

THE ECONOMIC ACTIVITY OF DISABLED PERSONS IN POLAND – STATISTICAL ANALYSIS OF DATA PROVIDED BY THE CENTRAL STATISTICAL OFFICE

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Abstract

Increased numbers of disabled persons both in Poland, as well as in other European countries, have been triggering many political debates. Guaranteeing dignity and full inclusion of persons with disabilities in society is one of the main objectives embraced by the new disability action plan 2016–2020 of the Council of Europe as regards the promotion of full social participation of persons with disabilities. The accomplishment of the targeted objective depends on an insightful monitoring of the situation of persons with disabilities. Factors that differentiate persons with disabilities with respect to their economic activity have been identified focusing on the problem of employment of disabled persons. For this purpose a multivariate correspondence analysis was applied with data provided by the National Census of Population and Housing 2011. In Poland, women aged 65+, with secondary education or lower, predominate the group of persons with disabilities. Most of disabled persons are related by marriage contract. Statistical analysis did not indicate any significant correlation between the categories of economic activity, and marital status and the degree of disability, whereas significant correlations have been observed between the categories of economic activity and such characteristics as: age, sex, education, and pursued profession.

Keywords: disabled persons, correspondence analysis, cluster analysis, economic activity

JEL Codes: J15, J18, J71

1. Introduction

The condition of persons with disabilities is a major issue both in Poland, as well as in other European countries. The Parliamentary Assembly of the Council of Europe evaluated the Council of Europe action plan to promote the rights and full participation of people with disabilities in society: improving the quality of life of people with disabilities in Europe 2006–2015 (Council of Europe, 2008), and perceived that persons with disabilities did not fully enjoy their rights in any member country of the European Union. The Council also emphasized the need of taking further determined actions by member states addressing persons with disabilities.

One of the objectives of the new action plan 2006–2015 is to guarantee dignity and full inclusion of persons with disabilities in society. Actions aimed at safeguarding equal

opportunities to members of all social groups, and ensuring the full inclusion in society should be key priorities not only for international policy, but also for national and local policies.

At present, despite cohesion policy that has been followed for many years, there are still many forms of prejudices and negative stereotypes with respect to persons with disabilities. Such negative attitudes in society unfavorably influence an individual's mood, especially his/her motivation to any activities aimed at improving quality of life. Employment of persons with disabilities is characterized by a harmful problem of discrimination in the workplace suffered by many countries (Jones, 2006). Many researchers show that the participation of persons with disabilities in a labour market is significantly lower than that of persons without disabilities (Wilkins, 2004; Hotchkiss, 2004; Jones *et al.*, 2006; Gannon, 2005). Park *et al.* (2016) and Pagan (2011) argue that being employed is extremely significant for anybody, particularly for persons with disabilities. Agovino *et al.* (2018) report a positive impact of appropriate policy targeted at employing persons with disabilities on their participation in a labour market.

The effectiveness of persons with disabilities policy will be high if it focuses on real problems of those persons, and if it considers relationships influencing respective areas of disabled people's lives. Thus, a necessary condition of finding correct solutions is to monitor insightfully and systematically the situation of persons with disabilities. Focusing on the problem of employment of persons with disabilities, this paper seeks to identify factors differentiating persons with disabilities as regards their economic activity. To this end a multivariate correspondence analysis was applied, and data provided by the National Census of Population and Housing 2011 were used.

2. Methodology

This paper seeks to find the relationships between the categories relating to economic activity of persons with disabilities and the categories relating to demographic and social variables, i.e. age, sex, education, marital status, and the degree of disability, by means of correspondence analysis. This technique belongs to a group of multivariate methods that examine the correlation. The major goal of the analysis is to graphically represent the relationships between qualitative variables in a one-, two- or three-dimensional space, to come up with inference about relationships between the variables, combined with the analysis of measures of quality and relationship (Audigier *et al.*, 2017; Fithian and Josse, 2017).

Correspondence analysis enables a graphic presentation of what we want to say, and corroborates a Chinese saying that 'A picture is worth more than a thousand words'.

