

WIKTORIA DOMAGAŁA*

Measuring Gender Occupational Segregation: OECD Countries in Comparative Perspective¹

Introduction

Source literature unambiguously indicates that gender occupational segregation occurs in two dimensions (Altonji and Blanc 1999; Blackburn 2009). From the horizontal perspective it is concentration of employment of one gender in certain economic sectors, market sectors and professions. At the same time, it is assumed that less prestigious industries and professions, as well as less paid occupations are feminised. From the vertical perspective it means uneven distribution of the employed women and men according to their position. In practice, it is connected with masculinisation of higher level management and clerk positions on the labour market.

There is no consensus whether the phenomenon of gender occupational segregation shall be treated as the effect of economic discrimination. Those who support this approach argue that occupational segregation results from arbitrary access limitations – based on subjective presumptions – for one gender to certain industries, professions or positions (Chien and Kleiner 1999; Zwiech 2011). Other researchers assume that occupational segregation shows only gender inequality at work which may be caused by various reasons (Duncan and Duncan 1955; Browne 2006; Strawiński et al. 2016). In compliance with this approach presented in the article, occupational segregation fosters flexibility and effectiveness of labour market perturbation by wasting some part of human resources (Anker 2001).

A significant body of research has highlighted the importance of elimination of gender occupational segregation which is believed to be the main reason for gender participation, remuneration and advancement gaps.² Moreover, especially

* Dr Wiktoria Domagała – Department of Macroeconomics and Development Research, Poznań University of Economics and Business; e-mail: Wiktoria.Domagala@ue.poznan.pl

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² The gender participation gap is captured using the difference between women and men in labour force participation rates. The remuneration gap is the wage disparity between females and males. The gap between the advancement of women and men is more complex and refers to such areas as: education (the

in highly developed countries the mentioned gender gaps are perceived as factors which inhibit socio-economic growth. As an example, S. Klasen (1999) noticed that gender inequalities in the level of economic activity, having their roots in stereotypical female and male industries and professions, impede economic development. It is confirmed by the research of J. Costa et al. (2009) which shows that the countries in which employment and pay gaps between genders are relatively high are under negative influence of the previously mentioned factors on the economic growth. In this research, the source of the pay gap is claimed to result from vertical occupational segregation which results in masculinisation of management positions that are relatively higher paid. The negative impact of gender inequality in the labour market on the level and dynamics of GDP has been also confirmed by the report of European Institute for Gender Equality (2017) and by Human Development Report (Jahan, 2016).

Although source literature agrees that occupational segregation may hinder economic growth as well as closing the gender gaps, still it is not clear how large this influence is, as the occupational segregation can be measured by a vast number of various indicators. In consequence, lack of precise and universally accepted measures of occupational segregation makes it difficult to assess its scale and socio-economic consequences. Thus, the goal of the study is to present a new way of measuring the scale of occupational segregation that can be used in empirical analysis. The study contributes to the field not only by a critical analysis of the indicators that are currently used in source literature, but also by estimation of the seminal Occupational Segregation Index. This measure has been calculated for 30 OECD countries for the years 1997–2016.

The method proposed by Knogler and Lankes (2015) is used to obtain this measure. It starts from conducting a principal components analysis to transform six variables that capture horizontal and vertical occupational segregation into a set of three components that reflects various (uncorrelated) dimensions of occupational segregation. In the next step the ratio of female to male labour force participation rate (RATIO) is regressed on these components by using within-between random effects model. It allows to obtain atheoretical weights which are used to aggregate these components into the final Occupational Segregation Index.

The article is organised as follows: the first part includes a critical review of source literature in the context of indicators of gender occupational segregation presented. Next section, empirical analysis, is divided into three parts: method,

level of education according to sex), labour market (participation of women and man in management and professional occupations as well as gender wage gap) (Samans and Zahidi, 2016). Moreover, the researchers from the United Nation Development Programme show that the gender advancement gap has significant influence on the level of socio-economic development (Jahan, 2016). The reasons for gender gaps lay in gender occupational segregation, especially in glass-ceiling and sticky-floor effect. Glass-ceiling stands for an invisible barrier which prevents social or professional promotion of women even though their qualifications and professional skills are comparable to the ones performed by men (Titkow, 2003). Sticky-floor effect is understood as feminisation of professions or less advanced economic sectors in which there is little possibility for promotion and the wage level is lower (Kalinowska-Sufinowicz and Domagała, 2016).

data, results. The first part presents arguments in favour of the employed measurement method in comparison to other indicators used in source literature. The second part presents variables used for main components' analysis which was collected by reviewing data bases of international organisations. The last part of empirical analysis presents the results of the PCA and the regression analysis of RATIO on the obtained segregation components. The most important conclusions are presented in the summary.

1. Insight from source literature

In this part of the article, various indicators of occupational segregation will be discussed according to their objective scope – beginning with those of the smallest and ending with those of the biggest range. In the first place, indicators of occupational structure in accordance with gender and economic sectors, national economy section and professional groups will be shown. Then, measures indicating the level of gender occupational segregation will be considered. Last but not least, the measures of gender inequality, including the issue of occupational segregation, will be discussed.

Data bases of international institutions and organisations are the source of many indexes connected with the discussed phenomenon. The main advantage of these data sources is their reliability, comparability and common applicability, as well as a broad time and distribution range of the published data.

For example, one of the areas mentioned in the World Bank data base focusing on World Development Indicators is the difference between women and men in the domains of social, economic and political life. Gender Statistics data base of the World Bank specifies this issue pointing at the number of women and men employed in certain economic sectors such as agriculture, industry and services (World Bank, 2017). OECD Statistics data base holds a similar data scope which, taking into consideration occupational segregation, is focused on the occupational structure according to gender and employment status (OECD, 2017). Furthermore, the data base of International Labour Organisation Ilostat presents data concerning the number of women and men employed in various sectors of national economy (i.e. overcrowding of women employed in such sectors as education, health care and community service and overcrowding of men employed in construction and mining) as well as professional groups – with particular focus on people employed as managers or directors (ILO, 2017). Gender inequalities existing in political authorities are the subject of research of the Inter-Parliamentary Union which is reflected in Women in Politics quantitative data base (IPU, 2017).

