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CLUSTER ANALYSIS OF THE EUROPEAN UNION GENDER EQUALITY AND ECONOMIC DEVELOPMENT

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Abstract. *Purpose* – The article aims at discovering classes and clusters of EU member-states considering their levels of economic development and gender equality to foster the enhancement of EU cohesion policy.

Research methodology – The methodology includes the grouping by two parameters, economic development and gender equality, and the cluster analysis, the "far neighbor principle", agglomerative hierarchical classification algorithm and the usual Euclidean distance as the distance between objects.

Findings – There are no gender equality laggards among EU member-states. More developed countries belong to gender equality leaders, while there are two gender equality leaders and one gender equality adopter among transition countries. The group of less developed countries consists of six gender equality leaders and seven gender equality adopters.

Research limitations – The results of cluster analysis may be impacted by off-shore activity of Ireland and Luxembourg.

Practical implications – The EU supranational bodies can use our results to develop more efficient cohesion policy tools to ensure the adherence to the principle of gender equality.

Originality/Value – The study is a pioneer one in determining nine classes and five clusters of EU member-states considering their levels of economic development and gender equality, as well as in introducing three types of countries depending on their level of gender equality, namely gender equality leaders, adopters, and laggards.

Keywords: cluster analysis, economic development, EU member-states, gender equality, GDP per capita.

JEL Classification: C38, D63, J16.

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Introduction

Ensuring equality between men and women is the EU fundamental value aiming at fostering socioeconomic progress for benefits of all members of the society. As stated in the Treaty on the Functioning of the European Union, integrated European nations strive to eliminate inequalities (European Union, 2021) making the EU one of the global leaders in female economic, social and political emancipation. This unique regional block demonstrates a significant progress in unlocking women's potential. Promoting gender equality in Europe goes back to the Treaty of Rome in 1957, which ensured the principle of equal pay for male and female workers for equal work or work of equal value. However, only the adoption of "Strategy for equality between women and men 2010–2015", "European Pact for gender equality 2011–2020", and "Strategic Engagement for gender equality 2016–2019" gave the additional momentum for ensuring gender equality in EU member-states (Jacquot, 2020), but the progress is not homogeneous among them and there are a lot of institutional efforts ahead to reach the universal emancipation of European women.

The EU doesn't have a specialized separate gender equality policy, but it follows the Gender Equality Strategy 2020–2025 aimed at building the Union of Equality till 2025. The above-mentioned strategy has an integrative approach consisting of intersectionality and gender mainstreaming. The gender equality will be introduced to all spheres of interior and exterior life, common actions and policies of EU member-states and partner countries. Therefore, there is a high demand for applied research on issues related to gender equality in terms of determining specialized approach to each country considering its social, economic and cultural peculiarities. Our hypothesis is that there is a definite interplay between levels of gender equality and economic development of EU member-states. The novelty of our research resides on the combination of cluster analysis and grouping with developing appropriate classifying terminology for countries of interest. Thus, the article aims at discovering classes and clusters of EU member-states considering their levels of economic development and gender equality to foster the enhancement of EU cohesion policy.

1. Literature review

There is a wide range of publications on gender equality and economic development. For instance, Altuzarra et al. (2021) display the effects of gender gaps in terms of education, labor market and institutional representation on economic growth. They analyze 105 developing countries in 1990–2017 leaving without attention European peculiarities useful for implementing efficient tailor-made policies in this region. Mitra et al. (2015) explored the impact of gender equality on economic growth, namely the role of equality of economic opportunities and equality in economic and political outcomes for economic development. These authors found that economic growth of developed countries result from equality in outcomes, while developing ones mostly depend on gender equality in opportunity. However, some developed countries demonstrate different tendencies, for instance, Bulgaria and Luxembourg proving the necessity for detailed investigation of EU member-states.