In a conducted study, the two variants of correspondence analysis have been used, i.e. conventional correspondence analysis (when examining the relationship between two qualitative variables), and multiple correspondence analysis based on the Burt matrix (when analyzing more than two qualitative variables).

An individual issue in correspondence analysis remains deciding on the number of dimensions of the needed space, so that the final solution is the best representation of underlying relationships, and the loss of original information is minimal. The dimension of the real space of coincident categories for two variables equals:

$$K = \min(r - 1, c - 1) \quad (1)$$

where r and s denote the number of categories of both variables. In turn, in case of multiple correspondence analysis, when frequencies of categorical variables are elements in the Burt matrix, the dimension of real space is determined from the formula:

$$K = \sum_{q=1}^Q (J_q - 1) \quad (2)$$

where J_q denotes the number of categories of variable q ($q = 1, 2, \dots, Q$).

In this paper, a graphical presentation of associations between categorical variables in a two-dimensional system of coordinates was decided, independently from the dimension of the real space. The presentation of data set under analysis in R^2 space is simpler for interpretation by many readers than in R^3 , but it can poorly reflect original relationships and result in more loss of information about the phenomenon under study.

To evaluate the quality of reproduced information in a space of the reduced dimensionality we use the measure of the explained variation interpreted as a proportion of inertia of selected dimension to the total inertia. The concept of total inertia is interpreted as a measure of relationship between properties. If the value of total inertia is small, then the points representing categories in a coordinate system are concentrated around the centre of projection, therefore one is not able to define any significant associations between them (Greenacre, 1984).

The interpretation of correspondence analysis results is typically based on visual assessment of scatter diagram of points. To limit a subjective interpretation of clusters of associated categories, the results of correspondence analysis presented in a normalized coordinate system have been classified into homogenous subsets of objects (categories) using cluster analysis – the Ward's method of hierarchical classification (Berk, 2008; Siciliano and Mola, 2000).

Using above-mentioned methods in this research seems justified, because analyzing separate subsets (clusters) and their graphical representation can provide information about the causes of extant differences in economic activities of people with disabilities.

The analysis was carried out for Lower Silesian voivodeship using survey data from the 2011 National Census of Population and Housing (NCP) conducted by the Central Statistical Office. As data from 2011 are today obsolete, one is not able to draw conclusions from this set about the actual condition of persons with disabilities, but they can be used as a good underlying material to detect associations between variables under study. At the same time, the NCP data represent the most up-to-date, unique and reliable source of information enabling an extensive analysis at the regional level.

3. Results of analysis

According to the 2011 NCP, there were 371,400 persons with inabilities aged 15+ in Lower Silesia. The official definition used in the census specifies that a person with disabilities is a person who has been legally granted a certificate of disability or feels difficulty when carrying out basic activities typical for his/her age.

Persons with disabilities are characterized by a relatively low level of their economic and social activity, especially compared with persons without disabilities. Low levels of economic activity are confirmed by census statistical data showing that in a population of disabled persons 20 per cent are economically active (i.e. either employed or unemployed) while remaining 80 per cent are economically inactive, i.e. they are unemployed and do not search for employment, or they search for employment but they are not able (ready) to begin working within next two weeks. The population of persons without disabilities is characterized by economic activity rate of approximately 60 per cent, i.e. three times more than that of disabled persons (GUS, 2013).

A high level of economic inactivity among persons with disabilities and a low employment rate (16 per cent) are worrying facts. The meaning of employment in the life of persons with disabilities is extremely important, because being unemployed does not allow to become economically independent and to create a positive image of a disabled person. Being employed fights poverty, gives satisfaction and life of enjoyment (Bartkowski, 2014).

The inclusion of persons with disabilities to economic life as well as planning programmes by self-governance entities and nongovernmental organizations aimed at creating integration markets and supporting persons with disabilities in their attempts to become employed require an insightful assessment of the situation of disabled persons in labour market and identification of factors that differentiate disabled persons according to their economic activity and employment status.

This paper analyzes and visualizes associations between the state of economic activity of disabled people and such variables as: sex, age, education, actual occupation, marital status and a degree of disability. These variables were assigned to categories as explained in Table 1.