The usage of quantitative data for the sake of describing the distribution of the employed women and men within economic sectors, market sections or professional groups is limited due to its narrow interpretation scope. The indicators show the number of women and men only in certain cross-sections which allows

to identify the under-representation or over-representation of one of the genders. What is more, it is unclear which of the criteria should be used as the indicators of feminisation or masculinisation of the given cross-section. The three-step classification of the cross-sections is a commonly used approach to divide the analysed structures into female-dominated, male-dominated and mixed (European Commission, 2009 as cited in Hakim, 1993). Identification of the character of the cross-sections is based on the share of women among the total number of employees. It is assumed that if in analysed structure the share of women is higher minimum by 15 p.p. than in a group of employed people in general, it shows feminisation. Similarly, lower share of female minimum by 15 p.p. means that the group is masculinised. In other cases, the cross-section is mixed. This approach, however, does not allow to fully evaluate the level of occupational segregation in the whole economy.

This is the reason why in source literature there is a number of indicators allowing to evaluate the total level of gender occupational segregation, as follows:

- Duncan and Duncan Index of Dissimilarity, defined as (Duncan and Duncan 1955):

$$ID = \frac{1}{2} \sum \left| \frac{F_i}{F} - \frac{M_i}{M} \right|; \quad (1)$$

- The Moir and Selby Smith Segregation Indicator, defined as (Emerek et al., 2003):

$$MSS = \sum \left| \frac{F_i}{F} - \frac{M_i}{M} \right|; \quad (2)$$

- Karmel and MacLachlan Index, defined as (Blackburn, 2009 as cited in: Karmel and MacLachlan, 1988):

$$IP = \frac{1}{N} \sum \left| \left(1 - \frac{M}{N} \right) \cdot M_i - \frac{M}{N} \cdot F_i \right|, \quad (3)$$

where: F represents the total number of women in labour force in a given economy in a given time, whereas M represents the number of men in labour force; F_i represents the number of women in labour force in the given cross-sections in the given time and M_i represents the number of men in labour force respectively; N is a number of occupations in the given economy in the time of the research and N_i represents the number of employees in the cross-sections under research.³

Occupational segregation indicators allow to define the percentage of employees who should be shifted to a different economic sector, section or occupation in order to eliminate gender occupational segregation. The indexes are based on understanding occupational segregation as a difference in employment between men and women in certain cross-sections. The lower the observed differences (the value of the indexes closer to zero), and hence, the more equal distribution of labour force, the smaller the scale of occupational segregation.

³ The percentage of women and men in the labour force, not the number of the employed persons, is used in order to calculate Duncan and Duncan Index of Dissimilarity (ID).

The main disadvantage of the indexes mentioned is the fact that they indicate the scale of shift among economic sectors, sections of economy and occupations disregarding the direction or scope of the shifts. Another problem is that the results obtained are dependent on the number of subpopulation into which the labour force was divided in the given cross-section. The more subpopulations there are in the cross-section, the lower the values of the indexes. Hence, the values of the indexes are subjective – they are dependent directly on the chosen classification method of the economic sectors, sections of economy or occupations researched (Blau and Kahn, 2001). On the other hand, the feature which makes the international comparison of the occupational segregation indicators impossible is the difficulty in grasping the differences of sections of economy or occupations classification among countries.

In source literature, there are indicators of gender inequality presented which reflect, among others, gender occupational segregation, such as: Gender Inequality Index (GII), Gender Empowerment Measure (GEM), Gender Equity Index (GEI) and Global Gender Gap Index (GGGI). The basic disadvantage of these indicators is their too broad objective scope which makes it impossible to measure the scale of gender occupational segregation. Moreover, international comparison of these indicators is difficult as the time range thereof is limited and the calculation method is too simplified and based on averaged values (see Table A1 in Appendix).

Summing up, the measure of gender occupational segregation is typically limited to the analysis of the structure of employment from the perspective of gender and cross-sections such as economic sectors, sections of economy and occupations. The result of such a research is the identification of feminine and masculine cross-sections. Such an approach inhibits an unambiguous evaluation of the scale of occupational segregation in the whole economy. More importantly, it limits the possibility of comparative analysis in the international perspective. A lot of indicators have been presented in source literature (such as ID, MSS or IP) which are used to evaluate the total level of occupational segregation. However, the inadequacy of calculations and the narrow scope of interpretation cause the search for more complex indicators of gender occupational segregation. The indicators of gender inequality should not be taken as adequate occupational segregation indicators as their objective scope is too broad and they focus on limited aspects of occupational segregation. There is a visible research gap in this area, hence it is worth developing an independent indicator of occupational segregation to be used in the research aiming at comparative analysis of the scale and range of gender occupational segregation in highly developed countries.

2. Empirical analysis

Method

The article used the two-step method proposed by Knogler and Lankes (2015) in order to construct synthetic measures of occupational segregation. The main advantage of this approach is the possibility of identifying the main and independent dimensions of the phenomenon discussed, i.e. measuring gender occu-

pational segregation using principal component analysis (PCA). Another benefit is the possibility of using these dimensions, by employing regression analysis, to explain the differences in the scale of gender participation gap in the research group of the highly developed countries. Although PCA is used for the analysis of socio-economic phenomena (Pilc, 2017), source literature provides no research on gender inequality, including occupational segregation based on it.

Initially, principal component analysis was carried out on 6 indicators presented in Table 1.⁴ The aim of PCA is to make the information included in the initial dataset precise and to identify the dimensions “hidden” behind the dataset, which differentiate the research objects using correlation matrix (see Table A3 in Appendix). The result of the first step of the analysis is a reduced dataset of uncorrelated components, which eliminates the problem of collinearity of the variables (Nardo et al. 2005).