Kabeer and Natali (2013) shed light on asymmetrical inter-influence of gender equality and economic growth showing that gender equality in education and employment

substantially fosters economic growth, but economic growth by itself doesn't lead to fast elimination of gender inequality in healthcare, human rights and well-being. It means that governments must focus on gender policy and efficient redistribution tools to ensure equal benefits for women and men. However, such a shift from the meritocratic principle of gender equal opportunities to gender equal results may cause social and political tensions.

Applying panel data analysis Rodríguez (2017) demonstrated that the growing female participation in labor markets has no or little effect on economic development of five Latin American countries implicating low productivity of female labor force probably due to comparatively low-productivity sectors of economy or limited amount of countries analyzed. Similarly, Baerlocher et al. (2021) did not discover any evidence of economic growth due to high productivity of women engaged in labor markets. Using the linear model based on neoclassical production function, these authors suggested that GDP grew only thanks to a greater parcel of working population resulting in a moderate increase of living standards. The limitations of this model include the underestimation of higher employment rates of males compared with female ones, as well as gender gap in education and training.

Minasyan et al. (2019) pointed out that there is a positive correlation between gender equality in education, especially initial one, and economic growth. However, Borgonovi and Han (2021) highlighted the problem of higher fear of failure among female students compared with male ones in developed countries preventing them from selection of certain highly-qualified and accordingly payed occupations that probably partially explains gender pay gaps and the lack of women in STEM.

Rai et al. (2019) emphasized the importance of including female second shifts at home, namely, house chores and childcare duties ignored by GDP, into UN Social Development Goal 8 focusing on productive employment and decent jobs, but economic theory is still in the process of developing adequate methodology for calculating economic value of male and female reproductive inputs that could be to some extent substituted by the government. For example, employing policy modeling and its gender impact, Ilkkraracan et al. (2021) discovered that Early Childhood Education and Care program in Turkey generated over million new jobs (females took 57% of them), decreased female unpaid time in households decreased by one third, and, therefore, resulted in improved living standards of women in general and the ones with small children in particular. The overall positive impact for gender equality was substantial, however, high budget expenses involved make such programs unbearable for many developing countries at least in the nearest future.

Barth et al. (2021) used Decennial Census of the United States and the Longitudinal Employer Household Dynamics (LEHD) data to show how the gender earnings gap changes considering career advancement within one company and gains changing employers for college educated workers and for those without a degree. They stated that career advancement within one company is the main driver of gender pay gap mainly caused by marriages. Therefore, regardless of education, a personal choice of creating a family undermines female careers and leads to the growing gender pay gap.

Kennedy et al. (2017) proved that there is an interplay between economic prosperity and decreasing the gender wage inequality. Using data for labor productivity and wage gap for 1986–2013 in Australia, they discovered that the reduction of gender pay gap by 10% results

in 3% increase in per capita output emphasizing the economic efficiency of eliminating gender pay gap.

Shehu et al. (2017) observed that that poor economic conditions hit women harder than men, e. g., US companies tend to provide lower compensations for women compared to men during harsh economic conditions with the exception of CEOs treated equally regardless of gender. Moreover, Brzezinski (2021) demonstrated that pandemics affected women more than men causing the increase in gender inequality, especially in terms of employment rates. Finally, Kovalenko and Töpfer (2021), using US data for 1979–2019 and structural vector auto-regression model to analyze the cyclical dynamics and gender pay gap, showed that gender pay gaps are diminished by bargaining power in the short-run period and technology shocks in the medium-run one. However, they found a link between the decrease in gender pay gap and increase in unemployment rates.

It is worth mentioning, that innovations and technology shifts could also increase the gender pay gap. For example, Aksoy et al. (2021) found out that robotization in analyzed 20 European countries enlarges earnings of employees of both genders, however it increases the gender pay gap due to the gender composition of the workforce, namely men accounting for the lion's share of employment in STEM.

