Maternity support policies: a cluster analysis of 22 European Union countries

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Abstract:
Maternity support varies among the European Union countries, but with shared goals such as improving natality, gender equality, fostering employment and maintaining incomes. Objective of the research is to identify clusters of countries regarding the maternity support policies on the trail of Esping-Andersen's categorisation of welfare states. Twelve indicators are used to capture the following three dimensions of the variety of the maternity support: design of public policies, their generosity and national context (economic performance, education and poverty levels, inequality, etc.). By using clustering methods and principal component analysis, the results suggest four regional/cultural clusters. Additionally, the proposed clusters are used to analyse the differences among countries in fertility levels, mothers' employment rates and gender gap in human development. Results are not definite, but do indicate that fertility levels are higher in economically stronger clusters, while lower gender gaps could be attributed to longer and better paid parental leaves.

Keywords: cluster analysis, fertility, gender equality, maternity.

JEL code: C38, I38, J13, J16.

1. Introduction

Parental support and, especially maternal support, is crucial in the times of great demographic challenges of low fertility rates. Families have disparities between their desired and actual number of children (Gauthier, Philipov, 2008; Letablier et al., 2009) and parenthood may be delayed due to various reasons: education, career, lack of financial security and appropriate housing or employment possibilities. To reduce the gap between actual and desired number of children, governments provide various public policies. These policies aim to achieve the objectives like increasing fertility, compensating for the costs of children and improving the standard of living of households with children, as well as reducing poverty. The support usually starts with leave policies, followed by various cash benefits (e.g. child allowance, birth grant) and in-kind benefits (e.g. kindergartens). All policies vary across the EU countries, with some common elements.

Significant comparative research has covered the cross-national perspective of family policies and general welfare regimes in the world. The most cited are Esping-Andersen's three types of welfare states. The liberal type is characterised by modest government transfers, the typical representatives being English-speaking countries. The corporatist countries, mostly situated in continental Europe, aim to preserve families, by providing medium government support. On the other hand, social democracies, like Nordic countries, have mainly universalistic programmes and most generous support (Esping-Andersen, 1990). This typology was later re-examined by many other researchers, including the seminal research of Esping-Andersen (1999).

In the field of family policies, researchers proposed their clusters and assessed the explanatory power of Esping-Andersen's typology, e.g., on defamilisation (Bambra, 2007) or female employment (Gornick, Meyers, Ross, 1997). Their analyses conclude that the three proposed welfare state types are not enough to account for all cross-national variations of their interest, and propose slightly different groups. There are several other research papers, proposing different clusters of family policies, that compare EU or OECD countries using different methods. Various variables (parental leave benefits, childcare, female average wage etc.) and outcomes (like fertility, child poverty, economic activity) were assessed to capture the objectives and instruments of family policies, with estimates of, usually, five clusters. Gauthier and Philipov (2008) assessed mainly fertility rates and a variety of state support for families across Europe, hoping to tackle fertility issues and relying on eyeballing methods. Thevenon (2011) focused on family policies in OECD. The research is distinctive due to the analysis of a wide set of variables as proxies for

family policies. Using principal component analysis, his research revealed five regional clusters. Mischke (2011) also proposes five clusters, partially matching those of Thevenon (2011) for 15 EU countries. Her analysis is based on eight measures of dual earner and general family support models, motivated by Korpi (2000), which differ in social outcomes.

The motivation for this research comes from microsimulation studies which used microdata to evaluate child benefits and their child poverty reduction. A method of "policy swapping" between countries or freestyle reforms were often used to adjust existing policies and compare with counterfactuals (different policy design, adjusted policy budget, etc.). Findings of Avram and Militaru (2016) point out to importance of the population characteristics and overall tax-benefit systems together with child related policies' design and budget for policy evaluation.

Policies for women as child bearers and child rearers with very young children are in focus of this research. The aim is to identify various maternity support clusters among 22 EU countries, using clustering methods and principal component analysis. The analysis is most similar to works of Mischke (2011) and Thevenon (2011), borrowing their methods and data. Taking into account all limitations and data availability, the research captures the design and generosity of maternity policies, focusing on parental leaves. Proxy variables (childcare coverage expenditure on family benefits, tax-benefit neutrality) are used for general family policies and overall tax-benefit system. In comparison to previous research, the most significant contribution of this paper, besides a different geo-political coverage, is the inclusion of the national context: female education, GDP, female poverty, mean age at birth and other.

