Quality of jobs and Innovation generated Employment outcomes

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INNOVATION AND JOB QUALITY REGIMES: A JOINT TYPOLOGY FOR THE EU

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Executive summary

The Lisbon Strategy as well as Europe 2020 are based on an optimistic view of the relationships between innovation, job creations and job quality that are supposed to be positively correlated. However, on the basis of recent trends in Europe (especially in the years following the Great Recession of 2008) one may question the existence of such a virtuous circle. Furthermore, country differences in both innovation and labour market regimes are very important and it appears necessary to account for that heterogeneity before translating them into policy recommendations.

In the following paper, we rely on an institutionnalist perspective to analyze differences in innovation, job quality and employment performances across Europe. We focus on the innovation-job quality relationship and construct an original typology based on two crossed taxonomies of innovation and job quality regimes.

In the first section we show the need for an extension of traditional approaches to innovation as purely driven by science and technology to a wider perspective including a large number of institutions that may affect production regimes, as in the NSI (National Systems of Innovation) or in the SSIP (social systems of innovation and production) perspectives. Such theoretical frameworks are directly related to the varieties of capitalism perspective, that has also analyzed the diversity of labour market functioning and can be used to make hypotheses about potential job quality outcomes throughout different types of capitalisms (CMEs vs LMEs, or market-based/continental/social-democratic/southern). A more specific focus on job quality leads to considering three types of employment regimes: market, inclusive and dualist. Considering these theoretical frameworks as well as existing empirical results leads us to the hypothesize a rather strong relation between innovation and job quality that must be linked not only to individual firms practices but more widely to the existence of institutions influencing both innovation and job quality.

In the second section we present the definitions and indicators of innovation and job quality that are used for our empirical analysis. In accordance with our theoretical perspective we take a wide approach to innovation and we use indicators related to policy context ("enablers" according to the Innovation Union Scoreboard (IUS): R&D expenditure and human resource in science and technology), as well indicators of innovation at the firm level (both technological and non-technological) and at the employee level. For job quality the analyses are based on the multi-dimensional definition of job quality that was adopted for the QuInnE project, and which includes six dimensions of job quality, i.e. wages, employment conditions,

work conditions, training and education, work-life balance and collective interest representation. The indicators come from different European databases. In terms of methodology, we use Principal Component Analysis (PCA) to analyse correlations between the various indicators and summarize existing information and hierarchical ascending classifications (HAC) to identify country clusters. Analyses are conducted for 2012 and 2000 to get a benchmark at the start of the Lisbon Strategy.

In the third section empirical results are presented.

Concerning innovation, the analysis confirms the interest of taking a wide perspective –as R&D expenditures are not well correlated to our other indicators of innovation. In 2012 we identify four clusters of innovation in Europe: a Nordic cluster (Denmark, Finland, Sweden); a "continental-liberal" cluster (Austria, Belgium, Germany, France, Luxembourg, the Netherlands, Ireland, the UK, Estonia); a Southern cluster (Greece, Italy, Portugal); and finally Eastern and Central European countries plus Spain. The Nordic cluster stands out in terms of very high levels of innovation especially in terms of Human Resources for Science and Technology (HRSCT) and workers' perceptions of innovation.

Concerning job quality, four clusters are also identified: Nordic countries (Denmark, Finland and Sweden); continental countries (Germany, Austria, Belgium, Luxembourg, and the Netherlands) as well as the UK and Ireland; Eastern and Central European countries (except Poland); Southern countries, France and Poland. Again Nordic countries exhibit very good performance, especially in terms of training, work-family reconciliation and social dialogue.

Comparing taxonomies in 2012 and 2000 is not straightforward as some indicators are missing in 2000. However, the general picture is one of stability of countries' situations, with a few changes (like a relative improvement for Estonia, or a relative degradation for France).

In the last step, innovation and job quality regimes are crossed in order to define a joint typology of EU countries. The results show that innovation and job quality clusters appear generally well correlated, which confirms previous results in the variety of capitalism perspective, and theoretical insights presented in the first section. In particular, the situation of Nordic countries illustrates a regime of complementarity between high job quality and high innovation. At the opposite end, most Eastern and Central European countries display low levels of innovation and job quality. However, some gaps also appear, like for instance in France or Estonia in 2012: both countries display a rather high innovation effort but only average or low levels of job quality.

		Innovation			
		- -	-	+	++
Job quality	++				DK FI SE
	+			AT DE IE NL UK BE LU	
	-	ES PL	EL IT PT	FR	
	- -	CZ LT LV SK HU		EE	

In the fourth section we try to relate the results of this typology to employment outcomes (global as well as social groups' employment and unemployment rates, productivity, etc). The results do not provide strong empirical evidence. If we consider all countries except those from the Central and Eastern European category, we can observe a positive relationship between job quality, innovation and employment performance (measured by global employment rate). However, Central and Eastern European countries combine low levels of job quality and innovation but at the same time average levels of employment.

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Introduction

Since 2000, innovation has become a policy goal for the European Union, in the framework of the Lisbon Strategy and in the more recent Europe 2020. Among the underlying motivations is that innovation is considered a driver of economic growth and job creation in an international context where Europe seems to be lagging behind the US. At the same time, the policy guidelines of the Lisbon Strategy and Europe 2020 also include employment (especially employment rate targets) and job quality (since the Laeken council in 2001), putting forward an optimistic view of the links between innovation and employment based on the idea of a virtuous circle.

However, empirical evidence is more mixed at the EU level and does not necessarily support that view. Several indicators of innovation have been improving (although they remain far from the initial target): for instance, between 2000 and 2014, R&D expenditure has increased from 1,79% to 2,03% of GDP (the target is at 3% in both the Lisbon Strategy and Europe 2020) and the share of human resources in the fields of science and technology has gone up from 27,4 to 39%[3]. According to the Innovation Union Scoreboard (European Commission, 2015) the global EU innovation performance (measured by a large series of indicators) has been increasing more rapidly than in the US between 2007 and 2014 even though the scoreboard remains 22% higher in the US in 2014. However, employment performance remains disappointing both from quantitative and qualitative sides. Global employment rates are slightly higher in 2015 than in 2000[4], but they are lower for some disadvantaged categories (youth and low qualified). Global unemployment stands also at a higher level than in 2000. At the same time, job quality has not improved in its various constitutive dimensions: atypical jobs (fixed-term contracts, short part-time, low income self-employment, etc) have increased in many countries, real wages have stagnated or even decreased since the Great Recession (Askénazy & Erhel, 2016) and the quality of the working environment (including working conditions) does not seem to have changed much according to existing surveys (OECD, 2016). From a firms' performance point of view it is also clear that productivity trends have been disappointing, with a stagnation of labour productivity between 2008 and 2010 in most European countries, followed by a limited growth since 2011, widening the medium run gap with the US (Askénazy & Erhel, 2016).

Considering these trends one may question the virtuous circle of innovation, employment and job quality at the European level –at least in hard times, following the 2008 recession. However, country differences in both innovation and labour market regimes are very

[3] In % of total population aged 15 to 64. Source : Eurostat

[4] The difference between 2015 and 2000 for the population aged 15 to 64 is 3.5 percentage points (source: Eurostat).

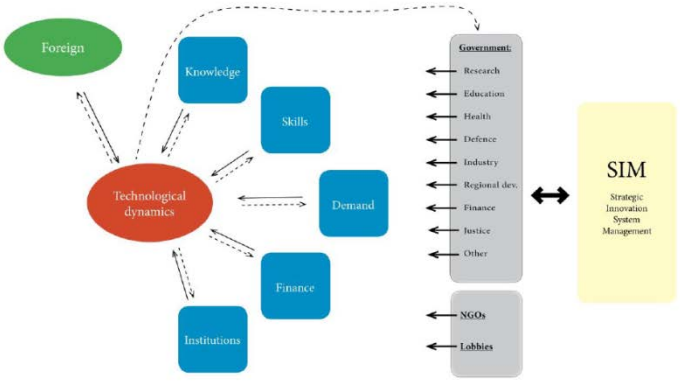
important and it appears necessary to account for that heterogeneity before formulating policy recommendations.

In the following paper, we rely on an institutionnalist perspective to analyze differences in innovation, job quality and employment performance across Europe. We focus on the innovation-job quality relationship and construct an original typology, based on two crossed taxonomies of innovation and job quality regimes. The first section presents the literature and the main hypotheses used to analyze innovation and job quality in an institutionnalist perspective. The second section presents the data and empirical methodology. In the third section, two successive taxonomies of innovation and job quality are constructed and then crossed in a typology of the innovation-job quality relationships. The fourth section discusses the links with employment outcomes before concluding.

1- An institutionalist perspective on the links between innovation and job quality

Since the 1990s, innovation has been approached through institutionalist and systemic approaches that go beyond a conception of innovation as purely driven by science and technology on the one hand and by the individual behavior of some isolated economic agents (firms/employers) on the other. Such a perspective was first developed by the national systems of innovation theories (Lundvall, 1992; Nelson, 1993), which rely on three main hypotheses: economic decision making is based on institutional foundations (which relates this approach to institutionalism); competitive advantage results from variety and specialization, and includes some path dependence; and technological knowledge is generated by some interactive learning processes that differ among agents and condition innovation opportunities. The national system of innovation approach includes a narrow perspective focused on science, research and technology, and a wider perspective, including all institutional structures and policies that may affect production regimes (Lundvall, 1992). In the latter perspective, some recent analyses of innovation systems put the stress on interactions between different fields and set of policies that may influence them, and technological dynamics (Fagerberg, 2014). The basic components interacting with innovation include knowledge (public R&D, universities, etc.), skills (education policies and vocational training), demand (existing markets for innovative solutions), finance and institutions (laws and regulations influencing entrepreneurial actions). The innovation system perspective leads to a holistic perspective on policy, including a range of policies and institutions that goes beyond the field of research and technology.