Analyzing the efficiency of introducing student loans in Chile to fight labor market gender disproportions, Didier (2021) argued that this funding tool increased female labor market participation and lowered gender pay gap, but intensified the glass ceiling raising the actuality of further research of expediency of implementing gender quotas to shatter the glass ceiling. Morsy (2020) used the World Bank Global Findex database for 141 countries considering ownership structure of banks and variables on gender gaps such as gender gap in education, income, and labor market participation to disclose conditions of limiting the access to finance for women. The worst situation is observed in countries where there is an insignificant share of foreign banks, prevalence of state-owned banks, non-transparent credit information and huge gender gaps in education.

Dheer et al. (2019) stressed the importance of female business contribution to the economic growth, but noticed that women are less likely to create a new business, because of social and cultural peculiarities regarding understanding of the essence of masculinity and femininity, as well as traditional institutions preventing from equalizing opportunities.

2. Methodology

Considering findings presented in the publication of Vinska and Tokar (2017) focused on gender gaps in economic opportunities and participation in the EU, we would like to determine groups of EU member-states in terms of levels of gender equality and economic development using the GDP per capita at current market prices in euros in 2016–2020, as well as the level of gender equality evaluated by the Gender Equality Index developed by the European Institute for Gender Equality [EIGE].

The EIGE fosters the pursuing the gender mainstreaming. It arranges gender equality training, assesses policies and actions via prism of their gender impact, advances institutional

transformation towards gender inclusiveness, provides guidance on gender equality in academia and research (helping to develop gender equality plans in research organizations), assists the European and national Parliaments in making their procedures gender sensitive and makes sure that gender budgeting is one of the priorities in management of the EU funds.

Its significant expertise was used to develop the Gender Equality Index, which is an important tool for countries' bench-marking on their levels of gender equality. The EIGE provides researchers with valuable statistical data for conducting investigations and enables policy makers to use research findings for fine-tuning measures on ensuring gender equality. Moreover, European Union intends to launch annual monitoring of gender equality based on the data withdrawn from the Gender Equality Index. The Gender Equality Index consists of six core main domains each in its turn including several indicators (European Institute for Gender Equality, 2021):

1. work – participation, segregation and quality of work;
2. money – financial resources, economic situation;
3. knowledge – attainment and participation, segregation;
4. time – care activities, social activities;
5. power – political, economic, social;
6. health – status, behavior, access.

Firstly, for further elaboration of recommendations aimed at tackling the gender gaps problem in Europe, we use the EU NUTS classification of more developed, transition and less developed regions (Eurostat, 2021) and adapt it to determine groups of the EU member-states considering the level of gender equality assessed by the Gender Equality Index:

- gender equality leaders – countries with the level of gender equality more than 90% of the EU average;
- gender equality adopters – countries with the level of gender equality ranging from 75% to 90% of the EU average;
- gender equality laggards – countries with the level of gender equality less than 75% of the EU average.

Secondly, we apply the "far neighbor principle" of cluster analysis and the Microsoft Excel data mining add-in for conducting computations. We use the agglomerative hierarchical classification algorithm. We will take the usual Euclidean distance as the distance between objects:

$$p\left(x_{i,j}\right)=\sqrt{\sum\left(x_{i,l}-x_{j,i}\right)^2}\ , \tag{1}$$

where: l – attributes; k – number of attributes.

The combination of two above-mentioned methods provides new opportunities for the EU member-states and supranational policy-makers to implement the Union of equality by 2035 via developing more tailor-made programs. Moreover, it is appropriate to expand this approach to the global context including advance and developing nations all over the world applying similar indices' databases for calculations, for instance, the Global Gender Gap Index.

3. Results

Cluster analysis

Table 1 indicates that the average growth of GDP per capita at current market prices in EU member-states equaled 11.6% in 2016–2020. Ireland showed the maximum relative increase – 29.1%, while Greece, Italy, Spain, and Sweden experienced decline.

