Quality of jobs and innovation generated employment outcomes

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AN APPROXIMATION OF JOB QUALITY AND INNOVATION USING THE 3rd EUROPEAN COMPANY SURVEY

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Muñoz-de-Bustillo, R., Grande, R. &
Fernández-Macías, E.

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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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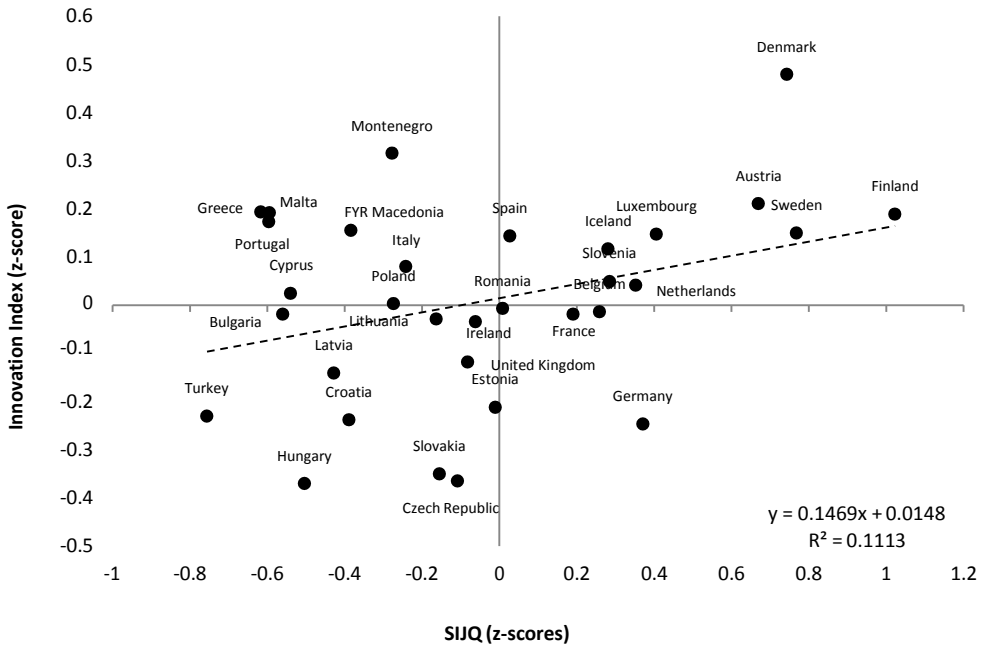
Executive summary

The purpose of this paper is to study the relation between innovation and job quality at the firm level for a large sample of 32 European countries. Building on the analysis of Muñoz de Bustillo *et al.* (2016), which focused on the multiple and complex relations existing between job quality and innovation from a theoretical and empirical perspective using workers´data, in this paper we will use the data on innovation at the firm level gathered by the European Company Survey 2013 (ECS-2013) (Eurofound, 2015), to explore the nexus between innovation and job quality. To do so we will develop a parsimonious aggregate index of job quality, the Summary Index of Job Quality (SIJQ), built from the somewhat limited information on job quality included in the ECS-2013, in order to test whether the different types of innovation carried out by firms (product, process, organizational and marketing), have an impact of job quality.

After introducing the job quality and innovation indicators constructed from ECS data, and presenting a first graphical approach to their relation (see Figure A below), we proceed to study in more detail the links between innovation and job quality by means of a lineal regression, with job quality as the dependent variable, and the four different types of innovations considered in the paper as independent variables. This analysis also includes a limited number of other independent variables potentially related with job quality.

Figure A. Relations at country level between job quality, SIJQ and the overall innovation index.



Source: Author´s analysis from ECS-2013 microdata.

The independent variables are grouped in 3 different models. Model 1 incorporates exclusively the variables related to innovation (product, process, organisational and marketing innovation). Model 2 excludes innovation and adds elements related to the firm and its workforce: size, rate of feminization (% of female employees), workers older than 50 years of age (%), education (% of workers with university degree), productive activity of the firm, absence of outsourcing of production, public or private nature of the firm and type of firm (single, headquarter or subsidiary). This model also adds variables related to the employment history of the firm and the existing system of industrial relation: participation of the firm in employers´ associations, collective bargaining, and growth in employment since 2010. Finally, in Model 3 we integrate the innovation variables and the other independent variables related to the firm and industrial relation system. In addition, as an important control variable, in these three models we introduce country dummies of the 32 countries included in the survey.

Among the conclusions obtained from the analysis we highlight the following:

(a) Starting with the innovation-job quality relation, according to the data, the implications for job quality of innovation at the firm level are quite different depending on the type of innovation. The types of innovation that show greater (and positive) impact on job quality are process and product innovation and marketing innovation (in this order) while organizational innovation, after controlling for other variables affecting job quality, does not seem to have any statistically significant impact on job quality. This result is consistent with the results obtained with employee data and a much richer index of job quality, by Muñoz de Bustillo *et al.* (2016).

(b) Labour relations do matter for job quality; having collective bargaining at the firm has a positive and large impact on the SIJQ. Furthermore, our complementary analysis on the impact of having union representatives in the firm confirms the role of trade unions in facilitating the translation of innovation into higher job quality in the firm.

(c) The evolution of past employment in the firm has an asymmetric impact on job quality, as job quality decreases significantly with the reduction of employment but does not increase with the same intensity (or statistical significance) with the growth of employment in the firm.

AN APPROXIMATION OF JOB QUALITY AND INNOVATIONS USING THE 3RD EUROPEAN COMPANY SURVEY

Rafael Muñoz de Bustillo
Rafael Grande
Enrique Fernández-Macías

1. INTRODUCTION

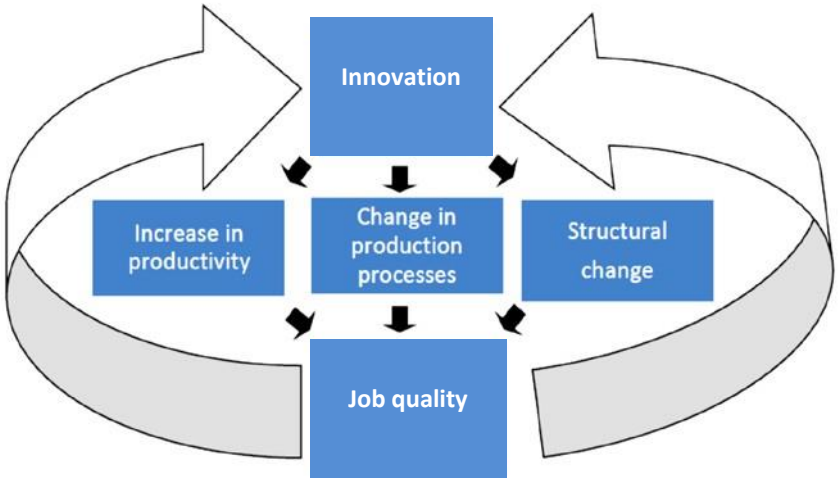
The purpose of this paper is to study the relation between innovation and job quality at the firm level for a large sample of European countries. Although often the attention on the socioeconomic implications of technical and organizational change is focused on its impact on employment (Evangelista and Savona, 2012; Van Roy and Vivarelli, 2015; Calvino and Virgillito, 2017), the potential impact of innovation goes well beyond employment, affecting all realms of labour. In this respect, it is clear, as the aim of the EU Lisbon Strategy of the early 2000s of "more and better jobs" shows, that the wellbeing of people depends not only of the level of employment, but also on the type of employment generated, and on its quality. In this regard, along with the study of the employment implications of innovation it is important to research its impact on job quality.

As argued in the general model of innovation and job quality developed in Muñoz de Bustillo *et al.* (2016), innovation and job quality are related through multiple and complex channels, going both from innovation to job quality and vice versa (Figure 1). Starting from the former perspective, innovation and the expected increase in productivity, will sooner or later translate into higher wages and lower working hours[1], two major items of job quality. Innovation will also affect the type of tasks performed, affecting thus intrinsic job quality. Lastly, innovation will have different impact in different economic activities, leading to structural change, with implications for job quality as well. The rich literature on employment polarization (Autor *et al.*, 2006, Fernández-Macías *et al.*, 2012) is a good example of such type of dynamics. Complementarily, it can be argued that job quality in itself can be a source of innovation. This is at least one of the hypotheses behind the literature of High Performance Work Systems (Hefferenan *et. al*., 2008; Eurofound, 2017).