Table 1. Variables by categories

Variable	Category
Economic activity, employment status	A1 – employed, A2 – self-employed, A3 – contributing family workers, A4 – unemployed, A5 – economically inactive
Sex	M – males, K – females
Age	<15, 15–19, 20–29, 30–39, 40–49, 50–59, 60–64, >=65
Education	W1 – tertiary, W2 – post-secondary, W3 – secondary, W4 – basic vocational, W5 – lower secondary or below
Occupation	1 – public government officers, senior officers and managers, 2 – professionals, 3 – technicians and midlevel staff, 4 – clerical workers, 5 – personal services workers and sales workers, 6 – agricultural, forestry and fishery workers, 7 – blue-collar workers and craft workers, 8 – plant and machine operators, and assemblers, 9 – elementary occupations, 0 – armed forces occupations, 10 – unidentified
Marital status	C1 – single, C2 – married, C3 – widowed, C4 – divorced
Degree of disability	Z – severe, U – moderate, L – minor, O – with valid certificate of disability for minors aged 0–15, b – disabled persons without certificate of disability who feel biologically disabled, N – unidentified

Source: the author's own elaboration.

Demographic and social variables considered in our analysis are extremely significant both as regards the process of influencing the attitudes of disabled persons towards their status in labour market, as well as to identify the groups of disabled persons who require effective promotional programmes.

A research hypothesis has been put forward that economic activity condition of disabled people depends on age, education, actual occupation, marital status, degree of disability, and sex. The hypothesis was tested by a chi-squared test of independence. The null hypothesis stating that economic activity of persons with disabilities does not depend on selected variables was rejected in each case ($p_{value} = 0.00$). Therefore, conducting comprehensive analyses of the state of economic activity of disabled people is fully justified with respect to demographic and social variables.

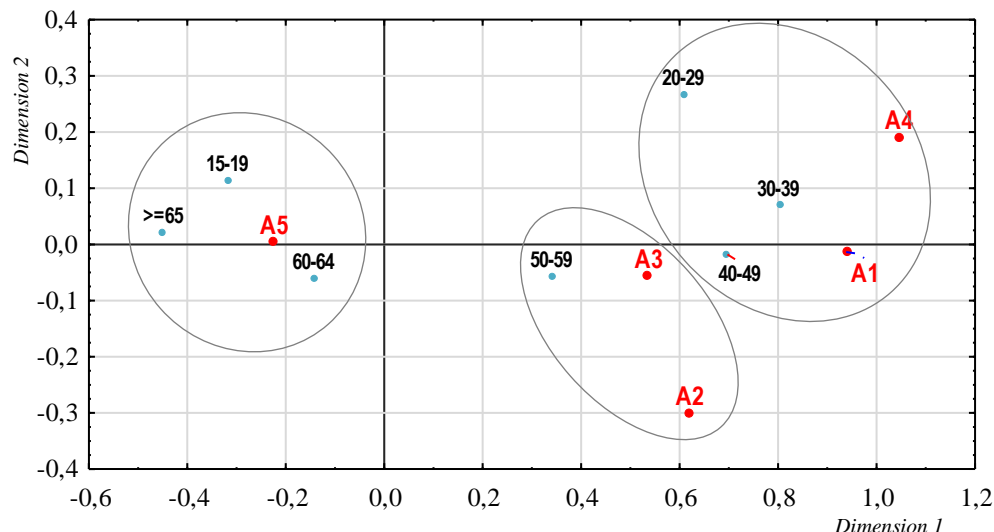
As no significant connections have been observed between categories regarding economic activity and marital status or degree of disability, a more detailed analysis of contingency of these categorical variables was excluded.

Before the presentation of the results of correspondence analysis, a short characteristics of persons with disabilities compared with persons without disabilities will follow with respect to demographic and social variables under study.

Approximately 40 per cent of persons with disabilities are aged 65 or more years, and only 10 per cent are aged 25–44 years, whereas among persons without disabilities these fractions are 9 per cent and 33 per cent, respectively. Both populations are similar regarding slightly higher fractions of women, as a result of longer life spans of women (in Lower Silesia mean life span of women was 81.4 years, and of men – 73.5 years, as of 2016). Approximately 36 per cent of persons with disabilities have secondary or lower education, i.e. by 20 percentage points less than among persons without disabilities. Both populations are similar regarding fractions of married persons (more than 50 per cent), whereas there are significantly more widowed persons among disabled people than among non-disabled (25 per cent versus 7 per cent).

