



**Quality of jobs and
innovation generated
employment outcomes**

Quinne.eu

INNOVATION REGIME AND VULNERABLE WORKERS' LABOUR MARKET INCLUSION AND JOB QUALITY

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QuInnE - *Quality of jobs and Innovation generated Employment outcomes* -is an interdisciplinary project investigating how job quality and innovation mutually impact each other, and the effects this has on job creation and the quality of these job.

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Quinne project brings together a multidisciplinary team of experts from nine partner institutions across seven European countries.

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Executive summary

A key aim of the European Commission's *Europe 2020* strategy is to stimulate the growth of high-innovation, high-job quality firms that create *more and better jobs*, and which in turn help tackle social inclusion and inequalities. The Quality of Jobs and Innovation Generated Employment Outcomes (QuInnE) is an interdisciplinary project that investigates how job quality and innovation interact to mutual benefit, and how this interaction might affect employment outcomes. QuInnE uses a mixed methods research design, with three main strands of research. The first strand involves policy analysis at both EU and country levels. The second strand involves quantitative analysis undertaken at both the aggregate (EU-level by country and industry) and firm-level. The third strand involves comparative case study research to probe firm-level behaviour in order to explain and understand the generative mechanisms underpinning the innovation-job quality- employment nexus.

A number of vulnerable groups have been identified by the European Commission as having relatively low rates of employment participation that need to be raised: female, young, old, migrant and low-skilled workers. This Working Paper examines the relationship between innovation regimes and social inclusion and job quality for these vulnerable workers. Unfortunately, there is currently no linked dataset that would enable direct analysis between innovation regime and the social inclusion and job quality of vulnerable workers. As a consequence, the Working Paper applies data from the European Social Survey (ESS) and the European Working Conditions survey (EWCS) to the innovation regimes typology developed for QuInnE by Erhel and Guergoat-Larivière (2016). The findings challenge the 'virtuous circle' hypothesis that innovation and inclusiveness are mutually reinforcing (EC 2010a), and that more better jobs will be created as a result – at least with respect to vulnerable workers. The analysis compares outcomes in terms of employment participation rates and job quality for vulnerable and non-vulnerable groups in the labour market by innovation cluster. For labour market inclusion, we look at the percentage of the working age population who are employed or unemployed in the clusters of countries identified by Erhel and Guergoat-Larivière to have different level of innovation. For job quality we look at the six measures adopted by QuInnE following Davoine et al (2008) and Muñoz de Bustillo et al (2011): wage satisfaction¹; job security; perceived health and safety at work; education and training; employee voice and representation; and work-life balance. To investigate inequality amongst vulnerable and non-vulnerable groups we compare the outcomes of women with those of men, the outcomes of young and older workers with those of prime-age workers, the outcomes of migrant workers with those of native born workers, and the outcomes of low-skilled workers with those of middle- and high-skilled workers. The aim is to assess if inequality – as measured by employment

¹ Wage satisfaction was used rather than absolute wages in order to overcome differences in relative wages between countries.

participation rates and job quality – is lessened within the high innovation country cluster for vulnerable workers.

While innovation regimes have beneficial outcomes on some measures for some vulnerable workers, the analysis finds that those outcomes are not comprehensive across all vulnerable workers. These findings reveal that that innovation regime can have quite different outcomes for different groups of vulnerable workers.

The key research findings are summarised in the tables below, present the level of inequality in outcomes for vulnerable workers in the high innovation cluster compared to their counterparts.

Table 1: High innovation cluster and inequality in workers' employment participation

Type of worker	Employment participation
Young	About the same
Older	Lower inequality
Female	Lower inequality
Migrant	Lower inequality
Low-skilled	Higher inequality

Table 2: High innovation cluster and inequality in vulnerable workers' job quality

Type of worker	Job quality measure					
	<i>Wages</i>	<i>Job security</i>	<i>Health & safety</i>	<i>Education & training</i>	<i>Voice & rep.</i>	<i>Work-life balance</i>
Young	Lower inequality*	About the same	Lower inequality	Lower inequality	Higher inequality	Lower inequality
Older	About the same	Lower inequality*	Lower inequality	Lower inequality*	About the same	About the same
Female	Higher inequality	About the same	Lower inequality	About the same	About the same	Higher inequality
Migrant	Lower inequality	Lower inequality	About the same	Higher inequality	Lower inequality	About the same
Low-skilled	Lower inequality	Lower inequality	Lower inequality	About the same	Lower inequality	Higher inequality

The findings show that reduced inequality, as measured by higher employment participation and better job quality, is not comprehensive for vulnerable workers within a high innovation regime. Indeed there is no clear evidence that high innovation can be expected to inevitably reduce inequality for these workers.

Notwithstanding the data availability problems analysing the outcomes for vulnerable workers by innovation cluster, these findings suggest that reductions in inequality cannot simply be inferred from innovation. It is possible that as innovation increases the possibilities for improvements in job quality, the scope for inequality between the least and most vulnerable increases on some measures. One

possibility is that other factors – particularly institutional – may need to be explored for their role in shaping outcomes for vulnerable workers, though such analysis is beyond the scope of the Working Paper.

The findings suggest that if reducing social inclusion is to be a major goal in EU Member States, economic strategy and innovation policy need to include specific measures to ensure that the potential productivity and job quality benefits of innovation are shared equitably.

1 Introduction

A key aim of the European Commission's *Europe 2020* strategy is to stimulate growth of high-innovation, high-job quality firms that create more and better jobs, and which in turn tackle social inclusion and inequalities (EC, 2010a). The Quality of Jobs and Innovation Generated Employment Outcomes (QuInnE) is an interdisciplinary project that investigates how job quality and innovation interact to mutual benefit, and how this interaction might affect employment outcomes. QuInnE uses a mixed methods research design, with three main strands of research. The first strand involves policy analysis at both EU and country levels. The second strand involves quantitative analysis undertaken at both the aggregate (EU-level by country and industry) and firm-level. The third strand involves comparative case study research to probe firm-level behaviour in order to explain and understand the generative mechanisms underpinning the innovation-job quality- employment nexus.

This Working Paper is part of the second strand. It examines the relationship between innovation regimes and social inclusion and job quality for different types of vulnerable workers in the labour market. A number of vulnerable groups have been identified by the European Commission as having relatively low rates of employment participation: young, old, female, migrant and low-skilled workers. The Commission would like to see the employment participation rates raised for these vulnerable workers (EC, 2010a, 2010b). Unfortunately, there is currently no linked dataset that would enable direct analysis between innovation regime and the social inclusion and job quality of vulnerable workers. Inter-linked examination does not exist for this purpose. As a consequence, this Working Paper applies data from the European Social Survey (ESS) and the European Working Conditions survey (EWCS) to the innovation regimes typology developed for QuInnE by Erhel and Guergoat-Larivière (2016). This bivariate analysis limits the study to exploring association between innovation and social inclusion and job quality for vulnerable workers rather than any causality.

The Commission's premise that there is a positive link between innovation and the creation of more and better jobs that lead to 'smart, sustainable and *inclusive* growth' (EC, 2011: 8 – emphasis added) is echoed by Member States. For example, the UK government's industrial strategy rests on innovation as driving growth and productivity gains, which in turn boosts employment levels, earnings, living standards, funding for public services (through increased tax take), improved quality of life and a

‘stronger and fairer economy’ (BEIS, 2017: 4). This belief appears to be influenced by the historical gains in productivity and job quality seen in the mid- to late-twentieth century on the one hand, and recent research that has attempted to predict the outcomes of current technological innovations on the future work on the other (e.g. Bakhshi et al., 2017).

However, it is not clear that innovation alone can deliver these gains and produce greater fairness and inclusiveness. A more critical view sees innovation as potentially leading to increased inequality, in terms of wages and other aspects of job quality, particularly where innovation is seen as essentially replacing labour. Other QuInnE research shows that while innovation can lead to improvements in some aspects of job quality, such as intrinsic work, it has a weaker impact on other measures such as work-life balance, health and safety in the workplace and wages, although the latter finding is confounded by national differences in pay (Muñoz de Bustillo et al., 2016). Similarly for QuInnE, Erhel and Guergoat-Larivière (2016) show that while there is a positive correlation between innovation regime and job quality regime in terms of job quality and innovation performance, there is some variability, and job quality cannot be directly inferred from innovation. For example, using the most recent data covered by the research, the ‘Nordic cluster’ of countries were the only ones to enjoy high levels of both innovation and job quality, while some countries had declined in terms of innovation (the UK and the Netherlands) or in terms of job quality (e.g. France). Both of these studies suggest that job quality needs to be a specific policy target and not just assumed to be an axiomatic outcome of innovation.

Given these caveats, it is reasonable to ask whether innovation does deliver social inclusion and enhanced job quality for vulnerable workers, especially as job quality as a function of innovation tends to be lower for some types of workers anyway (Muñoz de Bustillo et al., 2016). Moreover, as the following section highlights, there a number of existing theories that suggest a polarising effect on employment from technological change. In answering this question, the Working Paper compares the performance of different vulnerable groups under different innovation regimes in terms of labour market participation and job quality. The aim is to assess if inequality – as measured by employment participation rates and job quality – is lessened within the high innovation country cluster.

The next section of the Working Paper highlights the importance of inclusiveness in EU policy. Similarly as context, the following section then outlines some of the key and current theories about the impact of innovation and technological change on work and employment, as well as its labour market effects. The next section then outlines the methods and data used for this research, followed by the findings section, which is divided into two sub-sections, the first focused on the employment participation rates and the second on the job quality of vulnerable workers. A discussion section summarises the main findings, showing winners and losers amongst the vulnerable groups despite innovation cluster. The Paper concludes that, contrary to European Commission (2010a) expectations, a virtuous circle in which innovation and inclusiveness are mutually reinforcing is not evidenced, with

that neither higher employment participation nor better jobs being comprehensively created for vulnerable workers, even in high innovation cluster countries.

2 Social inclusion and labour market inequalities in European policy

The *Europe 2020* strategy aims to create ‘smart, sustainable, inclusive growth’ (EC, 2010a). Being ‘smart’ refers to a focus on knowledge and innovation, ‘sustainable’ refers to a greener and more resource efficient economy and ‘inclusive’ refers to high employment, and social and territorial cohesion. The three priorities of being smart, sustainable and inclusive are seen as ‘mutually reinforcing’ (p.10). Thus, with respect to the focus of this Working Paper, not only is innovation expected to positively impact social inclusion, social inclusion, with the creation of more better jobs, is also expected to positively impact innovation, thereby creating a virtuous circle.

This policy position moves away from regarding equality and efficiency as a trade-off (EC, 2014) and is informed by a changing view of the relationship between social and economic goals in economic thought. For example, for Stiglitz (2012), social inequality is not only socially divisive but economically disruptive: it undermines social cohesion and trust, and leads to wasted human capital. This view is set against earlier economic theories that saw the pursuit of equality as deleterious to the pursuit of economic efficiency (e.g. Okun, 1975). This change in approach appears to be justified, as recent research has failed to support the idea of a trade-off between social goals and economic goals, instead suggesting that greater equality may in fact help promote and sustain economic growth (e.g. Berg et al. 2011; Berg and Ostry 2011).