Figure 1: The national innovation systems



Source: Fagerberg (2014), Makó & Illéssy (2015)

That NSI literature has been quite directly related to the varieties of capitalism framework, especially through the work of Bruno Amable (2003a and 2003b, 2000). Amable (2000) identifies some weaknesses of the NSI approach and proposes an enlargement through the concept of social systems of innovation and production (SSIP). Focusing on institutional complementarities, the SSIP approach includes a wider set of institutions as drivers of innovation, and identifies four idealized models of innovation and production: market-based, social-democratic, meso-corporatist and public (Amable, 2000). The market-based SSIP conforms to a market-based logic and works through competition between laboratories and R&D departments of private firms. The labour market is flexible and favours a high mobility, but limited skill accumulation within firms. Financial markets are well developed and sophisticated, allowing the mobilization of capital and the emergence of new activities and sectors. Typical examples are the UK and the US. The social-democratic SSIP is based on compromise and negotiation, and follows egalitarian goals in terms of income and education. It favours the development of high value-added sectors and involves a permanent adaptation process and public policies that help the labour force rejected by the non-competitive sector branches. It corresponds to the situation of the Nordic countries. The meso-corporatist SSIP shares some characteristics with the social-democratic SSIP. But it puts large firms at the center of the innovation process. These firms are also characterized by important learning processes inside the firms (concerning products, processes, and forms of organization). Financing is possible over a long term horizon. Japan appears as the typical example for this SSIP. Finally, the public SSIP gives public institutions a determining role in the direction of innovation. Education and research are also mainly public-financed, which involves some transfer problems (towards the private sector). Financing is based on banks and credits. This model corresponds to continental European countries, with the exception of Germany that stands closer to the social-democratic SSIP.

Such broad approaches to innovation in the framework of NSI or SSIP include some direct links with education and training policies and (especially in Amable's perspective) with labour market regimes. In theory different production and innovation regimes may therefore

be associated with different employment and labour market outcomes (in terms of employment dynamics as well as job quality).

In the varieties of capitalism literature, some links between production regimes and employment quality are usually proposed at a theoretical level (Gallie, 2007; Davoine *et al*, 2008). In the dichotomous approach of Hall and Soskice (2001), better job quality should be observed in coordinated market economics. Indeed, Coordinated Market Economies (CMEs) encourage long-term financing relationships, cooperative industrial relations, serious initial vocational training and substantial cooperation on setting technological standards. Within Liberal Market Economies (LMEs), financial systems impose relatively short term horizons and high risk taking, labour markets are deregulated with weak forms of industrial relations, vocational training is also low with more encouragement of general education, and finally there is a high level of inter-company competition limiting cooperation possibilities. Therefore, LMEs would be characterized by a higher proportion of poor quality jobs. In the five regime typology of Amable (2003b)[5], the differentiation in terms of employment quality is more complex. Poor employment quality can still be associated here to the market-based model, which is close to the LME in Hall and Soskice's approach. But it also characterises the Mediterranean model, where the education and training levels of the workforce are relatively low, not enabling any high wage industrial strategy, and limiting the generosity of the welfare system due to financial constraints. Still, contrary to the market-based model, employment is rather well protected. At the opposite end, the social-democratic model, as developed in Northern Europe, exhibits a high welfare level, good training opportunities, generous active policies for the unemployed, and coordinated wage bargaining systems. The continental model is more ambiguous in terms of employment quality: it is close to the social-democratic model in the sense that it includes quite generous welfare, a certain degree of wage bargaining cooperation, active policies and training, but all these characteristics which favour employment quality are less developed than in the social-democratic model. Employment protection stands at a higher level in the continental model, which has an ambiguous consequence in terms of employment quality, since it favours insiders, but reduces employment opportunities for job seekers.

Gallie (2007) stresses the links between job quality and employment regimes, and more specifically the way institutions build power resources for labour rendered in three ideal-types: inclusive, dualist and market regimes. Inclusive employment regimes involve policies designed to extend employment and employment rights as widely as possible across the population. Dualist regimes provide strong rights to a core labour-force of skilled employees, but employment conditions are poor for the periphery. Market employment regimes assume that market adjustments will lead to high employment levels in the long run, and provideslimited protection for workers. In these three regimes, organized labour has been attributed a different role in employment policy and employment regulation: a strong participation in decision-making is guaranteed in inclusive employment regimes, whereas dualist regimes are characterized by a consultative involvement of labour, with some

[5] Amable (2003b) distinguishes between i) a market-based model; ii) a social-democratic model; iii) a continental European model; iv) a Mediterranean model and, v) an Asian model.

inequalities across firms (higher power in large firms). In market regimes labour is excluded from decision making and the relative position of workers in terms of job quality will be mainly structured by class. Key institutional factors contributing to these regimes involve initial skill formation systems, continuous vocational training systems, position of organized labour (trade union power), work integration policies (EPL and labour regulation –for instance working hours), and employment integration policies.

Empirical analyses of innovation systems, production regimes or employment regimes usually confirm the existence of several country clusters that are associated with different institutional regimes and performances. For innovation, the most recent analyses based on the innovation union scoreboard (IUS, 2015) differentiate between innovation leaders, innovation followers, moderate innovators and modest innovators. For job quality, despite the differences in existing studies[6], multi-dimensional analyses for the EU identify a Nordic group with a high level of job quality, an intermediate group composed of continental Europe, a Southern and an Eastern group both with lower job quality (Davoine *et al.*, 2008; Munoz de Bustillo et al, 2011; Leschke and Watt, 2008; Green *et al.*, 2013; OECD, 2014). The relative position of the UK may vary, but in the most recent analyses it usually belongs to the intermediate group (OECD, 2014; Cazes *et al*, 2015). Innovation and job quality typologies thus appear to match relatively well, in accordance with theoretical ideal-types identified above: a well-identified Nordic group is characterized by high innovation and high job quality; Continental countries, the UK and Ireland stand in an average position with regard to both innovation and job quality (with the exception of Germany that belongs to the innovation leaders cluster, but is characterized by an intermediate job quality level); Southern and Eastern countries exhibit lower levels of innovation and lower job quality. According to that literature, innovation and job quality appear interrelated, which must be linked not only to individual firms' practices, but more widely to the existence of institutions influencing both types of outcomes.

The goal of this paper is to analyze these links in a more systematic way and to provide a new typology of innovation and employment regimes crossing both types of indicators. We will also compare the situation in 2012 to the situation of 2000.

2- Indicators and data

Given the multidimensional nature of job quality and innovation, empirical analysis cannot be based on a single indicator but includes two sets of indicators representing job quality and innovation.

For innovation we use indicators related to policy context ("enablers" according to the IUS: R&D expenditure and human resources in science and technology) and indicators of innovation at the firm level (both technological and non-technological). To capture these innovation outputs we use both indicators from the Community Innovation Survey (CIS,

[6] These differences relate to the indicators included in the measurement of job quality.

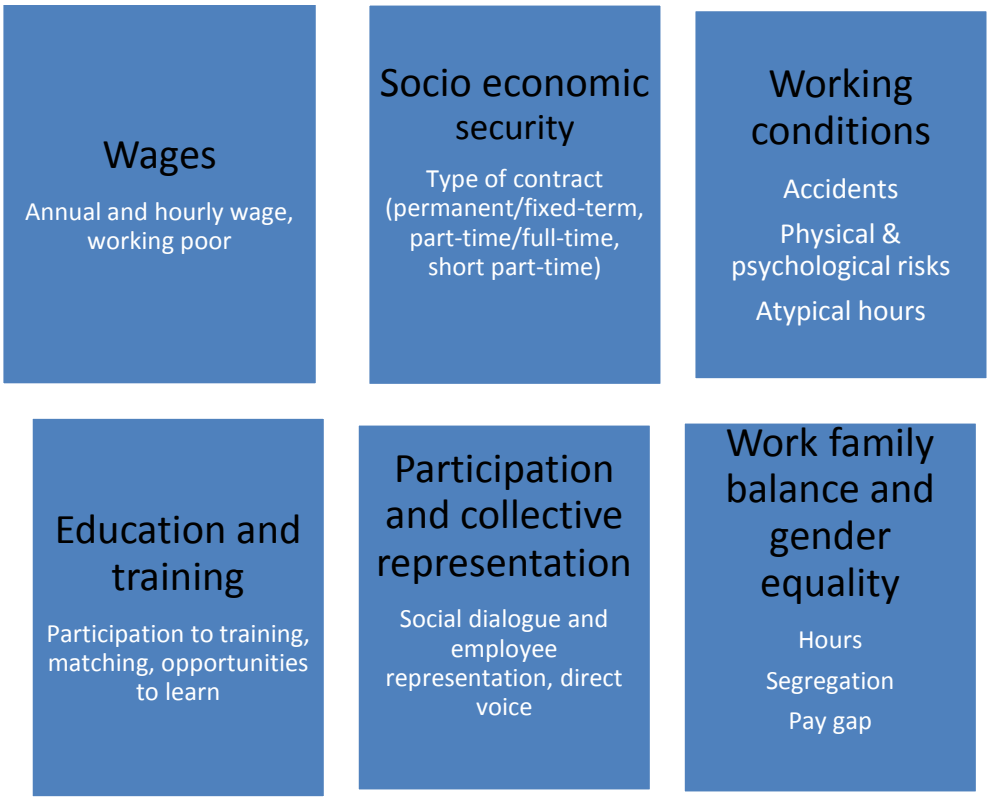
declared by employers) and indicators from EWCS (European Working Conditions Survey, declared by workers).