Building on the analysis of Muñoz de Bustillo *et al.* (2016), which focused on the multiple and complex relations existing between job quality and innovation from a theoretical and empirical perspective that used the European Working Condition Survey 2010 (with rich data on job quality), we will in this paper take advantage of the data on innovation at the firm level supplied by the European Company Survey 2013 (ECS-2013) (Eurofound, 2015) to explore the nexus between innovation and job quality. In order to do so, in section two, after presenting the main characteristics of the survey, we will develop a parsimonious aggregate model of job quality built from the limited information on job quality included in the ECS-2013. In the following section we will present from a critical perspective the information supplied by the ECS-2013 regarding innovation. Section four focuses on the interrelations between innovation and job quality at the European and country levels. Finally, as customary, section five will present the discussion and the major conclusions obtained from the analysis performed.

[1] We refer here to the progressive reduction of working days from as much as 16 hours to the now standard 8 hour working day, 40-42 working weekly hours (41.4 weekly hours for the EU-28, in 2016, for full time employee).

Figure 1. Innovation and job quality



Source: Muñoz de Bustillo et al. (2016: 2).

1. Building an Index of Job Quality from the ECS data.

The third wave of European Company Survey, carried out in 2013, is a questionnaire-based representative sample survey carried out by telephone in the language(s) of the country. When possible, certain questions in the survey are addressed both to management and employees´ representatives. Each wave has a special theme, the third survey focused on issues dealing with workplace organisation, workplace innovation, employee participation and social dialogue in European workplaces. The total target sample size for the 32 countries was 30112 management interviews and 9094 employee representative interviews, for country the total sample ranged from 300 to 1650 depending on the country size. The total number of interviews achieved for the ECS in 2013 was 39206. The interviews took place from February to May 2013. The unit of inquiry is all establishments in the country with 10 or more employees in all economic activities with the exceptions of NACE agriculture, forestry and fishing, activities of the household, and activities of extraterritorial organization and bodies (for more methodological details see Eurofound, 2015).

The index of job quality developed for the analysis, the Summary Index of Job Quality, SIJQ, follows the guidelines presented in Muñoz de Bustillo *et al.* (2011), although this time due to availability reasons the index had to be tailored to the information on job quality included in the ECS. The SIJQ is composed of four different dimensions: a) Employment quality, b) Intrinsic job quality, c) Work-life balance, and d) Participation.[2] The first three dimensions are weighted by 30%, while participation contributes to the aggregate index with the remaining 10% (Equation 1). The lower weight attached to the last dimension is explained by two different considerations. The first is that it is a dimension composed by only one indicator. The second is that we only want to consider here the positive impact on job quality of participation in itself,

[2] In comparison with the five dimensions model proposed by Muñoz de Bustillo *et al.* (2011), our SIJQ doesn´t include the pay dimension and the health and safety dimension (due to the lack of information on wages and health and safety in the CES) In contrast the SIJQ includes a dimension of participation. In relation to the six dimension model developed by Erhel and Guergoat-Larivière (2017), the SIJQ excludes the wages dimension (for the reasons already mentioned) and considers the dimension of Education and Training (for which only one indicator is available in the CES) as part of the employment quality dimension.

as the positive implications of participation in other realms are already accounted for in the different remaining dimensions of the index.

(1) SIJQ = (Dimension 1 x 0.3) + (Dimension 2 x 0.3) + (Dimension 3 x 0.3) + (Dimension 4 x 0.10)

Table 1 reproduces the indicators used to construct each of the dimensions of the SIJQ. It is convenient to stress that the SIJQ has an interpretation that is different from job quality indexes such as the IJQ, built from individual data (i.e. data regarding the characteristics of individual jobs). In this case, the data (every data point) refers to companies, not individual employees, and in that respect each individual SIJQ would be an approximation of the average job quality of the company interviewed, not a representation of the job quality of a given job- employee.

Table 1. Indicators of the Summary Index of Job Quality, SIJQ

Dimension	Indicator	Question of ECS2013
(1) Employment quality	% of employees with a permanent contract	Q33A
	% of employees working in jobs which require at least one year of on the job learning	Q16
	Employees are hired with the intention to employ them for a long time	H11B
	Does the management encounter difficulties in retaining employees	P1C
(2) Intrinsic quality	Who normally decides on the planning and execution of the daily work tasks of the employees at this establishment?	Q27 (Employees 1; Managers 0; Both 0,5)
	Does the management encounter high level of sickness leave x (-1)	P1A
	Does the management encounter low motivation of employees (-1)	P1E
(3) Work-life balance	Approximately what percentage of employees have the possibility to adapt – within certain limits - the time when they begin or finish their daily work according to their personal needs or wishes?	H14
	Is it possible for employees to use accumulated overtime for days off? This can be full or half days	H16 (Yes, for all employees: 1; Yes, for some employees 0.5. - No: 0)
(4) Participation	Are employees in this establishment covered by any of the following collective wage agreements?	ER1 (ER6)

Source: Author´s analysis from ECS2013.

Table 2 reproduces the results of the SIJQ and its dimensions for the 28 Member States of the EU plus Iceland, Macedonia, Montenegro and Turkey. In spite of the limited number of variables used in the construction of the SIJQ, with relevant variables such as wages completely missing from the index, the results obtained are reasonably alike other results obtained based on larger sets of indicators such as the Index of Job Quality, IJQ, developed by Muñoz de Bustillo *et al.* (2011) and Antón *et al.* (2016).[3] That is the case, for example, when we look at the ranking of countries represented in Figure 2, with the Scandinavian countries

[3] See Figure A.1 in the Appendix.

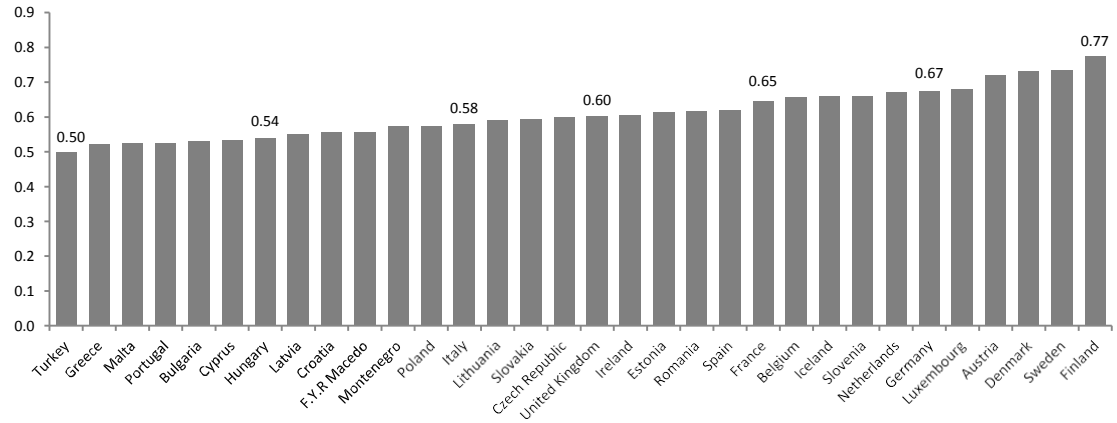
occupying the top positions, and the Eastern and Southern countries the lower positions. A major difference in this respect is the position of the UK, which usually occupies higher positions in these types of rankings. This difference is probably related to the lack of the wage dimension in the SIJQ.

Table 2. Summary Index of Job Quality and index´s dimensions in 32 European countries.

