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Gender differences in employment structures in Poland

1. Introduction

Gender inequalities can manifest themselves as: unequal pay, over-representation of men or women in selected sections of the economy, unequal access to managerial positions, to training, standard employment arrangements, etc. A popular research area in the field of gender inequalities is the analysis of differences in employment structures by occupational group or section of the economy. Most studies concerning differences in occupational employment structures conclude that men and women often work in typically male or female jobs,[1] and this results in different structures of employment of each sex.

A European Union report states the possible causes of different employment patterns of men and women: comparative biological advantages, investment in human capital (schooling or training), differential income roles, preferences and prejudices, stereotypes, entry barriers and organisational practices.[2]

Factors influencing the occupational choice can be divided into:

- demand side factors such as training, education and experience required by employers, and more general labour market trends, like product demand and labour productivity,
- supply side determinants, such as employee's background, demographic characteristics, individual abilities.[3]

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1 M. Charles, D. Grusky, *Occupational ghettos*: *the worldwide segregation of women and men*, CA: Stanford University Press 2004.

2 European Commission, *Gender segregation in the labour market*. *Root causes*, *implications and policy responses in the EU*, Publications Office of the European Union, Luxembourg 2009, p. 8.

3 P.E. Gabriel, S. Schmitz, *Gender differences in occupational distributions among workers*, "Monthly Lab. Rev." 2007, vol. 19, pp. 19–24.

England argues that there are jobs which are 'essentially' male or female, and women, on average, prefer occupations that are more interesting, allow them to work with other people and are not as demanding as men's occupations.[4] Petit and Hook find that women, struggling to reconcile career and family responsibilities, tend to choose 'women-friendly' jobs.[5] Stier and Yaish argue that women's jobs offer not only lower salaries and fewer opportunities for advancement, but also lower job security, worse job content, less time autonomy and worse emotional conditions.[6] Gabriel and Schmitz conclude that women frequently do not choose their occupations, but are rather 'pushed' into them.[7] Other analyses of gender differences in employment indicate that occupational differences between men and women are persistent, and traditional blue-collar jobs such as operatives and craft continue to be dominated by men, while women remain concentrated in service and clerical occupations.[8]

The aim of the article is to analyse dissimilarity of employment structures of men and women by occupational groups, sections of the economy, wage level, educational attainment, and the size of the employer. We also attempt to provide an explanation of some revealed gender differences in employment distributions.

2. Methodology

A number of methods use distance measures to determine the similarity (or dissimilarity) between a pair of multidimensional objects (structures). Examples of distance metrics include: *Euclidean metric*, *Mahalanobis metric*, *Manhattan metric*, *Minkowski metric* (of which special cases are *Euclidean* and *Manhattan metrics*), *Canberra metric*, etc. In the paper, the Canberra distance measure has

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4 P. England, *The gender revolution: uneven and stalled*, "Gender and Society" 2010, vol. 24(2), p. 149–166.

5 B. Petit, J.L. Hook, *Gendered tradeoffs*: *family, social policy and economic inequality in twenty-one countries*, Russell Sage Foundation, New York 2009.

6 H. Stier, M. Yaish, *Occupational segregation and gender inequality in job quality: a multilevel approach*, "Work, employment and society" 2014, vol. 28(2), pp. 225–246.

7 P. Findlay, J. Findlay, R. Stewart, *The consequences of caring: skills, regulation and reward among early years workers*, "Work, Employment and Society" 2009, vol. 23(3), pp. 422–441. B.F. Reskin, M.L. Maroto, *What trends? Whose choices? Comment on England* "Gender and Society" 2011, vol. 25(1), pp. 81–87.