For job quality the analyses are based on the definition of job quality that was adopted for the Quinne project[7], and which includes six dimensions of job quality, i.e. wages, employment quality, education and training, working conditions, work-life balance and gender equality and collective interest representation (figure 2 below). The data sources that are used are mainly the European Working Conditions Survey and the Labour Force Survey, with a few additional indicators from the Structure of Earnings Survey and the European Statistics on Accidents at Work[8]. In accord with existing literature we measure job quality through objective as well as subjective indicators (relying on workers' perceptions).

In this paper we have chosen to focus on European surveys and indicators[9] in order to try and cover as many EU countries as possible. However, in both analyses, the sample is limited to 22 countries, because of missing data and for reasons of comparability between classifications on job quality and innovation.

[7] Following Davoine et al (2008) and Munoz de Bustillo et al (2011).
[8] A detailed list of indicators is provided in appendix.
[9] Rather than sources from OECD for instance, that also publishes a large number of innovation and labour market indicators (including job quality indicators, see Cazes *et al*, 2015).

Figure 2: Dimensions of job quality



Source: adapted from IFA QuInnE, QuInnE Working Paper 3.1 (available at quinne.eu)

In terms of methodology, we use Principal Component Analysis (PCA) to analyse correlations between the various indicators and summarize existing information and hierarchical classifications (HAC) to identify country clusters (see box).

Analyses are conducted separately for job quality and innovation, and then we cross the results to study the links between job quality and innovation clusters. To get some overview of the trends since the implementation of the Lisbon Strategy, the results for 2012 are compared with the situation in 2000[10].

Box 1: Principles of PCA and a guide for reading the Figures.
Principal Components Analysis (PCA) is a technique to describe large correlation matrices. The value added of PCA is its ability to "reduce" large datasets to a few factors or principal components. Linear combinations of the principal components should be able to account for a high proportion of the total variation in the original data. A very useful property of PCA is that the principal components are uncorrelated and thus they can be seen as representing different "statistical dimensions" of the original dataset. However, it must be stressed that PCA cannot always reduce a large number of variables to a small number of transformed variables. In fact, a significant saving in reducing the dimensionality of the data set can only

[10] That comparison involves important limitations due to data availability. These limitations are discussed below.

be obtained when the original variables are highly correlated (either positively or negatively). PCA is of no value if the original variables are uncorrelated.
The greater the proportion of the variation in the data explained by the first two axes, the better the graphical representation. The contribution and meaning of the third and following axes is also mentioned when they provide valuable information.
For each PCA, two figures are presented. The first shows the contribution of each variable to the first two axes. The variables are all active. The second figure presents the factor scores for EU Member States on the first two axes. The software used for these PCAs is SPAD.
The first step of the clustering which is called hierarchical ascending clustering method consists in gathering together the most resembled individuals or classes of individuals. The output of this step is a classification tree or dendrogram that is presented in Appendix 3. In a second step, the tree is partitioned in order to get an optimal number of clusters. Several partitions are proposed by the software according to the optimisation criteria (minimization of inter-classes and/or maximisation of intra-classes' variance). Generally, we have chosen an intermediary number of clusters.

3- Taxonomies of innovation and job quality regimes

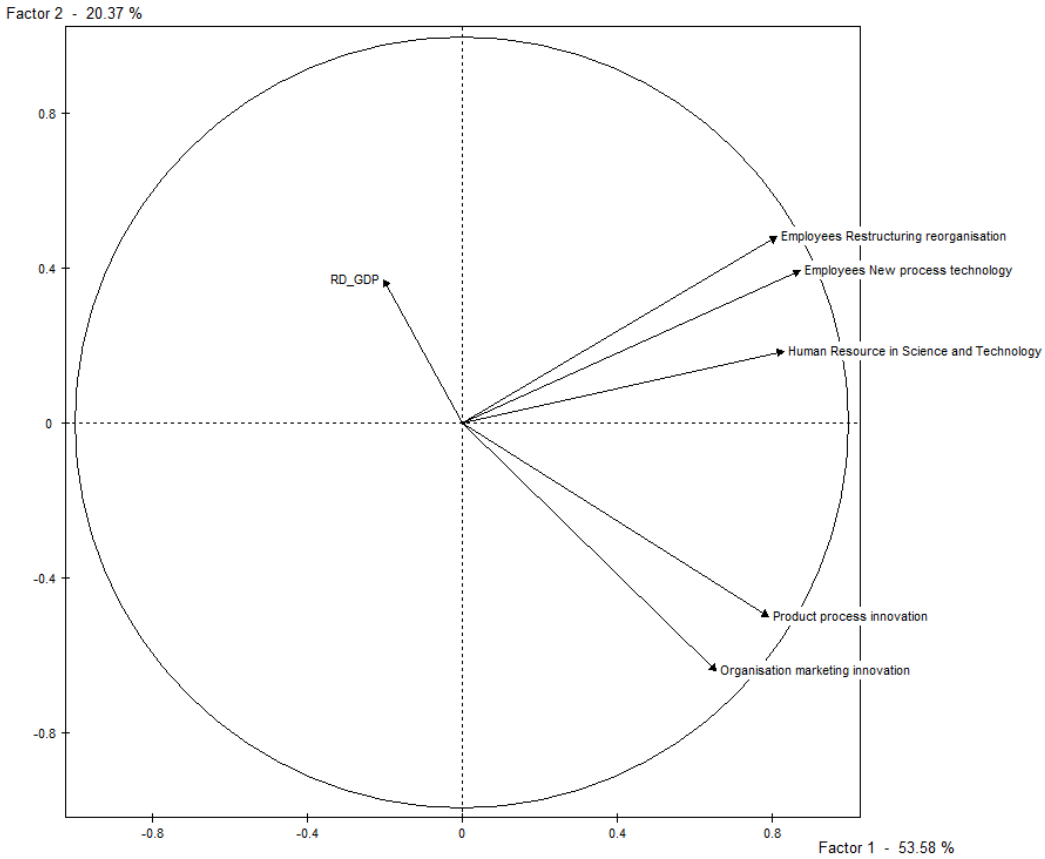
Based on these indicators of innovation and job quality we proceed in three steps. First we identify four clusters of innovation as well as four clusters of job quality in 2012 (and compare with the situation in 2000, at the launching of the Lisbon Strategy). Second we cross these two taxonomies to identify the variety of innovation-job quality relationships across the EU in 2012 and in 2000. Finally, we try to relate these various regimes to employment outcomes.

3.1 Four innovation clusters

Different kinds of variables are used to run a Principal Component Analysis and a Hierarchical Ascending Classification on innovation (see details in the appendicies). All of them are national averages but some are related to workers' expression about technological and organizational innovation (variables from EWCS), some other are measured at the firm level (variables from CIS) and finally some reflect the national dimension of innovation policy (research and development in % of GDP, human resources for science and technology).

The Principal Component Analysis displays positive correlations between different sets of variables on innovation.

Figure 3: Correlation circle for the PCA on innovation (projection on the two first factors space)



Sources: EWCS, CIS, Eurostat. See appendix for details.

There is a strong size effect; namely most of variables are represented on the right hand side of the graph, illustrating a positive correlation between almost all variables of the analysis (except R&D expenditure). In particular, we can observe a strong positive correlation between the percentage of workers declaring "New processes or technologies were introduced" and the percentage of workers declaring "Substantial restructuring or reorganisation was carried out" (corr=0.89). These two variables are well represented on the right-hand side of the first axis. The variable measuring Human Resources in Science and Technology also contributes largely to the first axis. The two variables from CIS (share of firms involved in product and/or process innovation (innoact) and share of firms with organization and/or marketing innovation (orga_or_market)) contribute positively to the first axis but also negatively to the second axis and are both very correlated (corr=0.82).

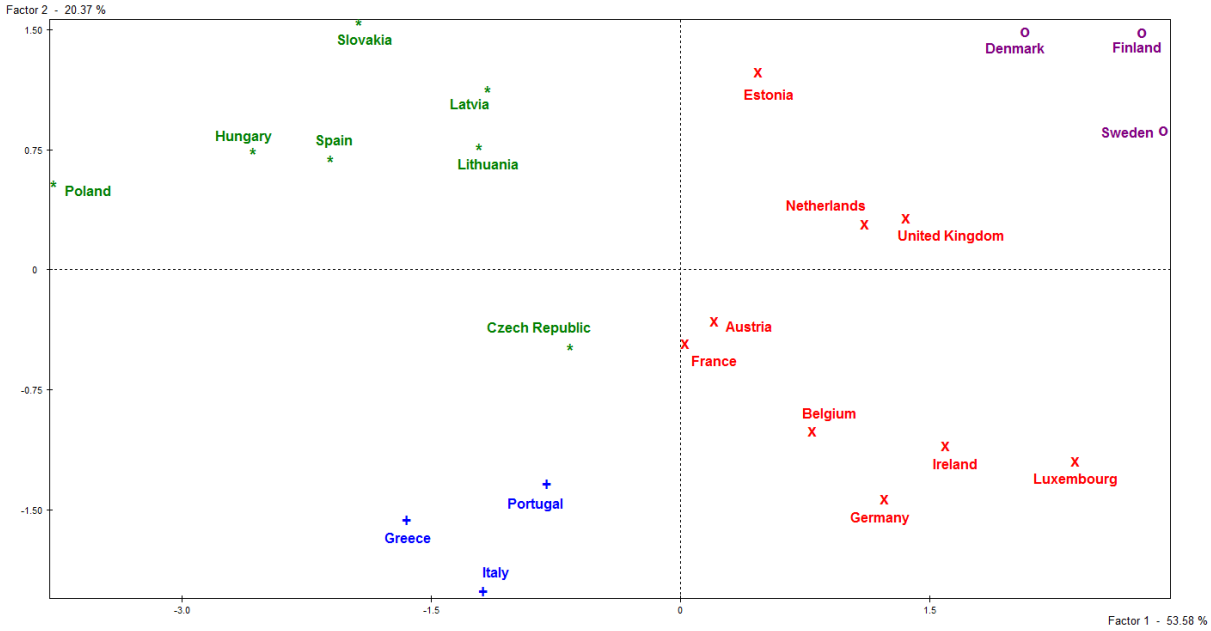
The first axis (factor 1 in figures 3 and 4) is related to both workers' and firms' declarations about innovation, while the second one (factor 2 in figures 3 and 4) is more exclusively related to what is declared at the firm level (CIS variables on its lower part). These two first axes explain about 74% of total variance which is high and makes the visual representation of Figure 3 very reliable. The third axis mainly captures the role of R&D expenditure. We can see that variables measuring technological innovation and those measuring organizational