To support its strategy for growth the Commission has set out five headline targets supported by seven flagship initiatives in which reducing inequality and social exclusion featuring prominently. The five headline targets cover the areas of employment, innovation, education, poverty reduction, and climate/energy. The three most directly related to social inclusion and inequality are: to lift at least 20 million Europeans out of poverty or social exclusion by 2020; to increase the employment rate of 20 to 64 year olds rate from 69 to 75 per cent (including women, older workers and migrants); and to improve educational attainment by reducing early school leaving and increasing the proportion of 30 to 34 year olds with tertiary education from 31 to 40 per cent (EC, 2010a). The seven flagship initiatives intended to support these goals are: Innovation Union; A digital agenda for Europe; Resource efficient Europe; An industrial policy for the globalisation era; Youth on the move; An agenda for new skills and jobs; and European platform against poverty (EC, 2010a). The latter four of these initiatives have particular relevance for tackling social exclusion and inequality.

The flagship initiatives are complemented by the Commission’s social investment packages, the European Social Fund and the European Pillar of Social Rights, all of which have strands aimed at

increasing social inclusion and reducing inequality. The Pillar is supported by a scoreboard of social indicators that can be used to monitor the progress of member states against the overall goals of the strategy, including measures related to: equal opportunities and access to the labour market, dynamic labour markets and fair working conditions, and public support/social protection and inclusion.² In EU policy, social exclusion arises from discrimination, and the most effective way of dealing with this discrimination and create social inclusion is by providing people with employment that provides independence, financial security and a sense of belonging.³

Within this policy, certain groups of people s are seen as being particularly vulnerable, and the *Europe 2020* the strategy expresses concern that these groups have a weaker attachment to work and could lose ground in the labour market. Female, older and young workers (the last group that most affected by the recession that followed the Global Financial Crisis) are seen as particularly at risk (EC, 2010a). In addition, 80 million people in Europe have low or basic skills, and with the demand for low-skills expected to drop by 12 million jobs, this group is also regarded as vulnerable to social exclusion. Within the ‘A New Agenda for Skills’ flagship initiative the groups cited as ‘vulnerable’ are again low skilled, young and older workers, along with the unemployed, the disabled, people with mental health difficulties, and migrants (EC, 2010b). In this context, vulnerability is largely defined on the basis of the ability of these groups gain and maintain employment.

For data availability reasons it is not possible for this Working Paper to investigate the link between innovation and the employment participation rates and job quality of all of the groups cited as vulnerable. As a consequence, the research focuses on the four groups outlined in the *Europe 2020* strategy – female, young, older and low-skilled workers plus, from the A New Agenda for Skills initiative, migrant workers. The following section offers an outline of some of the key and current theories about the impact of innovation and technological change on work and employment, and their labour market effects generally, as well as their implications for these vulnerable groups.

3 Technological innovation and its impact on employment, the labour market and vulnerable workers

Since the first industrial revolution, innovation, cast as technological change, has affected employment levels and job quality through a sharing of productivity gains between capital and labour (Muñoz de Bustillo et al., 2016). Muñoz de Bustillo et al., however, note that the way in which technological innovations effect job quality depends on the nature of the innovation and, assuming that the innovation leads to efficiency gains, the sorts of jobs replaced or created as a consequence. Thus, depending upon

² <http://ec.europa.eu/eurostat/web/european-pillar-of-social-rights/indicators>

³ <http://ec.europa.eu/esf/main.jsp?catId=50&langId=en>

what sorts of jobs are replaced or created, innovation in the broad sense, and technological innovation in particular, may or may not lead to better socio-economic equality and job quality outcomes in the long run. Indeed, there continues to be debate about the impact of innovation and technological change on employment and job quality, as the theories in the next section exemplify.

3.1 Skill Biased and Routine Biased Technological Change

The consequences of technological innovation for employment and the nature of jobs, particularly in the last half of the twentieth century and since the adoption of ICT in the 1980s is the subject debate. Two particular theories have attempted to directly explain the mechanisms by which technological innovation can lead to changes in employment and the occupational structure: Skill Biased Technological Change (SBTC) and Routine Biased Technological Change (RBTC). Both theories centre of skill outcomes and have become influential amongst academics and policymakers.

The theory of SBTC argues that technological change tends to increase demand for, and thus favours, skilled as opposed to unskilled labour (Levy and Murnane, 1992, 2013; Violante, 2008). In this view technological innovations are seen as replacing lower-skilled jobs on the one hand, while creating high-skilled occupations on the other. This development leads to a greater demand for higher-level skills and reduced demand for low-skilled labour. Consequently, low-skilled workers must up-skill in order to compete for more highly-skilled jobs or face increased competition and declining wages for the low-skilled jobs that remain. By contrast, the theory of RBTC argues that, rather than shifting demand from unskilled to skilled labour, technological change in production processes as well as expanded opportunity to offshore labour enabled by technology, leads instead to job polarisation, with decreased demand for workers with intermediate skills and relative increases in low and high-skilled occupations (Goos and Manning, 2007; Goos, Manning and Salamons, 2009, 2014; Acemoglu and Autor, 2010).

In both theories, the resultant structural change is thought to lead to wage inequality between low and high-skilled workers because the supply of high-skilled workers is limited by opportunities to attain the requisite skills and qualifications, whereas there are no such barriers for the supply of workers for low-skilled jobs and, in the case of RBTC, many intermediate-skilled workers move into low-skilled rather than high-skilled jobs. As a consequence, the wages of high-skilled workers tend to increase relative to low-skilled workers. Clearly, in both views, the resultant change to the occupational structure has significant implications for inequality based on skills levels. The implications for other vulnerable groups, though, are less clear. For young workers, these changes are likely to increase the imperative to remain in education for as long as possible to attain the required levels of education and skills, with obvious implications for young people for less-privileged backgrounds, while at the same time older workers may be less able to, or less inclined, to re-skill. Similarly, for all but the most highly-skilled migrants, the lack of social capital and deficits in cultural capital may put them at a disadvantage in the labour market. The implications for women, on the other hand, are less clear and are likely to depend very much on skills level and the particular industries and occupations affected. For example, a

significant proportion of women work in occupations in the public sector and service industries that are harder to replace. However, at the same time many women work in low-skilled service occupations that may be significantly affected by technological innovations that can have significant implications for working time arrangements and job quality (discussed later), with both positive and negative consequences.

3.2 Broader theories and research on technological change and employment

Debate about the impact of technological change on employment has, however, infused a broader range of research that both precedes and has come subsequent to these two influential theories. This research also adds important insights beyond skill outcomes, though again, whilst recognising that technological change can lead to productivity gains and growth, the impact on the labour market prospects of some workers has not always been positive.

In the 1980s, theories argued that rapid changes in demand due to technological change and increased global competition meant that employers needed to adjust their workforce through various forms of flexibility, such as numerical, functional and financial flexibility, and ‘distancing’ or offshoring (Atkinson, 1984; Atkinson and Meager, 1986). While these changes would lead to greater security and conditions for a ‘core’ workforce within organisations, a ‘peripheral’ workforce would be created with inferior work and employment, with obvious consequences for vulnerable workers, particularly the low skilled. By the 1990s, Castells (1996) was arguing more sweeping changes. He argued that, from the 1980s, the ICT revolution had led to a restructuring of the capitalist system, creating an ‘information capitalism’ in which the ability to use information and knowledge had become the main source of productive capacity. In this new system a new kind of organisation had emerged, the ‘network enterprise’, with a focus on flexible rather than mass production, new managerial systems, more horizontal organisation hierarchies and characterised by strategic alliances of large corporations. Labour was seen as being fragmented between those workers with skills that could be easily replaced by technology and those workers who have the ability (and means) to adapt their skills. Meanwhile, Beck (2000) argued that society was moving from a ‘work society’ to a ‘knowledge society’ with significant implications for the nature of work and employment. Technological change had increased the mobility of capital, and global competition had undermined a nation’s ability to protect jobs leading to increased labour market insecurity for many, he argued. While technological change was not the driver of these trends, it was seen as variously as a supporting and enabling factor. A common theme in this literature is concern that certain ‘inevitable’ global forces, facilitated by technological innovations, were leading to a new labour market in which many workers would face increasing labour market insecurity. It is also notable that, in most cases, low-skilled workers and those with weaker labour market attachments were seen as at most risk.

More recent research of labour market change has also implicated technology in changes to jobs and the occupational structure of the labour market. For example, Kalleberg (2011) cites rapid technological innovation as one of the major forces – along with globalisation, increased mobilisation of capital and financialisation of the economy – driving polarisation in the quality of jobs in terms of financial rewards and intrinsic work qualities; an increase in the incidence of poor-quality jobs; and increased precariousness of work in general. Kalleberg contrasts these developments to the relative improvements in prosperity and security that characterised the social contract of the post-World War II period. In this view, technological change – particularly computerisation and the spread of the internet – has:

- facilitated the globalisation of product, capital and labour markets, allowing companies to outsource and offshore production and other services;
- increased competition and shortened product cycles pressuring firms to seek flexibility in the manufacturing process;
- enabled efficiency savings, reducing the labour power needed to produce goods and services;
- changed work processes, changing developed economies from manufacturing-based mass production to information-based economies with more knowledge intense work and organisational structures that allow greater flexibility.

In Kalleberg's assessment, occupational restructuring linked to technological change disproportionately affected (in US terms) middle-class jobs in America, with these jobs being outsourced or offshored. At the same time, low- and semi-skilled jobs are at risk of routinisation by computers and other technological advances. For example, computerisation resulted in many intermediate-skill jobs being 'routinized' and de-skilled, thus reducing wages for workers in those jobs thereby increasing the number of lower paid jobs and increasing the inequality between high-skilled jobs on the one hand and low- and (routinized) intermediate-skilled jobs on the other.

These changes have obvious implications for labour market inequality between those with different skills and education levels, and while much of the polarisation in employment and job quality that Kalleberg describes reflects skills levels needed for jobs, there are also particular issues for different vulnerable groups. For example, Kalleberg argues that in the US increases in the immigration of low-skilled workers means they are particularly at risk of having to take poor quality jobs while also putting downward pressure on wages in low-skilled jobs. Similarly, while the situation for women varies considerably by level of education, women are still much more likely to occupy part-time work which is much more likely to be low-skilled. While an increased participation of women and a tendency for older workers to remain in the labour market for longer (particularly since the recession) means it is harder for young people to get work.

Rubery (2015) also cites 'transformational technology' as one of the three 'Ts' driving forces, alongside 'tertiarisation' – a shift towards services – and 'transnationalism'. These three 'Ts' have contributed to

four major trends in employment over the past 50 years, dubbed the four 'Fs': feminisation, flexibilisation, fragmentation and financialisation. In this view new technology has had a number of effects on employment with both negative and positive consequences. Firstly, more sophisticated ways of planning services, facilitated by new technologies, has extended opening hours, enabling women to enter the workforce in increasing numbers. However, while flexible working-time arrangements and flexible contracts have facilitated women's integration into the labour market, it has generally been based around employers' needs and demands rather than the needs of workers to balance work and family life. Secondly, mobile and communications technology has enabled managers and clients to contact staff at all times of the day. Along with a shift to results-based rather than time-based contracts, this contactability has extended the hours that a business can be operational and also facilitates offshoring, as it makes it easier for businesses to communicate across time zones. While these changes may lead to greater productivity, they put pressure on workers to work longer hours, accept insecure contracts and puts the jobs of some workers at risk of offshoring.