Table 1. GDP per Capita in EU Member-states at current market prices in 2016–2020, in euros (own calculations based on source: Eurostat, 2021)

Period	2016	2017	2019	2020	Average	Change, %	Ranking
Austria	40920	41990	44780	42300	42498	3.4	6
Belgium	37960	39130	41460	39110	39415	3.0	9
Bulgaria	6820	7400	8780	8750	7938	28.3	27
Croatia	11170	11920	13340	12170	12150	9.0	25
Cyprus	22230	23410	25270	23400	23578	5.3	14
Czech Republic	16790	18330	21140	20120	19095	19.8	18
Denmark	49420	51140	53370	53600	51883	8.5	3
Estonia	16670	18130	21220	20440	19115	22.6	17
Finland	39580	41080	43510	42940	41778	8.5	7
France	33430	34250	36140	34040	34465	1.8	10
Germany	38070	39440	41510	40120	39785	5.4	8
Greece	16170	16470	17110	15490	16310	–4.2	19
Hungary	11830	12960	14950	13940	13420	17.8	23
Ireland	57020	62550	72260	73590	66355	29.1	2
Italy	28210	28940	29980	27780	28728	–1.5	11
Latvia	12940	13890	15900	15430	14540	19.2	22
Lithuania	13560	14950	17470	17510	15873	29.1	21
Luxembourg	93930	95170	102200	101640	98235	8.2	1
Malta	23190	25010	26920	24630	24938	6.2	12
Netherlands	41590	43090	46880	45870	44358	10.3	5
Poland	11110	12170	13900	13640	12705	22.8	24
Portugal	18060	19020	20800	19660	19385	8.9	16
Romania	8630	9580	11510	11290	10253	30.8	26
Slovakia	14920	15540	17220	16770	16113	12.4	20
Slovenia	19590	20820	23170	22010	21398	12.4	15
Spain	23980	24970	26430	23690	24768	–1.2	13
Sweden	46990	47730	46390	45850	46740	–2.4	4
Average	*27955*	*29225*	*31615*	*30584*	*29845*	*11.6*	*X*

Table 2 shows that the level of gender equality in EU member-states increased by 4.7 points in 2010–2018.

Table 2. Levels of Gender Equality in EU Member-states in 2010–2018 (own calculations based on source: European Institute for Gender Equality, 2021)

Period	2010	2012	2015	2017	2018	Average	Change	Ranking
Austria	58.7	61.3	63.3	65.3	66.5	63.0	7.8	12
Belgium	69.3	70.2	70.5	71.1	71.4	70.5	2.1	6
Bulgaria	55	56.9	58	58.8	59.6	57.7	4.6	16
Croatia	52.3	52.6	53.1	55.6	57.9	54.3	5.6	22
Cyprus	49	50.6	55.1	56.3	56.9	53.6	7.9	23
Czech Republic	55.6	56.7	53.6	55.7	56.2	55.6	0.6	20
Denmark	75.2	75.6	76.8	77.5	77.4	76.5	2.2	2
Estonia	53.4	53.5	56.7	59.8	60.7	56.8	7.3	18
Finland	73.1	74.4	73	73.4	74.7	73.7	1.6	3
France	67.5	68.9	72.6	74.6	75.1	71.7	7.6	5
Germany	62.6	64.9	65.5	66.9	67.5	65.5	4.9	11
Greece	48.6	50.1	50	51.2	52.2	50.4	3.6	27
Hungary	52.4	51.8	50.8	51.9	53	52.0	0.6	26
Ireland	65.4	67.7	69.5	71.3	72.2	69.2	6.8	7
Italy	53.3	56.5	62.1	63	63.5	59.7	10.2	13
Latvia	55.2	56.2	57.9	59.7	60.8	58.0	5.6	15
Lithuania	54.9	54.2	56.8	55.5	56.3	55.5	1.4	21
Luxembourg	61.2	65.9	69	69.2	70.3	67.1	9.1	9
Malta	54.4	57.8	60.1	62.5	63.4	59.6	9.0	14
Netherlands	74	74	72.9	72.1	74.1	73.4	0.1	4
Poland	55.5	56.9	56.8	55.2	55.8	56.0	0.3	19
Portugal	53.7	54.4	56	59.9	61.3	57.1	7.6	17
Romania	50.8	51.2	52.4	54.5	54.4	52.7	3.6	25
Slovakia	53	52.4	52.4	54.1	55.5	53.5	2.5	24
Slovenia	62.7	66.1	68.4	68.3	67.7	66.6	5.0	10
Spain	66.4	67.4	68.3	70.1	72	68.8	5.6	8
Sweden	80.1	79.7	82.6	83.6	83.8	82.0	3.7	1
Average	*59.8*	*61.0*	*62.4*	*63.6*	*64.5*	*62.2*	*4.7*	*X*