innovation are strongly correlated. This is true for variables measured at the firm level (CIS variables, represented mainly on the first axis) and for those measured at the employee level (EWCS variables, also represented on the second axis of the PCA).

The only variable that is negatively (but very weakly) correlated to this first axis is the variable of R&D expenditure in % of GDP. This variable indeed defines the third axis of the PCA (not presented here). This variable grasps the effort made at the national level in terms of R&D. Our analysis confirms that this variable should not be used as an exclusive measure of innovation since it is not strongly related to indicators measuring innovations implemented at the firm level or to what workers declare about innovation at their workplaces.

Following this PCA, a Hierarchical Ascending Classification is run in order to distinguish different clusters of countries according to these variables on innovation. In 2012 we identify four clusters of innovation in Europe.

Figure 4: Four innovation regimes in Europe in 2012



Sources: EWCS, CIS, Eurostat. See appendix for details.

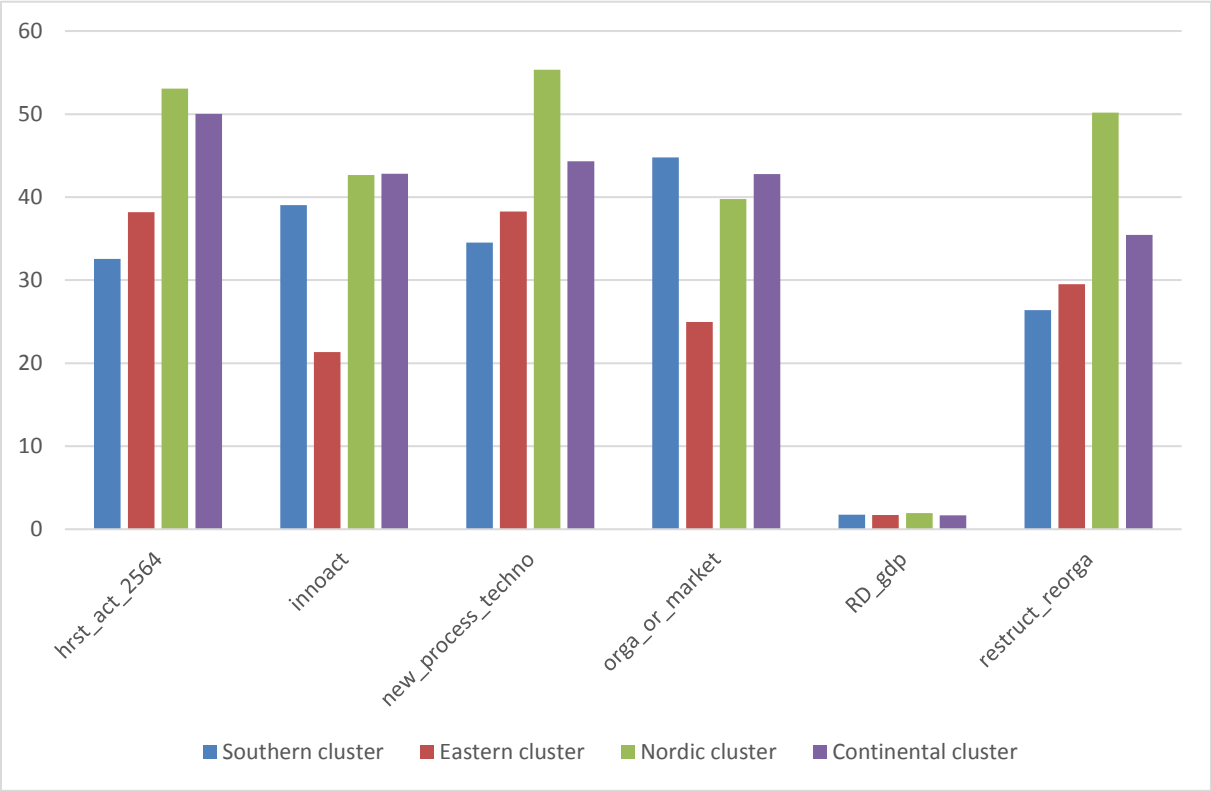
The first one includes the Nordic countries (Denmark, Finland, Sweden) and is on the right hand-side of Figure 4. It is characterized by higher levels than average for both enablers and outputs indicators. This is particularly remarkable for indicators that measure the perceptions of innovation by workers and for the proportion of Human Resources in Science and Technology (see Figure 5).

The second cluster groups countries that also perform better than the EU average (except for R&D expenditure) but with slightly lower levels of innovation than the Nordic cluster on average. This cluster corresponds to continental countries (Austria, Belgium, Germany, France, Luxembourg, the Netherlands), as well as Ireland and the UK. Estonia is the only Eastern European country belonging to this cluster.

The third cluster (Greece, Italy and Portugal) is characterized by rather high levels of organizational and marketing innovation and technological innovation stands close to the EU average (measured by R&D as well as CIS indicators), but the level of human resources in research and technology is low and the perceptions of innovation by workers (as declared in the EWCS) are also quite low.

The fourth cluster (including Eastern and Central European countries and Spain) displays much lower levels of innovation measured at the firm level (from CIS survey) than all other clusters. However, workers' perception of innovation (indicators from EWCS) is slightly higher than in Southern countries.

Figure 5: Innovation performances in 2012, by country clusters



Sources: EWCS, CIS, Eurostat. See appendix for details and variables names.

The results are globally consistent with the IUS (European Commission, 2015), although the composition of country clusters differs slightly. In particular, our first cluster includes all innovation leaders except Germany (which is included in the second cluster), and the second one correspond to the group of innovation followers. Estonia, which is ranked at the top of moderate innovators in the IUS, is also included in that cluster. Our third and fourth clusters include both moderate and modest innovators.

Comparing the situation in 2012 with 2000 is not easy because of changes in some definitions and availability of innovation indicators. However, Nordic, Continental and Anglo-Saxon countries already performed relatively well compared to Southern and Central and Eastern European countries in 2000. Using a more limited set of variables to run a PCA in 2000 brings a taxonomy where Southern countries and Central and Eastern European countries are

mixed in different clusters while Nordic countries do not stand apart in a specific cluster[11]. However, compared to the taxonomy of 2012, these changes seem to be mainly due to the introduction in 2012 of indicators from the European Working Conditions Survey on the perceptions of innovation at the worker level. These indicators stand at lower levels in Southern countries than in Central and Eastern European countries and at lower levels in continental and Anglo-Saxon countries than in Nordic countries. However, one country seems to have improved in terms of innovation over the 2000-2012 decade is Estonia which was part of the group of Central and Eastern European countries but joins the group of continental and Anglo-Saxon countries in 2012. That positive trend in innovation for Estonia is also observed in the IUS innovation index trend from 2007 to 2012[12].