2. Data and methods

Data used for clustering are twelve indicators that capture the three dimensions: policy design, generosity and national context. Table 1 shows an overview of indicators applied in the analysis. The sources for majority of indicators are the Eurostat's Database (mainly ESPROSS) (Eurostat, 2017), the OECD's Family database (2017) and International network on leave policies and research. All data refer to year 2014 (with leave policies valid in April 2014).

Table 1 Overview of indicators (author)

Dimension	**Indicators**	
Design:	Parental leave index Statutory paternity leave (binary variable) Tax-benefit neutrality at 133% of average earnings (OECD)	
Generosity:	Expenditure on parental leave per inhabitant (PPS) Expenditure on family related benefits (% GDP) Children aged less than 3 in formal child care (%)	
National context (general and female focus):	GDP per capita (PPS) Gini index Average household size	Female education (< lower secondary education), age 16-64 Female poverty (< 60% median), age 16-64 Mean age at birth

The design dimension includes the length of parental leaves, availability of paternity leaves and interaction of benefits and taxes. The generosity dimension measures how much resources a country devotes to parents and how available are formal childcare facilities. The national context captures variables also influencing parenting decisions, which are not so straightforward as parental leaves, e.g., level of education, which in turn affects employment opportunities.

The three proposed dimensions do overlap in some cases. Among the design indicators two of them also capture partially the generosity dimension. Parental leave index is constructed from the Moss (2014) overview of cross-country comparisons as a sum of products of maternity and parental leave duration (in months) and the level of payment. Maximum duration of statutory general maternity and parental post-natal leaves (public sector policies are used for Greece) are considered, while the level of payment ranges from 0 to 3 with 3 referring to leave „paid for half or more of duration to all parents at high flat rate (€1,000/month or more) or 66 per cent of earnings or more" (Moss, 2014). The index is interpreted as follows: the higher the value, the more generous and/or longer (better) the leave, with a score of 108 as a

maximum value (e.g., for countries with the highest level of payment and duration of 3 years). Maternity and parental leave are taken into account together due to Sweden and Portugal having only a parental leave as a unique leave covering both parts. The second two-dimensional indicator is the Tax-benefit neutrality. According to OECD (2016), if a country's tax-benefit (TB) system does not affect the amounts paid to government and net family income, when the distribution of paid work in a household changes, their TB system is neutral (0). Indicator can also be negative – if the TB system favours dual-earning households (most systems), or positive – if it favours single-earner couples. The higher the absolute value of the indicator, the more the TB system favours one type of couples (and in that way also capturing generosity). The third indicator in design dimension is the statutory paternity leave, a binary variable indicating the availability (1) or absence (0) of the leave.

Expenditure on parental leave per inhabitant (PPS) consists of Income maintenance benefit in the event of childbirth, Periodic parental leave benefit and Parental leave benefits lump sum from Eurostat's ESSPROS. Expenditure on family related benefits as a percentage of GDP (ESSPROS) consists of all benefits related to the family function, and serves as a proxy for the overall governments' family policies. This variable and the percentage of children aged less than 3 years in formal childcare (Eurostat) capture a wider benefit context.

The indicators of the national context (Eurostat) grasp general socio-economic and female related conditions in a country. The choice of analysed countries is based on the data availability; included are: Austria, Belgium, Croatia, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Lithuania, Netherlands, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden and United Kingdom. Table 2 shows an overview of summary statistics.

Table 2 Basic descriptive statistics, 2014, n=22 European countries (author)

Indicator	Mean	Std. Dev.	Min		Max	
GDP per capita (PPS)	26,918.18	6,912.63	16,300.00	(HR)	37,900.00	(IE)
Gini	29.70	3.63	25.00	(SI)	35.60	(EE)
Female poverty (%)	16.17	3.60	10.40	(CZ)	23.60	(EL)
Female low education (%)	24.61	9.98	12.50	(LT)	52.20	(PT)
Average HH size	2.39	0.26	2.00	(DK, DE)	2.90	(SK)
Mean age at birth	30.39	0.82	28.80	(SK)	31.80	(ES)
Family expenditures (% GDP)	2.05	0.78	0.90	(NL)	3.50	(DK)
Tax-benefit neutrality	-19.17	19.75	-71.50	(EL)	3.60	(DE)
Parental leave index	60.26	33.65	24.20	(EL)	108.00	*
Paternity leave (0 or 1)	0.68	0.48	0	-	1	-
Parental leave expenditure (PPS)	108.38	67.54	4.75	(NL)	238.73	(SE)
Children (age<3) in child care (%)	28.97	17.16	4.40	(CZ)	69.60	(DK)

Note: Data in original units of measure; official two letter country codes for minimum and maximum values; * denotes Hungary, Poland, Estonia, Sweden, Lithuania and Germany.

