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## **CROSS-NATIONAL CORRESPONDENCE ANALYSIS OF GENERATIONAL DIFFERENCES IN THE PERCEPTION OF WORK CONDITIONS**

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**Summary:** The paper attempts to verify the hypothesis of the existence of generational differences in the perception of the conditions and quality of work. The research issues considered in this paper are chosen following the regularities observed in the labor markets indicating that special attention should be paid to two age groups: the youngest and the oldest persons. The highest unemployment rate in the EU is observed among young people who encounter various barriers at the beginning of their professional career. On the other hand, the older group of people is expected to provide an important contribution to the labor force to face the problem of aging societies. The objective labor market indicators should be confronted with the results of the subjective opinions of the labor market participants in order to have a comprehensive outlook of the situation. The chosen multivariate method is applied to analyze the opinions of both young and older Europeans taking into consideration the spatial diversity. The opinions about current work given by European Social Survey respondents are analyzed, among others these are the variety of current work, possibilities of learning new things at work, effort-salary relation, support received from other workers etc. The paper presents some results obtained from the applications of correspondence analysis whose usefulness is determined by the measurement scales of the regarded variables.

**Keywords:** the perception of work conditions, correspondence analysis, younger and older generation.

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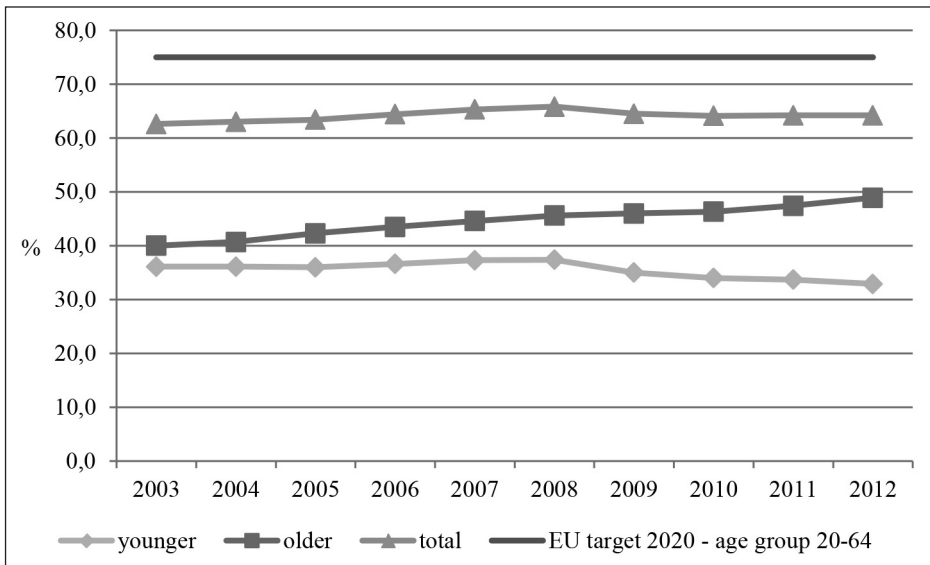
### **1. Introduction**

The main objective of this research is the analysis of the opinions concerning work given by both younger and older Europeans. By young Europeans we mean young people who can now start their careers, while as older Europeans we define people who have almost reached their retirement age. The data used for analysis were derived from Round 5 of the *European Social Survey*<sup>1</sup> (2010).

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<sup>1</sup> ESS Round 5: European Social Survey Round 5 Data (2010). Data file edition 3.0. Norwegian Social Science Data Services, Norway – Data Archive and distributor of ESS data.

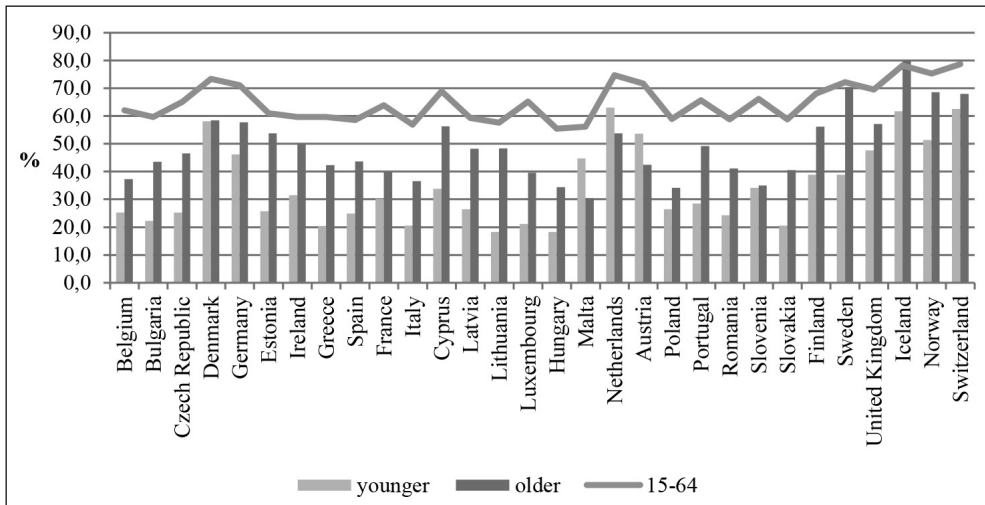
The choice of subjects of the study was affected by the observation of the changes in the labor market in the European Union. These changes mainly concern younger and older people. Figure 1 presents the unfavorable changes in the EU's sustainable development employment indicator. Level 2 in the socioeconomic development theme is the employment rate. The Europe 2020 strategy assumed that the employment rate in 2020 will reach 75%. However, the employment rate had increased from 62,6% (age group 15-64) in 2003 to 65,8% in 2008. It suddenly dropped in 2009 and no progress has been observed since then. The employment rate of younger and older Europeans in 2003 was almost at the same level. The group of older workers are more resistant to the recession. In 2012 the employment rate was observed to be almost equal to the projected level in 2020 (50%). In the same period of time the employment rate of younger persons dropped in 2009 and continued to fall.