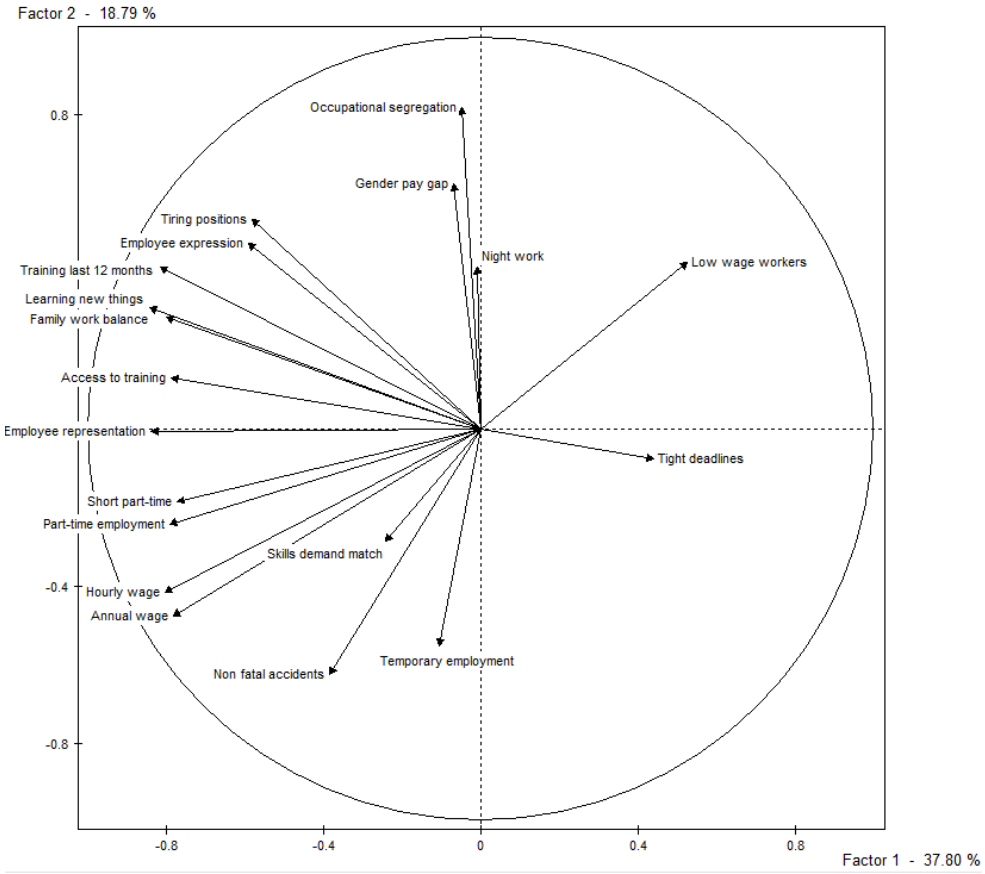
3.2 Four job quality regimes

The two first axes of the PCA on job quality represent 57% of the total variance. The left-hand side of the first axis is mainly defined by variables that indicate good levels on different dimensions of job quality, such as wages (annual and hourly), access to training, collective interest representation and good work-life balance. The proportion of workers on part-time work also contributes to this axis which could be related to good work-life balance. However, the share of workers on short part-time jobs which does not reflect good job quality also contributes to the definition of this axis. On the right-hand side of the first axis are represented the share of workers with tight deadlines as well as the proportion of low wage workers, that are both negative features of job quality. This first axis is mainly characterized by indicators on employment conditions (wages, part-time work, low wage workers), training and collective interest representation.

The second axis is defined on its upper part by high levels of gender pay gap and occupational segregation as well as by relatively poor working conditions (tiring positions, night work). The lower part of the second axis is characterized by the share of accidents at work and the share of temporary contracts. Apart from this last indicator, the second axis rather gathers indicators about two dimensions of job quality: gender equality and working conditions that are less well represented on the first axis.

[11] Average values of indicators per cluster in 2000 are presented in Appendix 2.
[12] But reverses after 2013. See IUS (2015), P13.

Figure 6: Correlation circle for the PCA on job quality (projection on the 2 first factors space)



Sources: EWCS, LFS. See appendix for details.

On the basis of our six dimensions' definition of job quality, four clusters are identified in 2012. The first cluster gathers three Nordic countries (Denmark, Finland and Sweden) and exhibits very good performance: the variables contributing the most to this cluster are training indicators, work family reconciliation and social dialogue indicators, which are higher than average and contribute positively to job quality. Wages also stand at high levels while the share of low wage employment is very limited. However, part-time, short part-time and temporary employment stand slightly above the average and may reduce job quality. Working conditions as well as gender pay gap or occupational segregation tend to be close to the average and are not distinctive for that cluster.

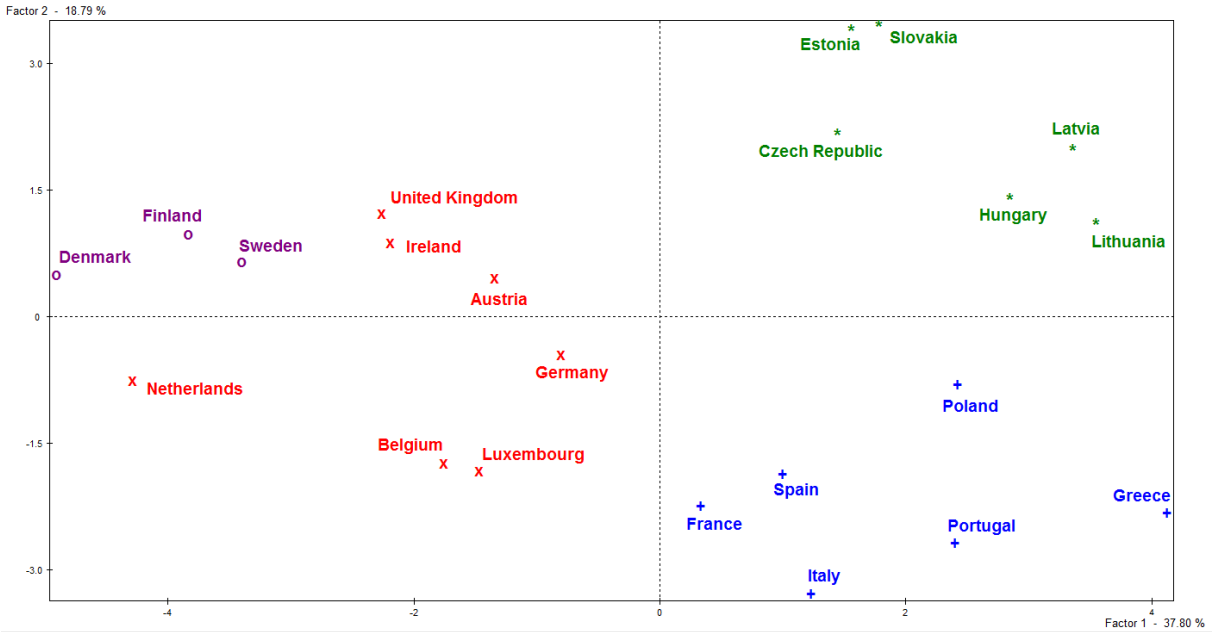
The second cluster includes most continental countries (Germany, Austria, Belgium, Luxembourg, and the Netherlands) as well as the UK and Ireland. It is characterized by the highest wages but also by a relatively high share of low wage employment. Shares of part-time and short part-time work are the highest from all four clusters. These countries perform rather well on training, gender equality, work-life balance and social dialogue indicators, even though a bit less than the first Nordic cluster.

The third cluster is characterized by a low share of atypical contracts (temporary or part-time), low average wages (and a high share of low wages), stronger occupational segregation than

average. Working conditions are generally less favorable than in the other clusters. It is composed of Eastern and Central European countries (with the exception of Poland).

The fourth cluster gathers Southern countries, France and Poland. Its distinctive characteristics are a higher share of temporary contracts than the average, and more limited access to training and limited opportunity to learn new things. Social dialogue indicators stand below the average. Wages are also below the average but low wage work is less prevalent and so are the shares of part-time and short-part time.

Figure 7: Job quality regimes in Europe in 2012



Sources: EWCS, LFS. See appendix for details.

Figure 8a: Wages and employment conditions indicators in 2012, by country clusters