Correspondence analysis begins by presenting associations between two categorical variables – economic activity and age. The results of the conducted analysis are presented in R^2 despite the fact that the actual space of contingency of these variables is four-dimensional. As much as 99.6 per cent of actual associations are explained in a two-dimensional space (equal to cumulative contribution of two first principal inertias in the total inertia). The distances between the centroid and category A5 and age group of 60–64 years in R^2 are the smallest (see Figure 1) (for two variables we have two colours on the figures), hence these variables are most similar to their respective mean profiles, that means they contribute least to the rejection of the null hypothesis.

Figure 1. Association between categorical variables: economic activity and age for the population of persons with disabilities



Source: the author's own elaboration.

Interpreting the visualization obtained from correspondence analysis and Ward's cluster method (see Figure 1) demonstrates that persons with disabilities at pre-working age, and those at post-working age (retired) are economically inactive. The same conclusion can be drawn for persons without disabilities. In addition, the location of the point representing

persons aged 15–19 indicates, with advancing age, a natural pursuit of employment, but before they start working, they will probably remain unemployed for some time, as persons aged 20–29. One may also expect that persons aged 50–59, now classified as employed (contributing family workers or self-employed) will start inclining towards economical inactivity. In turn, persons aged 30–49 are mostly employees, but they also suffer from unemployment (persons without disabilities aged 30–49 are mostly employees or self-employed, whereas those aged 20–29 suffer mostly from unemployment).

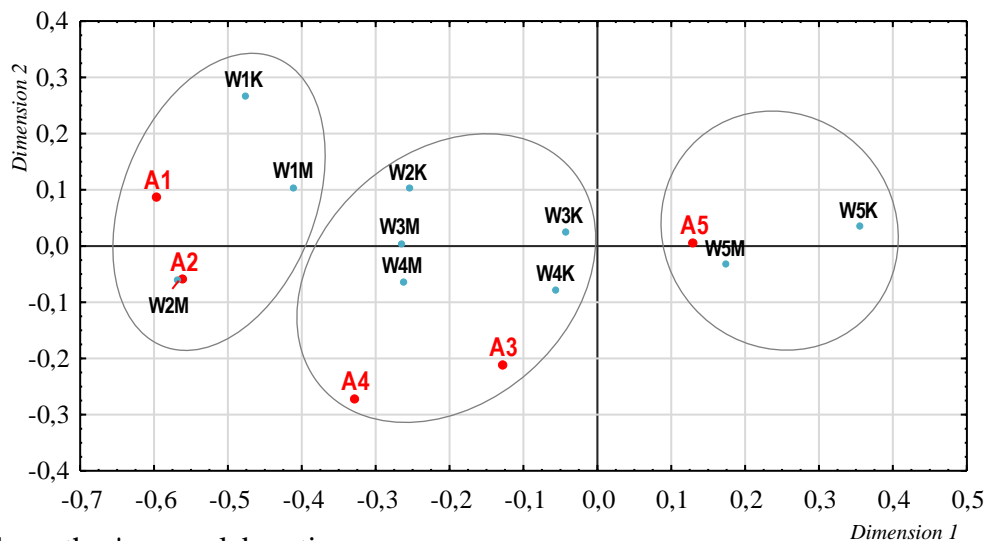
Later on, using correspondence analysis, the two hypotheses were tested:

1. Among persons with disabilities a high propensity to economic inactivity is typical for those at low level of education and employed as unskilled workers.
2. Being employed is autotelic predominantly for persons at higher level of education or higher propensity to take employment and to actively seek employment.