**Fig. 1.** Employment rate in three age groups: younger (15-24), older (55-64) and all (15-64)

Source: self-elaboration based on EUROSTAT (online data code [lfsi\_emp\_a]; [lfsi\_emp\_a]; [lfsi\_emp\_a]).

Figure 2 presents the employment rates by countries for younger and older workers in 2012. In most countries, employment rates for older people are higher than for younger people. The biggest difference between the employment rates of younger and older occurs in Sweden where the employment rate of older people is higher by 31 percentage points than the employment rate of younger persons. Only in Malta, the Netherlands and Austria in 2012 does the employment rate of younger workers exceed the employment rate of older ones. The employment rate in 2010 is



**Fig. 2.** Employment rate in three age groups: younger (15-24), older (55-64) and all (15-64) in EU Member States and Associated Countries in 2010

Source: self-elaboration based on EUROSTAT (online data code [lfsi\_emp\_a]; [lfsi\_emp\_a]; [lfsi\_emp\_a]).

higher than 70% in the population of 15-64 year olds in Denmark, Germany, the Netherlands, Austria, Sweden, the United Kingdom, Iceland, Norway and Switzerland.

## 2. Method of analysis

The study used data collected in the 27 countries that participated in *Round 5 of European Social Survey in 2010* (Belgium, Bulgaria, Switzerland, Cyprus, the Czech Republic, Germany, Denmark, Estonia, Spain, Finland, France, the United Kingdom, Greece, Croatia, Hungary, Ireland, Israel, Lithuania, the Netherlands, Norway, Poland, Portugal, the Russian Federation, Sweden, Slovenia, Slovakia, Ukraine). The relationship between the perceptions of their current job for younger and older people from different countries was examined. The European Social Survey literal question was: "(...) please tell me how true each of the following statements is about your current job:"

positive aspects of current job:

1. can get support/help from co-workers when needed
2. good opportunities for advancement
3. job requires learning new things
4. job requires working very hard
5. variety in work
6. can decide time start/finish work

7. wage/salary depends on effort put into work

8. job is secure

negative aspects of current job:

9. health/safety at risk because of work

10. never enough time to get everything done in job

The collected data are measured on the ordinary scale. Respondents selected the answer from the following options:

- Question 1, 3, 5, 6, 7, 8, 9, 10: 1. Not at all true, 2. A little true, 3. Quite true, 4. Very true;
- Question 2, 4: 1. Disagree strongly, 2. Disagree, 3. Neither agree nor disagree, 4. Agree, 5. Agree strongly.

Correspondence analysis is most commonly used in the analysis of nominal variables, but in the literature we can find more and more applications of this method for all categorical variables. As Greenacre [2010, p. 279] wrote “*simple correspondence analysis (CA) of two categorical variables, and multiple correspondence analysis (MCA) of more than two variables, are methods commonly used to visualize and interpret categorical data in the social and environmental sciences*”. Based on this definition, it is possible to use the correspondence analysis for ordinal variables. Between measurements made on the nominal and ordinal scales there are small differences. A detailed description of the construction of measurement scales and the availability of mathematical and statistical methods was presented by Stevens [1959]. For the presented results of the study it is important to identify the key similarities and differences between measurements made on the nominal and ordinal scales. Both categories of an ordinal variable and a nominal variable are state definitions or symbols. The most important difference between these scales concerns the order relationship in the ordinal scale (as opposed to the nominal scale). Thus, the use of correspondence analysis to study the relationship between categories of ordinal variables is appropriate. CA enables the analysis of concurrent instances of the category describing two nominal or ordinal variables. In order to conduct such an analysis it is necessary to present the observed frequencies of categories of variables in the contingency table (this is consistent with the Greenacre approach):

$$\mathbf{N} = [n_{ij}], \quad (1)$$

where:

- $n_{ij}$  is the observed frequency<sup>2</sup> of category  $i$  of variable  $A$  ( $i = 1, \dots, r$ ) and of category  $j$  of variable  $B$  ( $j = 1, \dots, c$ ).