The overall consequence of these developments, it is argued, are therefore mixed. There have been positive changes to some aspects of job quality, such as better workplace health and safety, improved opportunities for interesting work (albeit at the expense of intermediate skilled jobs) and a general raising of wages and living standards (at least until recently). However, some aspects of job quality have been negatively impacted, with increased insecurity of employment and working hours, a blurring of the work-life boundary, less transparent and more complex employment relationships, a fragmentation of career structures, a compression of wage differentials at the lower end of the distribution and a decline in the share of GDP that goes on wages. Lower and intermediate-skilled workers, and to some extent women, are felt to be most directly affected by technological change and accompanying organisational innovations, while others, such as migrants and both young, and some older workers, are disadvantaged to the extent that they are less likely to possess the skills to compete for the better jobs and because of a weaker attachment to the labour market more generally.

3.3 Evidence on technological innovation and labour market change

Technological change since the 1980s has had a transformative effect in the workplace, particularly in terms of the organisation of work. However, the extent to which it has resulted in a wholesale change in the occupational structure and labour market security is contested. For example, in response to earlier theories of labour market change such as those of Beck and Castells (outlined above), Fevre (2007) presented data from the UK Labour Force Survey in the UK and reviewed findings from Europe and the United States, to show that there had been no substantial increase in insecure forms of working in advanced economies. Likewise, using labour force survey data from the US and Europe, Doogan (2009) argued that the impact of technological change – and other global factors – had been overstated, and there was no evidence of a significant shift in the use of insecure forms of employment. However, it should be noted that the analysis used in both studies used data from before the 2007 Global Financial

Crisis and subsequent Great Recession and a number of more recent studies provide evidence of the sorts of increases in labour market insecurity and wage inequality predicted by the above theories, although perhaps not on the scale predicted by some theorists. Stone (2010) presents data from eleven OECD countries⁴ covering the period from 1985 to 2010 indicating: small declines in permanent contracts and small increases in temporary contracts in most countries studied, increases in part-time work in nearly all countries covered, a decline in tenure for mid-career males in most countries, and a rise in wage inequality (measured using Gini coefficients) in all countries covered except Spain and France. Other studies, using more recent data, have also shown similar trends, including: a general upward trend in temporary employment and non-standard contracts in most OECD countries (e.g. OECD, 2014a, 2014b; ILO, 2012), and a rise in wage inequality in two-fifths of advanced economies – particularly the UK, Ireland, Denmark, Spain, Cyprus, Iceland, Lithuania, Latvia and the US (ILO, 2015). Data also shows that young people are particularly vulnerable to insecure forms of employment (OECD, 2014a). It should be noted, however, that while the trends identified in these studies point to a general creep towards less secure forms of work they cannot isolate the effect that technological and other forms of innovation have on labour market insecurity and aspects of job quality from wider factors such as globalisation and/or political choices.

As noted previously, some theorists have attempted to examine the impact technological change can have on the occupational structure more directly and present evidence to support their claims. For example, using data from the European Labour Force Survey, Goos, Manning and Salamons (2009, 2014) have not only shown that job polarisation is prevalent in the 16 European countries covered by their research but also that RBTC and offshoring can explain much of the job polarisation observed. However, other empirical studies question the idea of a universal polarisation of jobs in developed countries (e.g. Fernández-Macías, 2010, 2012; Fernández-Macías and Hurley, 2008; Fernández-Macías, Hurley and Storrie, 2012; Gallie, 2007; Davoine, Erhel and Guergoat-Larivière, 2008; Amable, 2003). Instead, they highlight more varied outcomes for the impact of technological change on employment structures across European countries. Drawing on institutionalist type explanations they argue that the impact that technological change has on occupational structure very much depends upon the institutional arrangements within countries. Although findings differ depending upon the measure of job quality being used – for example, skill, pay or employment contract – the Netherlands, Germany and France are cited as examples of countries experiencing job polarisation and Finland, Denmark and Sweden as examples of countries experiencing job upgrading.

Widening the scope to a review of the evidence from empirical studies from the UK, Europe and the US looking at the impact of innovation on employment and job quality, Pianta (2005) also suggests that

⁴ The eleven countries covered in Stone's analysis are Australia, Japan, the USA, Spain, Italy, Germany, the Netherlands, Denmark, the UK, France and Canada.

the effect of innovation on jobs depends on institutional factors. These factors include labour market conditions and labour market institutions, demand dynamics, innovation system, and the form of innovation (product, process or organisational) or combinations thereof. Focusing first on firm-level studies, Pianta's findings tend to show positive effects of innovation on employment, with firms innovating in products and processes growing faster and tending to expand their employment relative to non-innovative firms. Similarly, firms combining technological innovation with organisational innovation tend to have greater employment growth compared to those carrying out organisational innovation on its own. However, while job outcomes might be good within innovating firms, the same might not be true for jobs in non-innovating firms. Shifting to industry-level studies, Pianta suggests that the impact of innovation on jobs tends to be positive in industries characterised by high-demand growth in which the focus tends to be on product (good or service) innovation, whereas process innovation tends to lead to job losses on aggregate. For example, studies looking at Europe during the 1990s, when growth was relatively low constraining the potential benefits of technological change, showed that while product innovation had positive effects on output and jobs, process innovations tended to revolve around restructuring in the face of international competition leading to labour-saving effects. Finally, macro-economic studies, that take account of different direct and indirect compensation mechanisms at the country level, suggesting again that institutional factors and national differences have a significant impact on the effect that technological change has on employment. These studies show that innovation tends to have a more positive impact on employment in economies where new product generation and investments in new activities are higher, and where the demand-increasing effects of price reductions are greater.

While Pianta's review shows that the effect innovation has on employment varies considerably depending on industry, the type of innovation and the institutional context, the impact innovation has on different groups of workers is less clear. It could be that where employment is growing it is likely to lead to greater labour market inclusion as more people are drawn into the labour market. However, this proposition needs to be substantiated. Particularly because, as we have seen in this review of the literature, much research and theory suggests that technological and other kinds of innovation can lead to winners and losers depending on occupations' skills levels, the sorts of occupations in which groups of workers tend to be employed and also institutional context. Winning and losing compounds inequalities. Building on the work of QuInnE, this Working Paper investigates this issue by examining outcomes for different groups of vulnerable workers in different innovation regimes. The aim is to assess if inequality – as measured by employment participation rates and job quality – is lessened within the high innovation country cluster.

4 Methods and data

The importance of institutional context and other factors in determining the effects that innovation as technological change has on work and employment, and the labour market underpins QuInnE's understanding of both innovation and job quality. Using data from the EU's Innovation Union Scorecard and European Working Conditions Survey and European Labour Force Survey (supplemented where necessary by data from the Structure of Earning Surveys and European Statistics on Accidents at Work), Erhel and Guergoat-Larivière (2016) identified distinct EU country clusters in terms of innovation and job quality regime. They further showed that the innovation regime can have different consequences for job quality depending upon the institutional context, and while innovation and job quality tend to be correlated, the effect of innovation on job quality is not always positive on all measures of job quality.

This Working Paper draws on Erhel and Guergoat-Larivière's innovation clusters approach. However while the findings from their research are important at a general level, Erhel and Guergoat-Larivière's research did not extend to a specific focus on the impact of innovation regime on the social inclusion and job quality of vulnerable workers. This Working Paper addresses this gap. It takes the innovation clusters from Erhel and Guergoat-Larivière's study and applies to them to data from two European surveys: the European Working Conditions Survey (EWCS) and the European Social Survey (ESS).

The EWCS is a sample survey conducted by the European Foundation for the Improvement of Living and Working Conditions (Eurofound). The survey focuses on working conditions and quality of work of both employees and self-employed in Europe. This survey has become an important source of information about working conditions and the quality of work in Europe. The survey is conducted in every five years starting from the year 1990 when the first wave was conducted. To date EWCS has six waves, the latest wave being conducted in 2015. The scope of the survey and the themes covered are extensive and include: working time arrangements, work-life balance, employment status, health and safety, work organisation, learning and training, physical and psychosocial risk factors, worker participation, earnings and financial security, and work and health.

For this study we use the latest wave of 2015 which has information on 35 EU countries and a sample size of 43,850.⁵ While EWCS is a rich source of information for quality of work and working conditions, it does not cover people who are not in employment. The sample used in the EWCS is representative of those aged 15 years and over (16 and over in Bulgaria, Norway, Spain and the UK) who are in

⁵ We do not use data from all the 35 countries for this study. A list of 22 countries presented in Table 1 has been used from EWCS.

employment. To address this limitation, we use the ESS to look at the employment and unemployment rate of the innovation clusters.

The European Social Survey (ESS) is a cross-national survey that has been conducted across Europe since 2001. It is a cross sectional sample survey which is repeated in every two years. The survey measures the attitudes, beliefs and behaviour patterns of diverse populations in more than thirty nations. Some of the main objectives of the ESS are to look at the changes in socio-economic structures across Europe and produce comparable cross-country data. It provides information on individual employment and unemployment status from which employment and unemployment rates can be estimated at national level. There are eight rounds of data available starting from 2002 to 2016. For this study we use the seventh-round survey data from the year 2014-15. Therefore, the results from both the EWCS and ESS databases are comparable in terms of time period. Twenty-one countries are covered in the ESS 7th round survey, with a sample size of 40,185. The ESS sample is representative of all persons aged 15 years and over (no upper age limit) resident within private households in each country, regardless of their country of birth, citizenship or language.

In both surveys, the analysis for this research focuses on the working age group 16 to 64 years of age. The descriptive tables presented in Appendix (A1 and A2) provide an overview of the sample used for the analysis. Our samples consist of 23,642 persons in the working age group in the ESS and 28,012 persons in the working age group in the EWCS.

4.1 Methodology

Erhel and Guergoat-Larivière identify four innovation clusters: Eastern or low innovation cluster; Southern or below EU average innovation cluster; Continental or above average innovation cluster; and Nordic or high innovation cluster. We divide 22 countries from Europe into these four clusters when using the EWCS data to analyse the job quality of vulnerable workers. However, this division is not possible when using the ESS, as data for Greece, Italy, Slovakia and Latvia are not available in the ESS. As a consequence, when analysing labour market inclusion for these workers, we, we group the only remaining ‘Southern cluster’ country with the ‘Eastern’ cluster countries, as the cluster with the closest family resemblance, to create a ‘low or below average innovation’ cluster. A list of the cluster groupings for the 22 EU countries used in the analysis is presented in Table 1.

Table 1: List of countries in each innovation cluster

EWCS (labour market inclusion analysis)	ESS (Job quality analysis)
<i>Eastern cluster (low innovation)</i> Czech Republic Spain Latvia Lithuania Hungary Poland Slovakia	<i>Eastern/Southern cluster (low or below average innovation)</i> Czech Republic Spain Lithuania Hungary Poland Portugal
<i>Southern cluster (below average innovation)</i> Greece Italy Portugal	
<i>Continental (above average innovation)</i> Belgium Germany Estonia France Ireland Luxembourg Netherlands Austria United Kingdom	<i>Continental (above average innovation)</i> Belgium Germany Estonia France Ireland Luxembourg Netherlands Austria United Kingdom
<i>Nordic (high innovation)</i> Denmark Finland Sweden	<i>Nordic (high innovation)</i> Denmark Finland Sweden

Source: Authors' own clustering applying Erhel and Guergoat-Larivière (2016) to the data used.