	SIJQ	Employment quality	Intrinsic quality	Work-life balance	Participation
Belgium	0.657	0.800	0.597	0.566	0.676
Bulgaria	0.530	0.745	0.605	0.255	0.486
Czech Republic	0.600	0.731	0.624	0.550	0.281
Denmark	0.732	0.766	0.715	0.665	0.877
Germany	0.674	0.813	0.652	0.651	0.390
Estonia	0.615	0.767	0.585	0.556	0.425
Ireland	0.607	0.781	0.655	0.429	0.472
Greece	0.521	0.773	0.656	0.235	0.216
Spain	0.621	0.781	0.631	0.419	0.714
France	0.646	0.781	0.623	0.521	0.683
Croatia	0.556	0.738	0.612	0.373	0.396
Italy	0.579	0.760	0.548	0.464	0.471
Cyprus	0.533	0.725	0.677	0.246	0.384
Latvia	0.549	0.721	0.581	0.459	0.212
Lithuania	0.590	0.685	0.593	0.464	0.682
Luxembourg	0.681	0.837	0.565	0.637	0.695
Hungary	0.538	0.688	0.580	0.411	0.347
Malta	0.524	0.689	0.611	0.375	0.213
Netherlands	0.670	0.764	0.651	0.585	0.704
Austria	0.720	0.846	0.702	0.698	0.463
Poland	0.574	0.695	0.590	0.469	0.477
Portugal	0.524	0.688	0.579	0.413	0.197
Romania	0.618	0.745	0.630	0.443	0.722
Slovenia	0.660	0.771	0.601	0.631	0.595
Slovakia	0.593	0.730	0.561	0.514	0.509
Finland	0.775	0.856	0.690	0.745	0.880
Sweden	0.735	0.790	0.737	0.694	0.689
United Kingdom	0.603	0.772	0.706	0.432	0.304
Iceland	0.660	0.774	0.639	0.465	0.966
Montenegro	0.574	0.736	0.634	0.426	0.354
F. Y. R. Macedonia	0.557	0.723	0.633	0.400	0.301
Turkey	0.499	0.720	0.525	0.287	0.396

Source: Author´s analysis from ECS2013 microdata.

Figure 2. SIJQ for 32 European countries



Source: Author´s analysis from ECS2013 microdata.

3. INNOVATION IN THE ECS2013

The information about innovation in the ECS2013 is encapsulated in a single question asking whether in the last 3 years (since the beginning of 2010) the establishment has introduced innovation in four different areas: marketing, products, production processes and organization (Table 3). In doing so, the survey follows closely the four types of innovation considered in the Oslo Manual (2005: 165), according to the OECD the "foremost international source of guidelines for the collection and use of data on innovation activities in industry". Unfortunately, although the questionnaire is rich in addressing all different sources of innovation, the answer is binary: yes/no, and thus does not offer indications about the intensity of the innovation. Our analysis will consider all the above mentioned types of innovations. On the one hand, technical innovations: product and process; on the other hand, non-technical innovation: organisational and marketing.

It could be argued that the connection between marketing innovation and job quality is dimmer and of a different kind vis a vis the other types of innovation, for at least for two different reasons. Firstly, if successful, the connection between marketing innovation and job quality would be undistinguishable from an exogenous increase in effective demand. Secondly, because marketing innovations are to a large extent decoupled from production and organizational technologies and should not affect largely job quality outside of the marketing department itself. Nevertheless, although indirectly, it is possible to think of different mechanism linking both items (marketing and job quality). To name two, we can think in marketing techniques, for example those related with direct marketing performed by employees of the firms while doing other tasks (*e. g.* cashiers at the checkout point of a grocery store that inform customers of the bargain of the day) with implications for job quality. From a different perspective, some companies may brand themselves as an ethical employer (a marketing innovation) with potentially sweeping implications across companies. In HRM "employer branding" is a growing field (Edwards, 2019), and is essentially either window-dressing, or marketing led job quality transformation. For these reasons, and in in order to have a complete picture of the forms of innovation carried out by European firms, we have included information regarding marketing innovation (the average of the two questions addressed to firms included in Table 3) along with the other types of innovation considered *ex-ante* more relevant to our analysis: technical and organizational.

Table 3. Variables of Technical Innovation in the ECS

Denomination	Question	N.
Marketing innovation	Any new or significantly improved marketing methods?	Q31
	Any new or significantly improved methods of communicating your activities to the public?	Q32
Product innovation	Any new or significantly changed products or services (either internally or externally)?	Q33
Process innovation	Any new or significantly changed processes, either for producing goods or supplying services?	Q23
Organizacional Innovation	Any organizational change? (*New business practices for organizing procedures, new methods of organising work responsibilities and decision making; New methods of organising external relations with other firms or public institutions;]*	Q25

Source: ECS2013.

Table 4 reproduces the indicators of technical (product and process), organizational and marketing innovation for the 32 countries of the sample, together with an overall Indicator of Innovation II, constructed as the average (at the firm level) of all the types of innovation considered. A first look at the results shows that a large percentage of firms declare to have introduced innovations in the last five years: on average 46 % in the case of product innovation, 42% in the other two types of innovations and 37% in the case of marketing. The dispersion between country scores is higher in the case of organizational innovation, a standard deviation of 11, compared to technical innovation, landing around 7-8.

In order to have a better look at the results, Figure 3 reproduces the data of Table 4, but this time ordered from lower to highest level of innovation. The first thing that stands out from Figure 3 is the relative odd ordering of countries resulting from the data. The frontrunners of innovation in other indexes, such as the *EU Innovation Scoreboard*,[4] like Germany, are placed in lower positions in the classification resulting from the ECS data on innovation. In order to see in greater detail the existing gap between the country value of the EU Innovation Scoreboard and the Overall Index of Innovation obtained from the CES, in Figure 4 we reproduce the country values of both indexes. As the EU Innovation Scoreboard is an aggregate index formed by three different dimensions: Enablers, Firm Activities and Outputs, the comparison has been done with a specific index constructed with those indicators included in the scoreboard directly related to firms: those included in the dimension of Firm Activity and those related with Innovators in the Output dimension.

Going back to the unexpected position in the innovation ranking of some of the countries included in Table 4 and Figure 3, several factors might explain these results. First, the innovation index we are using is of a subjective nature, reflecting the opinion of the manager. Moreover, innovation has a positive feeling to it, always related to dynamism, good management, etc. In this respect it is fairly possible that there will be a tendency for management to answer positively. This explanation, though, raises another question, as in order to affect the relative outcome the rate of overestimation among countries has to be different, i.e. in some countries managers would have to be more complacent about themselves in this regard than in others.

Second, it could be argued that the position occupied by some of the Eastern countries, such as Montenegro, quite high in the ranking, might be related to the process of structural restructuring associated with the still relatively recent transition from a planned to a market economy, but even so, the results are not those that might be expected. In relation to the countries usually considered as highly innovative, such as Germany, located in our index in the lower end of the ranking, using a similar argument, we could say that in those countries where most firms are already at the frontier of innovation, only a small number of firms will innovate,

[4] See http://ec.europa.eu/growth/industry/innovation/facts-figures/scoreboards

those developing new processes or products, as most firms will already be using the most updated technology or organisational practices (Makó and Illéssy, 2015)