In order to determine the relationship between categories of variables, singular value decomposition is used. Decomposition is made for the standardized residuals matrix:

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<sup>2</sup> The terminology was taken from Goodman [1963], Greenacre 1993, Jobson 1992].

$$\mathbf{A} = \mathbf{D}_r^{-1/2}(\mathbf{P}-\mathbf{r}\mathbf{c}^T)\mathbf{D}_c^{-1/2}, \quad (2)$$

where:

- $\mathbf{P}$  correspondence matrix;  $\mathbf{P} = \left[ \frac{n_{ij}}{n} \right]$ ;
- $\mathbf{r}$  vector of row sums of  $\mathbf{P}$ ;
- $\mathbf{c}$  vector of column sums of  $\mathbf{P}$ ;
- $\mathbf{D}_r$  is diagonal matrix of row sums of  $\mathbf{P}$ ;
- $\mathbf{D}_c$  is diagonal matrix of column sums of  $\mathbf{P}$ .

The element of  $\mathbf{P} = [p_{ij}]$  are observed proportions, which is the percentage share of occurrence in the study of category  $i$  of variable  $A$  and of category  $j$  of variable  $B$ . On this basis we shall determine the row proportion  $p_{i\bullet} = \sum_{j=1}^c p_{ij} = \sum_{j=1}^c \frac{n_{ij}}{n} = \frac{n_{i\bullet}}{n}$  and column proportion  $p_{\bullet j} = \sum_{i=1}^r p_{ij} = \sum_{i=1}^r \frac{n_{ij}}{n} = \frac{n_{\bullet j}}{n}$ . These values show the percentage of occurrence of the selected category in the grand total. Row proportions are denoted as vector  $\mathbf{r}$  and the column proportions as vector  $\mathbf{c}$ .

The SVD of  $\mathbf{A}$  is made as follows:

$$\mathbf{A} = \mathbf{U}\mathbf{\Gamma}\mathbf{V}^T, \quad (3)$$

where:

- $\mathbf{\Gamma}$  is a diagonal matrix ( $k \times k$ ) with singular values in descending order  $\gamma_k$  ( $k = 1, \dots, K$ ) of  $\mathbf{A}$ ,  $K$  is rank of matrix  $\mathbf{A}$  and  $K \leq \min(r-1; c-1)$ ;
- $\mathbf{U}$  is matrix  $((r-1) \times k)$  of left singular vectors;
- $\mathbf{V}$  is matrix  $((c-1) \times k)$  of right singular vectors.

The SVD provides all the results needed for the graphical presentation of CA results, i.e. the principal coordinates of rows ( $\mathbf{F}$ ) and columns ( $\mathbf{G}$ ) categories:

$$\mathbf{F} = \mathbf{D}_r^{-1/2}\mathbf{U}\mathbf{\Gamma}, \quad (4)$$

$$\mathbf{G} = \mathbf{D}_c^{-1/2}\mathbf{V}\mathbf{\Gamma}. \quad (5)$$

In the evaluation of quality of CA results (in presentation in low dimensional space), total inertia  $\lambda$  is very important. Total inertia is equal to the sum of principal inertias (eigenvalues). Squared singular values are eigenvalues of  $\mathbf{A}^T\mathbf{A}$  and  $\mathbf{A}\mathbf{A}^T$  matrices. Moreover, it is possible to indicate the following relationships:

$$\text{tr}\mathbf{A}^T\mathbf{A} = \text{tr}\mathbf{A}\mathbf{A}^T = \text{tr}\mathbf{\Lambda} = \frac{\chi^2}{n} = \lambda = \sum_{k=1}^K \gamma_k^2, \quad (6)$$

where:

- $\chi^2$  is the chi-square statistic used in the Pearson test of independence of two nominal variables.

This procedure also allows the graphical visualization of the analysis results with high quality projection after the reduction of multi-dimensionality and the correct interpretation of the points position. Detailed descriptions of CA and MCA algo-

rithms can be found in: Greenacre [2006; 1984; 1993], Stanimir [2005], Backhaus et al. [2003], Blasius [2001], Clausen [1998].

### 3. Results

Because in the analyses the simple correspondence analysis was used, so for each of the analyzed questions the contingency table was created, containing the observed number of each response in each country. Analyses were performed separately for younger and older people. For questions 2 and 4 real dimensional space is  $R^4$ . For other questions, it is  $R^3$ . This means that for a two-dimensional presentation we can expect a high quality of the projection of relationships between categories of variables. The projection quality was measured using the degree of explaining of the total inertia. In all analysis carried out the degrees of explaining of the total inertia to principal inertias were always higher than 80% (see Figure 3 and attachment 1).

Figure 3 presents the results of correspondence analysis in low dimensional space ( $R^2$ ) for the question: *can get support/help from co-workers when needed* (Fig. 3a – younger, 3b – older).