The aim of the second step was to identify the dimensions of occupational segregation according to gender (expressed by the components in the first stage of the analysis), which determines significantly the differences in gender participation gap on the labour market in the countries of the research group. In order to achieve this aim, the ratio of female to male labour force participation rate (RATIO) was regressed on the obtained components by using panel data model: within-between specification (Bell and Jones, 2015; Bell, Fairbrother and Jones, 2017), given in the following general form:⁵

$$y_{ij} = \beta_0 + \beta_1(x_{ij} - \bar{x}_j) + \beta_2\bar{x}_j + \beta_3z_j + (u_j + \varepsilon_{ij}). \quad (4)$$

The within-between model is variant of a random effects model, but where independent variables are divided into their time (_diff) and cross-country (_av) varying parts (see in Table 3). Moreover, the inclusion of means of time-variant variables calculated for each country into the model excludes the heterogeneity bias. Therefore, there is no need to conduct the Hausman test. However, the model should be estimated with a balanced dataset in order to obtain consistent estimates, which resulted in elimination of five countries (Iceland, Ireland, Israel, Latvia and Turkey) from the analysed group. The estimated (and statistically significant) coefficients were used as weights in the aggregation of the obtained components into Occupational Segregation Index (further: OSI_{RATIO}). The advantage of this step of the procedure is the construction of measures that are based on uncorrelated components aggregated with empirically obtained weights – therefore the more important the component, the higher its weight.

⁴ The observations-to-variables ratio is equal to 5.0 (30 countries and 6 variables), hence it fulfils the 5:1 criterion (Nardo et al. 2005).

⁵ The abbreviations as follows: y_{ij} – the dependent variable, x_{ij} – set of time-variant variables, \bar{x}_j – x_{ij} means calculated for each country, z_j – the set of time-invariant variables, u_j – first part of error term (a time-invariant element: unobserved heterogeneity of countries), ε_{it} – the second part of error term (idiosyncratic disturbance for each observation), parameter β_1 – within effect (average impact of changes in x over time on the dependent variable), β_2 – between effect (impact of a unitary difference in x among analysed countries on the dependent variable) (Naskręcka and Pilc, 2017, s. 14–15).

Data

In the first step, it was decided to use six indicators of gender inequality in the professional sphere that are described in Table 1. Their values were collected for the years 1997–2016 for 30 OECD countries. The variables were chosen based on the analysis of source literature, reports and databases of international organisations according to the following criteria: availability of the statistical data, international comparability as well as significance of the variables from the perspective of evaluation of the scale of gender occupational segregation. The choice of the criteria for the variables chosen for the analysis was based on OECD methodology (2015) and ILO (2016).

Table 1
The selected indicators of gender inequality used in the PCA

Variable	Definition	Source
<i>Measures of a vertical occupational segregation</i>		
MAN_RATIO	Ratio of women to men in senior and middle management (as a percentage of total employment).	International Labour Organization (2017), ILOSTAT database.
PAR_RATIO	Ratio of women to men in parliaments (as a percentage of parliamentary seats in a single or lower chamber).	IPU (2017), Women in Politics
VUL_RATIO	Ratio of women to men employed as contributing family workers and own-account workers – vulnerable employment (as a percentage of total employment).	World Bank (2017), Gender Statistics Database
<i>Measures of a horizontal occupational segregation</i>		
AGR_RATIO	Ratio of women to men employed in agriculture (as a percentage of total employment). The agriculture sector consists of activities in agriculture, hunting, forestry and fishing.	World Bank (2017), Gender Statistics Database
IND_RATIO	Ratio of women to men employed in industry (as a percentage of total employment). The industry sector consists of mining and quarrying, manufacturing, construction, and public utilities (electricity, gas, and water).	World Bank (2017), Gender Statistics Database
SER_RATIO	Ratio of women to men employed in services (as a percentage of total employment). The services sector consists of wholesale and retail trade; restaurants and hotels; transport, storage and communications; financing, insurance, real estate and business services; community, social and personal services.	World Bank (2017), Gender Statistics Database

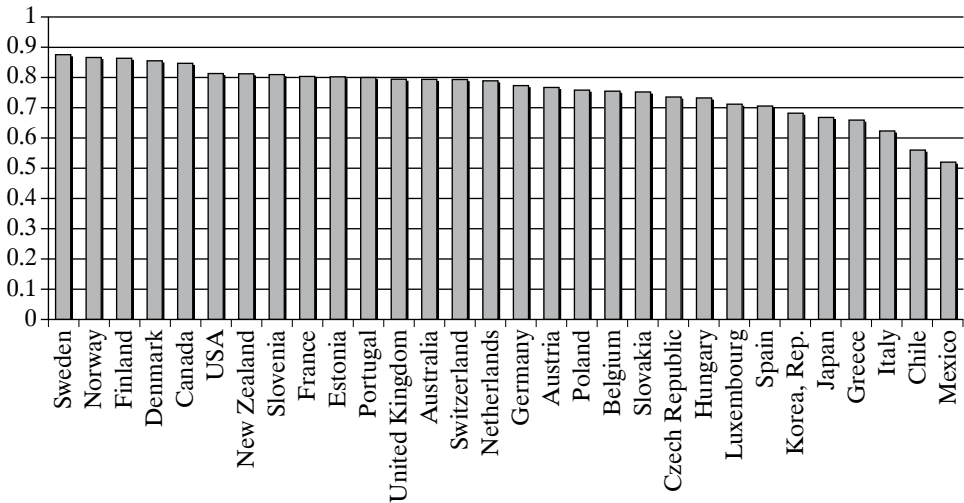
Note: Average values of the variables for the OECD countries are presented in Table A2 in Appendix.

Source: Own elaboration.

In the second step of the analysis – estimation of within-between model, the following dependent variable was used: ratio of female to male labour force participation rate (RATIO). RATIO is calculated by dividing female labour force participation rate by male labour force participation rate (World Bank, 2017). This variable has been chosen for the analysis because it illustrates the phenomenon of gender participation gap on the labour market. When the value of RATIO is closer to unity, gender equality in the context of economic activity is higher (see Figure 1). It is often indicated in the literature (Klasen 1999; Costa et al. 2009) that gender occupational segregation is one of the main determinants of gender participation gap; the conducted analysis allows to verify these conjectures. In order to do that it is crucial to compare the results for OSI_{RATIO} in the studied countries.