In the next step we investigate several indicators of labour market inclusion and job quality, and compare them for different vulnerable groups (Table 2) across the innovation clusters. For labour market inclusion, we look at the percentage of the working age population who are employed or unemployed in the three clusters. For job quality we look at the six measures adopted for the QuInnE project following Davoine et al (2008) and Muñoz de Bustillo et al (2011): wage satisfaction⁶; job security; perceived health and safety at work; education and training; employee voice and representation; and work-life balance. To investigate inequality amongst vulnerable and non-vulnerable groups we compare the outcomes of women with those of men, the outcomes of young and older workers with those of prime-age workers, the outcomes of migrant workers with those of native born workers, and the outcomes of low-skilled workers with those of middle- and high-skilled workers, see Table 2 below.

⁶ Wage satisfaction was used rather than absolute wages in order to overcome differences in relative wages between countries.

Table 2: Vulnerable and non-vulnerable groups in the labour market

	Vulnerable group	Non-vulnerable group
By sex	Women	Men
By age group	Young (16-24 years)	Prime age (25-49 year)
	Older (50-64 years)	
By country of birth	Migrants	Natives (person and both the parents born in the country)
By skill level	Low skilled	Middle skilled
		High skilled

Note: Categories based on EC (2010a) and documentation and initiatives supportive of the Europe 2020 plus the databases of the EWCS and ESS.

In both cases – inequality based on employment participation and job quality, the analysis is performed for the working age population 16 to 64 years old. We use ESS data from the latest round (round 7) conducted in 2014-15 to see the employment and unemployment rate, and EWCS survey from the same year (2015) to look at the job quality indicators.

The absence of a linked dataset covering innovation and the employment participation rates and job quality for vulnerable workers significantly limits analysis of the virtuous circle. Most obviously, it is not possible to ascertain if they are mutually reinforcing, as the EC (2010a) state, by exploring causality – whether bi- or even uni-directional. Instead, the bivariate analysis used in this study simply looks at social inclusion and job quality outcomes for vulnerable workers in the different innovation regimes and compares them across the innovation regimes. Because of the limited data availability, it should be noted that this form of analysis does not allow positioning of dependent variables (which in this case would have been social inclusion and job quality) with innovation as an independent or explanatory variable to test even simple hypotheses of association.

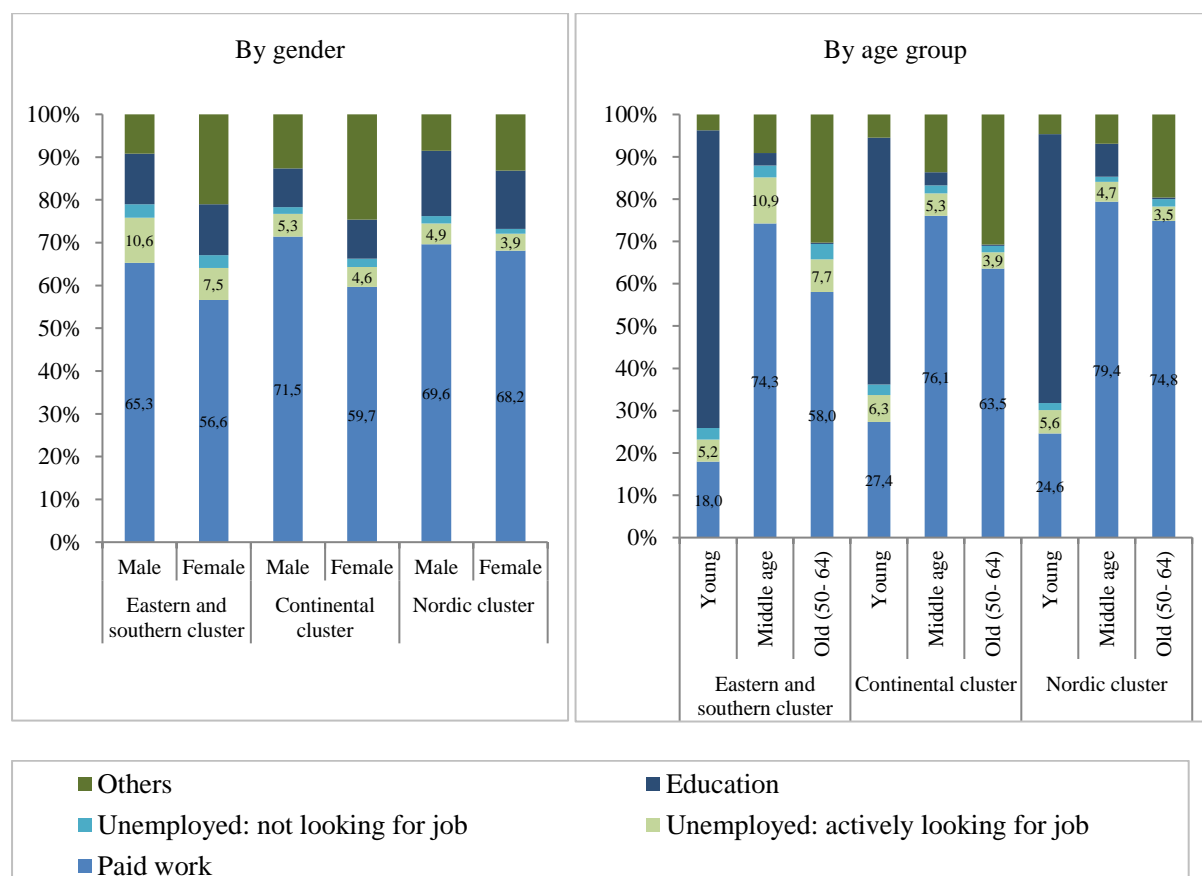
5 Results

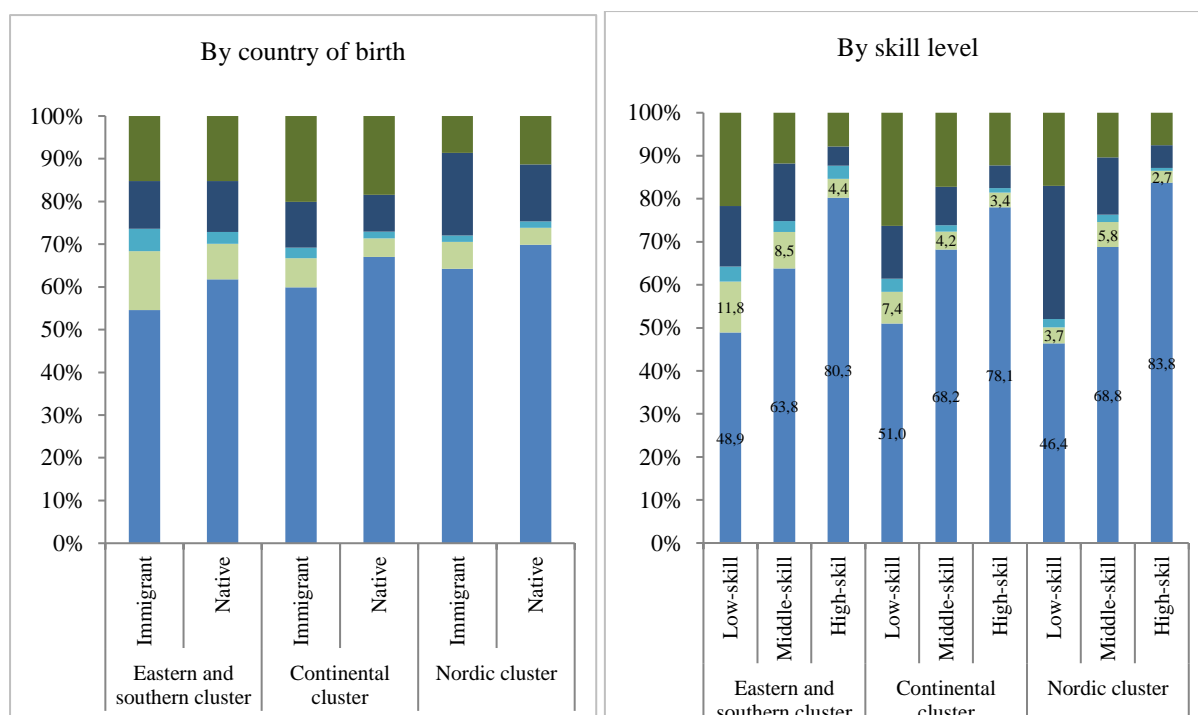
The analysis compares the employment outcomes such as employment rate, unemployment rate and job quality indicators of the vulnerable groups with their counterparts across the innovation clusters. In particular we aim to establish whether inequality in outcomes, as measured by employment participation and job quality for these workers, are lower or higher in regimes with a high level of innovation. We focus on the employment rates of female, young (16-24 years old), old (50-64 years old), migrant and low-skill workers. We define migrants based on the birthplace of a person and his/her parents. If a person and both of his/her parents are not born in the country, we treat them as migrants. Low-skilled persons are defined based on the International Standard Classification of Education (ISCED). Persons with an education level less than ISCED 2B (i.e. incomplete ISCED 1, complete ISCED 1 and ISCED 2A) are considered as low-skilled.

5.1 Employment and unemployment rates

Figure 2 presents the main activity status of the working age population (16 to 64) by gender, age groups, country of birth and skill level across the three innovation clusters.

Figure 2: Employment and unemployment rate across the innovation clusters (16 to 64 age groups)





Source: European Social Survey 2014-15.

There is a 10-percentage point difference in employment rates of male and female in Eastern as well as the Continental cluster. **Nordic cluster shows higher gender equality in terms of the employment and unemployment rates** (Figure 2). The unemployment rate follows a similar pattern, showing **higher inequality in the Eastern and southern cluster compared to the Nordic cluster**.

By age group, young (16-24 years old) workers have a substantially lower level of employment rate than the prime age (25-49) and older (50-64) people. This difference is explained by the fact that a high percentage of people from the young age group is in education across the innovation clusters. However, the percentage of people unemployed and actively looking for job is also higher for the younger cohort compared to the other two cohorts across the innovation clusters, except for the Eastern and southern cluster where unemployment is higher for the prime and older age groups. In terms of inequality between age groups, while the **Nordic cluster exhibits higher employment levels for all age groups, the inequality in employment rate is quite high between young and prime-age workers** but relatively **low between prime and older individuals**. However, the low employment rate for young people is quite clear from the comparatively high rate of educational participation in all the clusters. The **Eastern and southern cluster has the highest rate of inequality between both young and older workers, and between young and prime-age workers**.

The employment rate is substantially lower (around 5 percentage points) for migrants than the natives across all three innovation clusters. The unemployment (actively looking for job) rate is also higher for migrants than it is for natives in all three clusters. Significantly, employment rates are higher and unemployment rates lower in more innovative clusters. However, when examining differentials in

employment and unemployment rates, **inequality in the employment rate is highest in the Continental cluster** and **inequality in the unemployment rate is highest in the Eastern and southern cluster**.

Looking at skill level, people with a low level of skill (below ISCED 3) are as vulnerable as migrants across the innovation clusters, with lower rates of employment. The high innovation cluster has the lowest employment rate for low-skilled workers. While people with middle skill and high skill have a 69 and 83 per cent employment rate respectively, the low-skilled group has just a 46 per cent employment rate. Thus, the **Nordic cluster exhibits the highest inequality in employment rates of the three clusters**, although it should be noted that engagement in education among the low-skilled is particularly high in the Nordic cluster. **In terms of unemployment rate, the Eastern and southern cluster exhibits the highest level of inequality between the three skill levels.**

Overall, in terms of inequality in labour market inclusion we see that innovation regime appears to have different implications for different vulnerable groups. In the **Eastern and southern cluster** (with lowest innovation) there is high employment inequality for young and older workers, and to some extent for women, and there is high inequality in terms of the unemployment rates migrants and low-skilled workers. The **Continental cluster** generally exhibits medium levels of inequality, albeit with high levels of employment inequality for women and migrants. Finally, while the **Nordic cluster** exhibits low employment inequality for women, migrants and older workers, it has the highest levels of inequality by skill level and for young workers.