The loss of information due to the reduction to R^2 of dimensionality of associations between variables economic activity and education was insignificant – less than 2 per cent. The scatter diagram of points representing the state of economic activity among disabled population by the level of education confirms that economically inactive persons are typically persons at the lowest level of education, and more frequently males than females (similar conclusions can be drawn from the analysis of non-disabled population). Disabled persons working as employees or self-employed are usually highly educated (tertiary education) irrespective of sex, or they are males with post-secondary education. In turn, disabled females with post-secondary education typically work as contributing family workers or suffer from unemployment. The cluster representing unemployed or contributing family workers includes disabled persons mostly with secondary or basic vocational education.

In case of persons without disabilities, the picture seems more optimistic, especially as regards males. They mostly work as employees or self-employed, and have typically post-secondary, secondary or basic vocational education, besides those with tertiary education.

Figure 2. Associations between categorical variables: economic activity and education, by sex for the population of persons with disabilities



Source: the author's own elaboration.

The subsequent stage of the research focused on associations between three variables: economic activity, education and age. For this purpose a 17×17 Burt matrix was built to

examine whether a two-dimensional space satisfactorily represents actual distances and associations between data points of respective categories. Merely 20.3 per cent of actual associations have been explained in R^2 . This unsatisfactory result was “improved” by adjustment of solutions in the Burt matrix scaling its eigenvalues¹ (Greenacre, 1984). After Greenacre’s correction in our analysis, the first two dimensions account for 44 per cent of total inertia.

Another well-known eigenvalue correction is the formula due to Benzecri². However, in our research this result was found too optimistic (the percentage of explained inertia was as much as 98), and that is why it was not considered in our subsequent analysis.

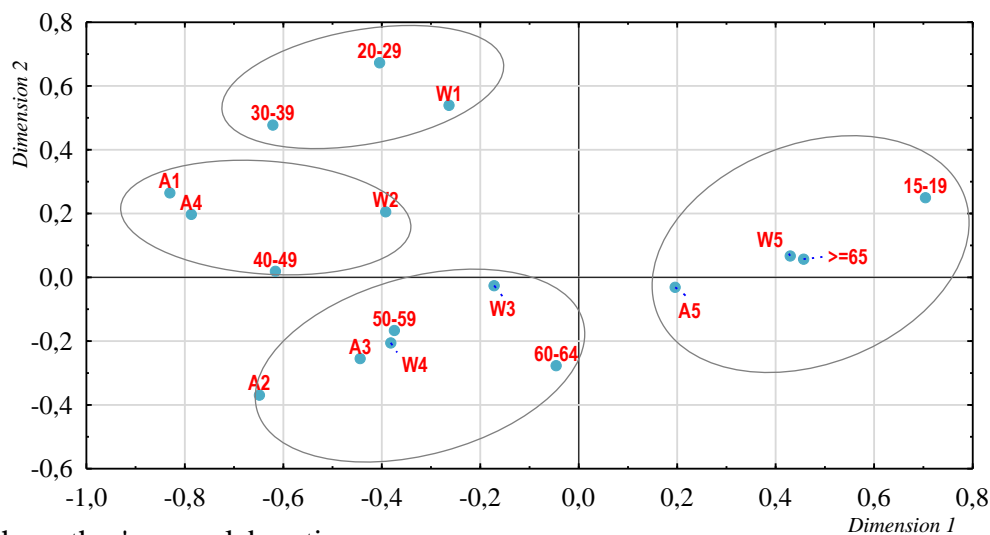
Figure 3 demonstrates our correspondence analysis results in a two-dimensional space using adjusted eigenvalues according to Greenacre’s correction.

Based on solutions shown in Figure 3, the four clusters of categorical variables were identified. Because data points of categories A3 and W2 were scarce in R^2 , the interpretation of their neighbourhood was excluded in the analysis.

The first cluster comprises economically inactive persons with disabilities who are mostly older people as well as young, aged 15–19, and those with the lowest level of education (a similar cluster was identified in the population of persons without disabilities).

The second cluster consists of categories W1, 20–29 and 30–39, indicating that persons aged 20–29 and 30–39 outnumber other age groups with tertiary education among disabled persons. Among persons without disabilities the distance between category W1 and groups 20–29 and 30–39 was the same, implying that persons from these age groups outnumber other persons with tertiary education.

Figure 3. Associations between categorical variables: economic activity, age and education for the population of persons with disabilities



Source: the author's own elaboration.