8 P.E. Gabriel and S. Schmitz, op.cit.

been used in order to determine the level of dissimilarity between structures (distributions).[9]

Let S_r^n and S_s^n represent two structures from the set of $\Gamma^n = \left\{ S_j^n = [\omega_{1j}, \omega_{2j}, ..., \omega_{nj}]^T \;\middle|\; 0 \le \omega_{ij} \le 1, \sum_{i=1}^{n} \omega_{ij} = 1 \right\}$ for $j = 1, ..., m$. Let the metric $d(S_r^n, S_s^n)$ have the following five properties:[10]

i. non–negativity: $d(S_r^n, S_s^n) \ge 0$;
ii. symmetry: $d(S_r^n, S_s^n) = d(S_s^n, S_r^n)$;
iii. identification mark: $d(S_r^n, S_s^n) = 0$;
iv. definiteness: if and only if $S_r^n = S_s^n$;
v. triangle inequality: $d(S_s^n, S_r^n) + d(S_r^n, S_p^n) \ge d(S_s^n, S_p^n)$.

The Canberra distance is a metric used for data scattered around the origin.[11] It was introduced in 1967 by G.N. Lance and W.T. Williams.[12] The formula to calculate the distance is as follows:

$$d_{rs}^{Can} = \sum_{i=1}^{n} \frac{\left|\omega_{ir} - \omega_{is}\right|}{\left|\omega_{ir}\right| + \left|\omega_{is}\right|}, (r, s = 1, ..., m). \tag{1}$$

The metric excludes double zeros and increases the effect of differences between variables with low values or many zeroes. Values of the Canberra metric (1) range from 0 to n, therefore a standardised version of the measure is often used. Its values are standardised in the interval $\left[0,1\right]$ and are described by the formula:

$$d_{rs}^{Can^*} = \frac{1}{n} \sum_{i=1}^{n} \frac{\left|\omega_{ir} - \omega_{is}\right|}{\omega_{ir} + \omega_{is}}, (r, s = 1, ..., m). \tag{2}$$

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[9] Oczki and Wędrowska used Csiszár's divergence measures to identify the degree of dissimilarity of income distributions among the EU countries (J. Oczki, E. Wędrowska, *The use of Csiszár's divergence to assess dissimilarities of income distributions of EU countries*, "Metody Ilościowe w Badaniach Ekonomicznych" 2014, no 2. vol. 15., pp. 167–176).

[10] O.A. Jafar, R. Sivakumar, *Hybrid fuzzy data clustering algorithm using different distance metrics: a comparative study*; "International Journal of Soft Computing and Engineering" 2014, vol. 3, Issue 6, p. 241–248.

[11] B.S. Charulatha, P. Rodrigues, T. Chitralekha, A. Rajaraman, *A Comparative study of different distance metrics that can be used in Fuzzy Clustering Algorithms*, "International Journal of Emerging Trends & Technology in Computer Science" 2013, Special Issue; NCASG2013.

[12] G.N. Lance, W.T. Williams, *Mixed-data classificatory programs I – Agglomerative Systems*, "Australian Computer Journal" 1967, pp. 82–85.

Since in the article we compare values of Canberra metrics calculated for structures with different number of elements, the standardised formula (2) has been used.

We use the data from the Polish Central Statistical Office survey on structure of earnings by occupations in October 2012.[13] The survey is carried out with biennial frequency and concerns individuals employed in organisations with the number of the employees exceeding 9 persons.

3. Gender differences in employment structures

In the first step of our analysis we consider gender differences in employment structures by earnings. Table 1 presents employment structures of men and women by gross monthly wage levels.[14] In case of each of the four distributions, for both sectors and both genders, the highest shares of employees receive wages lower than the national average wage (i.e., the distributions are positively skewed). This tendency is particularly apparent in the private sector, where 77% of women and 66% of men earned less than the average salary. In the public sector, 62.3% of women and 49.3% of men receive gross monthly wages which are smaller than the average salary. Moreover, in this sector of the economy, there are almost no employees earning less than PLN 1500. This could be due to the fact that state-owned organisations rarely use low-paying flexible employment contracts, which are relatively popular in privately owned companies. Such contracts do not guarantee the minimum wage, which in 2012 was at the level of PLN 1500.

The values of Canberra metrics indicate that gender differences in wage structures in the public sector are considerably larger (0.332), than in the private sector (0.190). This can be due to the fact that many large enterprises in Poland are state-owned and they typically represent male-dominated, high-wage industries, such as energy production and mining. On the other hand, numerous low-paying state-owned institutions in sections such as health care, education, social work, etc. are typically dominated by women. This division into highly-paying male

[13] Główny Urząd Statystyczny [Central Statistical Office of Poland], *Struktura wynagrodzeń według zawodów w październiku 2012*, GUS, Warszawa 2014.