Applying by analogy the NUTS approach (Eurostat, 2021) we receive the following groups of EU member-states considering GDP per capita and levels of gender equality (Table 3).

Table 3. Groups and classes of EU member-states considering GDP per capita at current market prices in 2016–2020 and applying NUTS classification approach (own calculations based on source: Eurostat, 2021)

EU member-state	Ratio of GDP per capita to the EU average one, %	Type	ratio of a level of gender equality to the EU average one, %	Type	Class
Austria	142	more developed country	101	gender equality leader	1
Belgium	132	more developed country	113	gender equality leader	1
Bulgaria	27	less developed country	93	gender equality leader	7
Croatia	41	less developed country	87	gender equality adopter	8
Cyprus	79	transition country	86	gender equality adopter	5
Czech Republic	64	less developed country	89	gender equality adopter	8
Denmark	174	more developed country	123	gender equality leader	1
Estonia	64	less developed country	91	gender equality leader	7
Finland	140	more developed country	118	gender equality leader	1
France	115	more developed country	115	gender equality leader	1
Germany	133	more developed country	105	gender equality leader	1
Greece	55	less developed country	81	gender equality adopter	8
Hungary	45	less developed country	84	gender equality adopter	8
Ireland	222	more developed country	111	gender equality leader	1
Italy	96	more developed country	96	gender equality leader	1
Latvia	49	less developed country	93	gender equality leader	7
Lithuania	53	less developed country	89	gender equality adopter	8
Luxembourg	329	more developed country	108	gender equality leader	1
Malta	84	transition country	96	gender equality leader	4
Netherlands	149	more developed country	118	gender equality leader	1
Poland	43	less developed country	90	gender equality leader	7
Portugal	65	less developed country	92	gender equality leader	7

End of Table 3

EU member-state	Ratio of GDP per capita to the EU average one, %	Type	ratio of a level of gender equality to the EU average one, %	Type	Class
Romania	34	less developed country	85	gender equality adopter	8
Slovakia	54	less developed country	86	gender equality adopter	8
Slovenia	72	less developed country	107	gender equality leader	7
Spain	83	transition country	111	gender equality leader	4
Sweden	157	more developed country	132	gender equality leader	1

Table 4 contains 9 potential classes of EU member-states depending on combination of their types of economic development (GDP per capita at current market prices) and level of gender equality.

Table 4. Classes of EU member-states considering GDP per capita at current market prices and levels of gender equality (own elaboration)

Class number and title	GDP per capita	Gender Equality	Amount of EU member-states
1	More developed countries	Gender equality leaders	11
2		Gender equality adopters	0
3		Gender equality laggards	0
4	Transition countries	Gender equality leaders	2
5		Gender equality adopters	1
6		Gender equality laggards	0
7	Less developed countries	Gender equality leaders	6
8		Gender equality adopters	7
9		Gender equality laggards	0