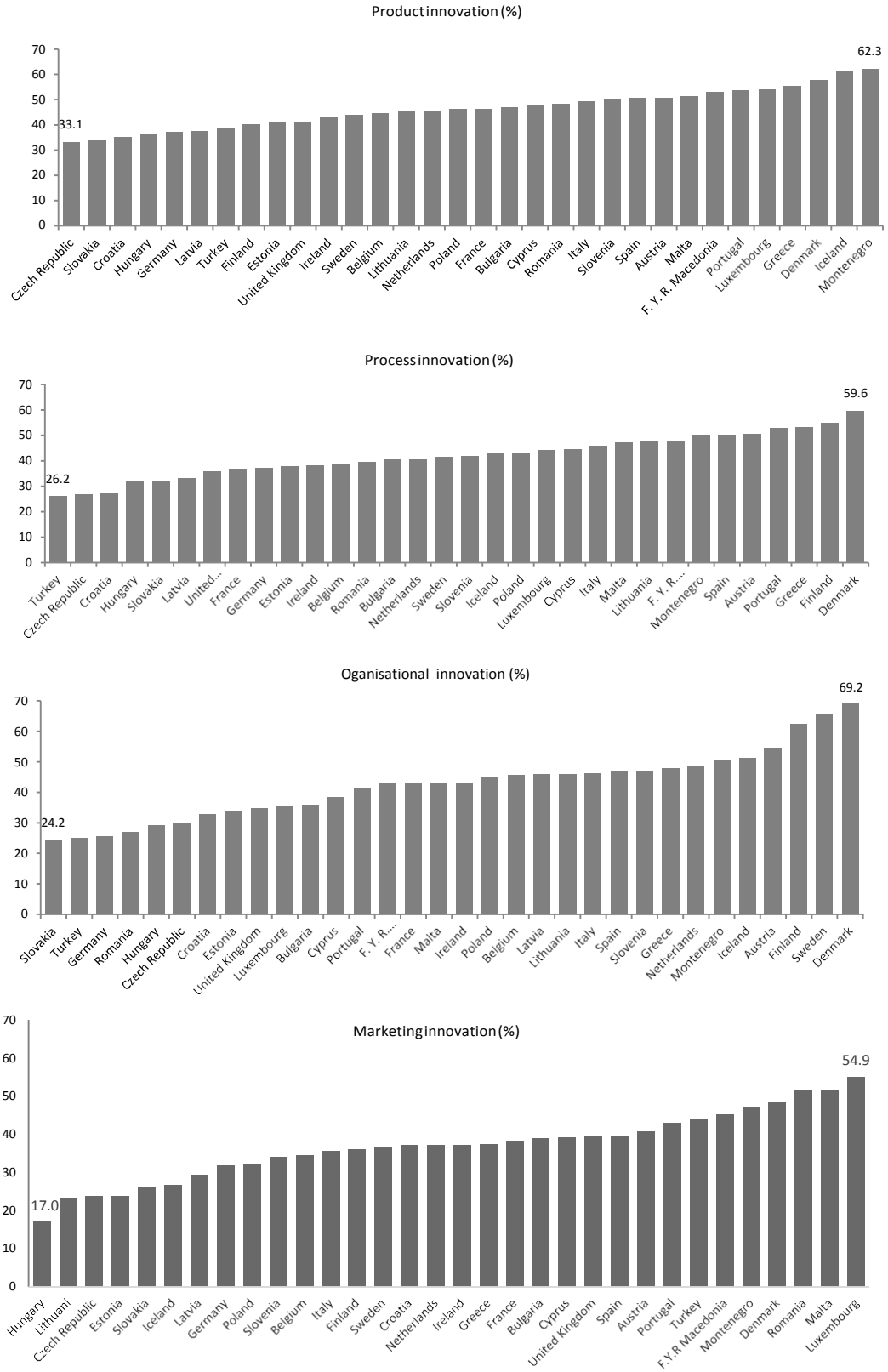
Third, it is important to stress that the index only applies to firms with 10 or more employees. If countries vary, as they do, in the size composition of firms, then the comparison would be compromised, as we would be comparing different portions of the economy (in terms of share of total establishments covered by the survey). In this respect, medium firms in countries with a larger share of small firms might behave different that medium firms in countries where such type of firm is the norm.

Table 4. Innovation in 32 European countries according to the ECS 2013

	Technological		Organisational	Marketing	Overall
	Product (%)	Process (%)	(%)	(%)	(%)
Belgium	44.6	38.9	45.7	42.2	34.5
Bulgaria	46.9	40.5	35.8	41.4	39.0
Czech Republic	33.1	26.8	30.1	30.2	23.8
Denmark	57.9	59.6	69.2	62.0	48.4
Germany	37.1	37.1	25.6	33.7	31.9
Estonia	41.1	37.8	33.8	37.6	23.8
Ireland	43.2	38.1	42.8	40.9	37.2
Greece	55.2	53.4	48.0	52.1	37.3
Spain	50.7	50.2	46.6	48.9	39.4
France	46.5	36.8	42.7	42.0	38.1
Croatia	35.3	27.1	32.7	32.0	37.1
Italy	49.4	46.0	46.2	47.2	35.6
Cyprus	48.1	44.6	38.4	44.1	39.1
Latvia	37.5	33.3	46.0	40.0	29.4
Lithuania	45.5	47.7	46.0	47.3	23.0
Luxembourg	53.9	44.3	35.5	43.8	55.0
Hungary	36.3	31.8	29.2	32.3	17.0
Malta	51.3	47.3	42.8	46.1	51.6
Netherlands	45.7	40.7	48.5	44.9	37.2
Austria	50.7	50.7	54.6	51.5	40.6
Poland	46.5	43.4	44.7	44.7	32.2
Portugal	53.8	53.0	41.5	49.0	42.9
Romania	48.2	39.7	27.0	39.4	51.3
Slovenia	50.3	41.9	46.8	46.2	34.1
Slovakia	33.7	32.3	24.2	30.8	26.1
Finland	40.1	55.1	62.3	52.8	36.1
Sweden	44.0	41.7	65.3	50.7	36.4
United Kingdom	41.2	35.8	34.6	38.1	39.3
Iceland	61.6	43.3	51.2	53.0	26.6
Montenegro	62.3	50.2	50.7	54.3	46.9
F. Y. R. Macedonia	53.1	47.9	42.7	47.5	45.1
Turkey	38.8	26.2	24.9	31.6	43.8
Standard deviation	7.58	8.26	11.07	7.68	8.88

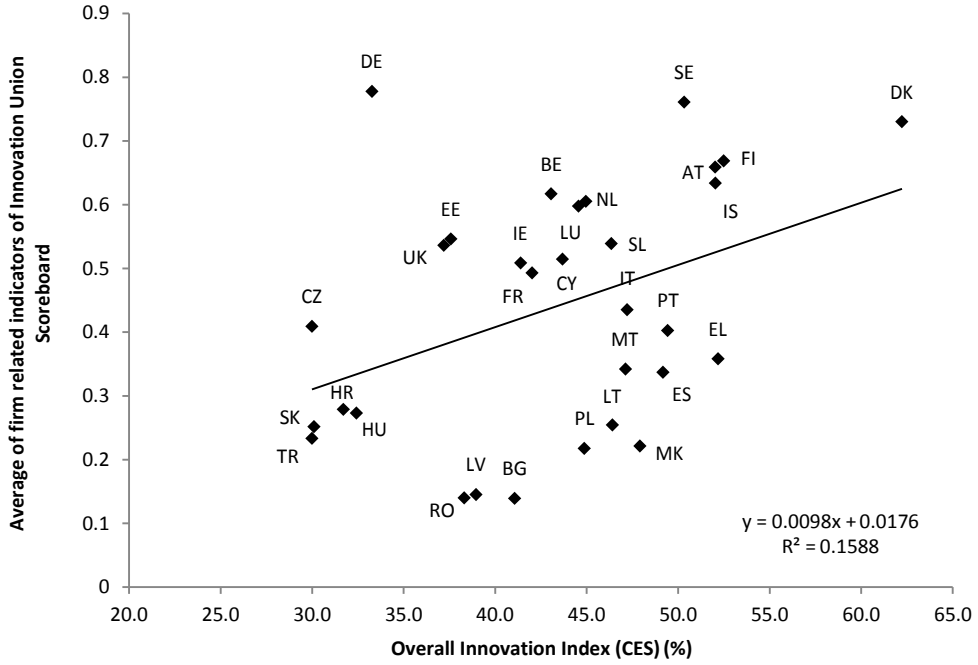
Source: Author´s analysis from ECS2013 microdata

Figure 3: Intensity of innovation (%) by type and country, from lowest to highest innovation rate.



Source: Author´s analysis from ECS2013 microdata.

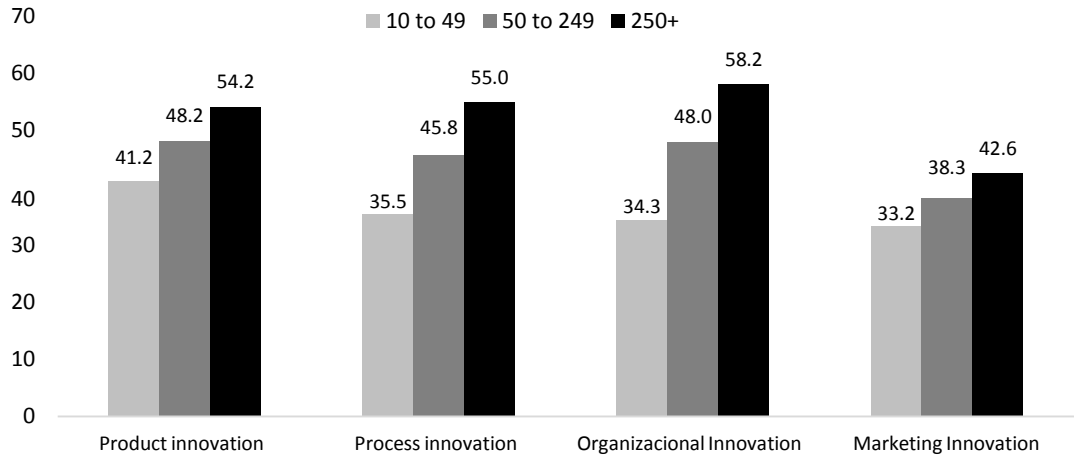
Figure 4: Relation between the averages of firm related indicators of the EU Innovation Scoreboard for 32 European countries (2013) and the Overall Innovation index.