Figure 1

RATIO in OECD countries – average values for the years 1997–2016 (in %)



Source: Own elaboration based on: (World Bank, 2017).

Results

As the result of PCA analysis 3 components have been derived, the criterion of eigenvalues greater than one taken for the later research – each of them explains more variability than a singular original variable (the values of SS loadings higher than 1 – see Table 2).

The first occupational segregation component (OSC_1) may be interpreted as a mixed-typed occupational segregation. Moreover, OSC_1 is positively correlated with the employment in agriculture, which is the indicator of horizontal occupational segregation. Positive correlation of the component with the vulnerable employees (see Table 2), which indicates vertical occupational segregation, is also an evidence for mixed-typed occupational segregation. Thus,

the results for OSC_1 allow to conclude that the higher the difference between women and men employment in agriculture (i.e. the higher the horizontal segregation is), the higher the vertical segregation. OSC_1 explains 33.0% occupational segregation data variability analysed in the OECD countries. The highest values of this component were noted for Netherlands, Mexico, Korea, Rep. (see Table A4).

The second occupational segregation component (OSC_2) shows strong positive correlation with employment in the industrial sector and, in contrast, negative correlation with political participation (see Table 2). However, negative correlation with F_PAR, which stands for the ratio of women to men seats in the parliament (in %), seems to be key for OSC_2. Hence, it confirms the conclusion that in the countries where the economy is rather industry-driven a negative attitude to the idea of gender equality (also in the political sphere) is noticeable (Inglehart and Norris, 2009). OSC_2 explains 25.0% data variance in gender occupational segregation in the researched countries. The highest values of this component were noted for Korea, Rep. and Japan (see Table A4).

The third occupational segregation component (OSC_3) has been identified as breaking the glass-ceiling effect as it shows positive correlation with the variable MAN_RATIO (see Table 2). This phenomenon expresses gender equality in high-skilled professions, prestigious professions with higher promotion opportunities, as well as high remunerations. Thereby, the higher the value of OSC_3, the lower the disparities of females and males employed in managerial positions in the given economy. OSC_3 explains 18.0% of variability of the data analysed. The highest values of this component were noted for the Czech Republic, United Kingdom and New Zealand (see Table A4).

Table 2
Characteristics of the obtained components and their loadings

Variable	OSC_1	OSC_2	OSC_3
AGR_RATIO	0.87		
SER_RATIO	-0.56		
VUL_RATIO	0.88		
IND_RATIO		0.88	
PAR_RATIO		-0.81	
MAN_RATIO			0.95
SS loadings	1.95	1.53	1.08
Percentage of variance	33%	25%	18%
Cumulative percentage	33%	58%	76%

Note: Only the loadings greater than $|0.4|$ are presented. The varimax rotation was used. Component rotation allows better interpretation and prevents from variables' duplication (those of high loading) in further components.

Source: Own elaboration based on the methods suggested by Kopczewska, Kopczewski and Wójcik (2016).

Due to PCA analysis, three components were adopted for the second step of the research. These components explain 76% of variability of the original database in the analysed highly developed countries.

In the context of gender participation gap, the RATIO was regressed on the obtained three components divided into their cross-country ($_av$) and time ($_diff$) varying parts. The results of estimation within-between model are presented in Table 3. They show that the three analysed occupational segregation components explain 45% of the RATIO heterogeneity.

Table 3
Results of the estimation within-between model

	Coefficients	<i>T</i> -tests for a heteroscedasticity – consistent standard errors	Bootstrap standard errors
Intercept	75.6153*** (1.1963)	1.2124***	1.1943 (73.27, 77.78)
OSC _{1av}	-4.2822** (2.1753)	1.4924***	2.1715 (-8.54, -0.20)
OSC _{1diff}	0.6038*** (0.1488)	0.6911	0.1480 (0.30, 0.88)
OSC _{2av}	-5.1578*** (1.3323)	1.3418***	1.3300 (-7.84, -2.48)
OSC _{2diff}	-5.8582*** (0.2783)	1.1299***	0.2767 (-6.43, -5.34)
OSC _{3av}	-1.8314 (1.3527)	1.5348	1.3504 (-4.69, 0.80)
OSC _{3diff}	-2.4791*** (0.2904)	1.2883***	0.2887 (-3.03, -1.89)
<i>R</i> -squared	0.45067	Adj. <i>R</i> -squared	0.44511
<i>F</i> -statistic	81.083	<i>F</i> -test <i>p</i> -value	0

Note: Asterisks denote significance levels: *** – 1%, ** – 5% and * – 10%. In 2nd column – coefficients, the standard errors are reported in parentheses. Independent variables represent measures that are a result of another estimation (PCA). On this account, besides the *T*-tests for a heteroscedasticity – consistent standard errors (3rd column), bootstrap standard errors were also used (4th column – 95% confidential interval are reported in parentheses). In consequence, bootstrap estimation confirmed that OSC_{3av} is statistically insignificant (the opposed values in 95% confidential interval).

Source: Own elaboration.