However, there are only 5 classes determined according to our calculations. Moreover, there are no gender equality laggards among EU member-states. More developed countries belong to the group of gender equality leaders. There are 2 gender equality leaders and 1 gender equality adopter among transition countries. Finally, we see 6 gender equality leaders and 7 gender equality adopters among less developed countries. Therefore, we strongly recommend to introduce the special gender prism for the EU funding allocated to Croatia, Czech Republic, Greece, Hungary, Lithuania, Romania, and Slovakia. Considering 5 classes found by our calculations, we apply the cluster analysis using formula (1) and receive:

$$p\left(x_{1,2}\right)=\sqrt{\sum\left(63.02-70.05\right)^2+\left(42498-39415\right)^2}=3083.01;$$

$$p\left(x_{1,3}\right)=\sqrt{\sum\left(63.02-57.66\right)^2+\left(42498-7938\right)^2}=34560;$$

$$p\left(x_{1,4}\right)=\sqrt{\sum\left(63.02-54.3\right)^2+\left(42498-12150\right)^2}=30348.$$

We put the received data into a table (distance matrix). From the distance matrix it follows that objects 6 and 8 are closest ($P_{6,8}$ = 20.04) and combined into one cluster. When forming a new matrix of distances, we select the largest value from the values of objects No. 6 and No. 8. As a result, we have 26 clusters: S (1), S (2), S (3), S (4), S (5), S (6,8), S (7), S (9), S (10), S (11), S (12), S (13), S (14), S (15), S (16), S (17), S (18), S (19), S (20), S (21), S (22), S (23), S (24), S (25), S (26), S (27).

Repeating the same procedures several times, finally, we receive the following five clusters (Table 5).

Table 5. Clusters of EU Member-states based on Levels of Gender Equality and Economic Development (own calculations)

Clusters	1, 9, 2, 11, 20, 27, 10	3, 23, 4, 21, 13, 16, 12, 24, 17	5, 19, 26, 15, 6, 8, 22, 25	7, 14	18
1, 9, 2, 11, 20, 27, 10	0	38802.008	27645.013	31890	63770
3, 23, 4, 21, 13, 16, 12, 24, 17	38802.008	0	20790	58417.001	90297
5, 19, 26, 15, 6, 8, 22, 25	27645.013	20790	0	47260.002	79140.001
7, 14	31890	58417.001	47260.002	0	46352.001
18	63770	90297	79140.001	46352.001	0

Table 6 shows that Cluster 1 consists of 9 countries, namely Bulgaria, Croatia, Greece, Hungary, Latvia, Lithuania, Poland, Romania, and Slovakia. The levels of gender equality are within 50.4–58.0 with the average value equaling 54.4. GDPs per capita are within 7938–16310 euros with the average value equaling 13255.8 euros.

Table 6. Cluster 1 of EU Member-states (own calculations)

EU member-states	Gender Equality	GDP per Capita
Bulgaria	57.7	7938.0
Croatia	54.3	12150.0
Greece	50.4	16310.0
Hungary	52.0	13420.0
Latvia	58.0	14540.0
Lithuania	55.5	15873.0
Poland	56.0	12705.0
Romania	52.7	10253.0
Slovakia	53.5	16113.0
Average	54.4	13255.8
Minimum	50.4	7938.0
Maximum	58.0	16310.0

Table 7 shows that Cluster 2 consists of 8 countries, namely Cyprus, Czech Republic, Estonia, Italy, Malta, Portugal, Slovenia, and Spain. The levels of gender equality are within 53.6–68.8 with the average value equaling 59.7. GDPs per capita are within 19095–28728 euros with the average value equaling 22625.6 euros.