The data for Tukey's test of differences between cluster means, shown in the results section, are gathered from Eurostat (total fertility rates and employment rate of females with children aged less than 6 years) and from the UN's database Gender Development Index (GDI). GDI is a measure of gender development gap; it expresses female human development index as percentage of the male index, and is based on indicators of long and healthy life, education and living standard (command over economic resources) (United Nations Development Programme, 2016, 2017).

In order to group similar countries according to chosen variables, clustering methods were used, together with the additional principal component analysis. K-means clustering method groups countries with closest means, based on an a priori specified number of clusters. It is useful for analysis and comparison of different number of clusters. The other clustering method in the analysis is Hierarchical clustering, which is a widely used method for grouping of similar countries in a hierarchy: initially as standalone, then in pairs and continuously joining them into one cluster. The end result is usually represented by a dendrogram. The approach used in this research is the Ward's method with Euclidean distances. Number of clusters for the analysis can be determined by a combination of pseudo F and pseudo

T statistic or by referring to the R-Square for data reduction, according to Milligan and Cooper (1985). The principal component analysis (PCA) is used to reduce and synthesize variables into independent components, which explain a part of the variance. In this research PCA's graphical representation was used to check the robustness and compare the proposed clusters. Analysis was carried out using SAS Studio. Although not widely used in comparing social policies, clustering methods were the methods in research of Bambra (2007), Gough (2001), Mischke (2011), Raitano (2009), and PCA in Thevenon (2011).

Because the indicators are measured on different scales, they have to be standardized for a proper cluster analysis (excluding the binary parental leave variable). The calculation used for standardization is the following (z-score):

$$z = \frac{x - \mu}{\sigma} \tag{1}$$

where z denotes the standardized value, x the original value, μ the mean and σ the standard deviation of the population.

Due to a high number of variables there is a risk of collinearity, distorting the clustering results; see Bambra (2007) and Sambandam (2003). Among the variables there is a strong positive correlation between GDP per capita and female poverty (0.9). The k means clustering showed highest sensitivity to the exclusion of female poverty for k is 4, while Ward's method (although adjusted the lower levels in the hierarchy) and PCA revealed almost identical clusters as the final chosen classification. The results presented here are with all variables included.

3. Results

The final number of clusters is 4, after experimenting with 3, 4 and 5 clusters. To determine the final clustering of countries, hierarchical clustering and principal component analysis were also performed. Hierarchical clustering is represented with a dendrogram (Figure 1). Taking into account the R-squared, the figure, suggests 3-5 clusters as the most meaningful; 3-4 clusters are suggested by the stoppage rule of Milligan and Cooper (1985).

Table 3 K-means clustering of 22 EU countries, 2014 (author)

Cluster 1	**Cluster 2**	**Cluster 3**	**Cluster 4**
Austria	Croatia	Greece	Denmark
Belgium	Czech Republic	Italy	Finland
Ireland	Estonia	Portugal	France
Netherlands	Hungary	Spain	Germany
United Kingdom	Lithuania		Sweden
	Poland		
	Slovakia		
	Slovenia		

For the four clusters both methods provide very similar results: distinguishable clusters based on their parental policies and national context. However, there are certain exceptions in respect to three countries: France, Germany and Slovenia. According to the k-means method, Slovenia is a part of cluster 2 (mainly consisting of central and eastern Europe countries), while Ward's method classifies Slovenia in the group with Nordic countries, similar to Wall (2007). The k-means cluster 4 consists of Nordic countries and France (similar to Thevenon (2011)) and Germany, while Ward's method groups Germany and France with Western Europe, in line with majority of welfare classifications.

Principal component analysis was used for additional assessment. The first two principal components account to 59.06% of data variance. They reveal groupings, which resemble the results of cluster analysis (Figure 2). The result could be interpreted as follows: the closer countries are, the more similar they are according to the two principal components. The PCA results are indicative but they show that the clusters are not very homogeneous, due to the wide spread of countries in the plane (Figure 2) and partial overlapping of some clusters.