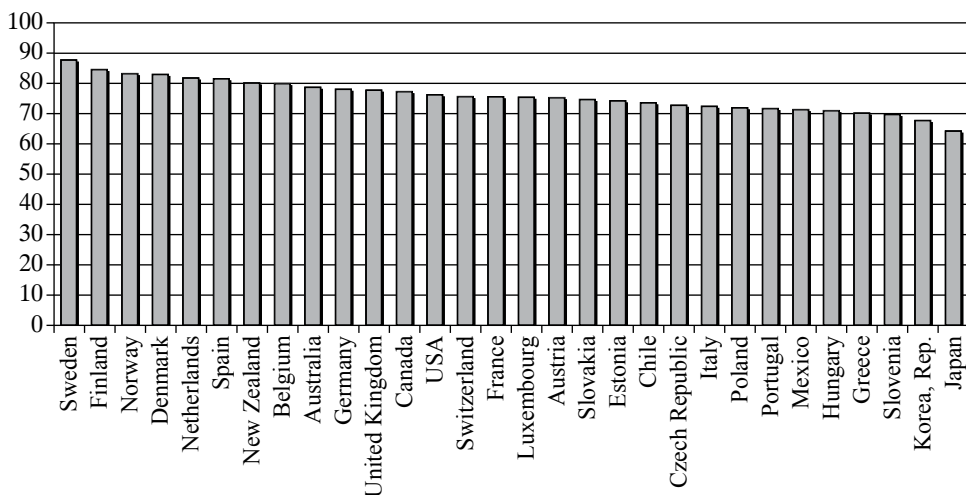
The obtained statistically significant estimates were used as weights in the following equation that allows to calculate OSI_{RATIO} for the studied countries:

$$OSI = 75.6153 - 4.2822 * OSC_{1av} + 0.6038 * OSC_{1diff} - 5.1578 * OSC_{2av} - 5.8582 * OSC_{2diff} - 2.4791 * OSC_{3diff} \quad (5)$$

The OSI_{RATIO} and components' values for the analysed countries are given in Table A4 in Appendix. The higher the value of Index, the higher RATIO (closer

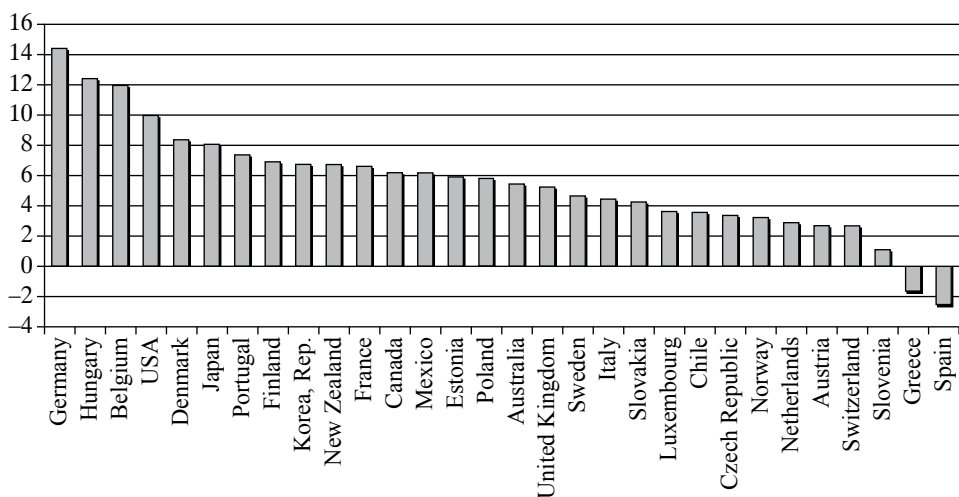
to gender equality in economic participation). The highest values of OSI_{RATIO} were noted for: Sweden, Finland, Norway, Denmark and the lowest for: Japan, the Republic of Korea, Slovenia and Greece (see Figure 2).

Figure 2
OSI – average values for the years 1997–2016



Source: Own elaboration.

Figure 3
OSI – changes in values between the years 1997 and 2016



Source: Own elaboration.

The conducted analysis of the change in values of OSI_{RATIO} between the years 1997–2016 highlighted the increase of gender occupational segregation in two of the studied countries: Spain and Greece. When it comes to the remaining countries, a change in the discussed phenomenon is positive, especially in Germany, Hungary and Belgium (see Figure 3).

Conclusions

The study was aimed at a critical analysis of measures of gender occupational segregation and presents a new way of measuring the scale of the discussed phenomenon. In order to fulfil this purpose the article used both the qualitative and econometric methods. The indicators of gender inequality have been analysed with the help of a critical review of the literature and the reports of international organisations. That part of research gave a theoretical basis to selection of variables used in further principal component analysis. The estimation of within-between model confirmed that vertical and horizontal occupational segregation have a significant influence on the prevalence of gender participation gap in the OECD countries in research period.

The OSI_{RATIO} was created in order to show how gender occupational segregation contributes to the ratio of female to male labour force participation rate in the OECD countries. The higher values of OSI_{RATIO} , the lower the level of occupational segregation in the studied countries. Gender occupational segregation explains 45.0% of the differences in the ratio of female to male labour force participation rate. It may be thus concluded that lowering the level of gender occupational segregation is an important aspect of closing gender participation gap on the labour market.

The obtained values of OSI_{RATIO} allow to assume that the Scandinavian countries successfully manage to eliminate the gender occupational segregation, which results in diminishing the gender participation gap. The gender occupational segregation has, however, detrimental influence on the mentioned gap in the post-socialist countries (Czech Republic, Hungary, Poland, Slovenia), East Asian (Japan, Korea, Rep.), Mediterranean (Greece, Italy, Portugal) and South American countries (Chile, Mexico). It may be presumed that this is caused by the impact of historical and socio-cultural conditions. At the same time, further analysis thereof in conjunction with the market factors and the socio-economic policies of the states should contribute to obtaining a more comprehensive explanation.

The research indicates that countries with nonservices-driven economies also note a higher level of the gender participation gap on the labour market. What is more, the phenomena of vulnerable employment and glass ceiling are more noticeable. Thus, the study has indicated that the relationship between vertical and horizontal segregation is not unequivocal, which indicates that they may be analysed as separate phenomena.

The differences not only in the gender participation gap, but also in the remuneration and advancement gaps require further explanation. The conducted research proved a significant role of occupational segregation in shaping the level of gender inequality on the labour market. Similarly, such an effect may be also characteristic for other mentioned gender gaps. It is hence justified to continue the research in this particular area.