Table 7. Cluster 2 of EU Member-states (own calculations)

EU member-states	Gender Equality	GDP per Capita
Cyprus	53.6	23578.0
Czech Republic	55.6	19095.0
Estonia	56.8	19115.0
Italy	59.7	28728.0
Malta	59.6	24938.0
Portugal	57.1	19385.0
Slovenia	66.6	21398.0
Spain	68.8	24768.0
Average	59.7	22625.6
Minimum	53.6	19095.0
Maximum	68.8	28728.0

Table 8 shows that Cluster 3 consists of 7 countries, namely Austria, Belgium, Finland, France, Germany, Netherlands, and Sweden. The levels of gender equality are within 63.0–82.0 with the average value equaling 71.4. GDPs per capita are within 34465–46740 euros with the average value equaling 41291.3 euros.

Table 8. Cluster 3 of EU Member-states (own calculations)

EU member-states	Gender Equality	GDP per Capita
Austria	63.0	42498.0
Belgium	70.5	39415.0
Finland	73.7	41778.0
France	71.7	34465.0
Germany	65.5	39785.0
Netherlands	73.4	44358.0
Sweden	82.0	46740.0
Average	71.4	41291.3
Minimum	63.0	34465.0
Maximum	82.0	46740.0

Table 9 shows that Cluster 4 consists of 2 countries, namely Denmark and Ireland. The levels of gender equality are within 69.2–76.5 with the average value equaling 72.9. GDPs per capita are within 51883–66355 euros with the average value equaling 59119.0 euros.

Table 9. Cluster 4 of EU Member-states (own calculations)

EU member-states	Gender Equality	GDP per Capita
Denmark	76.5	51883.0
Ireland	69.2	66355.0
Average	72.9	59119.0
Minimum	69.2	51883.0
Maximum	76.5	66355.0

Table 10 shows that Cluster 5 consists of Luxembourg only with the level of gender equality – 67.1, and GDP per capita equaling 98235.0 euros.

Table 10. Cluster 5 of EU Member-states (own calculations)

EU member-states	Gender Equality	GDP per Capita
Luxembourg	67.1	98235.0

Table 11 indicates that there are substantial discrepancies in the results of grouping of EU member-states applying the cluster analysis and comparison with the average values of GDP per capita and gender equality due to the abnormally high levels of GDP per capita of some countries sometimes referred to as the inner off-shores within the EU, namely, Ireland and Luxembourg. It is especially obvious, when there are no large differences in gender equality levels, while GPDs per capita differ to the large extent.

Table 11. Clusters and classes of EU member-states considering GDP per capita and level of gender equality (own elaboration)

#	Cluster	Class
1	Bulgaria, Croatia, Greece, Hungary, Latvia, Lithuania, Poland, Romania, and Slovakia	Less developed countries – gender equality adopters: Croatia, Czech Republic, Greece, Hungary, Lithuania, Romania, and Slovakia
2	Cyprus, Czech Republic, Estonia, Italy, Malta, Portugal, Slovenia, and Spain	Less developed countries – gender equality leaders: Bulgaria, Estonia, Latvia, Poland, Portugal, and Slovenia
3	Austria, Belgium, Finland, France, Germany, Netherlands, and Sweden	Transition countries – gender equality adopters: Cyprus
4	Denmark and Ireland	Transition countries – gender equality leaders: Malta, Spain
5	Luxembourg	More developed countries – gender equality leaders: Austria, Belgium, Denmark, Finland, France, Germany, Ireland, Italy, Luxembourg, Netherlands, and Sweden

We think that less developed countries which are gender equality adopters should fall under the special gender lens while receiving funds from the EU budget. European institutions should pay particular attention to the issue of gender equality fostering the economic

progress of theses EU member-states. The improperly tailored financial support under the cohesion policy may result in widening the gender gap contradicting the aim of the EU to build a Union of Equality by 2025. For example, Cyprus despite of economic progress does not distribute achieved benefits following the principle of gender equality.

