Sociodemographic characteristics			
Age in 10 year bands			
<24	7	13.3	6.3
25-34	26.6	30.7	26.2
35-44	27.3	23.3	27.7
45-54	24.7	18.8	25.3
55 plus	14.4	13.9	14.5
Education level			
Primary	4.5	8.8	4.1
Secondary	53.5	56.1	53.2
University	41.8	35.1	42.6
Missing values	0.2	0	0.1
Gender			
female	46	54.9	45.1
Male	54	45.1	54.9
Marital status			
Single	22.8	31.6	22
Living with spouse or partner	66.9	58	67.8
Missing values	10.3	10.4	10.2
Family responsibilities: Number of children			
No children	32.8	39.4	32.1
One child	21.3	22.6	21.2
Two children	32	24.6	32.8
Three children or more	13.9	13.4	13.9
Social background			
Immigration			
First generation immigrant	6.8	9.1	6.6
Second generation immigrant	2.2	2.4	2.2
Non 1st or 2nd generation immigrant	85.4	83.9	85.6
Missing values	5.6	4.6	5.6
Parents' level of education			
Uneducated parents	35.4	39.2	35
At least one educated parents	58.1	53.7	58.6
Missing values	6.5	7.1	6.4
Number of observations	89705	7192	82513

Source: First and second rounds PIAAC (2012 and 2015), OECD.

Coverage: These calculations include all participating countries and take into consideration those who have worked a paid job as employees during the last 12 months preceding the survey, excluding youths aged 16-24 in initial cycle of studies and retired people at State pension age.

Note: These percentages have been computed using sample weights and their standard errors are estimated using jackknife method. Bold figures for one group means they have a significantly higher percentage.

Table A2. Country-level variables

Countries/ Variables	Labour Market Institutions							Economic factors			
	Expenditures on Labour Market policies (LMP) in % of GDP					Strictness of employment protection legislation		Centralisation of wage bargaining	% of services in employment	GDP growth in %	Expenditures in R&D in % of GDP
	Active			Sheltered and supported employment and rehabilitation and direct job creation	Passive	Dismissal	Use of temporary contract				
	Public employment services and administration	Training	Employment and start-up incentives								
Belgium	0.20	0.16	0.22	0.21	2.02	1.89	2.38	0.48	78	0.2	2.36
Chile	0.03	0.04	0.00	0.04	0.23	2.63	3.00	.	67	2.3	0.39
Cyprus	.	.	.	.	.	.	.	0.29	80	1.7	0.46
Czech Republic	0.11	0.01	0.02	0.11	0.23	2.92	1.44	0.25	59	-0.8	1.78
Denmark	0.32	0.53	0.38	0.59	1.65	2.20	1.38	0.42	78	0.2	2.98
Estonia	0.10	0.14	0.03	0.00	0.42	1.81	1.88	0.32	64	4.3	2.12
Finland	0.15	0.50	0.16	0.19	1.40	2.17	1.56	0.43	73	-1.4	3.42
France	0.26	0.35	0.07	0.22	1.42	2.38	3.63	0.24	75	0.2	2.23
Germany	0.33	0.22	0.06	0.06	0.95	2.68	1.00	0.47	70	0.5	2.87
Greece	.	.	.	.	.	2.17	2.25	0.27	72	-0.2	0.97
Ireland	0.17	0.39	0.07	0.25	2.38	1.40	0.63	0.46	77	-1.1	1.56
Israel	0.02	0.06	0.06	0.03	0.56	2.04	0.88	.	80	2.5	4.25
Italy	0.12	0.14	0.19	0.00	1.56	2.76	2.00	0.38	69	-2.8	1.27
Japan	0.07	0.01	0.09	0.03	0.25	1.37	0.88	0.32	69	1.5	3.34
Korea	0.02	0.06	0.07	0.23	0.28	2.37	2.13	0.32	69	2.3	4.03
Lithuania	0.06	0.02	0.08	0.09	0.23	.	.	0.36	66	1.8	1.04
Netherlands	0.28	0.10	0.03	0.47	1.62	2.82	0.94	0.57	72	-1.1	1.94
New Zealand	0.09	0.12	0.01	0.05	0.39	1.39	1.00	0.31	71	3.4	1.16
Norway	0.12	0.15	0.09	0.16	0.34	2.33	3.00	0.51	77	2.7	1.62
Poland	0.08	0.01	0.14	0.20	0.32	2.23	1.75	0.18	57	1.6	0.88
Russia	.	.	.	.	.	.	.	.	65	3.5	1.05
Singapore	.	.	.	.	.	.	.	0.85	83	2.0	2.20
Slovakia	0.07	0.00	0.13	0.06	0.43	1.71	1.63	0.50	59	1.7	0.81
Slovenia	0.09	0.04	0.07	0.06	0.82	2.60	1.81	0.32	60	2.3	2.21
Spain	0.08	0.15	0.28	0.13	3.03	2.21	2.69	0.38	75	-2.9	1.29
Sweden	0.27	0.10	0.65	0.25	0.63	2.61	0.81	0.52	78	-0.3	3.28
Turkey	.	.	.	.	.	2.31	4.88	.	52	4.0	1.01
United Kingdom	0.20	0.01	0.01	0.01	0.31	1.26	0.38	0.11	79	1.3	1.61