5.2 Job quality

In this section we look at several indicators of job quality and compare them for vulnerable and non-vulnerable groups across the innovation clusters. The data we use for this exercise come from the sixth wave of EWCS of 2015. Following the multidimensional job quality model of Erhel and Guergoat-Larivière (2016), we focus on six dimensions of job quality: i) Wages (satisfaction with); ii) job security (type of contract etc.); iii) Working conditions (accidents, physical and psychological risks); iv) Education and training (participation to training, matching, opportunities to learn); v) Participation and collective representation; and vi) Work-life balance.⁷

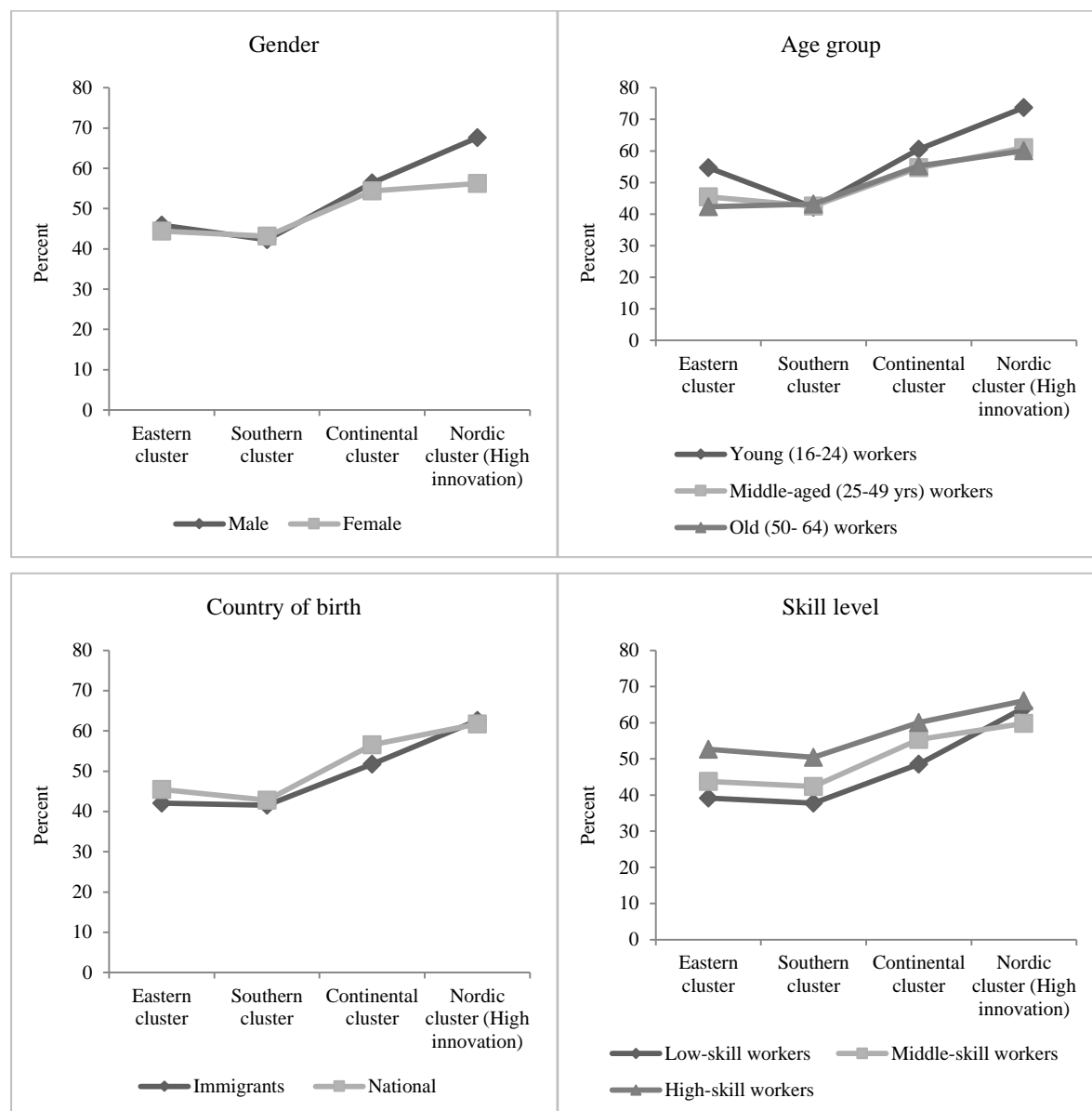
- i) **Wages:** Job quality based on this dimension can be measured using objective and subjective indicators. For this study we use the subjective indicator, wage satisfaction, in order to overcome relative differences in wages between countries. Overall there is a positive association with wage satisfaction and innovation except for the Southern cluster (Figure 3). However, a comparison of male and female workers reveals that women are less satisfied (56% compared to 67%) with the earnings as compared to men in the most

⁷ The analysis of job quality indicators is focused only on employees, and excludes self-employed.

innovative Nordic cluster. There is a notable inequality in wage satisfaction by skill level across the innovation clusters – with high-skilled workers reporting highest level of satisfaction and low-skilled workers reporting the lowest level of wage satisfaction. However, again, the high innovative Nordic cluster shows slightly different picture – both high and low skill workers have equal level of wage satisfaction while the middle skill workers have lowest level of wage satisfaction. We do not find much inequality in terms of wage satisfaction across vulnerable and non-vulnerable age groups, and across native and migrant workers. Instead, young workers report higher satisfaction compared to prime and older age employees across all the clusters (except the Southern cluster). Overall, there is high inequality in wage satisfaction by skill level and low inequality by gender in all innovation clusters, except the Nordic cluster where the reverse is true (i.e. low inequality by skill and high inequality by gender).

Figure 3: Job quality indicators across innovation cluster by gender, age group, country of birth and skill level

3A. Wage satisfaction (% reported 'satisfied with earning')

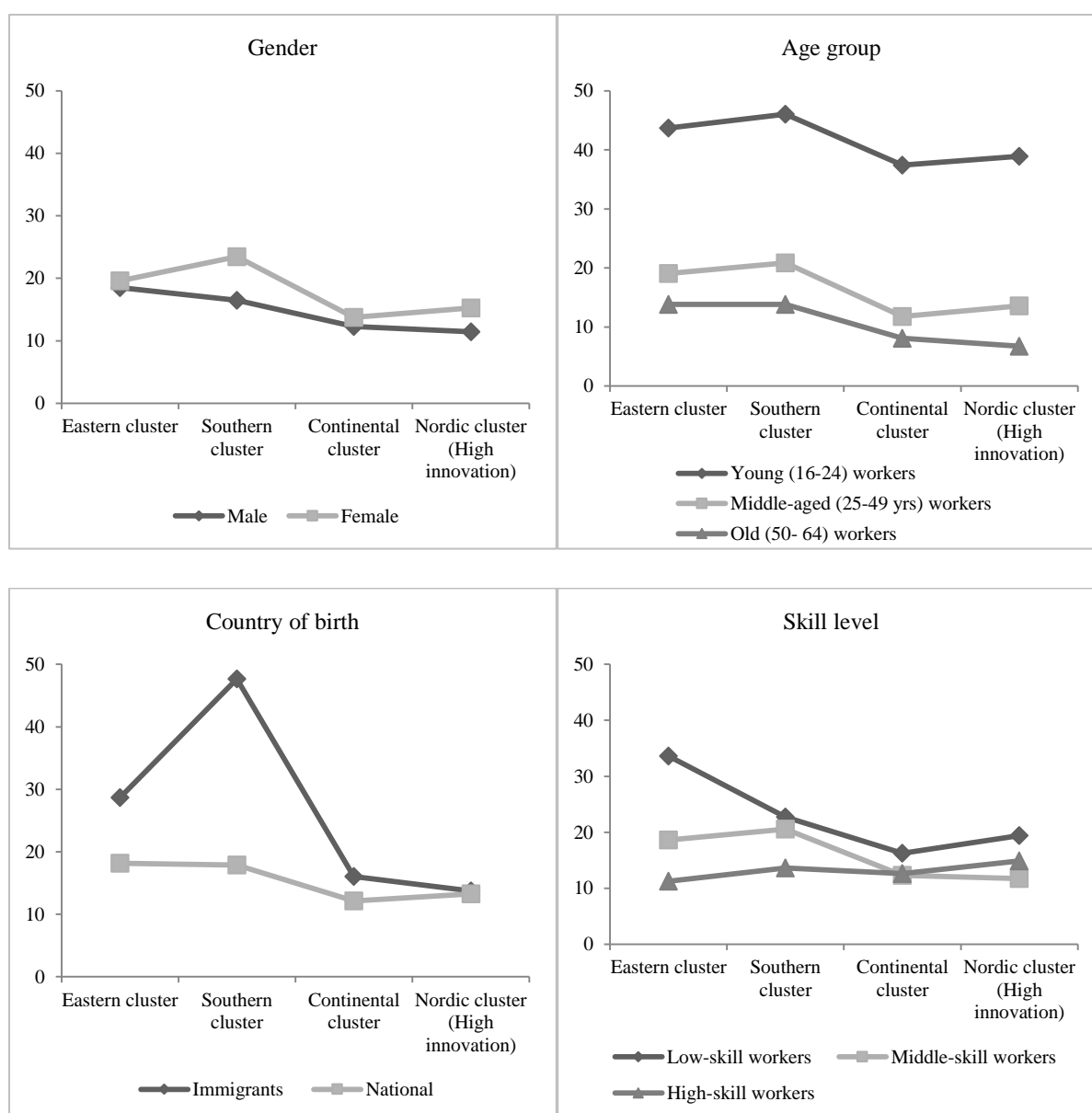


Source: European Working Conditions Survey 2015.

- ii) **Job security:** For this dimension we look at the objective measure of job security – whether the worker has a standard (permanent) job contract. We present the percentage of workers reported having a non-standard job contract (Figure 3B). This number includes workers with no contract, with a limited period contract, and a temporary employment agency contract. As can be seen, while there is relatively little inequality in job security for women and low-skilled workers, generally speaking, migrants and young workers are much worse off than their native or older counterparts on this measure. **In terms of the relationship**

between innovation regime and job security, the data reveals something of a mixed picture. While there is a high level of inequality between young and older workers, the level of inequality is more or less the same for all clusters. In other words young workers fair equally poorly in high or low innovating clusters. Migrant and low-skilled workers do appear to experience less job security inequality in more innovative clusters than those in lower innovating clusters, although inequality for low-skilled workers is higher in the Nordic cluster than in the Continental cluster. While gender inequality on this measure is low in all clusters, it is slightly higher in the Southern (below average) and Nordic (high innovating) clusters.