4. Discussion

Our results somewhat support the findings of Altuzarra et al. (2021) when it comes to influence of gender gaps in terms of education, labor market and institutional representation on economic growth. However, even though we have used a more comprehensive index it covers only the EU member-states. Analogically, considering that we have used the index containing wage and education dimensions, our conclusions are in harmony with the ones of Minasyan et al. (2019) highlighting a positive correlation between gender equality in education and economic growth, as well as, Kennedy et al. (2017) pointing out an interplay between economic prosperity and decreasing the gender wage inequality. We also agree with Mitra et al. (2015) that economic growth of developed countries result from equality in outcomes. However, our research has not included developing countries, therefore, we can neither prove nor reject the idea that developing countries mostly depend on gender equality in opportunity. Our findings concord with Kabeer and Natali (2013) showing that economic growth by itself doesn't lead to fast elimination of gender inequality in healthcare, human rights and well-being.

The first limitation of our research is connected with inner EU off-shore zones, namely Ireland and Luxembourg. Their distorted indicators of GDP per capita influence the cluster analysis. However, in our grouping both countries fall into the group of more developed gender equality leaders, therefore, we can state that our methodology has weakened this limitation. Moreover, the ongoing process of global corporate tax harmonization will lessen, if not eradicate, this limitation in the future.

The second limitation is caused by the nature of the Gender Equality Index used for calculations in our research. As any other index containing both quantitative and qualitative data, the Gender Equality Index is not totally free from subjective influence of experts' opinions. However, the strict procedures for selecting experts within EIGE minimize any potential bias, therefore, our results adhere to strict standards of reliability.

Conclusions

Combining the levels of economic development (more developed countries, transition countries, and less developed countries) and gender equality (gender equality leaders, gender equality adopters, and gender equality laggards), we introduce nine potential classes of EU member-states, five of them were found in the EU according to the results of our calculations, namely: eight less developed countries – gender equality adopters (Croatia, Czech Republic, Greece, Hungary, Lithuania, Romania, and Slovakia), six less developed countries – gender equality leaders (Bulgaria, Estonia, Latvia, Poland, Portugal, and Slovenia), one transition country – gender equality adopter (Cyprus), two transition countries – gender equality leaders (Malta and Spain), and eleven more developed countries – gender equality leaders

(Austria, Belgium, Denmark, Finland, France, Germany, Ireland, Italy, Luxembourg, Netherlands, and Sweden). All more developed countries are gender equality leaders supporting women's emancipation. There are no gender equality laggards proving that the Cohesion policy has a positive impact on gender equality.

Five clusters significantly differ from the above-mentioned classes due to the striking discrepancies in economic development of EU member-states, including the inner off-shores, Ireland and Luxembourg. Therefore, there is a need for fine-tuning European policies. There should be a special gender prism applied to the EU funding allocated to less developed countries – gender equality adopters (Croatia, Czech Republic, Greece, Hungary, Lithuania, Romania, and Slovakia) to ensure their gender sensitivity, while financial support for Cyprus should focus on combination of its economic progress and distribution of benefits following the principle of gender equality. We think that the strengthening of gender budgeting and suspension of EU financing in case of missing targets on female emancipation will result in improved levels of gender equality in EU member-states. The applied dimensions of designed methodology include the assessing progress of less developed EU member states in their advancement towards gender equality and economic prosperity.

The prospects for further pieces of research include the wide range of analytical investigations of EU and global structural analysis of groups and clusters considering levels of gender equality in various social and economic sectors for elaborating applied measures to improve the status quo. The EU and global economic systems move towards a new technological edge with the dominance of science, technology and innovations. Thus, we suppose that the retrospective approach can be turned into perspective one if to concentrate on female empowerment in STEM.

Author contributions

Oksana Vinska and Volodymyr Tokar conceived the study and were responsible for the design and development of the data analysis. Volodymyr Tokar was responsible for data collection and analysis. Oksana Vinska and Volodymyr Tokar were responsible for data interpretation. Oksana Vinska and Volodymyr Tokar wrote the first draft of the article.

Disclosure statement

The authors do not have any competing financial, professional, or personal interests from other parties.

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