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References

- Altonji J.G., Blank R.M., *Race and Gender in the Labor Market*, in: *Handbooks in Economics, Labor Economics*, Ashenfelter O., Card D. (eds.), vol. 3, North-Holland, Amsterdam 1999, p. 3143–3259.
- Anker R., *Theories of Occupational Segregation by Sex: an Overview*, in: *Women, Gender and Work: What is Equality and How Do We Get There?*, Loutfi M. (ed.), International Labour Office, Geneva 2001, p. 129–155.
- Blackburn R.M., *Measuring Occupational Segregation and its Dimension of Inequality and Difference*, “Cambridge Studies in Social Research” 2009, no. 12, SSRG Publications, Cambridge University.
- Blau F.D., Kahn L.M., *Understanding International Differences in the Gender Pay Gap*, Working Paper 8200, NBER Working Paper Series, Cambridge 2001.
- Browne J., *Sex Segregation and Inequality in the Modern Labour Market*, The Policy Press, University of Bristol, Bristol 2006.
- Chien E., Kleiner B., *Sex Discrimination in iHring*, “Equal Opportunities International” 1999, no. 18(5/6).
- Costa J., Silva E., Vaz F., *The Role of Gender Inequalities in Explaining Income Growth, Poverty and Inequality: Evidences from Latin American Countries*, Working Paper 52, Brasilia International Policy Center for Inclusive Growth, Brazil 2009.
- Duncan B., Duncan O.D., *A Methodological Analysis of Segregation Indexes*, “American Sociological Review” 1955, no. 20(2).
- Emerek R. et al., *Indicators on Gender Segregation*, Research Center on Industrial, Labour and Managerial Economics, Porto University, 2003.
- European Commission, *Gender Segregation in the Labour Market. Roots, Implications and Policy Responses in the UE*, Publications Office of the European Union, Luxembourg 2009.
- European Institute for Gender Equality, *Economic Benefits of Gender Equality in the European Union. Report on the Empirical Application of the Model*, Publications Office of the European Union, Luxembourg 2017.
- Hakim C., *Segregated and Integrated Occupations: A New Approach to Analysing Social Change*, “European Sociological Review” 1993, no. 9 (3).
- ILO, *Key Indicators of the Labour Market. Ninth Edition*, International Labour Office, Geneva 2016 (http://www.ilo.org/wcmsp5/groups/public/---dgreports/---stat/documents/publication/wcms_498929.pdf, access: 23.05.2017).
- ILO, *Ilostat Database*, Geneva 2017 (<http://www.ilo.org/ilostat>, access: 16.05.2017).

- Inglehart R., Norris P., *Wzbierająca fala. Równouprawnienie płci a zmiana kulturowa na świecie*, Państwowy Instytut Wydawniczy, Warszawa 2009.
- IPU, *Women in Politics Database*, Geneva 2017 (<http://www.ipu.org>, access: 16.05.2017).
- Jahan S. (ed.), *Human Development Report 2016. Human Development for Everyone*, UNDP, New York 2016 (http://hdr.undp.org/sites/default/files/2016_human_development_report.pdf, access: 16.05.2017).
- Kalinowska-Sufinowicz B., Domagała W., *Occupational Segregation on the Polish Labour Market in the Years 2004–2014*, “Studia Prawno-Ekonomiczne”, XCIX, Wydawnictwo Uniwersytetu Łódzkiego, 2016.
- Karmel T., MacLachlan M., *Occupational Sex Segregation – Increasing or Decreasing*, “Economic Record” 1998, no. 64.
- Klasen S., *Does Gender Inequality Reduce Growth and Development? Evidence from Cross-country Regressions*, Policy Research Report on Gender and Development, World Bank, Washington 1999.
- Knogler M., Lankes F., *Institutional Determinants of Labour Market Outcomes in the EU – A Social Model Employment Efficiency and Income Distribution Index*, IOS Working Papers, 2015, no. 349.
- Kopczewska K., Kopczewski T., Wójcik P., *Metody ilościowe w R. Aplikacje ekonomiczne i finansowe*, Wydawnictwo CeDeWu, Warszawa 2016.
- Nardo M. et al., *Handbook on Constructing Composite Indicators: Methodology and User Guide*, OECD Statistics Working Papers, no. 2005/03, OECD Publishing, Paris 2005.
- Naskręcka M., Pilc M., *Are There any Differences in How Democratic and Autocratic Countries Adapt the Employment Protection Legislation in Reaction to the Macroeconomic Shock?*, Poznan University of Economics and Business Working Paper, 2017.
- OECD, *Social Institution and Gender Index, Europe and Central Asia. SIGI Regional Report*, OECD Development Center’s Social Cohesion Unit, Paris 2015 (<https://www.oecd.org/dev/development-gender/SIGI-BrochureECA-2015-web.pdf>, access: 23.05.2017).
- OECD, *OECD Statistics Database*, Paris 2017 (<http://stats.oecd.org>, access: 16.05.2017).
- Pilc M., *Cultural, Political and Economic Roots of the Labor Market Institutional Framework in the OECD and Post-Socialist Countries* “Equilibrium. Quarterly Journal of Economics and Economic Policy” 2017, no. 12(4).
- Samans R., Zahidi S. (eds.), *The Global Gender Gap Report 2016*, The World Economic Forum, Geneva 2016 (http://www3.weforum.org/docs/GGGR16/WEF_Global_Gender_Gap_Report_2016.pdf, access: 16.05.2017).
- Social Watch, *Spotlight on Sustainable Development 2016*, Report by the Reflection Group on the 2030 Agenda for Sustainable Development, Montevideo 2016.
- Strawiński P., Majchrowska A., Broniatowska P., *Zmiany struktury zatrudnienia kobiet w Polsce w latach 2000–2013*, “Gospodarka Narodowa” 2016, no. 1(281).
- Titkow A. (red.), *Szklany sufit. Bariery i ograniczenia karier kobiet. Monografia zjawiska*, Instytut Spraw Publicznych, Warszawa 2003.
- UNDP, *Gender Equality in Human Development – Measurement Revisited*, Issue Paper Prepared for the Expert Group Meeting, Human Development Report Office, Geneva 2015.
- UNDP, *Human Development Data*, 2017 (<http://hdr.undp.org/en/data>, access: 26.05.2017).
- World Bank, *Gender Statistics Database*, 2017 (<http://data.worldbank.org/data-catalog/gender-statistics>, access: 16.05.2017).
- Zwiech P., *Rodzaje dyskryminacji kobiet na rynku pracy*, “Polityka Społeczna” 2011, no. 38 (445).