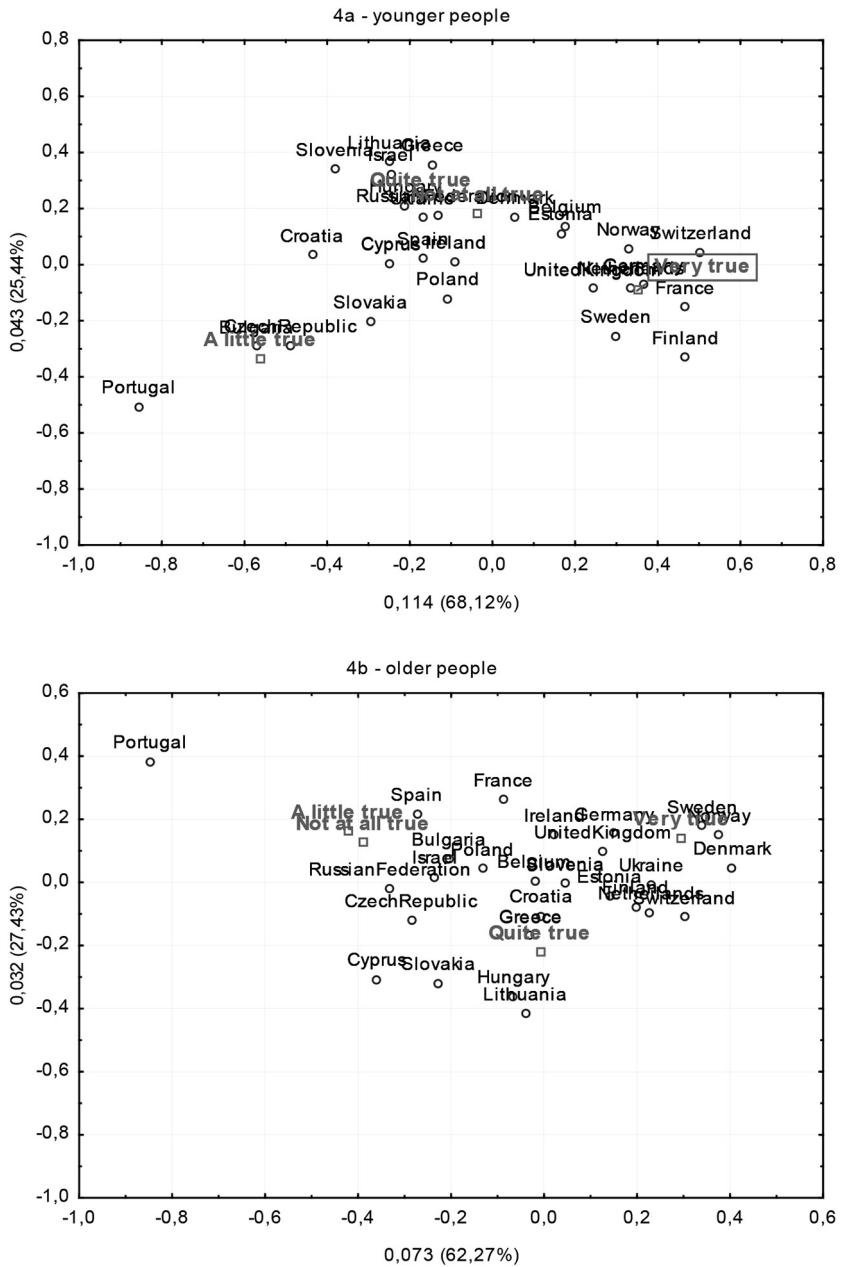
In Figure 3, both young and old Portuguese differ in their opinions of people from other countries. Their assessment of willingness to support work by co-workers is very low. Mutual assistance at work is also poorly assessed by young Czechs and Bulgarians. The opinions of older Czechs, however, are better (quite true). The situation is similar for younger and older Slovaks. Points showing young Poles and the Irish and older Belgians, Slovenians and Croats are closest to the center (origin), which means that they cannot be assigned unequivocally.

For young citizens of Israel, Lithuania, Greece, Israel, Hungary, Ukraine, the Russian Federation, and Denmark it is quite true that they can get support/help from co-workers when needed, similarly for older Greeks, Croats, Hungarians and Lithuanians.

The discussed statement is very true for young British, Germans, Dutch, French, Swedes, Hungarians, Ukrainians as well as for older Swedes, Irish, Germans, British, Dutch, Norwegians and Ukrainians.

Based on further analysis (see visualizations of results in attachment 1) information was collected about whether young and older residents of different countries have similar opinions or not. Table 1 and Figure 2 presented at the end of the article show the positive or negative opinions on particular subjects of research. The opinions, however, were always consistent for young and older people (e.g. both young and old Swedes, Norwegians, British, Germans, Swiss and Finns fully agree with the statement *can get support/help from co-workers when needed*).

The conclusion, based on Table 1, is that the most consistent opinions of their current jobs in various aspects are shown by younger and older Estonians, Portuguese, Belgians, Norwegians, Russians, French and Slovaks.



**Fig. 3.** Younger (3a) and older (3b) people assessment of the support among the colleagues  
 Source: self-elaboration based on *Round 5 of European Social Survey in 2010*.