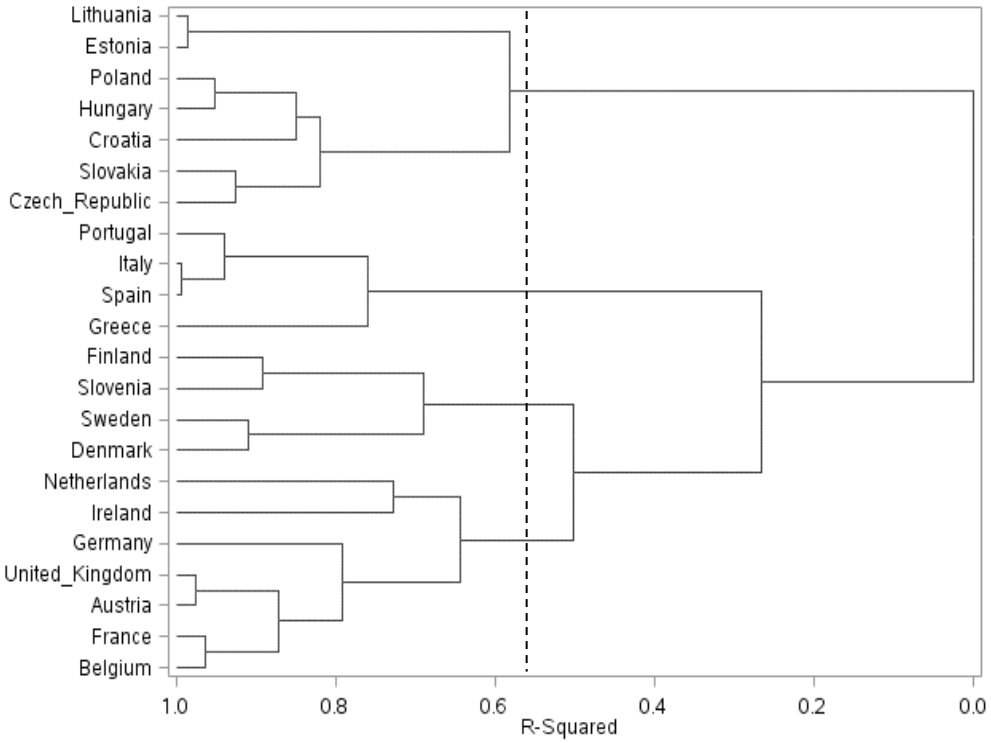

Figure 1 Hierarchical clustering of 22 EU countries, 2014, Ward's method and Euclidean distances (SAS output, author)