¹ Adjusted eigenvalues (λ_k) are calculated for Q variables and $\lambda_k > 1/Q$ according to the formula: $\tilde{\lambda}_k = (\frac{Q}{Q-1}(\sqrt{\lambda_k} - \frac{1}{Q}))^2$

² Adjusted eigenvalues (λ_k) are calculated for Q variables and $\lambda_k > 1/Q$ according to the formula: $\tilde{\lambda}_k = (\frac{Q}{Q-1}(\lambda_k - \frac{1}{Q}))^2$.

Disabled persons who are economically active (they either work as employees or are unemployed, but they actively seek employment) are typically aged 40–49 (among non-disabled persons those with secondary education are mostly affected by unemployment). Non-disabled persons aged 40–49 differ from persons with disabilities in that their status of employment is typically self-employment.

The last cluster embraces self-employed persons with disabilities. They are mostly aged 50–59, with secondary education or basic vocational education (self-employed persons without disabilities are likewise typically aged 50–59, but mostly with basic vocational education).

Irrespective of whether a person is non-disabled or disabled, economic inactivity mostly characterizes persons with the lowest education, at pre-working or post-working age (retired). Thus, our research hypotheses have been confirmed.

To answer the question whether persons with lower level of education, whose occupations are elementary and undemanding, are more inclined towards economic inactivity, correspondence analysis was conducted examining the associations between age groups and education, and actual occupation within the group of employed persons with disabilities.

In accordance with the definition used by Ministry of Labour and Social Policy in the Regulation on classifying occupations and specialities for labour market, an occupation is a source of income and includes a group of activities distinguished as a result of social division of labour, which require skills acquired in the course of education or training.

Table 2 presents required levels of competencies defined by ISCO-08 (International Standard Classification of Occupations, 2008) and levels of education defined by the International Standard Classification of Education (ISCED 2011) for given groups of occupations.

Table 2. Groups of occupations by level of skills and level of education³

Groups of occupations	ISCO 2008 level of skills	ISCED 2011 level of education
1 Public government officers, senior officers and managers	3, 4	3, 4, 5, 6, 7, 8
2 Professionals	4	5, 6, 7, 8
3 Technicians and midlevel staff	3	3, 4
4 Clerical workers	2, 3	3, 4
5 Personal services workers and sales workers	2, 3	3, 4
6 Agricultural, forestry and fishery workers	2	3

³ **Skill level 1** according to ISCO-08 implies elementary competencies, and applies to the ISCED first level of education gained at primary school. **Skill level 2** relates to the ISCED education level 2, or lower secondary education, and to the ISCED education level 3 completed at general secondary and specialized secondary schools, as well as at basic vocational schools. **Skill level 3** relates to the ISCED education level 4 completed at post-secondary schools, and to the ISCED education level 3 completed at professional technical schools. **Skill level 4** relates to the ISCED education levels 5, 6, 7 and 8, completed at short-cycle vocational tertiary institutions (graduates obtain a bachelor's or engineer's degree, and are prepared to enter the labour market), master studies, postgraduate studies, and doctoral studies.

7 Blue-collar workers and craft workers	2	3
8 Plant and machine operators, and assemblers	2	2, 3
9 Elementary occupations	1	1, 2
0 Armed forces occupations	1, 2, 3, 4	2, 3, 4, 5, 6, 7, 8