Source: Authors' analysis from CES (2013) and Innovation Union Scoreboard (2014) p. 92-93

Regarding the former topic, as we can see in Table 5, the data of the ECS is representative, at the most, of 1/4 of the firms. The diversity in size composition of firms among the countries of the sample is important because, as reproduced in Figure 5, there is a positive correlation between the size of firms and innovation rates. In this regard, large firms (250 or more employees) have an index of organisational innovation 70% larger than firm with 10 to 49 employees, 55% larger in the case of process innovation and 31 % larger in the case of product innovation. As we can see, regarding innovation, sizes matter.

Figure 5. Innovation by firm size in the Europe (32 countries)



Source: Author´s analysis from ECS2013 microdata.

Table 5. Distribution of firms in terms of size (%)*

	From 1 to 4 employees	From 5 to 9 employees	10 and more employees
Netherlands	56.3	18.8	24.9
Lithuania	53.4	22.3	24.3
Luxembourg	61.2	17.3	21.5
Malta	65.3	14.9	19.8
Germany	63.1	17.5	19.4
Czech Republic	67.5	15.3	17.2
Latvia	68.4	14.4	17.2
Austria	66.2	16.9	17.0
Belgium	69.0	14.6	16.4
Denmark	71.1	12.8	16.1
France	67.6	17.0	15.4
Bulgaria	71.8	12.8	15.3
Sweden	69.9	14.9	15.2
Finland	72.8	12.4	14.8
Average (simple)	71.0	14.1	14.9
Estonia	72.7	13.5	13.8
United Kingdom	76.0	12.2	11.8
Portugal	74.3	14.2	11.5
Croatia	75.5	13.1	11.4
Italy	76.3	12.9	10.8
Slovenia	78.7	11.1	10.3
Hungary	80.6	10.4	9.0
Slovakia	82.8	8.5	8.7
Romania	82.4	9.0	8.6
Spain	80.3	11.5	8.2

* Industry, construction and services except insurance activities of holding companies
Source: Authors´ analysis from Eurostat (Employer business demography by size class).

3. INNOVATION - JOB QUALITY NEXUS IN THE EU

After presenting the data regarding job quality and innovation in European companies, in this section we will investigate whether job quality and innovation are related, as well as the nature of such a relation. As mentioned in the introduction, there are multiple potential relations between innovation and job quality, going both from innovation to job quality (through increase in productivity, for example) and from job quality to innovation (through better identification of employees with the firm and better collaboration and complicity when innovations are introduced, for example). Although the limited availability of information included in the job quality index developed from ECS data preclude us from doing a detailed investigation of such relations, not to say researching the underlying causality, in what follows we will test, first graphically and later on by regression analysis, the existence and type (positive or negative) of such relations.

In order to the present the data and due to the different nature of the innovation and job quality indicators used in the analysis, we have considered it convenient to use Z-scores to generate standardized variables of the items of interest. As is well known, Z-scores allow expressing the variables in terms of standard deviations from their means. We use such a

transformation of the variables to make sure that all the variables have the same scale when items are added together. Moreover, these transformations facilitate the interpretation of the results in a standardized regression model, as the one used further down. The formula for calculating z-score is the value of the element, *x*, less the population mean, *m*, divided by the standard deviation, *sd* (Equation 2) As result, these z-scores have a distribution with a mean of 0 and a standard deviation of 1.

$$(2)\ \text{Z-score} = (x\text{-m})/sd.$$

Figure 6 reproduces the bi-plots of the Z-scores of the SIJQ and the Overall Innovation Index, II, (Figure 6a) as well as the relations between the SIJQ and the four different major types of innovation considered in the paper: product (Figure 6.b), process (Figure 6.c), organizational and (Figure 6.d) and marketing (Figure 6.e). As we can see, there is an overall positive relation between job quality and innovation (R^2= 0,111). This positive relation between the variables is almost fully explained by the organisational innovation that shows a very intense relation with job quality (R^2 =0,307) and to a lesser extent to marketing innovation (R^2 = 0.152). The bi-plot representing product innovation and job quality shows no relation at all, while the positive relation between process innovation and job quality is very weak.

Figure 6a. Relations at country level between job quality, SIJQ and overall Index of Innovation (Z-scores)