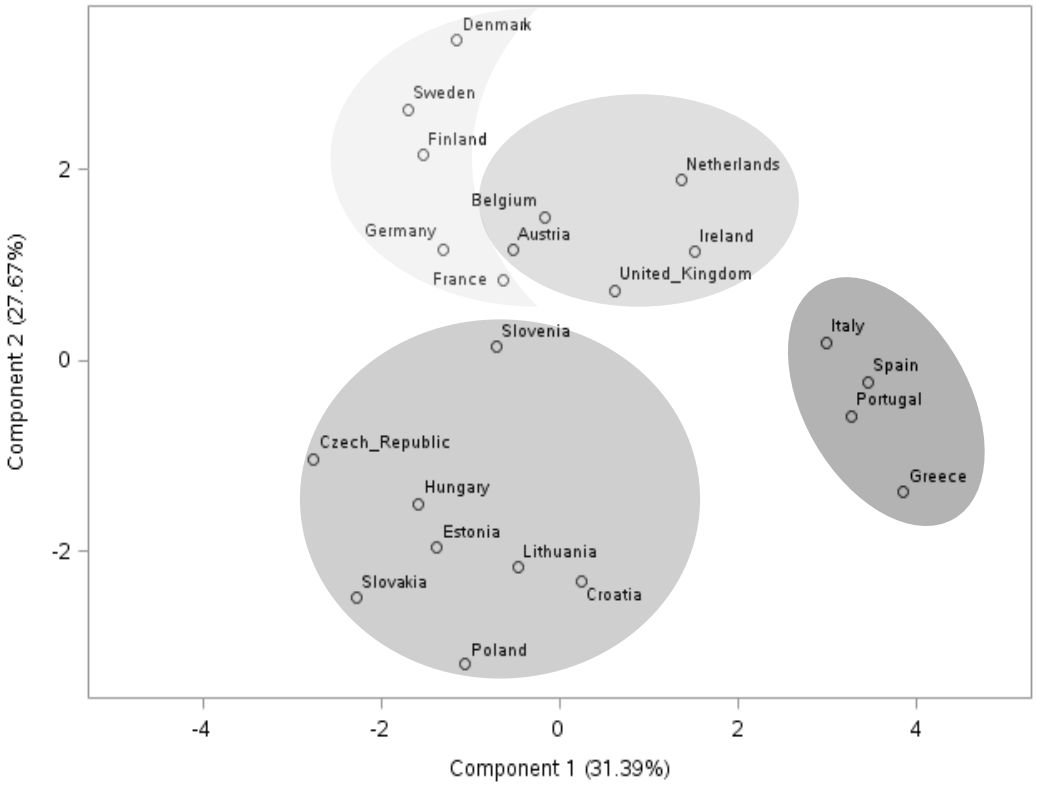

Figure 2 Principal component analysis of 22 EU countries, 2014, (SAS output, author)

There is no one dimension or one key variable contributing mostly to either of the first two components (correlation between variables and principle components not shown in this paper). The first component explains 31.39% of data variance. Some of the major contributors to the first component are female socio-economic indicators (poverty and education) and parental policy indicators. The second component, contributing to 27.67% variance, captures in the first place the economic strength (GDP per capita), followed by the percentage of children in formal childcare. The national context (HH size, mean age at birth) and expenditure on family benefits are also notable. These two components divide the countries in quadrants, illustrated with Figure 2. Component 1 classifies countries with less favourable conditions and policies supporting maternity on the right hand side and those with more favourable conditions on the left hand side. Economically stronger countries are situated in the north part and less strong countries in the south. The Mediterranean countries (Cluster 3) are grouped together. Cluster 2 is also noticeable, with Slovenia being closer to the Nordic countries what is in line with Ward's method. Clusters 1 and 4 are in the upper part of the Figure 2 due to their economic power but differing left and right based on their maternity support and female population characteristics.

The chosen clusters of countries are based on k-means method which corresponds to the PCA and matches strongly the Ward's method. Mean analysis of the clusters is represented graphically in Figure 3.

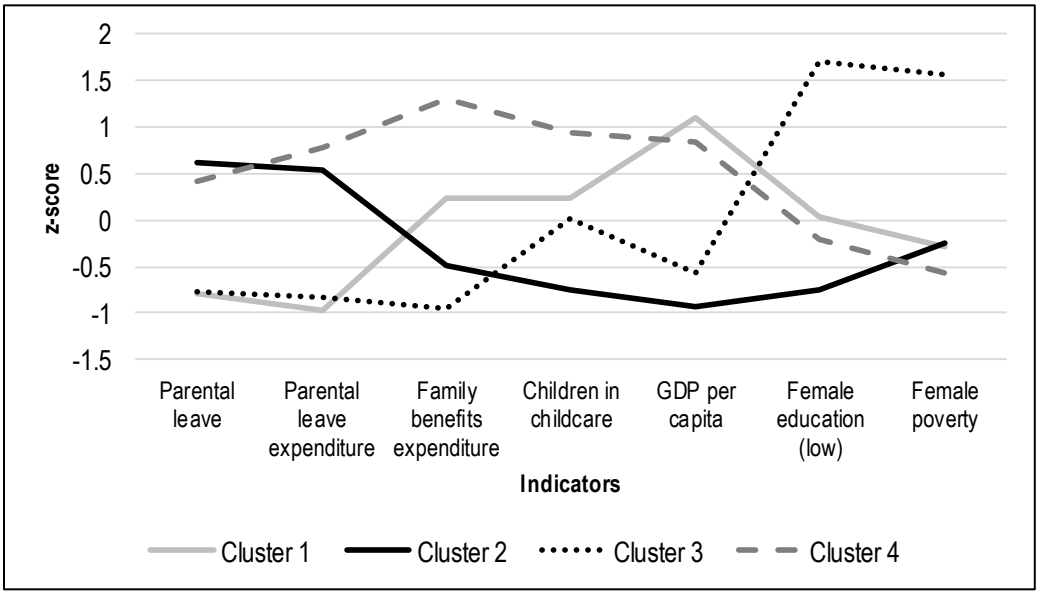

Figure 3 Means of selected indicators for 22 EU clustered countries, standardized values (z-score), 2014 (author)