**Table 1.** Consistent opinions of younger and older people

„(...) please tell me how true each of the following statements is about your current job:”		The same opinions, irrespective of age (for both younger and older)	
		Agree/true	Disagree/not true
1	can get support/help from co-workers when needed	Swedes, Norwegians, British, Germans, Swiss, Finns	Bulgarians, Russians
2	good opportunities for advancement	Belgians and Estonians	French, Hungarians, Danes, Czechs
3	job requires learning new things	Norwegians, Swedes, French, Estonians and British	Portuguese, Bulgarians, Russians, Hungarians
4	job requires working very hard	Irish, British, Ukrainians, Slovaks, Slovenians, Portuguese and Spanish	French and Danes
5	variety in work	Dutch, Belgians, French, Germans, British, Swiss, Finns, Slovaks, Slovenians, Estonians, Norwegians	Portuguese
6	can decide time start/finish work	Swiss and Israelis	young and older people in most countries
7	wage/salary depends on effort put into work	Slovaks, Ukrainians, Russians, Estonians, Czechs	Germans, Belgians, Dutch, British, Spanish, Finnish, Irish, French, Hungarians
8	job is secure	Swiss, Estonians, Norwegians, Swedes, Finns, Belgians, Israelis, Germans	Cypriots, Czechs, Slovaks
9	health/safety at risk because of work	Ukrainians, Estonians, Slovaks, Lithuanians, Slovenians	Norwegians Irish, Spanish, Danes, Portuguese, Belgians, Dutch
10	never enough time to get everything done in job	Portuguese, Belgians, Swedes and Slovenians	Russians, Dutch, Bulgarians

Source: self-elaboration based on correspondence analyzes of *Round 5 of European Social Survey in 2010* data.

The positive aspect is the same perception of support from colleagues and learning new things at work by the Swedes, Norwegians and British. The inhabitants of these countries positively fully agree with these statements, therefore, to learn new things with the help of co-workers can bring greater benefits than in other countries. The situation is different in Bulgaria and Russia. In these countries, young and old



feel that they cannot count on help from colleagues and also do not learn new things at work.

The comparison ratings of the statements: *job requires learning new things* and *job requires very hard work* shows that younger and older French workers learn new things at work but at the same time work does not require much effort from them. The Portuguese think otherwise: at work they do not learn new things but the work requires an intensive effort from them.

The inhabitants of the discussed countries also evaluated the variety of work. The only country in which both younger and older people find their work not varied is Portugal.

The opinions expressed on how to decide the time to start/finish the work are very surprising. Only younger and older Swiss and Israelis believe that they can decide on their working hours. In most of the other countries, both younger and older feel that they cannot decide on that.

Younger and older citizens of Slovakia, Ukraine, the Russian Federation, Estonia and the Czech Republic think that their salary depends on the work effort. Germans, Belgians, Dutch, British, Spanish, Finnish, Irish, French and Hungarians think quite the opposite.

#### 4. Conclusions

The opinions presented by younger and older Europeans are different, but not in all countries and not for all the considered questions. Both young and old often evaluate the problems similarly. The biggest similarities were identified in the case of younger and older Estonians, Portuguese, Belgians, Norwegians, Russians, French and Slovaks – the answers to more than half of the questions were convergent.

Regarding the positive aspects of work the most consistent opinions among younger and older people were found for *Variety in work*.

- In 11 countries both young and old agree that their current job is characterized by variety.
- Only in Portugal did both young and old disagree with this statement.

In the case of the question *Can decide time start / finish work* the opposite pattern occurred. In many countries, young and old feel that they have no influence on the time of starting and finishing work. In Switzerland and Israel, the respondents believe that they can make such decisions (regardless of age group)

*Wage / salary depends on effort put into work* is another factor for which some regularities in the opinions of Europeans were identified:

- persons in Eastern countries agree with this statement
- persons in Western countries do not agree with this statement

Due to the fact that young and old often cooperate, the answers to the question *Can get support / help from co-workers* were particularly important. In six countries, both young and older think they can get help from co-workers. Residents of three

countries pointed out the lack of such a possibility. In other countries the opinions expressed by the older people differ from those formulated by the younger people.

Younger and older Poles consistently and positively assess the following statements: *Job is secure* (quite secure) and *Health / safety at risk because of work* (not true). However, they evaluate negatively the following statements: *can get support / help from co-workers when needed* (not true), *good opportunities for advancement* (not agree), *can decide time start/finish work* (not true), *never enough time to get everything done in job* (agree).