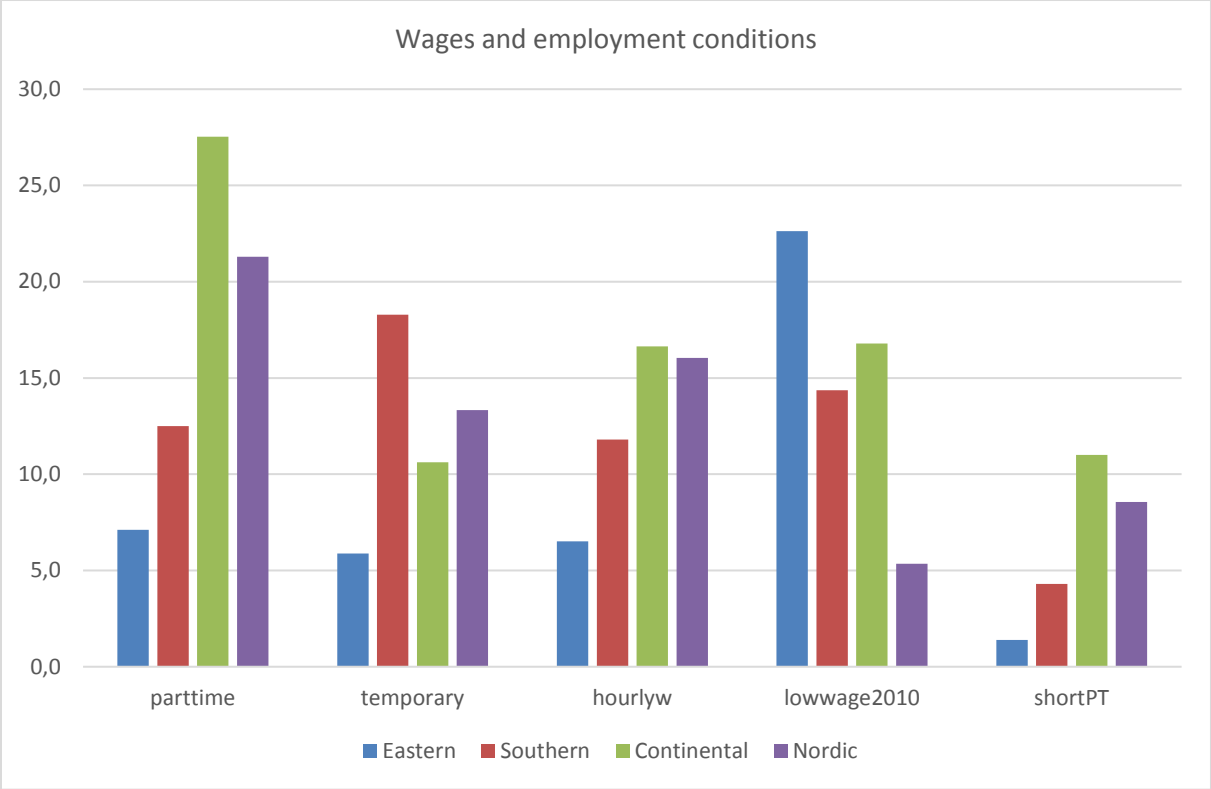
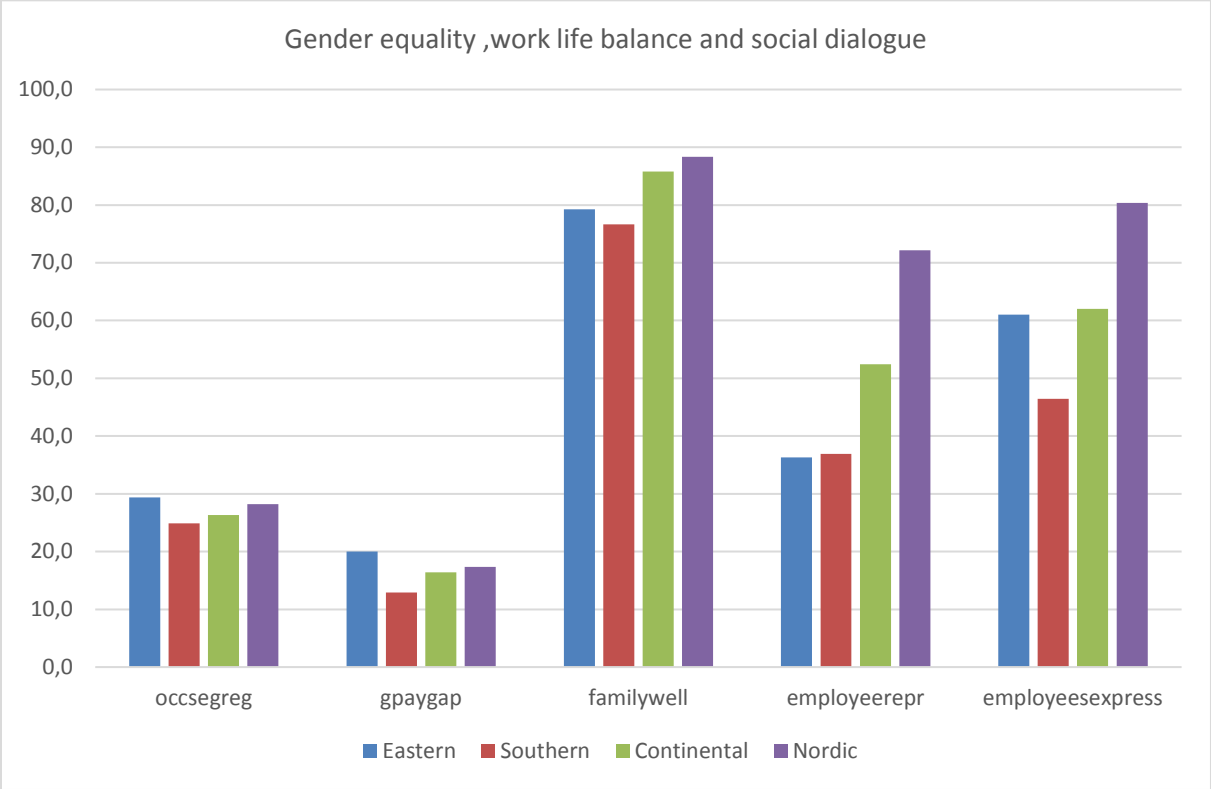


Figure 8b: Training and working conditions indicators in 2012, by country clusters

Figure 8c: Gender equality and collective interest representation indicators in 2012, by country clusters



Sources: EWCS, LFS. See appendix for details and variables' names.

That taxonomy for 2012 remains relatively stable when the indicators are restricted to those which were already available in 2000[13]. Comparing 2000 and 2012, we can observe that Nordic countries stand apart in 2012 while they were together with the UK and the Netherlands in a single cluster in 2000. The position of Central and Eastern countries in 2012 is rather close to that of 2000, even though Poland now stands closer to Southern countries. Southern countries are gathered in a single group, joined by France and Poland. In particular, Italy which was rather close to continental countries in 2000 belongs to the Southern cluster in 2012. The global picture of countries in terms of job quality in 2000 is close to other results obtained for the 2000s (Davoine *et al.*, 2008).

[13] In 2000 the two variables on social dialogue (from EWCS) as well as the indicator on low wage work are not available. Belgium and Luxembourg change position from the continental cluster to the "Southern" cluster (joining France, Poland and Southern countries).

3.3 Job quality and innovation: a joint typology

In this last step of our data analysis, we cross innovation and job quality regimes in order to define a joint typology of EU countries. The results for 2012 and 2000 are presented in the following tables.

Table 1: Crossing JQ clusters and innovation clusters in 2012

		Innovation			
		- -	**-**	**+**	**++**
Job quality	**++**				DK FI SE
	+			AT DE IE NL UK BE LU	
	-	ES PL	EL IT PT	FR	
	- -	CZ LT LV SK HU		EE	

Table 2: Crossing JQ clusters and innovation clusters in 2000

		Innovation			
		- -	**-**	**+**	**++**
Job quality	**++**			DK NL UK	FI SE
	+	IT		AT BE DE FR LU	
	-	EL ES			
	- -	CZ HU LV PL PT SK	EE LT		

According to these tables, innovation and job quality clusters appear generally well correlated, which confirms previous results in the variety of capitalism perspective, and theoretical insights presented in the first section. In particular, the situation of Nordic countries illustrates a regime of complementarity between high job quality and high innovation. At the opposite end, most Eastern and Central European countries display low levels of innovation and job quality. However, some gaps also appear, such as for instance in France or Estonia in 2012: both countries display a rather high innovation effort but only average or low levels of job quality.

4- Innovation and job quality clusters: are there some links with employment outcomes?

The joint typology on innovation and job quality leads to identify seven clusters:

- Nordic countries that are characterized by very high levels of innovation and job quality (Innov ++ JQ ++)
- Most continental countries and Anglo-Saxon countries characterized by rather high levels of innovation and rather high levels of job quality (Innov + JQ +)
- France that is characterized by rather high levels of innovation and a rather low level of job quality (Innov + JQ -)
- Estonia that is characterized by rather high levels of innovation and a very low level of job quality (Innov + JQ - -)
- Most Southern countries that are characterized by both relatively low levels of innovation and job quality (Innov - JQ -)
- Spain and Poland that are characterized by very low levels of innovation and rather low levels of job quality (Innov – JQ -)
- Most Central and Eastern European countries that are characterized by very low levels of innovation and job quality (Innov - - JQ - -).

Considering the Lisbon Strategy as well as Europe 2020, the links between these innovation and job quality regimes with employment performances have to be investigated. Employment rates are explicitly targeted by these two successive policy frameworks, both at the global level and by social groups (as an indicator of labour market inclusiveness). We also introduce information on unemployment rates and on labour productivity.

Our method is descriptive: building on the joint typology, employment performances (employment rate, unemployment rate…) of each group are observed. When considering the different social groups we focus on employment rates that reflect better the labour market integration of each subgroup. Based on the Labour Force Survey we disaggregate employment rates by gender, age, education level and nationality.

The global picture in employment performance (Figures 8 and 9 below) is not straightforward: employment rates are on average higher in clusters that combine very high levels of innovation and job quality or rather high levels of both. Looking at countries where job quality and innovation levels are lower, the picture is more mixed. In particular, Southern countries that perform slightly better than Central and Eastern European countries in terms of job quality and innovation have lower employment rates and higher unemployment rates. This has to be related to the crisis even though Southern countries have always had the lowest employment rates in Europe over the last decades.

Productivity trends are also very diverse across the country clusters and no relationship emerges for 2012 and 2013 (Figure 10 below).

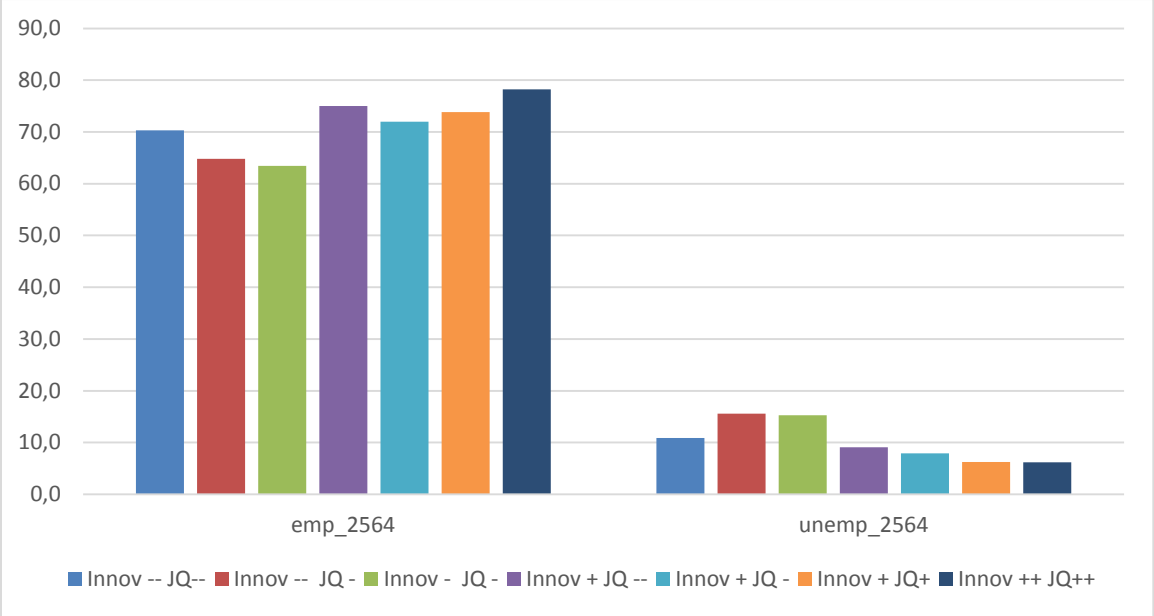
The relationship between job quality and innovation on the one hand and more quantitative employment performance on the other hand is thus not obvious. If we consider all countries

except the Central and Eastern European ones, we can observe a positive relationship between job quality, innovation and employment performance (measured by global employment rate). However, Central and Eastern European countries combine low levels of job quality and innovation but at the same time average levels of employment.