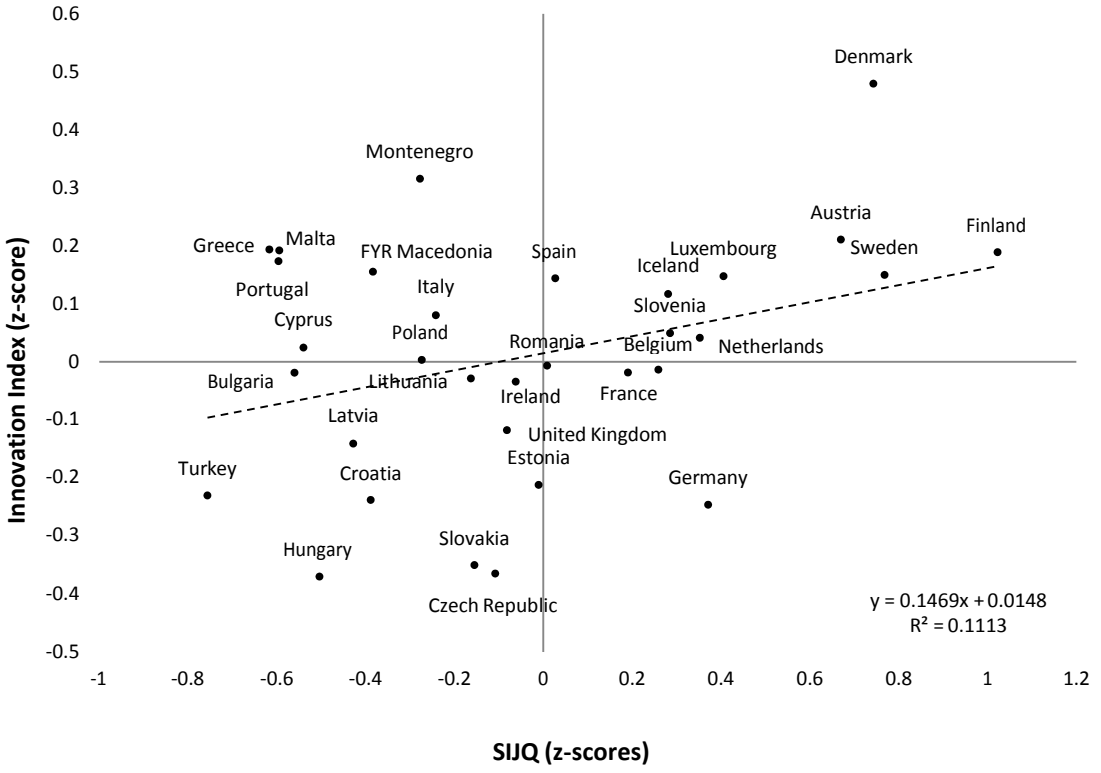
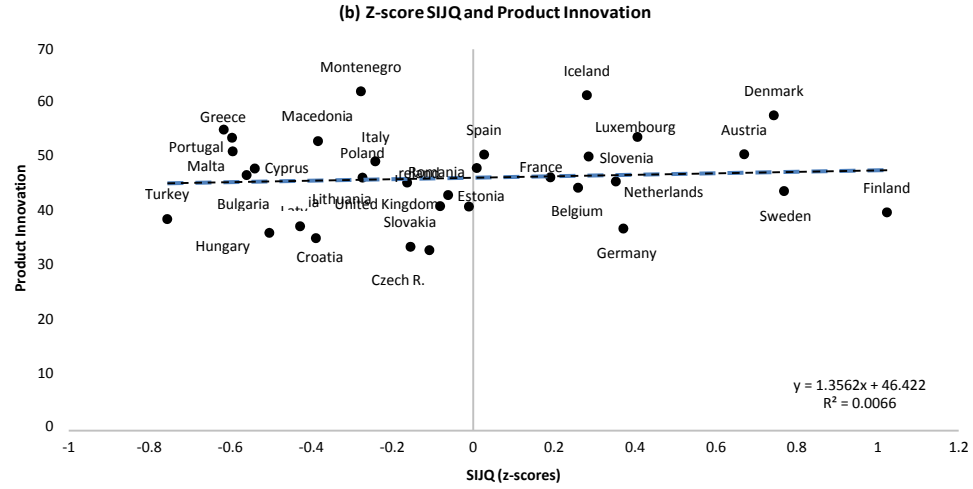
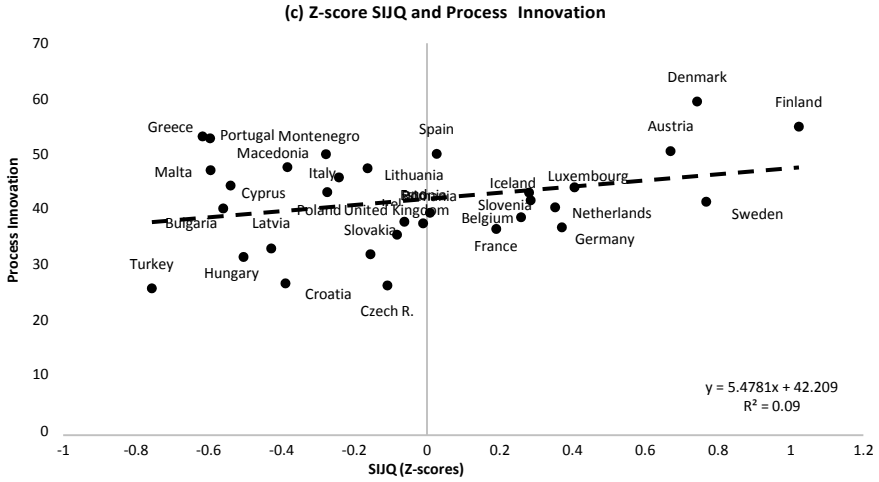
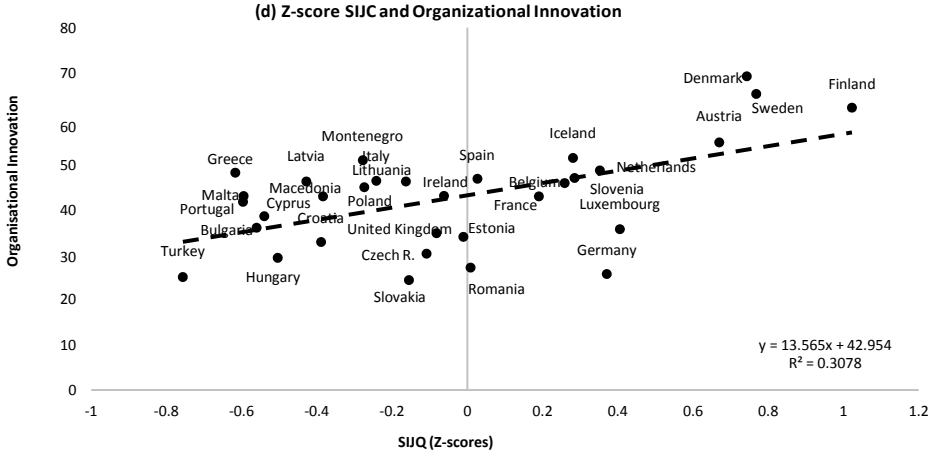
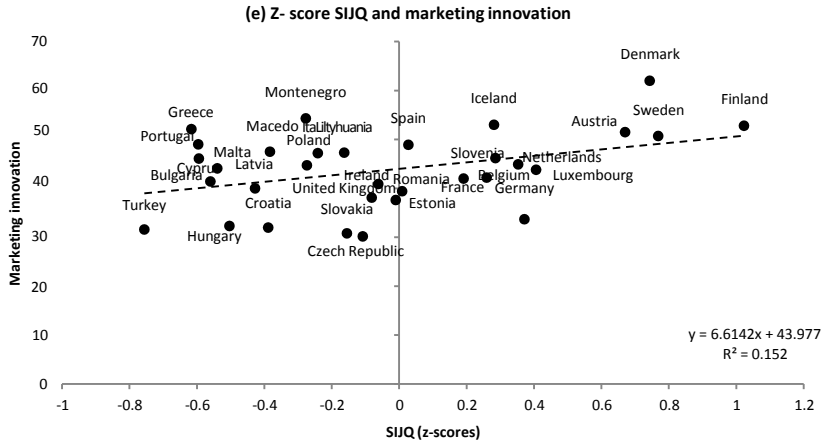


Figure 6b-e. Relations at country level between job quality, SIJQ and innovation (Z-scores product, process organisational and marketing)









Source: Author´s analysis from ECS2013 microdata.

In order to study in more detail the links between innovation and job quality, we have conducted a lineal regression, with job quality as the dependent variable, and all the different types of innovations considered in the ECS-2013 as independent variables, together with a limited number of other independent variables potentially related with job quality. The independent variables are grouped in the following 3 different models. Model 1 incorporates exclusively the variables related to innovation (product, process, organizational and marketing innovation). Model 2 excludes innovation and adds elements related to the firm and its workforce available in the ECS-2013: size, rate of feminization (% of female employees), workers older than 50 years of age (%), share of employees with university degree, productive activity of the firm, absence of outsourcing of production, public or private nature of the firm and type of firm (single, headquarter or subsidiary). Model 2 also adds variables related to the employment history of the firm and the system of industrial relation in place: participation of the firm in employers´ associations, collective bargaining and growth in employment since 2010. Finally, Model 3 brings together the types of innovation and the other independent variables related to the firm and industrial relation system. In addition, as an important control variable, in these three models we introduce country dummies of the 32 countries included in the survey.

Table 6 reproduces the results of the three models mentioned above. Before being absorbed in the details, the first thing worth mentioning is that keeping in mind the proxy nature of the SIJQ, the complete model shows a certain capacity of explanation, with an adjusted R^2 of 0,254.

The first result worth mentioning is that the regression analysis shows a positive and significant effect of the four different types of innovation on job quality. However, when controlling according to elements related to the firm and the employer-worker relationship system (Model 3), the results contradict what was shown in Figure 6. Although the four beta coefficients of the variables related to innovation have the expected positive effect, only process innovation and, with lower statistical significance, product and marketing innovation are relevant dependent variables in the complete model when one controls for the characteristics of firms. We could say that the positive relationship shown in Figure 6(d) between organizational innovation and the SIJQ was a mirage produced by the correlation between organizational innovation and other variables considered in the model with positive impact on job quality, but absent from the bi-plot. Something similar happens with marketing innovation, its influence and significance decreases as other characteristics of the firms are included in the model.

Secondly, turning our attention now to the elements related to the firm, the models show their importance both directly and as aforementioned in conjunction with control effects on innovation. Regarding the size of the firms, and taking firms from 50 to 249 employees as the reference variable, size has an inverse relationship to job quality: smaller firms have significantly higher job quality, even after controlling for the effect of innovation. As for the demographic variables, the presence of women in the firm, as expected (Stier and Yaish, 2014), correlates negatively with job quality. The gender-segregated workplaces in general have lower job quality than gender-integrated workplaces. However, when we control by the effect of the types of innovation, we observe that greater feminization of the employees is related to a less job quality; although (statistically speaking) we cannot say the opposite regarding firms highly “masculinized”. The age structure (measured by the percentage of older workers) has a negative, but marginal impact on job quality regardless of whether we control or not for innovation (firms with more than 60% of the workers with more than 50 years have worse job quality). In contrast, educational structure has a very significant effect on job quality in the expected direction: the higher the share of employees with university degrees in the firm job quality grows the higher the SIJQ.

Thirdly, taking industry as the activity of reference, financial services and other services show higher job quality, while working in construction and transport and communication has the opposite implication in terms of job quality. After the introduction of the innovation variables in model 3, we note that commerce and hospitality have significantly worse job quality than industry. These results show that (higher) job quality in the commerce and hospitals sector is closely related to innovation. Another clear, if surprising, result is the negative impact on job quality of being headquarters of the firm. In contrast, being a single company and a public-sector firm has a positive impact on job quality. The negative role of being a headquarters is maintained but decreases in intensity and statistical significance with the introduction of the innovation variables of Model 3.