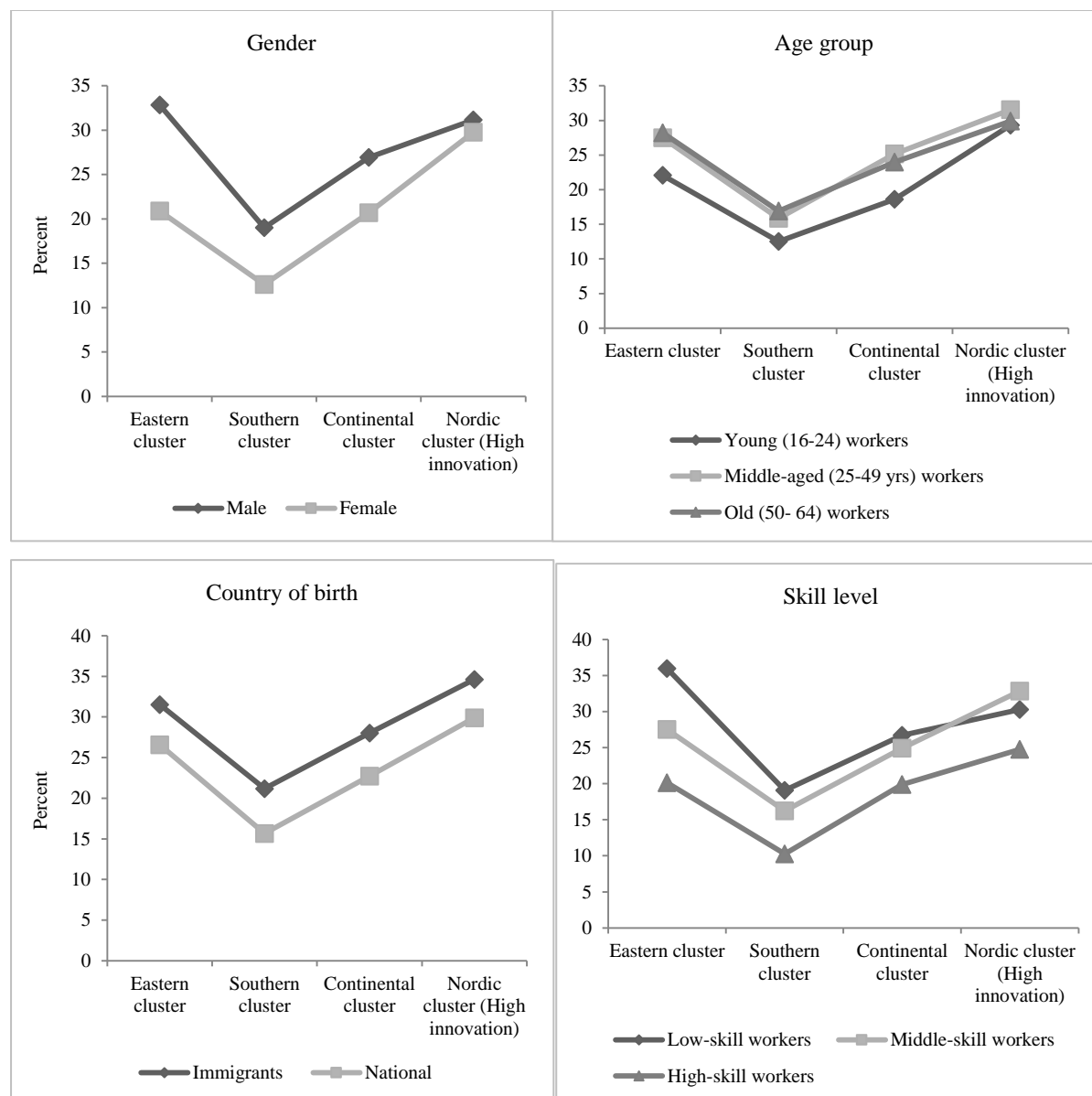
3B. Job security (% reported 'Non-standard employment')



Source: European Working Conditions Survey 2015.

- iii) **Working conditions:** In this dimension we look at the working environment and how it is suitable for the employees' health and well-being. We measure it by examining answers to the question '*Do you think your health or safety is at risk because of your work?*'. Workers who answer 'yes' to this question are considered to have relatively poor working condition in terms of their health and safety. Surprisingly, workers in more innovative clusters are more likely to feel their health and safety is at risk; the only exception is the Eastern cluster in which workers have a similar level of concern about health and safety as those in the Continental cluster (Figure 3C). **In terms of inequality, we see a broadly similar pattern in all the clusters with men, migrants, older and prime-age and low to middle-skilled workers being more likely to feel their health is at risk at work.** This finding perhaps reflects the types of jobs performed by these groups. However, **gender and skill inequality is slightly higher in the Eastern (low innovation) cluster and gender and age inequality is slightly lower in the Nordic (high innovation) cluster.** It is of note though that although health risk inequality is generally lower in the Nordic cluster it is still relatively high for migrants and low-skilled workers.

3C. Health and Safety at work (% reported health and safety is at risk at work)

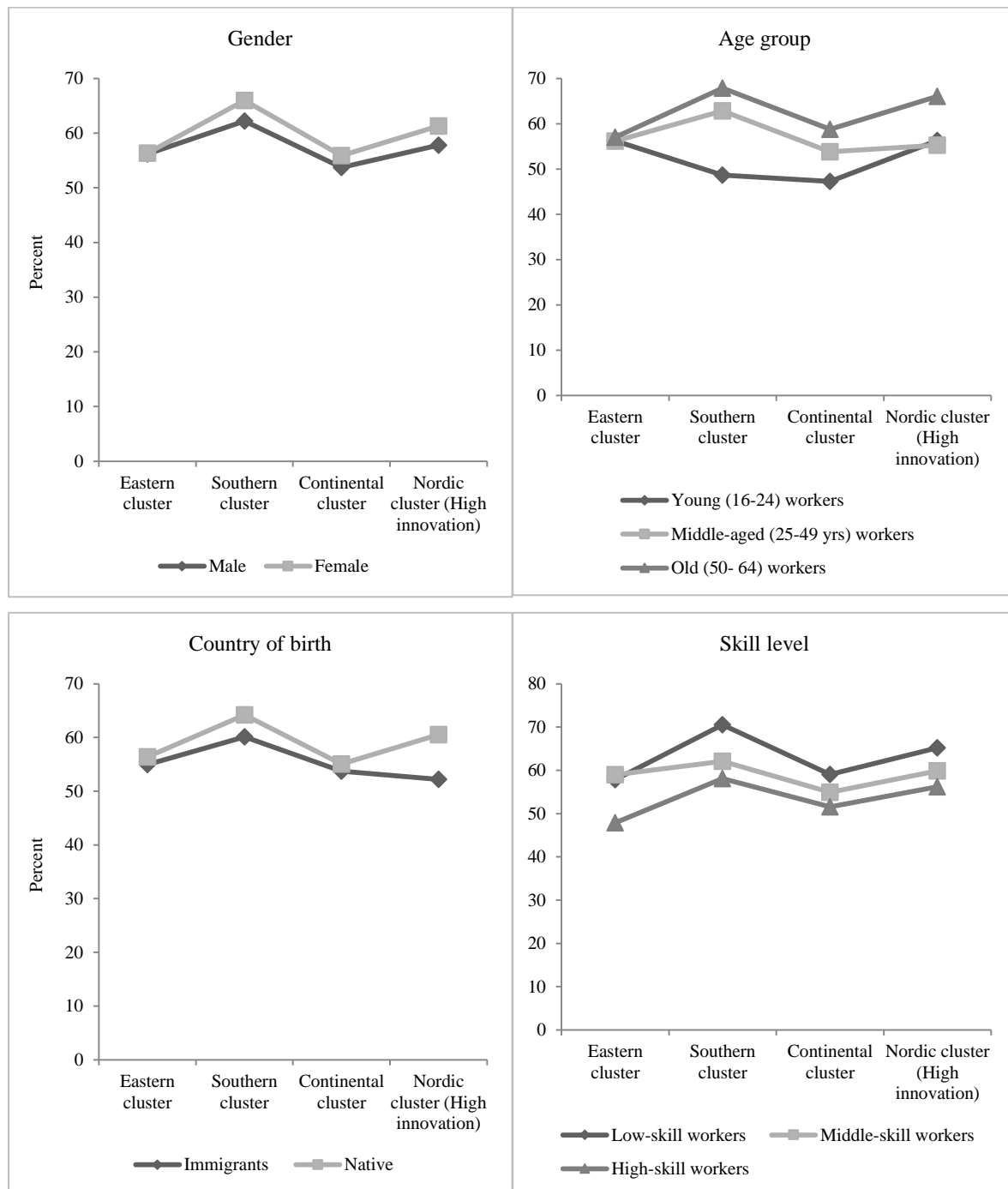


Source: European Working Conditions Survey 2015.

- iv) **Education and training:** This dimension captures the extent to which employees' jobs are felt to match their skills. EWCS asks workers directly about their present skills and job requirements; whether the employee needs further training to cope well with the tasks or his/her present skills correspond well with the job requirements. We look at the percentage of employees reported to have skills that correspond well with the requirements of their job. Those who are well-matched in their job are expected to perform well, have higher job satisfaction, and earn more compared to peers with the same level of skills but in an unmatched job (Duncan and Hoffman, 1981; Tsang, 1987; Green and Zhu, 2008). There was very little inequality in self-reported job-skills match between men and women,

or between migrants and natives, although migrants in the Nordic high-innovation cluster were slightly less satisfied with their job-skills match than their native counterparts. When it comes to age, young workers in the Southern and Continental clusters were much less likely to feel their skills corresponded well with their current duties than their older counterparts. Whereas young people in the Nordic and Eastern clusters were no less likely to report a skills mismatch than those in the prime age group. Low-skill workers were more likely than high-skill workers to report their skills fitted the job in all of the clusters, perhaps reflect some level of over-qualification among more highly qualified workers (Figure 3D).