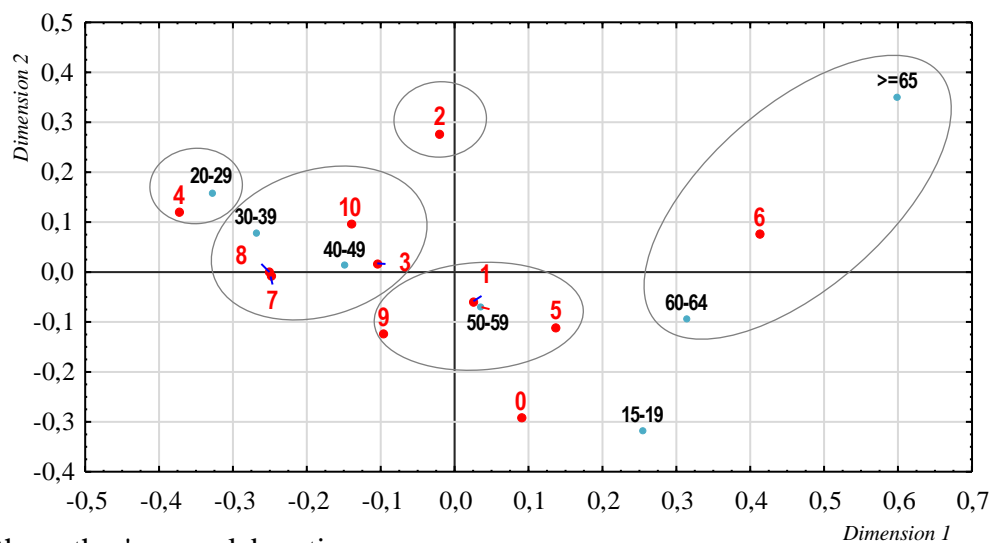
Source: own elaboration based on the Regulation of Ministry of Labour and Social Policy of 7 August 2014 on classifying occupations and specialities for labour market, and the scope of its implementation (Dz. U. 2014 Item 1145).

The interpretation of the neighbourhood of the point representing armed forces occupations was excluded, because persons with disabilities were extremely rarely employed in occupation groups of commissioned armed forces officers, non-commissioned armed forces officers and private soldiers. Insignificant frequencies were also observed in case of public government officers, senior officers and managers, and of age group of 15–19 years, for this reason their neighbourhoods were not interpreted either.

As much as 83.2 per cent of the actual associations between age and occupation of disabled employed persons have been explained in R^2 .

The analysis resulted in four clusters and lead to a conclusion that disabled persons aged 30–49 are typically employed in the group technicians and midlevel staff, and in the group of occupations that require at most medium professional skills, i.e. industrial workers, operators and assemblers. Non-disabled persons aged 30–39 typically work as professionals or technicians and midlevel staff. While disabled persons aged 50–59 are typically employed as services workers and sales workers or in elementary occupations, non-disabled persons of this age group are typically employed in elementary occupations that require skills at the simple level.

Figure 4. Associations between categorical variables: actual occupation and age for the population of persons with disabilities



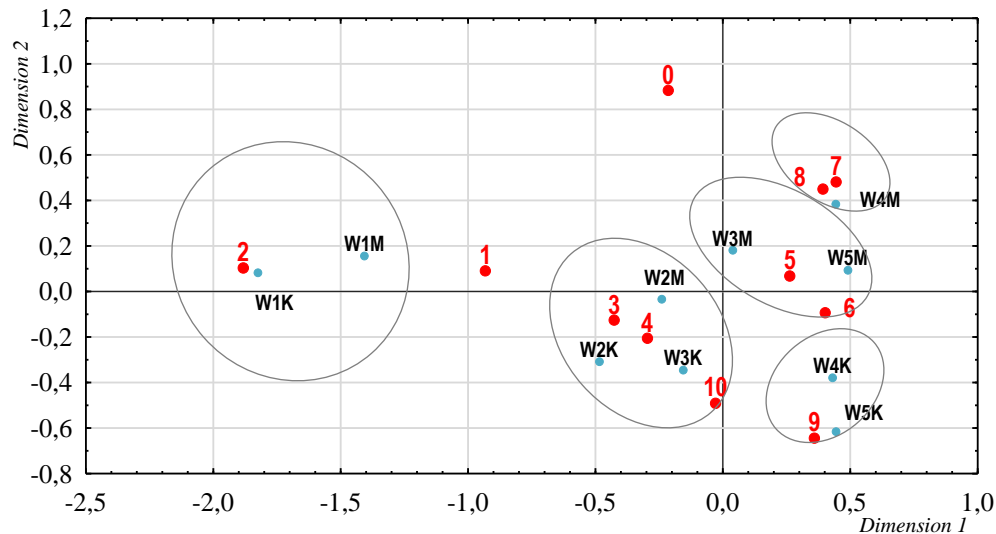
Source: the author's own elaboration.