[14] The wage intervals were constructed as a fraction or multiple of average gross monthly wage in Poland in 2012 – PLN 3895.72.

sections and low-paying sections which employ an overproportionate share of women is much more apparent in the public sector than in the private one. The above finding is also confirmed by the comparison of employment distributions by sections of the economy (table 2). Gender differences in employment structures by sections are also larger in the public sector than in the private one – the values of the Canberra metric reach 0.468 and 0.389 respectively.

Table 1. Dissimilarity of employment distributions of men and women by wage

Gross monthly wage (in PLN)	Overall			Public sector			Private sector		
	men	women	d_{rs}^{Can*}	men	women	d_{rs}^{Can*}	men	women	d_{rs}^{Can*}
	(%)			(%)			(%)		
up to 1500.00	8.0	7.1		0.2	0.4		10.7	12.9	
1500.01–1947.86	9.4	13.3		3.7	7.9		11.2	18.0	
1947.87–2921.79	23.5	28.8		21.9	27.0		24.0	30.3	
2921.80–3895.72	21.0	21.2		23.5	27.0		20.1	16.1	
3895.73–4869.65	13.2	13.2		16.7	18.8		12.1	8.4	
4869.66–5843.58	7.8	6.9		11.0	9.5		6.8	4.6	
5843.59–6817.51	4.9	3.4	0.202	6.9	4.2	0.332	4.3	2.8	0.190
6817.52–7791.44	3.3	1.8		5.0	1.9		2.7	1.8	
7791.45–8765.37	2.3	1.2		3.6	1.1		1.9	1.2	
8765.38–9739.30	1.5	0.8		2.3	0.7		1.2	0.8	
9739.31–10713.23	1.0	0.5		1.5	0.5		0.9	0.6	
10713.24–11687.16	0.8	0.4		1.0	0.3		0.7	0.5	
11687.17–20000.00	2.4	1.1		2.3	0.6		2.4	1.5	
20000.01 and more	0.9	0.3		0.4	0.1		1.0	0.5	

Source: own calculations based on Central Statistical Office data.

Relatively high values of the Canberra metric describing dissimilarity of employment structures by sections of the economy, as compared with values of the metric for employment distributions by wage level, confirm that there are strong patterns of traditionally male- and female-dominated sections in the Polish economy.

In the public sector, the highest share of employees work for educational institutions – 20.8% of men and 37.4% of women. In the female population, the second most popular section after education is human health and social work with a share of almost 30%, while in the male population it is transportation and storage, with over 15% of men employed. The largest gender differences in employment shares in the public sector are observed in male- and female-dominated

sections: education, mining and quarrying, human health and social work, and transportation and storage. In the private sector, most women are employed in trade and repair of motor vehicles – 28.6% (usually as shop salespersons – almost 16% of all women employed in the private sector) and manufacturing – 28.4%. Most men are employed in manufacturing – 41%, followed by trade, repair of motor vehicles (16.8%), and construction (12.2%). The highest gender differences in percentages of employees working for private enterprises were noted in construction, manufacturing, trade, and repair of motor vehicles.

Table 2. Dissimilarity of employment structures of men and women by sections of the economy