Looking in more detail at employment rates by gender, it appears that the differences across clusters are the same for the whole population. Differences are however more noticeable for women who have very low employment rates in Southern countries while women's employment rate in Central and Eastern countries is close to the EU average. The results by levels of education are quite interesting: it seems that countries that combine high levels of innovation and job quality have higher employment rates of low educated people while those that combine low levels of innovation and job quality have lower employment rates of low educated people. The relationship seems relatively linear when we look at Figure 9. This would mean that countries that combine high levels of job quality and innovation (Nordic countries in particular) also have the more inclusive labour markets while in countries where both innovation and job quality stand at low levels, low-educated people are less integrated on the labour market (CEEC).

The two groups that combine either high or very high levels of both innovation and job quality also seem to have more inclusive labour markets for young people and senior workers.

Figure 9: Employment rates and unemployment rates by country cluster in 2012



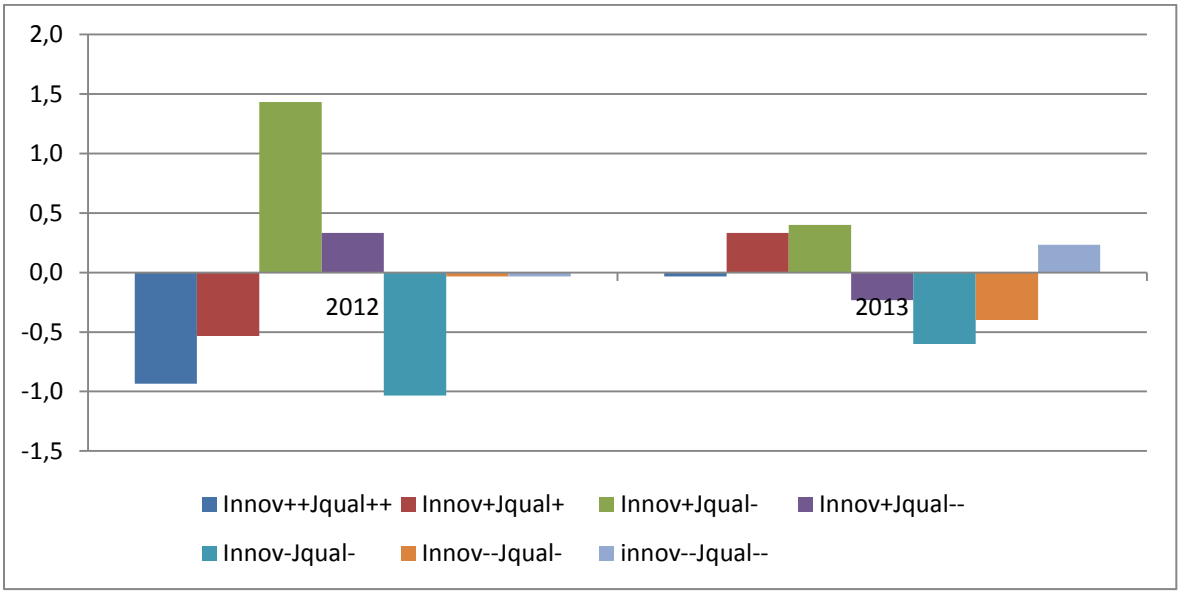
Source: LFS

Table 3: Employment rates by social groups (education, gender, age and nationality)

	Innov -- JQ--	Innov -- JQ -	Innov - JQ -	Innov + JQ --	Innov + JQ -	Innov + JQ+	Innov ++ JQ++
Low educated	39,4	44,6	54,0	50,3	55,7	55,2	60,7
Medium educated	69,6	65,9	68,1	74,4	73,6	74,7	79,1
High educated	83,5	81,1	77,4	82,3	84,4	85,1	86,5
Women	65,3	58,5	55,3	72,2	67,5	67,8	75,6
Men	75,4	71,2	71,9	78,0	76,7	79,9	80,8
15-24	22,8	21,6	18,2	32,3	28,6	40,4	45,7
25-54	77,7	72,0	69,9	79,5	80,9	80,5	83,0
55-64	46,6	41,3	41,1	60,5	44,5	49,8	64,0
EU15-foreigners	91,0	75,2	59,9	-	70,1	74,4	76,1
Non-EU foreigners	68,3	60,6	62,6	65,6	50,6	62,2	57,8
Nationals	70,8	65,3	63,4	77,0	73,2	74,3	79,3

Source: LFS

Figure 10: Productivity growth (annual growth rate, average by country group), 2012 and 2013



Source: Eurostat, National accounts

Conclusion

Relying on an institutionalist perspective, this working paper brings some new empirical evidence of the diversity of innovation and job quality regimes in Europe and of their correlations. Our typology crossing job quality and innovation regimes shows a general positive correlation between innovation and job quality performance, but the variety of existing relationships is higher and job quality cannot be directly inferred from innovation, suggesting that job quality should be a specific target for national policies (independent of innovation efforts). The links with employment performances are not straightforward, putting the hypothesis of a virtuous circle of innovation and "more and better jobs" in question. In 2012 the Northern countries are the only ones combining high innovation, good quality of jobs and labour market inclusiveness, thus exemplifying the virtuous circle. In comparison with 2000, the global situation of European countries has not improved, and several countries display a lower relative situation either in terms of innovation (UK, NL) or in terms of job quality (FR).

However, the aggregate perspective adopted in this paper makes it impossible to disentangle between different factors explaining national performance, and to establish any causal link between innovation and job quality or employment levels. Such questions will be answered in QuInnE's future work through econometric analyses based on firm level data, as well as case studies.

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Appendix 1: List of indicators used in PCAs and classifications

List of indicators used in the PCA and classification on job quality (section 3)

Wages

- Mean hourly earnings, Structure of earnings survey, 2010 [hourlyw]
- Mean annual earnings, Structure of earnings survey, 2010 [annualw]
- Low-wage earners as a proportion of all employees (excluding apprentices), Structure of Earnings Survey, firms of 10 employees or more, 2010 [lowwage]

Employment quality

- Part-time employment as percentage of the total employment (%),15years+, Labour Force Survey, 2012 [parttime]
- Short part-time employment (usual weekly hours worked=0-19 hours) as percentage of the total dependent employment (%), 15years+, OECD data, 2012 [shortPT]
- Temporary employees as percentage of the total number of employees (%), 15-64 years old, Labour Force Survey, 2012 [temporary]

Education and training

- Participation rate in education and training (last 4 weeks), 25-64 years old [training]
- Percentage of workers declaring training over the last 12 months (paid for or provided by the employer or by themselves if self-employed), European Working Conditions Survey, 2010 [training12mths]
- Percentage of workers declaring that skills and demands match, European Working Conditions Survey, 2010 [demandmatch]
- Percentage of workers declaring that their main paid job involves learning new things, European Working Conditions Survey, 2010 [learningthings]

Working conditions

- Employed persons working at nights (usually or sometimes) as a percentage of the total employment (%), 15-64 years old, Labour Force Survey, 2012 [nightw]
- Non-fatal accidents at work (involving 4 days absence or more) (standardised incidence rates per 100 000 persons employed), European Statistics on Accidents at Work, Eurostat website, 2012 [nonfatalacc]
- Percentage of workers declaring tiring or painful positions, European Working Conditions Survey, 2010 [tiringpos]
- Percentage of workers declaring that their job involves working to tight deadlines, European Working Conditions Survey, 2010 [tightdeadlines]

Work-life balance and gender equality

- Gender segregation in occupations, Labour Force Survey, 2013 (from the report on equality between men and women, 2014) [occsegreg]
- Gender pay gap in unadjusted form in %, Structure of Earnings Survey, 2012 (except 2010 for Greece) [gpaygap]
- Percentage of workers declaring that their working hours fit in with their family or social commitments outside work very well or well, European Working Conditions Survey, 2010 [familywell]

Collective interest representation

- Percentage of workers declaring that there is an employee acting as an employee representative at their workplace, European Working Conditions Survey, 2010 [employeerepr]
- Percentage of workers declaring that, at their workplace, management hold meetings in which they can express their views about what is happening in the organization, European Working Conditions Survey, 2010 [employeesexpress]

List of indicators used in the PCA and classification on innovation (section 3):