## Literature

- Backhaus K., Erichson B., Plinke W., Weiber R., *Multivariate Analysemethoden*, Springer-Verlag, Berlin 2003.
- Blasius J., *Korrespondenzanalyse*, R. Oldenbourg Verlag, München 2001.
- Clausen S.E., *Applied Correspondence Analysis. An Introduction*, University Paper 121, Sage 1998.
- ESS Round 5: European Social Survey Round 5 Data (2010). Data file edition 3.0. Norwegian Social Science Data Services, Norway – Data Archive and distributor of ESS data. <http://www.european-socialsurvey.org/> (retrieved 2013-06-23).
- Goodman L.A., *On Plackett's test for contingency table interactions*, "Journal of the Royal Statistical Society" Series B. 1963, vol. 25, no. 1, pp. 179-188.
- Greenacre M., *Correspondence Analysis in Practice*, Academic Press, London 1993.
- Greenacre M., *Theory and Application of Correspondence Analysis*, Academic Press, London 1984.
- Greenacre M., *From Simple to Multiple Correspondence Analysis*, [in:] M. Greenacre, J. Blasius (eds.), *Multiple Correspondence Analysis and Related Methods*, Chapman&Hall/CRC, London 2006, pp. 41-76.
- Greenacre M., *Canonical Correspondence Analysis in Social Science Research*, [in:] H. Locarek-Junge and C. Weihs (eds.), *Classification as a Tool for Research*, Springer, Heidelberg 2010, pp. 279-286.
- Jobson J.D., *Applied Multivariate Data Analysis. Vol. II: Categorical and Multivariate Methods*, Springer-Verlag, New York 1992.
- Stanimir A., *Analiza korespondencji jako narzędzie do badania zjawisk ekonomicznych*, Wydawnictwo Akademii Ekonomicznej, Wrocław 2005.
- Stevens S.S., *Measurement, Psychophysics and Utility*, [in:] C.W. Churchman and P. Ratoosh (eds.), *Measurement. Definitions and Theories*, John Willey & Sons, Inc, New York 1959.

## ANALIZA KORESPONDENCJI POKOLENIOWYCH RÓŻNIC POSTRZEGANIA WARUNKÓW PRACY W WYBRANYCH KRAJACH

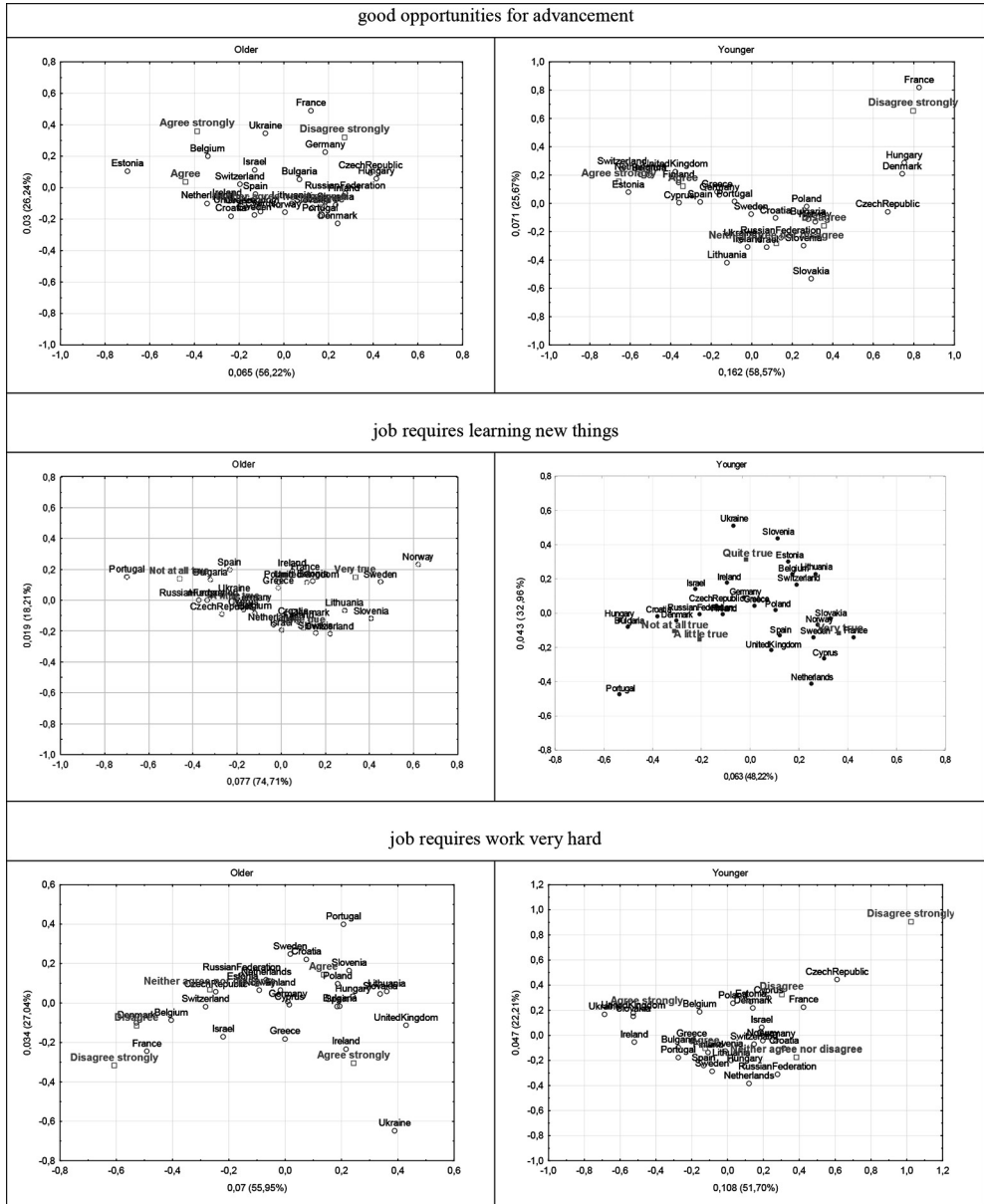
**Streszczenie:** Celem artykułu jest weryfikacja hipotezy o istnieniu różnic pokoleniowych w postrzeganiu warunków i jakości pracy. Wybrany zakres badania odpowiada przeprowadzonym na rynku pracy spostrzeżeniom, że szczególną uwagę należy kierować na dwie grupy wieku osób pracujących: najmłodszych i najstarszych. Najwyższa stopa bezrobocia w UE jest obserwowana wśród najmłodszych osób, które napotykać wiele przeszkód na drodze