Section of the economy (PKD 2007 classification)	Overall			Public sector			Private sector		
	men	women	d_{rs}^{Can*}	men	women	d_{rs}^{Can*}	men	women	d_{rs}^{Can*}
	(%)			(%)			(%)		
Agriculture, forestry and fishing (A)	1.2	0.4		2.2	0.4		0.9	0.4	
Mining and quarrying (B)	3.3	0.4		9.1	0.5		1.4	0.2	
Manufacturing (C)	31.9	15.6		4.4	0.8		41.1	28.4	
Electricity, gas, steam and air conditioning supply (D)	2.7	0.7		4.1	0.6		2.2	0.8	
Water supply, sewerage; waste management and remediation activities (E)	2.3	0.7		6.3	1.0		0.9	0.4	
Construction (F)	9.4	1.3	0.363	1.0	0.1	0.468	12.2	2.3	0.389
Trade, repair of motor vehicles (G)	12.7	15.3		0.2	0.1		16.8	28.6	
Transportation and storage (H)	8.6	3.3		15.2	4.5		6.4	2.2	
Accommodation and catering (I)	1.2	2.2		0.4	0.5		1.5	3.6	
Information and communication (J)	2.7	1.7		0.6	0.2		3.4	3.0	
Financial and insurance activities (K)	2.5	5.1		1.3	1.7		2.9	8.1	
Real estate activities (L)	1.2	1.4		1.6	0.9		1.1	1.8	

Section of the economy (PKD 2007 classification)	Overall			Public sector			Private sector		
	men	women	d_{rs}^{Can*}	men	women	d_{rs}^{Can*}	men	women	d_{rs}^{Can*}
	(%)			(%)			(%)		
Professional, scientific and technical activities (M)	2.5	2.7		2.5	1.6		2.5	3.7	
Administrative and support service activities (N)	3.5	3.1		0.4	0.2		4.5	5.7	
Public administration and defence, compulsory social security (O)	3.8	8.2	0.363	15.0	17.6	0.468	0.0	0.0	0.389
Education (P)	5.7	18.8		20.8	37.4		0.7	3.0	
Human health and social work activities (Q)	3.5	17.2		11.6	29.1		0.8	6.7	
Arts, entertainment and recreation (R)	0.9	1.5		3.2	2.8		0.2	0.4	
Other service activities (S)	0.4	0.4		0.1	0.0		0.5	0.7	

Source: own calculations based on Central Statistical Office data.

Comparison of employment distributions by educational attainment (table 3) indicates, again, that gender differences are more significant in the public sector ($d_{rs}^{Can*} = 0.315$) than in private companies ($d_{rs}^{Can*} = 0.230$). This finding is not surprising in the light of higher gender differences in the public sector revealed in employment structures by section.

In both sectors, women have, on average, higher educational attainment than men, with the following important differences in employment distributions:

- higher proportion of women than men holding a tertiary education diploma,
- considerably higher proportion of men than women with basic vocational education.

In general, employees in public institutions are better educated than those in private companies. In the public sector, as much as 58% of women and 45% of men hold a tertiary education diploma, while in private sector 34% of women and 24% of men are university graduates.

Table 3. Dissimilarity of employment distributions of men and women by educational attainment

Educational attainment	Overall			Public sector			Private sector		
	men	women	d_{rs}^{Can*}	men	women	d_{rs}^{Can*}	men	women	d_{rs}^{Can*}
	(%)			(%)			(%)		
Tertiary with master degree	21.5	36.6		37.6	49.7		16.1	25.2	
Tertiary with engineer or bachelor degree	7.7	8.6		7.3	8.2		7.9	8.9	
Post–secondary	3.0	7.1		3.2	7.5		3.0	6.7	
Vocational secondary	23.9	19.8	0.270	19.6	18.0	0.315	25.3	21.5	0.230
General secondary	6.9	9.8		4.5	5.9		7.6	13.2	
Basic vocational	30.1	13.6		22.2	7.3		32.8	19.1	
Lower secondary	0.4	0.1		0.1	0.0		0.5	0.2	
Primary and incomplete primary	6.5	4.4		5.5	3.4		6.8	5.2	

Source: own calculations based on Central Statistical Office data.

As the final step, we have analysed employment structures of men and women by occupational group (table 4). The most significant gender differences in these employment distributions are:

- high representation of women in the group of professionals, clerical support, service and sales workers,
- considerably higher representation of men among plant and machine operators and assemblers, and craft and related trades workers.

Higher gender dissimilarity in public sector is, again, the effect of the typical pattern of employment in the heavy industry and energy sectors (men-dominated), as well as the overproportionate presence of women in clerical and specialist jobs. Surprisingly, gender difference of employment share in the group of managers is relatively small – 8.8% of men are employed in managerial positions, compared to 7.3% of women, and this trend is similar both in public and private sectors. In the public sector, most persons are employed as professionals (in case of women it is more than half). In the private sector, most women work as service and sales workers, while most men are employed as craft and related trades workers, plant and machine operators and assemblers.