- Share of enterprises from "Innovation core activities (Com.Reg. 995/2012)" with product and/or process innovation, regardless of organizational or marketing innovation (including enterprises with abandoned/ suspended or ongoing innovation activities) in % of total firms from these sectors, Eurostat CIS 2012 [innoact]
- Share of enterprises from "Innovation core activities (Com.Reg. 995/2012)" with organisation and / or marketing innovative enterprises, regardless of product or process innovation, in % of total firms from these sectors, Eurostat CIS 2012 [orga_or_market]
- Persons with tertiary education (ISCED) and/ or employed in science and technology (Human Resource in Science and Technology). Aged 25 to 64. % active population, Eurostat, 2012 [HRST_act_2564]
- Expenditure for R&D, total, in % GDP, Eurostat, 2012 [RD_GDP]
- Percentage of workers declaring "New processes or technologies were introduced", EWCS, 2010 [newprocesstechno]
- Percentage of workers declaring "Substantial restructuring or reorganisation was carried out", EWCS, 2010 [restructreorga]

Appendix 2: Average indicators per cluster in 2000

Innovation clusters	CZ, EL, ES, HU, IT, LV, PL, PT, SK	FI, SE	EE, LT	AT, BE, DE, DK, FR, LU, NL, UK
innoact	0,28	0,46	0,32	0,47
sme_productprocess	0,24	0,41	0,26	0,41
RD_gdp	0,84	3,69	0,59	1,95
HRSCT_pop	21,83	41,15	39,25	32,05

Job quality clusters	EL, ES	CZ, EE, HU, LT, LV, PL, PT, SK	AT, BE, DE, FR, IE, IT ,LU	DK, FI, NL, SE, UK
Accidents	98,00	88,88	96,43	100,00
Occupational segregation	22,80	28,65	26,01	27,68
Part time	6,20	6,71	15,67	24,10
Short part time	2,36	1,53	5,91	10,48
Temporary employment	23,10	6,99	9,14	12,52
Gender pay gap	15,00	18,25	15,29	18,40
Training last 4 weeks	2,75	5,18	5,37	18,90
Night work	13,20	17,70	16,11	15,94

Job quality clusters	EL, ES	CZ, EE, HU, LT, LV, PL, PT, SK	AT, BE, DE, FR, IE, IT, LU	DK, FI, NL, SE, UK
Annual wage	19974,11	6426,87	32223,55	35320,63
Hourly wage	7,90	2,67	14,34	16,26
Tiring positions	0,54	0,69	0,70	0,75
working hours fit family	64,86	78,52	83,25	85,29
Tight deadlines	0,63	0,65	0,58	0,53
Learning new things	56,69	64,19	72,01	82,89
Skills and demand match	84,87	90,38	83,96	86,99
Training over 12 months	15,03	28,06	28,80	47,79

Appendix 3: complementary results from PCA and HAC on innovation and job quality

Figure A1: Dendrogram from the Hierarchical Ascending Classification on innovation in 2012

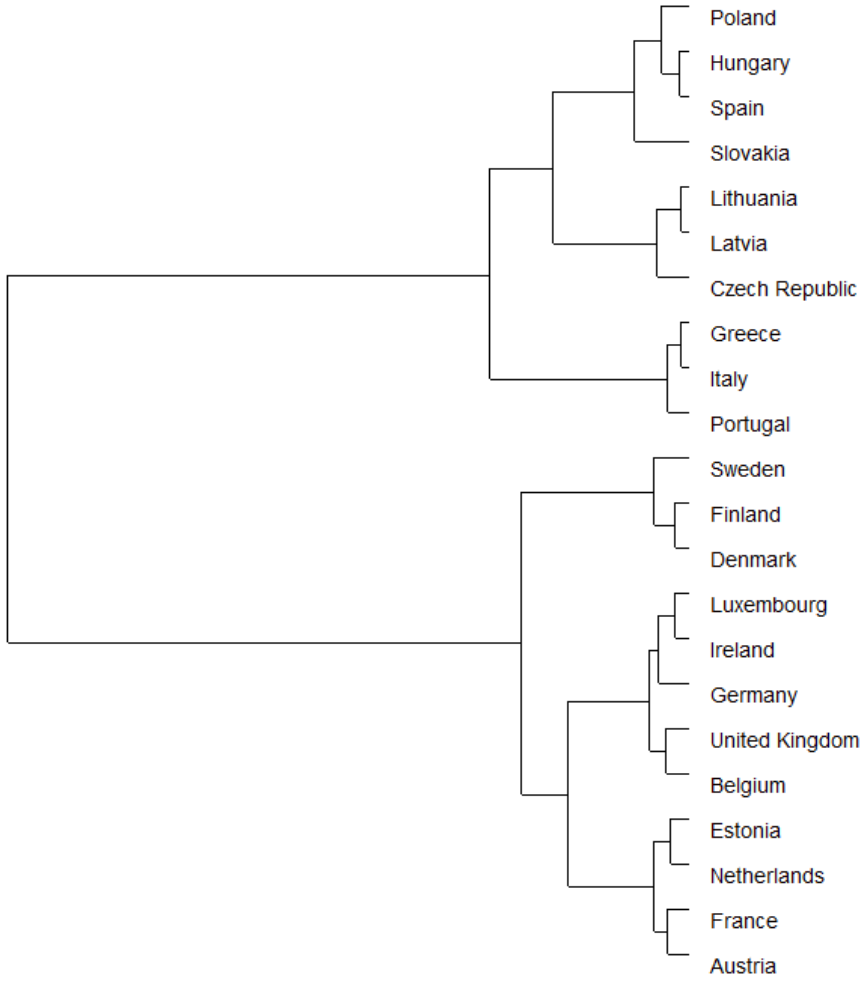
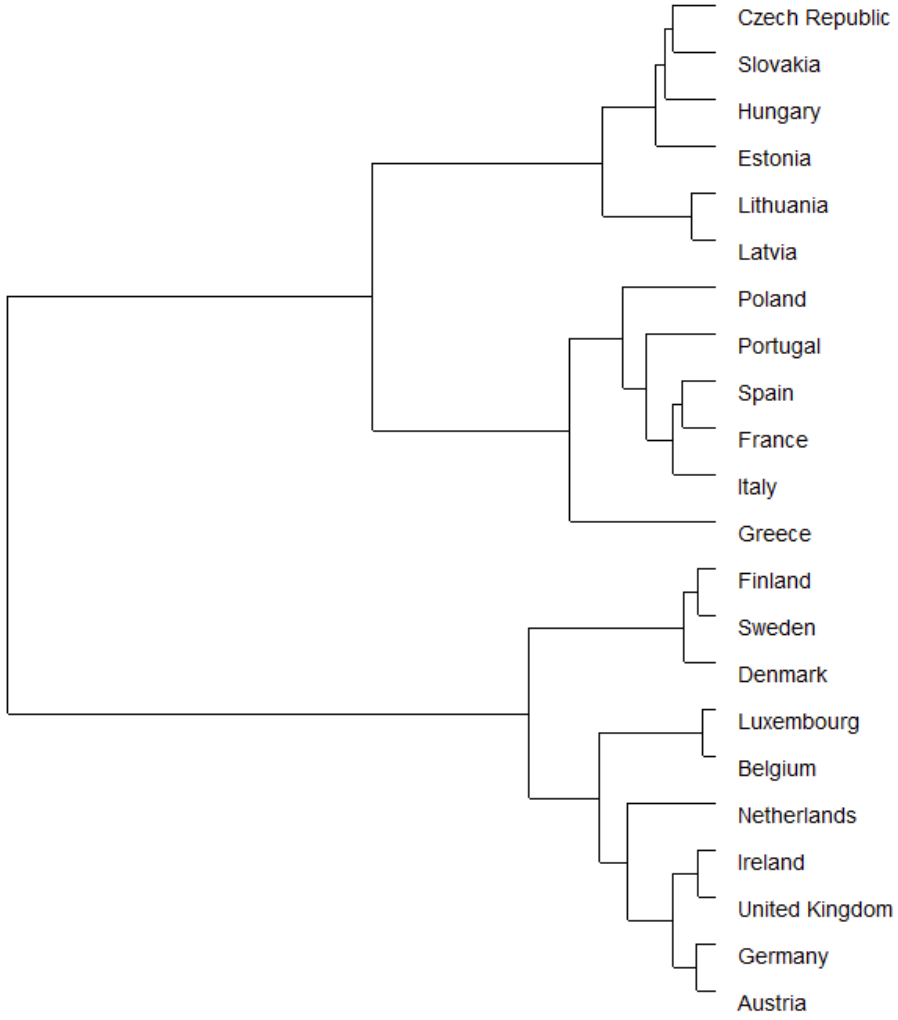


Figure A2: Dendrogram from the Hierarchical Ascending Classification on job quality in 2012



Appendix 4: The distribution of a job quality (three indicators) and innovation across countries (in 2012)

		share of innovative Firms	
		<=median	>median
Gender Pay Gap	<=median	BG, EU, HR, HU, IS, LT, MT, NO, PL, RO, SI	BE, DK, EL, FR, LU, SE, TR
	>median	CH, CY, CZ, ES, LV, SK, UK	DE, EE, FI, IE, IT, NL, PT

		share of innovative Firms	
		<=median	>median
Temporary work	<=median	BG, CY, C, HU, LT, LV, MT, NO, RO, SK, UK	AT, BE, DK, EE, EL, IE, LU,
	>median	CH, EA, ES, EU, HR, IS, MK, PL, SI,	DE, FI, FR, IT, NL, PT, SE, TR

		share of innovative Firms	
		<=median	>median
Part time work	<=median	BG, CY, CZ, ES, HR, HU, LT, LV, MK, MT, PL, RO, SI, SK,	EE, EL, PT, TR
	>median	CH, EA, EU, IS, NO, UK	AT, BE, DE, DK, FI, FR, IE, IT, LU, NL, SE,

Source: CIS, LFS