An interesting remark is that disabled persons aged 50–59 who mostly work as contributing family workers, without agreed upon remuneration (in family business or family farm), work in occupations requiring higher skills than non-disabled persons of this age group.

Persons aged 60+ (who predominantly are economically inactive) typically are employed as agricultural, gardening, forestry and fishery workers.

Correspondence analysis conducted in R2 to evaluate associations between education and actual occupation of persons with disabilities determined the quality of representation equal to approximately 85 per cent, i.e. at a satisfactory level.

Figure 5. Associations between categorical variables: actual occupation and education by sex for the population of persons with disabilities



Source: the author's own elaboration.

Based on Figure 5, one can distinguish several clusters showing that persons with disabilities employed as professionals, men and women alike, have mostly tertiary education that is a required level of education in this group of occupation (a similar association has been observed in the population of persons without disabilities).

In next cluster, occupations in groups of technicians and midlevel staff and of clerical workers are typically associated with disabled women who have post-secondary or secondary education (education levels required at this skill level), and by disabled men with post-secondary education. In the non-disabled population, women with secondary education are typically employed as services workers and sales workers.

Disabled men with secondary education are predominantly employed as services workers and sales workers, or as agricultural workers – these occupations are most appropriate for their skills. Disabled men with basic vocational education are mainly employed in groups of occupations of blue-collar workers and craft workers, and of operators and assemblers.

Disabled women with basic vocational education are worse off than men, because they are mostly employed in occupations requiring lower skills, i.e. they work in elementary occupations (similarly as women in the population of persons without disabilities).

A positive phenomenon is observed of men with the lowest education mostly working in occupations that require higher skills levels, i.e. they are employed as service workers and sales workers, as well as agricultural, gardening, forestry and fishery workers (non-disabled men more often as plant and machine operators, and assemblers). Unfortunately, both disabled

and non-disabled women, with lower secondary education or less, are employed in elementary occupations according to required skills in these jobs.

The hypothesis that persons with low education levels are employed in occupations that do not require high skills can be supported only in the population of women, disabled and non-disabled alike. On the other hand, men with the lowest education levels have jobs consistent with their competencies, and also jobs requiring higher competencies than just elementary skills. Therefore, the hypothesis that disabled persons with lower education levels are characterized by higher propensity to economic inactivity has not been confirmed.

Programmes aimed at solving the problem of economic activity of women who are employed below their skills and competencies can be identified as one of the major issues that require changes and improvement.

4. Conclusion and further research

Both correspondence analysis and cluster analysis are methods that allow to describe and visualize qualitative data, and to recognize structures and associations between categorical variables under study. Scatter plots presented in a two-dimensional space that is easy to interpret, demonstrate in a transparent fashion how variables correspond with each other and how they build clusters.

According to the 2011 National Census of Population and Housing, disabled women aged 65 and more, with secondary education or lower outnumber other groups of persons with disabilities in Poland. Most of persons with disabilities are married. Unfortunately, economic activity rate in the population of persons with disabilities is three times smaller than that of persons without disabilities. Statistical analysis did not validate any significant associations between categorical variables of economic activity and categorical variables of marital status and disability degree. On the other hand, significant associations were demonstrated between categorical variables of economic activity and such variables as age, sex, education, and also actual occupation. Women with disabilities, with low level of education, employed in occupations that do not require high levels of skills, are characterized by a high propensity to economic inactivity compared with other groups of disabled persons.

The conducted analysis also revealed that employed persons in the population of persons with disabilities are predominantly those with the highest level of education, mostly men with post-secondary education. One should discuss the labour market problems of disabled women with this level of education, in order to launch programmes aimed at improving their economic activity.

In order to settle differences between economic activities of non-disabled and disabled persons, one should improve labour market conditions of disabled males with post-secondary, secondary or basic vocational education, who actively seek employment, but are unemployed more often than persons without disabilities.

Endeavouring to create equal opportunities for persons with disabilities and to effectively oppose their social exclusion depends on integrating and coordinating the actions of various entities.

Acknowledgements

The authors are grateful to an anonymous referee for their constructive comments and suggestions. Any errors are solely those of the author.

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