The Western European countries (cluster 1) comprise of the higher living standard countries, which provide below average parental leave duration and compensation; with Austria being the most generous due to the longest leave duration. All other indicators are medium-sized, similar to Thevenon (2011). The cluster 2 (Central and Eastern Europe), has on average the longest and most generous leave policies (with Slovenia and Croatia being the least supportive), despite being the cluster with the lowest GDP per capita. This cluster also has the lowest percentage of children in childcare, which is a consequence of too high fees and the lack of availability (Mills et al., 2014). But the cluster stands out positively with the lowest share of females below lower secondary education level. The cluster 3 (Mediterranean countries) is also the one with lower living standard and it does not provide generous support to mothers, but they all have statutory paternity leaves. The cluster 3 is also the one with highest female poverty and lowest education levels. The Nordic countries with France and Germany, which form cluster 4, are the countries which have good results, on average, in all aspects: economically strong, providing good support during (lengthy) parental leave and above-average family benefits.

Table 4 Total fertility rate (TFR), Gender development index (GDI) and Mothers employment rate with children age < 6 (MER) means by cluster and significant differences, n=22, 2014 (author)

Cluster	TFR	GDI	MER, %
Cluster 1 (AT, BE, IE, NL, UK)	1.73	0.96	66.30
Cluster 2 (CZ, EE, HR, HU, LT, PL, SI, SK)	1.48**	1.00**(*)	55.04
Cluster 3 (EL, ES, IT, PT)	1.30***	0.97	58.43
Cluster 4 (DK, DE, FI, FR, SE)	1.75	0.98	68.68

Note: Tukey-Kramer test: TFR - cluster 2 is significantly different from clusters 1 and 4 (α=5%), cluster 3 is significantly different from clusters 1 and 4 (α=1%); GDI – cluster 2 is significantly different from clusters 1 (α=1%) and 3 (α=5%).

In order to validate the cluster grouping, three objectives of maternity support policies have been assessed and compared among clusters (Table 4); see Mischke (2011). The results imply that the proposed clusters could explain the differences in outcomes, but the conclusions are not definite. In the analysis of fertility rates, what stands out the most are their low values (below replacement: 2.1) in all clusters, but higher fertility rates appear in clusters and countries that are economically stronger: France, Ireland and Sweden having the highest rates. The lowest fertility rates are in the Mediterranean cluster, not surprisingly, due to their lower living standard and very low maternity support in terms of shorter leaves, income compensation and expensive childcare. The GDI across clusters is highest for cluster 2. This could be attributed not only to adequate maternity support but also to education level, as is the case in Lithuania, whose GDI is slightly above 1. For mothers with children aged less than 6 years, the employment rates are highest (although not significantly) in Nordic countries, probably as a result of highly affordable, available and quality formal childcare but also their economic strength.

4. Conclusions

This paper compares maternity support policies within national context across 22 EU countries and proposes four clusters of countries. These clusters can serve as a framework for explaining the differences in socio-economic outcomes, like fertility rates, GDI and employment rates of mothers. In comparison with previous research (Gough, 2001), the paper offers a combination of two multivariate analysis methods, namely the cluster analysis and principal component analysis, which represents the advancement over some earlier research, based on eyeballing methods.

The obtained results are very much in line with the literature, but also reveal a pattern of higher fertility rates and mothers' employment in countries with higher living standards in EU. Some differences in classification of countries, compared to previous research, could be attributed to policy changes, data availability, impact of recent financial crisis, geo-political coverage, maternity focus, etc. Some limitations, which should be taken into account, are the lack of information on take-up of leave benefits and their average duration (only the statutory post-natal entitlements are taken into account). Moreover, this research refers to basic parental leaves and it does not include additional privileges in case of, e.g., twins, multiple births, etc. Also, employers' benefits and policies are not covered with this analysis, although they play a vital role in family planning.

Some recommendations for future research would be to rely more on micro-data and application of microsimulation models, which prove to be useful in capturing the design and generosity of family benefits. Previous research used various proxies for child related family benefits, with less details in comparison to leave policies, e.g., not taking into account the design of universalistic policies or social assistance programmes. Furthermore, the use of some shorter time-series and national context data from the International Social Survey Programme (ISSP), such as religion, would highly increase the quality of cross-country comparisons.

The four proposed clusters could be used as a starting point for future policy reforms, pointing to various countries' weaknesses. The availability and generosity of parental leaves and other family policies are important for women to balance their careers and family life. However, the analysis also raises the

awareness of the country's overall economic strength as a strong driver of positive demographic developments.

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