Source: OECD database for labour market policy and employment protection legislation variables; for the centralization measure, the database on institutional characteristics of trade unions, wage setting, state intervention and social pacts (ICTWSS) by Jelle Vesser; and World Bank database for all the economic factors variables. The strictness of employment protection is based from an OECD index and range from 1 to 6 for each country. The measure of the centralisation of the wage bargaining takes into account of both union authority and union concentration at multiple level and range from 0 to 1. All these variables are measured in 2012, except for countries from the round 2 of PIAAC for which the variables are measured in 2015.

Table A3. Multilevel logistic regression estimates for coefficients attached to control variables

	Multilevel logistic regression			
	Model 1	Model 2	Model 3	Model 4
Fixed effects estimates				
Characteristics of the employer				
Economic sector (ref. private sector)				
public	0.089	-0.139	-0.103	-0.137
Nonprofit	0.141	0.158	0.139	0.183
Missing values	0.442	0.395	0.418	0.443
Establishment size (ref. <10 employees)				
11-50 employees	-0.070	-0.124**	-0.107*	-0.126**
51-250 employees	-0.289***	-0.221**	-0.202**	-0.232**
251-1000 employees	-0.434***	-0.359***	-0.314***	-0.349***
>1000 employees	-0.381***	-0.340***	-0.364***	-0.351***
Missing values	0.295	-0.056	-0.122	-0.045
Industry classification ISIC Rev 4 (ref. isic1_BC: Manufacturing, mining and quarrying)				
A: Agriculture, forestry and fishing	0.227	0.403***	0.387***	0.351**
DE: Electricity, gas, steam and air conditioning supply, and	0.909***	0.581***	0.507***	0.578***
F: Construction	0.325***	0.260**	0.291**	0.255*
G: Wholesale and retail trade; repair of motor vehicles and	0.031	0.207	0.185	0.201
H: Transportation and storage	-0.031	0.169	0.078	0.135
I: Accommodation and food service activities	0.274**	0.422***	0.333**	0.418***
J: Information and communication	-0.018	0.291	0.275	0.289
KL: Financial and insurance activities; Real estate activities	0.340	0.710***	0.625***	0.693***
M: Professional, scientific and technical activities	0.451***	0.352***	0.353***	0.368***
N: Administrative and support service activities	0.131	0.350**	0.211	0.335**
O: Public administration and defence; compulsory social se	-0.170	0.220	0.093	0.217
P: Education	-0.141	0.230*	0.129	0.236*
Q: Human health and social work activities	-0.131	0.001	-0.051	-0.001
R: Arts, entertainment and recreation	0.410**	0.541***	0.549***	0.569***
STU: Other service activities; Activities of households as en	-0.566***	-0.404***	-0.394***	-0.352**
Missing values	1.786**	0.309	1.980***	0.264
Characteristics of the job				
Occupational classification ISCO 1 digit (ref. ISCO 9 elementary occupations)				
0: Armed forces	-0.050	-0.472	-0.556	-0.751
1: Legislators, senior officials and managers	-0.313	-0.649***	-0.687***	-0.601***
2: professionals	-0.221**	-0.326***	-0.354***	-0.312***
3: Technicians and associate professionals	-0.452***	-0.393**	-0.424***	-0.373**
4: Clerks	-0.092	-0.170*	-0.210**	-0.116
5: Service workers and shop and market sales workers	-0.160***	-0.139*	-0.153**	-0.116
6: Skilled agricultural and fishery workers	-0.085	-0.138	-0.121	-0.032
7: Craft and related trades workers	-0.181***	-0.133	-0.157**	-0.107
8: Plant and machine operators and assemblers	-0.253***	-0.219**	-0.270**	-0.195**
Missing values	-0.863	0.347	-0.569	0.448*
Experience with computer at work (ref. Do not use ICT at work)				
Use of ICT at work	-0.320***	-0.354***	-0.327***	-0.409***
Missing values	0.506	-0.646	-0.944	-0.239
Type of employment contract (ref. indefinite)				
Temporary	1.102***	1.377***	1.331***	1.406***
Others: temporary employment agency contract; apprentice	0.876***	1.269***	1.137***	1.291***
Missing values	0.899***	1.085**	0.944*	0.899
Hours worked per week	-0.003	-0.004	-0.004	-0.003