Table 4. Employment distributions of men and women by occupational group

Occupational group	Overall			Public sector			Private sector		
	men	women	d_{rs}^{Can*}	men	women	d_{rs}^{Can*}	men	women	d_{rs}^{Can*}
	(%)			(%)			(%)		
Managers	8.8	7.3	0.356	6.9	6.0	0.386	9.4	8.5	0.304
Professionals	17.2	35.0		31.7	51.7		12.4	20.3	
Technicians and associate professionals	10.2	13.0		12.8	14.9		9.4	11.4	
Clerical support workers	6.8	11.8		6.8	11.6		6.8	12.1	
Service and sales workers	7.0	14.1		5.4	4.2		7.6	22.7	
Skilled agricultural, forestry and fishery workers	0.3	0.1		0.4	0.1		0.2	0.1	
Craft and related trades	23.5	4.8		14.1	0.3		26.6	8.7	
Plant and machine operators, and assemblers	19.2	3.5		15.4	0.7		20.4	5.9	
Elementary occupations	7.0	10.4		6.5	10.5		7.2	10.3	

Source: own calculations based on Central Statistical Office data.

The relatively high Canberra metric level for overall employment structures by occupation – 0.356 – is comparable with the value of the metric calculated for employment structures by section – 0.363 (table 2). Out of all Canberra metric values analysed in our study, those describing gender dissimilarities in employment structures by section of the economy are the highest. Interestingly, the metric value for distributions by earnings is significantly lower – 0.202, which means that occupational and sectional differences in employment structures of men and women are not fully reflected in gender differences in employment structures by earnings. Thus, the male-female dissimilarity of distributions of wage structures is more modest than gender division of labour by sections of the economy and occupations.

4. Conclusions

The Canberra metric is a useful tool for measuring dissimilarity of structures and can be applied to analysing gender differences in employment distributions. Relatively high values of the metric describing dissimilarity of employment structures of men and women, by occupations and by sections of the economy, indicate that there are strong patterns of male- and female-dominated sections and occupations in Poland, especially in the public sector. The high gender dissimilarity of employment distributions in the public sector can be due to the fact that, firstly, many large companies are state-owned, and they typically represent male-dominated, high-wage industries, such as energy production and mining, and secondly, numerous low-paying public institutions in sections such as health care, education and social work are dominated by women.

Gender dissimilarity of employment distributions by earnings is rather modest in comparison to the differences in distributions of men and women by occupation and section. In other words, occupational and sectional gender differences in employment structures are not fully reflected in dissimilarities in wage distributions. Wages of men and women tend to be more similar than it would follow from differences in employment patterns, highly influenced by the prevalence of male- and female-dominated sections.

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Zróżnicowanie struktur zatrudnienia ze względu na płeć w Polsce

Streszczenie

Zróżnicowanie struktur zatrudnienia ze względu na płeć jest przedmiotem analiz specjalistów z zakresu nauk ekonomicznych i społecznych. W artykule przedstawiono wyniki analizy rozbieżności w strukturze wynagrodzeń w populacjach kobiet i mężczyzn w Polsce w sektorze publicznym i prywatnym według sekcji klasyfikacji GUS, grup zawodowych, wynagrodzeń oraz wykształcenia. Do pomiaru rozbieżności struktur zastosowano metrykę Canberra, miarę odległości pomiędzy obiektami wielowymiarowymi. W opracowaniu podjęto również próbę wskazania czynników objaśniających zdiagnozowane różnice w strukturach zatrudnienia. Dane uwzględnione w badaniu pochodzą z reprezentacyjnego badania struktury wynagrodzeń według zawodów przeprowadzonego przez Główny Urząd Statystyczny (badanie GUS o symbolu Z-12).

Słowa kluczowe: różnice ze względu na płeć w zatrudnieniu, struktury zatrudnienia, metryka Canberra