Appendix

Table A1
Selected composite gender inequality measures

Measure	Research areas and variables	Data availability	Method	Source
Gender Inequality Index	<p>Reproductive health: maternal mortality ratio, adolescent birth rate.</p> <p>Education: female and male shares of population with at least secondary education.</p> <p>Labour market: female and male labour force participation rates.</p> <p>Political empowerment: female and male shares of parliamentary seats.</p>	Annually, since 2008	Harmonic mean of geometric means	UNDP (Jahan 2016)
Gender Empowerment Measure	<p>Political participation: women’s shares of parliamentary seats.</p> <p>Economic participation: female legislators, senior officials and managers, female professional and technical workers.</p> <p>Income: ratio of female to male estimated earned income (PPP \$).</p>	Annually, 1995–2009	Un-weighted arithmetic mean	Social Watch (2016)
Gender Equity Index	<p>Education: primary, secondary and tertiary education enrolment, adult literacy rate.</p> <p>Economy: labour market participation gap, income gap, professional and technical workers, legislators, senior officials and managers.</p> <p>Political empowerment: seats in parliament, women in ministerial positions.</p>	2004–2007, 2008, 2009, 2012		
Global Gender Gap Index	<p>Health: sex ratio at birth, ratio of female healthy life expectancy over male value.</p> <p>Education: ratio of female net primary, secondary, tertiary enrolment rate over male value, ratio of female literacy rate over male value.</p> <p>Economics: ratio of female over male value in: labour force participation, estimated earned income, legislators, senior officials, and managers, professional and technical workers, wage for similar work.</p> <p>Politics: ratio of female over male value in: seats in parliament, ministerial level position, head of state position.</p>	Annually, since 2006		World Economic Forum (Samans and Zahidi 2016)

Source: Own elaboration based on UNDP (2015).

Table A2
The selected indicators used in PCA, mean values 1997–2016

Country	AGR_RATIO	IND_RATIO	SER_RATIO	MAN_RATIO	VUL_RATIO	PAR_RATIO
AUS	0.550924	0.298305	1.36338	0.643774	0.61652	0.325275
AUT	1.016273	0.331872	1.47427	0.477642	1.033723	0.433579
BEL	0.53942	0.30183	1.402214	0.595509	0.840708	0.488922
CAN	0.485578	0.316631	1.355666	0.641686	0.741809	0.288108
CHL	0.322451	0.379663	1.570373	0.898305	0.956046	0.154515
CZE	0.555064	0.521789	1.570139	0.485051	0.611213	0.213299
DNK	0.309987	0.361969	1.371974	0.37359	0.605915	0.605467
EST	0.455731	0.495119	1.530516	0.549595	0.588052	0.239213
FIN	0.446499	0.302486	1.545692	0.431621	0.581562	0.64298
FRA	0.49847	0.348737	1.393296	0.677458	0.721152	0.212514
DEU	0.621949	0.378977	1.492335	0.47956	0.831769	0.480746
GRC	1.109786	0.360851	1.266832	0.564046	0.96611	0.166285
HUN	0.389233	0.530381	1.461915	0.685649	0.679498	0.105849
ITA	0.7038	0.444574	1.394716	0.562328	0.805933	0.2294
JPN	1.201158	0.519329	1.382575	0.169902	1.201267	0.088198
KOR	1.109904	0.482877	1.284702	0.122022	0.922625	0.137535
LUX	0.590126	0.227567	1.272564	0.4316	1.234683	0.275301
MEX	0.224554	0.629307	1.552192	0.689914	1.107181	0.370004
NLD	0.606071	0.270947	1.333787	0.448263	0.836938	0.589205
NZL	0.513788	0.337432	1.438677	0.733581	0.63311	0.460096
NOR	0.657445	0.249938	1.41549	0.493817	0.648764	0.58945
POL	0.935083	0.424884	1.558527	0.664982	0.8832	0.253635
PRT	0.965957	0.466375	1.412997	0.553446	0.908515	0.325459
SVK	0.487466	0.478839	1.657394	0.579505	0.486561	0.203842
SVN	0.973407	0.527602	1.488835	0.615307	0.850455	0.253938
ESP	0.473331	0.308393	1.516918	0.660121	0.722562	0.524032
SWE	0.347497	0.276805	1.411461	0.523746	0.52287	0.775662
CHE	0.622887	0.345346	1.348354	0.506498	0.984559	0.353644
GBR	0.483539	0.323242	1.377993	0.604722	0.429873	0.204227
USA	0.375685	0.323297	1.317236	0.846265	0.700688	0.190042
OECD	0.619102	0.385512	1.432101	0.556984	0.788462	0.339347

Note: See Table 2 for description and sources.

Source: Own elaboration.

Table A3
Spearman's correlation matrix of the selected indicators used in PCA

	AGR_RATIO	IND_RATIO	SER_RATIO	MAN_RATIO	VUL_RATIO	PAR_RATIO
AGR_RATIO	1					
IND_RATIO	0.23***	1				
SER_RATIO	-0.24***	0.33***	1			
MAN_RATIO	-0.26***	0.00	0.23***	1		
VUL_RATIO	0.50***	0.20***	-0.19***	-0.03	1	
PAR_RATIO	-0.33***	-0.55***	0.12***	-0.17***	-0.27***	1

Note: The significance level was indicated by asterisks: *** p -value < 0.001; ** p -value < 0.01; * p -value < 0.05. See Table 1 for the description and sources.

Source: Own elaboration.