Fourthly, a particularly relevant result worth mentioning is the effect of outsourcing of production on job quality. Outsourcing production has a positive effect on job quality (probably explained by the type of jobs outsourced: those of lower quality), however when controlling for the types of innovation this effect reduces its statistical significance.

Fifthly, past employment history of the firm has an asymmetric impact depending on whether employment has increased or decreased in the period 2010-2013. Employment growth in the period 2010 to 2013 doesn't affect job quality. In contrast, those firms with reductions in employment levels during the period have clearly lower job quality in the present, i.e., downsizing lowers job quality and its effect increases when we control for innovation.

Lastly, variables related to industrial relations have a very important role in the regression analysis. In both Model 2 and 3, the existence of collective agreements is clearly related to better working conditions. The same effect is also found (although with less intensity) regarding the participation of the firm in employers' organizations.

Although our Summary Index of Job Quality (SIJQ) includes participation as one of its dimensions, measured as having collective bargaining in the firm (although only weighted by 10%), and so the relation between having a union representative in the firm and SIJQ is expected to be positive and has been excluded for the above reviewed regressions, we have considered it relevant to examine its relationship to the four types of innovation in more detail. In order to do so, we have developed a fourth model, including all variables but only run for companies with union representation and a fifth model run only for companies without representation. In Figure 7 we represent the beta coefficients of the innovation dummies of these two models. In the firms with employee representation, process and organisational innovation has a significant positive effect on job quality. In contrast, in firms without employee representation, organisational innovation does not have this significant effect (the relationship is similar with respect to process innovation). These results confirm the importance of having a union representative in the workplace and collective voice to boosts job quality for employees (Hoque *et al.,* 2017). It is striking that for companies that do not have union representation marketing innovation has an inverse relationship with job quality.

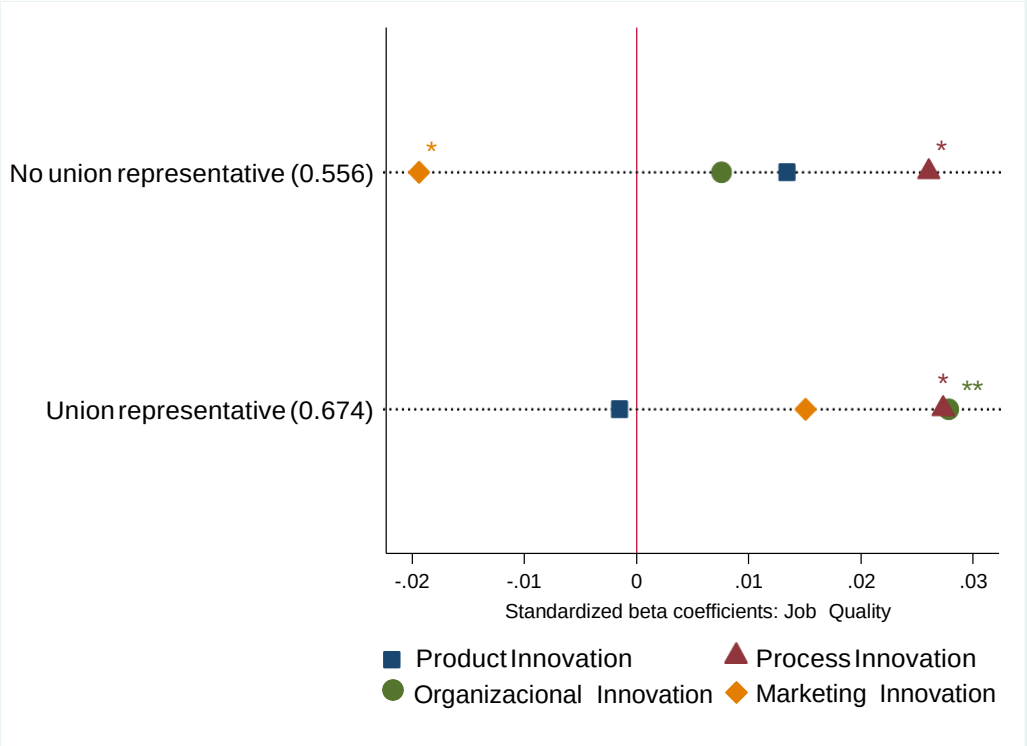
Table 6: Determinants of Job Quality in 32 European countries (2013)

		Model 1			*Model 2*			*Model 3*		
		Beta	(Std. Err.)	Sig.	Beta	(Std. Err.)	Sig.	Beta	(Std. Err.)	Sig.
Innovation product		0.023	0.0021	**				0.015	0.002	*
Innovation process		0.040	0.002	***				0.034	0.002	***
Innovation Organizacional		0.032	0.002	***				0.008	0.002	
Innovation Marketing		0.024	0.002	***				0.012	0.002	*
Establishment size	10 to 49				0.030	0.002	***	0.035	0.002	***
	50 to 249				ref.			ref.		
	250+				0.006	0.003		0.003	0.003	
% female	Lees than 40%				-0.011	0.002	*	-0.007	0.002	
	40% to 59%				ref.			ref.		
	60% or more				-0.038	0.003	***	-0.038	0.003	***
% older than 50 years of age	Lees than 40%				-0.003	0.003		0.001	0.003	
	40% to 59%				ref.			ref.		
	60% or more				-0.011	0.005	*	-0.012	0.005	*
% university degree	Lees than 40%				-0.091	0.003	***	-0.087	0.003	***
	40% to 59%				ref.			ref.		
	60% or more				0.077	0.004	***	0.077	0.003	***
NACE	Industry				ref.			ref.		
	Construction				-0.032	0.003	***	-0.029	0.003	***
	Commerce and hospitality				-0.017	0.003	*	-0.019	0.003	**
	Transport and communication				-0.030	0.004	***	-0.029	0.004	***
	Financial services and real estate				0.049	0.005	***	0.049	0.005	***
	Other services				0.040	0.003	***	0.040	0.003	***
Outsourcing production					0.025	0.002	***	0.017	0.002	**
Establishment company organization	Singel company				0.016	0.003	*	0.016	0.003	*
	Subsidiary site				ref.			ref.		
	Headquarters				-0.036	0.003	***	-0.031	0.003	**
Private (Public)					-0.037	0.003	***	-0.036	0.003	***
Employers' organisation					0.042	0.002	***	0.039	0.002	***
Collective bargaining					0.080	0.002	***	0.078	0.002	***
Number of employees sice 2010	Increased				0.008	0.002		-0.002	0.002	
	Stayed about the same				ref.			ref.		
	Decreased				-0.029	0.002	***	-0.032	0.002	***
Number of obs		25007			22237			22062		
R-squared		0.226			0.270			0.273		
Adj R-squared		0.225			0.269			0.271		
Root MSE		0.880			0.133			0.132		

*** significant at 99%; ** significant at 95%; * significant at 90%

Control variable: dummies of the 32 countries included in the ECS
Source: author's elaboration from European Company Survey (2013) microdata.

Figure 7. Effect (standardized beta coefficients) of types of innovation on the job quality by employee´s representation, 2013. Between parenthesis the country SIJQ