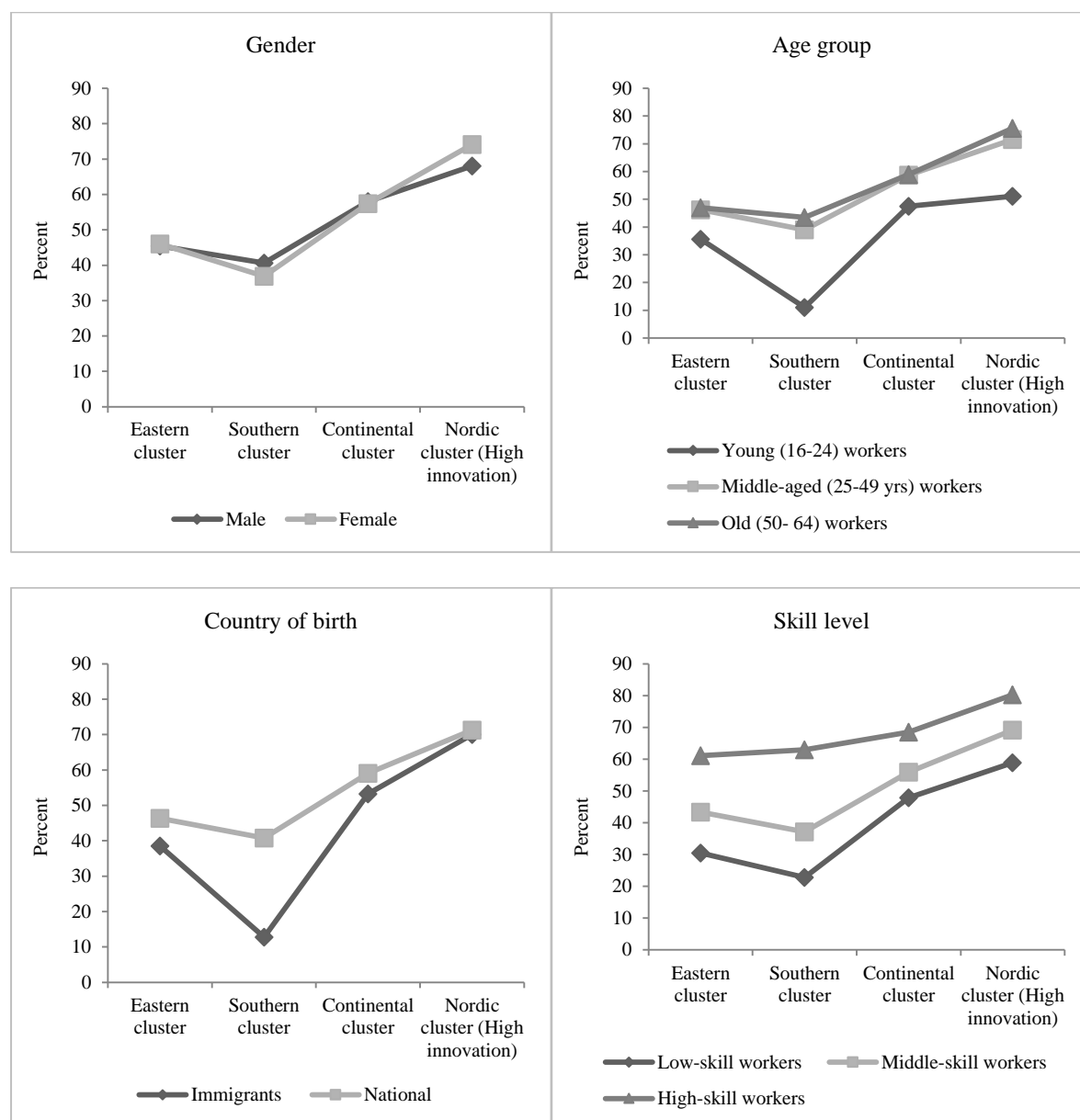
3D. Education and training in the job measured by skills in the job (% reported “My present skills correspond well with my duties”)



- v) **Voice and representation:** In order to measure voice and representation at the workplace we use a positive response to the question ‘Does the following exist at your company or organisation ... - A regular meeting in which employees can express their views about what is happening in the organisation?’. Though there is not much difference between male and female workers in this aspect, young, migrants and low-skill workers have substantially

lower levels of voice and representation in their workplace across the innovation clusters (Figure 3E). **For skill level the general picture is one of higher inequality in voice and representation in lower innovation clusters.** We see a **similar pattern for migrants but with particularly high levels of inequality in the Southern cluster.** In terms of age, the picture is more complex, with **very high levels of age inequality in the Southern cluster,** **relatively high levels of age inequality in the Nordic cluster,** and **lower but still substantial levels of inequality in the Eastern and Continental clusters.**

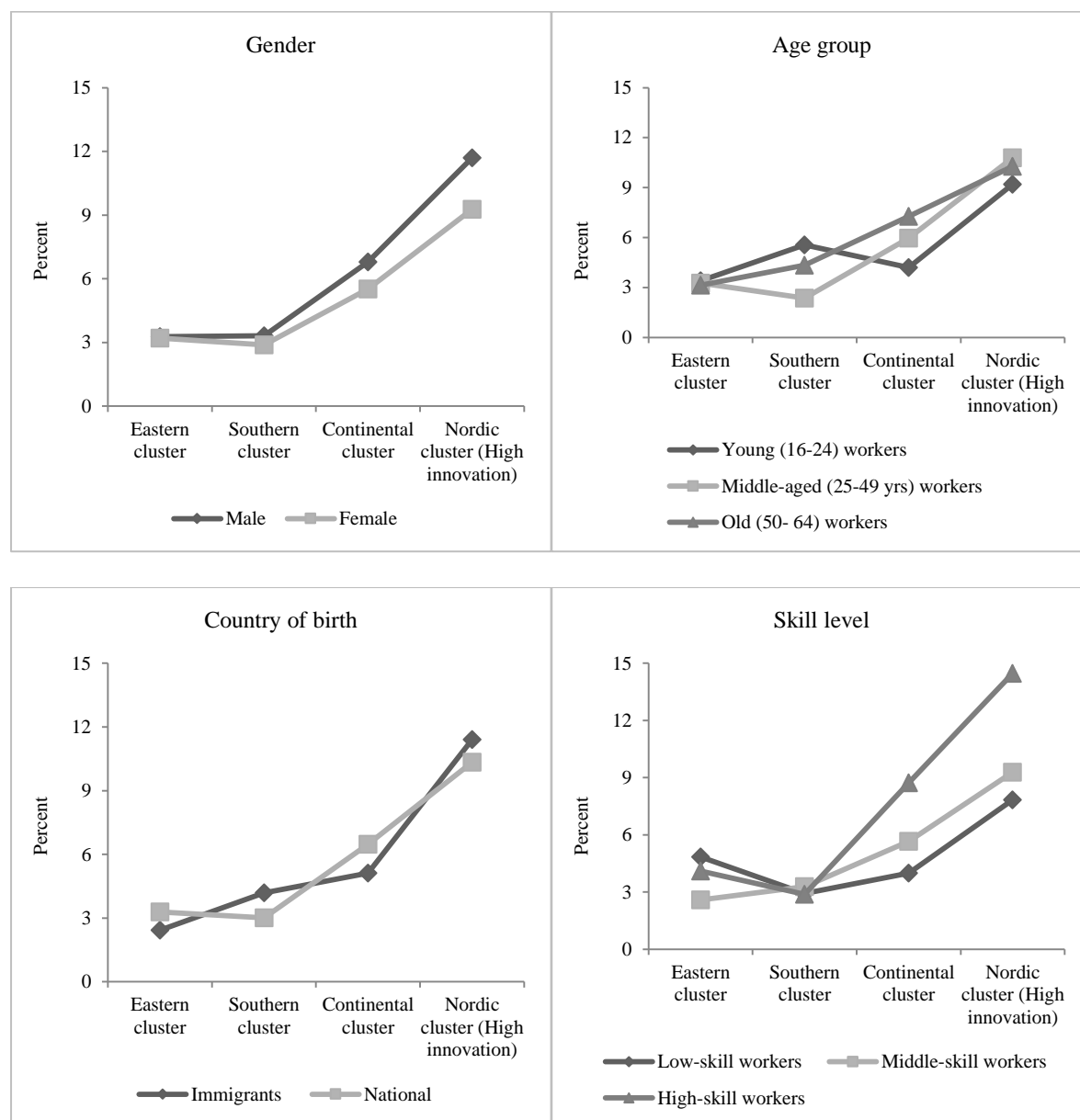
3E. Voice and representation (At your company or organisation - A regular meeting in which employees can express their views? % reported yes)



Source: European Working Conditions Survey, 2015.

- vi) **Work life balance:** Working time arrangements play an important role in balancing work and personal life. Assuming that a worker who is able to determine his/her working time will have a better work-life-balance, we examine answers to the question '*How are your working time arrangements set?*' as an indicator to measure this dimension. Those answering '*Your working hours are entirely determined by yourself*' were assumed to exhibit a high level of control in terms of their work-life balance (Figure 3F). **Gender inequality appears to increase in more innovative clusters**, which perhaps is unexpected as gender inequality is generally assumed to be low in Scandinavian countries. However, this finding may reflect differences in occupations performed by men and women. Similarly, there is high inequality by skill level for more innovative clusters. **Low-skilled workers report the lowest level of autonomy in determining their working time; the difference is stark for the higher innovation clusters – Continental and Nordic –** with around twice as many high-skill workers able to determine their work arrangements compared to low-skill workers. **Inequality in the ability to set work arrangements is lowest in the Southern cluster** but here it seems that very few workers are able to set their own hours entirely. It is possible that as a worker's opportunity to set his/her own hours increases, the scope for inequality between those who can and cannot set their own hours also increases. In low innovation regimes, there is very little scope for workers to set their own hours across all groups. **The pictures for both age inequality and inequality based on immigration status are more complex.** Migrants seem to be in a slightly better situation than nationals in the Southern and Nordic clusters, but a slightly worse position in the Eastern and Continental clusters (although the differences are relatively small). Young workers are slightly better off, in terms of setting their own hours, in the Southern cluster, but slightly worse off in the Continental and Nordic clusters.

3F. Work life balance (How are your working time arrangements set? ‘% reported entirely determined by me’)



Source: European Working Conditions Survey 2015.

Summary of findings

Overall, the findings reveal a mixed picture in terms of the impact of innovation regime on reducing inequality for vulnerable groups of workers. The summary table of the main findings (Tables 3 and 4 below) highlights this mixed picture in terms of the effect of innovation on labour market inclusion and job quality for these vulnerable workers. While inequality in **labour market inclusion** was generally lower for women and migrants in higher innovation clusters, it was higher for young workers and those with lower levels of education. Similar mixed results were found for nearly all measures of job quality examined in the analysis. There was a narrowing of inequality in **wage satisfaction** based on skill levels

in more innovative clusters but inequality was higher for women in more innovative clusters. Perhaps surprisingly, young people in the Nordic (a high innovation cluster) and the Eastern (low innovation) clusters appear to be relatively more satisfied with their wages than their older counterparts, which may reflect cultural differences and/or labour market conditions in those countries. In terms of **job security** there was also a mixed picture. While the Eastern (low innovation) cluster exhibits high insecurity and inequality for most vulnerable groups (except women), the Southern (below average) cluster has high levels of job security inequality for some groups, but lower levels of inequality for others. And while employment insecurity is generally low in the high innovation Nordic cluster, inequality for women, low-skilled and, to some extent, young workers is higher in this cluster than in the Continental cluster, which has lower innovation. However, on this measure, institutional differences need to be taken into account when considering patterns of inequality in levels of job security between the clusters. For example, lack of a permanent contract, and inequality for vulnerable groups, may be higher in the Southern cluster because protections associated with permanent contracts tend to be stronger in the Mediterranean countries, leading to greater use of non-standard employment contracts in these countries. Weaker protections for those workers with permanent contracts in countries in the Continental cluster mean that there is less benefit for employers to use non-standard contracts to achieve flexibility (Inanc 2016).

In terms of the relationship between innovation regime and inequality in **employee voice and representation** there is again a mixed picture. While for some groups, such as migrants and low-skilled workers, there is lower levels of inequality in the higher innovation clusters, for young workers there is higher inequality in the high innovation Nordic cluster than in the Continental and Eastern clusters (medium and low innovation respectively) – although inequality is still highest in the below average innovation Southern cluster. Similarly, the picture for inequality in **work-life balance** is also mixed. Whilst there appears to be greater opportunity for workers to set their own hours in clusters with higher innovation, gender and skill-level inequality appears to increase for these clusters. As noted above, it may be the case that as opportunities for setting one's own hours increases, the scope for inequality between those who can and cannot set their own hours also increases. This possibility would fit with theories such as those of Rubery (2015) which highlight the ways in which advances in ICT and communications technology have facilitated new ways of work scheduling and working across different time zones, which have extended opening hours of workplaces. Of course, it would be unwise to ignore other differences between countries in different clusters that may also influence the extent to which workers can set their own hours. For example, certain types of self-employment may be higher in some countries, giving workers more control over their own hours in principle and/or some countries may have stronger regulations regarding workers' ability to set their own hours. For self-reported **skill to job match** again there is a slightly mixed picture. While there is little inequality based on gender and country of birth in most clusters, migrants are slightly worse off relative to natives in the Nordic cluster

than they are in other less innovative clusters. Whereas young workers in the Southern and Continental clusters appear to face much more inequality in this measure than are young workers in the Nordic and Eastern clusters.