Table A4
Values of the obtained components and OSI_{RATIO} in the OECD countries

Country	OSI _{RATIO}	OSC_1	OSC_2	OSC_3	Rank
Australia	78.40297	-0.01734	-0.52606	0.473831	9
Austria	75.00386	0.667703	-0.43579	-0.24816	17
Belgium	79.6271	0.118477	-0.87616	0.203089	8
Canada	76.97934	0.136511	0.558634	-0.00263	12
Chile	73.29448	0.098551	-0.34627	0.527333	20
Czech Republic	72.47022	-0.07974	0.516182	2.244307	21
Denmark	82.67842	-0.72808	1.214265	-0.45028	4
Estonia	73.91612	-0.60706	-0.86538	-1.35108	19
Finland	84.27436	-0.73713	0.941454	-0.13976	2
France	75.26335	-0.72055	-1.08058	-0.80208	15
Germany	77.78226	-0.48986	1.29734	0.508998	10
Greece	69.90486	0.015141	0.055682	0.762294	27
Hungary	70.70993	0.465196	-0.33558	-0.18865	26
Italy	72.14949	-0.36482	-0.06255	0.266569	22
Japan	63.95597	-0.49579	1.362699	0.624298	30
Republic of Korea	67.42801	1.018226	1.415166	-1.87363	29
Luxembourg	75.1439	0.724357	0.985985	-2.35842	16
Mexico	71.02166	1.113453	-0.83302	-0.22077	25
Netherlands	81.48626	1.141417	0.159511	0.169563	5
New Zealand	79.81041	-0.25732	-0.5997	0.819227	7
Norway	82.94174	0.246984	-1.34331	-0.69384	3
Poland	71.63676	-0.06427	-1.36708	-0.42874	23
Portugal	71.40125	0.236024	0.575422	0.759217	24
Slovakia	74.37275	0.420483	0.467939	-0.12532	18
Slovenia	69.44415	-1.01982	1.087616	0.167069	28
Spain	81.19922	-0.12661	-0.315	-0.45503	6
Sweden	87.38559	-0.3189	-0.81784	0.554928	1
Switzerland	75.35417	0.173935	1.052076	0.207798	14
United Kingdom	77.50025	0.108056	-0.14928	1.631689	11
United States	75.92261	-0.65723	-1.73636	-0.58181	13

Source: Own elaboration.

MEASURING GENDER OCCUPATIONAL SEGREGATION: OECD COUNTRIES IN COMPARATIVE PERSPECTIVE

Summary

The main purpose of the article is to present a new way of measuring the scale of occupational segregation that can be used in empirical analysis. The method proposed by Knogler and Lankes is used to obtain seminal Occupational Segregation Indexes for 30 OECD countries for the years 1997–2016. It starts from conducting a principal components analysis to transform variables that captures horizontal and vertical occupational segregation into a set of components that reflects various dimensions of that phenomenon. In the next step the ratio of female to male labour force participation rate (RATIO) is regressed on these components by using within-between random effects model. The obtained results confirm that women empowerment has positive influence on both the situation of women and men on labour market and, in a more general context, on obtaining better economic results.

Key words: labour market, occupational segregation, gender

JEL: J24, J70

POMIAR SEGREGACJI ZAWODOWEJ WEDŁUG PŁCI – ANALIZA PORÓWNAWCZA KRAJÓW OECD

Streszczenie

Głównym celem niniejszego artykułu jest opracowanie miary zjawiska segregacji zawodowej według płci oraz jej zastosowanie do empirycznej analizy zakresu jego występowania. W artykule wykorzystano dwuetapową procedurę zaproponowaną przez Knoglera i Lankes'a do estymacji miernika segregacji zawodowej według płci w 30 badanych krajach, należących do Organizacji Współpracy Gospodarczej i Rozwoju (OECD), w latach 1997–2016. W pierwszym etapie, na podstawie analizy głównych składowych, ze zbioru wielu zmiennych charakteryzujących poziomą i pionową segregację zawodową wyróżniono główne i niezależne od siebie wymiary omawianego zjawiska. Celem drugiego etapu była identyfikacja wymiarów segregacji zawodowej według płci istotnie oddziałujących na różnice w aktywności ekonomicznej kobiet i mężczyzn za pomocą estymacji modelu danych panelowych typu *within-between*. Wnioski płynące z przeprowadzonych analiz wskazują na pozytywne oddziaływanie eliminowania segregacji zawodowej według płci na sytuację kobiet i mężczyzn na rynku pracy, a w szerszej perspektywie na koniunkturę gospodarczą.

Słowa kluczowe: rynek pracy, segregacja zawodowa, płć

JEL: J24, J70

ИЗМЕРЕНИЕ ПРОФЕССИОНАЛЬНОЙ СЕГРЕГАЦИИ ПО ПРИЗНАКУ ПОЛА – СРАВНИТЕЛЬНЫЙ АНАЛИЗ СТРАН ОЭСР

Резюме

Главной целью настоящей статьи является презентация показателя, позволяющего измерить явление профессиональной сегрегации по признаку пола и его применения для

эмпирического анализа диапазона этого явления. В статье использована двухэтапная процедура, предложенная Кноглером и Ланксом для эстимации показателя профессиональной сегрегации по признаку пола в 30-ти исследуемых странах-членах ОЭСР в 1997–2016 гг.

На первом этапе, на основании анализа главных составных частей, из множества переменных, характеризующих вертикальную и горизонтальную профессиональную сегрегацию по признаку пола, были выделены основные и независимые друг от друга показатели измерения обсуждаемого явления. Целью второго этапа была идентификация проявлений профессиональной сегрегации по признаку пола, существенно влияющих на различия в экономической активности мужчин и женщин с помощью эстимации модели панельных данных типа within-between. Проведенный анализ позволяет отметить, что устранение профессиональной сегрегации по полу положительно сказывается на положении мужчин и женщин на рынке труда, а в более широкой перспективе на экономической конъюнктуре.

Ключевые слова: рынок труда, профессиональная сегрегация, пол

JEL: J24, J70