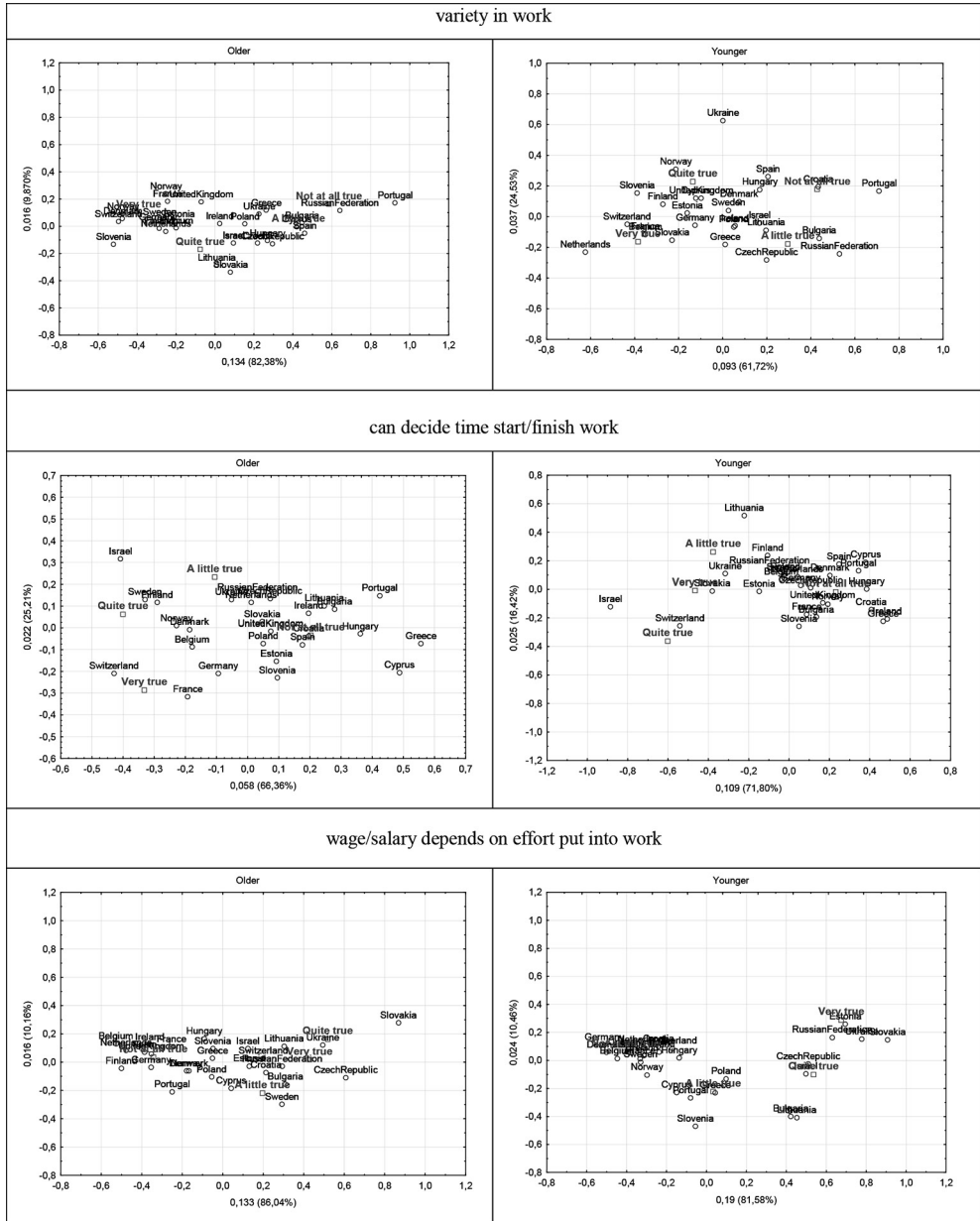
swojej kariery zawodowej. Obiektywne wskaźniki rynku pracy powinny być konfrontowane z wynikami analiz subiektywnych opinii uczestników rynku pracy w celu uzyskania całościowego spojrzenia na sytuację. Przeprowadzono analizę opinii młodych i starszych Europejczyków, biorąc pod uwagę zróżnicowanie przestrzenne. Przeanalizowano opinie o obecnej pracy podane przez respondentów European Social Survey. Opinie dotyczyły między innymi: różnorodności wykonywanej pracy (brak monotonii), możliwości uczenia się nowych rzeczy w pracy, relacji między wysiłkiem wkładanym w wykonanie pracy a wynagrodzeniem, możliwości uzyskania pomocy ze strony współpracowników i innych. Artykuł prezentuje wyniki analizy korespondencji, której użyteczność jest uzasadniona ze względu na skalę pomiaru rozpatrywanych zmiennych.