Table A3 (continued). **Multilevel logistic regression estimates for coefficients attached to control variables**

	Logistic regression		Multilevel logistic regression	
	Model 1	Model 2a	Model 2b	Model 3
Fixed effects estimates				
Socio-demographic characteristics				
Age in 10 year bands (ref. under 24)				
25-34	-0.261***	-0.152**	-0.159**	-0.134*
35-44	-0.436***	-0.360***	-0.346***	-0.337***
45-54	-0.560***	-0.506***	-0.466***	-0.474***
55 plus	-0.377	-0.136	-0.102	-0.107
Education level (ref. primary or less)				
Secondary	-0.308**	-0.168*	-0.195**	-0.178*
University	-0.337***	-0.216*	-0.233**	-0.217*
Missing values	-0.373	0.027	-0.012	-0.285
Gender (ref. male)				
female	0.438***	0.357***	0.411***	0.354***
Marital status (ref. living with spouse or partner)				
Single	0.122*	0.078	0.088	0.073
Missing values	0.153	0.150	0.132	0.148
Family responsibilities: Number of children (ref. no children)				
One child	0.015	-0.027	-0.051	-0.050
Two children	-0.222**	-0.200	-0.260**	-0.212
Three children or more	-0.058	-0.182	-0.219*	-0.199
Social background (ref. Non 1st or 2nd generation immigrant and Educated parents)				
First generation immigrant	0.186	0.053*	0.056*	0.031
second generation immigrant	0.344**	0.226*	0.221*	0.196
Missing values	-1.156***	-0.512	-0.517	-0.509
Uneducated parents				
Uneducated parents	-0.117***	-0.107***	-0.135***	-0.102**
Missing values	0.049	0.022	0.009	0.051
Number of observations level 1	89705	78439	78985	80317
Number of observations level 2	28	23	24	24
-2 Log Pseudo-Likelihood	3.0089E8	2.3121E8	2.4958E8	2.2601E8

Source: First and second rounds PIAAC (2012 and 2015), OECD.

Coverage: These calculations include all participating countries and take into consideration those who have worked a paid job as employees during the last 12 months preceding the survey, excluding youths aged 16-24 in initial cycle of studies and retired people at State pension age.

Notes: Significant at 1% ***, 5% ** and 10% *. This table shows estimates of the coefficients attached to the control variables as a complement to the results presented in Tables 5 and 6. Model 1 does not include any country-level variables. Model 2 to 4 include economic factors and their interactions to the different types of work organisation. In addition to these variables, Model 2 considers labour market policy variables, while Model 3 includes employment protection legislation variables and Model 4 takes into account of the wage bargaining system.

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