The only measure of labour market inclusion and job quality covered in this analysis that does show a more or less consistent reduction in inequality for vulnerable groups in clusters with higher innovations is the **working conditions** measure. While the differential between the proportion of workers from different groups, and therefore inequality in, reporting a health and safety risk at work is lower in the clusters with higher innovation, workers in these clusters are more likely to report a risk than workers in lower innovation clusters, generally speaking.

Tables 3 and 4 below summarise the level of inequality in outcomes for vulnerable workers in the high innovation cluster compared to the other clusters. Findings present the vulnerable group in the high innovation cluster compared to their counterparts, e.g. female vs male workers, as outlined in Section 4 of this Working Paper.

Table 2: High innovation cluster and inequality in workers' employment participation

Type of worker	Employment participation
Young	About the same
Older	Lower inequality
Female	Lower inequality
Migrant	Lower inequality
Low-skilled	Higher inequality

Table 3 shows that in the high innovation cluster employment participation and thereby social exclusion, is lower for older, female and migrant workers, about the same for young workers and higher for low-skilled workers.

Table 3: High innovation cluster and inequality in vulnerable workers' job quality

Type of worker	Job quality measure					
	<i>Wages</i>	<i>Job security</i>	<i>Health & safety</i>	<i>Education & training</i>	<i>Voice & rep.</i>	<i>Work-life balance</i>
Young	Lower inequality*	About the same	Lower inequality	Lower inequality	Higher inequality	Lower inequality
Older	About the same	Lower inequality*	Lower inequality	Lower inequality*	About the same	About the same
Female	Higher inequality	About the same	Lower inequality	About the same	About the same	Higher inequality
Migrant	Lower inequality	Lower inequality	About the same	Higher inequality	Lower inequality	About the same
Low-skilled	Lower inequality	Lower inequality	Lower inequality	About the same	Lower inequality	Higher inequality

Table 4 shows that in the high innovation cluster shows outcomes for job quality are very mixed, with no clear pattern by type of vulnerable worker. However older workers seem to fare better than other vulnerable workers, at least not increasing their inequality. In terms of measure of job quality findings are equally mixed. However, there are at least no increases in inequality for job security and health and safety, with tendencies to lower inequality on these measures

Taken together, the summary tables show that reduced inequality, as measured by higher employment participation and better job quality, is not comprehensive for vulnerable workers within a high innovation regime. Indeed there is no clear evidence that high innovation can be expected to inevitably reduce inequality for these workers.

6 Discussion and conclusion

Current EU policy on innovation positions innovation as a key strategic means of pursuing sustainable and inclusive growth (EC 2010a, 2011). Going further, this policy posits that a mutually reinforcing virtuous circle exists between innovation, inclusiveness and job quality. Focusing on this claim, this Working Paper has examined whether innovation (in the form of innovation regime) tends to reduce inequality for the types of workers identified as vulnerable within EU policy by analysing their employment participation, and job quality by innovation regimes and compared to non-vulnerable workers.

The analysis is hampered by data availability. Statistically, the claim of a virtuous circle needs to be tested with linked data that allows exploration of causality between innovation and social inclusion, including creation of more better jobs. That dataset is currently absent. The European Commission, if it is to test its claim, needs to address this data gap. If policy is premised on the assumption of a virtuous circle in which innovation and inclusiveness are mutually reinforcing (EC 2010a), then Commission needs to data to support and test this assumption. In the meantime, this Working Paper applies data about vulnerable workers from the EWCS and ESS to the innovation clusters identified by Erhel and Guergoat-Larivière (2016). Bivariate analysis enabled us to compare only social inclusion and job quality outcomes for vulnerable workers across the innovation clusters.

Overall, the findings point to a variable relationship between innovation regime and inequality, with inequality tending to decrease in higher innovation clusters for some vulnerable workers on some measures yet increasing inequality for other workers on other measures. While the analysis presented is based on a simple bivariate analysis, the findings challenge the assumption that high innovation automatically leads to reduced social exclusion and better job for vulnerable workers. Innovation cannot simply be assumed to lead to reductions in inequality, as measured by employment participation and job quality. Innovation potentially increases the scope for inequality between the least and most vulnerable. It should be emphasised that due to data availability limitations, these findings only highlight the lack of association between innovation and these measures of inequality, neither correlation nor causation can be inferred. However, in extending analysis to these types of workers, the findings add further weight to the more general finding in other QuInnE working papers that while innovation and innovation regime can lead to improvements in job quality, job quality cannot be directly inferred from innovation (Muñoz de Bustillo et al. 2016; Erhel and Guergoat-Larivière 2016), The findings about vulnerable workers also add further support to the finding of Erhel and Guergoat-Larivière that a virtuous circle between innovation and job quality is absent more generally.

It should be noted, however that the findings presented in this Working Paper add nuance to current understanding in as much as they reveal that predicting who will benefit and who will lose out, and in

what ways, is difficult to predict. EU policy is premised on the idea that higher levels of innovation help reduce social exclusion and, with it, the creation of better quality jobs. By contrast, key current theories (i.e. SBTC and RBTC) predict that low-skilled (and to some extent intermediate-skilled) workers are likely to be negatively affected by technological change. The analysis for this Working Paper finds more mixed outcomes, even for the same type of vulnerable worker. Thus, while low-skilled workers in high innovation regimes are at risk of labour market exclusion and employment insecurity, they fare better on wage satisfaction, health and safety, and voice and representation. Outcomes are similarly nuanced for other groups of vulnerable workers. For example, while women in high innovation regimes tend to fare well in terms of labour market inclusion and workplace conditions, they fare less well in terms of wage satisfaction and work-life balance. While the young in high innovation regimes face less inequality in wage satisfaction, health and safety and work-life balance, inequality in labour market inclusion, job security, and voice and representation is higher. In the absence of any comprehensive improved outcomes for vulnerable workers within high innovation regimes – and the absence of even positive association between innovation and inequality, Erhel and Guergoat-Larivière (2016) would also appear to be right in arguing that innovation policy needs to explicitly consider its varying impacts on different groups of workers, and policy initiatives aimed at increasing productivity and growth through innovation need to attend to these groups to ensure the benefits are shared in an inclusive way.

In this respect, the findings emphasize the need to think about institutional context in shaping employment outcomes; in this case in relation to outcomes from innovation for vulnerable groups. There are arguments that institutional factors impact the effect of innovation on jobs (Pianta, 2005) and the development of job quality per se (Fernández-Macias, 2012). Whilst the analysis presented in this Working Paper does not incorporate such institutions, it seems reasonable to assume that labour market institutions can have a role in protecting and promoting the interests of vulnerable workers. One obvious such institution when it comes to voice and representation, for example, for these workers would be trade unions and their varying strengths, policies and practices across the innovation regimes – and even within those regimes by country (Gallie 2007).

The need to explore this possibility has become more pressing with the emergence of new digital technology and, with it, debates about the future of work. Some commentators predict massive job losses in advanced economies due to artificial intelligence led automation that will replace human labour. Using a combination of expert interviews, foresight workshops and machine learning using the O*Net database and Office of National Statistics figures based on the UK Labour Force Survey, a number of studies (e.g. Frey and Osborne, 2013; Deloitte, 2014; Bakhshi et al., 2017) have attempted to predict occupations and jobs at risk of contraction or created as a consequence of these new technologies. The general picture presented by these studies is of either a contraction of low-skilled work and an expansion of high-skilled work leading to a general upgrading of jobs and job quality akin

to the STBC thesis or a contraction of both low- and intermediate-skilled occupations, which still produces an upgrade in the stock of jobs. Once again there are likely to be winners and losers with this technological change to work.

The need to understand the impact of technological innovation on already vulnerable workers has come sharply into focus recently with debates about gig work. In the UK the 2017 *Taylor Review of Modern Working Practices* drew on the findings from these studies to highlight the ways in which technology, in this case that underpinning the platform economy, is transforming employment relationships and the ways people work, presenting both challenges and opportunities (Taylor, 2017). While gig work can provide greater flexibility for both workers and ‘employers’ (or more precisely the app providers) it can also diminish other aspects of job quality (Warhurst et al., 2017). Whilst the Taylor Review notes the possibility that this digital disruption to work might lead to labour market polarisation, it is claimed that it has not affected the wage distribution, ‘easing fears of inequality’ according to Taylor (2017: 30). However, despite the reassuring words about a lack of evidence of polarisation, the implications of these predicted developments need to be considered. Many of the predicted changes outlined in debates about the future of work have similar implications to those highlighted by the theories and research outlined previously in this Working Paper. Moreover, policy based on skill acquisition for vulnerable workers may be too limited in scope (see the range of policy options outlined in Warhurst et al., 2018f) or have too little leverage if more high-skilled workers exist than high-skill jobs (Keep and James, 2012).

What these developments suggest and what this Working Paper’s findings have highlighted is that further research – and better data – is needed if effective innovation policy is to be developed and the gains from enhanced innovation are to benefit vulnerable workers. If reducing inequality through improved social inclusion and better job quality for vulnerable workers is to be a major aspiration goal of the European Commission, economic strategy and innovation policy need to include specific measures to ensure that the potential benefits of innovation are shared more equitably.

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Appendix

Table A1: Description of the working age sample in the ESS by cluster

	Southern (below avg.)	Continental (innovation above avg.)	Nordic (high innovation)	All
<i>Gender</i>				
Male	50.44	46.38	49.89	48.14
Female	49.49	53.62	50.11	51.84
<i>Age groups</i>				
16-24	14.24	12.02	14.59	13.08
25-49	50.52	52.05	49.92	51.26
50 – 64	35.25	35.93	35.5	35.66
<i>Country of birth</i>				
Migrant	10.52	24.3	13.41	18.48
Native	89.48	75.7	86.59	81.52
<i>Skill level</i>				
Low-skill	38.65	29.67	19.3	30.79
Middle-skill	41.59	46.2	49.71	45.35
High-skill	19.77	24.13	30.99	23.87
Number of Obs.	6,947	12,772	3,923	23,642

Source: European Social Survey 2014-15.

Table A2: Description of the working age sample in the EWCS by cluster

	Eastern (low level innovation)	Southern (below avg.)	Continental (innovation above avg.)	Nordic (high innovation)	All
<i>Gender</i>					
Male	51.03	52.61	51.7	51.03	51.52
Female	48.95	47.36	48.27	48.94	48.46
<i>Age groups</i>					
16-24	6.15	4.71	9.01	8.48	7.5
25-49	64.16	63.11	61.47	56.34	62.02
50 – 64	29.69	32.17	29.52	35.18	30.47
<i>Country of birth</i>					
Migrant	8.13	6.32	22.51	12.04	14.75
Native	91.87	93.68	77.49	87.96	85.25
<i>Skill level</i>					
Low-skill	14.04	29.14	16.39	9.43	16.38
Middle-skill	63.15	51.5	57.47	65.18	59.45
High-skill	22.8	19.36	26.14	25.39	24.16
<i>Are you working as an employee or are you self-employed?</i>					
Employee	84.26	72.09	87.66	90.42	84.99
Self-employed	14.85	26.71	11.73	9.21	14.26
Number of Obs.	9,293	3,284	12,538	2,897	28,012

Source: European Working Conditions Survey 2015.