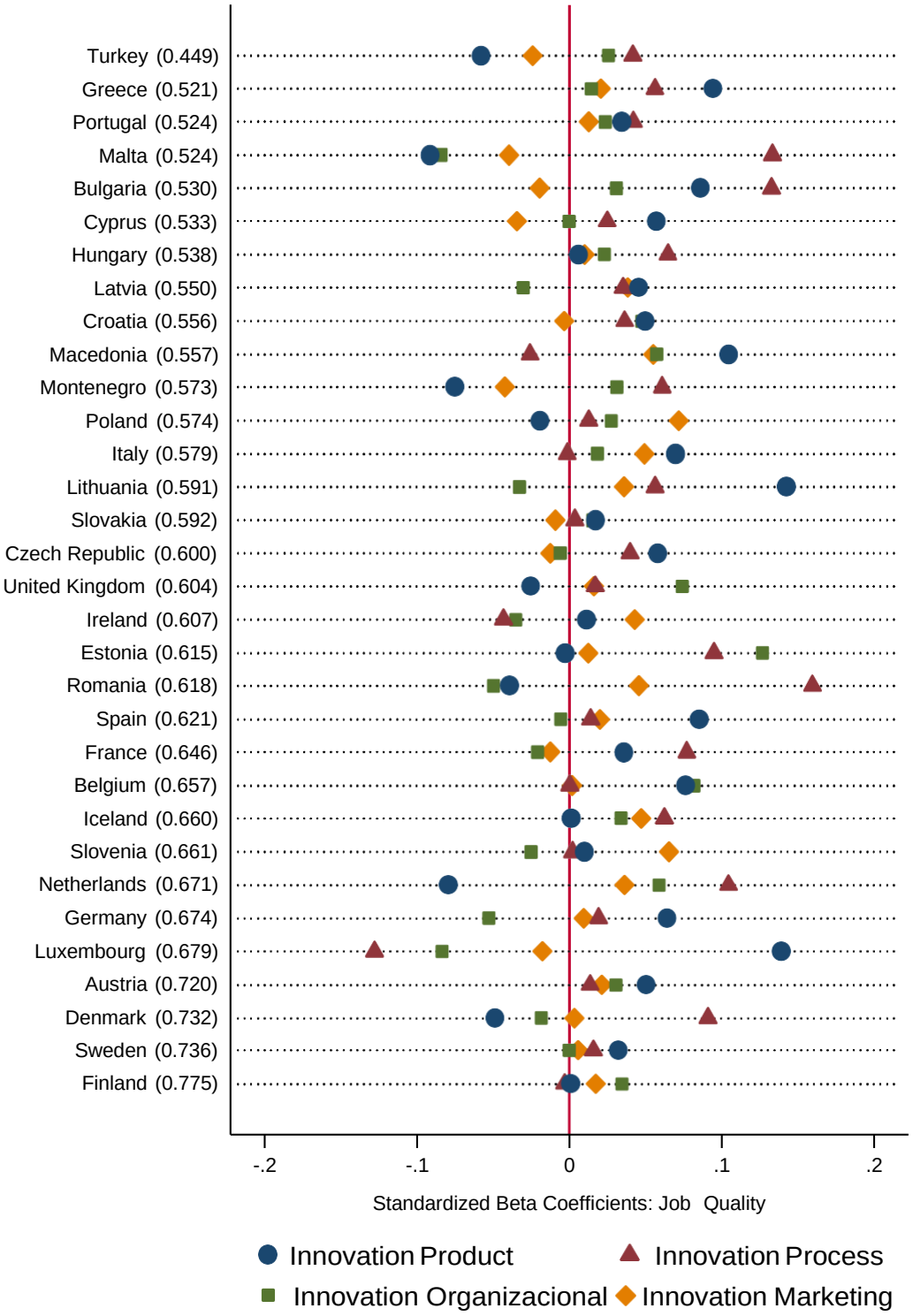


*** significant at 99%; ** significant at 95%; * significant at 90%

Control variable: dummies of the 32 countries included in the ECS, establishment size, % female, % older than 50 years of age, % university degree, sector, outsourcing production, establishment company organization, private or public firm, employers' organization, collective bargaining and number of employees since 2010.

Source: author's elaboration from European Company Survey (2013) microdata.

Figure 8. Effect (standardized beta coefficients) of types of innovation on the job quality by country, 2013. Between parenthesis the country SIJQ.



Source: author's elaboration from European Company Survey (2013) microdata.

Finally, as mentioned, starting with the first model, country dummies have been introduced to control for the differences in innovation culture that could influence how firms interpreted the question regarding innovation (Figure 8). The dummies also account for other differences among countries not included in the model. The estimates show the complexity of the

relationship between innovation and job quality. They emphasize that those countries with the highest job quality index (Scandinavian countries) have lower beta coefficients, *i.e.*, the effect of different types of innovation is more limited in these countries.

Summing up, the analysis of the firm data of the ECS shows the existence of a clear positive relation between process and product innovation (in this order, highest first) and job quality (as measured by the aggregate SIJQ). The analysis also points to the importance of past employment history of the firm, with a strong negative impact on job quality in cases of downsizing and no effect in terms of statistical significance in cases of growing employment. Finally, it is worth mentioning the important positive effect of having collective bargaining (and employee representation) in the firm on job quality.

5. CONCLUSIONS

Along with measurement issues, one of the major problems of the study of innovation's implications for job quality at the firm level is the lack of suitable data offering simultaneously information on job quality and innovation. This paper aimed at increasing our knowledge of this question by exploring the microdata of the 2013 European Company Survey. This survey includes a limited number of variables related to job quality, while at the same time it includes items on innovation in firms, drawing on the four types identified in the Oslo Manual: product, process, organisational and marketing. Among the conclusions obtained from the analysis we would like to highlight the following:

a) Starting with the innovation-job quality relationship, according to the data, the implications of innovation by the firm for job quality are quite different depending on the type of innovation. The types of innovation that show greater (and positive) impact on job quality are process and product innovation (in this order) and marketing innovation), while organisational, after controlling for other variables affecting job quality, doesn´t seem to have any statistically significant impact on job quality. This result is coherent with the results obtained with employee data (European Working Condition Survey) and a much richer index of job quality by Muñoz de Bustillo *et al.* (2016).

b) Labour relations do matter for job quality; having collective bargaining at the firm has a positive and large impact on the SIJQ. Furthermore, our complementary analysis on the impact of having employee representative in the firm confirms the role of trade unions in facilitating the translation of innovation into higher job quality in the firm.

c) The evolution of employment in the firm in the past has an asymmetric impact on job quality, as job quality decreases significantly with the reduction of employment but does not increase with the same intensity (or statistical significance) with the growth of employment in the firm.

Although these results contribute to a better understanding of the relationship between innovation and job quality (and the determinants of job quality) at the firm level, it is important to stress, before concluding this paper, that nothing has been said about the causality between the variables or the possibility of having mutually reinforcing dynamics: i.e. innovation leading to improvements in job quality that leads to further innovation. The exploration of the key issue of causality is unfortunately beyond the possibilities offered by the ECS.

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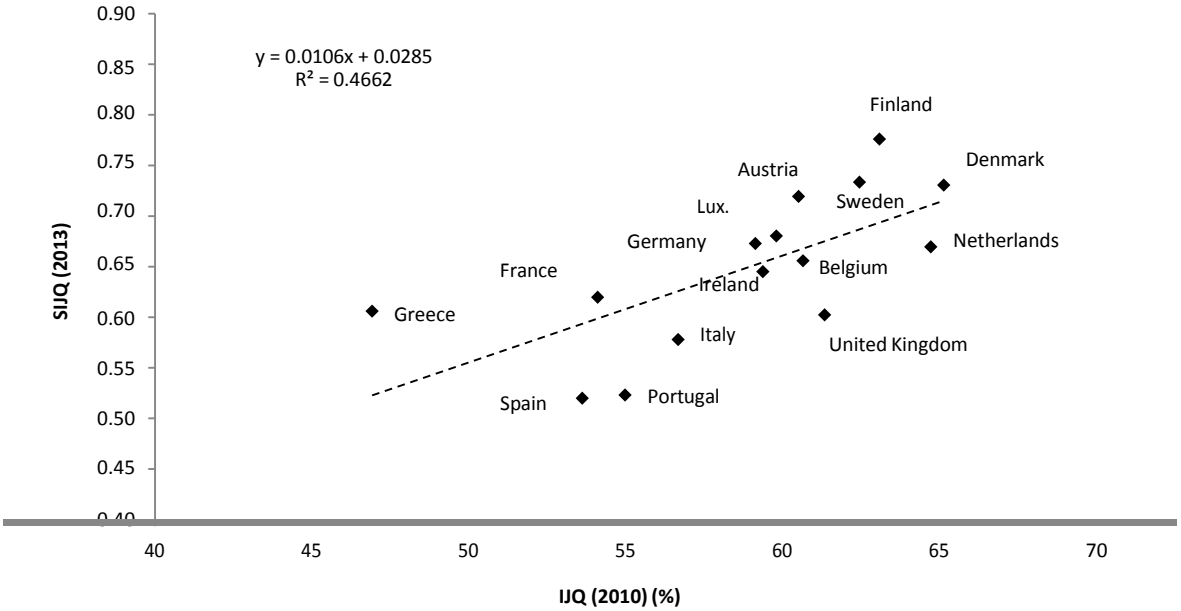
APPENDIX

Figure A.1. Relation between the SIJQ based on ECS data and the Index of Job Quality, IJQ, based on EWCS data. EU(15)



Source: author's elaboration from European Working Conditions Survey (2010) and European Company Survey (2013) microdata