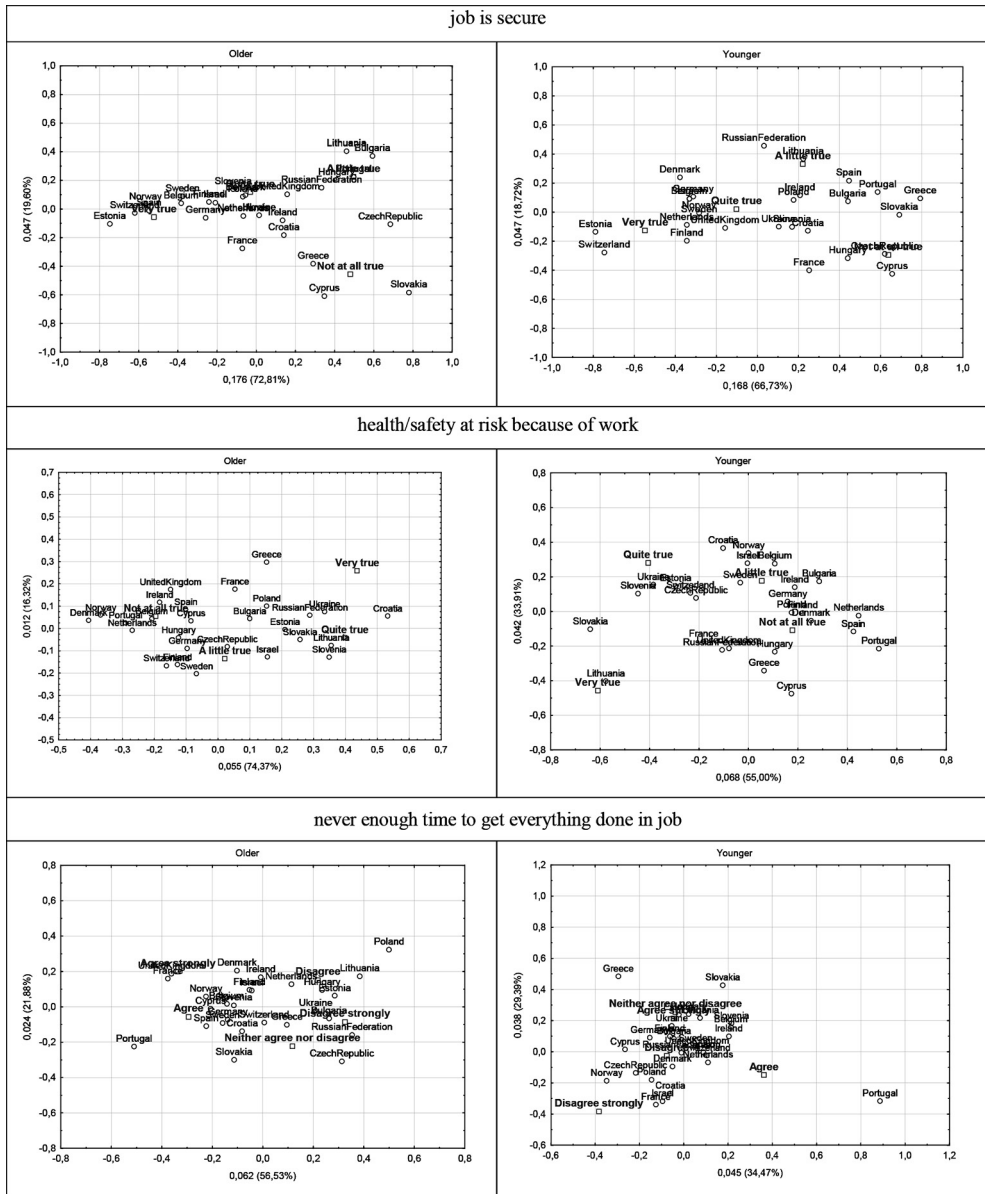
**Słowa kluczowe:** postrzeganie warunków pracy, analiza korespondencji, młodsze i starsze pokolenie.

ATTACHMENT 1

Younger and older people assessment of other questions







Source: self-elaboration based on Round 5 of European Social Survey in 2010.